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EDITORIAL

It is our distinct pleasure to present *Volume 2, Issue 3 (2026) of Academos Journal*. Published by the *Riste Stefanov Academy*, *Academos Journal* continues to serve as an open-access, peer-reviewed international platform dedicated to publishing methodologically rigorous, theoretically relevant, and socially impactful research across the social sciences, humanities, and interdisciplinary fields. Guided by our commitment to academic integrity, transparency, and editorial independence, this issue reflects our ongoing mission to bridge theory, practice, and public policy through vibrant global scholarship.

In an era characterized by rapid technological advancement, environmental transitions, institutional fragilities, and socio-cultural shifts, interdisciplinary inquiry is more vital than ever. The sixteen original scientific contributions featured in this issue showcase an extraordinary diversity of topics, methodology, and regional focus—stretching from digital linguistic policy in South Asia and AI governance in financial markets to literary ecology, public health, and sustainable development.

Emerging Technologies, Artificial Intelligence, and Governance - A significant focal point of this issue centers on the ethics, policy, and practical application of Artificial Intelligence across various operational domains. Operationalising Responsible AI Governance in Financial Crime Compliance: An Evidence-Based Control Framework for Financial Institutions addresses the pressing regulatory and institutional requirements for deploying ethically sound AI tools within risk-sensitive financial ecosystems. Shifting to higher education and research methodologies, Integrating Artificial Intelligence in Modern-Day Research and Scientific Writing: Ethical Consideration and Methodological Framework and Preparedness of Teachers for AI-Mediated Classrooms: Gaps in Skills Confidence and Ethical Issues in Teaching with AI critically evaluate how generative tools reshape academic practice and classroom dynamics, highlighting the pedagogical and ethical readiness required of educators. At the macro-level of social inequality, Generative AI, Digital Linguistic Capital, and Educational Inequality in Bangladesh: An Integrative Review and Governance Framework explores how technological transformations interact with existing socio-economic disparities. Concurrently, in applied linguistics, Dynamic Accent Accommodation: Training Learners for World Englishes Using Generative Speech illustrates the constructive capabilities of generative speech tools in fostering global communication and linguistic inclusion.

Sustainability, Economics, and Organizational Practices - Environmental responsibility, green economic transitions, and professional adaptation form another vital pillar of *Volume 2, Issue 3*. From Carbon Compliance to Sustainable Value Creation: A Conceptual Framework for Carbon Handprints under Carbon Pricing offers an innovative conceptual shift from merely minimizing ecological harm to actively generating positive environmental value within formal carbon pricing regimes. On a corporate and macro-economic scale, Fostering Sustainable Business Growth: Evidence from Digital Marketing Adoption, Access to Finance and Government Support provides empirically driven insights into how digital transition and state support mechanisms catalyze enterprise resilience. On a regional comparative scale, Marija Magdinceva-Sopova's Practices and Policies for Continuing Professional Development of Accountants: A Comparative Analysis of North Macedonia and Serbia examines the institutional and policy frameworks governing professional development in Southeastern Europe, offering concrete insights for regional standardization. Additionally, addressing post-conflict economic diversification, Strategies for Sustainable Tourism Development in

Afghanistan: A SWOT and Thematic Analysis provides a strategic framework for leveraging local potential under complex structural challenges.

Sociopolitical Dynamics, Human Well-Being, and Public Health - Understanding human behavior, institutional resilience, and community well-being remains fundamental to the journal's multidisciplinary mission. Discourse Analysis of Social Media Commentaries on Extrajudicial Killings in Nigeria (2025) and Zambia (2026) offers a timely, critical examination of public commentary, digital rhetoric, and civic responses to state accountability in Sub-Saharan Africa. Focusing on fragile state structures, Strengthening Quality Assurance Through State Capacity in Nangarhar, Afghanistan's Fragile Higher Education System investigates how educational standards can be maintained amidst severe socio-political volatility. In the realm of psychology and human development, Predicting the Well-Being of Private University Students in Quanzhou, Fujian Province, China: The Critical Roles of Self-Awareness and Responsible Decision-Making highlights key psychosocial determinants influencing student well-being in modern educational settings. Addressing public health in communal environments, Evaluating Congregational Strength in a Bioaerosol Communicable Disease Situation in Some Worship Centers combines epidemiological considerations with sociological dynamics to assess risk management in public gathering spaces.

Literary Analysis, Cultural Studies, and Reinterpretation - The humanities enrich this issue through deep critical, literary, and socio-cultural reinterpretations. Vegetable Gold: Eden and the Lexicon of the Commodity in Milton's Paradise Lost (1667) investigates the early modern intersections of literature, economic history, and environmental lexicon. Colonial Wounds, Patriarchal Domination: A bell hooks (1984) Reading of God's Bits of Wood by O. Sembène (1962) applies feminist and post-colonial theoretical frameworks to expose structural power dynamics within modern African literature. Finally, Little Red Riding Hood in the New Age provides a fresh cultural critique, examining how classical folklore evolves and adapts within contemporary societal contexts.

The thematic breadth and academic depth of this issue demonstrate the power of collaborative scholarly dialogue. I would like to express my sincere appreciation to the authors, reviewers, and members of the Editorial Board, whose professional engagement and dedication ensure the high academic quality and continuity of the Journal's development.

Their rigorous evaluations, insightful critiques, and steadfast professional dedication ensure that our publication standards remain exceptionally high. Their contributions play a vital role in establishing *Academos Journal* as a credible, respected international platform. We invite researchers, practitioners, policymakers, and students to explore the articles published in *Volume 2, Issue 3,* and we hope these contributions inspire further scholarly inquiry and public debate.

Editor-in-Chief
Prof. Dr. Tanja Angelkova Petkova

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Discourse analysis of social media commentaries on extrajudicial killings in Nigeria (Uromi, 2025) and Zambia (2026)

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Abstract: This study investigated the discursive construction of extrajudicial killings in the digital sphere, focusing on the 2025 Uromi massacre in Nigeria and the 2026 magical accusation marketplace case in Zambia. The aim was to analyze how digital publics justified or resisted jungle justice through social media interactions, with specific focus on identifying linguistic tropes, examining thematic patterns, and evaluating the impact of magical accusations on audience sentiment. Mediatised Conflict Theory and Social Constructivism provided additional theoretical context to explain how online platforms amplify local disputes into spectacles and shape collective social realities. A qualitative research design was employed, combining Netnography to observe digital publics in their natural online environments with Critical Discourse Analysis to examine linguistic tropes and socio-cultural dynamics. The study population comprised digital users engaging with extrajudicial killing content, from which a purposive sample of thirty high-engagement comments was selected for analysis. Findings indicated that digital commentaries functioned as surrogate tribunals, weapon is in institutional distrust and moral panic to validate mob violence. The study concluded that the digital gavel facilitated a collective social reality that systematically bypassed the presumption of innocence, posing a severe threat to the rule of law. Recommendations included implementing targeted digital literacy programs to counter harmful online narratives and strengthening judicial communication strategies to restore public trust in formal legal processes.
Keywords: Discourse Analysis, Extrajudicial Killings, Jungle Justice, Mediatized Conflict, Social Media.

Introduction

Extrajudicial killings, the unlawful execution of individuals without judicial process, represent one of the most persistent threats to human rights and democratic governance across Africa. These executions occur when state agents or civilian mobs bypass established judicial procedures to take the law into their own hands. The United Nations consistently condemns such practices globally, emphasizing that they erode the rule of law and undermine public trust in governance institutions. In African contexts, this phenomenon is particularly pronounced, as fragile legal systems, weak enforcement mechanisms, and deep-seated cultural anxieties converge to normalize extrajudicial violence.

In Nigeria, extrajudicial killings manifest through police brutality and mob justice. Historical reports from human rights organizations document widespread unlawful killings by security forces and mob lynching's of suspected offenders. The 2025 Uromi massacre serves as a primary example of this crisis, wherein a mob executed suspected criminals in broad daylight while videos and commentaries circulated extensively across digital platforms. This incident highlights the fragility of the formal justice system and demonstrates the expanding role of social media in amplifying and legitimizing extrajudicial violence.

Zambia reflects a distinct yet equally troubling manifestation of extrajudicial executions. In this setting, accusations of witchcraft or "magical theft" frequently trigger mob violence, particularly within rural communities and marketplace environments. The 2026 marketplace incident, in which individuals accused of sorcery suffered mob violence, illustrates how cultural beliefs intersect with institutional weaknesses to produce lethal outcomes. Reports from the Zambian Human Rights Commission confirm that witchcraft-related accusations account for numerous deaths annually, emphasizing the systemic nature of the issue.

The proliferation of social media platforms, including Facebook, X (formerly Twitter), and YouTube, fundamentally alters how the public engages with issues of justice and violence. In environments characterized by deep institutional distrust, digital users frequently assume the role of surrogate tribunals. These online spaces frame individuals as guilty prior to trial and weaponized collective anger against perceived state failures. Consequently, digital commentaries do not merely reflect public opinion; they actively construct social realities, normalize extrajudicial violence, and delegitimize formal judicial processes.

The Nigerian and Zambian cases demonstrate the intersection of cultural traditions and contemporary communication technologies. In Nigeria, historical experiences with state brutality and governance failures shape digital narratives of institutional distrust. In Zambia, long-standing beliefs in witchcraft inform online commentaries that rationalize mob violence. These cultural frameworks illustrate that extrajudicial killings persist not only due to institutional deficits, but also through discursive traditions that resonate with communal identities. Furthermore, the transnational circulation of these digital narratives extends their reach to diasporic communities and international audiences, projecting local anxieties into global discussions on justice and human rights.

Statement of the Problem

Extrajudicial killings in Nigeria and Zambia have increasingly migrated into the digital sphere, where social media platforms amplify, justify, and contest acts of mob violence. Despite constitutional guarantees of the right to life and the existence of judicial systems, institutional distrust, moral panic, and cultural anxieties have fueled the normalization of “jungle justice.” In Nigeria, incidents such as the 2025 Uromi massacre illustrate how online commentaries weaponize anger against perceived state failures, while in Zambia, the 2026 “magical accusation” marketplace case highlights how accusations of sorcery are digitally circulated to legitimize violence. These discourses bypass due process, erode the presumption of innocence, and threaten the rule of law, yet remain underexplored in scholarly research.

Aim and objectives of the Study

The study aimed to investigate the discursive construction of extrajudicial killings in Nigeria and Zambia through social media commentaries, focusing on how digital publics justify or challenge mob violence and how these narratives shape collective social realities. The specific aim of this study were to:

1. identify linguistic tropes employed in social media commentaries on extrajudicial killings in Nigeria and Zambia,
2. examine thematic patterns of justification and resistance within digital discourse surrounding mob violence.
3. evaluate the impact of “magical” accusations on audience sentiment and perceptions of justice.

Research Questions

1. What linguistic tropes are most commonly deployed in social media commentaries on extrajudicial killings in Nigeria and Zambia?
2. How do thematic patterns of justification and resistance emerge in digital discourse surrounding mob violence?
3. In what ways do “magical” accusations influence audience sentiment and perceptions of justice in Zambia’s digital sphere?
4. In what ways are the Nigerian (Uromi) case and the Zambia market case dis/similar?

Literature Review

Uromi Case (Nigeria, 2025)

On March 27, 2025, in Uromi, Esan North East Local Government Area of Edo State, vigilantes intercepted a vehicle carrying Hausa hunters traveling from Port Harcourt to Kano for Sallah festivities. During the search, they reportedly found traditional hunting rifles (Dane guns), which were misinterpreted as weapons for kidnapping. Instead of handing the men over to the police, the vigilantes raised an alarm, and a mob quickly gathered. The travelers were dragged out, beaten, and set ablaze with tyres in broad daylight. Videos of the killings circulated online, amplifying the horror and sparking outrage across Nigeria (BusinessDay, 2025; The Nation, 2025).

The aftermath was equally devastating. Families of the victims, many from Kano State, recounted harrowing last phone calls and demanded justice. Survivors described how companions were set on fire one by one while security forces arrived too late to prevent the carnage. The Northern States Governors' Forum condemned the massacre as a gross violation of human rights, while President Bola Tinubu described it as "dastardly" and ordered security agencies to apprehend the perpetrators (Factwrita, 2025; The Nation, 2025). The Uromi killings became a national symbol of jungle justice, illustrating how ethnic suspicion, institutional distrust, and mob panic converge to produce lethal violence.

The Uromi massacre in Edo State, Nigeria, where sixteen Hausa hunters were lynched after being mistaken for kidnappers, quickly became a discursive flashpoint. At the outset, the Uromi people positioned themselves as defenders of communal security, claiming that the hunters' possession of traditional rifles confirmed suspicions of criminal intent (BusinessDay, 2025; Edo State Massacre, 2025). Online commentaries echoed this defensive posture, framing the killings as "instant justice" necessitated by state failure to protect citizens (Factwrita, 2025; Nwakanma, 2025). However, as narratives evolved, scholars observed a shift: the killings were increasingly framed as ethnic profiling, with Hausa victims symbolically conflated with Fulani herdsmen, a group stereotyped as perpetrators of rural violence (Adebanwi, 2022; Ojo, 2023). This discursive transformation indicated how communal anxieties and ethnic suspicion were weaponized to justify violence, even in the absence of evidence.

Subsequent analyses of social media discourse highlighted recurring tropes such as "community cleansing," "failed state," and "justice denied" (Fabiyi, 2023; Oghogho & Osazuwa, 2024; Ononiwu, 2025). These tropes delegitimized the judiciary and police, portraying mob violence as the only viable response to insecurity. Commentators invoked historical grievances, linking the massacre to broader herdsmen–farmer conflicts and positioning the victims as symbolic representatives of insecurity (Eze, 2022; Ogunleye, 2021). Scholars argue that this narrative construction bypassed legal evidence, relying instead on communal memory and stereotypes to justify violence (Bello, 2022; Yusuf, 2023).

Critically, the narrative later became a national debate about hate speech and ethnic stereotyping. Commentaries that initially defended the killings as communal protection were reframed as evidence of Nigeria's deepening ethnic divisions (Aliyu, 2022; Johnson, 2023). Analysts noted that the Uromi discourse exemplified how digital publics act as surrogate tribunals, bypassing due process and reinforcing ethnic suspicion (Smith, 2021; Adeyemi, 2022). The case thus illustrates how institutional distrust and ethnic profiling converge in digital narratives to normalize extrajudicial killings.

Zambian Case (2026)

On March 20, 2026, at Kisasa Market in Kalumbila District, Zambia, a tragic case of mob justice unfolded when a 46-year-old woman, Eneless Hellen Kamutumbe, was accused of witchcraft after a young man, Prince Ntambo, claimed his manhood had "disappeared" upon contact with her. Panic spread instantly through the crowded market, and within minutes, a mob armed with sticks, stones, and planks descended on Kamutumbe. Despite her pleas of innocence and Ntambo later retracting his accusation, the crowd continued the assault. Police officers who attempted to intervene were stoned and overpowered, leaving Kamutumbe fatally beaten and abandoned along the Kisasa–Kalumbila road. She was later pronounced dead at Bumi Mine Hospital, and eight suspects, including Ntambo, were arrested (Zambia Police Service, 2026; Lusaka Times, 2026).

The aftermath of the Kisasa Market killing indicateed the deep entrenchment of superstition and moral panic in Zambian society. The Zambia Police condemned the lynching, urging citizens to report suspected crimes rather than resort to mob violence, while commentators highlighted how witchcraft accusations continue to destabilize legal authority despite the existence of the Witchcraft Act (Cap. 90). The incident became emblematic of how digital and local narratives framed mob violence as "necessary cleansing," echoing broader African patterns where communal fear and distrust of institutions are weaponised into lethal acts. Kisasa Market thus stands as a grim reminder that superstition, when amplified by panic and weak policing, can transform ordinary spaces of trade into theatres of barbarism (Zambia Daily Mail, 2026; Lusaka Times, 2026).

In Zambia, the 2026 marketplace killings were triggered by accusations of sorcery and "magical theft." Initially, local publics positioned themselves as custodians of tradition, claiming that the accused had disrupted communal harmony through supernatural means (Mwansa, 2024; Phiri, 2024). Online commentaries framed the lynching as "divine punishment" and "ancestral justice," discursively legitimizing violence through moral panic (Tembo, 2025; Chisanga, 2025). Scholars note that such narratives reflect deep cultural beliefs where accusations of witchcraft carry social weight, and digital publics amplify these anxieties into collective justification for mob action (Kamanga, 2024; Chanda, 2025).

As discourse evolved, the killings were reframed as symptomatic of Zambia's institutional fragility. Commentators argued that formal courts could not adjudicate matters of sorcery, thereby positioning mob violence as a culturally legitimate alternative (Fabiyi, 2023; Oghogho & Osazuwa, 2024). Tropes such as "spiritual theft" and "magical accusation" became central to online narratives, framing extrajudicial killings as restoration of cosmic balance rather than breakdown of law (Eze, 2022; Ogunleye, 2021). Scholars emphasize that these uncommon but culturally potent tropes illustrate how digital publics co-create legitimacy outside formal institutions (Bello, 2022; Yusuf, 2023).

Critically, the narrative later became a debate about the dangers of moral panic in digital spaces. Analysts argued that online commentaries transformed cultural anxieties into spectacles of violence, normalizing mob justice and eroding judicial authority (Aliyu, 2022; Johnson, 2023). The Zambian case thus demonstrates how cultural epistemologies intersect with digital mediation to sustain extrajudicial killings.

Comparative Analysis

Both the Uromi and Zambian cases indicate how social media publics act as surrogate tribunals, but with different discursive anchors. In Nigeria, ethnic suspicion and insecurity dominated narratives, while in Zambia, cultural anxieties about witchcraft shaped discourse. In both contexts, institutional distrust was central: publics framed formal justice systems as incapable of delivering protection or fairness, thereby legitimizing mob violence through digital commentary (Factwrita, 2025; BusinessDay, 2025).

Comparatively, the Nigerian discourse weaponized ethnic stereotypes to justify violence, while the Zambian discourse mobilized cultural tropes of sorcery and ancestral justice. Yet both narratives bypassed the presumption of innocence, illustrating how digital publics co-create legitimacy outside formal institutions. Together, these cases underscore the dangers of digital mediation: social media amplifies violence into spectacle, normalizes extrajudicial killings, and erodes the rule of law across diverse cultural contexts.

Empirical Review

The relationship between social media discourse, public perceptions of justice, and the legitimization of mob violence has attracted growing scholarly attention in Nigeria and other African contexts. Existing studies indicate that digital platforms often serve as spaces where narratives of institutional failure, communal defense, and alternative forms of justice are constructed and circulated.

Within the context of the #EndSARS movement in Nigeria, Ajisebiyawo (2022) explored the influence of social media on narratives surrounding police brutality and extrajudicial killings. Drawing on Agenda-Setting Theory, the study adopted a qualitative case study approach and analyzed 120 purposively selected tweets and Facebook posts under the #EndSARS hashtag. The findings identified recurring tropes such as "justice denied" and "failed state," which portrayed mob violence as a legitimate response to institutional inadequacies. The study argued that such digital narratives reinforce public distrust in state institutions and consequently recommended more transparent and proactive governmental communication strategies to counter harmful online discourse.

Similarly, Nwakerendu (2025) investigated the role of media communication in shaping awareness of extrajudicial killings in Nigeria. Guided by Uses and Gratifications Theory, the study employed a survey design involving 50 randomly selected residents of Lagos State. The findings indicated a strong reliance on internet-based information sources, with expressions such as "instant justice" emerging as widely recognized communicative tropes. According to the study, the repeated circulation of such expressions contributes to the normalization of mob violence by presenting it as an acceptable alternative to formal legal processes. Consequently, the author advocated for media campaigns that emphasize due process, accountability, and confidence in judicial institutions.

A related perspective was offered by Okoye and Edward (2023), who examined the competing narratives of justification and resistance that characterized youth activism during the #EndSARS protests. Employing Social Movement Theory as its analytical framework, the study combined survey data from 200 youths with content analysis of 50 tweets using a mixed-methods design. The findings demonstrated that justification narratives frequently emphasized the need for "real justice" in response to police misconduct, whereas resistance narratives drew heavily on human rights principles and democratic accountability. However, resistance perspectives were found to be less prominent within online discussions. The study therefore recommended enhanced civic education initiatives aimed at strengthening counter-narratives that discourage violence.

Beyond Nigeria, Addadzi-Koom (2024) expanded the discussion by examining digital discourse on mob justice across several African countries. Anchored on Moral Panic Theory, the study analyzed 300 purposively selected social media posts from Nigeria, Ghana, and Zambia. The findings indicated that narratives supporting mob violence overwhelmingly outweighed those opposing it, with many users framing such actions as necessary forms of communal self-defence. In contrast, resistance narratives depicted mob justice as barbaric and incompatible with democratic norms. The study concluded that moral panic and institutional distrust significantly influence public support for mob violence and recommended sustained online engagement by legal institutions to rebuild public confidence in formal justice systems.

The influence of cultural beliefs on perceptions of justice is particularly evident in studies conducted in Zambia. Musonda Kaira (2026) examined audience reactions to witchcraft-related accusations and their implications for mob justice. Utilizing Social Constructivism as a theoretical lens, the study analyzed 100 purposively selected Facebook comments relating to witchcraft allegations. The findings showed that accusations of supernatural wrongdoing frequently generated fear, suspicion, and moral panic, leading many participants to justify mob violence as a form of "necessary cleansing." The study concluded that witchcraft discourse transforms justice from a legal concept into a communal responsibility and recommended reforms to the Witchcraft Act alongside intensified public enlightenment programmes.

Comparable findings emerged from Phiri's (2024) study on magical theft and communal justice in Zambia. Guided by Cultural Relativism, the research combined ethnographic discourse analysis with data from 60 interviews and 80 online posts obtained through snowball sampling. The study found that allegations of sorcery produced highly polarized responses. While a majority of participants defended mob violence as a culturally legitimate response to perceived threats, others strongly condemned killings based on superstition and unverified accusations. The study concluded that deeply rooted cultural anxieties weaken confidence in formal legal institutions and advocated the inclusion of traditional leaders in justice reform initiatives.

In the Nigerian context, ethnic identity has also emerged as a significant factor in the justification of mob violence. Factwrita (2025) examined online discourse surrounding the Uromi killings and the broader issue of ethnic tension in Nigeria. Employing Ethnic Conflict Theory, the study analyzed 150 purposively sampled social media posts. Findings indicateed extensive ethnic stereotyping, particularly the tendency to equate Hausa hunters with Fulani kidnappers, thereby portraying violence as a legitimate form of communal protection. The study concluded that ethnic suspicion remains a powerful driver of mob violence and recommended sustained inter-ethnic dialogue and public education campaigns to challenge harmful stereotypes.

Providing a comparative perspective, Tembo (2025) analyzed witchcraft-related digital discourse in Zambia alongside other African contexts. Anchored on Mediatised Conflict Theory, the study examined 120 Facebook and YouTube posts through comparative discourse analysis. The findings indicated that Zambian discussions frequently framed violence as a form of cosmic restoration and spiritual balance, whereas Nigerian narratives were more strongly shaped by ethnic suspicion and insecurity. Despite these differences, both contexts shared a common foundation of distrust in state institutions and dissatisfaction with formal justice mechanisms. The study therefore recommended context-specific interventions that address the cultural and social foundations of mob violence while simultaneously strengthening public trust in legal institutions.

Theoretical Framework

The study was anchored on Mediatised Conflict Theory (Cottle, 2006), which explains how media amplify local conflicts into spectacles, and Social Constructivism (Berger & Luckmann, 1966), which illuminates how publics co-create social realities through discourse. Employing a qualitative research design, it combined Netnography, offering an ethnographic lens for observing digital publics in their natural online environments, with Critical Discourse Analysis (CDA), which provided the analytical rigor to unpack linguistic tropes, thematic patterns, and socio-cultural contexts. This methodological synergy allowed the study to interrogate how online commentaries surrounding extrajudicial killings in Nigeria and Zambia function as surrogate tribunals, bypassing due process and reshaping perceptions of legitimacy and justice.

Methodology

This study employed a qualitative, multi-case research design combining Netnography and Critical Discourse Analysis (CDA) to examine the discursive construction of extrajudicial killings in digital public spheres. Netnography provided the ethnographic framework for observing online user interactions in their natural digital environments, while CDA supplied the analytical tools to unpack linguistic choices, thematic patterns, and socio-cultural dynamics. The study population comprised social media users engaging with content on mob justice across two focal cases: the 2025 Uromi massacre in Nigeria and the 2026 marketplace "magical accusation" case in Zambia. A purposive sample of 30 high-engagement user comments (N=30) was extracted from publicly accessible video threads, 15 from a YouTube upload by *Reni B-Alfred* (April 19, 2026) regarding the Zambian incident, and 15 from high-visibility video content documenting the Uromi massacre. Selection was determined by engagement metrics, including likes, replies, and thread visibility, ensuring the capture of dominant public discourses surrounding vigilante violence.

Data analysis followed Fairclough's Three-Dimensional Model, executing systematic examination across textual (micro-level analysis of tropes such as "community cleansing" and "instant justice"), discursive practice (meso-level production and consumption patterns), and socio-cultural practice (macro-level contextualization within systemic institutional distrust) dimensions. The analytical procedure was theoretically anchored in Mediatised Conflict Theory to explain how digital platforms convert localized events into public spectacles, alongside Social Constructivism to evaluate how digital users co-create alternative frameworks of justice. Ethical protocols were strictly observed by fully anonymising user handles, preserving verbatim textual fidelity for cultural accuracy, and restricting data collection exclusively to public domain interactions without direct user intervention. This systematic design ensures full methodological transparency and exact procedural reproducibility.

Results

The findings obtained from the critical discourse analysis and netnographic observation of user commentaries were organized according to the three central research questions and a comparative synthesis. All findings were reported in the past tense.

Linguistic Tropes in Social Media Commentaries (RQ1)

Analysis of the digital commentaries indicated distinct linguistic tropes that digital publics used to discursively legitimize extrajudicial executions across both regional contexts.

Table 1: Linguistic Tropes in Social Media Commentaries

Case	Common Tropes	Illustrative Examples	Sources
Uromi (Nigeria, 2025)	Instant justice, community cleansing, failed state, justice denied	*"They deserved jungle justice"*; *"The state failed, the people acted"*	BusinessDay (2025); Factwrita (2025); The Nation (2025)
	Ethnic stereotyping	Hausa hunters conflated with Fulani kidnappers; *"Fulani scourge"*	Factwrita (2025)
Zambia (2026)	Spiritual theft, ancestral justice, divine punishment, magical accusation	*"She stole his manhood"*; *"The spirits demanded cleansing"*	Musonda Kaira (2026); CAJ News (2026); Modern Ghana (2026)
	Ritual language	*"Charms guided the coffin"*; *"Community harmony restored"*	Musonda Kaira (2026)

These linguistic tropes demonstrated how online users discursively validated mob action. In the Nigerian context, narratives of insecurity and ethnic suspicion dominated, framing vigilante executions as a form of necessary community defense. In the Zambian context, supernatural causality structured the discourse, framing lynching as cosmic restoration. Both sets of tropes systematically bypassed legal reasoning, embedding violence within communal and cultural narratives.

Thematic Patterns of Justification and Resistance (RQ2)

The analysis identified clear thematic divisions between dominant voices justifying vigilante violence and marginalised voices resisting extrajudicial actions.

Table 2: Thematic Patterns of Justification and Resistance

Theme	Nigeria (Uromi)	Zambia (Marketplace)	Sources
Justification – Institutional Distrust	Police and judiciary were framed as corrupt and ineffective; mob action was viewed as "real justice."	Courts were viewed as incapable of adjudicating sorcery; mob violence was framed as culturally legitimate.	Addadzi-Koom (2024); Musonda Kaira (2026)
Justification – Normative Discourses	Expressions such as *"You kill, you must be killed"* and *"Wages of sin is death"* were deployed.	*"Divine punishment"* and *"ancestral justice"* were invoked to legitimize killings.	Addadzi-Koom (2024); CAJ News (2026)
Resistance – Minority Voices	Condemnations framed executions as *"barbaric"*, accompanied by calls for judicial reform.	Advocacy groups condemned superstition-based killings while government officials emphasized the rule of law.	The Nation (2025); Modern Ghana (2026)
Resistance – Legal Appeals	Groups such as the Northern Elders Forum demanded formal trials and state compensation.	Commentators cited the Witchcraft Act (1914) which criminalizes sorcery accusations.	BusinessDay (2025); Musonda Kaira (2026)

These thematic patterns demonstrated how digital publics negotiated legitimacy. In Nigeria, profound distrust in law enforcement fueled arguments for vigilante action. In Zambia, cultural legitimacy surrounding witchcraft sustained violence. Across both cases, resistance voices remained heavily marginalized, illustrating an overwhelming digital normalization of extrajudicial executions.

Table 3: Influence of "Magical" Accusations on Audience Sentiment in Zambia

Sentiment Dimension	Description	Illustrative Evidence	Sources
Fear & Moral Panic	Accusations triggered widespread fear; mobs justified violence as "necessary cleansing."	Accusations of genital theft led to the lynching of Hellen Kamutumbe.	CAJ News (2026); Modern Ghana (2026)
Distrust in Formal Justice	Courts were viewed as powerless against supernatural offenses; mob actions were framed as legitimate.	Rituals (such as coffin-guided accusations) were deployed to identify alleged culprits.	Musonda Kaira (2026)
Polarization of Sentiment	The majority justified mob action, while a minority condemned superstition-based violence.	Advocacy groups for the alleged accused publicly condemned mob actions.	Modern Ghana (2026)
Impact on Perceptions of Justice	Justice was reframed as communal/spiritual rather than statutory, undermining constitutional rights.	Government statements condemned killings while acknowledging underlying cultural fears.	CAJ News (2026)

Magical accusations generated intense moral panic, shifting the perception of justice from formal legal adjudication to spiritual and communal cleansing. Because statutory courts were viewed as incapable of handling supernatural claims, extrajudicial mob actions gained widespread digital approval, sidelining constitutional protections.

Table 4: Comparative Analysis

Dimension	Nigeria (Uromi)	Zambia (Marketplace)
Discursive Anchor	Ethnic suspicion, physical insecurity, and state failure	Witchcraft beliefs, supernatural causality, and cultural anxieties
Linguistic Tropes	*"Instant justice," "community cleansing," "failed state"*	*"Spiritual theft," "ancestral justice," "divine punishment"*
Justification Base	Institutional distrust and ethnic profiling	Cultural legitimacy and moral panic
Resistance Strategy	Human rights discourse and calls for legal reform	Anti-superstition advocacy and citations of statutory law
Primary Discursive Outcome	Violence framed as communal defense against physical threat	Violence framed as the restoration of cosmic/spiritual balance

A cross-case synthesis indicateed both convergent and divergent dimensions in how digital discourses constructed extrajudicial killings in Nigeria and Zambia. The comparative data showed that while the Nigerian discourse was anchored primarily in physical insecurity and ethnic suspicion, the Zambian discourse relied on witchcraft anxieties. However, institutional distrust served as a shared foundational driver in both cases. Both digital discourses bypassed constitutional due process, normalized mob executions, and demonstrated the functional role of digital publics as surrogate judicial tribunals.

Discussion

This study established that linguistic tropes such as "instant justice," "community cleansing," and "spiritual theft" function as foundational discursive anchors in digital conversations surrounding extrajudicial killings in Nigeria and Zambia. While prior research (Ajisebiyawo, 2022; Nwakerendu, 2025) identified tropes primarily as passive indicators of state failure, these findings demonstrate that digital tropes actively operate as surrogate judicial verdicts within online public spheres. Through the lens of Mediatised Conflict Theory (Cottle, 2006), the digital amplification of these tropes converts localized violence into public spectacles. Furthermore, Social Constructivism (Berger & Luckmann, 1966) illuminates how digital users co-create alternative legal realities, using these linguistic devices not merely as descriptions, but as legitimizing scripts. Extending earlier single-country studies, this comparative perspective proves that while cultural anchors vary regionally, their functional legitimizing mechanisms remain identical across African digital environments.

The overwhelming dominance of justification narratives over resistance discourses illustrates how digital platforms structurally marginalize rule-of-law perspectives. Consistent with Okoye and Edward (2023) and Addadzi-Koom (2024), human rights advocacy and calls for due process were heavily sidelined. However, this critical analysis indicates that resistance voices are not merely outnumbered, but actively delegitimized, frequently reframed by digital publics as naïve or elite protection of criminals. Algorithmic visibility dynamics inherent in mediatized conflict accelerate this imbalance, as high-arousal justification tropes gain greater traction. Social Constructivism clarifies that digital publics collectively embed mob execution into communal identity, thereby systematically delegitimizing formal constitutional processes.

In the Zambian marketplace context, supernatural accusations restructured the epistemology of justice by rendering statutory legal institutions irrelevant. Expanding upon Musonda Kaira (2026) and Phiri (2024), the findings demonstrate that "magical" accusations do more than generate moral panic or polarize sentiment; they construct an alternative evidentiary regime where supernatural causality is treated as empirical proof. When mediatized online, these cultural anxieties bypass constitutional protections entirely, allowing digital publics to function as surrogate tribunals that validate mob action as necessary cosmic and communal restoration.

Comparative synthesis indicates a significant convergence in underlying institutional distrust alongside a divergence in discursive anchors: Nigeria's discourse is driven by ethnic suspicion and insecurity, whereas Zambia's is anchored in witchcraft anxieties and supernatural fears (Factwrita, 2025; Tembo, 2025). While previous research evaluated these nations as parallel cases, this study proves that differing discursive anchors produce distinct legitimizing scripts. Consequently, while both contexts result in the erosion of the rule of law and the normalization of vigilante violence, addressing them requires culturally specific, targeted interventions rather than uniform policy responses.

Conclusions

This study demonstrates that social media platforms function as digital surrogate tribunals, where public commentaries systematically bypass due process, normalize extrajudicial killings, and threaten democratic governance in Africa. Whether anchored in physical insecurity and ethnic suspicion in Nigeria or supernatural anxieties and witchcraft accusations in Zambia, digital publics weaponize deep-seated institutional distrust to construct alternative frameworks of justice. By transforming mob violence into mediatised spectacles and legitimizing scripts, these digital discourses erode constitutional protections and undermine public trust in formal judicial systems. Addressing this phenomenon requires recognizing online commentaries not merely as passive reactions, but as active, constitutive discourses that demand immediate, culturally sensitive, and multi-sectoral interventions to restore the rule of law.

Recommendations

1. Government communication agencies in Nigeria and Zambia should execute strategic digital campaigns designed to replace harmful tropes like "instant justice" with narratives emphasizing due process, utilizing trusted community figures and local languages.
2. Social media platforms and national communication regulators should refine content visibility algorithms to elevate human rights and rule-of-law discourses, while educational authorities integrate critical digital literacy modules into national civic curricula.

3. Zambian lawmakers and traditional leaders should collaborate to update the Witchcraft Act, criminalizing harmful sorcery accusations and leading community dialogues that demystify supernatural claims.
4. Civil society organizations should establish culturally tailored programmes, such as inter-ethnic dialogue initiatives in Nigeria and cultural demystification projects in Zambia, supported by transparent judicial communication to rebuild public trust in formal legal institutions.

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Conflict of Interest

The author declares no conflict of interest.

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Practices and Policies for Continuing Professional Development of Accountants: A Comparative Analysis of North Macedonia and Serbia

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Abstract: In the context of dynamic changes, globalization, and the growing need for enhanced transparency and high-quality financial reporting, continuing education, i.e., continuing professional development, represents a key factor in maintaining and enhancing the professional competencies of accountants.
The subject of this research is to analyze and examine the role and significance of continuing professional development for accountants and certified accountants, with particular emphasis on the policies and practices implemented in the Republic of North Macedonia and the Republic of Serbia.
The established research objective has been achieved through the application of appropriate research and analytical methods. The aim of the paper is to conduct a comparative analysis of the continuing professional development systems in the two countries by examining the legal framework, institutional arrangements, types of training, monitoring and control mechanisms, as well as the sanctions imposed for non-compliance with the prescribed obligations. The analysis indicates that, although the two systems share significant similarities in their fundamental structure, Serbia demonstrates a higher level of development with regard to digitalization and the diversity of educational programs, whereas the system in North Macedonia is more focused on the formal fulfillment of statutory requirements. The study contributes to the literature by identifying institutional and digital differences in CPD governance between North Macedonia and Serbia and by proposing policy recommendations for strengthening accountants' professional competencies in the era of digital transformation and artificial intelligence.
The conclusion of the paper presents opportunities for improving training and professional development systems through the adoption of best practices, enhancement of training quality, and the promotion of lifelong learning as a fundamental value of the accounting profession.
Keywords: accountants, certified accountants, regulatory framework, professional development, comparative analysis.

Introduction

Continuing Professional Development (CPD) represents an organized and continuous process of enhancing the knowledge and skills of accountants and certified accountants, with the objective of ensuring the high-quality, efficient, and professional performance of accounting activities. This process facilitates compliance with contemporary standards, legal regulations, and practices in the fields of accounting, finance, and taxation. All member organizations of the International Federation of Accountants (IFAC) are entitled and obliged to harmonize their national standards and educational programs for professional education, continuing development, and specialization with the requirements of the International Education Standards (IES 1–8), as well as to work towards the implementation and application of all international standards relating to the education and professional development of accountants. Recent studies indicate that digital transformation fundamentally changes the competencies required from accountants. Besides traditional accounting knowledge, accountants increasingly need digital literacy, data analytics competencies and AI-related skills.

Jingbo and Zaini (2026) systematically reviewed 22 empirical studies published between 2021 and 2025 to examine the use of artificial intelligence in higher accounting education. Their findings indicate that AI can improve learning efficiency, critical thinking, and other higher-order skills, while its adoption depends considerably on perceived usefulness and users' digital competencies. Nevertheless, academic integrity, excessive reliance on AI, and data privacy remain significant concerns. Although the review follows the PRISMA 2020 framework, the available evidence is dominated by quantitative perception-based studies from Asian emerging economies, with limited experimental and longitudinal research. The study therefore supports the inclusion of AI literacy, ethical judgment, data protection, and critical evaluation of AI-generated outputs in accounting curricula and continuing professional development programmes (Jingbo & Zaini, 2026).

Viviers et al. (2026) provide evidence that practice-oriented simulation can support the development of digital acumen, ethical awareness, decision-making, communication, and lifelong learning among postgraduate accounting students. A particular strength of the study is its convergent mixed-methods design, which links students' perceptions with assignment performance. However, the findings are based primarily on self-reported competence development within a specific postgraduate tax-education context, which limits their broader generalizability. The study is nevertheless relevant to continuing professional development because it suggests that accounting education should move beyond formal participation and technical knowledge toward authentic, technology-enabled activities with measurable learning outcomes. This supports the argument that CPD programmes should integrate digital, ethical, and professional competencies rather than focus solely on mandatory training hours (Viviers et al., 2026).

Arise and Moloi (2025) examine how artificial intelligence is reshaping the competencies required in the accounting profession and argue that accounting education must extend beyond traditional technical knowledge. Their AI Competency Adaptation Framework emphasizes digital literacy, critical thinking, problem-solving, ethical awareness, and responsible decision-making. Although the study is based on a literature review rather than empirical testing of the proposed framework, it provides a useful foundation for redesigning accounting education. Its findings are also relevant to CPD systems, which should incorporate AI-related competencies, faculty and trainer development, and ethical issues such as algorithmic bias and potential job displacement. Consequently, future-oriented CPD should support accountants in adapting to technological change rather than focusing solely on formal compliance requirements (Arise & Moloi, 2025).

Evidence from North Macedonia and Serbia indicates that awareness of artificial intelligence does not automatically translate into implementation readiness, as organizations continue to face shortages of professional expertise, institutional support, and clearly developed adoption strategies (Stojanovska-Stefanova et al., 2025).

In today's environment of rapid economic and technological change, the accounting profession is confronted with continuous challenges arising from globalization, digitalization, and increasing demands for transparency and accuracy in financial reporting. These developments necessitate the continuous updating of accountants' knowledge and competencies to enable them to respond effectively to evolving regulatory requirements and professional standards.

The implementation of information and communication technologies in the educational process, aimed at improving its quality and effectiveness, is not a new concept. As early as the late 1990s, it was recognized as one of the priorities in the education of accounting professionals (Todorović, 2022, p. 23).

Continuing Professional Development constitutes a fundamental element in maintaining and enhancing the competencies of accountants and certified accountants. As a profession, accounting must increasingly emphasize the continuous education of its practitioners, enabling them to advance their professional expertise, develop relevant knowledge and competencies, and represent the profession appropriately (Jeremić & Jakovljević, 2023, p. 4).

Within this context, the establishment of effective policies and practices for Continuing Professional Development represents a key prerequisite for the development of a high-quality and responsible accounting profession. Of particular importance is the role of the institutions responsible for regulating and supervising the professional development process, as well as the mechanisms for monitoring and evaluating the knowledge and competencies acquired. Continuing Professional Development encompasses the undertaking of appropriate activities that contribute to the continuous enhancement of professional competence and result in the expected development of professional knowledge, skills, values, ethics, and attitudes of accountants and/or certified accountants, as well as activities relevant to their current and future professional responsibilities (Annual Continuing Professional Development Programme, 2026).

Through the concept of Continuing Professional Development, accountants and certified accountants not only enhance their theoretical and practical knowledge but also fulfill the statutory requirements relating to the minimum standards for mandatory professional development. This contributes to maintaining their professional competence and credibility in the performance of their professional duties.

According to the American Accounting Association, accounting is defined as the process of identifying, measuring, and communicating economic information to facilitate informed decision-making by users of such information (American Accounting Association, 1966). In accordance with the applicable legal framework, accountants and certified accountants are required to participate regularly in Continuing Professional Development training programmes. Regional research provides additional evidence that digital transformation depends on more than the availability of technology. In North Macedonia, a considerable gap has been identified between organizations' interest in digitalization and their actual use of advanced digital solutions, with institutional support, financial capacity, and skilled human resources emerging as important constraints (Magdincheva-Shopova et al., 2025). A comparative study of SMEs in North Macedonia and Serbia similarly found that AI implementation readiness was influenced by access to expertise, organizational planning, perceived risks, and public institutional support (Stojanovska-Stefanova et al., 2025). Although these studies did not focus specifically on accounting CPD, their findings provide relevant contextual evidence that professional digital transformation requires coordinated investment in technology, institutional capacity, and human competencies. Although numerous studies analyse CPD from the perspective of accounting education and professional competence, very few compare CPD governance systems across neighbouring transition economies. To the best of the authors' knowledge, no comparative study has examined the institutional organisation, legal framework, digitalisation and monitoring mechanisms of CPD in North Macedonia and Serbia.

In the Republic of North Macedonia, these training programmes are organized and delivered by the Institute of Accountants and Certified Accountants, in cooperation with authorized legal entities licensed to provide education in the fields of accounting, finance, and taxation, as well as qualified individuals who are recognized experts in the relevant professional areas.

Unlike North Macedonia, where the Institute of Accountants and Certified Accountants performs the central coordinating role, in the Republic of Serbia Continuing Professional Development programmes are organized and implemented by relevant professional organizations and institutions, such as the Association of Accountants and Auditors of Serbia and the Chamber of Certified Auditors, in cooperation with accredited educational centres and other authorized legal entities. These organizations play a central role in designing and delivering educational programmes covering accounting, auditing, finance, and taxation.

In addition, Continuing Professional Development programmes may also be delivered by qualified individuals possessing appropriate professional expertise and competencies. In accordance with national legislation and international standards, CPD programmes are developed while ensuring continuous monitoring and proper record-keeping of accountants' participation in such educational activities.

Continuing Professional Development training is mandatory in both countries, although certain differences exist regarding its implementation. In order to maintain and enhance their professional knowledge in the field of accounting, accountants are required to complete a minimum of 90 hours of Continuing Professional Development over a three-year period, including at least 24 hours during each calendar year. The initial three-year cycle begins in the year following the year in which the accountant is entered into the Register of Accountants (Law on Performing Accounting Activities, "Official Gazette of the Republic of North Macedonia," No. 173/2022).

This system of mandatory Continuing Professional Development constitutes a fundamental mechanism for ensuring continuous professional growth, improving the quality of accounting services, and strengthening public confidence in the accounting profession.

The subject of this paper is the analysis of the Continuing Professional Development systems in the Republic of North Macedonia and the Republic of Serbia, with the aim of examining their characteristics, similarities, and differences. Through a comparative approach, the study seeks to identify best practices and highlight opportunities for improving the existing systems, thereby contributing to the enhancement of the quality and effectiveness of the accounting profession.

The remainder of the paper is organised as follows. Section 2 presents the methodology. Section 3 discusses the comparative findings. Section 4 interprets the results and discusses policy implications, while the final section concludes the paper.

Materials and methods

Depending on the established research objectives and the need to analyze the policies and practices of Continuing Professional Development (CPD) for accountants and certified accountants in the Republic of North Macedonia and the Republic of Serbia, this study employs qualitative and comparative research methods.

In preparing this paper, the research was primarily based on relevant laws and secondary legislation governing all aspects of the accounting profession and the obligations relating to Continuing Professional Development, as well as reports issued by the competent institutions and relevant professional and academic literature in the fields of accounting and professional education. In addition, official information concerning CPD training programmes, their methods of delivery, and the criteria for recording and monitoring CPD activities was examined.

The content analysis method was applied to examine and systematize the practices implemented in both countries, while the comparative method was used to identify the similarities and differences between their Continuing Professional Development systems, with particular emphasis on the legal framework, institutional arrangements, types of training programmes, and the mechanisms for monitoring and ensuring compliance with CPD requirements. Furthermore, the descriptive method was employed to explain the characteristics of the Continuing Professional Development programmes and to formulate appropriate recommendations.

The documentary corpus for North Macedonia included the Law on Performing Accounting Activities ("Official Gazette of the Republic of North Macedonia," No. 173/2022), the Rulebook on Continuing Professional Development (2024), the Annual Continuing Professional Development Programme (2026), and official information published by the Institute of Accountants and Certified Accountants. For Serbia, the analysis included the applicable Law on Accounting, the National Accounting Educational Standard ROS 31 – Professional Education and Development of Accountants, the Rulebook on Continuing Education and Professional Development of Accountants, the Association's Decision for 2026, and official information published by the Association of Accountants and Auditors of Serbia and the Institute of Accounting and Auditing. The documents were examined in relation to their regulatory scope, competent institutions, annual CPD requirements, recognized training formats, programme content, record-keeping procedures, monitoring mechanisms, consequences of non-compliance, and availability of digitally delivered training. The same analytical criteria were applied to both countries to ensure consistency, transparency, and comparability of the findings presented in Table 1.

To ensure a systematic and objective comparison of the Continuing Professional Development (CPD) systems in North Macedonia and Serbia, the analysis was conducted according to seven predefined analytical dimensions derived from the research objectives, the relevant legal framework, and the International Education Standards (IES) issued by the International Federation of Accountants (IFAC).

The selected comparison criteria were as follows:

- **Legal framework** – to examine the extent to which CPD is regulated by national legislation and professional regulations, including mandatory requirements for accountants and certified accountants.
- **Institutional arrangements** – to identify the competent professional bodies responsible for organizing, implementing, supervising, and coordinating CPD activities.
- **CPD obligations** – to compare the prescribed requirements regarding the number of mandatory training hours, reporting obligations, and compliance with continuing professional education requirements.
- **Delivery models** – to analyse the forms through which CPD programmes are delivered, including traditional classroom training, seminars, conferences, webinars, and online learning.
- **Digitalisation** – to assess the integration of digital technologies into the organisation, delivery, registration, and management of CPD programmes, including online platforms and digital learning opportunities.
- **Monitoring mechanisms** – to compare the procedures used for recording participation, verifying compliance, and maintaining professional development records.
- **Sanctions and enforcement** – to examine the legal and institutional consequences of non-compliance with mandatory CPD obligations and the effectiveness of enforcement mechanisms.

These analytical dimensions were selected because they represent the key institutional and regulatory components that determine the effectiveness of CPD systems. Together, they provide a comprehensive framework for evaluating similarities and differences between the two countries and for identifying best practices that may contribute to improving professional education, strengthening institutional capacity, and supporting the continuous development of the accounting profession in the context of digital transformation.

The comparison criteria were established before conducting the analysis in order to ensure methodological consistency and to reduce subjective interpretation. The same analytical framework was applied to both countries, allowing a transparent and comparable assessment of their respective CPD systems.

This methodological approach provides a comprehensive understanding of the existing systems and establishes a reliable basis for the comparative analysis and evaluation of the effectiveness of Continuing Professional Development systems in the two countries.

The research corpus consisted of national accounting legislation, secondary legislation governing continuing professional development, annual CPD programmes, regulations and reports issued by the competent professional bodies, and relevant IFAC International Education Standards. Documents were included when they directly regulated or described CPD obligations, delivery formats, monitoring procedures, digital learning opportunities, or sanctions applicable to accountants and certified accountants. General promotional materials and documents without a clearly identifiable institutional source were excluded from the analysis.

For North Macedonia, the corpus included the Law on Performing Accounting Activities, the Rulebook on Continuing Professional Development, the Annual Continuing Professional Development Programme, and official information published by the Institute of Accountants and Certified Accountants. For Serbia, the corpus included [insert the exact title and year of the applicable accounting legislation], the regulations of the relevant professional accounting bodies, CPD programmes, and official information concerning seminars, webinars, professional licensing, monitoring, and compliance.

The study is limited by the exclusive use of documentary analysis and does not include interviews or survey data.

Results

The results of the conducted analysis indicate that Continuing Professional Development (CPD) represents a key mechanism for maintaining and enhancing the professional competencies of accountants and certified accountants in the Republic of North Macedonia and the Republic of Serbia. Continuing Professional Development contributes significantly to the professional growth and competence of accountants and certified accountants (Rulebook on Continuing Professional Development, 2024).

The comparative analysis demonstrates that both countries have established mandatory Continuing Professional Development systems, with clearly defined obligations regarding annual participation in training activities, as well as mechanisms for monitoring and recording completed CPD activities. This reflects a high level of institutional commitment to the professional development of the accounting profession.

In the Republic of North Macedonia, the organization and coordination of all Continuing Professional Development activities are entrusted to the Institute of Accountants and Certified Accountants, in cooperation with authorized legal entities and qualified professionals. In contrast, in the Republic of Serbia, a larger number of professional associations and accredited institutions participate in the implementation of professional development programmes.

The Association of Accountants and Auditors of Serbia (SRRS) is a non-governmental, non-profit professional association of accountants in the Republic of Serbia, established in 1955. Its principal activities are focused on the development of the accounting profession, the education of its members, and the harmonization of national professional regulations with international standards and best practices. A significant part of the Association's activities is devoted to the continuous education and professional development of accountants, as well as to the continuous alignment of national educational programmes with internationally recognized educational standards, with the objective of improving financial reporting in accordance with international professional regulations (www.srrs.rs). The Institute of Accounting and Auditing was established in 1999 by the Association of Accountants and Auditors of Serbia.

The Institute of Accounting and Auditing is organized in such a way that, by drawing upon its extensive professional experience, it provides year-round support to its clients regarding the interpretation of legislation, the organization of business operations, and other issues related to their business activities. The Institute continuously organizes thematic seminars and webinars on current professional topics, provides direct consulting services, and publishes periodical publications as well as specialized professional editions (https://www.irr.rs/main/home).

Through the continuous education and professional development of its members, the Association of Accountants and Auditors of Serbia strives to accelerate the development and harmonization of the accounting profession while promoting the globalization of professional knowledge among accountants. The findings further indicate that Serbia has developed more advanced practices with respect to digitalization and the diversity of Continuing Professional Development programmes, providing greater accessibility and flexibility for participants. By comparison, the system in the Republic of North Macedonia remains more focused on fulfilling formal statutory requirements, with less emphasis placed on digital forms of professional education.

In both the Republic of North Macedonia and the Republic of Serbia, participation in Continuing Professional Development is mandatory. Consequently, any failure to comply with the prescribed legal obligations may result in the imposition of appropriate sanctions.

The similarities and differences between the Continuing Professional Development programmes in the Republic of North Macedonia and the Republic of Serbia are presented in Table 1.

Table 1: Similarities and Differences between the Continuing Professional Development Programmes in the Republic of North Macedonia and the Republic of Serbia

Criterion	Republic of North Macedonia	Republic of Serbia
Legal framework	CPD is legally mandatory for accountants and certified accountants	CPD is mandatory, regulated through professional bodies and legislation
Competent institutions	Institute of Accountants and Certified Accountants	Association of Accountants and Auditors of Serbia; Institute for Accounting and Auditing
Annual obligations (hours/credits)	Prescribed minimum annual hours of continuous education	Prescribed minimum number of hours (continuous education requirements)
Types of training	Lectures, trainings, online training sessions	Seminars, conferences, training sessions, online programmes
Monitoring system	Record-keeping through the institution (attendance and certificates)	Formal system for registration and reporting of activities
Control mechanisms	Institutional checks and verification procedures	More stringent control through professional bodies
Digitalization	Partially developed	More developed online learning systems

Source: Authors' own research

Note. The comparison is based on the legislation, professional standards, institutional regulations and official CPD information identified in the Materials and Methods section.

The comparative analysis of the implementation of Continuing Professional Development (CPD) programmes for accountants and certified accountants in the Republic of North Macedonia and the Republic of Serbia indicates that both countries have established mandatory CPD systems.

The reviewed institutional materials suggest that Serbian professional bodies offer a broader range of online and hybrid CPD formats. However, the available documentary evidence does not permit a definitive assessment of the overall effectiveness or quality of digitalized CPD provision in either country.

In the Republic of North Macedonia, the training activities are primarily focused on fulfilling formal legal requirements. The findings obtained from this analysis provide a basis for further improvement of CPD programmes through the adoption and implementation of best practices. This finding suggests that Serbian CPD has shifted from compliance-oriented education toward competence-based lifelong learning.

Discussion

The comparison showed that the existence of mandatory CPD requirements did not necessarily guarantee a competence-oriented professional development system. A predominantly compliance-based approach may ensure formal participation without demonstrating whether accountants have developed the digital, analytical and AI-related competencies increasingly required by contemporary practice. Therefore, the effectiveness of CPD should be assessed not only through completed training hours, but also through learning outcomes, practical application, and the capacity of professionals to respond to technological and regulatory change.

In the context of accelerated economic and digital changes in the business environment, Continuing Professional Development (CPD) programmes represent a fundamental element for ensuring quality and professional competencies within the accounting profession.

CPD training and the continuous enhancement of the knowledge and skills of accountants and certified accountants is not merely a legal obligation, but also a practical necessity arising from increasing demands for transparency, accuracy, and compliance with international standards, namely the International Education Standards (IES 1–8).

The comparative analysis between the Republic of North Macedonia and the Republic of Serbia indicates that both countries have established mandatory CPD systems, which reflects an adequate level of institutional regulation in this field. However, differences exist in terms of institutional structure, organization, and implementation methods.

The differences identified between the two countries may also reflect broader contextual factors, including institutional capacity, available financial resources, the supply of qualified trainers, the digital maturity of professional bodies, and regulatory inertia. Consequently, the apparently broader digital offer in Serbia should not automatically be interpreted as evidence of superior learning quality. Future evaluations should examine participation rates, completion data, learning outcomes, user satisfaction, and the practical application of acquired competencies.

A key role in improving CPD systems is played by digitalization processes.

However, digitalization should not be limited to the online delivery of conventional training. In line with Arise and Moloi (2025), CPD programmes should also integrate AI literacy, critical thinking, ethical awareness, and problem-solving competencies required by the changing accounting profession.

In this regard, the Republic of Serbia demonstrates a more widespread use of online training and flexible learning models, which provide greater accessibility and adaptability for accountants and certified accountants, compared to the Republic of North Macedonia, where CPD programmes are primarily oriented towards the fulfilment of legal obligations.
Previous research in North Macedonia identified a substantial gap between interest in digital transformation and the actual adoption of advanced technologies. Organizations mainly relied on basic digital tools, while limited financial resources, shortages of skilled personnel, and insufficient institutional support constrained more advanced transformation (Magdincheva-Shopova et al., 2025).
Based on the findings obtained, it can be concluded that there is a clear need for further improvement of the Continuing Professional Development process, particularly in the direction of digitalization and shifting the focus of training from mere compliance with obligations towards the enhancement of professional competencies. The effectiveness of CPD systems can be further improved through the introduction of more flexible and innovative learning models.
The originality of this study lies in providing the first comparative analysis of CPD governance systems in North Macedonia and Serbia, integrating legal, institutional and digital dimensions while identifying policy recommendations for strengthening professional accounting education in the context of digital transformation.

Conclusions

Continuing Professional Development (CPD) represents a key and mandatory element for maintaining and enhancing the competencies of accountants and certified accountants in the Republic of North Macedonia and the Republic of Serbia. It ensures compliance with contemporary legal regulations, international standards, and dynamic changes in the economic and technological environment, thereby directly contributing to the high-quality and professional execution of accounting activities.
Professional sustainability increasingly depends on employees' capacity to acquire new competencies in response to technological, economic, and organizational change. This reinforces the need for CPD policies that move beyond formal compliance and support the continuous development of relevant professional skills (Magdinceva Sopova & Stojanovska-Stefanova, 2024).
The comparative analysis of the implementation of Continuing Professional Development programmes for accountants and certified accountants in the Republic of North Macedonia and the Republic of Serbia shows that both countries have established mandatory systems of continuous education. In the Republic of Serbia, a higher level of institutional development is observed, particularly in terms of digitalization and the diversity of training programmes, whereas in the Republic of North Macedonia training activities are predominantly focused on the fulfilment of legally prescribed obligations. The findings obtained provide a basis for further improvement of CPD systems through the application of positive experiences and best practices.
The study was limited to documentary analysis and did not assess accountants' experiences, satisfaction, learning outcomes, or the practical application of competencies acquired through CPD. Therefore, the findings should be interpreted as a comparison of formal regulatory and institutional arrangements rather than a definitive evaluation of CPD effectiveness. Future research should combine document analysis with surveys or interviews involving accountants, certified accountants, regulators, professional bodies, and training providers in both countries.
Based on the conducted analysis, it can be concluded that Continuing Professional Development represents a fundamental prerequisite for the development of a high-quality, responsible, and trustworthy accounting profession. In the future, it is particularly important to

further enhance these systems by increasing digitalization, expanding the range of training programmes, and placing greater emphasis on the practical application of acquired knowledge, with the aim of improving the effectiveness of professional development.

Conflict of interests

The authors declare no conflict of interest.

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Operationalising Responsible AI Governance in Financial Crime Compliance: An Evidence-Based Control Framework for Financial Institutions

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Abstract: Purpose: The deployment of artificial intelligence in financial institutions now focuses more on transaction-monitoring alerts and investigative support, but responsible-AI principles at a higher level do not address the evidentiary requirements for reconstructing decisions. This paper provides an auditable governance solution to this challenge. **Methodology**: Conceptual design science research applies framework synthesis and thematic analysis to the Monetary Authority of Singapore FEAT principles and Veritas methodology, the NIST AI Risk Management Framework and Generative AI Profile, Financial Action Task Force technology guidance, the European Union Artificial Intelligence Act, model risk guidance, and explainability and human factors literature. **Results**: The Governance-to-Evidence Responsible AI Framework maps the mandate and ownership, data and fairness, model validation, decision orchestration, human accountability, and continuous assurance control domains to decision rights, controls, and retained evidence. An illustrative transaction-monitoring use case demonstrates how controls depend on consequence. **Conclusions**: The responsible adoption of AI requires the governance of the entire decision-making process, rather than only the accuracy of models and human-in-the-loop. **Recommendations**: Institutions should consider use case classification, independent validation, user-oriented explanation, decision logging, third-party controls, sampling for closure, and suspension controls. **Additional data**: The framework is conceptual; there were no human participants, no confidential data, and no production results.
Keywords: financial crime compliance; anti-money laundering; FATF risk-based assessment; AI governance; human oversight; Governance-to-Evidence Responsible AI Framework.

Introduction

Problem context and transaction-monitoring scope

Detecting complex forms of financial crime across more customers, transactions, devices, and counterparties requires more sophisticated alerting technology. Transaction monitoring on a rules-based engine is still necessary but generally results in big populations of alerts that need to be reviewed manually. Machine learning can prioritize alerts, recognize non-linear patterns, and show relationships that cannot be recognized by static rules. Artificial intelligence can find procedures, synthesize case documents, and draft narratives. The application of interest in this paper is alert prioritization: Alerts are generated by existing rules, the AI model estimates their investigative priority, and human operators decide on their further action.

There are risks on both sides of a decision. A false positive will slow down or harm a legitimate customer; a false negative will let suspicious transactions go unnoticed. AI can affect the order in which alerts are investigated, which investigations will get less attention, and what evidence will come into play for a decision maker. Accuracy will not be sufficient to control these effects. Purpose, data, threshold, human authority, explanation, record-keeping, change control, and challenge should all be governed as part of the decision process.

Transaction monitoring is a good case study for responsible-AI governance since the algorithm works in combination with other mechanisms in a regulated process of customer-risk assessment, sanctions controls, investigation decision-making, quality assurance, suspicious transaction reporting, document retention, and oversight. A prioritization score may be just advisory in theory, but its place in the process may determine which alerts are to be considered in case of scarce investigative resources. Responsible governance then requires paying attention not only to the technical characteristics of AI but to how it influences the process, including such parameters as function-specific influence, data availability and quality, threshold, human operator's authority, transparency of the AI process, record-keeping, and change control.

The same issue arises regarding efficiency claims. Reducing the number of alerts, decreasing the time of investigations, or reducing the backlog can be important, but each of these measures is insufficient without understanding of residual risk and the quality of decisions made. The system might become more efficient on average while accumulating more risk within one customer segment or a new typology. Alternatively, it could increase efficiency by delegating verification tasks to quality assurance team members. Therefore, responsible operating model must define efficiency as sustainable improvement in detection, investigation quality, impact on customers, resilience, and cost.

Conceptual foundations and research gap

Responsible-AI guidance centres on the principles of fairness, transparency, accountability, privacy, robustness, and human oversight (Jobin et al., 2019). In finance, the Monetary Authority of Singapore (MAS, 2018) captures the FEAT principles through fairness, ethics, accountability, and transparency, while the Veritas method helps with the actual assessment (MAS, 2022a, 2022b). Risk management at the National Institute of Standards and Technology (NIST, 2023) consists of Govern, Map, Measure, and Manage steps; the Generative AI Profile covers the risks such as confabulation, information integrity, privacy, security, and human–AI interaction (Autio et al., 2024). Financial Action Task Force (FATF, 2021) encourages technology that enhances AML/CFT effectiveness without disrupting the risk-based approach. These guiding documents give direction but do not explicitly describe how a financial institution will show that certain AI-assisted result was approved, reviewed, and monitored. Thus, the operational gap is the gap between the principle and the proof. While the policy states that the AI should be fair and accountable, the auditor still needs to know which model and version of data was used, which threshold, whose review was performed, why there was an escalation (or not), and what happened when the limitations were identified.

The EU Artificial Intelligence Act strengthens risk management, documentation, record-keeping, human oversight, accuracy, robustness, and cybersecurity of covered systems (European Parliament & Council of the European Union, 2024). Guidance on model-risk and operational resilience further stresses the importance of challenge process, change control, governance, and recoverability (Basel Committee on Banking Supervision, 2021; Board of Governors of the Federal Reserve System & Office of the Comptroller of the Currency, 2011). These documents are not considered as equally binding; they provide different control needs for the synthesis.

The socio-technical systems theory states that the outcome is a product of joint design of the technology, people, task, and organization (Bostrom & Heinen, 1977). The institutional theory shows how the regulatory and professional pressures shape the governance structure (DiMaggio & Powell, 1983). The dynamic-capabilities theory concentrates on sensing and reconfiguration of the resources (Teece et al., 1997). Taken together, the above-mentioned theories suggest that the responsible adoption should be based on technical assurance, institutional accountability, and operating capability that adapt to changing crime typology, data, and models.

The second gap is related to the unit of governance. Many responsible-AI publications focus on the model, whereas the regulated outcome is an artefact of the combined design of the data pipelines, business rules, model scores, thresholds, interfaces, people, processes, vendors, and fallback arrangements. While the model remains unchanged, threshold changes, data source switch, interface redesign, or staff changes significantly alter the result. At the same time, minor changes in the model might require increased review if the population routed to the investigation changes. Thus, GERAI considers the decision pathway as the object of governance and models as components of that pathway.

The third gap is related to the symmetry of evidence. Most of the governance programs keep more information about the escalated cases since escalation leads to investigation and reporting. However, AI prioritization leads to one of the greatest blind spots in the form of alerts that do not require increased attention. When an institution cannot recreate the non-escalation pathway, it is impossible to understand whether an adverse outcome is caused by the model score, the threshold, the interaction of the rules, missing data, interface design, reviewer workload, or authorized override. The symmetric evidence does not mean that every case needs to be independently reviewed; it means that there should be enough version-controlled information and risk-based sampling of the pathways.

Research question and contribution

The main research question is: how may financial organizations apply responsible AI principles as auditable controls for AI-supported financial crime compliance? Some subordinate research questions will address special transaction monitoring risks, proportional deployment of AI and evidence needed to reproduce escalation and non-escalation decisions. The paper provides contributions in the form of GERAI Framework, standards mapping, illustrative case study, and testable propositions. GERAI is not a substitute for AML/CFT programs or model risk management but rather links them through decision rights and evidence retained.

Key terms and abbreviations

AI stands for artificial intelligence; AML/CFT for anti-money laundering and countering the financing of terrorism; FATF for Financial Action Task Force; FEAT for fairness, ethics, accountability, and transparency; GERAI for Governance-to-Evidence Responsible AI Framework; MLRO for money laundering reporting officer; NIST AI RMF for NIST Artificial Intelligence Risk Management Framework; and XAI for explainable artificial intelligence. In the current research, evidence object refers to a retained artifact that provides evidence of a control or decision, whereas decision orchestration refers to the thresholds, routing rules, overrides, and fallbacks associated with the model output.

Materials and methods

Research design

This is a conceptual, non-empirical study using design science methodology. It is fitting in design science methodology because it involves creating and assessing artefacts to solve known organisational problems (Hevner et al., 2004; Peffers et al., 2007). In this case, it is not software but a governance control framework. It has the following design goals: proportionality, lifecycle consideration, traceability, accountable human intervention, challenge, compliance governance integration, and applicability to internally created and third party systems.

The design science process involved six connected activities based on a proven methodology: problem identification, definition of design goals, artefact construction, demonstration through illustrative use case, conceptual evaluation against source requirements and limitations and propositions communication. The problem to be solved is the existence of the gap between the principles and their reviewable evidence. Design goals were obtained from the recurring

requirements within the selected governance tools. Then, the construction was done in iterations: candidates domains were combined when they referred to the same decision right and divided when there were different owners, controls and evidence required. Next, the transaction monitoring example was used for revealing gaps in controls and accountability.
The artefact was evaluated through traceability, completeness, internal consistency, proportionality and implementation. Traceability questioned whether all domains were linked to a recognised governance requirement. Completeness asked whether the framework included design, deployment, operation, change, incident and retirement considerations. Internal consistency questioned whether the decision rights corresponded with the control ownership and evidence. Proportionality questioned whether the approach was able to differentiate insignificant assistance from material automation. Implementation questioned whether the evidence suggested was feasible by ordinary governance, model risk, compliance, technology and audit procedures. This is an analytical evaluation and not empirical proof of effectiveness.

Search strategy and selection criteria

A literature search for relevant academic articles was undertaken between February and August 2026 and updated on 10 August 2026. Academic sources were found via Google Scholar and publishers' archives; regulatory and standards sources were obtained from the MAS, NIST, FATF, EU, BIS, and United States banking supervisor archives. Search combinations used were: ("responsible AI" AND finance), ("AI governance" AND AML), ("transaction monitoring" AND explainability), ("human oversight" AND automation bias), fairness without demographics, counterfactual explanations, and (generative OR agentic AI) AND governance. Inclusion criteria required sources to be published/accepted in English, relevant to a specific governance requirement/control design, and either authoritative regulation or standards, or peer-reviewed research that served as foundational or application-specific literature. Theory predating the search period was included if necessary. Duplicate sources, commentaries without methodology, vendor marketing, and irrelevant sources to the artefact were removed. There remained 23 sources after synthesis. As the objective was artefact development rather than estimating an intervention effect, the review is purposive and not systematic in nature, with no meta-analysis undertaken.

Framework synthesis and conceptual evaluation

The material selected was examined through thematic content analysis and framework synthesis. Requirements in regard to governance, fairness, transparency, validation, human supervision, documentation, third party involvement, and monitoring were coded and aggregated. Each of these themes was checked against four questions: What risk is mitigated? To whom the decision rights belong? What kind of control enables the requirement to work? What kind of evidence allows future reconstruction and validation? The resulting areas were compared to FEAT and the NIST AI RMF in terms of coverage and were then used to check coherence and usability in case of transaction monitoring. The evaluation is conceptual; neither any claims about production effectiveness nor any claims of statistical validation are made.
Coding was done at the level of actionable requirements and not just keywords. Thus, accountability references were separated into ownership, approval authority, review competency, escalation, and evidence preservation since each of these means something different in terms of control. Similarly, transparency was divided into data lineage, model documentation, local interpretation, user communication, and management reporting. Human supervision was separated not by its presence or absence but rather by reviewer's access to information, time, competence, authority, and ability to influence the outcome. That allowed avoiding counting one policy as control for several different requirements.

The crosswalk has been designed in order to find a design tool and not to prove that all frameworks cover the same area and have the same legal status. FEAT provided finance-specific principles; Veritas provided guidance in terms of assessment; the NIST AI RMF provided lifecycle risk functions; FATF placed the technology in the context of risk-based AML/CFT; the EU AI Act supported the ideas of documentation and oversight; and banking guidelines provided guidance in terms of validation, change control, and resilience. Necessary differences were preserved. The synthesis, therefore, helps designing institutional control but does not give any jurisdictional legal opinion or determine if an application belongs to the statutory risk category.

Results

The GERAI artefact

GERAI operates on a basic design rule: a principle is auditable if it has an accountable actor, a control, and an evidence object to retain. Figure 1 illustrates the chain of logic from external principles to governance outcomes. The framework comprises six control domains, which are not phases in an ad hoc project.

Mandate and ownership define permitted purpose, prohibition of uses, autonomy, risk classification, approval and suspension authority. Data and fairness manage provenance, quality, relevance of features, proxy risk, missingness, and differential effects. Validation verifies discrimination, calibration, stability, sensitivity, explainability, security, resilience, and user interface. Decision orchestration controls thresholds, routing, override conditions, mandatory escalation, segregation of duties, and fallback. Human accountability includes reviewers competent in information and process, having enough time and authority to disagree. Continuous assurance monitors drift, data quality, performance, overrides, complaints, quality-assurance results, incidents, and typology evolution.

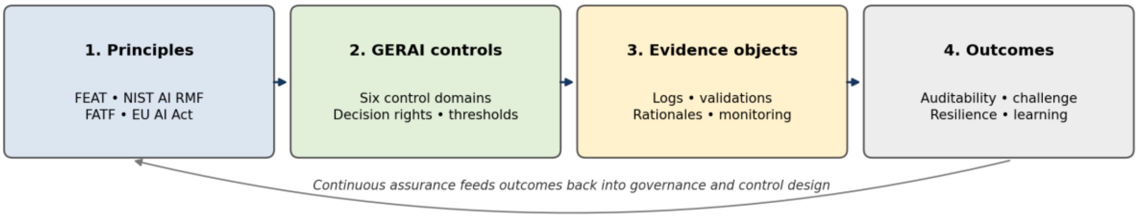
Table 1 correlates each domain with the evidence objects that management, validation, internal audit and supervisors can sample. GERAI enables prospective accountability prior to deployment, concurrent accountability during deployment, and retrospective accountability in case an outcome is disputed.

The six domains operate as a system of control. Mandate defines what the use case is allowed to do; data and fairness specify what information may influence the decision; validation specifies under what conditions trust is warranted; orchestration transforms output into workflow; human accountability controls judgment and challenge; and continuous assurance decides whether the original reasons for approval are still valid. Weakness in one domain cannot be made up for by strength in another. For instance, a well-calibrated model does not cover the problem of an unauthorized use, and a human approval step does not cover the problems of an uncertain interface and of workload making the review perfunctory.

Evidence objects need to be designed in tandem with controls. A threshold approval control is incomplete if the organization cannot find out about the approved value, its validity period, reasons, covered population, approving entity, dependencies of validation, and rollback condition. Similarly, a human review control is incomplete if the record does not include information presented, relevant warnings issued by the system, reviewer's decision and rationale where needed, and any escalation and override actions. The design of evidence objects specifies the retention, access, integrity, and correlation needed to preserve usability of the record without generating uncontrolled repositories of sensitive information.

GERAI uses three assurance horizons. Prospective assurance focuses on purpose, risk classification, data suitability, testing, approval, training and fallback prior to deployment. Concurrent assurance documents versions, inputs, scores, decision rules, human actions and exceptions during the decision-making process. Retrospective assurance samples outcomes, investigates incidents, assesses drift and complaints, and provides feedback into thresholds, training, validation or suspension. The horizons make the governance dynamic: evidence is not only stored for audit but also used to check whether the underlying assumptions of the approval are still valid.

Figure 1: Governance-to-evidence logic of GERAI



Source: Author's synthesis.

Table 1: GERAI control domains and core evidence

Domain	Control objective	Core evidence
Mandate and ownership	Define purpose, autonomy, owners, approvals, and suspension	Use-case charter; risk classification; RACI; approval
Data and fairness	Control provenance, quality, feature rationale, proxies, and outcomes	Lineage; data tests; feature register; segment analysis
Model validation	Establish fitness, limitations, robustness, and explanation quality	Model card; validation report; limitations log
Decision orchestration	Govern thresholds, routing, overrides, escalation, and fallback	Decision log; threshold approval; fallback test
Human accountability	Enable competent, authorised, meaningful challenge	Rationales; overrides; QA results; training records
Continuous assurance	Detect drift, incidents, and control deterioration	Dashboard; incidents; revalidation; board reporting

Source: Author's synthesis based on MAS (2018, 2022a, 2022b), NIST (2023), and FATF (2021).

Proportional controls and explainability

Control Intensity relies on consequence, autonomy, uncertainty, data sensitivity and customer or regulatory effect. An alert retrieval assistant which identifies approved procedures but cannot make changes to a case involves less consequence than an automatic alert closure or customer limitation. This is demonstrated in Table 2. Less consequence never indicates ungovernance: access, source integrity, testing, logging, and ownership are all still required.

Interpretability is context-dependent, depending on audience and decision being made. LIME explains predictions locally (Ribeiro et al., 2016) whereas SHapley Additive exPlanations (SHAP) explain how the prediction was attributed (Lundberg & Lee, 2017). Counterfactual explanations provide changes that would be associated with a different prediction (Wachter et al., 2017). All of these are tools and do not provide justification or evidence of causation and correctness. The validator will require stability and fidelity tests; the investigator requires concise risk indicators and source evidence; the board requires limitations, trends, and incidents. User-centred design should start with the question that is to be asked and then test if explanations help with a proper challenge to the system, not passive acceptance (Liao et al., 2020). In consequential decisions, an interpretable model may be better than the post hoc explanation of the black box (Rudin, 2019).

Fairness in AML/CFT does not involve statistical parity irrespective of risk. The differentiation in terms of risk might be justified when explained and proportionate. When protected attributes cannot be legally or practically used by the institution, they should not presume that fairness cannot be evaluated. They can perform quality and error rate checks across available operational segments, do worst-case sub-group analysis and proxy analysis, check complaints and overrides, and employ techniques developed for evaluating fairness without using demographic variables as additional diagnostic techniques (Lahoti et al., 2020). Such techniques must be validated properly.

Table 2: Proportional governance by use-case consequence

Use case	Consequence	Minimum control response
Retrieve approved procedure	Lower	Approved sources; access control; citation; answer logging; owner
Summarise case evidence	Moderate	Source traceability; factuality check; human edit; no unsupported claims
Prioritise alert queue	High	Independent validation; segment tests; overrides; closure sampling; fallback
Close alert or restrict customer	Very high	Named human approval; enhanced validation; complete decision record; appeal/escalation

Source: Author's synthesis.

Illustrative transaction-monitoring application

Take a model that maximises detection of alerts produced by current rules. Mandated prohibitions preclude automatic reporting of suspicious transactions, closing accounts and reusing model predictions. Compliance responsibility belongs to the MLRO, not the owner of the model who cannot independently tune a threshold affecting the scope of the investigation. There are data lineages from source transactions and customer attributes to approved features with a rationale for their relationship with financial crime. Historical dispositions are assumed noisy labels, not an objective truth.

The validation tests the model against the current process and any alternative process. They include recall of quality-assured escalations, precision at proposed thresholds, calibration, stability, sensitivity to missing data, segment errors, scenario tests, service failure, and investigator usability. Volume reduction is only counted as success when residual risk and quality of investigations are acceptable. Low-priority alerting option comes into play only after governance accepted the residual risk; sanctions escalation, law-enforcement requests, specified high-risk typologies, and missing critical data always take precedence over the score. In case of a model failure, rules-based backup process is used after testing.

Decision log keeps alert identifier, time stamp, referenced inputs, version of the model and feature pipeline, score, threshold, explanation, override trigger, assigned reviewer, disposition, rationale and approvals. Quality assurance purposely uses low-priority closures because governance needs to explain why the alert was not escalated, not only why another alert was. Human oversight is calibrated by consequences, and user interface presents uncertainty and evidence rather than score as the answer. This approach is suggested as bounded automation architecture and will have to prove itself empirically.

The implementation starts with establishing baseline for the current process. Institution describes rule coverage, alert volumes, age of queues, investigator resources, quality assurance findings, gaps in typologies knowledge, distribution of outcomes. Baseline makes comparison possible and protects new model from taking credit for improvements resulting from other factors, like tuning rules or hiring more people. At the same time, it helps to establish controls that need to operate independently of the model, including sanctions escalation, law-enforcement requests, mandatory scenarios and manual referral routes. Approval criteria must be defined before the pilot to avoid motivated interpretation of the results.

A controlled pilot can utilise shadow operation prior to live application of the model. Scores and explanations are calculated and logged, but the current process still controls the routing of alerts. The reviewers evaluate recommendations against actual cases, register any disagreements, and point out flaws in explanations or user interface. When live usage starts, its scope can be limited by customer population, typology, geography or queue. Expanding into new territories happens based on pre-defined criteria, not just feeling of success. Rollback conditions include material drift, data failure, unexplained segment degradation, excessive overrides, missed mandatory scenarios, service instability, and evidence gaps that make reconstruction impossible.

Population for low-priority alerts requires explicit quality assurance because outcomes are likely to appear after some time. Samples can be taken at random, risk-based, near-threshold cases, new customer/new product segments, unusual missing data patterns, and alerts that were impacted by recent changes. Reviewers evaluate whether there is enough evidence to close the alert and whether the model or workflow prevented escalation of this particular case. Findings should be traced to root cause and corrective actions, not just presented as aggregate error rate. Information that arrives later, such as escalation or law-enforcement response, should be considered when possible.

Third-party, generative, and agentic AI governance

Third-party procurement does not shift responsibility. Due diligence and contractual arrangements should cover data rights, confidentiality, security, documentation of training-data and model where available, validation access, performance assurances, incident reporting, subcontracting, change notification, continuity, audit privileges, and exit provisions. Institutions should document components they cannot independently evaluate and assess whether compensating controls mitigate residual risk to an acceptable level. Vendor model changes should not occur without internal change control approval.

For generative AI, evidence should include the use approval, sources retrieved, prompt and model version where proportional, citations, automated and human reviews, edits and approval. Unsubstantiated language should not enter a regulatory report just because it sounds plausible. Agentic multi-step workflows need controls over permissions, action limitations, memory, delegation, intermediate decision-making, and termination of process. Logs should cover tool invocation and hand-offs; high-impact actions require human oversight; and independent testing should validate prompt injection, unauthorized tool invocation, cascading error, and inability to terminate. These extensions extend the NIST governance principles to higher levels of system autonomy and not assume that autonomy is safe (Autio et al., 2024; NIST, 2023).

Vendor governance record should specify what the institution knows, what vendor guarantees, what an independent third party has tested and what is opaque. Opaque components increase rather than eliminate the necessity for outcome testing, contractual notification, interface management, monitoring, and exit strategy. Significant changes made by vendor should be traced to internal validation requirements, such as changes in training data, model architecture, safety controls, hosting provider, subprocessor, data location, or service agreement terms. Concentration and continuity analysis should cover availability of evidence, configurations, prompts, and decision history in case of service suspension or replacement.

Generative systems also complicate the distinction between retrieval and creation. A response approved through the process might still omit a qualification, combine sources inappropriately or express a tentative judgment with undue certainty. As a result, controls should confirm that the source is authoritative, up-to-date, aligned with the citation, consistent with the facts, avoids prohibited data, and the distinction between summary and decision-making. In case where generated content serves as basis for a regulatory report or customer correspondence, the human approving the document should have access to the relevant source materials and edits. The documentation kept for the purpose should be proportional to consequence and avoid retention of sensitive prompts any longer than necessary.

Agentic systems also introduce additional risks related to state and delegation. Agent may choose the tool to use, create a subtask, invoke another agent, modify plan, or take action based on intermediate results. Governance framework covers the whole execution graph: who initiates, objective, permissible tools, actors delegating, data accessed, intermediate decisions, approvals, termination criteria, and the final action. Least privilege, transaction limits, sandboxing, timeouts, and human review limit impact. Evaluation includes adverse and failure scenarios like conflicting instructions, tool unavailability, corrupt memory, cyclic delegation, repeated action, and partial execution. The final answer is not enough evidence if the process can affect external records or case status.

Metrics and operating model

Third-party procurement does not relieve anyone from their responsibilities. Due diligence and contracts should address data rights, confidentiality, security, training data and model documentation when applicable, validation access, performance guarantees, incident reporting, subcontracting, change notification, continuity, audit rights, and contract termination terms. The organizations should document the components that are outside their capability to evaluate and determine whether mitigating controls reduce the remaining risk to an acceptable level. Changes to vendor models should not happen without internal change control approval.

When dealing with generative AI, the evidence base should include the use approval, sources used, prompt and model version when proportional, citations, automated and human reviews, edit and approval. Unsupported language should not be included into a regulatory report only because it sounds like a plausible statement. Agentic multi-step workflows will require controls around permission, action restriction, memory, delegation, intermediate decision making, and process termination. Log should capture tool invocation and hand-offs; high impact actions need to have human approval; and independent testing should validate prompt injection, tool invocation without authorization, cascading errors, and inability to stop the process. These additions extend the NIST governance principles to the higher levels of the system autonomy and do not assume that autonomy is safe (Autio et al., 2024; NIST, 2023).

The vendor governance record should include what is known by the institution, what the vendor guaranteed, what was tested by the independent third party and what is opaque. Opaque components increase rather than decrease the necessity for outcome testing, contract notification, interface management, monitoring and exit strategy. Major changes made by the vendor should be tracked to the internal validation requirement, such as changes in training data, model architecture, safety controls, host, subprocessor, data location, and service agreement terms. Concentration and continuity analysis should be done in relation to the availability of evidence, configurations, prompts and decision history in the event of suspension or replacement of the service.

Generative systems make the difference between retrieval and creation more ambiguous. An output that was approved through the governance process could still omit a qualification, combine the sources improperly, or state a tentative opinion with unwarranted confidence. As a result, the controls should confirm that the source is authoritative, current, aligns with the citation, is factually correct, does not use prohibited data, and the distinction between summarization and decision-making. When the output becomes the basis for a regulatory report or customer communication, the person approving it should have access to the source material and be able to make the necessary corrections. Documentation that needs to be maintained for this purpose should be proportional to the consequence and should not retain sensitive prompts longer than needed.

State and delegation are new risks associated with agentic systems. The agent could decide on the tool usage, initiate a subtask, call another agent, modify the plan, or act based on the intermediate result. Governance framework should cover the entire execution graph, including who started the process, goal, permitted tools, actors delegating, data used, intermediate decisions, approvals, termination criteria, and the final action. Least privilege, transaction limits, sandboxing, timeouts, and human review reduce the impact. Evaluation should account for adverse and failure scenarios like inconsistent instructions, unavailable tools, corrupted memory, cyclic delegation, repeated actions, and incomplete execution. The answer itself is not enough evidence if the process has an impact on the external records or case status.

Table 3: Balanced governance scorecard

Dimension	Illustrative indicators	Governance question
Effectiveness	Recall; escalation quality; typology coverage; review time	Is detection improving within residual-risk appetite?
Fairness	Segment errors; delays; overrides; complaints	Is differential treatment risk-relevant and justified?
Reliability	Drift; missingness; outages; open findings	Does the system remain within validated limits?
Human oversight	Override patterns; QA defects; review time; competence	Can reviewers understand and challenge outputs?
Operational value	Queue age; hours redeployed; case quality	Does value remain consistent with control quality?

Source: Author's synthesis.

Discussions

Contribution and theoretical propositions

The GERAI framework contributes in three ways. First, it reconceptualizes responsible AI as an evidence architecture. Documentation is not merely administrative detritus but the means by which to challenge, assure, and learn from decisions. Second, it takes non-escalation as a governance outcome. Prioritization places risks in the less-attended population, making closure sampling and delayed-outcome analysis critical. Third, it couples responsibility with bounded efficiency. Explicit constraints and evidence enable limited forms of automation rather than an either/or between innovation and control.

In turn, the framework suggests four propositions for future research. P1: There is a positive association between greater governance-to-evidence traceability and auditability. P2: Data governance and independent validation moderate the association between AI capability and compliance effectiveness. P3: Meaningful human oversight mediates the association between model recommendation and accountable outcomes. P4: Continuous assurance contributes to operational resilience through early detection and treatment of drift, data failure, and control breakdown. The four propositions bridge socio-technical joint design, institutional pressure, and dynamic reconfiguration.

The evidence-architecture approach explains why governance maturity should not be measured on the basis of the existence of policies and committees alone. Two institutions could implement identical principles yet vary considerably in the extent to which they are able to reconstruct decisions, locate accountable owners, prove that constraints have been followed, and respond to degradation. This framework proposes a maturity path from the development of principles to controls to linked evidence and analysis, and even beyond to continuous analysis and reconfiguration. The highest level is not maximal automation. It is the consistent ability to change or terminate automation when evidence no longer supports it.

In addition, the framework implies some testable constructs. Traceability may be measured as the percentage of decisions for which purpose, version, threshold, owner, rationale, and assurance status are retrievable. Meaningful human oversight may be measured as the extent to which reviewers comprehend explanations, disagree appropriately, override recommendations effectively, escalate problems, and the time and data that are available to them. Continuous assurance may be measured as the time required to detect, investigate, and remedy problems of drift and control breakdown. Further research may test the association between these constructs and audit findings, decision quality, and incident severity.

Human factors, practical tensions, and proportional implementation

A nominal human-in-the-loop approach is inadequate where throughput goals, persuasive interfaces, or absence of authority pressures agreement. Automation could be abused through over-reliance or disrespected through under-reliance (Parasuraman & Riley, 1997). Supervision should therefore be tested via disagreements, quality outcomes, speed, and the ability to get evidence and elevate limits. Explanation fidelity, rather than visual appeal, should be evaluated using appropriate standards (Doshi-Velez & Kim, 2017).

Retention of evidence can clash with issues of privacy, minimization, security, and retention duties. The segment analysis may be limited by legal access and sample size. Explanations may reveal sensitive detection processes or promote gaming. The above contradictions need documentation of balanced decisions, access controls, retention schedule, aggregation, and risk tolerance—rather than the assumption that transparency equals unlimited disclosure.

The basic standard for smaller financial institutions and fintech businesses would include: AI inventory, accountable owner, statement on use allowed, data records, proportionate validation, logging of decisions with material impact, human escalation, incident management, oversight and monitoring, and third party exit plans. Independent expert knowledge can be secured from external parties; however, the management is responsible for accountability. Additional activities by bigger organizations can include specialized validation, automated evidence pipeline, cross-use-case analytics, and assurance. Proportionality impacts the depth and frequency of controls, not the existence of essential controls.

Limitations and future research

GERAI itself is a theoretical construct, emerging from a purposeful review of the literature and not yet validated through empirical studies in production environments. The example application is a simplification of numerous models, pipelines, vendors, investigation teams, and reporting regimes. Inadequate ground truth limits assessment of AML/CFT systems and the preservation of evidence introduces additional privacy and security risks. The framework does not answer jurisdictionally specific legal questions.

Further research will rely on expert interviews and comparative case studies, followed by controlled pilots that evaluate investigator challenge, quality of decisions, closure certainty, and auditability. Survey research could be conducted to examine the hypotheses about relationships between the maturity of the governance, the pressure from regulators, adoption and operational resilience. Additional work is required on explanation fidelity, fairness without the presence of protected attributes, delayed outcomes, privacy-preserving collaborative analytics, and governance of agentic systems involving delegation and tools.

Empirical evaluation should not equate the deployment to one intervention. Comparative designs would allow investigating how variations in threshold values, explanations, workload, training of reviewers, and evidence design impact outcomes while keeping the underlying model constant. The mixed-methods approach would be especially useful: the quantitative analysis can help to measure error rates, delays, overrides and drift, and interviews and observations can identify whether reviewers understand explanations, perceive challenges to recommendations, and develop workaround strategies. The research designs should include populations of low-priority and non-escalated cases whenever possible because otherwise the bias of exclusive focus on confirmed cases would replicate the very asymmetry that GERAI aims to address.

The cross-institution research can investigate proportionality in community banks, fintech firms, multinational banks and outsourced compliance. Among other things, such research should evaluate the adequacy of external validation to ensure independence of small institutions, what evidence objects can be standardized across vendors and how the expectations of supervisory authorities vary depending on advisory or autonomous function of an institution. For the generative and agentic applications, the longitudinal design is required to separate the effect of pilot performance from the effects of typology change, staff turnover, vendor releases and production pressure.

Conclusions

What matters is not whether an organization utilizes AI, but whether it can control its integrated system of data, models, rules, people, vendors, and decisions. GERAI takes well-established guidelines on responsible AI and applies them across six domains of control linked to responsible actors, controls, and evidence objects. It includes the focus on decision orchestration, meaningful human challenge, third party governance, and non-escalation path, expanding the scope of governance beyond model performance.

Practitioners have a proportional way of implementing principles through GERAI. For supervisory bodies, it serves as the source of challenge. For researchers, it serves as the testable artifact and propositions. The responsible implementation must be evaluated according to the ability of the organization to understand what happened, why it was possible, who was responsible, what controls were used, and what lessons were learned from it. Empirical validation is the logical step forward.

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Conflicts of Interest

The author declares no conflict of interest.

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Integrating Artificial Intelligence into contemporary research and scientific writing: Ethical consideration and a methodological framework

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Abstract: Artificial intelligence (AI), particularly generative AI and large language models (LLMs), is increasingly used to support literature discovery, research organization, data analysis, coding, and scientific writing. This narrative and conceptual review examines how AI can be integrated into postgraduate research and manuscript development, with particular attention to the Nigerian higher-education context and to agricultural, environmental, GIS, and health-related research. The synthesis identifies opportunities for improved efficiency and communication alongside risks involving inaccurate or fabricated information, algorithmic bias, authorship ambiguity, confidentiality, inappropriate reliance on generated text, and weaknesses in academic integrity. Five research questions guide the synthesis: the transition from conventional computational support to AI-assisted research; categories and applications of AI tools; academic-integrity, accuracy, authorship and ethical risks; principles for acceptable AI use; and the requirements of a practical integration framework. The review develops a five-pillar framework comprising (1) collaboration and human responsibility, (2) task-specific AI tool selection, (3) controlled AI use across the research workflow, (4) empirical cross-validation and verification, and (5) transparency, disclosure and academic integrity. The framework positions AI as a decision-support and language-assistance technology rather than an autonomous researcher. Responsible adoption therefore requires researchers to retain responsibility for research questions, evidence, interpretation, citations, methodological decisions, data protection and the final manuscript. The framework provides a practical basis for postgraduate researchers and Nigerian higher-education institutions seeking to integrate AI while preserving scientific rigour, research independence and academic integrity.
Keywords: Artificial intelligence; Generative AI; Large language models; Postgraduate research; Scientific writing; Research ethics; Academic integrity; Human-centered AI.

Introduction

Artificial intelligence (AI) has become increasingly relevant to higher education, particularly in literature searching, academic writing, data analysis, coding, summarization and research organisation. Generative AI (GenAI), including large language models (LLMs), can support researchers with brainstorming, idea organisation, language refinement, summarisation and manuscript development. These functions are most appropriate when they complement, rather than replace, independent scholarly thinking and human judgement. Dgebuadze and Kenkebashvili (2025), for example, emphasize responsible AI use in learning and research, with critical thinking and academic integrity remaining central Dgebuadze and Kenkebashvili (2025),

The Nigerian postgraduate context provides an important case for examining responsible AI integration and Postgraduate students are expected to search and evaluate extensive literature, formulate research problems, design studies, analyze evidence and communicate findings through thesis, dissertations and journal articles Granjeiro et al, (2025). These requirements occur across agricultural, environmental, engineering, health and social-science disciplines, where researchers increasingly encounter large bodies of literature and complex datasets. AI-assisted tools can improve efficiency at several stages of this process, but they also introduce questions concerning accuracy, transparency, authorship, confidentiality, data protection and academic integrity Hani et al. (2026). Similarly, Muazu (2024) similarly highlights the importance of responsible AI use for research evaluation, quality assurance and academic integrity in higher education Muazu (2024).

A critical conceptual distinction is necessary between AI hallucination and plagiarism because Hallucination refers to inaccurate, fabricated, unsupported or misleading output generated by an AI system, including invented references or unsupported claims while Plagiarism, by contrast, concerns the presentation or use of another person's words, ideas, data or intellectual contribution without appropriate acknowledgement Joshi (2025). Meanwhile AI-generated text is therefore not automatically plagiarism. Nevertheless, AI-assisted work may contribute to academic-integrity violations when generated material is presented as independently verified scholarship, when sources are fabricated or misrepresented, or when institutional and journal requirements for disclosure are ignored Ifeanyichukwu, A., & Vina, V. (2025).

The evolution of AI-assisted research should also be distinguished from conventional computational support. Statistical packages, geographic information systems (GIS) and other specialized software remain important research technologies, while contemporary AI adds conversational systems, semantic search, machine-learning applications and LLM-based assistance Muazu (2024). Python is a general-purpose programming language rather than an advancement of natural language processing (NLP); its relevance arises from its extensive use for implementing machine-learning, NLP, statistical, visualization and data-analysis methods Oyelude (2024). This distinction is important because postgraduate researchers may use both specialised AI platforms and programmable environments to implement, evaluate or customize analytical approaches Oyelude (2024).

The research gap addressed by this review is therefore not the absence of ethical guidance on AI. Rather, existing guidance and discussions are dispersed across general AI ethics, academic-integrity policies, publishing guidance and tool-specific literature. Less attention is given to a coherent, field-sensitive workflow that shows postgraduate researchers how to select AI tools, limit their roles, verify outputs, preserve human responsibility and document appropriate use across the research cycle. This need is especially relevant in Nigeria as institutions adapt to rapidly changing AI capabilities and expectations for responsible scholarly practice. Obasi et al. (2026). Accordingly, this study examines AI applications in postgraduate research and scientific manuscript development, identifies their benefits and limitations, analyses associated ethical and academic-integrity risks, and proposes a five-pillar methodological framework for responsible integration in the Nigerian postgraduate context. The framework is intended to support researchers in using AI without compromising scientific accuracy, research independence, academic integrity or established principles of authorship Obasi et al. (2026).

The study is therefore guided by the following research questions:

Research questions

1.How does the transition from conventional computational approaches to AI-assisted research influence the postgraduate research process?

2.What categories of AI tools and applications can support literature searching, research design, data preparation, coding, technical writing and data analysis?

3.What academic-integrity, accuracy, authorship and ethical risks are associated with generative AI and LLMs in postgraduate academic writing and research?

4.What ethical and authorship principles should guide acceptable AI use in seminar papers, theses, dissertations and scientific manuscripts?

5.What methodological framework can guide postgraduate researchers in evaluating and responsibly integrating AI tools throughout the research and manuscript-development process.

Objective of the study

The general objective is to examine the responsible use of AI in postgraduate research and manuscript development in Nigeria and to propose a structured framework for its effective and ethical integration.

1.Examine the transition from conventional computational approaches to AI-assisted and AI-collaborative research.

2.Identify categories and applications of AI tools that can support literature searching, research design, data preparation, coding, technical writing and data analysis.

3.Examine accuracy, academic-integrity, authorship and ethical risks associated with generative AI and LLMs in postgraduate research and academic writing.

4.Identify ethical and authorship principles for responsible AI use in seminar papers, theses, dissertations and scientific manuscripts.

5.Develop a five-pillar methodological framework incorporating human responsibility, task-specific tool selection, controlled AI use, cross-validation and transparent disclosure.

Materials and method

This study employed a narrative and conceptual literature review to examine the applications, benefits, limitations and ethical implications of AI in postgraduate research and scientific manuscript development. The review was designed to support conceptual synthesis rather than statistical aggregation or systematic-review estimation.

Relevant literature was searched primarily through Scopus, Web of Science and PubMed. MDPI was consulted separately as a publisher platform rather than treated as a bibliographic index. Open-access availability was used to facilitate access to eligible material, while CrossMark was used where appropriate for publication-status or document-version verification. Search concepts included combinations of artificial intelligence, generative AI, large language models, academic writing, postgraduate research, research ethics, academic integrity, authorship, hallucination, literature review, scientific writing, agriculture, environmental research, GIS and data analysis. The literature focused mainly on publications from 2020 to 2026, with greater attention to recent work from 2023 to 2026 because of the rapid development of generative AI. Sources were selected for relevance to the research questions and objectives, with emphasis on peer-reviewed studies, scholarly discussions and authoritative publishing or authorship guidance. The selected material was thematically analyzed around AI applications, workflow integration, risks, ethical principles, human oversight and responsible disclosure. The framework was derived from recurring themes rather than from a formal systematic-review protocol.

AI tools used during manuscript preparation were limited to language editing, grammar correction, sentence restructuring, organization of researcher-generated ideas and paraphrasing. AI-generated outputs were critically reviewed by the authors, while factual claims and citations were checked against the original scholarly sources. Unsupported statements, fabricated references and other inaccurate outputs were corrected or removed. The study did not apply a PRISMA protocol, conduct quantitative meta-analysis or empirically test the proposed framework; consequently, the framework should be understood as a conceptual model requiring future empirical evaluation.

Results and thematic synthesis

The thematic synthesis produced five connected findings corresponding directly to the five research questions. The first finding concerns a shift from conventional computational support towards AI-assisted and AI-collaborative research. The second concerns task-specific applications across the research workflow. The third identifies risks associated with accuracy, integrity, authorship and over-reliance. The fourth establishes ethical principles for acceptable use. The fifth integrates these findings into a five-pillar framework for responsible postgraduate research.

Table 1. Comparative thematic synthesis of the reviewed literature. Source: Authors' compilation based on the sources cited within the table.

Research focus	Synthesis finding	Principal sources	Framework implication
Transition to AI-assisted research	AI extends conventional statistical, GIS and computational workflows through semantic search, conversational assistance, coding support and language generation; human judgement remains necessary.	Dgebuadze & Kenkebashvili (2025); Muazu (2024); Obasi et al. (2026)	Collaboration and human responsibility
Tool categories and applications	Semantic-search and research-discovery tools can assist literature filtering and gap identification, while conversational LLMs and coding environments support drafting, organisation and analysis.	Oyelude (2024); Pessin et al. (2025); Mtotywa et al. (2026)	Task-specific AI tool selection; controlled AI use
Accuracy and integrity risks	AI systems can generate fabricated citations, unsupported claims, biased or superficial outputs and contextually inappropriate interpretations.	Joshi (2025); Sontake (2025); Ifeanyichukwu & Vina (2025)	Empirical cross-validation and verification
Ethical and authorship principles	AI tools do not assume the accountability expected of human authors; responsible use requires disclosure, source verification, confidentiality and compliance with institutional and journal requirements.	COPE Council (2024); ICMJE (2023); Scott-Kennel et al. (2025)	Transparency, disclosure and academic integrity
Integrated responsible-use framework	AI is most defensible as decision support when researchers define the task, select appropriate tools, verify outputs and retain responsibility for the final scholarly product.	Hani et al. (2026); Mtotywa et al. (2026); Muazu (2024)	Five-pillar framework

Transition from conventional computation to ai-assisted research

The literature indicates a shift from research workflows dominated by statistical packages, GIS and manually managed literature searches towards workflows in which AI can provide interactive support as outline in the work of Muazu (2024); Obasi et al. (2026).This does not make conventional computational methods obsolete but instead AI can operate as an additional layer for literature discovery, coding assistance, thematic organization, semantic retrieval and communication which is apparent in the work of Sontake, (2025). In agricultural and environmental research, for example, AI can complement GIS and remote-sensing workflows by aiding spatial-data interpretation, classification and modelling (Obasi et al., (2024); Obasi et al., (2026). The key change is therefore organizational: mandating researchers increasingly interaction with computational systems through natural-language interfaces while retaining responsibility for the underlying research design and analytical decisions.

CATEGORIES AND APPLICATIONS OF AI TOOLS

AI applications can be organized according to the task rather than by brand name. Literature-discovery and semantic-search tools such as Elicit, Consensus, Semantic Scholar and related systems can assist with locating, filtering and organizing literature. Gap-identification approaches can support the extraction of themes and possible research gaps from large collections of documents by Pessin et al., (2025). Conversational LLMs such as ChatGPT and comparable systems can assist with brainstorming, outlining, language refinement, summarization and code generation, while statistical and programming environments such as R and Python remain responsible for executing reproducible analyses. Domain-specific AI applications can also support GIS, remote sensing, spatial modelling and agricultural data interpretation (Oyelude, 2024; Obasi et al., 2026). The appropriate principle is task-specific selection: the researcher should choose a tool according to the purpose, evidence requirements, privacy implications and acceptable level of automation.

Figure 1. Sequential integration of AI across the postgraduate research workflow.

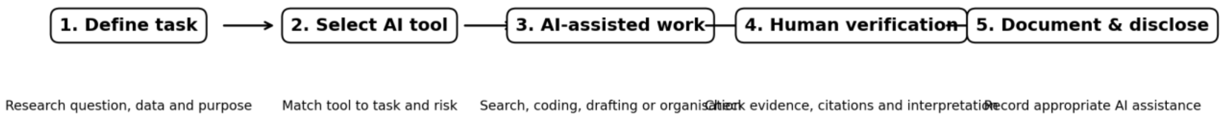

Figure 1. Sequential integration of AI across the postgraduate research workflow**.**

Accuracy, integrity, authorship and ethical risks

The synthesis identifies five closely related risks associated with ai usage without following the order or protocol of disclosure as it concerns accuracy, integrity and authorship models. First, AI systems may generate hallucinations, including fabricated citations, unsupported claims and incorrect interpretations. Second, outputs may reproduce or amplify bias contained in data or model training. Third, over-reliance on generated prose can weaken critical engagement with the literature and obscure the researcher's own reasoning. Fourth, authorship and accountability become unclear if AI-generated material is treated as an independent contributor rather than a tool. Fifth, confidential or sensitive research information may be exposed if it is entered into inappropriate external systems. These risks make human verification essential (Joshi, 2025; Sontake, 2025; Scott-Kennel et al., 2025).

The distinction between hallucination and plagiarism must be preserved because hallucination concerns the reliability of generated content; plagiarism concerns attribution and ownership of intellectual work. They may interact in practice for example, an invented reference may lead to inaccurate scholarship but they are not synonymous. The term 'AI-giarism' is therefore not used in this manuscript because it obscures rather than clarifies the distinction Scott-Kennel et al., (2025).

Ethical and authorship principles

Several principles and guidelines has mandated human researchers on a must to remain accountable for the accuracy and integrity of their work. AI systems should not be treated as authors because they cannot assume the responsibilities associated with authorship, accountability and disclosure (ICMJE, 2023; COPE Council, 2024). Researchers should verify citations and factual claims, protect confidential information, comply with institutional and journal policies, and disclose .AI assistance when required or when it materially affects manuscript preparation. AI use should be proportionate to the task and should not substitute for independent research design, interpretation or scholarly judgement in accord with the work of Hani et al. (2026). These principles also apply to postgraduate assessments. Seminar papers drafts, term papers, thesis and dissertations should demonstrate the student's own reasoning, methodological understanding and interpretation. AI can assist with language and organization, but the student remains responsible for the intellectual content and for demonstrating that the evidence has been independently evaluated Dgebuadze, M., & Kenkebashvili, K. (2025).

Methodological framework for responsible integration

These methodological framework is a synthesis that supports a single five-pillar framework. The five pillars are deliberately defined with fixed labels and are used consistently throughout the manuscript: viz (1) Collaboration and human responsibility; (2) Task-specific AI tool selection; (3) Controlled AI use across the research workflow; (4) Empirical cross-validation and verification; and (5) Transparency, disclosure and academic integrity. Together, the pillars define AI as a decision-support technology operating within a human-led research process Mtotywa et al. (2026).

Figure 3. Five-pillar methodological framework for responsible AI deployment in postgraduate research.

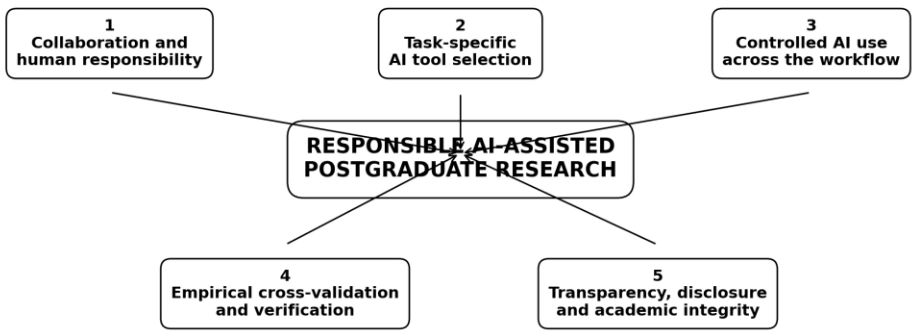

Figure 3. Five-pillar methodological framework for responsible AI deployment in postgraduate research.

Methodological and ethical challenges

The framework responds to several practical challenges. And one major challenge is the possibility of a closed loop in which AI is used to generate scholarly text and other automated systems are then used to evaluate or refine that text with adequate human judgement and consistent verifications. Such a process can reward a shallow readability while weakening attention to empirical evidence and disciplinary reasoning. Because LLMs generate outputs from learned statistical patterns, fluent language does not establish factual accuracy. Human researchers must therefore test important claims against appropriate evidence to refine a developed manuscript.

A second challenge is accountability which is a narrative whereby AI systems do not carry the scholarly, ethical or legal responsibility expected of researchers. Researchers must decide what evidence is relevant, whether an analytical approach is valid, whether a citation actually supports a claim, and whether the final manuscript accurately represents the study. AI literacy should therefore be understood not simply as the ability to operate a tool, but as the ability to judge when a tool is appropriate, recognize its limitations and verify its outputs.

A third challenge concerns confidentiality and responsible data handling processes like collection, cleaning, analysis and the ability of using them for informed decisions. Researchers should not place confidential manuscripts, identifiable participant information, unpublished datasets, proprietary information or other protected material into AI systems unless the relevant institutional, legal and publisher requirements permit such use. Tool selection should therefore consider not only performance but also data governance and privacy.

The five-pillar methodological framework

The framework is intended as a practical guide for postgraduate researchers. It does not prescribe one software package. Instead, it establishes a sequence of responsibilities that can be applied across disciplines and research stages.

Collaboration and human responsibility

The researcher defines the research problem, determines the scope of AI assistance, sets constraints and evaluates outputs. AI functions as an interactive assistant rather than as an autonomous research authority. Human responsibility begins before a prompt is entered and continues through final manuscript approval Hani et al. (2026).

Task-specific AI tool selection

Tool choice should follow the research task. A semantic-search system may be suitable for literature discovery, an LLM may assist with language refinement or code explanation, and statistical or GIS software may remain the appropriate environment for formal analysis. Researchers should consider accuracy, reproducibility, privacy, disciplinary suitability and institutional policy before using a tool Mtotywa et al. (2026).

Controlled AI use across the research workflows

AI use should be limited to clearly defined functions such as brainstorming, literature organization, language editing, coding assistance, summarization or restructuring of researcher-generated drafts. Generated material should be treated as provisional. AI should not independently determine the research question, fabricate evidence, create unsupported results or replace the researcher's interpretation of empirical findings Scott-Kennel et al., (2025).

Empirical cross-validation and verification

Every substantive AI-generated claim, reference, numerical statement, methodological recommendation or interpretation should be checked against appropriate primary literature, verified datasets, institutional resources or data analysis. Citation checking is particularly important because a fluent response can contain references that do not exist or do not support the associated claim. Figure 2 summarizes the human-in-the-loop verification sequence.

Figure 2. Human-in-the-loop verification workflow for responsible AI use.

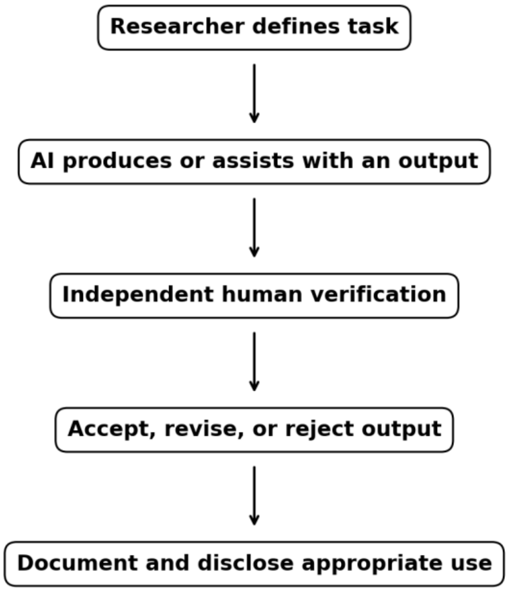

Figure 2. Human-in-the-loop verification workflow for responsible AI use.

Transparency, disclosure and academic integrity

Researchers should document and disclose AI assistance in accordance with institutional and journal requirements. Disclosure should be sufficiently clear to indicate the tools used and the general purpose of their use when such information is requested or materially relevant. AI assistance does not transfer authorship responsibility from the researcher to the tool. Compliance with authorship guidance, citation rules, confidentiality requirements and research-integrity standards remains essential (ICMJE, 2023; COPE Council, 2024).

Discussion

The findings indicate that responsible AI integration is best understood as a governance problem within the research workflow rather than simply a question of whether AI is beneficial or harmful. The first research question is answered by the observed transition from conventional computational support to interactive AI-assisted workflows, while the second is addressed by organizing applications according to research tasks. The third question is answered by the identified risks of hallucination, bias, over-reliance, authorship ambiguity and confidentiality. The fourth is addressed by principles of human accountability, verification, appropriate disclosure and compliance with authorship guidance. The fifth is addressed by the five-pillar framework, which integrates these findings into a coherent workflow.

The framework also clarifies why AI should not be positioned as a substitute for research competence. Efficiency gains in searching, drafting or coding are valuable only when the researcher can evaluate the quality of the resulting output. In agricultural and environmental research, for example, an AI-assisted interpretation of soil, GIS or remote-sensing information still requires disciplinary knowledge and validation. Similarly, a generated statistical script must be checked for the correctness of the model, assumptions, variables and interpretation before results are reported.

For Nigerian postgraduate education, the practical implication is that institutions should move beyond either unrestricted adoption or blanket prohibition. Training should focus on AI literacy, critical evaluation, research integrity, responsible tool selection and appropriate disclosure. Institutional guidance can also clarify which forms of AI assistance are acceptable in theses, dissertations and journal manuscripts and which forms would undermine independent scholarly assessment. These measures are consistent with the broader objective of strengthening research quality while acknowledging the realities of rapidly evolving AI technologies.

Implications for Nigerian higher education and research practice

The Nigerian context requires practical institutional responses. Universities and polytechnics can develop clear guidance for postgraduate researchers on acceptable AI-assisted activities, verification responsibilities, confidentiality and disclosure. Research-methods training can incorporate practical exercises in evaluating generated references, checking factual claims, reviewing AI-assisted code and distinguishing language assistance from substantive generation of scholarly content. Academic libraries can support researchers by providing access to reliable scholarly databases and training in source evaluation. Institutions and research funders can incorporate responsible-AI expectations into research governance and quality-assurance procedures.

At the national level, agencies such as the National Universities Commission (NUC), National Board for Technical Education (NBTE) and Tertiary Education Trust Fund (TETFund) can support harmonized guidance for ethical AI use in postgraduate research. Such guidance should emphasize human accountability, evidence verification, data protection, transparent disclosure and research independence rather than prescribing dependence on particular commercial tools. The objective should be to strengthen scientific quality and equitable access to research-support technologies.

Limitations of the review

This study is a narrative and conceptual review rather than a systematic review. It does not estimate effect sizes, compare AI tools experimentally or empirically test the proposed five-pillar framework. The rapidly changing AI environment also means that specific tools and policies may evolve faster than the literature. In addition, the Nigerian context is used as the principal institutional setting while the evidence base includes international literature. Future research should therefore test the framework with postgraduate students, supervisors and research institutions across Nigerian disciplines and compare its implementation with institutional and journal requirements.

Conclusion

AI has significant potential to support postgraduate research and scientific writing through literature discovery, research organization, coding assistance, data analysis support and language refinement. The benefits, however, depend on the researcher's ability to evaluate and control AI-generated outputs. The review demonstrates that hallucination is distinct from plagiarism, that Python is a general-purpose programming language rather than an advancement of NLP, and that fluent AI output cannot substitute for empirical verification or scholarly judgement.

The study proposes a single, consistent five-pillar framework comprising collaboration and human responsibility; task-specific AI tool selection; controlled AI use across the research workflow; empirical cross-validation and verification; and transparency, disclosure and academic integrity. These pillars provide a practical structure for integrating AI into postgraduate research while preserving research independence, scientific rigour and accountability. In Nigeria, the framework can support institutional guidance and postgraduate training as higher-education systems adapt to the opportunities and risks associated with generative AI.

Recommendation

Postgraduate programmes should provide practical training in responsible AI use, including source verification, citation auditing, critical evaluation and data-protection principles.

Institutions should establish clear guidance on acceptable and unacceptable AI-assisted activities in theses, dissertations, seminar papers and research publications.

Researchers should retain human responsibility for research design, evidence selection, analysis, interpretation, citations and final manuscript approval.

AI-assisted outputs should be independently verified before they are incorporated into scholarly work, particularly claims, references, numerical results, methodological recommendations and interpretations.

Researchers should disclose AI assistance in accordance with institutional and journal requirements and should avoid entering confidential or protected research information into inappropriate AI systems.

NUC, NBTE and TETFund should support coherent national and institutional guidance that promotes ethical AI adoption while protecting research integrity and independence.

Conflict of Interest

The authors declare that the research was conducted in the absence of commercial or financial relationships that could be construed as a potential conflict of interest. AI tools discussed in this review were considered as academic productivity and decision-support tools; the authors have no financial endorsement from the developers of the software platforms discussed.

Generative AI Statements

During preparation of this manuscript, generative AI and semantic-search tools, including ChatGPT, Google Gemini, Consensus and Elicit, were used as decision-support and language-assistance tools for preliminary organisation, language editing, syntax refinement and restructuring of researcher-generated text. The authors critically reviewed all AI-assisted outputs and independently verified factual claims and references against the cited scholarly sources. The authors retain full responsibility for the content, interpretation and final version of the manuscript.

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Little Red Riding Hood in the new age

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Abstract: This study examines how Angela Carter's *The Company of Wolves* (1979) and Neil Jordan's 1984 film adaptation, transform the traditional *Little Red Riding Hood* narrative through an interdisciplinary comparative methodology, combining psychoanalytic interpretation, feminist literary criticism, film semiotics, adaptation theory, and historicist analysis, with the poststructural approach for the terms and their significance and/or meaning, and the hermeneutical comparison. Particular attention is given to the changing relationship between human and animal, the symbolic function of the wolf, representations of sexuality and danger, and the transformation of the heroine from passive recipient of moral instruction into an active subject capable of knowledge and interpretation. Traditional versions of the tale are compared with Carter's rewritings and Jordan's composite cinematic adaptation in order to trace how meanings of obedience, desire, fear, and female agency shift across historical and cultural contexts. Hutcheon's distinction between telling and showing provides a methodological framework for examining how Carter's linguistic and narrative strategies are translated into Jordan's visual language through mise-en-scène, costume, sound, dream logic, visual irony, repetition, and nonlinear editing. Historicist comparison further situates these transformations within the cultural climate of the 1980s, while avoiding assumptions that modern feminism represents a simple linear progression from earlier traditions. The red color (or scarlet, or purple) was a synonym for aristocracy in the Byzantine Empire, since it was the most expensive; the dye came from marine sea snails of the Muricidae family, commonly called murex. Later, knights in the Mediterranean region were wearing cloak in this color with hood in same color. The author insists this is the first article claiming Little Red Riding Hood was dressed as a man, because of the red cooler, and because of the time when the first versions appeared, when women were surely not riding.
Key words: eighties, Neil Jordan, screen adaptation, feminism, gender

Introduction

Neil Jordan's *The Company of Wolves* (1984), adapted from Angela Carter's fiction collection of stories *The Bloody Chamber* (1979), belongs to a particularly productive cultural moment, in which conventional distinctions between masculine and feminine identities, sexuality, danger, and agency were increasingly being questioned. Carter's rewriting of the fairy tale and Jordan's cinematic adaptation transform *Little Red Riding Hood* from a relatively straightforward didactic narrative, into a complex exploration of desire, fear, sexuality, knowledge, and female agency.

Carter's intervention can be understood as a form of what may be termed **magic feminism**: rather than simply reversing the traditional gender hierarchy, she changes the relationship between the heroine and the supposedly dangerous animal. The wolf is no longer merely an external enemy who must be defeated by a male rescuer. Instead, he becomes a figure through which the heroine encounters sexuality, danger, instinct, and the less rational dimensions of human existence. Jordan translates this literary transformation into cinematic language, through visual excess, irony, parody, dream logic, nonlinear editing, and deliberately artificial settings.

The present study adopts an interdisciplinary comparative approach combining psychoanalytic interpretation, feminist literary criticism, film semiotics, adaptation theory, and historicist analysis. It first examines the animal-human relationship in *Little Red Riding Hood* as a structural ambiguity, through which the conventional boundaries between fable, fairy tale, allegory, and short narrative can be reconsidered. It then compares traditional versions of the tale with Carter's rewritings and Jordan's *The Company of Wolves*, focusing on transformations in the meanings of the wolf, the girl, sexuality, danger, and female agency.

Psychoanalytic theory is particularly useful because the traditional tale disciplines: desires and fears, remain only partially visible on the surface. The wolf can consequently be understood not merely as an animal, but as a symbolic embodiment of sexuality, predation, fear, and instinct. Adaptation theory further clarifies why Jordan's film cannot be evaluated simply according to its fidelity to Carter's prose. As Hutcheon (2006) explains, "Storytelling requires of its audience conceptual work; showing calls on its perceptual decoding abilities" (p. 130). The movement from Carter's prose to Jordan's film therefore entails a transformation in the way meaning is produced: what literature suggests through language and narrative structure, cinema can make visible through image, sound, performance, editing, and mise-en-scène.

The central questions of this study are therefore 2. First, does the narrative ultimately preserve an opposition between the human and the animal, or does it present these dimensions as mutually formative? Second, how does Carter's feminist rewriting become translated into Jordan's cinematic language, as a process through which Little Red Riding Hood acquires knowledge, agency, and the ability to transform the danger that traditionally threatens her?

The advanced argument here is that both Carter and Jordan reject the absolute opposition between the human and the animal. The wolf represents not simply an external threat, but a latent dimension of human desire, fear, sexuality, and instinct. Likewise, the heroine does not become powerful by eliminating this dimension; rather, she becomes powerful by recognizing and negotiating with it. Feminism is therefore a starting point for understanding the transformation, rather than its final interpretive category.

Animals and People in the Narrative: Difference or Mutual Formation?

Traditional classifications frequently distinguish between tales whose characters are human and fables whose characters are animals. Umberto Eco's work on narrative and semiotics is relevant to this problem because it questions the rigid distinctions between apparently different narrative structures and emphasizes the active role of the reader in constructing meaning. "The meaning of a proposition embraces 'every obvious necessary deduction. So the meaning is in some way entailed by the premise, and, in more general terms, meaning is everything that is semantically *implied* by a sign. One could thus say that, according to Pierce, the meaning of a sign *inchoatively* contains all the texts within which that sign can be inserted. A sign is a textual matrix."- (Eco, 1979, p. 184). *Little Red Riding Hood* is particularly interesting in this regard because it resists a completely stable classification.

The wolf is simultaneously an animal, a metaphor, a social danger, and a representation of human sexuality. The girl, meanwhile, occupies an unstable position between innocence and knowledge, obedience and curiosity, human rationality and instinct. The narrative consequently approaches the structure of a fable while remaining fundamentally concerned with human behavior.

This ambiguity becomes especially significant when Little Red Riding Hood encounters the wolf. In traditional versions, the encounter is generally organized around a moral warning: the child must remain on the prescribed path and must not trust strangers. The apparently simple instruction conceals a more complex cultural anxiety concerning sexuality, danger, disobedience, and the transition from childhood to adulthood.

The traditional narrative therefore operates simultaneously as entertainment and instruction. Its pedagogical purpose is to teach the young listener how to behave in a dangerous world. Yet the very existence of the wolf introduces an element that exceeds rational instruction. The wolf represents something that cannot be completely controlled by rules: desire, curiosity, sexuality, aggression, and the attraction for the forbidden.

This is precisely where Carter and Jordan intervene. Their versions do not simply eliminate the traditional warning. Instead, they expose the desires and fears that the warning attempts contain. The heroine is no longer merely the object of a lesson. She becomes a participant in the production of meaning.

From a psychoanalytic perspective, the wolf can therefore be interpreted as a figure of the repressed. The traditional tale teaches the child to remain on the safe path and avoid the stranger; Carter and Jordan ask what happens when the supposedly dangerous stranger is also the object of curiosity. The result is not a simple celebration of danger, but an examination of the psychological attraction that makes danger narratively and sexually powerful.

Hutcheon's (2006) distinction between telling and showing is particularly useful here. Literature can leave psychological tensions partially implicit, whereas film can make them perceptible through bodies, gestures, lighting, sound, costume, editing, and visual juxtaposition. Consequently, Jordan's film does not merely reproduce Carter's feminist reinterpretation; it gives that reinterpretation a visual and sensory form.

The film also reestablishes the traditional division between rational human beings and irrational animals. The wolf is certainly dangerous, but human beings are not represented as completely rational either. The animal becomes a figure through which the supposedly civilized human subject encounters impulses that civilization attempts to regulate.

The question consequently changes from "How can the girl escape the wolf?" to "What does the wolf reveal about the girl and about the society that teaches her to fear him?"

Carter's "Magic Feminism" and the Transformation of the Heroine

Carter's rewriting deliberately challenges conventional representations of women as passive victims waiting for rescue. Her fairy-tale revisions repeatedly transform women from objects of narrative action into subjects who possess knowledge and agency.

In the traditional *Little Red Riding Hood*, the heroine's survival is frequently dependent upon external intervention. In Carter's versions, however, the relationship between heroine and wolf becomes more complicated. The woman does not necessarily defeat the animal by destroying him. Instead, she recognizes what he represents and learns how to negotiate with him.

This is the central principle of what may be called Carter's **magic feminism**. The heroine does not become free by pretending that sexuality, aggression, fear, and instinct do not exist. She becomes free by acquiring knowledge about them.

Jordan's film extends this principle. Hutcheon (2006) notes that Jordan and Carter combined material from several Carter texts, including "The Company of Wolves," "The Werewolf," and "Wolf-Alice," while also incorporating a contemporary prologue derived from Carter's earlier radio adaptation. The resulting film is therefore deliberately composite rather than a literal adaptation of a single narrative.

The significance of this strategy is considerable. Jordan creates a dream structure in which several versions of the wolf story coexist. The narrative becomes a network of stories, memories, dreams, warnings, and repetitions. The heroine therefore does not enter a single stable fairy tale. She enters a cultural archive of stories about women, men, sexuality, danger, and violence.

This strategy is consistent with Carter's broader interest in dismantling what might be called mythic versions of femininity. The passive girl waiting for rescue is replaced by a heroine capable of interpreting the situation in which she finds herself.

The transformation is therefore not merely from weak woman to strong woman. More fundamentally, it is a transformation from ignorance to knowledge.

The European Cultural Context

The history of *Little Red Riding Hood* cannot be reduced to a single national origin. Although Italian versions such as *La finta nonna* (The False Grandmother) are important to the genealogy of the tale, scholarship increasingly understands the narrative as part of a trans-European and broader Eurasian tradition. Graça da Silva and Tehrani's (2016) phylogenetic study, for example, traces relationships among versions circulating across Europe and Asia and identifies connections between later *Little Red Riding Hood* traditions and older forms, such as *The Story of Grandmother*.

The best-known literary versions are associated particularly with Charles Perrault and the Brothers Grimm. Perrault's *Le Petit Chaperon rouge* appeared in 1697, while the Grimms published *Rotkäppchen* in 1812. These literary versions participate in a much longer process of oral and written transformation rather than representing a single original text.

This history is important because the moral meaning of the story changes with its cultural context. Perrault's version is strongly didactic, while later versions can modify the relationship between warning, punishment, sexuality, and rescue. The active heroine in Carter and Jordan is consequently, not necessarily, an entirely unprecedented invention. Some earlier variants already provide the girl with greater intelligence and activity, including the Middle Ages versions in which Little red Riding Hood outwits the wolf.

The cultural history of the tale can therefore be understood as a succession of redactions in which ideas concerning female sexuality, education, obedience, rationality, and social danger are repeatedly reconsidered.

The Mediterranean and northern European traditions should likewise not be treated as absolute opposites. Nevertheless, differences in modes of moral communication can be useful as a comparative framework. Some traditions tend toward explicit moral instruction, while others rely more heavily on implication, taboo, symbolism, or indirect communication. The fairy tale is especially suited to such indirect communication because its apparently simple narrative can contain meanings that are not directly articulated.

Psychoanalytic and semiotic approaches become particularly useful at this point. The fairy tale can say one thing on the surface while communicating another through its symbols. The wolf, the forest, the grandmother's house, the path, the hood, and the night can all function simultaneously as narrative objects and cultural signs.

The Three Historical Moments: Medieval, Renaissance, and Modern

The history of *Little Red Riding Hood* can be approached through three broad cultural moments: medieval, early-modern/Renaissance, and modern.

The medieval model can be understood primarily through its emphasis on social discipline, religious morality, proper conduct, and the regulation of interpersonal relationships. The heroine is expected to behave correctly because social order depends upon obedience to established rules.

The Renaissance and early-modern literary transformations introduce different emphases. The fairy tale increasingly participates in literary culture, courtly ideals, social aspiration, and the representation of class. Perrault's literary version, for example, turns the tale into a polished moral narrative appropriate for the literary culture of the period.

The modern transformation is radically different. Carter does not simply repeat the moral lesson; she exposes the ideological assumptions behind it. The heroine's sexuality is no longer merely something to be protected from the wolf. It becomes a dimension of identity that must be understood.

The resulting contrast can be summarized as follows:

Historical-cultural model	**Dominant representation of the heroine**	**Relationship to the wolf**	**Primary lesson**
Medieval/didactic	Obedient girl	External danger	Obey the prescribed path
Early modern	Girl associated with social and marital aspiration	Moral and sexual danger	Proper conduct preserves social order
Carter/Jordan	Self-aware young woman	Encounter with desire, danger, and instinct	Knowledge produces agency

This historical movement should not be understood as a simple linear progression from primitive to modern. Rather, different versions coexist, overlap, and contradict one another. The modern feminist version becomes powerful precisely because it reactivates elements already latent within the older narrative.

Carter, Jordan, and Adaptation

Jordan's film is not especially interested in reproducing the literal storyline of *Little Red Riding Hood*. Its relationship to Carter is instead characterized by transformation, accumulation, and reinterpretation.

Cheu (2007) provides a useful warning against interpreting film exclusively through an intellectualized critical framework. Discussing feminist film theory and the spectator, Cheu cites Walkerdine's realization that "the reader is not simply in the text," just as the spectator cannot be understood merely as a passive voyeur (p. 24). The broader point is that spectators bring their own histories, desires, fantasies, and social positions to the film.

This observation is especially relevant to *The Company of Wolves*. Jordan's film constantly asks the spectator to reconsider what is being seen. The wolf may appear as a literal animal, a man, a sexual metaphor, a dream figure, or a representation of fear. The spectator is therefore required to participate in the process of interpretation.

The film's dream structure intensifies this effect. Stories are embedded within stories; characters recount other versions of the wolf narrative; visual motifs recur in altered forms; and the heroine moves through a world in which dream and waking reality are difficult to distinguish.

The film thus becomes a cinematic equivalent of Carter's literary method. Both writers reject the idea that the fairy tale has only one stable meaning.

The 1980s and Gender

The cultural environment of the 1980s provides an important context for Jordan's film. Fashion, music videos, popular music, and cinema were increasingly experimenting with gender presentation. MTV, launched in 1981, contributed to a visual culture characterized by rapid editing, elaborate costumes, stylized performance, and the transformation of the body into central visual sign.

Films such as *Victor/Victoria* (1982), *Tootsie* (1982), *Yentl* (1983), *Just One of the Guys* (1985), and TV-film *Second Serve* (1986), participated in broader cultural discussions about gender performance and identity. At the same time, action cinema associated with stars such as Sylvester Stallone and Arnold Schwarzenegger, who frequently exaggerated conventional

masculine physicality.
The cultural contradiction is important. The decade did not simply represent liberation. It simultaneously challenged gender stereotypes and reproduced them. Women could be represented as independent, sexually assertive, and professionally active while still being subjected to conventional visual objectification.
The Company of Wolves belongs to this contradiction. Its heroine is neither simply a traditional fairy-tale victim, nor a straightforward modern feminist heroine. She is a figure through whom the film explores the unstable relationship between innocence, sexuality, fear, curiosity, and power.

Jordan's Cinematic Innovations
Three formal characteristics are especially important in Jordan's adaptation: illustration, open development of action, and nonlinear editing.
1) <u>Illustration and Visual Irony</u>
In conventional film criticism, illustration can sometimes be used negatively, suggesting that a director merely depicts what could have been communicated more subtly, through narrative or dialogue. Jordan, however, deliberately uses visual excess.
The oversized red hood, grotesquely emphasized wolf imagery, elaborate settings, exaggerated performances, and highly artificial landscapes create a visual world that resembles an illustrated fairy-tale book. Yet the content is so sexual, violent, and psychologically complicated to belong comfortably to a children's fairy tale. This contradiction is deliberate.
Béla Balázs's film theory is relevant here because he argues that filmic nature should not simply reproduce neutral physical reality. Rather, visual style can transform setting into an expressive component of the narrative. As Balázs (2011) argues, the stylization of nature allows the cinematic environment to convey mood and meaning, rather than functioning merely as geographical background (pp. 52–53).
Jordan's forests therefore do not function simply as realistic forests. They are psychological landscapes. The artificiality of the sets makes visible the artificiality of the cultural rules surrounding the heroine.
2) <u>Open Development of the Action</u>
The film also resists a straightforward linear narrative. Episodes refer to one another without immediately forming a complete causal structure. The viewer frequently receives explanations only after encountering their consequences.
This technique produces uncertainty about the heroine's psychological state. Is she naïve? Is she dreaming? Does she understand that she is speaking with a wolf? Is the wolf external to her, or does he represent something she recognizes within herself?
The ambiguity is central to the film's feminist transformation. If the heroine was simply ignorant, the narrative would reproduce the traditional pedagogical structure. But if she possesses partial knowledge, the meaning of her actions changes. She is no longer merely being deceived; she is experimenting with knowledge.
3) <u>Nonlinear Editing</u>
Nonlinear editing further disrupts the traditional fairy-tale structure of once-upon-a-time, followed by a clear moral conclusion. Jordan's film does not provide the reassuring narrative progression of a conventional children's tale. Instead, meaning emerges through repetition, juxtaposition, visual motifs, and associations. The spectator is encouraged to connect images rather than merely follow events. The moon, the forest, the wolf, the red hood, and the recurring stories of transformation become signs within a larger symbolic structure. The film therefore privileges meaning over chronological clarity.
The absence of strict linearity also weakens the traditional moral lesson. Instead of ending with a simple warning—do not speak to strangers—the film asks the spectator to consider why the

stranger is dangerous, why the heroine is attracted to him, and what social mechanisms have constructed that danger.

The Wolf as Sexual and Psychological Figure

The wolf is the central symbolic figure of the narrative. Murphy (2015), in his discussion of the "Little Red Riding Hood genotype," demonstrates the persistence of the wolf figure across later narratives. In his analysis of *Psycho*, for example, Norman Bates can occupy the structural position of the wolf: he is a predator whose identity the heroine must recognize before it is too late (pp. 151–171).

This structural interpretation helps explain why the wolf remains culturally powerful even when the literal animal disappears. The wolf is not simply a character; he is a narrative function. In *The Company of Wolves*, however, Carter and Jordan complicate that function. The wolf remains dangerous, but the heroine is not reduced to an object of predation. She enters into a relationship with danger and consequently acquires knowledge about herself.

This transformation is central to the feminist meaning of the story. The objective is not to claim that women should embrace danger indiscriminately. Rather, the narrative challenges a system in which women can only be protected by remaining ignorant of sexuality and by depending on male authority. The heroine becomes active precisely because she is willing to understand what the wolf represents.

Blood, the Body, and Cultural Anxiety

The relationship between the female body and cultural taboo is also important. Sellers (2001, 119-121) places fairy-tale representations of femininity within broader historical discourses concerning sexuality, Christianity, bodily boundaries, and taboo. Discussing Julia Kristeva's analysis of menstrual blood, Sellers emphasizes the cultural significance of substances associated with bodily transgression and the disruption of constructed identities.

This framework helps illuminate the symbolic importance of blood and bodily transformation in *The Company of Wolves*. The female body is repeatedly represented as a site where cultural boundaries become unstable: childhood and adulthood, innocence and sexuality, humanity and animality, and purity and danger intersect.

The wolf consequently becomes part of a larger symbolic system surrounding the body. He is dangerous because he represents the boundary that civilization attempts to maintain. Carter's intervention is to make that boundary visible rather than pretending that it does not exist.

The Grandmother and Female Knowledge

The grandmother occupies a particularly important position in the transformation of the narrative. In the conventional tale, she is often a victim who must be rescued. In Carter and Jordan, older female knowledge becomes more significant.

The grandmother can be interpreted as a mediator between generations. She possesses knowledge that the younger woman has not yet acquired. Rather than functioning simply as a helpless victim, she becomes part of a female chain of knowledge.

This is important because Carter's feminism is not based exclusively on individual rebellion. Female characters can transmit knowledge to one another. The younger heroine therefore does not become independent by rejecting older women; she becomes more capable through contact with them.

Any claim that the grandmother's historical role specifically encoded a hidden medieval message about the desired aristocratic status, or about the desired company for the girl from the high society, not from the wolf-company, however, should be treated as speculative rather, than established historical fact. According to this the grandmother cannot say things directly, but when she is retailing her story, will say- the girl was wearing red riding hood. Then the listener (the granddaughter) is expected to understand that the girl in the story was dressed like a prince (because red was the color of the aristocracy). The medieval "code of speaking" can be retained as an interpretive hypothesis, but there is insufficient evidence to present it as a demonstrable historical origin of the red hood. By this code the grandmother cannot be caught by the inquisition and sentenced to death for being witch.

The Red Hood and Historical Symbolism

The red hood itself is an important symbolic object. Red has long carried associations with blood, sexuality, danger, power, and status in European visual culture. However, the argument that the red hood specifically indicated medieval aristocratic status should not be presented as historical fact without documentary evidence.

Its significance is more securely understood within the later literary tradition as a marker of the heroine's identity. The hood separates her visually from the surrounding environment, while simultaneously making her vulnerable to recognition.

Jordan intensifies this visual function. The red hood becomes an almost theatrical object: too visible to be ignored, too artificial to be entirely realistic. Its exaggeration contributes to the film's larger strategy of making fairy-tale conventions visible.

The hood therefore becomes a sign of both femininity and narrative identity. The heroine cannot simply escape the story because she is visually marked as its central character.

The Fairy Tale, Cinderella, and Redaction

The broader history of fairy-tale redaction also demonstrates how stories change through transmission. The *Cinderella* tradition provides a useful example. Perrault's *Cendrillon* (1697) explicitly contains the famous glass slipper, while the Brothers Grimm's version uses a golden slipper. The popular explanation that the glass slipper resulted simply from a mistranslation of *vair* (fur) should not be treated as established fact; Perrault's text itself explicitly describes the slippers as glass.

The example is relevant because it demonstrates that fairy tales are not stable objects. Their details change according to literary, cultural, linguistic, and ideological circumstances. The same principle applies to *Little Red Riding Hood*. Carter and Jordan are not corrupting an original, fixed story. They participate in the same historical process of transformation that produced the versions we now regard as traditional.

The Film as a Modern Redaction

Jordan's *The Company of Wolves* can consequently be understood as a modern redaction rather than a conventional adaptation. It combines elements of Carter's stories with older versions of the fairy tale and with the visual language of contemporary cinema. Its formal contradictions are therefore meaningful. The film can look simultaneously old-fashioned and modern, theatrical and cinematic, literary and commercial, intellectual and spectacular.

Jordan's lavish production style creates a tension between artistic experimentation and

mainstream cinema. The film's elaborate sets, stylized photography, and musical score place it within the visual culture of the 1980s, while its fragmented narrative and intellectual ambition resist the straightforward conventions of commercial fantasy.
Balázs's (2011, 52) theory of cinematic stylization helps explain this contradiction. The film does not attempt to reproduce reality neutrally. It constructs an artificial world in which the environment itself participates in the meaning of the story. The forest is therefore not merely a forest. It is a psychological and cultural space.

Conclusion

The Company of Wolves should be understood not simply as a feminist version of *Little Red Riding Hood*, but as a complex transformation of the fairy tale's underlying system of meanings. Angela Carter's literary rewriting and Neil Jordan's cinematic adaptation challenge the traditional division between human and animal, innocence and sexuality, danger and desire, and victimhood and agency.
The wolf is no longer merely an external enemy. He becomes a figure through which the heroine encounters the dangerous and irrational dimensions of existence. The girl, correspondingly, is no longer simply an object requiring protection. She becomes a subject capable of interpretation and action.
This transformation is achieved differently in literature and cinema. Carter's prose exposes the ideological structures hidden inside the fairy tale, while Jordan translates those structures into visual form. Hutcheon's (2006, 152) distinction between telling and showing is therefore particularly useful: the film does not merely repeat the literary narrative, but changes the way the audience encounters it.
Jordan's use of illustration, visual irony, dream logic, open narrative development, parody, and nonlinear editing makes the ideological transformation visible. The viewer is forced to reconsider whether the wolf is an external monster or a representation of something already present within the human subject.
The historical development of *Little Red Riding Hood* likewise demonstrates that the story has never possessed a single, immutable meaning. Its versions have emerged from overlapping European traditions, and its moral and sexual meanings have changed according to cultural circumstances. Carter and Jordan continue this process of redaction, rather than breaking with it. The most important transformation is therefore not simply from passive femininity to active feminism. It is from obedience to knowledge.
Traditional versions instruct the girl to avoid the wolf. Carter and Jordan ask her to understand him. That difference changes the entire structure of the narrative. The heroine's strength does not consist in eliminating the animalistic dimension of existence, nor in waiting for a male rescuer to eliminate it for her. Instead, she acquires the ability to recognize danger, interpret desire, negotiate with uncertainty, and determine her own response.
In this sense, the human and animal dimensions of the tale are not ultimately opposites. They are mutually decisive. The wolf teaches the heroine something about herself, while the heroine's encounter with the wolf transforms the meaning of the wolf himself.
The modern Little Red Riding Hood therefore does not simply leave the path. She learns why the path exists, who constructed it, what lies beyond it, and how she might choose her own direction.

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Predicting the Well-Being of Private University Students in Quanzhou, Fujian Province, China: The Critical Roles of Self-Awareness and Responsible Decision-Making

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Abstract: As higher education transitions toward quality enhancement, student development evaluations increasingly encompass psychological and adaptive resilience alongside traditional academic metrics. While internal resources are critical for student adaptation, empirical evidence focusing on private university students in regional China remains limited. This is a critical omission because these students frequently face distinct career orientations, intense employment pressures, and unique resource constraints. This study addresses this gap by examining the relationship between multi-dimensional internal competencies and subjective well-being among private university students in Quanzhou, Fujian Province, with a specific focus on identifying which specific self-regulatory and behavioral dimensions matter most. Data were collected via convenience sampling from 297 students across application-oriented majors at two private universities in the locality. Descriptive statistics revealed generally favorable internal competencies and moderately high well-being among the participants. Multiple linear regression analysis demonstrated that after controlling for demographic and academic background variables, the overall competency framework served as the strongest predictor of well-being. Crucially, when all five behavioral and psychological dimensions were analyzed simultaneously, only responsible decision-making and self-awareness emerged as statistically significant positive predictors of student flourishing. These findings indicate that student support in regional private higher education must transcend mere vocational training to cultivate core cognitive-behavioral assets. Institutional interventions within similar local contexts should prioritize reflective training and structured decision-making curricula to systematically foster long-term student well-being.
Keywords: Subjective well-being; Private university students; Responsible decision-making; Self-awareness; Quanzhou city

Introduction

As higher education moves away from sheer expansion and toward quality enhancement, the criteria used to evaluate student development are being recast. Grades, graduation rates, and employment outcomes still matter. They no longer tell the whole story. University life also requires students to regulate emotion, build workable relationships, sustain effort under pressure, and shape a plausible sense of future direction. Once that broader developmental task is acknowledged, social-emotional competence becomes difficult to treat as a secondary concern. It refers to the capacity to recognize emotion, manage behavior, relate to others, and act with responsibility. Because these capacities stand between academic performance, psychological health, and social adjustment, they have come to occupy a central position in educational research. Prior work has argued that social-emotional learning is not an auxiliary goal running beside academic development; it forms part of the foundation that supports classroom participation, problem solving, and sustained engagement (Jones & Bouffard, 2012; Weissberg & Cascarino, 2013).

Well-being brings this discussion closer to students' lived experience, the concept reaches beyond temporary positive mood. It includes cognitive evaluations of life, emotional experience, perceived relationship quality, a sense of meaning, and judgments about personal accomplishment. With the rise of positive psychology in higher education research, well-being has increasingly been treated as a major indicator of student development. Fan (2020) describes subjective well-being as a structure that combines cognitive appraisal and emotional experience, both closely tied to learning adjustment, social connectedness, health, and developmental task completion. Bakker and Mostert (2024) argue that student well-being is shaped through a dynamic balance between study demands and study resources. Pressure, time organization, institutional support, and personal competence work together rather than separately. Li (2025) reaches a similar conclusion, showing that students' well-being is produced through the joint influence of personal characteristics, academic experience, and institutional conditions.

Interest in the link between social-emotional competence and well-being has grown from this line of reasoning, students who can identify emotional shifts more clearly are often better positioned to respond before distress intensifies. Those who handle relationships with greater steadiness may preserve support even when conflict emerges. Students who make more responsible decisions are also more likely to retain a sense of control when academic and personal demands accumulate. Jiang et al. (2022) report that academic performance, family support, and social relationships are all significantly associated with university students' happiness. Thongsri et al. (2024) likewise show that attitude, GPA, and time management shape happiness in higher education learners. The message is consistent: internal resources and external conditions meet within the same developmental process.

Recent studies have pushed this argument further by identifying several contextual pathways, social support can buffer pressure while promoting positive adjustment. Higher self-efficacy is linked to more stable positive emotion and stronger developmental expectations. Perceived learning climate, especially autonomy support and teacher support, predicts multidimensional well-being among university students (Cobo-Rendón et al., 2024). A kinder university climate is also associated with longitudinal growth in well-being (Datu & Lin, 2022). Evidence from intervention research points in the same direction. Yang et al. (2024) found that a PERMA-based positive psychology intervention improved subjective well-being and reduced social interaction anxiety among vocational nursing students in China. Pan et al. (2025) showed that physical activity can improve subjective well-being through social support, self-esteem, and resilience. Furthermore, recent empirical findings on regional higher education institutions demonstrate that targeted psychological and environmental support strategies significantly elevate subjective well-being among specialized college cohorts (Wu, Kong, & Lv, 2026). Well-being, then, is not a fixed outcome. It can be shaped by educational settings, relationship networks, and competence-building efforts.

There are still two major research gaps at present. Firstly, most of the existing evidence comes from public universities, comprehensive colleges, or sample groups outside of China, and empirical research on Chinese private university students is still insufficient. This limitation is crucial because private university students often face more distinct career orientations, more urgent employment pressures, and unique institutional and family resource allocation patterns, and their sense of happiness may differ significantly from that of public university students. Secondly, although many studies have confirmed the important value of social emotional competence at the overall level, there is still a lack of in-depth exploration into which specific dimensions have more critical impacts. In specific educational contexts, which of the dimensions of self-awareness, interpersonal relationship management, self-regulation, social cognition, and responsible decision-making has the strongest explanatory power is still a question that needs to be further explored. To address these gaps, the present study establishes a direct transition from the overarching role of social-emotional competence to the specific empirical investigation of private university students in regional China.

Quanzhou offers a useful site for addressing these issues, private higher education is active in the city, and the two sampled institutions show a degree of representativeness in their program offerings and student composition. Examining students in this context makes it possible to capture how social-emotional competence and well-being are patterned among learners in practice-oriented private universities. It also provides evidence that can inform student support services, curriculum reform, and mental health education in private higher education. Against this background, the present study reexamines the relationship between social-emotional competence and well-being among students from two private universities in Quanzhou and compares the predictive roles of different competence dimensions.

Research Objectives

The study aims to examine the relationship between social-emotional competence and subjective well-being among university students in private higher education. The focus does not rest on overall association alone. Equal attention is given to the relative contribution of different competence dimensions. Using student samples from two private universities in Quanzhou, the study pursues three objectives: to describe the overall levels and dimensional profiles of social-emotional competence and well-being, to test whether a significant association exists between the two constructs, and to compare the predictive effects of the five competence dimensions after relevant background variables are controlled.

Specifically, the following research questions guide the investigation:

1. What are the general levels and dimensional profiles of social-emotional competence and subjective well-being among private university students?
2. Which specific dimensions of social-emotional competence significantly predict subjective well-being after controlling for relevant background variables (age, gender, academic performance, and major)?

Research on public and comprehensive universities is already more established. Evidence from private higher education remains thinner. This study seeks to extend that evidence base and to provide a more precise foundation for student development support in private institutions.

Research Methods

3.1 Participants

Participants were recruited from two private universities in Quanzhou, Fujian Province, China, identified here as University A and University K. Convenience sampling was adopted. The field survey was conducted in March 2026. A total of 314 questionnaires were distributed, 309 were returned, and 297 valid responses remained after cases with logical inconsistencies or incomplete answers were removed. Regarding ethical considerations and data screening: Written informed consent was obtained from all participants prior to data collection, outlining the voluntary nature of participation, confidentiality, and data anonymization. Institutional ethical approval was secured from the respective university research ethics committees. To ensure data integrity, questionnaires with completion rates below 90% or exhibiting straight-line response patterns were excluded during the data cleaning procedure.

3.2 Instruments

Participants' social-emotional competence was assessed with the Social Emotional Competence Questionnaire (SECQ), adapted from the CASEL framework (2020) and validated in the Chinese population by Zhou and Ee (2012). The scale contains 25 items distributed across five distinct dimensions: self-awareness, self-management, social awareness, relationship management, and responsible decision-making. All items are answered on a 6-point Likert scale, where 1 refers to "not at all true of me" and 6 refers to "very true of me". The total score of the scale ranges from 25 to 150, with higher scores indicating more favorable social-emotional competence. In the present study, the Cronbach's alpha for this scale was 0.95, indicating excellent internal consistency.

Participants' well-being was assessed with the PERMA Well-being Questionnaire for College Students, adapted from Seligman's (2011) PERMA model and validated in the Chinese college student population by Zhang et al. (2023). All items are answered on a 6-point Likert scale, where 1 refers to "never experiencing the state" and 6 refers to "experiencing the state almost always". The total score of the scale ranges from 5 to 30, with higher scores indicating more favorable overall well-being. In the present study, the Cronbach's alpha for this scale was 0.89, indicating satisfactory internal consistency.

3.3 Data Analysis

All analyses were conducted in SPSS. Descriptive statistics were first used to summarize demographic characteristics and scale scores. Means (M) and standard deviations (SD) were calculated to describe the overall patterns of social-emotional competence and well-being. Pearson correlation analysis was then applied to test the linear association between the two constructs. In the regression stage, overall social-emotional competence was entered first to predict well-being, after which the five competence dimensions were entered simultaneously to compare their relative explanatory power. All tests were two-tailed, with the significance level set at 0.05.

Results

4.1 Sample Characteristics

The analytic sample included 297 students from application-oriented majors such as social sports, art and design, computer application technology, and preschool education. Of these participants, 164 were male (55.2%) and 133 were female (44.8%). The mean age was 19.2 years. Most students reported a GPA in the "good" range or above, while only 4.0% fell at the "average" level (2.0 / 4.0 scale) or lower. Taken together, the sample provides a reasonable picture of gender composition, disciplinary distribution, and academic standing among students in private universities in Quanzhou.

4.2 Social-Emotional Competence among Students in Private Universities

Table 1 summarizes the descriptive statistics for the five dimensions of social-emotional competence among the participants.

Table 1: Descriptive Statistics for the Dimensions of Social-Emotional Competence Among Students at Private Universities

No.	Dimension of Social-Emotional Competence	*M*	*SD*
1	Self-awareness	4.47	0.81
2	Self-management	4.19	0.95
3	Social awareness	4.31	0.87
4	Relationship management	4.46	0.82
5	Responsible decision-making	4.57	0.77
6	Overall social-emotional competence	4.40	0.72

As shown in Table 1, mean scores for the five dimensions of social-emotional competence ranged from 4.19 to 4.57, all above the midpoint of the scale. The pattern suggests that the sample displayed a generally favorable level of competence. Responsible decision-making had the highest mean (M = 4.57, SD = 0.77), indicating that many students showed a clear sense of responsibility and consequence judgment when dealing with academic and everyday choices. Self-awareness (M = 4.47, SD = 0.81) and relationship management (M = 4.46, SD = 0.82) followed closely, suggesting relatively stable performance in self-monitoring and interpersonal interaction. Self-management had the lowest score (M = 4.19, SD = 0.95). The result points to a weaker area: emotional regulation, impulse control, and sustained execution remain in need of support. The overall mean for social-emotional competence was 4.40.

4.3 Well-Being among Students in Private Universities

Table 2 presents the descriptive statistics for subjective well-being and its constituent dimensions.

Table 2. Descriptive Statistics for Well-Being and Its Dimensions Among Students at Private Universities

No.	**Dimension of Well-Being**	M	SD
1	Positive emotion	4.07	1.42
2	Engagement	3.97	1.43
3	Relationships	4.11	1.46
4	Meaning	4.19	1.39
5	Accomplishment	4.27	1.34
6	Overall well-being	4.12	1.31

As detailed in Table 2, the mean overall well-being score was 4.12 (SD = 1.31), indicating a moderately high level. Accomplishment ranked highest among the PERMA dimensions (M = 4.27, SD = 1.34), which suggests that students reported relatively strong positive experiences in task completion, goal attainment, and self-affirmation. Meaning (M = 4.19, SD = 1.39) and relationships (M = 4.11, SD = 1.46) followed, indicating that many students perceived value and support in campus life. Positive emotion scored 4.07, whereas engagement was the lowest dimension (M = 3.97, SD = 1.43). Students were not devoid of satisfaction. What appeared less stable was sustained concentration, immersive learning, and consistent psychological energy.

4.4 The Relationship between Social-Emotional Competence and Well-Being

Table 3 presents the correlation matrix between subjective well-being and the examined demographic/competence variables.

Table 3. Correlations Between Well-Being and Each Variable

Variable	*r*	*p*
Social-emotional competence	0.428	0.000
Academic performance	0.118	0.042
Gender	0.021	0.721
Age	0.067	0.249

Table 3 presents the correlations between well-being and each variable. There was a moderate and statistically significant positive correlation between social-emotional competence and well-being ($r = 0.428$, $p < 0.001$), indicating that higher levels of social-emotional competence were generally associated with higher student well-being. GPA was weakly positively correlated with well-being ($r = 0.118$, $p < 0.05$), suggesting that students with better academic performance tended to report slightly higher well-being. Neither gender nor age showed a statistically significant relationship with well-being at the bivariate level. In addition, age showed weak negative trends with both GPA ($r = -0.091$, $p = 0.117$) and social-emotional competence ($r = -0.108$, $p = 0.062$), although neither reached statistical significance.

Table 4 presents the results of the linear regression analysis between social-emotional competence and well-being.

Table 4. Linear Regression Results for Social-Emotional Competence and Well-Being

Variable	*B*	*β*	*t*	*Sig.*
Constant	0.679	-	1.804	0.072
Social-emotional competence	0.781	0.428	8.238	0.000
$R = 0.428$, $R^2 = 0.183$, $F = 67.864$, $p < 0.001$.				

As shown in Table 4, social-emotional competence significantly and positively predicted well-being ($\beta = 0.428$, $p < 0.001$). The model explained 18.3% of the variance in well-being, suggesting that social-emotional competence is an important factor associated with the well-

being of students at private universities. The unstandardized regression coefficient B = 0.781 indicates that for every one-unit increase in the total social-emotional competence score, well-being increased by an average of 0.781 units on the 6-point scale.
Table 5 presents the multiple linear regression model controlling for background variables.

Table 5. Multiple Linear Regression Results for the Independent Variables and Well-Being

Variable	*B*	*SE*	*β*	*t*	*Sig.*
Constant	-2.390	1.147	-	-2.084	0.038
Social-emotional competence	0.791	0.085	0.436	9.348	0.000
Age	0.119	0.057	0.097	2.085	0.038
Gender	0.085	0.140	0.028	0.609	0.543
Academic performance	0.163	0.094	0.081	1.737	0.083
Major	0.025	0.026	0.045	0.953	0.341

Table 5 presents the results of the multiple linear regression analysis between the independent variables and well-being. The findings show that after controlling for age, gender, academic performance, and major, social-emotional competence remained the most significant predictor of well-being ($\beta = 0.436$, $p < 0.001$). The positive effect of age was relatively weak but reached statistical significance ($p = 0.038$), indicating that older students reported slightly higher well-being after controlling for the other variables. Gender, academic performance, and major did not reach statistical significance in this model, suggesting that these background variables had relatively limited explanatory power for well-being. Overall, the explanatory power of social-emotional competence was clearly stronger than that of the general background variables.
To compare the relative effects of different dimensions of social-emotional competence, all five dimensions were entered into the regression model simultaneously. Table 6 displays the results of this regression analysis.

Table 6. Multiple Linear Regression Results for the Components of Social-Emotional Competence and Well-Being

Independent variable	*B*	*SE*	*β*	*t*	*p*	Tol.	VIF
Constant	0.247	0.371	-	0.667	0.505	-	-
Self-awareness	0.317	0.106	0.206	3.000	0.003	0.452	2.214
Self-management	0.071	0.089	0.053	0.792	0.429	0.454	2.201
Relationship management	0.164	0.113	0.107	1.457	0.146	0.386	2.588
Responsible decision-making	0.439	0.125	0.264	3.498	0.001	0.344	2.903
Social awareness	-0.151	0.109	-0.103	-1.379	0.169	0.362	2.761
F = 20.884, Adj R2 = 0.226, p < 0.001.							

Table 6 shows that among the five dimensions, self-awareness ($B = 0.317$, $p = 0.003$) and responsible decision-making ($B = 0.439$, $p = 0.001$) had significant positive predictive effects on well-being, with the latter showing a higher standardized coefficient, indicating that responsible decision-making is a key dimension in explaining differences in well-being. Self-management, relationship management, and social awareness did not reach statistical significance in this model. The multicollinearity test results showed that the VIF values for all variables ranged from 2.201 to 2.903, which is within an acceptable range, indicating that the model did not suffer from serious multicollinearity. Therefore, self-awareness and responsible decision-making can be regarded as the two core social-emotional dimensions that promote well-being among students at private universities.

Discussions

The findings show that students in the two private universities reported generally favorable social-emotional competence and moderately high well-being, and that the two constructs were significantly related. One implication follows immediately. Student development in private higher education cannot be reduced to knowledge acquisition and vocational training alone. The quality of campus life is also shaped by whether students can steady emotion, maintain workable relationships, and respond to pressure without losing direction. This interpretation fits the broader literature on social-emotional learning, which treats social-emotional resources as part of the internal conditions that sustain adaptation and long-term development (Jones & Bouffard, 2012; Weissberg & Cascarino, 2013).

The dimensional pattern is equally instructive, responsible decision-making, self-awareness, and relationship management scored relatively high, whereas self-management was comparatively weak. That contrast suggests that students may be more able to judge choices and sustain interaction than to regulate emotion and behavior over time. The structure of well-being echoes this point. Achievement and meaning ranked relatively high, but engagement lagged behind. Students appear able to see value in their efforts and to recognize concrete goals. Remaining consistently absorbed, however, is another matter. Pressure, uncertainty, and uneven resources can drain sustained attention. Robotham and Julian (2006) described higher education stress as persistent and composite in nature. Bakker and Mostert (2024) later framed student well-being as the product of a shifting balance between study demands and study resources. Stronger social-emotional competence may help students keep that balance from collapsing.

The regression results sharpen the argument, even after demographic and academic variables were controlled, social-emotional competence remained the strongest predictor of well-being. It should be explicitly noted that 'prediction' in this statistical context refers to accounting for variance in cross-sectional data rather than demonstrating a direct causal trajectory. This suggests that competence is closer than background indicators to the psychological core of how well-being is formed. For private universities, the point is practical as much as theoretical. If student development is assessed mainly through grades and employability, the support system may focus on outward performance while leaving the internal mechanisms of adaptation untouched. Emotion understanding, behavioral regulation, peer collaboration, and responsible choice are not decorative additions to education. They form part of the operating base that allows students to function well under ordinary campus pressures.

Two dimensions stood out in particular: self-awareness and responsible decision-making. The significance of self-awareness suggests that students who can recognize emotional change, understand their own limits, and identify their developmental needs are more likely to maintain realistic plans and more stable self-evaluations. Responsible decision-making showed even stronger explanatory power, which may reflect the practical demands facing students in private universities. Choices about major pathways, internships, postgraduate options, employment, financial strain, and daily self-management often arrive early and carry direct consequences. Better decisions can reshape pressure, accomplishment, and future expectation at the same time. Wu and Kong (2024) argue that self-efficacy and well-being strengthen one another. Read together with the present findings, these studies suggest that students who know themselves more clearly and decide more responsibly may also be better able to seek support and make better-fitting choices, thereby strengthening their sense of control.

Contextual influences should also remain in view, Cobo-Rendón et al. (2024) found that learning climate significantly predicts university students' well-being. Datu and Lin (2022) showed that a kind university climate is associated with gains in well-being over time. A fuller picture therefore emerges: social-emotional competence is not a private trait produced in isolation. It takes shape through teacher-student interaction, peer relationships, and institutional arrangements. If private universities hope to improve student well-being in a sustained way, the response cannot stop at individual intervention. Class management, project-based learning, faculty mentoring, career guidance, and a supportive campus culture all need to be brought into the same developmental design. Intervention studies by Yang et al. (2024) and Pan et al. (2025)

support this direction by showing that student well-being can be improved through targeted courses and activity programs.

Conclusions

Using data from 297 students enrolled in two private universities in Quanzhou, Fujian Province, this study examined the relationship between social-emotional competence and well-being. The findings show that students reported generally favorable social-emotional competence and moderately high well-being. A significant positive association was observed between the two constructs, and social-emotional competence remained the most important predictor of well-being after age, gender, academic performance, and major were controlled.

Further analysis indicated that self-awareness and responsible decision-making were the two dimensions that best explained differences in well-being. For private universities, the implication is clear. Efforts to improve student well-being should not begin only when difficulties have already become visible. Social-emotional learning needs to be woven into everyday educational practice through developmental advising, reflective training, decision-making courses, peer support mechanisms, and a more supportive campus culture. Strengthening social-emotional competence is therefore not simply a way to help students feel better in the short term; it is a practical route toward building a more stable basis for long-term development.

Several limitations should be acknowledged, the study used a cross-sectional design, which prevents direct causal inference about the direction of the association between social-emotional competence and well-being. The sample was drawn from only two private universities in Quanzhou. Although the institutions offer a meaningful case, caution is still needed when extending the findings to other regions or institutional types. The analysis also focused on social-emotional competence and a limited set of background variables. Factors such as family economic pressure, dormitory relationships, social support intensity, and internship experience were not entered into the same model. Future research that incorporates richer contextual variables and longitudinal or intervention-based designs would provide a clearer account of how well-being develops among students in private higher education.

Conflict of interests

The authors declare no conflict of interest.

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Dynamic accent accommodation: Training learners for world Englishes using generative speech

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Abstract: Traditional English Language Teaching (ELT) and Computer-Assisted Language Learning (CALL) have largely privileged native-speaker pronunciation models, despite the fact that much international communication occurs among speakers from Outer and Expanding Circle English contexts. This conceptual paper proposes Dynamic Accent Accommodation (DAA), a theoretically grounded framework that integrates generative speech synthesis with World Englishes pedagogy to develop learners' receptive flexibility across diverse English accents. Drawing on World Englishes theory, Communication Accommodation Theory, and the Lingua Franca Core, the framework introduces a three-phase Graduated Exposure Model; Baseline Calibration, Controlled Phonological Shift, and Conversational Complexity supported by an adaptive human-in-the-loop speech generation architecture. The paper explains the technical logic of accent manipulation via an Acoustic Accent Vector (α), pedagogical task sequencing, and proposed evaluation metrics for measuring auditory processing efficiency, decoding accuracy, and communicative confidence. It also addresses ethical issues related to algorithmic bias, accent authenticity, voice privacy, and linguistic equity. The principal contribution is the formulation of a pedagogically operational architecture intended to guide future empirical research on AI-supported listening instruction and Global Englishes education. Instead of promoting accent imitation, DAA emphasizes intelligibility, perceptual adaptation, and inclusive multilingual communication.
Keywords: World Englishes; Generative Speech Synthesis; Dynamic Accent Accommodation; Communication Accommodation Theory; Computer-Assisted Language Learning.

Introduction

The landscape of global communication has changed substantially, yet many English language teaching practices continue to rely on monolithic native-speaker pronunciation models (Bayaro et al., 2026; Olorunfemi, 2026). English now functions as a global lingua franca across multilingual and multicultural settings, where successful communication depends increasingly on listeners' ability to understand diverse English varieties rather than approximate a single prestige accent. Although research in World Englishes and Global Englishes has challenged the native-speaker benchmark, this perspective has not been adequately operationalized within AI-supported listening pedagogy. The central gap addressed in this paper is the absence of an adaptive instructional framework that systematically develops receptive accommodation across multiple English accents using generative speech technologies (Blair, 2020; Rose et al., 2021; Wang et al., 2023).

When language learners are exposed exclusively to standardized, native-speaker auditory input, their perceptual systems undergo hyper-specific acoustic tuning. The human auditory cortex adapts to recognize phonemic boundaries, stress patterns, and intonational contours based entirely on the narrow statistical distributions of these standard varieties. When such learners enter real-world communicative spaces and encounter non-native regional varieties, this rigid perceptual calibration fails. Learners experience acute cognitive overload, manifested as severe drops in listening comprehension, extended auditory processing latency, and elevated affective filters. The mental energy expended simply trying to decode unfamiliar segmental and suprasegmental variations depletes working memory capacity, leaving inadequate cognitive resources for higher-level semantic processing, pragmatic interpretation, and responsive turn-taking (Olorunfemi, 2025).

Traditional language learning environments have attempted to address this gap by incorporating authentic audio recordings of non-native speakers into listening curricula. However, static audio repositories such as pre-recorded audio tracks, podcasts, or video clips suffer from insurmountable structural limitations. They are expensive to curate, difficult to update, fixed in speed and complexity, and incapable of dynamic adaptation to individual learner needs. Furthermore, static audio tracks cannot provide targeted, real-time scaffolding that isolates specific phonological features for perceptual recalibration (Bayaro et al., 2026). To overcome these limitations, language education requires a fundamental paradigm shift that marries advanced sociolinguistic theory with emerging computational capabilities. The research gap that motivates DAA can be decomposed into three interrelated dimensions. Pedagogically, existing CALL materials and accent-familiarisation programmes typically rely on static audio corpora or limited recorded samples; they cannot systematically vary the intensity of accent features, isolate individual phonological targets, or adapt difficulty in real time to a learner's Zone of Proximal Development. Thus, learners rarely receive graduated, feature-focused perceptual training that builds from low to high accent load while preserving intelligibility. Technologically, most generative speech and zero-shot voice-conversion systems have been optimised for production quality or automated pronunciation assessment against native-speaker norms; they have not been architected as pedagogically controllable engines that expose a continuous Acoustic Accent Vector (α), inject controllable environmental noise (SNR), and close the loop with learner performance analytics.

Theoretically, while World Englishes, Communication Accommodation Theory (CAT), and the Lingua Franca Core (LFC) each supply essential insights, no existing framework has integrated them into a single operational architecture that simultaneously justifies accent diversity (Kachru), specifies the cognitive mechanism of receptive accommodation (CAT), and defines the phonological boundaries of intelligibility (LFC). Cognitive Load Theory and second-language acquisition principles further inform the sequencing of the Graduated Exposure Model (GEM), ensuring that acoustic challenge remains within manageable cognitive limits (Sweller, 2011). Within DAA, the three theoretical pillars occupy distinct structural roles. Kachru's Concentric Circles model supplies the sociolinguistic mandate: the generative engine must be capable of authentic Outer- and Expanding-Circle varieties rather than treating them as deviations. CAT supplies the learner-side mechanism: receptive accommodation is conceptualized as a trainable capacity for real-time perceptual convergence. The LFC supplies the algorithmic constraint: the engine may freely manipulate non-essential regional features while preserving essential intelligibility parameters. Cognitive Load Theory and SLA principles govern the pedagogical sequencing of GEM, determining the progression of α values and task complexity across the three phases (Sweller, 2011). Together these components address the gap left by prior accent-familiarization and perceptual-training procedures, which have lacked adaptive generative control, explicit theoretical integration, and a clear separation of receptive from productive goals.

By operationalizing these theoretical pillars, the primary objective of this paper is to detail the technical, pedagogical, and evaluative architecture of Dynamic Accent Accommodation. This paper addresses three core conceptual research questions:

i. How can deep learning speech synthesis models be architected to dynamically generate authentic, pedagogically controlled multi-accented audio across World Englishes contexts?
ii. What instructional frameworks and micro-pedagogical task designs effectively operationalize receptive Communication Accommodation Theory to accelerate auditory processing speed and comprehension?
iii. What standardized quantitative, qualitative, and sociolinguistic criteria are required to evaluate the efficacy, ethical integrity, and equity of generative speech interventions in language education?

Materials and Methods

Generative Speech System Architecture

The architectural and pedagogical model presented below was derived through a purposive synthesis of three literature streams. First, core theoretical sources on World Englishes (Kachru, 1992; Rose et al., 2021; Blair, 2020), Communication Accommodation Theory (Giles & Edwards, 2025; Derwing & Munro, 2015), and the Lingua Franca Core (Jenkins, 2000) were selected for their direct relevance to intelligibility and receptive accommodation. Second, recent technical literature on neural text-to-speech, diffusion-based generation, and zero-shot voice conversion (Tan et al., 2024; Liu, 2024; Soleymanpour et al., 2024) was examined to identify controllable latent representations suitable for pedagogical accent manipulation. Third, cognitive-load and second-language listening research (Mattys et al., 2012; Pichora-Fuller et al., 2016) informed the design of graduated exposure and noise-masking parameters. Sources were summarised thematically and mapped onto the three functional layers of DAA (input processing, generative latent engine with Acoustic Accent Vector α, and adaptive scaffolding loop) and onto the three phases of the Graduated Exposure Model.

The practical implementation of Dynamic Accent Accommodation requires a speech generation infrastructure capable of producing authentic, controllable, and pedagogically adaptive accent variation. Recent advances in neural text-to-speech synthesis, diffusion-based speech generation, and zero-shot voice conversion have significantly improved the naturalness, prosodic control, and speaker adaptation capabilities of AI speech systems (Tan et al., 2024; Liu, 2024). However, most educational applications continue to prioritize pronunciation production and automated assessment rather than receptive adaptation to accent diversity. The proposed DAA architecture addresses this gap by integrating acoustic control, adaptive scaffolding, and learner analytics into a unified pedagogical system.

The Input Processing Layer accepts raw text inputs representing authentic communicative scenarios, such as international business negotiations, academic panel discussions, or informal social interactions. These scripts are processed through a linguistic analyzer that marks syntactic boundaries, nuclear stress points, and pragmatic intonation targets consistent with Lingua Franca Core parameters. The core of the architecture resides in the Generative Latent Engine. This engine utilizes deep latent feature manipulation, separating speaker identity, text content, and acoustic accent characteristics into decoupled vector spaces. Leveraging advanced neural architectures such as diffusion-based acoustic models and zero-shot latent voice cloning systems the engine can project target accent characteristics onto synthesized speech without requiring thousands of hours of region-specific training audio (Liu, 2024; Soleymanpour et al., 2024).

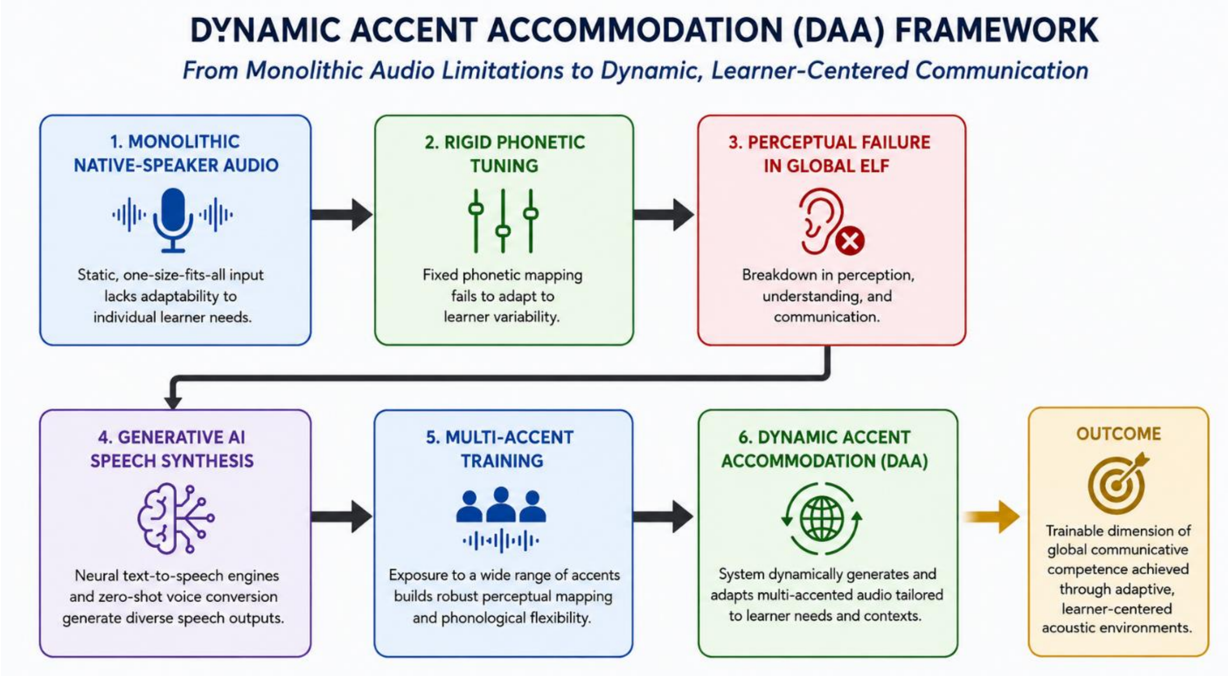

Figure 1. Dynamic Accent Accommodation Framework (Sources: Authors' own elaboration)

This framework contributes a pedagogically operational architecture that connects sociolinguistic theory with AI-enabled listening instruction and provides a foundation for future experimental validation. Kachru's Concentric Circles model provides the foundational sociolinguistic orientation for DAA. By categorizing English speakers into the Inner Circle (norm-providing), Outer Circle (norm-developing), and Expanding Circle (norm-dependent), Kachru (1992) established that regional varieties of English are not imperfect approximations of a singular standard, but are legitimate, rule-governed, and culturally vibrant linguistic systems. In the context of language learning technology, Kachru's model challenges the historical hegemony of Inner-Circle acoustic models. Recent scholars in Global Englishes Language Teaching emphasize that true communicative competence requires receptive flexibility across all three circles (Blair, 2020; Rose et al., 2021). The DAA framework operationalizes this theoretical stance by embedding the full spectrum of World Englishes directly into the acoustic generation engine.

While Kachru (1992) provides the sociolinguistic justification for diversity, Giles' Communication Accommodation Theory (CAT) provides the cognitive and behavioral mechanism governing listener adaptation. CAT posits that interlocutors continuously adjust their communicative behaviors through strategies of convergence, divergence, and maintenance to manage social distance and optimize communicative efficiency. While CAT historically focused on productive accommodation, recent extensions to listening psychology highlight the concept of receptive accommodation (Derwing & Munro, 2015; Mohammadreza & Okim, 2019). Receptive accommodation refers to a listener's willingness and cognitive capacity to adjust their perceptual filters in real time to decode unfamiliar speech variants without experiencing communicative breakdown. The DAA framework conceptualizes receptive accommodation as a plastic, highly trainability skill. By systematically exposing the auditory system to variable acoustic inputs, DAA trains the brain to execute real-time perceptual convergence, broadening the listener's phonemic acceptance bands and mitigating the shock of unfamiliar prosodic structures.

The operational boundaries of this perceptual training are defined by Jenkins' Lingua Franca Core (LFC). Formulated through extensive empirical observation of English as a Lingua Franca interactions, the LFC distinguishes between phonological features that are critical for maintaining mutual intelligibility and those that are non-essential. Essential LFC features include consonant quantity, maintenance of vowel length distinctions, and correct placement of nuclear stress. Non-essential features, conversely, include the substitution of dental fricatives (such as pronouncing the voiced and voiceless "th" sounds as stops /t, d/) and regional pitch variations. Traditional ELT over-emphasizes the elimination of non-essential features, treating harmless regional pronunciations as critical errors. The generative engine is designed to manipulate non-essential regional variants to build perceptual tolerance, while preserving essential LFC parameters to ensure that synthesized speech remains fundamentally intelligible.

Environmental Noise Masking and Signal-to-Noise Ratio (SNR) Control

A critical oversight in legacy Computer-Assisted Language Learning (CALL) research is the assumption that acoustic processing occurs within pristine, acoustically isolated environments. In real-world international discourse, non-native accents are rarely encountered in studio-quality quiet; rather, they are embedded within noisy, dynamic environments such as international airport terminals, bustling industrial sites, or digital video conferences compromised by bandwidth compression and packet loss. When unfamiliar phonetic realization coincides with degraded signal quality, the listener's cognitive load increases exponentially, often precipitating complete communicative breakdown (Mattys et al., 2012; Strori et al., 2020). To prepare learners for these multi-layered acoustic challenges, the Generative Latent Engine incorporates an Environmental Noise Masking sub-module. This module dynamically injects controllable Signal-to-Noise Ratios (SNR) measured in decibels (dB) alongside ambient background interference (e.g., babble noise, HVAC hum, digital jitter) directly into the synthesized audio pipeline. By systematically lowering the SNR parameter in tandem with adjustments to the Acoustic Accent Vector (α), the system operationalizes what speech perception literature terms perceptual resilience (Pichora-Fuller et al., 2016; Keerstock & Smiljanic, 2019). This dual-stress training forces the learner's auditory cortex to rely on top-down semantic constraints and robust phonemic restoration mechanisms, ensuring that dynamic accommodation skills remain functional under adverse, real-world listening conditions.

To achieve precise pedagogical control, the system introduces a continuous mathematical scalar known as the Acoustic Accent Vector (α), bounded between 0.0 and 1.0: α in [0.0, 1.0] When α = 0.0, the engine generates a baseline, highly standardized acoustic model (e.g., standard General American). As α increases toward 1.0, the engine progressively injects region-specific acoustic features associated with target World Englishes varieties, such as Nigerian English, Indian English, or Singaporean English. The manipulation of the Acoustic Accent Vector (alpha) governs three primary phonetic and prosodic transformations:

First, the system manages Segmental Realization shifts. At lower values of α, consonant clusters and vowel qualities remain aligned with standard global baselines. As α advances, the system introduces targeted segmental variations characteristic of specific outer-circle regions. For instance, in synthesizing a Nigerian English acoustic profile, the engine executes dental fricative stopping, shifting voiceless /θ/ to voiceless alveolar stop /t/ and voiced /ð/ to voiced alveolar stop /d/. Simultaneously, monophthongization is applied to specific diphthongs (e.g., shifting /eɪ/, /e/ and /oʊ/ /o/), reflecting authentic regional phonological patterns (Udofot, 2003; Gut, 2008).

Second, the engine executes Suprasegmental Rhythm Adjustments. Standard British and American Englishes are prototypically stress-timed, characterized by significant duration contrasts between stressed and unstressed syllables, alongside extensive vowel reduction in unstressed positions. Conversely, many Outer and Expanding Circle Englishes such as

Singaporean, West African, and Indian varieties exhibit syllable-timed or mora-timed prosodic tendencies, where syllables recur at relatively equal temporal intervals and full vowel quality is preserved across unstressed positions (Gardiner & David, 2020; Fuchs, 2023). The DAA latent engine dynamically modifies durational trajectories across synthesized speech segments. By dampening the duration contrast between stressed and unstressed vowels and reducing schwa substitutions, the engine transforms the rhythm from stress-timed to syllable-timed, training the learner's auditory system to process altered temporal pacing.

Third, the system modulates Pitch Contour and Intonational Trajectories. In many global varieties of English, intonational movement is realized through discrete tone shifts on nuclear syllables rather than the sweeping pitch contours typical of Inner-Circle varieties. The generative engine alters pitch contours across macro-rhythmic phrases, exposing learners to pitch movements that might otherwise be misinterpreted as abrupt or pragmatically inappropriate by listeners tuned exclusively to native standards.

Crucially, the architecture incorporates an Adaptive Scaffolding Loop that transforms the system from a static generator into a human-in-the-loop, responsive learning engine. As the learner interacts with synthesized audio prompts during listening tasks, the system continuously tracks performance metrics, specifically phonetic decoding accuracy and processing latency (response time). If the analytics engine detects a spike in decoding errors or cognitive delay when processing a specific phonological feature (e.g., syllable-timed prosody in South Asian English), the adaptive algorithm dynamically recalibrates the Acoustic Accent Vector (α). The algorithm lowers α to provide scaffolding, isolating the troublesome feature, and then gradually increments α across subsequent items as performance stabilizes. This closed-loop design ensures that the acoustic challenge remains within the learner's Zone of Proximal Development, preventing both cognitive boredom from overly simplified input and affective shutdown from overwhelming complexity.

The Graduated Exposure Pedagogical Model

Technology alone cannot transform learning outcomes without a structured instructional framework. To operationalize the system architecture described above, this paper formulates the Graduated Exposure Model (GEM), a pedagogical framework designed to systematically build receptive accommodation capacity in L2 learners. Grounded in cognitive load theory and second language acquisition principles, GEM structures learning activities into three progressive, highly targeted phases: Baseline Calibration, Controlled Phonological Shift, and Conversational Complexity.

Phase 1, termed Baseline Calibration, focuses on establishing stable cognitive anchor points while introducing low-level acoustic variation. In this phase, the Acoustic Accent Vector is set to a low intensity (α = 0.2 to 0.3). Learners are exposed to audio prompts featuring local or highly familiar non-native varieties. The pedagogical goal of Phase 1 is not to challenge the auditory system with radical phonological shifts, but to desensitize the learner to the presence of non-native voice quality features. Listening tasks in this phase focus on high-frequency lexical items and familiar contextual themes. By ensuring that semantic content remains transparent, Phase 1 reduces affective anxiety and builds initial self-efficacy, establishing the foundational mindset required for dynamic accommodation.

Phase 2, designated Controlled Phonological Shift, advances the instructional challenge by isolating specific phonological deviations mapped directly to the Lingua Franca Core. In this phase, the system operates at moderate accent weights (α = 0.4 to 0.6). Rather than presenting chaotic, unanalyzed audio, the GEM framework introduces systematic, targeted phonological shifts one feature at a time. For instance, a module may focus specifically on consonant cluster simplification in East Asian Englishes or vowel length neutralization in African Englishes.

The micro-pedagogies employed in Phase 2 utilize specialized auditory training techniques designed to recalibrate phonemic categories:

i. Perceptual Shadowing Tasks: Learners listen to short generative prompts exhibiting targeted accent variations and immediately repeat the utterance aloud. This real-time auditory-to-articulatory mapping forces the brain to process the precise acoustic structure of the input, accelerating the formation of flexible mental representations for non-standard phonemes.

ii. Differential Minimal-Pair Cloze Exercises: Learners listen to sentences containing words where non-standard segmental realizations create potential lexical ambiguities (e.g., distinguishing between "thin" /θɪn/ synthesized as "tin" /tɪn/ in varieties exhibiting dental stop substitution). Learners must select the intended lexical item based on context, directly training the brain to rely on semantic constraint when phonetic cues diverge from standard norms.

iii. Auditory Recalibration Drills: Learners are presented with the same underlying sentence synthesized across an escalating gradient of accent vectors ($\alpha = 0.2 \longrightarrow 0.4 \longrightarrow 0.6 \longrightarrow 0.8$). This gradual acoustic morphing allows the auditory cortex to track structural transformations in real time, developing explicit cognitive awareness of how specific sounds shift across regional boundaries.

Discussion

Response to Research Questions

The conceptual architecture responds directly to the three research questions posed in the Introduction. Research Question 1 asked how deep-learning speech synthesis models can be architected to generate authentic, pedagogically controlled multi-accented audio. The proposed Generative Latent Engine, with its decoupled latent spaces and continuous Acoustic Accent Vector (α [0.0, 1.0]), together with the Environmental Noise Masking module, supplies a controllable mechanism for generating Outer- and Expanding-Circle varieties while preserving Lingua Franca Core intelligibility parameters. Research Question 2 asked what instructional frameworks and micro-pedagogical tasks operationalize receptive Communication Accommodation Theory. The Graduated Exposure Model (GEM). Baseline Calibration ($\alpha = 0.2$–0.3), Controlled Phonological Shift ($\alpha = 0.4$–0.6), and Conversational Complexity ($\alpha = 0.7$–1.0) together with perceptual shadowing, differential minimal-pair cloze, auditory recalibration drills, rapid-switching turn-taking, and noise-masked decoding, provides a sequenced answer grounded in cognitive-load and SLA principles. Research Question 3 asked what criteria are required to evaluate efficacy, ethical integrity, and equity. The proposed multi-dimensional matrix comprising APRT, DPDA, affective/WTC measures, and the ethical guidelines (authentic data sourcing, participatory design, compensation and data sovereignty, voice privacy and consent, voice-cloning safeguards, and sociolinguistic scaffolding) constitutes the evaluative framework. All metrics and mechanisms remain proposed and await empirical validation.

The Receptive-Productive Boundary: Preventing Unintended Phonetic Drift

A vital theoretical nuance that distinguishes Dynamic Accent Accommodation from conventional pronunciation frameworks is the strict conceptual separation between receptive processing capacity and productive phonetic modification. A known risk in intensive perceptual training is the phenomenon of uncontrolled phonetic drift or accidental productive over-accommodation, wherein a learner unintentionally begins to mimic the non-native acoustic, prosodic, or segmental features of their interlocutor (Chang, 2019; Piazza et al., 2023). In cross-cultural interactions, uncalibrated productive mimicry by an L1 or advanced L2 speaker can be misconstrued as patronizing, culturally insensitive, or mockingly performative (Giles & Edwards, 2025; Mohammadreza & Okim, 2019). The Graduated Exposure Model explicitly safeguards against this by establishing a firm Receptive-Productive Boundary. While interactive tasks (such as Perceptual Shadowing and Cloze Drills) require internal auditory-to-articulatory mapping for perceptual recalibration, the system's automated evaluation metrics assess exclusively listener decoding accuracy and processing speed, never rewarding productive accent imitation. By decoupling receptive convergence from productive mimicry, the framework trains learners to effortlessly decode diverse World Englishes without compromising their own authentic, highly intelligible productive speech identity.

Phase 3, titled Conversational Complexity, represents the advanced operational stage of the GEM framework. In this phase, the system operates at high accent weights ($\alpha = 0.7$ to 1.0) and simulates authentic, unscripted global communicative environments. Real-world international interactions rarely involve a single speaker communicating at a measured cadence. Instead, they feature multi-party discussions, rapid speaker switching, overlapping speech, background noise, and varying degrees of pragmatic directness. To prepare learners for these complex environments, Phase 3 deploys multi-speaker dialogic simulations. The generative engine synthesizes real-time conversations involving multiple AI speech agents, each programmed with distinct World Englishes acoustic profiles (e.g., a multi-party business meeting featuring a Nigerian executive, an Indian software architect, a German logistics director, and a Brazilian marketing specialist).

The micro-pedagogies in Phase 3 emphasize macro-comprehension and real-time processing under pressure:

i. Rapid-Switching Turn-Taking Drills: The learning interface presents fast-paced dialogue exchanges where the active speaker shifts every few seconds, requiring the learner's auditory processor to rapidly recalibrate to a new acoustic accent profile without losing the thread of the conversation.

ii. Interactive Noise-Masked Decoding: To simulate real-world communicative conditions, the generative engine overlays synthesized multi-accent dialogues with ambient environmental noise (e.g., airport terminal chatter, conference hall reverberation). Learners must extract key semantic information despite competing acoustic distractions, testing the robust integration of their perceptual accommodation skills.

iii. Bidirectional Accommodation Simulations: Learners actively participate in dialogue simulations using their own voices. The generative AI speech agent evaluates the learner's input and adjusts its synthesized responses, creating a dynamic conversational loop where both human learner and machine agent continuously negotiate mutual intelligibility.

iv. By progressing sequentially through Baseline Calibration, Controlled Phonological Shift, and Conversational Complexity, the Graduated Exposure Model ensures that receptive accommodation capacity is systematically built, reinforced, and automated.

Sociolinguistic Implications

To transition Dynamic Accent Accommodation from a conceptual model into an empirically validated, ethically grounded educational framework, rigorous evaluation standards must be established. Traditional language learning assessments are themselves heavily compromised by native-speaker bias, evaluating learner success through standardized listening tests recorded exclusively by British or American voice actors. Such tests fail to measure receptive accommodation capacity, as they test only how well a learner decodes a singular, highly artificial acoustic standard. Evaluating DAA requires a multi-dimensional assessment framework combining quantitative processing metrics, qualitative affective scales, and sociolinguistic equity audits.

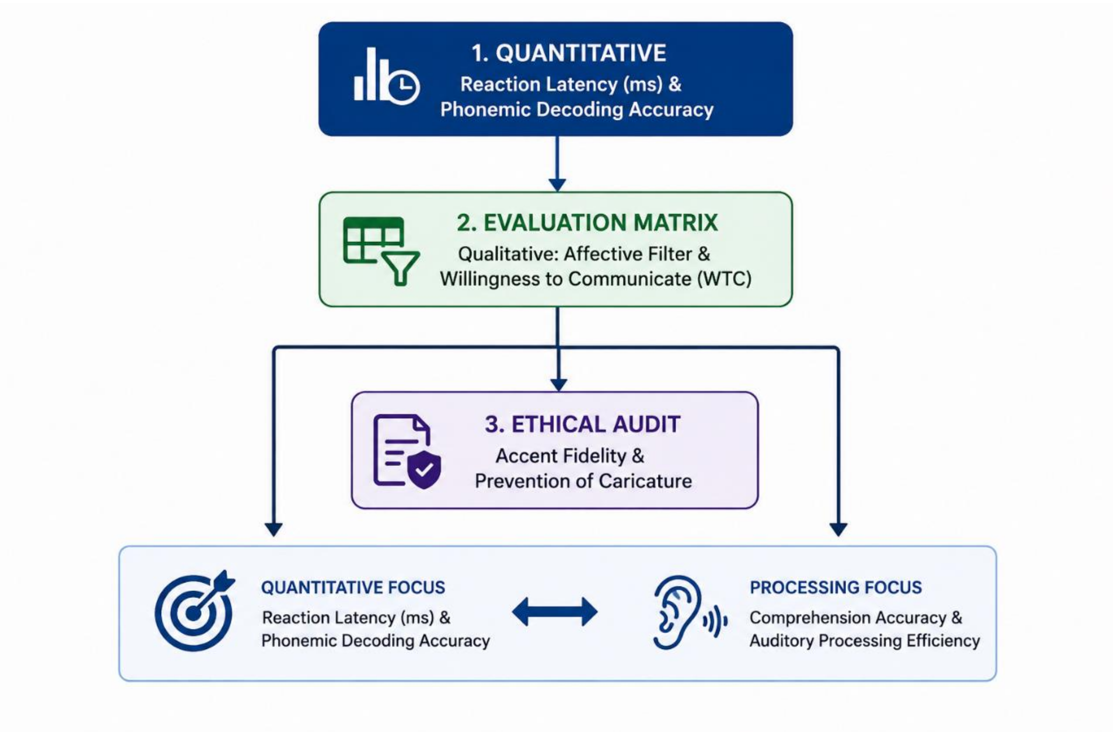

Figure 2. Evaluating DAA (Source: Authors' own elaboration)

Figure 2 summarizes the proposed multi-dimensional evaluation matrix, integrating quantitative processing metrics (APRT, DPDA), qualitative affective measures, and sociolinguistic equity audits. Quantitative evaluation of receptive accommodation must focus on measuring both comprehension accuracy and auditory processing efficiency. Processing efficiency is critical because a learner who understands a non-native accent only after ten seconds of intense mental reconstruction will fail in real-time, fast-paced international conversations.

The proposed assessment matrix establishes two core quantitative metrics:

First, Auditory Processing Reaction Time (APRT), measured in milliseconds (ms). APRT records the temporal latency between the precise acoustic offset of a multi-accented auditory prompt and the learner's correct selection of a semantic or phonological choice on a digital testing interface. A significant baseline latency indicates high cognitive friction and manual decoding effort. As receptive accommodation becomes automated through DAA training, APRT curves should demonstrate a steep negative slope, signaling that the auditory cortex is decoding non-standard input with minimal cognitive delay.

Second, Differential Phonemic Decoding Accuracy (DPDA), calculated as a percentage score across specific World Englishes categories. Rather than aggregating listening scores into a single monolithic grade, DPDA breaks performance down into region-specific sub-scores (e.g., West African English Decoding Accuracy, South Asian English Decoding Accuracy). This diagnostic granularity enables educators and adaptive algorithms to pinpoint specific perceptual blind spots in a learner's acoustic repertoire.

Qualitative evaluation must assess psychological and affective transformations within the learner. In alignment with MacIntyre (2007) Willingness to Communicate (WTC) framework, DAA evaluations must measure reductions in accent-induced communicative anxiety. When learners feel terrified of encountering unfamiliar accents, their affective filter rises, causing them to withdraw from global interactions. Standardized Likert-scale instruments, combined with semi-structured qualitative interviews, should track changes in learner self-efficacy, perceived listening ease, and readiness to engage in translingual contexts following DAA intervention. Effective DAA training should manifest as a significant drop in accent anxiety and a corresponding surge in global WTC scores. Beyond technological and pedagogical metrics, the implementation of generative speech technology in language education carries profound sociolinguistic and ethical implications. Generative artificial intelligence systems are notorious for reflecting and amplifying the structural biases embedded within their training datasets (Weidinger et al., 2022; Bender et al., 2021). If an AI speech engine is trained on low-quality, limited, or biased voice samples, it risks synthesizing acoustic caricatures exaggerated, unnatural, or mocking representations of regional accents that reinforce harmful linguistic stereotyping. Auditory Processing Reaction Time (APRT) and Differential Phonemic Decoding Accuracy (DPDA) are proposed metrics; their reliability, validity, and sensitivity remain to be established through future empirical pilot studies.

Normative Assessment AI vs. Accommodative Pedagogy AI

To fully grasp the disruptive novelty of Dynamic Accent Accommodation, it must be positioned in direct theoretical opposition to the prevailing paradigm of commercial automated language assessment. Contemporary speech-evaluation AI embedded in mainstream language learning applications and high-stakes standardized testing platforms operates almost exclusively on Normative Assessment AI models. These systems utilize Automatic Speech Recognition (ASR) acoustic models trained primarily on native-speaker datasets, explicitly penalizing non-native stress patterns, vowel shifts, and consonant cluster reductions as "errors" or "deviations" (Galaczi, & Pastorino-Campos, 2025; Litman et al., 2018). This architectural bias reinforces linguistic hegemony by forcing non-native speakers to conform to an Anglo-American acoustic monolith while simultaneously training human listeners to view non-standard accents as deficient (Lippi-Green, 2012). In contrast, the framework proposed here establishes an Accommodative Pedagogy AI paradigm. Rather than using AI as a punitive gatekeeper that demands speaker conformity, Accommodative Pedagogy AI harnesses deep generative networks to expand human listener flexibility. By shifting the computational burden of adaptation from the speaker to the listener, this framework fundamentally reconfigures the sociolinguistic role of artificial intelligence in education moving from an instrument of linguistic assimilation to a tool for global linguistic equity.

To safeguard against these risks, DAA implementations must adhere to strict ethical guidelines:

i. Authentic Data Sourcing and Participatory Design: Generative accent models must be built using extensive high-fidelity voice data contributed directly by native speakers from Outer and Expanding Circle regions. Linguistic communities must be involved as co-designers, ensuring that synthesized acoustic profiles accurately represent authentic, prestigious regional varieties rather than offensive stereotypes.

ii. Fair Compensation and Data Sovereignty: AI developers must ensure fair financial compensation and clear data sovereignty rights for speakers whose voice data is utilized to train neural speech engines, preventing digital extraction and exploitation of global South voice talents.

iii. Explicit Sociolinguistic Scaffolding: DAA software must integrate explicit sociolinguistic commentary into the learner interface. The software should clearly inform learners that Outer and Expanding Circle varieties are legitimate, highly sophisticated linguistic systems integral to global trade and culture, explicitly counteracting historical narratives of linguistic deficit.

iv. By adhering to these ethical guardrails, Dynamic Accent Accommodation transforms generative AI from a potential tool of linguistic homogenization into a powerful engine for decolonizing language education. Historically, language teaching technology has enforced Western native-speaker dominance, compelling millions of learners worldwide to conform to a narrow linguistic ideal. DAA flips this paradigm, using advanced computational power to celebrate, validate, and operationalize global linguistic diversity.

Limitations

As a conceptual contribution, this paper does not report empirical results; all mechanisms, metrics, and expected outcomes are proposed and require future validation. Several limitations must therefore be acknowledged. First, the authenticity of synthesized accents remains an open question. Even high-fidelity generative models may produce acoustic profiles that diverge from the statistical distributions of natural speech in a given variety; community validation and participatory design are essential but do not fully eliminate the risk of residual artificiality or stereotyping. Second, World Englishes varieties are internally heterogeneous. A single Acoustic Accent Vector continuum cannot capture the full range of sociolectal, regional, and individual variation within, for example, Nigerian or Indian English. The framework currently treats varieties at a relatively coarse level of granularity. Third, the validity of the continuous α parameter as a psychologically meaningful dimension of accent "strength" has not been established. Whether linear interpolation in latent space corresponds to linear changes in perceived accentedness or processing difficulty is an empirical question. Fourth, transfer of trained receptive skills to spontaneous, multi-party, real-world interaction cannot be assumed. Laboratory or platform-based gains in APRT or DPDA may not generalize to high-stakes communicative settings without additional ecological validation. Fifth, despite ethical safeguards, the risk of accent stereotyping persists if training data are unbalanced or if interface design inadvertently frames non-Inner-Circle varieties as marked or deficient. Sixth, access to the computational resources, bandwidth, and devices required for interactive generative-speech training is unevenly distributed; without deliberate attention to low-resource deployment, DAA risks reinforcing rather than reducing educational inequities.

Future Research

Future empirical work can operationalize the proposed metrics in small-scale pilot studies. For example, a within-subjects pilot might expose intermediate L2 learners ($N \approx 20$–30) to a two-week GEM sequence (Phases 1–2) targeting one Outer-Circle variety, measuring APRT and DPDA before and after training on matched pre-/post-test item banks. A second pilot could compare noise-masked versus clean-speech conditions at fixed α levels to test the contribution of Environmental Noise Masking to perceptual resilience. Qualitative interviews and WTC scales administered at both time points would complement the quantitative indices. Such pilots would supply the first empirical evidence of feasibility, effect-size estimates, and metric sensitivity before larger controlled trials.

Conclusion

Dynamic Accent Accommodation offers a theoretically grounded conceptual framework for aligning language education more closely with the multilingual realities of contemporary global communication. By integrating World Englishes, Communication Accommodation Theory, and the Lingua Franca Core with adaptive generative speech technologies, the framework shifts pedagogical emphasis from accent conformity toward receptive flexibility and intelligibility. The proposed architecture and Graduated Exposure Model provide a coherent basis for future empirical studies examining listening comprehension, processing efficiency, communicative confidence, and equitable AI-supported language learning. The paper's contribution is the formulation of a research agenda that connects sociolinguistic diversity, educational technology, and responsible artificial intelligence within a single pedagogical framework. Realization of the intended benefits remains contingent on rigorous empirical validation, community participation, and attention to the limitations outlined above.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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From Carbon Compliance to Sustainable Value Creation: A Conceptual Framework for Carbon Handprints under Carbon Pricing

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Abstract: Environmental regulation is increasingly expected not only to reduce carbon emissions but also to promote sustainable value creation through positive environmental incentives. However, existing studies generally examine carbon pricing, carbon handprints, and sustainable value creation separately, leaving the economic mechanism linking these research streams insufficiently explained. This conceptual paper develops a unified theoretical framework that integrates carbon pricing, recognized carbon handprints, and institutional recognition into firms' production decisions. Using an optimization-based analytical approach, the framework examines how carbon-pricing costs and the recognized economic value of avoided emissions jointly affect firms' optimal production decisions. The analysis shows that institutional recognition transforms avoided emissions into measurable economic value and identifies the threshold at which environmental regulation shifts from a compliance-oriented mechanism toward sustainable value creation. The findings suggest that carbon pricing and carbon handprint recognition can operate as complementary policy instruments. Policymakers may therefore strengthen climate-policy effectiveness by combining carbon-cost internalization with institutional mechanisms that reward positive environmental performance. As a conceptual study, the analysis does not rely on empirical datasets.
Keywords: Carbon pricing; Carbon handprints; Institutional recognition; Sustainable value creation; Climate policy.

Introduction

Environmental regulation is increasingly expected not only to reduce carbon emissions through regulatory compliance but also to encourage positive environmental contributions. Carbon pricing has become a cornerstone of contemporary climate policy by assigning an explicit economic cost to greenhouse-gas emissions and encouraging firms to adopt cleaner production technologies (Porter & van der Linde, 1995; Nordhaus, 2019). Although carbon pricing promotes environmental efficiency by internalizing emission-related costs, growing attention is being directed toward policy mechanisms that also recognize and reward environmentally beneficial activities. This development reflects a broader shift in climate policy from a predominantly compliance-oriented approach toward sustainable value creation, creating a need for conceptual frameworks that explain how positive environmental contributions influence firms' economic decisions.

Carbon pricing is widely recognized as one of the most effective market-based instruments for mitigating greenhouse-gas emissions because it encourages firms to internalize environmental costs while maintaining flexibility in production and investment decisions (Porter & van der Linde, 1995; Aldy & Stavins, 2012; Nordhaus, 2019). Consequently, the existing literature has primarily examined firms' responses to climate policy through environmental compliance, emission reduction, and the internalization of carbon-related costs. This perspective has substantially advanced our understanding of the economic effects of environmental regulation. However, focusing exclusively on cost internalization provides only a partial explanation of firms' environmental decision-making. In practice, firms increasingly pursue environmental strategies not only to reduce compliance costs but also to create long-term economic value through cleaner production and sustainable innovation. This development suggests that an effective climate-policy framework should incorporate mechanisms capable of recognizing and rewarding positive environmental contributions in addition to pricing carbon emissions.

This changing policy perspective has led to increasing attention to carbon handprints, which emphasize positive environmental contributions generated through cleaner technologies and sustainable production (Grönman et al., 2019; Tuppura et al., 2024; Eberhardt et al., 2024). Unlike conventional carbon-footprint measures that primarily quantify environmental burdens, carbon handprints highlight the environmental benefits created by reducing or avoiding emissions. As a result, they provide a broader perspective for evaluating firms' environmental performance. Despite this growing interest, the economic role of carbon handprints remains insufficiently understood. Existing studies have primarily focused on environmental measurement and sustainability assessment, while relatively little attention has been devoted to explaining how positive environmental contributions influence firms' production decisions or create measurable economic incentives. Consequently, an important conceptual question remains unresolved: How can positive environmental contributions become measurable economic incentives that influence firms' production decisions under carbon pricing?

Although carbon pricing, carbon handprints, and sustainable value creation have each attracted increasing academic attention, they have largely developed as separate lines of research. Consequently, existing studies do not explain how positive environmental contributions can be systematically incorporated into firms' production decisions or transformed into measurable economic value within a unified optimization framework. This missing analytical linkage limits our theoretical understanding of how environmental regulation influences firms beyond conventional cost internalization. To address this issue, this conceptual paper introduces institutional recognition as the economic mechanism that connects recognized carbon handprints with firms' production decisions. By explicitly incorporating institutional recognition into a unified optimization model, the proposed framework explains how positive environmental contributions become measurable economic incentives and identifies the conditions under which environmental regulation evolves from compliance to sustainable value creation.

This conceptual paper develops a unified theoretical framework that integrates carbon pricing, recognized carbon handprints, and institutional recognition within firms' production decisions. The framework offers a theoretical perspective on how environmental regulation may evolve from compliance toward sustainable value creation.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature and identifies the research gap. Section 3 presents the theoretical framework and analytical methodology. Section 4 reports the main analytical results, Section 5 discusses their theoretical and policy implications, and Section 6 concludes the paper.

Literature review

Carbon pricing and firms' production decisions

Carbon pricing has become one of the principal market-based instruments for addressing climate change by incorporating the environmental costs of greenhouse-gas emissions into firms' economic decision-making. Rather than prescribing specific abatement technologies, carbon-pricing mechanisms influence firms' production, investment, and innovation decisions by assigning an explicit economic cost to carbon emissions. Consequently, firms are encouraged to reduce emission intensity through market incentives while retaining the flexibility to determine their own production strategies (Porter & van der Linde, 1995; Nordhaus, 2019).

A growing body of research has investigated how carbon pricing influences firms' production behavior and economic performance. Existing studies generally conclude that higher carbon prices increase production costs, alter firms' input choices, encourage technological upgrading, and accelerate investment in cleaner production technologies (Aldy & Stavins, 2012; Martin et al., 2014; Calel & Dechezleprêtre, 2016). These findings suggest that carbon pricing plays an important role in promoting technological innovation and facilitating the transition toward low-carbon production systems.

More recent studies further argue that the effectiveness of carbon pricing depends not only on the carbon price itself but also on firms' responses to environmental regulation. Well-designed environmental policies may improve both environmental and economic performance by encouraging technological innovation, resource reallocation, and productivity improvement rather than merely increasing regulatory costs (Porter & van der Linde, 1995; Calel & Dechezleprêtre, 2016). Consequently, firms increasingly regard environmental investment as part of their long-term competitive strategy instead of viewing emission reduction solely as a regulatory obligation.

Despite these important advances, existing carbon-pricing models continue to interpret environmental regulation primarily from the perspective of cost internalization. Carbon pricing typically enters firms' objective functions as an additional production cost or environmental compliance expenditure, implying that environmental improvement mainly serves to reduce regulatory burdens (Nordhaus, 2019; Aldy & Stavins, 2012). Relatively less attention has been devoted to the possibility that superior environmental performance may itself become a source of measurable economic value capable of influencing firms' production decisions.

This limitation becomes increasingly important as firms adopt climate strategies that emphasize innovation, sustainability, and long-term value creation. Recent environmental and corporate sustainability research suggests that firms may generate competitive advantages through environmental leadership rather than simply minimizing compliance costs (Hart, 1995; Eccles et al., 2014; Friede et al., 2015). However, the existing carbon-pricing literature has not yet established a formal theoretical framework explaining how positive environmental performance can be incorporated directly into firms' production decisions as a source of measurable economic value. Addressing this issue requires extending the traditional cost-internalization perspective toward a theoretical framework that explicitly recognizes the economic value of recognized avoided emissions. The following section therefore reviews the emerging literature on carbon handprints.

Carbon handprints and environmental value creation

The concept of carbon handprints has recently emerged as an important complement to conventional carbon-footprint assessment. Whereas carbon footprints quantify the environmental burdens generated by production and consumption activities, carbon handprints emphasize the positive environmental impacts created through avoided emissions, cleaner technologies, and sustainable innovation (Grönman et al., 2019). This perspective shifts environmental assessment from measuring negative environmental impacts toward recognizing positive climate contributions, thereby providing a broader framework for evaluating firms' environmental performance.

Building upon this concept, subsequent studies have further expanded the methodological foundations of carbon handprints. Existing research has primarily focused on developing standardized assessment methods, life-cycle evaluation procedures, sector-specific applications, and environmental reporting frameworks capable of quantifying avoided emissions generated by products, technologies, and production systems (Tuppura et al., 2024; Eberhardt et al., 2024). These studies have substantially improved the consistency and transparency of carbon handprint measurement and have demonstrated its usefulness for environmental communication, sustainability assessment, and life-cycle management.

The increasing adoption of carbon handprints also reflects a broader transition in sustainability research from environmental burden reduction toward positive environmental value creation. Rather than evaluating firms solely according to the emissions they generate, carbon handprints recognize the environmental benefits that firms create by replacing more carbon-intensive technologies or production processes. Consequently, carbon handprints provide an important conceptual foundation for understanding how technological innovation contributes to climate-change mitigation while simultaneously improving firms' environmental performance (Hart, 1995; Grönman et al., 2019).

Despite these important developments, the existing carbon handprint literature remains primarily concerned with environmental measurement rather than economic decision-making. Current studies generally treat carbon handprints as indicators of environmental performance, sustainability reporting, or life-cycle assessment, while relatively little attention has been devoted to explaining how avoided emissions influence firms' production decisions, profitability, or resource allocation. Consequently, carbon handprints remain largely measures of environmental performance rather than variables that directly influence firms' economic decisions.

This limitation has become increasingly important as governments, investors, and financial institutions place greater emphasis on climate-related corporate performance. Growing evidence indicates that environmental information is becoming progressively more relevant to investment decisions, corporate valuation, and sustainable finance (Eccles et al., 2014; Friede et al., 2015; Krueger et al., 2020; Bolton & Kacperczyk, 2021). Nevertheless, the existing carbon handprint literature has not yet established a theoretical framework explaining how recognized avoided emissions influence firms' production decisions or generate measurable economic value. This limitation naturally leads to the next stream of research, which examines how environmental performance is translated into measurable economic value through sustainable value creation and institutional recognition.

Sustainable value creation and institutional recognition

Recent advances in sustainability research have increasingly shifted attention from environmental compliance toward sustainable value creation. Rather than viewing environmental protection solely as a regulatory obligation or an additional production cost, contemporary studies argue that superior environmental performance may generate long-term economic benefits by strengthening firms' competitiveness, improving stakeholder relationships, and enhancing corporate value (Hart, 1995; Eccles et al., 2014; Friede et al., 2015). Consequently, environmental performance is increasingly regarded as a strategic resource capable of contributing to firms' long-run economic success.

The growing importance of sustainable finance has further strengthened this perspective. Investors, financial institutions, and capital markets increasingly incorporate climate-related information into investment decisions, corporate valuation, and lending activities. Firms demonstrating superior environmental performance generally experience lower financing costs, improved access to capital, and stronger investor confidence because climate-related risks and sustainability performance have become increasingly relevant to corporate valuation (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Flammer, 2021). These developments suggest that environmental performance may generate measurable economic value through institutional recognition rather than solely through regulatory compliance.

From an economic perspective, the recognition of environmental performance depends on institutional mechanisms capable of translating environmental improvements into economic incentives. Institutional recognition encompasses market- and policy-based mechanisms, including carbon-credit markets, sustainability disclosure standards, green public procurement, transition-finance policies, and environmental certification systems. These mechanisms influence firms' production and investment decisions by increasing the private value associated with environmental improvement, thereby complementing conventional carbon-pricing policies that primarily operate through cost internalization (Porter & van der Linde, 1995; Krueger et al., 2020; Flammer, 2021).

Despite the rapid development of sustainable finance and corporate sustainability research, relatively little attention has been devoted to formally incorporating institutional recognition into firms' production decisions. Existing studies generally document the relationship between environmental performance and corporate value using empirical evidence, whereas the underlying economic mechanism through which recognized environmental performance influences firms' production behavior remains largely unexplored. Consequently, institutional recognition is typically treated as an empirical observation rather than an explicit mechanism within firms' economic decision-making.

This limitation is particularly important for the emerging carbon handprint literature. Although carbon handprints quantify positive environmental contributions through avoided emissions, existing studies do not explain how these environmental improvements become economically valuable once they are recognized by market and policy institutions. The present study addresses this limitation by introducing an explicit recognition mechanism through which avoided emissions are transformed into measurable economic value that directly enters firms' production decisions. This institutional-recognition perspective provides the theoretical foundation for integrating carbon pricing, carbon handprints, and sustainable value creation within a unified optimization framework.

Research gap and theoretical contribution

The preceding review highlights three important research streams concerning climate policy and sustainable production. Carbon-pricing studies have established how environmental regulation influences firms' production decisions by internalizing the costs of carbon emissions (Porter & van der Linde, 1995; Nordhaus, 2019). Carbon handprint research has advanced the measurement of avoided emissions and positive environmental contributions (Grönman et al., 2019; Tuppura et al., 2024; Eberhardt et al., 2024). Meanwhile, sustainable finance studies have demonstrated that environmental performance increasingly affects corporate valuation, financing conditions, and firms' long-term competitiveness (Eccles et al., 2014; Krueger et al., 2020; Bolton & Kacperczyk, 2021).

Despite these advances, these research streams remain only loosely connected. Existing carbon-pricing models primarily emphasize environmental cost internalization, whereas carbon handprint studies focus mainly on environmental measurement. At the same time, sustainable finance literature generally documents the economic consequences of environmental performance without explicitly incorporating those effects into firms' production decisions. Consequently, the economic role of recognized avoided emissions remains insufficiently explained within a unified theoretical framework.

To address this gap, this conceptual paper develops an optimization-based theoretical framework that integrates carbon pricing, carbon handprints, and institutional recognition into a single analytical framework. The model treats recognized carbon handprints as an explicit economic incentive rather than merely an environmental-performance indicator, allowing avoided emissions to directly influence firms' production decisions and sustainable value creation.

Accordingly, this study makes three contributions. First, it integrates carbon pricing, carbon handprints, and institutional recognition within a unified theoretical framework. Second, it introduces an explicit recognition mechanism through which avoided emissions become measurable economic value affecting firms' optimal production decisions. Third, it identifies the institutional conditions under which environmental regulation evolves from a compliance-oriented mechanism into a value-creation mechanism.

Materials and methods: Theoretical framework

This study adopts an optimization-based analytical approach to develop a conceptual model of firms' production decisions under carbon pricing and carbon handprint recognition. Rather than relying on empirical data, the analysis specifies a representative profit-maximizing firm and derives its optimal production decision from a formal economic model. The analytical procedure consists of defining the model environment, specifying the production and environmental cost structure, deriving the firm's optimal output, and examining the resulting comparative-static effects and transition condition.

Conceptual framework

The proposed theoretical framework integrates three research streams that have largely developed independently in the existing literature: carbon pricing, carbon handprints, and sustainable value creation. Carbon pricing influences firms' production decisions by internalizing the environmental costs of carbon emissions, whereas carbon handprints represent the positive environmental contributions generated through avoided emissions. The present study further introduces institutional recognition as the mechanism through which these avoided emissions are transformed into measurable economic value.

Within this framework, firms simultaneously face two environmental incentives. Carbon pricing increases production costs through environmental compliance obligations, while recognized carbon handprints generate economic benefits by rewarding cleaner production technologies. Consequently, firms determine their production decisions by balancing conventional production costs, carbon-pricing costs, and the economic value created by recognized carbon handprints.

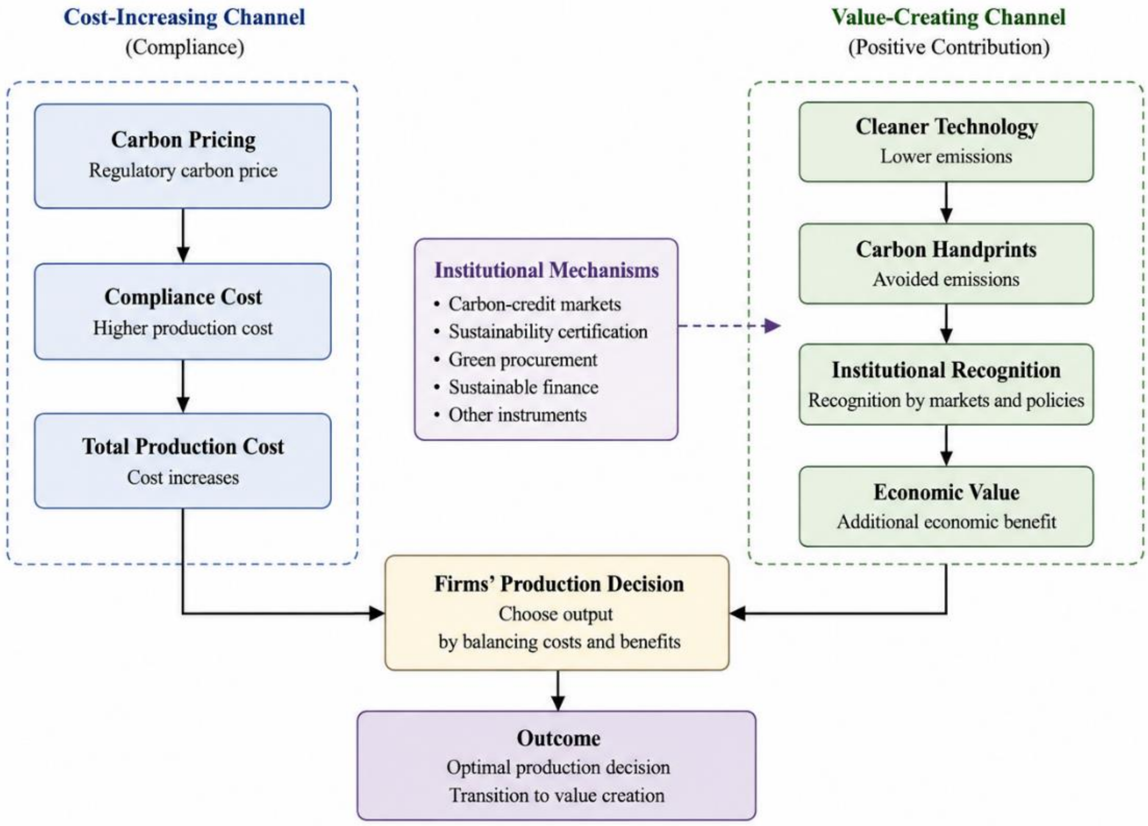

Figure 1: Conceptual Framework for the Interactions among Carbon Pricing, Carbon Handprints, and Institutional Recognition

Note. The framework illustrates the cost-increasing channel through carbon pricing and the value-creating channel through recognized carbon handprints. Source: Authors' own elaboration.

Figure 1 summarizes the conceptual structure of the proposed framework. Environmental regulation and institutional recognition jointly influence firms' production decisions through two complementary economic channels: carbon pricing discourages carbon-intensive production by increasing environmental costs, whereas recognized carbon handprints encourage cleaner production by creating additional economic value. The interaction between these two mechanisms determines firms' optimal production decisions and establishes the conditions under which environmental regulation evolves from a compliance-oriented system toward sustainable value creation.

Based on this conceptual framework, the following sections formally develop the theoretical model. Section 3.2 defines the model environment, while Sections 3.3 and 3.4 specify the firm's production-cost structure and derive its optimal production decision. Section 4 presents the analytical results, and Section 5 discusses their theoretical and policy implications.

Model environment

We consider a representative profit-maximizing firm operating under a carbon-pricing regime. The firm produces a homogeneous product using a technology characterized by its carbon-emission intensity and determines its production decisions by jointly considering conventional production costs, carbon-pricing obligations, and the economic value generated by avoided emissions. Consistent with the environmental economics literature, carbon pricing internalizes the social cost of greenhouse-gas emissions by assigning an explicit price to carbon emissions, thereby encouraging firms to adopt cleaner production technologies (Porter & van der Linde, 1995; Nordhaus, 2019). At the same time, recent developments in carbon handprint research emphasize that firms may create positive environmental value through avoided emissions relative to a benchmark technology rather than merely reducing their own emissions (Grönman et al., 2019; Eberhardt et al., 2024). Accordingly, firms simultaneously face two complementary environmental incentives: the regulatory cost imposed on emissions and the economic opportunity created by superior environmental performance.

Let $Q \geq 0$ denote the firm's production level. The firm's production technology is characterized by its carbon-emission intensity $E_T > 0$, measured as carbon emissions per unit of output. Total emissions generated by the firm are therefore expressed as

$$\varepsilon(Q) = E_T Q \tag{1}$$

To evaluate environmental performance, production emissions are compared with those generated by a benchmark technology. Let $E_B > 0$ denote the benchmark emission intensity, which may represent an industry-standard production process, a conventional technology, or an appropriate baseline adopted for environmental assessment (Grönman et al., 2019; Tuppura et al., 2024). Throughout the analysis, the benchmark technology is assumed to be exogenously given and observable to regulators, investors, customers, and other market participants.

Following the carbon handprint framework proposed by Grönman et al. (2019), the firm's carbon handprint is defined as the avoided emissions generated per unit of output relative to the benchmark technology,

$$C_H = E_B - E_T \tag{2}$$

Accordingly, the firm's total avoided emissions are

$$H(Q) = C_H Q = (E_B - E_T) Q \tag{3}$$

A positive value of C_H indicates that the firm's production technology emits less carbon than the benchmark technology and therefore generates positive environmental benefits through avoided emissions. When $C_H = 0$, the firm's environmental performance is identical to that of the benchmark technology. Conversely, $C_H < 0$ implies that the firm's technology is more emission-intensive than the benchmark and therefore does not generate a positive carbon handprint. Because this study focuses on the transformation of environmental performance into economic value, the subsequent analysis considers firms satisfying $C_H > 0$.

Although carbon handprints measure avoided emissions, avoided emissions alone do not automatically create economic value. Their economic significance depends on whether positive environmental performance is recognized and rewarded through institutional arrangements such as carbon-credit systems, green procurement programs, sustainability certification, environmental subsidies, climate-related financial markets, or investors' valuation of low-carbon production (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Eberhardt et al., 2024). To capture this institutional mechanism, let $\theta \geq 0$ denote the recognition coefficient assigned to each unit of avoided emissions. The parameter θ summarizes the extent to which environmental performance can be converted into measurable economic value through market and policy institutions. The recognized economic value generated by carbon handprint per unit of output is therefore defined as

$$h = \theta C_H = \theta(E_B - E_T) \tag{4}$$

and the firm's total recognized handprint value is

$$H(Q) = hQ = \theta(E_B - E_T)Q \tag{5}$$

When $\theta = 0$, avoided emissions receive no economic recognition, and the carbon handprint remains solely an environmental-performance indicator. As θ increases, avoided emissions generate progressively greater economic value, strengthening firms' incentives to adopt cleaner production technologies and improve environmental performance. Consequently, the parameter θ reflects not only environmental policy but also the maturity of sustainable finance,

carbon markets, and institutional mechanisms that reward positive climate contributions (Eccles et al., 2014; Friede et al., 2015).
This formulation establishes an important distinction between physical environmental performance and economic value creation. The carbon handprint C_H is determined by technological differences between the firm's production process and the benchmark technology, whereas the recognized handprint value $H(Q)$ depends on institutional recognition through the parameter θ. Consequently, environmental performance alone is insufficient to generate economic benefits unless supported by effective policy and market institutions. This distinction enables the carbon handprint to be interpreted as an environmental asset whose measurable economic value depends on technological performance and institutional recognition, thereby providing the analytical foundation for the production-cost and profit-maximization framework developed in the following sections (Hart, 1995; Porter & van der Linde, 1995).

Production and cost structure
Production activities simultaneously generate market output and carbon emissions. Under carbon-pricing regulation, firms therefore face a broader production problem than that considered in conventional production theory. Besides conventional operating expenditures, firms must bear the environmental costs associated with carbon emissions while simultaneously considering the potential economic benefits arising from avoided emissions. Consequently, production costs are jointly determined by technological efficiency, environmental regulation, and the institutional recognition of positive environmental performance (Porter & van der Linde, 1995; Nordhaus, 2019; Grönman et al., 2019).
The firm's conventional production cost is assumed to consist of a constant marginal production cost together with increasing marginal operating costs associated with capacity utilization, production adjustment, and organizational coordination. This cost structure is represented by

$$C_P(Q) = cQ + kQ^2 \tag{6}$$

where $c > 0$ denotes the constant marginal production cost and $k > 0$ measures the degree of increasing marginal operating costs. The quadratic specification provides a tractable convex-cost structure in which marginal production costs increase with output (Dixit, 1979).
Environmental regulation further modifies the firm's production cost through two distinct but complementary mechanisms. First, carbon pricing imposes an environmental compliance cost proportional to emissions. Second, recognized carbon handprints generate an economic benefit by rewarding avoided emissions relative to the benchmark technology. Combining these two effects, the firm's total production cost is specified as

$$C(Q) = cQ + kQ^2 + \tau E_T Q - \theta(E_B - E_T)Q \tag{7}$$

where the third term represents the carbon-pricing obligation, while the fourth term represents the recognized economic value generated by carbon handprints. The parameter τ measures the regulatory price assigned to carbon emissions, whereas θ captures the degree to which avoided emissions are recognized and rewarded by environmental policies, carbon markets, sustainable finance, and other institutional mechanisms (Krueger et al., 2020; Bolton & Kacperczyk, 2021).
Eq. (7) constitutes the central cost function of the proposed framework. Unlike conventional environmental-economic models, in which carbon regulation only increases firms' production costs, the present formulation explicitly incorporates both the cost-increasing effect of carbon pricing and the cost-reducing effect of recognized carbon handprints. Consequently, firms are encouraged not only to reduce emissions in order to avoid regulatory costs but also to create positive environmental value that can be transformed into measurable economic returns. This dual-incentive mechanism distinguishes the proposed framework from traditional carbon-pricing models and establishes the theoretical foundation for the firm's optimal production decisions developed in the following section (Hart, 1995; Eccles et al., 2014; Eberhardt et al.,

2024).

Optimal production decisions

Having established the firm's production-cost structure, we now examine how carbon pricing and carbon handprint recognition jointly influence production decisions. Unlike conventional environmental-economic models, in which firms respond only to the compliance costs generated by carbon regulation, the proposed framework recognizes that cleaner production technologies may simultaneously create measurable economic value through recognized carbon handprints. Consequently, firms determine their production decisions by balancing market demand, production costs, environmental compliance costs, and the economic benefits associated with avoided emissions (Porter & van der Linde, 1995; Hart, 1995; Nordhaus, 2019).
Assume that market demand is represented by the inverse demand function:

$$P(Q) = a - bQ \tag{8}$$

where $a > 0$ is the intercept of market demand, and $b > 0$ measures the responsiveness of market price to output. Accordingly, the firm's total revenue is given by $R(Q) = P(Q)Q$, and together with the production-cost function in Eq. (7), profit can be expressed as

$$\Pi(Q) = (a - bQ)Q - [cQ + kQ^2 + \tau E_T Q - \theta(E_B - E_T)Q] \tag{9}$$

Eq. (9) indicates that carbon pricing and carbon handprint recognition influence firms' production decisions through distinct but complementary channels. Carbon pricing reduces profitability by increasing environmental compliance costs, whereas recognized carbon handprints improve profitability by transforming avoided emissions into measurable economic returns. Consequently, firms have incentives not only to reduce emission intensity but also to create environmental value that can be recognized by policy and market institutions (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Eccles et al., 2014).
Maximizing Eq. (9) with respect to production yields the firm's optimal production decision:

$$Q^* = \frac{a - c - \tau E_T + \theta(E_B - E_T)}{2(b + k)} \tag{10}$$

Since both the slope of market demand (b) and the marginal operating-cost parameter (k) are assumed to be positive, the profit function is strictly concave with respect to output. Accordingly, the second-order condition is satisfied, ensuring that Eq. (10) represents a unique interior optimum.
Eq. (10) constitutes the central behavioral result of the proposed framework. Unlike conventional carbon-pricing models, the firm's optimal production depends not only on production costs and environmental compliance obligations but also on the economic value generated by recognized carbon handprints. A higher carbon price lowers the firm's optimal production by increasing compliance costs, whereas stronger institutional recognition of carbon handprints increases optimal production by improving the profitability of cleaner technologies. The carbon handprint therefore functions not merely as an environmental-performance indicator but as an explicit economic incentive that directly influences firms' production decisions. This mechanism provides the theoretical foundation for the comparative-static analysis presented in Section 4.1 (Porter & van der Linde, 1995; Friede et al., 2015; Eberhardt et al., 2024).

Results

Comparative statics and theoretical implications

The analytical solution in Eq. (10) provides the basis for evaluating how environmental regulation and carbon handprint recognition affect firms' optimal production decisions. Comparative-static analysis demonstrates the individual effects of policy variables on optimal production while providing theoretical insights into the interaction between carbon pricing and

positive environmental incentives.
Differentiating Eq. (10) with respect to the carbon-pricing parameter yields

$$\frac{\partial Q^*}{\partial \tau} = -\frac{E_T}{2(b+k)} < 0 \tag{11}$$

Eq. (11) indicates that a higher carbon price unambiguously reduced the firm's optimal production level. As environmental compliance costs increased, production became more expensive, thereby reducing firms' incentives to expand output. This result is consistent with the primary objective of carbon-pricing policies, namely to internalize environmental externalities by discouraging carbon-intensive production (Nordhaus, 2019; World Bank, 2024).
By contrast, differentiating Eq. (10) with respect to the recognition coefficient gives

$$\frac{\partial Q^*}{\partial \theta} = \frac{E_B - E_T}{2(b+k)} > 0 \tag{12}$$

provided that the firm generates a positive carbon handprint ($E_B > E_T$). Eq. (12) demonstrates that stronger institutional recognition of avoided emissions increased firms' optimal production by improving the private returns to cleaner production technologies. Unlike carbon pricing, which operated through a cost-increasing mechanism, carbon handprint recognition created incentives through value creation. Consequently, environmental regulation may simultaneously discourage carbon-intensive production while encouraging environmentally superior production.
Taken together, Eqs. (11) and (12) reveal that carbon pricing and carbon handprint recognition represented two complementary policy instruments rather than competing regulatory approaches. Carbon pricing penalized undesirable environmental outcomes, whereas carbon handprint recognition rewarded positive environmental contributions. The interaction between these two mechanisms enabled environmental policy to influence firms through cost-increasing and value-creating incentives, thereby establishing a more balanced framework for sustainable production (Porter & van der Linde, 1995; Hart, 1995; Eccles et al., 2014).
The above results lead directly to the following theoretical propositions.
Proposition 1. An increase in carbon pricing reduces the firm's optimal production by increasing environmental compliance costs.
Proposition 2. For firms generating a positive carbon handprint, an increase in carbon handprint recognition raises the firm's optimal production by increasing the economic value generated by avoided emissions.
Proposition 3. Carbon pricing and carbon handprint recognition constitute complementary policy instruments, simultaneously penalizing carbon emissions and rewarding positive environmental performance.
Unlike conventional environmental-economic models that emphasize only the cost of carbon emissions, the present framework demonstrates that sustainable production depends on the joint operation of regulatory pressure and positive environmental incentives. The carbon handprint therefore functions as an explicit economic mechanism through which recognized avoided emissions influence firms' production decisions and sustainable value creation. This theoretical result provides the conceptual basis for the transition conditions discussed in Section 4.2 (Friede et al., 2015; Eberhardt et al., 2024).

Transition from compliance to value creation
The preceding analysis demonstrates that carbon pricing and recognized carbon handprints influence firms through two distinct economic channels. Carbon pricing increases production costs by assigning an explicit economic cost to greenhouse-gas emissions, whereas recognized carbon handprints create economic value by rewarding avoided emissions generated through

cleaner production technologies. Recent developments in climate policy increasingly emphasize that effective environmental regulation should combine both mechanisms by discouraging environmentally harmful activities while simultaneously encouraging environmentally beneficial innovation (Porter & van der Linde, 1995; Nordhaus, 2019; Stern et al., 2021). Consequently, firms' production decisions depend not only on the level of carbon pricing but also on whether environmental institutions recognize and reward positive climate contributions.

Within the proposed framework, the transition occurs when the economic value generated by recognized carbon handprints exactly offsets the environmental compliance cost associated with carbon pricing:

$$\theta(E_B > E_T) = \tau E_T \tag{13}$$

Eq. (13) defined the threshold separating two fundamentally different regulatory environments. The left-hand side represented the economic value created through recognized avoided emissions, whereas the right-hand side represented the environmental compliance cost imposed on production. Their relative magnitudes determined whether environmental regulation functioned primarily as a compliance obligation or as a source of economic value creation.

When $\theta(E_B > E_T) < \tau E_T$, carbon-pricing obligations exceed the economic value generated by recognized carbon handprints. Under this condition, firms primarily respond by reducing emissions to minimize environmental compliance costs. Environmental regulation therefore operates predominantly through cost internalization, which remains the principal objective of contemporary carbon-pricing policies (Nordhaus, 2019; World Bank, 2024). When $\theta(E_B > E_T) = \tau E_T$, the economic value created by recognized carbon handprints exactly compensates for environmental compliance costs. At this threshold, firms become economically indifferent between treating environmental regulation as a compliance obligation and viewing environmental improvement as a source of competitive advantage. The production system therefore reaches a transition point between cost internalization and value creation. Finally, when $\theta(E_B > E_T) > \tau E_T$, recognized carbon handprints generate economic value exceeding environmental compliance costs. Environmental performance consequently becomes a source of profitability rather than merely a means of reducing regulatory burdens. Firms therefore have incentives to invest continuously in cleaner technologies, thereby expanding recognized carbon handprints and reinforcing sustainable value creation. This outcome is consistent with the Porter Hypothesis that appropriately designed environmental regulation stimulates innovation and competitiveness (Porter & van der Linde, 1995), while also reflecting growing evidence that financial markets increasingly reward firms exhibiting superior climate performance and sustainability outcomes (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Flammer, 2021).

Unlike existing carbon-pricing models, which primarily emphasize environmental compliance, the proposed framework identifies the institutional conditions under which environmental regulation evolves into a value-creation mechanism. Recognized carbon handprints therefore constitute a measurable source of economic value whose magnitude depends jointly on technological performance and institutional recognition. This theoretical perspective extends the existing carbon handprint literature (Grönman et al., 2019; Tuppura et al., 2024; Eberhardt et al., 2024) by integrating recognized carbon handprints directly into firms' production decisions and establishing a formal transition from compliance-driven regulation to sustainable value creation.

The above analysis led to the principal theoretical proposition of this study.

Proposition 4. Environmental regulation evolves from a compliance mechanism to a value-creation mechanism when the economic value generated by recognized carbon handprints exceeds the environmental compliance cost imposed by carbon pricing.

This proposition represented the central theoretical contribution of this study by identifying the condition under which carbon pricing and recognized carbon handprints operated as complementary institutional mechanisms. This result provides a theoretical explanation for the transition from compliance-oriented regulation toward sustainable value creation.

Discussion

The proposed theoretical framework offers several policy implications for the design of carbon-pricing systems and sustainable industrial policies. Unlike conventional environmental-economic models, which primarily rely on carbon pricing to discourage carbon-intensive production, the present framework suggests that effective environmental regulation should combine carbon-pricing mechanisms with institutional arrangements that recognize and reward positive environmental performance. Sustainable production therefore depends not only on increasing the cost of carbon emissions but also on strengthening the economic incentives associated with recognized carbon handprints (Porter & van der Linde, 1995; Nordhaus, 2019).
The findings extend the existing literature in several ways. Consistent with Porter and van der Linde (1995), the model suggests that environmental regulation may influence firm behavior through channels beyond simple compliance-cost increases. However, the present framework further shows that this effect depends on whether positive environmental performance is institutionally recognized and converted into measurable economic value. This result also complements the carbon handprint literature, which has primarily focused on environmental measurement (Grönman et al., 2019; Tuppura et al., 2024; Eberhardt et al., 2024), by demonstrating how recognized avoided emissions can directly affect firms' production decisions. In this sense, the proposed framework provides a theoretical bridge between carbon pricing, positive environmental performance, and sustainable value creation.
First, the analytical results indicate that carbon pricing alone may be insufficient to support sustained technological transformation. Although higher carbon prices increase firms' incentives to reduce emissions, they also increase production costs and may discourage productive investment when environmental compliance costs become excessive. Consequently, environmental policies should be designed to complement carbon pricing with mechanisms that recognize avoided emissions and reward firms that continuously improve environmental performance. Such complementary policies may strengthen incentives for environmental innovation while limiting an exclusive reliance on compliance-cost mechanisms (Porter & van der Linde, 1995; Stern et al., 2021).
Second, Eq. (13) demonstrates that institutional recognition plays a decisive role in determining whether environmental regulation functions primarily as a compliance mechanism or as a value-creation mechanism. Governments can strengthen the recognition coefficient, θ, through the development of credible carbon-credit markets, environmental certification systems, green public procurement, sustainability disclosure standards, and transition-finance policies. By increasing the economic value associated with recognized avoided emissions, these institutional arrangements may strengthen firms' incentives to invest in cleaner technologies and expand positive environmental contributions (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Flammer, 2021).
Third, the proposed framework suggests that environmental innovation should be evaluated not only according to its ability to reduce emissions but also according to its capacity to generate recognized environmental value. Firms that improve production technologies increase the difference between benchmark emissions and actual emissions, thereby expanding recognized carbon handprints and potentially improving their economic performance. Consequently, technological innovation, environmental improvement, and firm competitiveness may become mutually reinforcing objectives rather than necessarily conflicting policy goals. This conclusion is consistent with the growing emphasis on

sustainable value creation in both environmental economics and sustainable finance (Hart, 1995; Eccles et al., 2014; Friede et al., 2015).

Finally, the proposed framework provides implications for sustainable finance. Financial institutions increasingly incorporate climate-related information into investment decisions, lending policies, and corporate valuation. The present model suggests that recognized carbon handprints may serve as an economically meaningful indicator of positive climate performance, complementing conventional carbon-emission measures that primarily capture environmental costs. Integrating recognized carbon handprints into sustainable-finance frameworks could strengthen the alignment between environmental performance and financial incentives, thereby supporting the transition toward a low-carbon economy (Krueger et al., 2020; Bolton & Kacperczyk, 2021; Flammer, 2021).

Overall, the discussion highlights that the effectiveness of climate policy depends not only on carbon-cost internalization but also on the institutional capacity to recognize positive environmental performance. This perspective broadens the policy interpretation of carbon handprints by emphasizing their potential role in linking environmental improvement with economic incentives. More specifically, institutional recognition converts verified avoided emissions into measurable economic value through mechanisms such as carbon credits, green procurement, sustainability certification, and sustainable finance. In this way, carbon handprints complement carbon pricing by transforming positive environmental performance from a measurement indicator into an economic incentive for sustainable value creation.

Conclusions

This study developed a unified theoretical framework integrating carbon pricing, carbon handprints, and institutional recognition into firms' production decisions. The results showed that environmental regulation influenced firms through both cost-increasing and value-creating channels and identified the condition under which recognized carbon handprints could offset carbon-pricing compliance costs.

The proposed framework makes three principal theoretical contributions. First, it establishes an integrated optimization model linking carbon pricing, carbon handprints, and institutional recognition within a unified analytical framework. Second, it introduces institutional recognition as an explicit economic mechanism through which avoided emissions directly influence firms' production decisions rather than serving solely as environmental-performance indicators. Third, it identifies the transition condition under which environmental regulation evolves from a compliance-oriented mechanism toward sustainable value creation, providing a new theoretical explanation for the interaction between environmental regulation and firms' economic incentives.

From a policy perspective, the findings suggest that carbon pricing is likely to be more effective when complemented by institutional mechanisms that recognize and reward positive environmental performance. Such complementary arrangements may strengthen the alignment between climate-policy objectives and firms' economic incentives.

This study has several limitations that provide directions for future research. The present study develops a deterministic theoretical framework and therefore abstracts from uncertainty, dynamic technological change, and heterogeneous firm behavior. Future studies may extend the model by incorporating dynamic optimization, stochastic production environments, supply-chain interactions, general-equilibrium analysis, or empirical validation using firm-level data. Such extensions would further enhance our understanding of how recognized carbon handprints influence firms' production decisions and sustainable economic development under evolving climate-policy environments.

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Colonial Wounds, Patriarchal Domination: A bell hooks (1984) Reading of *God's Bits of Wood* by O. Sembène (1962)

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Abstract:
God's Bits of Wood (1960/1962) has been widely celebrated for its portrayal of women's collective resistance, yet the psychic wound colonial capitalism inflicts on African masculinity, and its displacement into domestic domination, remains underexplored. This gap raises the problem of how Sembène (1962) represents African masculinity as simultaneously wounded by colonial subjugation and complicit in patriarchal domination over women, and how women's resistance answers both. The article's general objective is to trace this double dynamic across three movements: colonial emasculation, displaced patriarchal compensation, and women's counter-resistance. The study draws primarily on bell hooks's (1984) theory of interlocking domination, supplemented by Frantz Fanon's account of colonial alienation. Methodologically, it adopts a qualitative, text-based close reading of key episodes alongside these theoretical categories. The findings reveal that patriarchal domination in the novel functions not as inherited privilege but as compensation for colonial wounding, while women's solidarity constitutes a deliberate counter-wound targeting both colonial and patriarchal structures at once.
Keywords: African masculinity, colonial capitalism, psychic wound, patriarchal domination, women's resistance

Introduction

God's Bits of Wood (1962), Sembène Ousmane's fictionalized chronicle of the 1947-1948 Dakar–Niger railway strike, has long been read as a triumphant narrative of collective solidarity, its women namely Penda, Ramatoulaye, Maïmouna, Dieynaba, celebrated as agents of resistance against colonial capital. This celebration is warranted, but it has tended to leave underexamined the men against whom, and alongside whom, that resistance unfolds: railwaymen whose own masculinity is first wounded by colonial subjugation and then, in the domestic sphere, redeployed as a compensatory form of patriarchal authority over the very women whose solidarity the novel ultimately honors. This double movement - men victimized by one system while reproducing another - is what justifies the present study. To read the novel's women without accounting for the psychic economy of the men they live alongside is to leave half the novel's ethical architecture unexamined.

The existing literature on *God's Bits of Wood* (1962) has developed along two main axes. The first examines women's mobilization and labour as forms of resistance. Raja (2011) identifies solidarity as the novel's organizing "ideologeme," while Lubbungu (2020) argues that characters such as Penda challenge gender stereotypes by assuming leadership roles in a male-dominated society. McDonald (2015) develops a more nuanced argument, showing that women's revolutionary agency remains constrained by colonial structures and patriarchal family arrangements. Similarly, Bichang'a (2025) examines how Ramatoulaye, Penda, and Maïmouna emerge as leaders despite prevailing male attitudes. The second axis concerns colonial violence and psychological dehumanization. Drawing on Fanon's *The Wretched of the Earth* (1963), Dick (2016) interprets the strikers' revolutionary consciousness as a response to accumulated colonial aggression. However, these studies do not fully explain how colonial humiliation reshapes masculine authority within the household or how women resist the resulting displacement of male frustration. This unresolved question constitutes the present study's point of departure.

The problematic that organizes the article can accordingly be stated as follows: how does Sembène's novel represent African masculinity as a site simultaneously wounded by colonial domination and complicit in patriarchal domination over women, and how does women's collective resistance function as a counter-force to both? This double bind - men as objects of colonial subjugation and subjects of domestic power - resists any reading that treats gender and colonial oppression as separate axes of analysis. Three objectives follow from this problematic. First, this study demonstrates how the male characters in the novel are psychologically wounded (emasculated) through labor exploitation, racial humiliation, and systematic denial of paternal and civic authority. Second, it explores how this wound is alleviated through the displacement of frustrated power onto the domestic haven, where patriarchy reigns supreme. Third, it analyzes women's collective action as a counter-wound: a rupture that exposes and contests displaced domination while reconfiguring the possibilities of solidarity across gender lines.

The theoretical framework draws primarily on bell hooks' (1984) analysis of interlocking systems of domination - her account of imperialist white-supremacist capitalist patriarchy - adapted here from its original American context to the colonial economy of French West Africa. hooks' (1984) insight that patriarchal violence among Black men frequently originates in the wound of racial-economic subjugation supplies the vocabulary needed to read Sembène's (1962) male characters without either exonerating or flattening their exercise of domestic power. This framework is supplemented by Frantz Fanon's (1967) theory of colonial alienation, developed in *Black Skin, White Masks,* which situates the psychic mechanism of emasculation within the racial and historical conditions of colonial domination.

Methods

Methodologically, the study adopts a qualitative, text-based approach combining close reading with thematic analysis. Primary evidence is drawn from key episodes - the strike's origins in wage and dignity claims, scenes of domestic conflict and paternal authority, and the culminating women's march to Dakar - read against the theoretical categories established above. These episodes were selected because they most clearly represent the study's three analytical stages: colonial emasculation, the domestic displacement of wounded masculine authority, and women's collective resistance to both colonial and patriarchal domination.

The analysis proceeds through the article's three-part structure, tracing a single argumentative thread from psychic injury, through domestic compensation, to collective rupture and transformative possibility.

Results and discussions

The results and discussion are organized into three interconnected sections. The first examines how colonial labour exploitation and racial humiliation produce a psychic wound in African male workers. The second explores how this wounded masculinity is displaced into the domestic sphere, while the third analyzes women's collective resistance as a challenge to both colonial oppression and patriarchal authority.

I. Colonial Emasculation: The Making of a Wound

Before *God's Bits of Wood* (1962) becomes a chronicle of solidarity, it is first a ledger of humiliation. Sembène (1962) situates his railwaymen within a colonial wage economy that measures African labor against the standard of the animal rather than the human, and it is this economy - not any innate deficiency - that constitutes the wound around which the novel's masculinities take shape. bell hooks' (1984) account of interlocking domination offers a precise vocabulary for what Sembène dramatizes narratively: men denied the very manhood that patriarchal ideology promises them, so that the injury inflicted by colonial capital becomes psychically indistinguishable from an injury to masculinity itself.

The novel names this condition in its opening pages, through Mamadou Keita's reflection on what is at stake in the walkout:

> Our wages are so low that there is no longer any difference between ourselves and animals. Years ago the men of Thiès went out on strike, and that was only settled by deaths, by deaths on our side. And now it begins again. At this very moment meetings like this one are taking place from Koulikoro to Dakar (Sembène, 1962, p. 8).

What is described here is not simply low pay but ontological demotion - a wage structure that revokes the category of the human before it touches the pocket. Frantz Fanon's (1967) account of the colonized subject's alienation under a racial hierarchy that continually withholds recognition, clarifies the stakes of this demotion. As for Fanon (1967), colonization does not only deprive the colonized people materially, it makes them feel like they will never be civilized enough because they are perpetually judged by white standards. Sembène's (1962) striker names in economic terms what Fanon (1967) theorizes psychically - a subjectivity structurally denied full humanity. bell hooks (1984) names this same ontological demotion as the foundation of imperialist white-supremacist capitalist patriarchy, arguing that Black men are conditioned to seek a manhood the system simultaneously withholds. Sembène's (1962) striker thus embodies hooks' (1984) diagnosis precisely: colonial wage exploitation strips him of humanity before it strips him of pay, manufacturing the very wound patriarchal compensation will later attempt to heal. This demotion sharpens into direct interrogation moments later, when Tiemoko demands:

> We're the ones who do the work,' he roared, 'the same work the white men do. Why then should they be paid more? Because they are white? And when they are sick, why should they be taken care of while we and our families are left to starve? Because we are black? (Sembène, 1962, p. 8)

Tiemoko's demand exposes the racial arithmetic hooks (1984) identifies at the core of imperialist white-supremacist capitalist patriarchy: equal labor met with unequal recognition, care rationed along racial lines. His rhetorical questions - "Because they are white? Because we are black?" - refuse the naturalization of that hierarchy, articulating precisely what hooks (1984) argues Black men are systematically denied: not privilege itself, but the provisioning and protection patriarchal ideology promises yet colonial capitalism withholds. As hooks (1984) writes, men "are taught that they will be able to rule in the home, to control and dominate, that this is the big payoff for their acceptance of an exploitative economic social order" (p. 134) - the very payoff Keita's outrage suggests is already failing to arrive.

Another passage pushes this analysis toward its philosophical center: "It isn't those who are taken by force, put in chains and sold as slaves who are the real slaves: it is those who will accept it, morally and physically" (Sembène, 1962, p. 20). Read alongside Cathy Caruth's (1996) theorization of trauma as a structural disruption that resists immediate assimilation and returns only belatedly, in symptomatic form, this line performs a striking act of self-diagnosis. Bagayoko recognizes that the deepest wound of subjugation is not the external chain but the internal accommodation to it, an accommodation that, in Caruth's (1996) framework, need not be conscious to be operative. The men of Thiès have not simply been forced into an exploitative wage system; many have absorbed its terms as given, and it is this latency - the wound not yet fully registered as a wound - that the strike itself begins to interrupt.

That interruption is met, in turn, with what hooks (1984) identifies as the second half of the compensatory structure: displaced aggression. hooks (1984) writes that men's "need to dominate women, coupled with suppressed aggression towards employers who rule over them, makes the domestic environment the center of explosive tensions that lead to violence" (p. 134). Sembène's (1962) narration of the strikers' astonishment at their wives' emerging political consciousness – "the men began to understand that if the times were bringing forth a new breed of men, they were also bringing forth a new breed of women" (Sembène, 1962, p. 34) - registers precisely this tension in its early, still-ambivalent form. The syntax records a delay: astonishment before understanding, resistance before accommodation, exactly the lag Caruth's (1996) model of belated trauma would predict when an old injury - the wound of colonial subjugation - is abruptly confronted with a new and unanticipated threat to the one domain of authority still presumed intact.

Yet Sembène's (1962) narrative, like hooks' (1984) theory, refuses to romanticize the violence this wound produces even as it explains it. hooks' (1984) account of a man who, in "beating or raping women, is not exercising privilege or reaping positive rewards" but "may feel satisfied in exercising the only form of domination allowed him," while "the ruling-class male power structure that promotes his sexist abuse of women reaps the real material benefits" (pp. 90–91), insists on a distinction the novel itself will not let its male characters use as an alibi. To explain domination is not to excuse it. This distinction anticipates the ethical horizon toward which both hooks (1984) and Sembène (1962) ultimately gesture - hooks' (1984) insistence that "men must begin to challenge notions of masculinity that equate manhood with ability to exert power over others, especially through the use of coercive force" (p. 135), is not a coda external to the novel but a demand the novel's own women will begin to enact. It is to that demand - displaced domination met by collective refusal - that Section II now turns.

II. Displaced Domination: Patriarchy as Compensation

If Section I traces the wound inflicted on African men by colonial capitalism, this section traces what happens once that wound is carried home. The transition Sembène (1962) narrates is structural rather than incidental. The same men denied dignity on the rail line reassert it, almost by reflex, within their households, and it is precisely this displacement - power confiscated in one sphere, reclaimed in another - that bell hooks (1984) identifies when she observes that a man conditioned to expect male privilege "often finds that few, if any, of these benefits are automatically bestowed on him in life" (p. 90). What he loses to the colonial wage system, he seeks to recover at home.

The novel supplies an ideological justification for this recovery through El Hadji Mabigué, who tells Ramatoulaye when she comes to him for help:

> I know that life is often hard, but that should not cause us to turn our backs on God. He hasassigned a rank, a place, and a certain role to every man, and it is blasphemous to think of changing His design. The toubabs are here because that is the will of God. Strength is a gift of God, and Allah has given it to them. We cannot fight against it – why, look, they have even turned off the water ...' (Sembène, 1962, pp. 44-45).

What is notable is the direction of the argument. Colonial subjugation itself is naturalized as divine order, and this same logic of fixed, God-given rank will, moments later, be redeployed to fix women's place beneath men. Ifi Amadiume's (1987) study of precolonial Igbo gender arrangements is instructive here, since she demonstrates that rigid, binary gender hierarchy was not an indigenous African given but a structure substantially hardened under colonial administration, which imported its own patriarchal theology onto more flexible systems of status. Mabigué's invocation of divine rank, then, is not the recovery of an authentic precolonial order but a colonial-inflected theology of hierarchy, borrowed to legitimate a domestic authority that the same colonial system has elsewhere stripped from him. This colonial-inflected theology of submission finds its clearest expression in El Hadji Mabigué's attempt to break the strikers' resolve by appealing to a divinely ordained economic order saying:

> Everything here belongs to them – the shops, and the merchandise in the shops, even the water we drink. This strike is like a band of monkeys deserting a fertile plain – who gains from that? The owner of the plain! It is not our part in life to resist the will of heaven (Sembène, 1962, p. 228).

Mabigué's argument explicitly illustrates what bell hooks (1984) conceptualizes as the seamless operation of interlocking systems of domination. By naming colonial ownership and total resource control as "the will of heaven", Mabigué describes economic subjugation as natural and places it into the category of divine hierarchy that demands passive acceptance. In hooks' (1984) framework, imperialist white-supremacist capitalist patriarchy relies on this precise ideological mechanism: teaching the oppressed that domination is an inevitable, natural state rather than an artificial structure of exploitation. Mabigué compares African workers to animal, when he says "a band of monkeys", to legitimate colonial control. He urges men to be obedient to the capitalist economic system making them believe that this will allow them to be master in their household and rule over their wives.

This hierarchical organization is not an abstract idea, it has a direct influence on the daily, personal lives of women in their homes. When colonial exploitation strips the African worker of his economic capability, the failure of the imperialist system is brought home to an empty hearth. Unable to challenge the colonial power that starves his household, the disempowered male worker redirects his frustration into an unthinking assertion of domestic intimacy and authority. Sembène (1962) captures this unconscious displacement of economic emasculation into domestic possession at the moment when a striker returns home. Sembène (1962) depicts:

> the first things he saw were always the unfired stove, the useless cooking vessels, the bowls and gourds ranged in a corner, empty. Then he would seek the arms of his wife, without thinking, or caring, whether she was the first or the third (p. 33).

The sequence is illustrative - empty pockets, empty stove, then the wife's body, sought "without thinking." This automatic progression underscores what hooks (1984) identifies as the compensatory function of male domination under capitalist exploitation. For hooks (1984), working-class men socialized into patriarchal ideology often use women's bodies and domestic spaces to reclaim a sensation of power denied to them in the economic sphere. The worker who appears to be seeking his wife's body "without thinking" is subject to a conditioned reflex. Colonial capital has stripped him of human agency, so he tries to assert his remaining patriarchal influence over the female body as a substitute for his loss of systemic control.

However, this redirection of patriarchal power does not remain confined to direct interactions between men and women. It filters viciously into the fabric of the domestic sphere. As patriarchal domination sets its roots within the colonized families, it dismantles the harmony among women themselves causing them to internalize hierarchies that reflect systemic oppression. As hooks (1984) observes:

> Between women and men, sexism is most often expressed in the form of male domination, which leads to discrimination, exploitation, or oppression. Sexism teaches women woman-hating, and both consciously and unconsciously we act out this hatred in our daily contact with one another (p. 93).

While hooks (1984) highlights how patriarchal sexism socializes women into internalized self-hatred, Chandra Talpade Mohanty (1988) cautions against reducing Third World women to passive, homogeneous victims. Sembène's (1962) female characters move beyond internalized oppression, converting shared domestic suffering into localized, transformative political agency.

Sembène (1962) demonstrates that domestic patriarchal assertion is neither an authentic cultural retention nor a realm isolated from colonial capital, but a direct, compensatory byproduct of structural disempowerment. By revealing the mechanism by which economic emasculation entrapped women and make them prisoners within their own home spaces, the novel shakes the myth of a pure domestic hierarchy. However, as the women anchor their collective tribulation into grassroots revolution, they overwhelm both colonial power and internalized patriarchal violence. Ultimately, *God's Bits of Wood* (1962) illustrates that true decolonization cannot occur solely at the railway gates, but must simultaneously dismantle the compensatory tyranny within the home.

III. Rupture and Possibility: Women's Resistance as Counter-Wound

Sections I and II have traced how colonial subjugation produces a wound in African masculinity, and how that wound is displaced into patriarchal domination over women, now this final section turns to what interrupts the cycle. Sembène (1962) stages this interruption gradually, and bell hooks' (1984) insistence that "solidarity strengthens resistance struggle" and that "women must take the initiative and demonstrate the power of solidarity" (p. 61) frames how it should be read: the novel's women confront not one form of domination but two at once - colonial and patriarchal - and their resistance must therefore answer both simultaneously.

Sembène (1962) captures this exact movement from internalized domestic suffering to organized collective action during the crucial assembly at Thiès. Standing before the male leadership, Penda articulates a radical redefinition of political agency that merges female solidarity with the survival of the entire community. She declares:

> I speak in the name of all of the women, but I am just the voice they have chosen to tell you what they have decided to do. Yesterday we all laughed together, men and women, and today we weep together, but for us women this strike still means the possibility of a better life tomorrow. We owe it to ourselves to hold up our heads and not to give in now. So we have decided that tomorrow we will march together to Dakar (p. 187).

Penda's speech marks the realization of what bell hooks (1984) identifies as revolutionary political solidarity. Women taking autonomous initiative to redefine resistance beyond patriarchal boundaries. The women refuse to remain as passive support for male strikers, so they organize themselves independently to transform their shared domestic vulnerability into collective agency. This dual confrontation supports Collins' (2000) matrix of domination, as the march to Dakar openly resists the intersecting forces of racial, economic, and gendered oppression. When Penda asserts "we have decided", she does not only challenge both colonial exploitation and traditional male authority, but also shows that true liberation requires fighting patriarchal power and dismantling colonial control as well.

This collective march to Dakar is far from being a celebrated or easy victory. It is a brutal struggle that brings the women to collide with colonial violence. Dieyneba's painful breakdown illustrates the exact moment when imperial power stops being an abstract concept and becomes a heartbreaking, personal loss. Sembène (1962) writes: "Dieynaba did not appear to be crying, and yet, one by one, tears rolled down her cheeks and dropped to the cloth that covered her breasts. She murmured, 'Why can't we just kill all the white men?'" (p. 191). Her question returns the analysis to the colonial source of the wound named in Section I. It is white colonial rule, not only the men of her own community, that she names as the object of her rage. hooks' caution against romanticizing resistance is instructive here - solidarity does not erase this grief or redirect it away from its true colonial target. It gives the anger a shared, organized form without pretending the underlying wound has healed.

Rather than fracturing under this immense grief and violence, the women synthesize their shared pain into an unstoppable, highly visible vanguard. The visual arrangement at the front of the march captures a radical reordering of community, uniting the political organizer, the traditional wife, and the marginalized outcast in a single, resolute front. Sembène (1962) observes:

> Penda, still wearing her soldier's cartridge belt, marched at the head of the procession with Mariame Sonko, the wife of Balla, and Maimouna, the blind woman, who had joined them in the darkness without being noticed by anyone. Her baby was strapped across her back with an old shawl (p. 192).

This tableau exemplifies what Raewyn Connell (1995) conceptualizes as the destabilization of hegemonic masculinity. Penda the fiercest and most engaged character appears in a military cartridge belt, this soldiery picture is a clear message that the women seek to overwhelm colonial and patriarchal domination. Masculine hegemony favors marginalizing female agency and seeks to maintain patriarchal domination. However, the women of the novel are very combative and have a high sense of leadership. The collective mobilization aligns with bell hooks' (1984) idea of radical solidarity, where women subvert socially imposed divisions to create a consolidated front. Their collective movement triggers an alternative structure of authority that questions submissive gender roles. This proves that anti-colonial liberation begins with deconstructing the gender hierarchies that prevails within patriarchal structure.

This new form of reordering authority does not only reconfigure the march itself, it utterly changes how male leaders view women's position within the anti-colonial struggle. The patriarchal domination, confronted with this powerful feminine mobilization, is forced to admit the commitment and determination of the women which signals a new political awareness. Sembène (1962) captures this reluctant awakening in Lahbib's letter reflecting on the women's unexpected force:

> At first, they even pounced on me like tigresses — they wanted to start running everything! But things are a little calmer now — the children have not come back yet, and the women go out to the lake every day. In future, though, we will have to reckon with them in whatever we do (Sembène, 1962, p. 228).

This passage underscores what bell hooks (1984) calls authentic solidarity. Women coming together by transcending domestic suffering to protest against unfair systemic oppression. When Lahbib acknowledges that "we will have to reckon with them", he admits that patriarchal control cannot stop the determined women and therefore is bound to collapse.

This turning point also aligns with Walker's (1970) examination of Black female resilience. She shows how Black women, for a long time, have been excluded from agrarian capital and domestic hierarchy. She also underlines how their gather strength and courage to move from endurance to full agency. All in all, Sembène (1962), hooks (1984), and Walker (1970) agree on the same truth: anti-colonial and racial liberation cannot be achieved without shattering the yoke of internal patriarchal domination.

Dembélé and Diakité (2026) refuse to regard colonial violence as a justification for domestic oppression. Drawing on Walker's (1970) assertion that "The white man's oppression of me will never excuse my oppression of you, whether you are man, woman, child, animal or tree, because the self that I prize refuses to be owned by him. Or by anyone" (pp. 345-346), they argue that genuine agency constitutes a powerful counterforce to systemic subjugation. Their analysis reveals that ending the cycle of violence requires resistance on two interconnected fronts. External opposition to colonial domination must be accompanied by a critical confrontation with the patriarchal structures that reproduce similar forms of violence within the domestic sphere.

Paul Gilroy's (1993) account of Black diasporic solidarity as a transnational space connecting struggles across distance offers a final frame for the march's direction, back toward its colonial target. The decision to walk not simply out of Thiès but "to Dakar" ties this local women's action to the same rail line that has organized the entire colonial economy examined in Section

I, turning the very infrastructure of colonial extraction into a route of solidarity. The march gains its force because it travels toward the colonial capital itself, not away from it.
Ultimately, this section demonstrates that genuine anti-colonial liberation requires an uncompromising, dual confrontation. Sembène (1962), in his narrative, demonstrates that women's collective force challenges both colonial rule and internal patriarchal control. In so doing, they transform their shared vulnerability within the home spaces into collective agency. As black feminist thought and contemporary ethical scholarship observe, fighting against colonial oppression is never a justification for committing abuse or violence against family. True liberation is possible only when inferior subjects reclaim their agency, break internal gender role, and focus their well-structured, unflinching resistance directly against the colonial rule.

Conclusion

This study addresses a central gap in literary scholarship on Sembène Ousmane's *God's Bits of Wood* (1962) by examining the psychological and social dynamics of African masculinity under colonial rule alongside women's collective mobilization. The core scholarly problem centers on the double condition of the railwaymen, who are simultaneously emasculated by colonial capitalism and driven to displace this psychic wound into compensatory patriarchal domination over women within the domestic sphere. The analysis grounded on a text-based close reading around hooks' (1984) framework of intersecting systems of dominance and Fanon (1967) theory of colonial alienation, shows how colonial labor exploitation dehumanized African men and strips them of the role provider. This leads them to reproduce the same master-subject system in their very family. Textual evidence, ranging from wage-driven demotion and the naturalization of hierarchy to domestic authority claims, confirms that domestic patriarchy operates not as inherited privilege, but as a reaction to colonial powerlessness. In response, the women's collective resistance, culminating in the march to Dakar, functions as a counter-wound targeting both colonial power and domestic dominance at once. The major scientific contribution of this work lies in adapting hooks' (1984) "imperialist white-supremacist capitalist patriarchy" to French West Africa, offering a conceptualization of domestic oppression as a compensatory response to racialized trauma.
Based on these results, future research can further develop this analytical reflection of hooks (1984) and Fanon (1967) and put them into dialog with other postcolonial African texts to examine whether displaced oppression recurs across various colonial labor regimes. They can also deepen the comparison to see whether Black diaspora writers theorize the domestic impact of systemic racism.

Conflict of interests

The authors declare no conflict of interest.

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Strategies for sustainable tourism development in Afghanistan: a SWOT and thematic analysis

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Abstract: Purpose: This study examines strategies for sustainable tourism development in Afghanistan, focusing on environmental sustainability, economic development, community participation, and preservation of cultural and natural heritage. Consistent with UN Tourism sustainable tourism principles, it assesses opportunities and challenges affecting Afghanistan's tourism sector and identifies strategies for responsible, inclusive, and resilient tourism development.

Methodology: The study employed a mixed-methods approach, integrating quantitative and qualitative data collected through questionnaires and focus group discussions. Participants are selected using random and snowball sampling techniques. Thematic analysis identified recurring themes related to sustainable tourism, while SWOT analysis assessed internal strengths and weaknesses and external opportunities and threats affecting tourism development in Afghanistan.

Results: The findings indicate that sustainable tourism development requires environmental protection, community participation, cultural preservation, economic support, effective governance, tourist awareness, and technological innovation. The SWOT assessment demonstrates a strong internal position (IFE = 3.36) and favorable external conditions (EFE = 3.65). However, inadequate funding, weak stakeholder coordination, political instability, climate-related risks, and institutional constraints remain important challenges.

Conclusion: Afghanistan has considerable potential for sustainable tourism development if its cultural and natural resources are responsibly managed and supported by effective governance, community participation, investment, and institutional cooperation.

Recommendations: The study recommends strengthening environmental management, protecting cultural heritage, supporting local tourism businesses, expanding investment and public-private partnerships, improving institutional capacity, and enhancing coordination among government agencies, communities, and tourism stakeholders to promote responsible and sustainable tourism development.

Keywords: Afghanistan; Community Participation; Cultural Heritage; Sustainable Tourism Development; SWOT Analysis; Thematic Analysis; Tourism Strategy.

Introduction

Afghanistan possesses considerable potential for tourism development because of its diverse cultural heritage, historic sites, mountainous landscapes, archaeological resources, and distinctive local traditions. Despite these assets, the country's tourism sector remains underdeveloped and faces significant challenges related to governance, infrastructure, investment, environmental management, security perceptions, institutional capacity, and coordination among relevant stakeholders. Developing tourism in Afghanistan therefore requires more than simply increasing visitor numbers; it requires a strategic approach that generates economic opportunities while protecting cultural heritage, conserving natural resources, and ensuring meaningful benefits for local communities.

Tourism can contribute to economic development through employment creation, income generation, business development, investment, and cultural exchange. These potential benefits are particularly relevant to developing countries such as Afghanistan, where tourism may provide opportunities for local economic diversification and community-based enterprise development. However, poorly planned tourism can also generate negative environmental, economic, and socio-cultural consequences. Pressure on natural resources, environmental degradation, damage to cultural and historical sites, unequal distribution of tourism benefits, and insufficient community participation can undermine the long-term contribution of tourism to sustainable development. Consequently, tourism development in Afghanistan requires careful planning that balances economic opportunities with environmental protection, cultural preservation, and social inclusion.

Sustainable tourism provides an appropriate framework for achieving this balance. It considers the present and long-term economic, social, cultural, and environmental consequences of tourism while addressing the needs of visitors, host communities, tourism businesses, government institutions, and the environment. Sustainable tourism development therefore depends on effective policies, responsible resource management, stakeholder participation, institutional cooperation, and the involvement of local communities in tourism planning and decision-making. These principles are particularly important in Afghanistan, where institutional and socioeconomic conditions can influence the capacity of the tourism sector to develop sustainably.

Government policy and institutional capacity are central to sustainable tourism development. Clear tourism policies can establish priorities for destination development, environmental protection, cultural heritage conservation, investment, infrastructure, and community participation. However, policies alone are insufficient without effective implementation and coordination. Tourism development often involves several government institutions, private businesses, local communities, investors, cultural organizations, and other stakeholders. Weak coordination among these actors can result in fragmented initiatives, inefficient resource allocation, and inconsistent implementation of tourism strategies. Strengthening mutual understanding and cooperation between government institutions and relevant stakeholders is therefore essential for developing a coherent and sustainable tourism sector in Afghanistan.

Community participation is another important component of sustainable tourism. Local communities are directly affected by tourism activities and can play an important role in protecting cultural traditions, managing local resources, providing tourism services, and creating authentic visitor experiences. When communities participate meaningfully in tourism planning and receive equitable economic benefits, tourism can contribute to employment, entrepreneurship, poverty reduction, and local development. In contrast, limited community participation and unequal distribution of tourism benefits may reduce local support for tourism initiatives and weaken their long-term sustainability.

Environmental protection and cultural heritage preservation are equally important in the Afghan context. Afghanistan's natural landscapes, historical monuments, archaeological sites, and cultural traditions represent important potential tourism resources. However, tourism development without appropriate environmental and heritage-management measures may place these resources at risk. Sustainable tourism strategies should therefore incorporate environmental management, responsible visitor behavior, conservation practices, and mechanisms for protecting cultural and natural assets for future generations.

Despite Afghanistan's tourism potential, the development of a sustainable tourism sector is constrained by several interconnected challenges. These include limited financial resources, insufficient tourism infrastructure, institutional weaknesses, fragmented stakeholder coordination, inadequate implementation of tourism policies, environmental risks, and limited community participation. At the same time, Afghanistan possesses strengths and opportunities that could support tourism development, including its cultural diversity, historical heritage, natural attractions, local traditions, and opportunities for community-based tourism. Understanding both the internal and external conditions affecting tourism is therefore necessary for developing realistic strategies for sustainable tourism development.

Existing discussions of sustainable tourism provide important general principles, but these principles must be examined within Afghanistan's specific institutional, environmental, economic, and socio-cultural context. Sustainable tourism strategies developed for other countries may not be directly applicable to Afghanistan because tourism development is shaped by local governance structures, stakeholder relationships, available resources, community conditions, and national development priorities. There is therefore a need for context-specific evidence that identifies the strengths, weaknesses, opportunities, and threats affecting tourism development while also examining stakeholder perspectives on environmental sustainability, economic benefits, cultural preservation, governance, and community participation.

Against this background, this study investigates strategies for sustainable tourism development in Afghanistan using SWOT and thematic analysis. It examines current tourism development practices, their environmental, economic, and socio-cultural implications, the major barriers and enabling factors affecting sustainability, and the perspectives of relevant stakeholders. By integrating these dimensions, the study seeks to develop practical and context-sensitive recommendations for strengthening tourism governance, stakeholder coordination, environmental management, cultural heritage protection, community participation, and sustainable destination development in Afghanistan.

Problem statement

Afghanistan has significant cultural, historical, and natural resources that could support tourism development and contribute to employment creation, local business development, income generation, and economic diversification. However, realizing this potential sustainably remains challenging because tourism development is influenced by institutional capacity, policy implementation, infrastructure, environmental management, investment, community participation, and cooperation among government institutions and other stakeholders.

Although tourism can generate substantial economic and social benefits, poorly planned development can contribute to environmental degradation, pressure on natural resources, damage to cultural heritage, unequal distribution of economic benefits, and exclusion of local communities from tourism decision-making. These concerns are particularly important in Afghanistan, where limited resources and institutional constraints may make the effective management of tourism destinations more difficult.

A further challenge is the need for stronger coordination among government institutions, private-sector actors, local communities, tourism businesses, and other relevant stakeholders. Fragmented initiatives and insufficient stakeholder cooperation can limit the effectiveness of tourism policies and prevent the development of integrated approaches to destination management. Similarly, inadequate community participation may reduce the ability of tourism development to generate sustainable socioeconomic benefits at the local level.

Despite increasing recognition of sustainable tourism, there remains a need for context-specific evidence concerning the internal and external factors influencing sustainable tourism development in Afghanistan. In particular, greater understanding is required regarding current tourism practices, environmental and socio-economic impacts, institutional and policy constraints, stakeholder relationships, and opportunities for sustainable destination development. Therefore, this study addresses this gap by applying SWOT and thematic analysis to identify the major factors affecting sustainable tourism development in Afghanistan and to develop practical strategies for responsible, inclusive, and environmentally sustainable tourism.

Scope of the study

This study focuses on sustainable tourism development in Afghanistan, with particular attention to selected tourism destinations and relevant stakeholders. It examines the environmental, economic, and socio-cultural dimensions of tourism development and considers the roles of tourism policies, institutional capacity, stakeholder coordination, community participation, cultural heritage protection, and environmental management. The study uses stakeholder perspectives to identify the major strengths, weaknesses, opportunities, and threats affecting sustainable tourism and to formulate practical strategies for responsible and inclusive tourism development in Afghanistan.

Research objectives

- Examine current tourism development practices in Afghanistan and assess their alignment with sustainable tourism principles.
- Assess the environmental, economic, and socio-cultural impacts of tourism development on local communities and destination.
- Identify the major barriers and enabling factors affecting the implementation of sustainable tourism strategies in Afghanistan.
- Develop strategic recommendations and policy directions for promoting responsible, inclusive, and sustainable tourism development in Afghanistan.

Research questions

Research questions are:

- What tourism development practices are currently applied in Afghanistan, and to what extent do they align with sustainable tourism principles?
- What are the environmental, economic, and socio-cultural impacts of tourism development on local communities and tourism destinations?
- What major barriers and enabling factors influence the implementation of sustainable tourism practices in Afghanistan?
- What strategies and policy measures can promote responsible, inclusive, and sustainable tourism development in Afghanistan?

Significance of the study

This study is significant because it addresses sustainable tourism development within the specific context of Afghanistan, where considerable cultural and natural tourism potential exists alongside institutional, economic, environmental, and governance challenges. Academically, the study contributes to the sustainable tourism literature by providing context-specific evidence on tourism development in Afghanistan and by examining the interaction between environmental protection, economic development, cultural preservation, community participation, governance, and stakeholder coordination.

From a policy perspective, the findings can assist government institutions and tourism authorities in identifying priority areas for improving tourism policies, institutional capacity, destination management, and coordination with relevant stakeholders. The study can also support private-sector actors and development organizations by identifying opportunities for investment, partnerships, and sustainable tourism initiatives.

For local communities, the research emphasizes participation, equitable distribution of tourism benefits, local enterprise development, and protection of cultural and natural resources. By identifying the major strengths, weaknesses, opportunities, and threats affecting tourism and integrating these findings with stakeholder perspectives, the study provides practical recommendations for developing a more responsible, inclusive, resilient, and sustainable tourism sector in Afghanistan.

Literature review

According to Zamfir, A., & Corbos, R. A. (2015), the study shows the increasing significance of urban development simultaneously with sustainable tourism. Cities are urged to shed light on the planning of urban tourism from the eco-friendly angle. This case study describes sustainable urban tourism in Romania. It offers primary data designed to address sustainable urban tourism and lists the most determined factors of successful management. These factors

can guide future endeavors in urban tourism management.
According to Risteskia, M., Kocevskia, J., & Arnaudov, K. (2012), the expected effects of tourism growth when left unsupervised is detrimental to the economy, the culture of the nations, as well as the surroundings. In the case of unsustainable overcrowding, the growth of the tourism industry, like every other economic sector, needs to be regulated, monitored, and dispersed in an optimal manner. Sustainable development, like the other form of modern tourism developments, necessitates to be embraced by modern tourism leaves policymakers no choice but to advocate and bring forth the adoption of practices and the refinement of frameworks and methodologies like destination planning and strategic tourism quality control to maintain relevance.
According to the Seraphin, H., & Gowreesunkar, V. G. (2021), the study analyzes the global case studies of various countries engaged in cross-border tourism in relation to the Sustainable Development Goals (SDGs). It pinpoints barriers and achievements in the hospitality, agriculture, and wildlife tourism industries. The results of the research strongly support cross stakeholder collaboration and the scale of the organization as central components to achieving sustainability, which helps to inform strategic management and provide much needed tools for practitioners and destination managers, across the globe.
According to Angelevska-Najdeska, K., & Rakicevik, G. (2012), the foundation of the tourism economy's sustainability rests on the proper use of valuable natural and cultural sites, thus setting them aside for future generations. These sites are the very foundation of the tourism economy. Therefore, the development of the economy of the tourism region and the protection of the surrounding environment is a question which must be studied in detail and very thoroughly planned. This ensures that the area remains a prime destination for visitors while also serving the needs of the surrounding population.
According to Romagosa, F., Priestley, G., & Llurdés, J. C. (2013), the selected years hinged on in recent, now planning must, along with parallel activities, incorporate sustainability. And yet, in general planning, tourism is rare as a subject of concern. This article addresses diverse approaches to mid-range planning that aim to include tourism in order to construct concurrent rationalizations to the subsequent review of a planning exercise done in Catalonia, Spain. This reasoning is grounded in the plans, the challenges that have risen with goal-setting and indicator systems, and the subsequent decision on the balance and likely impact of the chosen measures.
According to the Dunets, A. N., Vakhrushev, I. B., Sukhova, M. G., Sokolov, M. S., Utkina, K. M., & Shichiyakh, R. A. (2019), the paper examines sustainable tourism development options for the Altai-Sayan mountain region. It proposes a five-stage strategy focusing on preserving biodiversity and ethnic heritage through ethnoecological tourism. The study emphasizes functional zoning and landscape- adaptive spatial planning to balance tourism and environmental management. Different types of tourist networks are analyzed, leading to prioritized development zones for intensive tourism, nature preservation, and ecotourism, as well as areas with varying economic activity levels.
According to the Mason, P., Augustyn, M., & Seakhoa-King, A. (2023), the research won't discuss other scholarly works or compare them; it will focus on examining and analyzing improving the quality of a place and how it helps achieve the UN Sustainable Development Goals (SDGs). It will delve into principles of sustainability with regards quality of a destination and discusses strategic destination quality attributes (safety, authenticity and hospitality) that support the SDGs. The study suggests enhancing destination quality advances sustainable development and proposes a destination management approach for advancing quality along with sustainability. There is also a strong case for pursuing further research to confirm these links.
According to the Brokaj, R. (2014), tourism is a rapidly growing global industry important to many developing countries' economies but can cause environmental and cultural harm without

proper planning. This paper examines sustainable tourism development in Vlora, Albania, focusing on the roles and challenges faced by key stakeholders: local government, tourism businesses, and the community. Using interviews and data analysis, the study highlights multiple factors that hinder sustainable tourism practices in Vlora, emphasizing the need for better collaboration and management.

According to Pascariu, G. C., & Frunză, R. (2012), the tourism plays a vital role in the European Union's economy and integration, increasingly linked to sustainable development goals. This paper examines how tourism enterprises can support sustainability by adopting corporate social responsibility (CSR) practices, especially in developing destinations. It highlights the relationship between tourism and regional development and discusses the benefits of alternative markets for aligning the interests of tourists, businesses, and local communities within an integrated sustainable management framework.

According to Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021), the tourism is a dynamic global industry that requires careful, sustainable planning to balance environmental, economic, and social goals. This paper reviews how strengthening tourism competitiveness can be achieved by integrating sustainability targets and new technologies. It highlights challenges such as changing consumer behavior and the impact of COVID-19 on sustainable tourism. The study offers insights and future research directions to support the development of competitive, sustainable tourism destinations.

According to the Zhu, L., Zhan, L., & Li, S. (2021), using data collected from 130 destinations, this research investigates the relationship between environmental competitiveness and the growth of tourism. The findings, as research found, suggest there is a positive relationship for developed destinations, whereas for developing countries the relationship is weak and insignificant, which might be a consequence of a lack of resources. The results of this research show the relationship between destination competitiveness and the environment, and affirm the need for advocating tourism which is sustainable in principle, particularly in developing countries.

RESEARCH METHODOLOGY

Research design

This study used a mixed-methods research design, integrating quantitative and qualitative approaches to examine strategies for sustainable tourism development in Afghanistan. A mixed-methods design is considered appropriate because sustainable tourism is a multidimensional phenomenon involving environmental, economic, socio-cultural, institutional, and governance factors that cannot be adequately understood through a single source of evidence. The quantitative component is used to identify patterns in stakeholders' perceptions of sustainable tourism practices and conditions, while the qualitative component provided deeper explanations of participants' experiences, concerns, opportunities, and recommendations.

The study therefore combined questionnaires and focus group discussions (FGDs). The findings generated through these methods are analyzed using descriptive analysis and thematic analysis and are subsequently synthesized within a SWOT framework to develop strategic recommendations for sustainable tourism development in Afghanistan.

Data Collection

Primary data are collected through questionnaires and focus group discussions (FGDs). Used these two sources allowed the study to obtain both structured stakeholder responses and more detailed qualitative explanations of the issues influencing sustainable tourism development.

Questionnaire

A structured questionnaire containing both closed-ended and open-ended questions is used to collect information from relevant tourism stakeholders, including visitors, members of host communities, local business operators, and other individuals involved in or knowledgeable about tourism development.

The questionnaire examined participants' perceptions of current tourism practices, environmental sustainability, economic benefits, cultural heritage preservation, community participation, governance, stakeholder cooperation, and barriers and opportunities related to sustainable tourism development in Afghanistan.

Focus Group Discussions

Focus group discussions are conducted to obtain deeper qualitative insights into sustainable tourism development. Participants included individuals with relevant knowledge or experience, such as local residents, tourism-related business representatives, and individuals concerned with cultural or environmental conservation.

The discussions focused on major challenges and opportunities affecting tourism development, environmental protection, cultural heritage preservation, community involvement, institutional support, stakeholder coordination, and possible strategies for improving sustainable tourism in Afghanistan.

The FGDs complemented the questionnaire findings by allowing participants to explain their experiences and perspectives in greater depth and to identify issues that could not be fully captured through structured questionnaire responses.

Sampling Technique

The study used different sampling procedures according to the requirements of the two data-collection methods. Random sampling is used for questionnaire respondents where an appropriate sampling frame or accessible respondent population is available. This approach is intended to obtain responses from a broader range of participants and reduce systematic selection bias.

For the qualitative component, snowball sampling is used to identify participants with relevant experience or specialized knowledge for the focus group discussions. Initial participants helped identify other suitable individuals who possessed knowledge of tourism development, local communities, tourism businesses, environmental conservation, or related areas. Snowball sampling is considered useful because some knowledgeable tourism stakeholders could not easily be identified through a conventional sampling frame.

Data Analysis

The quantitative and qualitative data are analyzed separately before being integrated during the interpretation and strategic synthesis of the findings.

Quantitative Analysis

Responses to the closed-ended questionnaire items are organized and summarized used descriptive analysis. Weight, weightage score, or other appropriate descriptive measures are used to identify general patterns in respondents' perceptions of sustainable tourism development. The quantitative results provided an overview of stakeholder perceptions regarding environmental, economic, socio-cultural, governance, and institutional dimensions of tourism development.

Open-ended questionnaire responses are treated as qualitative evidence and analyzed together with relevant FGD data.

Thematic Analysis

Qualitative data obtained from the open-ended questionnaire responses and focus group discussions are analyzed using thematic analysis, following the systematic procedure proposed by Braun and Clarke (2006). Thematic analysis is selected because it provides a flexible and systematic method for identifying, analyzing, and interpreting recurring patterns of meaning within qualitative data.

The analysis followed six stages. First, the researchers became familiar with the data through repeated reading of the responses and FGD records. Second, relevant statements are systematically coded. Third, related codes are grouped to generate potential themes. Fourth, the identified themes are reviewed against the original data to ensure consistency and relevance. Fifth, the themes are clearly defined and named. Finally, the themes are interpreted and reported in relation to the research objectives and questions.

Particular attention is given to themes concerning environmental sustainability, economic benefits, community participation, cultural heritage preservation, governance, stakeholder coordination, institutional capacity, challenges, and opportunities for sustainable tourism development in Afghanistan.

SWOT-Based Strategic Synthesis

In this study**,** SWOT analysis is not treated as the primary method for analyzing raw questionnaire or FGD data. Instead, it is employed as a strategic synthesis framework after the quantitative and thematic analyses had been completed.

Evidence generated from the questionnaire results and thematic analysis is systematically categorized into four strategic dimensions: strengths, weaknesses, opportunities, and threats. Strengths and weaknesses represented internal factors influencing tourism development, whereas opportunities and threats represented external conditions that could facilitate or constrain sustainable tourism development.

This approach enabled the researchers to integrate empirical findings into a structured strategic assessment of Afghanistan's tourism sector. The resulting SWOT framework is subsequently used to formulate strategic options and recommendations concerning environmental management, cultural heritage protection, community participation, institutional development, stakeholder coordination, investment, and sustainable tourism policy.

Therefore, the SWOT framework served primarily as a decision-support and strategy-development tool rather than an independent method of empirical data analysis.

Integration of Quantitative and Qualitative Findings

The final stage involved integrating the quantitative questionnaire results, qualitative themes, and SWOT-based strategic assessment. Areas of convergence and divergence between the different sources of evidence are examined to develop a comprehensive interpretation of sustainable tourism development in Afghanistan.

This integration strengthened the analysis by combining broad stakeholder patterns with detailed contextual explanations. The resulting evidence is used to develop practical and context-sensitive strategies for responsible, inclusive, environmentally sustainable, and economically viable tourism development in Afghanistan.

Ethical Considerations

Participants are informed about the purpose of the study and the voluntary nature of their participation. They are informed that their responses would be used for research purposes and that confidentiality would be maintained. Participants are free to decline participation or withdraw where applicable. Personal identifying information is not disclosed in reporting the findings, and the collected information is used solely for academic research purposes.

Findings

Strategies for achieving sustainable development in tourism and tourist destinations

The thematic analysis of data related to sustainable tourism development reveals several recurring and interrelated themes that are critical to creating balanced, long- term strategies in the tourism sector.

THEMES

Environmental sustainability practices

According to the focus group discussion the participants narrated that the "Environmental Sustainability Practices" the participants consistently emphasize the importance of protecting natural resources, minimizing pollution, and integrating eco-friendly infrastructure into tourism planning. Initiatives such as the reduction, renewable energy use, and conservation programs are commonly viewed as essential to reducing tourism's ecological footprint.

Community involvement and empowerment

The participants of the focus group discussion consider "Community Involvement and Empowerment" and most of them declare that the Sustainable tourism cannot flourish without the active engagement of local residents. Data points to the necessity of having participatory governance systems, their inclusive decision-making processes, and equity in the tourism payout. The social well-being and regional stability in the long run is assured through the local people.

Cultural heritage preservation

The focus group participants narrated that "Cultural Heritage Preservation" also emerges as a critical topic. Respondents emphasize that cultural erosion should not be caused by tourism. Rather, it should actively defend and advocate for local customs, traditions, and historical resources. This topic highlights the notion of 'performing tourism' and the positive exchange of real cultural practices that advantage both parties.

Economic sustainability and local development

The focus group participants narrated that "Economic Sustainability and Local Development" the Participants highlight that tourism must support local economies through job creation, support for small businesses, and minimizing revenue leakage. There is a clear demand for tourism models that prioritize long-term economic benefits over short-term profit.

Policy, governance, and strategic planning

The focus group participants stressed on "Policy, Governance, and Strategic Planning" Almost all participants stated that these are the all the policies that formed the backbone of responsible and sustainable tourism development. It is considered that effective governance, collaboration across different sectors, and the formation of public-private partnerships are all essential for the effective implementation of sustainability measures.

Tourist experience and awareness

The focus group participants showing so much focus on "Tourist Experience and Awareness" speaks to the growing realization that sustainability should enhance the visitor's experience. A sustainable destination not only has a low environmental impact, but also offers authentic and quality, meaningful experiences.

It is noted that explaining sustainable practices and promoting responsible tourism are some of the practices that are discussed.

Technology and innovation in sustainability

In the end focus group participants concentrating on, "Technology and Innovation in Sustainability" comes up as a contemporary theme. Stakeholders remarked on the possible uses of digital technology and smart tourism in monitoring and managing environmental impact, as well as in optimizing destination management and providing tailored, sustainable experience. Planning and innovation driven by data are perceived more and more as core facilitators of sustainability.

SWOT ANALYSIS - INTERNAL FACTOR ANALYSIS (IFEM)

TABLE 1: INTERNAL FACTOR ANALYSIS (IFEM): STRENGTHS

INTERNAL FACTORS EVALUATION MATRIX				
S.No	**STRENGTHS:**	**Rating**	**Weights**	**Weighted score**
S1	The organization/destination has a clear and actionable sustainable tourism strategy.	3	0.076923	**0.230769**
S2	There is strong leadership commitment to environmental sustainability.	4	0.102564	**0.410256**
S3	Local tourism businesses actively collaborate on sustainability initiatives.	4	0.102564	**0.410256**
S4	Sustainable practices (e.g., the reduction, water conservation) are well integrated into daily operations.	3	0.076923	**0.230769**
S5	The destination has unique natural or cultural assets that attract responsible tourists.	4	0.102564	**0.410256**
S6	**Staff are trained and motivated to support sustainability goals.**	**3**	**0.076923**	**0.230769**

TABLE 2: INTERNAL FACTOR ANALYSIS (IFEM): WEAKNESSES

INTERNAL FACTORS EVALUATION MATRIX				
W.No	**WEEKNESSES:**	**Ratings**	**Weights**	**Weighted score**
W1	Lack of funding or investment in sustainable tourism infrastructure.	4	0.102564	**0.410256**
W2	Limited awareness or training among staff on sustainability practices.	3	0.076923	**0.230769**
W3	Poor coordination between public and private tourism stakeholders.	3	0.076923	**0.230769**
W4	Overdependence on mass tourism instead of diversified sustainable tourism models.	3	0.076923	**0.230769**
W5	Insufficient data collection or monitoring of environmental impacts.	3	0.076923	**0.230769**
W6	Inadequate communication of sustainability policies to tourists and stakeholders.	2	0.051282	**0.102564**
TOTAL			**1.00**	**3.358971**

Interpretation of item

The IFE matrix provides a structured assessment of the internal strengths and weaknesses related to sustainable tourism at the destination/organization. The total weighted score from the matrix is **3.36**, which indicates that the destination has a strong internal position in supporting sustainable tourism development.

Table 1 illustrates the most important internal strengths an organization may possess.

- Very strong internal factors outweighing competitive pressures include strong leader's commitment to ecological sustainability & the active cooperation with other local performers in tourism (both 4's) which internal strength, sustainability & sustainable tourism each weighted 0.410
- Benevolently, the destination is enriched with specific natural/cultural attractions (3) which socially responsible travelers are more than eager to visit- this further consolidates the competitive edge in sustainable tourism.

- Other favorable conditions are the clear sustainability framework & the integration of training.

In Table 2, although there is a strong internal foundation, a number of internal issues are recognized:

- The greatest weakness is the absence of financial resources or investments in the infrastructure of sustainable tourism (W1) which, having a weighted value of 0.410, shows the greatest need for attention.
- Other weaknesses include lack of awareness and training, inadequate internal stakeholder coordination, and overreliance on mass tourism, which are all associated with moderate internal environment risks.
- The communication of sustainability policies (W6), although the lowest weighted value, demonstrates a lack of stakeholder involvement and lack of educational initiatives for tourists.

External factor analysis (efem)

TABLE 3: EXTERNAL FACTOR ANALYSIS (EFM): OPORTUNITIES

EXTERNAL FACTORS EVALUATION MATRIX				
O.No	**OPPORTUNITIES:**	**Ratings**	**Weights**	**Weighted score**
O1	Increasing global demand for eco-friendly travel experiences.	3	0.069768	**0.209304**
O2	Availability of government incentives or international grants for sustainability.	4	0.093024	**0.372096**
O3	Growing partnerships with NGOs and environmental organizations.	4	0.093024	**0.372096**
O4	Development of green technologies (e.g., energy-efficient transport, smart tourism tools).	4	0.093024	**0.372096**
O5	Expansion of sustainable tourism certification programs.	4	0.093024	**0.372096**
O6	**Enhanced interest from tourists in community-based and cultural tourism.**	**4**	**0.093024**	**0.372096**

TABLE 4: EXTERNAL FACTOR ANALYSIS (EFM): THREATS

T.No	**THREATS:**	**Ratings**	**Weights**	**Weighted score**
T1	Climate change and extreme weather affecting tourist seasons or destinations.	3	0.069768	**0.209304**
T2	Over-tourism causing environmental and cultural degradation.	3	0.069768	**0.209304**
T3	Political or economic instability impacting long-term planning.	4	0.093024	**0.372096**
T4	Lack of enforcement of environmental regulations.	3	0.069768	**0.209304**
T5	Global pandemics or health crises disrupting tourism.	4	0.102564	**0.372096**
T6	Competition from unsustainable low-cost tourism models.	3	0.069768	**0.209304**
TOTAL			**1.00**	**3.651192**

Interpretation of EFEM

The EFEM analyzes the key external opportunities and threats that influence the strategic direction of a destination or organization focused on sustainable tourism. The total weighted score is 3.65, which reflects a very favorable external environment for sustainable tourism development.

The matrix in Table 3 illustrates a number of significant external opportunities that the destination is able to take advantage of:

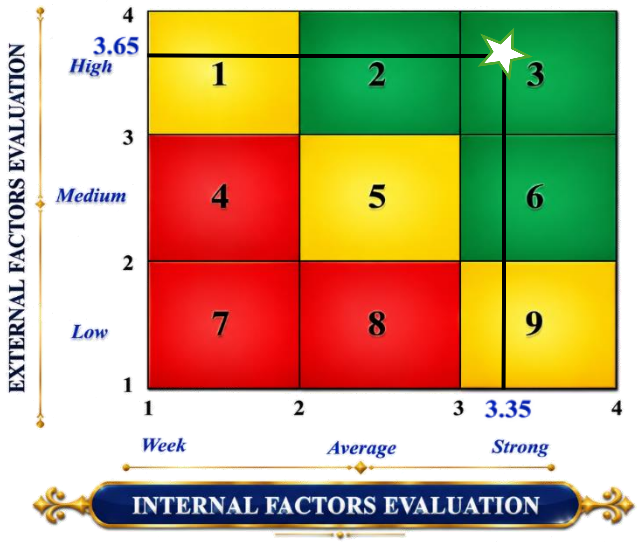
- Grants and funding by the government (O2), collaboration with NGOs (O3), development of green technologies (O4), green certification (O5), and interest in community-based tourism (O6) are all rated the highest with a score of 4 signifying that they are all very pertinent and tremendously influential.
- All of these highly rated opportunities are weighted with a score of 0.372 which is of equal and great significance, affirming that they are all strategically critical.
- Also the rising global market for green tourism (O1) has a positive contribution, although rated and weighted lower.

In general, the array of opportunities available is very positive, providing avenues for funding, technological enhancement, and greater interaction of tourists with sustainable practices.

The matrix in Table 4 has identified several external threats likely to hinder the success of sustainable tourism initiatives:

- Political and economic instability (T3) and global health crises (T5) are rated 4 and considered primary threats of high magnitude each receiving weighted scores of 0.372.
- Additional threats of climate change, over tourism, inadequate enforcement of regulations, and competition from models of sustainable tourism are all rated 3 and considered valuable impediments to the efforts toward sustainability.

All of the above suggest the importance of some form of strategic risk management, which would include thorough preparatory governance on crises, and market positioning against the competition for unsustainable tourism.



1	HARVEST & DIVEST	4, 7,
2	HOLD & MAINTAIN	1, 5,
3	GROW & BUILD	2, 3,

Interpretation of IEM
IE Matrix position (Cell 3) confirms that the destination/organization is in a high- growth, high-opportunity strategic zone. Leadership should confidently pursue expansion, innovation, and investment in sustainability to reinforce its competitive edge and long-term resilience.

Strategies
The following strategies for achieving sustainable development in tourism and tourist destinations derived from SWOT analysis (IFE & EFE Matrices), are organized using the TOWS Matrix approach matching Strengths (S) and Opportunities (O) to formulate growth strategies, and addressing Weaknesses (W) and Threats (T) to formulate corrective or defensive strategies.

SO strategies
(Using strengths to maximize opportunities)
Use internal strengths to exploit external opportunities:

1. Strengthen Public-private-NGO collaborations
   - Form and sustain long-term partnerships with NGOs and environmental organizations (O3) for technical support, co-marketing, and funding using strong leadership commitment (S2) and active local business collaboration (S3). Use the Existing Clear Sustainable Tourism Strategy the the Sustainability Strategy for Green Certifications & Grants.
   - Apply for government incentives and international sustainability grants (O2), and green certification programs (O5) to use the clear sustainable tourism strategy (S1).
2. Promote unique natural and/or cultural assets for eco tourism projects
   - To design and implement destination promotion (O1, O6) sustainable travel packages with eco-friendly and community-based tourism to the growing world (S5) demand.
3. Integrate green technologies in tourism operations
   - Apply (O4) energy-efficient transport and smart tourism tools using integrated sustainability practices (S4), and leadership support (S2).

WO strategies
(Overcome weaknesses by using opportunities)
Minimize internal weaknesses by taking advantage of external opportunities:
1. Secure Funding for Sustainable Infrastructure Development
   - Address the lack of investment in sustainable tourism infrastructure (W1) by vigorously securing government grants and NGO funding (O2, O3). Implement Staff Training through NGO Collaborations
   - Resolve the restricted staff awareness and training issue (W2) by working with NGOs (O3) and certification bodies (O5) to develop capacity-building workshops and sustainability training. Promote Sustainable Alternatives to Mass Tourism
   - Reduce the overdependence on mass tourism (W4) by developing and advertising community-based and cultural tourism experiences (O6) on social media and through eco-certifications. Develop Data-Driven Monitoring Systems with Tech Support
   - Address the insufficient monitoring of environmental impacts (W5) by using intelligent technologies and digital tools (O4) for tracking, reporting, and managing sustainability.

ST strategies
(Counteract weaknesses by leveraging opportunities)
Minimize internal weaknesses by taking advantage of external opportunities, ST strategies

(utilize strengths to diminish threats) (counter external threats by using internal strengths) to formulate crisis-resilient sustainable policies:

- S1, S2 strong sustainability, S1, S2 strong sustainability to develop crisis- resilient plans for tourism Position the Destination as a Sustainable Brand.
- S5, S4 Coupling the end site to an internationally recognized eco-tourism destination, using the geographic differentiation (S5) and certification (S4) to market it as a premium eco-tourism offering, thus avoiding the competitive corridor of unsustainable low-priced offers (T6). Increase Effectiveness of Collaborative Environmental Governance.
- S3 Use collaborative structures to enhance the enforcement of environmental policy (T4) and control the consequences of over-tourism (T2).

WT strategies *(Defensive strategies intended to mitigate internal weaknesses and eliminate external risks)*

Defensive strategies:

1. Enhancing stakeholders' communication and crisis readiness:
   - Focus on communication silos (W6) and political/health-related risks (T3, T5) by creating and deploying a unified communication strategy for tourists, employees, and local stakeholders.
2. Set up a cross-industry sustainability council
   - Reduce poor integration (W3) and lack of enforcement (T4) by establishing a destination-level sustainability council. This council will consist of government, business, and community leaders.
3. Broaden the range of tourism activities to the control of visitor distribution
   - Diminish effects of over-tourism (T2) and dependence on mass tourism (W4) by supplying varied products (agricultural tourism, cultural heritage trails, shoulder season) to better control the flow of visitors.

Conclusion

Focus group participants underline that sustainable tourism should be regarded as an approach that integrates the mitigation of possible negative impacts on the environment and downtrodden local communities with the protection of the culture and the maximization of profit. The study also shows that the practice of sustainable tourism should add value to the traveler's experience as well as to the destination and all other participants of the value chain. This should be from a perspective of intergenerational and persistent returns.

Based on the SWOT analysis, the destination has the potential to dominate in the development of sustainable tourism. Strong internal (IFE score: 3.36) and supportive external (EFE score: 3.65) factors place the destination in the "Grow and Build" zone of the IE Matrix, which means the internal factors may be relied on to take advantage of external opportunities which is the case here. Sustainable tourism initiatives, funding, partnerships, and stakeholder engagement can be all be expanded. While there still exist internal weaknesses of inadequate investment and coordination, these weaknesses are surpassed in importance by committed leadership and collaboration and unique tourism assets.

To capitalize on external opportunities, the destination has to continue dominating in the development of sustainable tourism, along with managing key threats such as political instability and climate change. This can be done by smooth coordination of several key actions to reinforce the resilient, responsible, and forward-thinking global position in leadership of tourism in the world.

Recommendations are:

1. Strengthen the ecology practices Integrate new development and infrastructure under the operationalization of zero waste approach, renewable energies and eco-logical practices. In tourism development, develop policies and new programs that promote the use of more sustainable practices and green technologies, including smart tourism systems and clean mobility.
2. Preserve and Promote Cultural Heritage: Develop and promote tourism that fosters the safeguarding of the local culture, traditions, languages, and heritage sites, especially the world heritage sites. Work with cultural institutions to create original cultural tourism products that have educational value and promote cultural pride.
3. Ensure Economic both local and sustainable growth: Integrate local entrepreneurs and small businesses into the value chain of tourism developed to provide local, sustainable and responsible tourism. Reduce economic leakage by supporting the purchase of local products and services by foundation that promote sustainable development.
4. Secure Sustainable Tourism Funding: Look for government support and international grants to fill the infrastructure investment gap. Build alliance with NGOs and other organizations that promote sustainable development for technical and financial support.
5. Strengthen the Governance, Policy and Institutional Capacity: Implement and integrate tourism policies that have been developed with a long-term sustainability goal. Establish inter-disciplinary sustainability councils that cut across government, private and civil society for the purpose of a coordinated approach to sustainable development.
6. Improve Internal and External Stakeholder Coordination and Communication: Integrated awareness campaigns support stakeholder communication to fill the gaps in internal communication. Enhance policy execution through strengthened Public-Private Partnerships on conservation works.
7. Improve Visitor Education and Experience: Integrate tourism interpretive and digital materials on the awareness and education of sustainability. Provide efficient and low-impact experiences to respond to the growing request for responsible tourism.
8. Apply the Adoption of Digital Transformation and Intelligent Systems: Implement digital systems to monitor and analyze the environmental impacts and visitation patterns. Integrate smart tourism approaches to optimize operations, reduce carbon footprints, and enhance responsible experience.
9. Improve the Ability to Anticipate and Prepare for External Shocks: Formulate appropriate mitigation plans to preemptive and reactive risks, and disruptions in politics, economy, and health, with a tourism crisis.
10. Diversification of tourism activities (i.e. agri-tourism, off peak season activities) to reduce dependence on the problem of overtourism, and the uncontrolled dispersal of visitors.
11. Broaden Community Participation and Empowerment: Create structures of participatory governance that improve the engagement of local people in the planning and decision-making of tourism development. Community-based tourism should promote and practice sustainable tourism that provides the community with social and economic benefits.

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Digital Linguistic Capital and Educational Inclusion: The Case of Generative AI in Bangladesh

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Abstract: Generative artificial intelligence (AI) is increasingly promoted as a tool for educational inclusion, but its benefits are unevenly distributed across language, class, geography, and infrastructure. This article examines Bangladesh as a critical Global South case in which Bangla has deep national and cultural authority while English continues as a powerful source of educational, professional, and symbolic advantage. Drawing on Bourdieu's concept of linguistic capital (1991), postcolonial language theory (Phillipson, 1992; Pennycook, 2017), and contemporary AI ethics (Floridi & Cowls, 2019; UNESCO, 2021), the article develops the concept of digital linguistic capital. This concept refers to the capacity to use AI-enabled multilingual tools to access, translate, evaluate, produce, and circulate knowledge across Bangla, English, and other local language repertoires. The article argues that generative AI can lower some barriers faced by Bangla-medium learners by supporting mother-tongue explanation, translation, academic writing, teacher preparation, and bilingual learning. However, it can also reproduce inequality through unequal device access, English-centric training data, premium platform markets, weak AI literacy, unreliable outputs, surveillance, privacy risks, and dependence on foreign technology platforms. Four illustrative case vignettes show how these opportunities and risks appear in rural schooling, public universities, teacher professional practice, and inclusive education. The article proposes a four-pillar governance framework for Bangladesh and comparable Global South contexts. The pillars are inclusion, linguistic justice, accountability, and capacity building. It concludes that AI will not automatically democratize education. Its encompassing potential depends on public governance, local language investment, data protection, teacher preparation, assessment reform, and participatory design with learners, teachers, and communities.
Keywords: artificial intelligence; AI ethics; linguistic capital; Bangla; Bangladesh; Global South; education policy; linguistic justice; digital inclusion.

Introduction

AI has been touted as a general-purpose educational technology. A dual framing: various policy documents and commercial narratives document how AI tutors, chatbots, automated feedback systems, translation tools etc. are technologies that could personalize learning, offload teacher workload and widen access to knowledge. These claims are at least partially true, but they often hide what is the societal context in relation to who stands to actually benefit. AI is not entered in a vacuum. This ends its way into classrooms, universities and homes pre-configured by language hierarchy, income inequality, gendered access to devices, urban-rural infrastructural inequities and colonial education histories (Bourdieu 1991; Phillipson 1992; van Dijk 2020).

Thus, the primary policy issue is not if AI can be exploited for good in education more generally. The far deeper question is whether the data cooking of AI enables value-subordinate people (who have been historically devalued by social, linguistic and institutional means) to access knowledge-steeped markets in ways that were previously unavailable.

A compelling case to answer this question is Bangladesh. Language was a fundamental element of national identity from which the nation shared its roots deep in their history. But the events of 1952 surrounding the use and preservation of Bangla, namely the Bangla Language Movement, both as a phenomenon and symbolic status upon which was woven national liberation struggle lends to Bangla, in return, rightful respectability and contextual religiosity within crucial values such as honor – represented by filled stomachs citizenship symbolized with directed pens & literates that hollowed paper also supplied soul electric duplicates of our hearts for all who welcomed salutation dignity like shiny stars snuggling our internal compass; not merely text amongst texts alone for its own sake but pervasive impetus behind collective efforts steering toward self-determination. Naturalized high market worth to English still prevails in the postcolonial education system (Rahman, 2005; Hamid, 2016). Thus, Bangla is the language of citizenship; however, English retains its state-level prestige associated with elite schooling, international scholarships and job opportunities (especially in corporations), international research and mobility (Chaudhury, 2011; Hamid & Honan, 2012).

As a result, students also leave English-medium or resource-rich urban schools with kinds of linguistic capital few Bangla-medium, rural (under-serving), madrasa and first-generation learners possess when they negotiate entry to the academic and labor market (Karim et al., 2023; Islam & Stapa, 2021).

Generative AI intensifies this tension. On one end of the spectrum, multilingual AI tools can provide a Bangla-medium student the possibility to understand an English-academic article, get prepared for university admission, feedback on writing, translate technical words in non-English languages or ask questions which will usually not have been entertained in their classroom (Sarkar 2022; Chakrabarty 2021). For instance, a teacher in a rural community could access AI-generated bilingual lesson plans, examples of local context, and even formative assessment tasks (Holmes et al., 2022). On the contrary, AI systems are continually trained on English and other high-resource languages; they are operated via commercial platforms that collect data from users and provide outputs that may be false, socially biased or fabricated evidence (Bender et al., 2021; Ji et al., 2023). For example, if AI tools perform better on English prompts than Bangla ones, and if affordability only allows the urban middle-class or elites to use premium versions, while schools respond to AI either with bans or panic mode in resisting students being able to write anything original (Kasneci et al., 2023; Zawacki-Richter et al., 2019), then AI may well reinforce rather than resist the hierarchies of language and class that it appears like it would disrupt.

This paper tackles three research questions as follows:

1. Like any other brand, language brings with it the advantage of social capital: why does English remain a dominant form of linguistic capital in Bangladeshi education even after the nationhood of Bangla?
2. So how could generative AI be a new digital linguistic capital for Bangla learners and change basic access to educational knowledge?
3. What sort of governance framework is needed to ensure that AI achieves linguistic justice?

Perhaps your research has a conceptual and/or policy orientation where you tackle these questions without them being the main focus of fieldwork. Informed by sociological perspectives, the postcolonial language studies literature, AI ethics texts, policy discussions of education in Bangladesh and between global frameworks for debating efficacy on AI and education.

The article makes three contributions. Theoretical Contribution: The Concept of Digital Linguistic Capital; a conceptual extension of Bourdieu's account of linguistic capital to AI mediated multilingual learning environments. It orients discussions around AI education in Bangladesh, at the same time as it continues to frame our learners from the Global South as vessels ready to be filled by those further developed elsewhere. The title indicates that: Contribution to Policy; A Governance framework grounded in inclusion, linguistic justice, accountability and capacity-building is structured around four pillars.

LITERATURE REVIEW

Colonial Legacies and Linguistic Capital

This draws on Bourdieu's (1991) notion of linguistic capital as a theory that analyzes language as a resource with historical ties to power structures whereby postcolonial oral fluency in English has long been associated with social advantage. In British India, English was institutionalized as the language of administration and governance in addition to elite education in Bangladesh. Using Bangladesh as a backdrop, Rahman (2005) has traced the trajectory of how English developed to become a symbol of social identity and an access point to privilege. This colonial legacy left in place what Phillipson (1992) labelled "linguistic imperialism," where English remains a vehicle of neocolonial domination. The national language is Bengali, but English has continued to dominate in higher education, the judiciary and corporate domains (Chaudhury, 2011). Bangladesh was classified as part of the Outer Circle or regions in which English is an additional language and has a significant presence in institutions (Kachru, 1983). In these contexts, the mastery of English serves as symbolic capital that can be traded for more advantageous social and academic memberships (Pennycook 2017).

Language, AI, and Postcolonial Societies

The emergence of generative AI tools marks a paradigm shift in how language is accessed and used. Initially designed primarily for English, these technologies now support regional languages such as Bengali, making them more inclusive. Sarkar (2022) argues that AI tools are contributing to the democratization of language in South Asia by providing platforms where users can engage in their native languages.

Chakrabarty (2021) further notes that AI tools in regional languages can empower marginalized communities by giving them access to global knowledge without English proficiency. This is particularly significant in Bangladesh, where English has historically served as a barrier to educational and professional advancement for non-English speakers (Hamid, 2016).

However, Dasgupta (2019) cautions that while AI can bridge linguistic gaps, it cannot solve the digital divide between urban and rural populations in Bangladesh. Access to high-speed internet, smartphones, and digital literacy remains unevenly distributed (van Dijk, 2020; Lythreatis et al., 2022). Nonetheless, the integration of Bengali into AI technologies presents a unique opportunity to challenge the postcolonial dominance of English and potentially reshape linguistic hierarchies across generations.

Generational Shifts in Language Use

Research has shown that younger generations, who are more likely to adopt new technologies, may show different language preferences compared to older generations. Miller (2015) explores how younger generations in postcolonial societies increasingly shift their language preferences as they engage with digital technologies.

Zhou and Tseng (2017) found that online platforms encourage younger people to embrace code-switching between languages. Giddens (1990) argues that digital technologies, including AI, act as catalysts for social change by shifting power dynamics between languages. In Bangladesh, this suggests that Gen Z, who are digital natives, may increasingly view Bengali as a practical and efficient language for AI-mediated tasks, while Gen X, who invested heavily in English proficiency under postcolonial education systems, may retain English as a marker of distinction (Twenge, 2017).

Gaps in the Literature

While there is rich scholarship on colonial legacies, language policy, and educational inequality in South Asia, the intersection of generative AI, generational language shift, and linguistic capital remains underexplored. Existing research focuses primarily on English dominance or on AI's technical capabilities, without examining how these technologies might disrupt established language hierarchies across different age groups. This paper addresses this gap by applying Bourdieu's framework to analyze the potential generational reconfiguration of linguistic capital in the age of AI.

THEORETICAL FRAMEWORK

Bourdieu's Linguistic Capital and Symbolic Power

Bourdieu's (1991) concept of linguistic capital explains how certain ways of speaking acquire value while others are devalued. In postcolonial contexts, colonial languages have historically functioned as dominant capital (Phillipson, 1992). Bourdieu also introduces symbolic violence, the process by which dominated groups accept their own domination as natural. When a person is told that their accent is 'illegitimate,' they may internalize this judgment (Bourdieu & Passeron, 1977).

In Bangladesh, English has historically functioned as a symbol of social distinction and elite status (Rahman, 2005). Bengali, in contrast, has often been relegated to more informal and local settings. This paper extends Bourdieu's insight: symbolic violence operates not only within societies but also across linguistic hierarchies, where language difference becomes grounds for exclusion.

Postcolonial Theory and Language

Postcolonial theory examines how colonial rule continues to shape social structures in former colonies. Fanon's (1967) writings on colonial language as a tool of cultural domination are relevant: English became not only a means of communication but also a marker of superiority. Bhabha's (1994) concept of hybridity explains how postcolonial subjects both resist and adopt elements of the colonizer's culture, including language. In Bangladesh, while Bengali remains the symbol of national identity, English continues to dominate formal domains (Ngũgĩ wa Thiong'o, 1986).

Digital Linguistic Capital: A Proposed Extension

This article proposes the concept of digital linguistic capital as an extension of Bourdieu's original framework. Digital linguistic capital refers to the ability to use AI-enabled digital tools to access, translate, evaluate, produce, and circulate knowledge across languages in ways that generate educational, social, and economic value.

Digital linguistic capital has five interrelated components:

1. Prompting ability: The capacity to ask useful questions in Bangla, English, or mixed language forms.
2. Translational ability: The capacity to move between Bangla and English without losing conceptual meaning.
3. Evaluative ability: The capacity to judge whether an AI output is accurate, biased, incomplete, or fabricated.
4. Productive ability: The capacity to use AI support for summaries, lesson plans, essays, applications, and professional documents.
5. Critical ability: The capacity to understand ethical limits, citation norms, privacy risks, and the difference between learning support and academic misconduct.

These five skills were identified through the integrative review of literature on AI literacy (Holmes et al., 2022; Kasneci et al., 2023), multilingual education (García & Li Wei, 2014), and digital competence frameworks (van Dijk, 2020; Lythreatis et al., 2022). The concept differs from traditional linguistic capital in that it is language-neutral, accessible through guided digital practice, and potentially more democratic.

METHODOLOGY

This article adopts a qualitative, non-empirical methodology. It is a theoretical and conceptual study grounded in Bourdieu's framework of linguistic capital, postcolonial theory, and AI ethics. No primary fieldwork such as interviews, surveys, or field visits was conducted.

The study draws on two types of secondary data:
First, existing reports on AI adoption in South Asia from Google, UNESCO, and Bangladesh government digital literacy surveys are critically examined. These provide contextual insights into AI accessibility and language support in Bangladesh, including data on internet penetration, smartphone usage, and digital literacy rates across urban and rural areas.
Second, a discourse analysis of publicly available online discussions among Bengali AI users across different age groups is conducted. Sources include social media forums (Reddit), Facebook groups dedicated to ChatGPT users in Bangladesh, and YouTube comment threads where users discuss their experiences with AI tools. These discussions illustrate generational attitudes toward language choice in AI interaction, revealing patterns of code-switching, expressions of linguistic anxiety, and pragmatic language use.

LITERATURE SEARCH STRATEGY

The literature search was conducted using academic databases relevant to linguistics, education, international studies, and artificial intelligence. The primary databases included Scopus, Web of Science, ERIC, Google Scholar, and JSTOR. Additional evidence was obtained from international organizations and policy institutions, including UNESCO, OECD, World Bank, UNICEF, and Bangladesh government sources.
Search period: 2010–2026
Languages: English and Bangla
Keywords: "linguistic capital," "Bourdieu," "Bangladesh language policy," "AI education," "digital divide," "Global South AI ethics"
Inclusion criteria:
· Studies examining language, education, AI, or digital inequality
· Studies discussing linguistic power, language hierarchy, or educational access
· Studies focusing on Bangladesh or providing relevant Global South perspectives
· Peer-reviewed journal articles, academic books, conference proceedings, and recognized institutional reports
Exclusion criteria:
· Studies unrelated to language, education, or AI
· Duplicate publications
· Commercial opinions or non-academic commentary
· Studies discussing AI applications without considering educational or social implications

Screening and Thematic Synthesis

The literature selection involved three stages. First, relevant publications were identified through database searches using predefined keywords. Additional sources were identified through reference lists of key publications. Second, titles and abstracts were examined to determine relevance. Third, selected publications were analyzed according to recurring themes: language as social power, educational reproduction of linguistic inequality, digital inequality and AI accessibility, opportunities and risks of generative AI, and governance approaches for equitable AI adoption.
A total of 45 peer-reviewed articles and 12 policy documents were included in the final synthesis. Thematic analysis was used to identify patterns and relationships across sources. The findings were then synthesized to develop the concept of digital linguistic capital and the four-pillar governance framework.

Findings

The integrative review yielded five thematic findings, each supported by the reviewed literature.

Theme 1: English as Dominant Linguistic Capital in Bangladesh

The review confirms that English continues to function as dominant linguistic capital in Bangladesh's education system (Rahman, 2005; Hamid, 2016). Students from English-medium schools and privileged urban institutions develop early exposure to English academic practices and digital resources (Karim et al., 2023; Islam & Stapa, 2021). In contrast, many Bangla-medium students, rural learners, and first-generation university students have fewer opportunities to acquire advanced English skills (Chaudhury, 2011; Hamid & Honan, 2012).

Theme 2: Generative AI as a Potential Equalizer

The review identifies that AI tools can support Bangla-speaking learners through multilingual explanation, translation, writing assistance, and access to previously inaccessible knowledge resources (Sarkar, 2022; Chakrabarty, 2021). Generative AI may lower barriers by enabling multilingual interaction, translation, and explanation (Kasneci et al., 2023). A Bangla-speaking learner who previously struggled to access English academic resources may now interact with knowledge systems through AI-assisted translation and explanation.

Theme 3: Risks of AI-Mediated Inequality

Despite its potential, AI may reinforce existing inequalities (Bender et al., 2021; Ji et al., 2023). Unequal access to digital infrastructure, limited Bangla-language AI resources, commercial inequalities, algorithmic bias, hallucination, and privacy concerns may reinforce existing educational disparities (Dasgupta, 2019; van Dijk, 2020). Premium AI services may create a new educational divide where wealthy students gain access to advanced AI support while disadvantaged learners remain dependent on limited resources (Zuboff, 2019).

Theme 4: The Digital Divide and AI Readiness

Digital inequality in Bangladesh exists across multiple dimensions: access to devices, internet connectivity, digital literacy, quality of digital resources, and ability to use advanced technologies (Lythreatis et al., 2022). Rural students are more likely to depend on shared devices, limited mobile data, and restricted access to technology (Dasgupta, 2019). Gender, rurality, and disability also influence digital access (UNESCO, 2021).

Theme 5: Governance Frameworks for Equitable AI

The review identifies that AI governance in education requires frameworks that address inclusion, linguistic justice, accountability, and capacity building (UNESCO, 2021; Floridi & Cowls, 2019; Holmes et al., 2022). Without appropriate governance, AI risks becoming another mechanism through which privileged groups accumulate educational advantages (Zawacki-Richter et al., 2019).

Table 1: Summary of Thematic Findings

	Theme	*Key Finding*	*Supporting Sources*
1	English as dominant capital	English continues to shape educational opportunity in Bangladesh	Rahman (2005); Hamid (2016); Chaudhury (2011)
2	AI as potential equalizer	AI can support Bangla-speaking learners through multilingual access	Sarkar (2022); Chakrabarty (2021); Kasneci et al. (2023)
3	Risks of AI-mediated inequality	AI may reinforce inequality through unequal access and bias	Bender et al. (2021); Ji et al. (2023); Zuboff (2019)
4	Digital divide	Digital inequality exists across devices, connectivity, and literacy	Dasgupta (2019); van Dijk (2020); Lythreatis et al. (2022)
5	Governance frameworks	Equitable AI requires inclusion, linguistic justice, accountability, capacity building	UNESCO (2021); Floridi & Cowls (2019); Holmes et al. (2022)

Source: Author's compilation based on literature review

DISCUSSION

This section addresses three research questions based on the findings.

Research Question 1: English as Dominant Linguistic Capital

The findings confirm that English continues to function as dominant linguistic capital in Bangladeshi education. This is evident in the unequal distribution of English-medium schooling, private tutoring, and digital resources (Rahman, 2005; Hamid, 2016; Chaudhury, 2011). Students from privileged backgrounds acquire English capital through schooling, family resources, urban location, and private spending (Karim et al., 2023). In contrast, many Bangla-medium students, rural learners, and first-generation university students face barriers to acquiring advanced English skills (Hamid & Honan, 2012; Islam & Stapa, 2021).

Research Question 2: Generative AI and Digital Linguistic Capital

The findings suggest that generative AI may reshape access to educational knowledge for Bangla-speaking learners through the development of digital linguistic capital (Sarkar, 2022; Chakrabarty, 2021). AI can support mother-tongue learning by allowing students to understand complex concepts through familiar languages (Kasneci et al., 2023). However, digital linguistic capital is not automatically democratic. It can become another class-bound asset if only privileged students receive AI literacy training and paid platform access (Zuboff, 2019; van Dijk, 2020).

Research Question 3: Governance Framework

The findings indicate that equitable AI governance requires a framework based on inclusion, linguistic justice, accountability, and capacity building (UNESCO, 2021; Floridi & Cowls, 2019; Holmes et al., 2022). Without appropriate governance, AI may reproduce the same inequalities that exist within traditional education systems (Zawacki-Richter et al., 2019).

Four-Pillar Governance Framework

Based on the review findings, this article proposes a four-pillar governance framework:

Pillar 1: Inclusion

AI tools used in education must be accessible across class, gender, region, and disability. Policy actions should include subsidized student data packages, rural school device-sharing schemes, AI learning corners in libraries, and accessibility requirements for disabled learners (Dasgupta, 2019; van Dijk, 2020; UNESCO, 2021).

Pillar 2: Linguistic Justice

AI should support Bangla and other local languages rather than reinforcing English dominance. Policy actions should include public funding for Bangla educational datasets, evaluation benchmarks for Bangla AI outputs, and partnerships among Bangla Academy, universities, and local developers (Sarkar, 2022; Chakrabarty, 2021; Pennycook, 2017).

Pillar 3: Accountability

Responsibility for AI harm must be clear. Policy actions should include algorithmic impact assessments for AI tools used in public education, child-safe consent standards, school-level complaint mechanisms, and independent review of high-risk uses (Floridi & Cowls, 2019; Holmes et al., 2022; Zuboff, 2019).

Pillar 4: Capacity Building

AI inclusion requires human capacity. Policy actions should include AI literacy modules in Grades 6-12, teacher training on prompt design and output verification, university-level AI ethics courses, and community workshops for parents (Kasneci et al., 2023; UNESCO, 2021; Holmes et al., 2022).

Table 2: Four-Pillar Governance Framework

Pillar	*Key Actions*	*Expected Outcome*
Inclusion	Affordable devices, connectivity, accessibility	Equal participation
Linguistic Justice	Bangla AI resources, multilingual support	Language equality
Accountability	Transparency, privacy, evaluation	Responsible AI use
Capacity Building	AI literacy and teacher training	Effective human-AI collaboration

Source: Author's compilation based on literature review

Policy Recommendations

Based on the analysis, the following policy recommendations are proposed for Bangladesh:

Immediate Actions (2026-2027)

1. Create national guidelines for GenAI in education
2. Develop Bengali-language AI literacy resources
3. Pilot AI learning support in selected rural schools
4. Create school-level rules on ethical AI use
5. Issue child data protection guidance for AI platforms

Responsible actors: Ministry of Education, ICT Division, NCTB, DSHE, UGC, teacher training colleges, Bangla Academy

Short-Term Actions (2027-2029)

1. Integrate AI literacy into Grades 6-12
2. Train secondary teachers in AI-supported pedagogy
3. Develop Bengali AI evaluation benchmarks
4. Support public-private partnerships for Bengali educational AI
5. Create open educational resources in Bengali using AI assistance

Medium-Term Actions (2029-2032)

1. Establish an independent AI and Education Ethics Council
2. Require AI impact assessments for public education tools
3. Create a national Bengali educational corpus
4. Build local AI research capacity in public universities
5. Support AI tools for minority-language learners

Assessment Reform

AI-generated essays require new assessment approaches. Recommendations include oral defence, in-class writing, reflective AI-use statements, process-based assessment, AI-supported but teacher-verified learning tasks, and clear citation rules for AI use (Perkins, 2023; Cotton et al., 2024).

Figure 1: Conceptual Model of Digital Linguistic Capital Development

Existing Inequalities
(Language + Class + Geography + Digital Access)
↓
Access to Generative AI
(Device + Connectivity + Availability)
↓
Digital Linguistic Capital

Prompting Ability	Translation Ability	Evaluation Ability
Productive Ability	Critical Ability	

↓
Educational Participation
Knowledge Access
Academic Mobility
↓
Governance Feedback Loop
(Inclusion + Linguistic Justice +
Accountability + Capacity Building)

Source: Author's conceptual synthesis

CONCLUSION

This article has examined how generative AI may influence language-based educational inequality in Bangladesh, where Bangla represents national identity and cultural recognition, while English continues to function as a dominant language of academic advancement, employment, and global mobility. Through an integrative literature review, the study has identified both the transformative possibilities and potential risks of GenAI in the Bangladeshi education system.

The article has introduced the concept of digital linguistic capital as a new form of educational resource that combines linguistic ability, AI competence, critical evaluation, and responsible technological use. Like traditional linguistic capital, digital linguistic capital is shaped by social structures and institutional recognition (Bourdieu, 1991). Students with greater access to devices, digital education, and AI resources may accumulate greater digital linguistic capital.

The proposed four-pillar governance framework—inclusion, linguistic justice, accountability, and capacity building—offers a route forward for Bangladesh and comparable Global South contexts. These pillars require concrete actions: subsidized access, Bangla benchmarks, child-safe data rules, teacher training, assessment reform, public educational corpora, and participatory design.

The future of AI in Bangladeshi education will not be determined by technology alone. It will depend on whether policymakers, educators, developers, and communities can transform AI from a market-driven tool into a public resource for linguistic justice, educational inclusion, and democratic participation.

Limitations and Future Research

This article has several limitations. It is a theoretical paper without primary fieldwork, so its claims remain hypotheses to be empirically tested. The rapid pace of AI development means that specific tools and platforms discussed may change quickly. The article focuses on Bangladesh as a case study; findings may not be directly generalizable to other Global South contexts, though the framework may be adaptable.

Future research should conduct surveys and interviews with Bengali-speaking AI users across different generations, regions, and educational backgrounds to test the concept of digital linguistic capital. Comparative studies across multiple Global South countries would test the generalizability of these findings. Longitudinal studies tracking changes in language attitudes and educational outcomes as AI tools become more widely available in Bengali are also needed.

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Evaluating Congregational Strength in a Bioaerosol Communicable Disease Situation in Some Worship Centers

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Abstract: The study aimed at evaluating bioaerosol agents in some congregational worship centers across Port Harcourt City, Nigeria. The sample size population/congregation sizes of 100 - 600 persons were investigated using the settled/exposure plate technique. The analysis screened the atmosphere for the recovery of bioaerosols and the determination of the relationship that exist between congregants and the bioaerosols expelled in the worship centers. Linear regression analysis of the data recovered showed that the bioaerosols expelled where dependent on the congregant's population. This implies that a positive linear regression of the congregants exists with a R^2 of 0.9841 for bacteria bioaerosols, ranged from less than 100 congregants for 80 CFU/30 minutes to less than 600 congregants for 312 CFU/30 minutes. Similarly, a R^2 of 0.981 for fungal bioaerosols was obtained, which ranged from 100 congregants for 8 CFU/minutes to 600 congregants for 106 CFU/30 minutes. The morphological and biochemical characterization of the recovered bioaerosols showed diverse bacteria genera namely, *Staphylococcus* spp., *Bacillus* sp. and diverse fungi genera namely; *Penicillium* sp., *Aspergillus* sp. and *Rhizopus* sp. The results clearly, indicated that a strong correlation exist between the congregation size and bioaerosol load. Inhaling either of the bioaerosols isolated can be detrimental to an immune-compromised congregant. The study therefore recommends total responsiveness of congregants towards signs of associated disease and calls for studies on congregational population greater than 700 persons.

Keywords: Communicable diseases, Congregants, Colony forming unit (CFU), Bioaerosols, Linear regression, Worship centers.

Introduction

Unhealthy congregants come to worship centers with the believe that they could get healed, so also some healthy congregants come, to receive knowledge and blessings from God. Worship centers are referred to as dedicated places where people come together to connect with their God (Peter & Musiliudeen, 2021). The centers include mosque, church, shrine/temple, chapel etc. and the congregants carry out worship activities such as talking, clapping, singing, dancing and other operations as required (Zaluchu, 2021). These activities expel bioaerosols to the atmosphere, which in-turn could be inhaled (Fu & Zhu, 2024). Bioaerosols are very small airborne living particles comprised of microorganisms (bacteria, fungi, virus, protozoa etc). They are pathogenic and dispersed from one environment to another due to their light size and weight (Kim et al., 2017). It is important to note that bioaerosols are causative agents to communicable diseases. Diseases such as whooping cough, tuberculosis, and flu are transmissible from person to person (Fu & Zhu, 2024) and therefore should be observed. In addition, high contamination of fungal bioaerosols have been isolated from an indoor environment (Marcu et al., 2021). Indoor bioaerosols have been noted heavy in some public facility such as schools, residential areas (Adekunle et al., 2025) and hospitals (Upula et al.,2023), however, records of bioaerosols isolation in worship centers, specifically churches in Nigeria have not been reported. Bioaerosols when confined in busy indoor spaces can reach concentrations that affect breath (Agi et al., 2024). Bioaerosols inhalation activates allergic reaction which in-turn inflames the lungs (Roy et al., 2004). Thus, worship centers enclosed in environment with regular congregation gatherings, and varying ventilation systems could serve as potential hotspots for the accumulation, dispersal, and transmission of bioaerosols which ultimately may result to the emergence of communicable diseases (Heo et al., 2017; Balasubramanian et al., 2012). Moreso, bioaerosols transmission of communicable diseases have not been adequately reported excluding viral airborne, which made headlines in the 20s (Tang, 2021). The corona virus bioaerosols threatened worship centers specifically during spiritual rituals/ceremony such as sprinkling of holy water, self-flagellation to blood brotherhood, communion service amongst many others (Aira et al., 2007). These rituals or activities of the church could transfer corona viruses (Gajurel & Deresinki, 2021). Consequently, some congregants acquired infections from poor church facilities such as limited spaces in situations church facility cannot carry the huge congregation, gives opportunity for disease transmission (Cool, 2021). Evaluating congregation strength and bioaerosol transmission in worship center are important in safeguarding the public health. Sequel to the likelihood of communicable diseases, the study seeks to justify congregation strength and bacterial and fungal bioaerosols expelled.

Materials and Methods

The study area

The study area for the study is the Church in the City of Port Harcourt, Nigeria. The City is home to so many Christian denomination and serves as a communion point for Christians. It is orderly reserved for believers of God Almighty. It is more or less a serene vicinity, and offers congregants safety, security and confidence. Congregants both healthy and unhealthy converge to worship and hear the word of God Almighty. As a result of converging, congregants engage in several activities such as singing, shouting, and praying aloud, which definitely expel bioaerosols from their mouth.

Experimental design

The study adopted a stratified sampling technique for the recovery of heterotrophic bacteria and fungi bioaerosols, in a 30 minutes' air exposure of nutrient and sabouraud agar media respectively, in an indoor congregation. Twenty air sampling plates were provided each for the congregation strength of less than 100, 200, 300, 400, 500 and 600 persons, all totaling 120 air sampled plates. The suspension of the plates was made one meter above the ground level to prevent contaminants from the floor into the plates. The process was repeated three (3) different times and results obtained were recorded accordingly.

Nutrient agar and sabouraud dextrose agar media preparation

Nutrient agar media and sabouraud (SDA) agar medium were adopted for the culture of bacteria and fungi spores present in the Church atmosphere. For preparation of the media, four grams (4g) and three grams (3g) of SDA and nutrient agar respectively, were weighed and suspended in 100ml of distilled water accordingly, stirred to obtain a uniform mixture and autoclaved at 121ºC for 15 minutes. The nutrient medium was allowed to cool and then dispensed into petri dishes. Prior to the dispensing of the SDA media, 500mg antibiotics was added to the media aimed at inhibiting any bacterial contaminant. Thus, both media were prepared according to the manufacturer's specification, weighed, autoclaved and dispensed accordingly in a petri dish, before exposure to the atmosphere (Cheesbrough, 2000).

Bacterial and fungal bioaerosols (samples) collection

The bioaerosol collection involved taking the sterile prepared media plates to the worship centers and their subsequent exposure to air. Bacterial and fungal bioaerosols in the air where determined using the settled/exposure plate technique, were the freshly prepared nutrient and sabouraud agar media where air-exposed to the Church congregation strength of less than 100, 200, 300, 400, 500 and 600 attendees for 30 minutes. Thereafter the plates where transferred to the Microbiology Laboratory of Ignatius Ajuru University of Education, Port Harcourt, Nigeria. In the laboratory, the nutrient agar media plated samples where then incubated at 37 degrees centigrade for 20 hours while the sabouraud agar media plates were incubated at a room temperature for 96 – 110 hours (Cheesbrough, 2000).

Determination of the bacteria bioaerosol load

After the nutrient media plates were incubated at a temperature of 37 degrees for 20 hours. Colonies that developed were counted and documented as colony forming unit per 30 minutes (Chakraborty & Nishith, 2008).

Determination of fungi bioaerosol load

After the sabouraud media plates were incubated at a room temperature for 96 - 110 hours. Colonies that developed were counted and documented as colony forming unit per 30 minutes (Chakraborty & Nishith, 2008).

Characterization of the recovered isolates (bacteria and fungi)

Characterization of the bacteria and fungi isolates recovered involved description of the isolate's appearance on the media plates and under the microscope and finally their reaction to certain important chemical reagents. All processes adopted were geared towards identifying the spores recovered from the atmosphere. The biochemical analysis did not involve the fungal spores' isolates (Cheesbrough, 2000).

Colonial morphology/characterization of the bacteria isolates

Colonial morphology considered the physical appearance of the isolated bacteria/fungi colony in terms of shape, color, shape, margin, surface, size, elevation, and opaque as may be required as carried out by Hafezi and Khamar (2024).

Microscopic examination /characterization of the bacteria isolates

In the microscopic examination of the isolates in terms of shape, color, margin, size, and elevation. The isolates were subjected to screening with the aid of a microscope, prior to the use of microscope the isolates were stained. Gram stain was adopted for staining of the bacteria while lactophenol cotton blue stain, was adopted for the staining of the fungi. For Gram staining, it was carried out to differentiates the bacteria recovered into Gram-positive and Gram-negative bacteria based on the differences in the nature of their cell wall. The Gram staining process firstly, involved the heat fix of the bacteria colony unto the microscopic glass slide. Followed by application of the crystal violet stain which lasted for 60 seconds. Thereafter, the stain was washed-off under running water for 2 seconds. Iodine was then applied for 60 seconds and washed-off with water for 2 seconds. Ethanol was applied for 10-30 seconds and washed-off with water again for 2 seconds. Finally, the application of safranin for 30-60 seconds and washed off again with water for 2 seconds. Following all these steps, the slide was allowed to air-dry before viewed under a light microscope. On viewing, Gram positive bacteria showed purple blue coloured background appearance while Gram negative bacteria showed red/pink colour (Teeseling et al., 2017).

Motility test

The motility test was carried out to determine the ability of the isolate to move. Motility as carried out was determined using the hanging drop method. The process as described by

Chakraborty and Nishith (2008) involved introducing the isolate into a sterile microscopic cover slip, thereafter a petroleum jelly was introduced around the slide well and then placed in an inverted position (hanging down). The slide was then viewed under a light microscope with an objective lens of 40x. Cells that move were identified tumbling hence positive result, while cells stationed were declared negative (Hafezi & Khamar, 2024).

Fungi microscopic morphology/characterization

For microscopic examination, lactophenol cotton blue stain was adopted for the staining of the fungi. Firstly, the fungi were impregnated on the microscopic slide before the application of the stain. Thereafter, the slide was covered and the microscope used to view the slide as stated by Olumuyiwa at el. (2025).

Biochemical characterization of bacterial isolates

Biochemical tests were carried out to identify the bacteria reactions to some biochemical agents. Biochemical agents such catalase, oxidase, coagulase, motility, indole, methyl-red, vogue proskauer, citrate utilization and sugar fermentation test were adopted for the test on the bacteria isolates as carried out by Hafezi and Khamar (2024).

Catalase test

In carrying out the catalase test, a colony of the test bacteria was introduced into a clean microscopic slide, thereafter a drop of hydrogen peroxide was added onto the colony, and with the aid of a wooden applicator stick, the components were smeared and observed for gas bubbles. Catalase negative bacteria produced no bubbles while catalase positive bacterial produced bubbles of oxygen (Hafezi & Khamar, 2024).

Heat resistant (spore) test

The heat resistant test was done to confirm the ability of the bacteria to produce spore. In carrying out the test, a colony of the test bacteria was introduced into a nutrient broth with the aid of a wire loop. Thereafter, the broth was heated to a temperature of 80 degrees for 10 minutes. following the heating the broth culture was incubated at 37 degrees for 24 hours. An absence of a growth indicated no spore while an appearance of a growth signified spore formation (Hafezi & Khamar, 2024).

Indole production test

In carrying out the indole production test, a colony of the test bacteria was introduced into a freshly prepared indole medium contained in a test tube with the aid of a sterile wire loop. Thereafter the test bacteria were inoculated onto the medium and the components incubated at 37°C for 48 hours. After incubation, 10 drops of Kovac's reagent was added to the component, then shock, allowed to stand for 5 minutes. Negative result showed no red colour at the surface of the medium/component, while positive result showed indicated a red colony (Hafezi & Khamar, 2024).

Methyl red test

In carrying out the methyl red test, a colony of the test bacteria was introduced into a freshly prepared sterile Methyl Red/ Voges Proskauer broth with the aid of a sterile wire loop r. Thereafter, the broth culture was incubated for 48 hours at a temperature of 37 degrees. After incubation, 2-5 drops of methyl red indicator were added to the broth culture. The medium was well swirled and allowed to stand for 15 minutes. Negative result was noted with a yellow colored appearance while positive results was indicated with a red colored appearance (Hafezi & Khamar, 2024).

Voges Proskauer (vp)test

In carrying out the voges proskauer test, a colony of the test bacteria was introduced into a freshly prepared sterile Methyl Red/ Voges Proskaurer broth with the aid of a sterile wire loop. Thereafter, the broth culture was incubated for 24 hours at a temperature of 37 degrees. After incubation, about 10 drops each of a-naphthal and potassium hydroxide were introduced into the broth culture. The medium was well swirled and allowed to stand for 15 minutes. Negative results indicated no colour change on the surface of the medium while a positive result indicated a pink or red colour at the surface of the medium (Hafezi & Khamar, 2024).

Citrate utilization test

In carrying out the citrate utilization test, a colony of the test bacteria was introduced into a freshly prepared sterile Simmons citrate agar that was prepared according to the manufacturer's instructions with the aid of a sterile wire loop. The tube contained Simmons citrate medium was then slanted and allowed to cool and solidify. The slanted media component was then incubated at 35^0C for 18 to 24 hours. The emergence of a blue color indicated a positive result while a negative result was indicated with no color change in the medium (Hafezi & Khamar, 2024).

Glucose test

In carrying out the glucose test, a colony of the test bacteria was introduced into a freshly prepared sterile broth composed of sugar, phenol red indicator was compounded and an insertion of a Durham tubes, with the aid of a sterile wire loop. The broth culture was then incubated at 35 to 37^0C for 24 hours. Tubes were observed for colour change. Red colored medium was interpreted positive/ reaction with remains of bubbles in the Durham tubes while lack of bubbles indicated no gas production and therefore declared negative / reaction (Hafezi & Khamar, 2024).

Urease test

In carrying out the urease test, a colony of the test bacteria was introduced into a freshly prepared sterile urea agar medium with the aid of a sterile wire loop. The culture media was then incubated at 35°C for 24 hours. Thereafter the culture media was examined for development of pink colour. Pink coloured media indicated a positive reaction while a reverse indicated a negative result (Hafezi & Khamar, 2024).

Coagulase test

In carrying out the coagulase test, a colony of the test bacteria was introduced into a clean microscopic slide contain a drop of normal sale all of which aided by a sterile wire loop, thereafter a drop of human plasma was added onto the colony, and with the aid of sterile wire loop again, the components were smeared and observed for clumping within 10 seconds. Coagulase negative bacteria produced no clump while coagulase positive bacterial produced clump (Hafezi & Khamar, 2024).

Macroscopic morphology of the fungi isolate

The Fungi isolated was again characterized based on macroscopic features as seen on the sabourouad culture media plate. Macroscopic features involved the visual observation of the fungi texture, colour, shape, size etc. as carried out by Cheesbrough (2000).

Statistical analysis

Linear regression analysis of the congregation strength and recovered microbial load was carried out using the simple linear regression analysis to show the relationship between congregation strength (X) and the microbes expelled (Y). The output expected were the R^2 value and an equation of a line graph. An R^2 at a very high percentage signified a correlation exist in the relationship, that is: the line fits the data. The congregation is said to determine the bacteria expelled, while a low percentage of R^2 signifies no correlation exist. The line therefore does not fit the data and the microbes generated is not dependent on the congregation strength/ population (Montgomery et al., 2021).

Results

Bacteria bioaerosol load recovered from the congregants

Figure 1, showed the regression analysis result of the bacteria bioaerosol load in the air as expelled by a congregation strength of less than 100, 200, 300, 400, 500 and 600. Result showed a R^2 value of 0.9841, which implies a strong correlation between congregation size and bioaerosol load. Hence, the congregation size determines the bacteria load expelled.

The Table 1(b) also showed the mean bacteria bioaerosols generated with respect to the congregation strength accordingly. The mean result ranged from less than 100 congregants for 80 CFU/30 minutes to less than 600 congregants for 312 CFU/30 minutes.

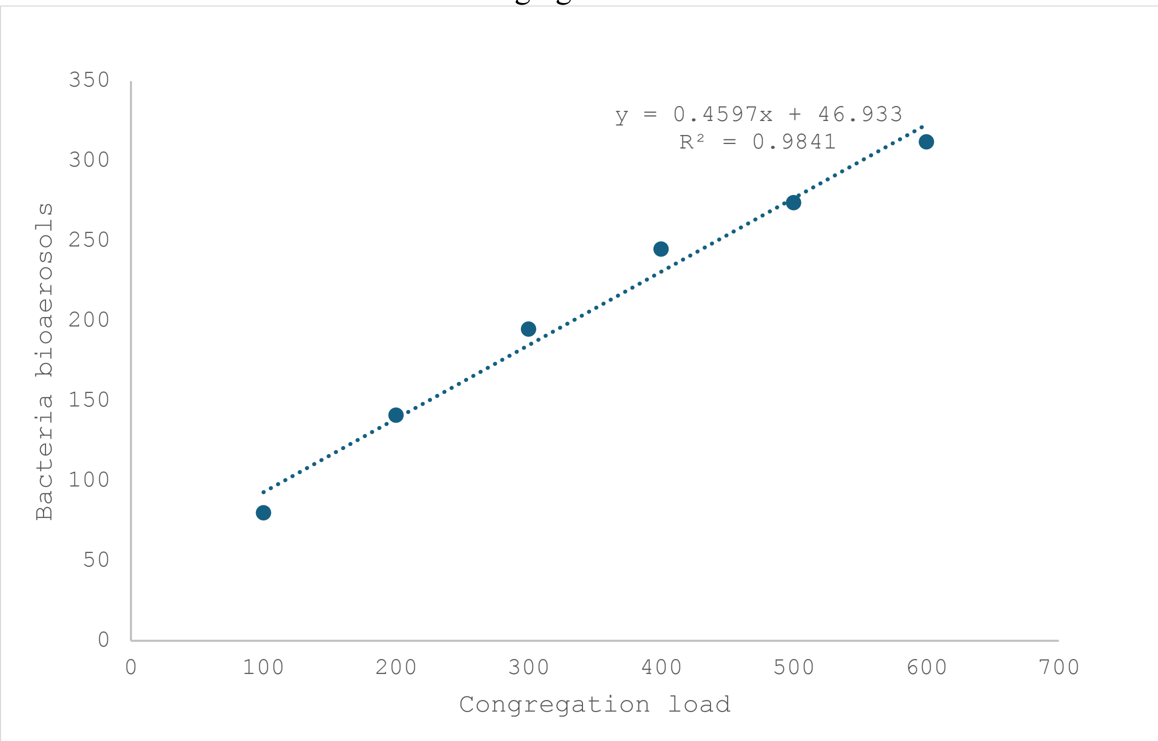

Figure 1: Bacteria bioaerosols generated with respect to congregation strength

Table 1(a) Bacteria bioaerosol load recovered from the congregants

Congregation population	Bacteria (bioaerosols) CFU/30minutes
<100	80
<200	141
<300	195
<400	245
<500	274
<600	312

Fungi bioaerosol load recovered from the congregants

Figure 2 showed the regression analysis result of the fungi bioaerosol load in the air as expelled by a congregation strength of less than 100, 200, 300, 400, 500 and 600. Result showed a R^2 value of 0.981, which implies a strong correlation between congregation size and bioaerosol load. Hence, the congregation size determines the bacteria load expelled.

The Table 2(a) also showed the mean fungal bioaerosols generated with respect to the congregation strength accordingly. The mean result ranged from less than 100 congregants for 8 CFU/30 minutes to less than 600 congregants for 106 CFU/30 minutes.

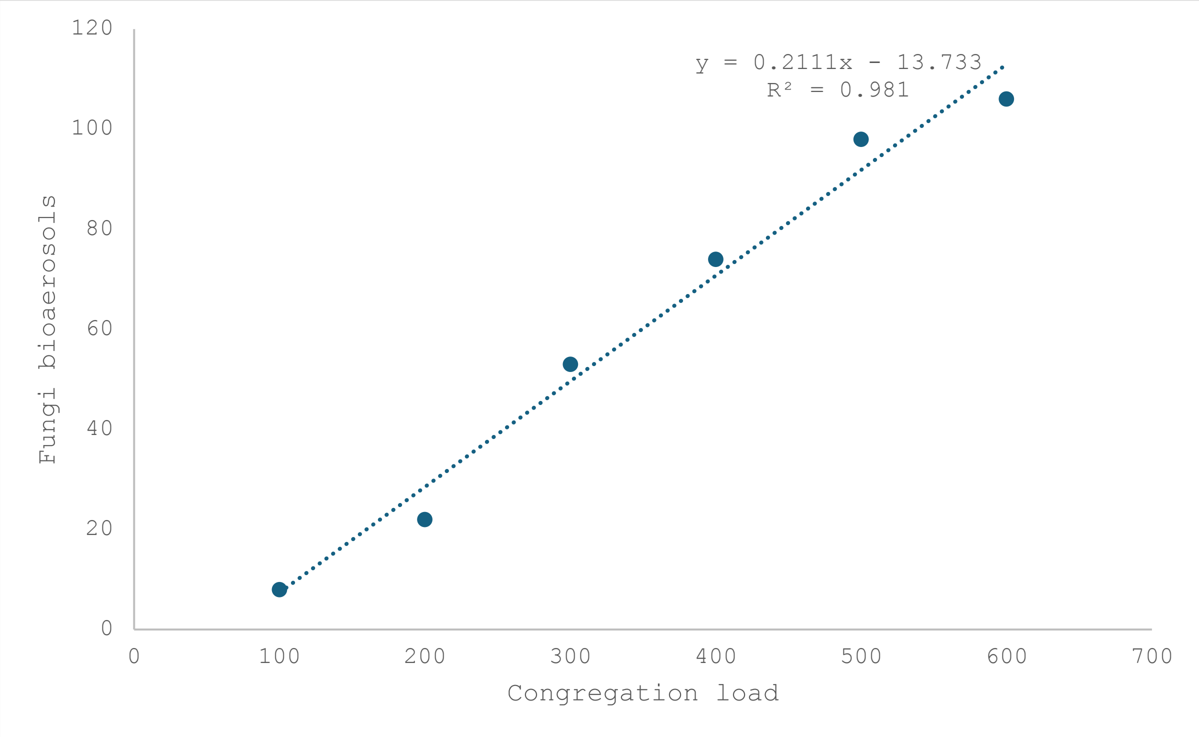

Figure 2: Fungi bioaerosols generated with respect to congregation strength

Table 2(a) Fungi bioaerosol load recovered from the congregants

Congregation population	Fungi (bioaerosols) CFU/30minutes
<100	8
<200	22
<300	53
<400	74
<500	98
<600	106

Colonial characterization of bacteria isolate

Table 1 showed the colonial morphology of the bacteria isolates revealing probable bacteria such as *Staphylococcus* sp. and *Bacillus* sp. with striking/unique appearance of light yellow and off-white colour respectively.

Table 1: Colonial characterization of bacteria isolate

Edge	Colour	Size	Shape	Elevation	Surface	Probable bacteria
Curved	Light Yellow	Small	Circular	Low	Smooth	*Staphylococcus* sp.
Curved	Off- white	Large	Round	Convex	Rough	*Bacillus* sp.

Biochemical characterization of the bacteria isolates

Table 2 showed the biochemical characterization of the bacteria isolates confirming bacteria: *Staphylococcus* sp. and *Bacillus* sp. with a confirmatory formation of spore by *Bacillus* sp. and clumping feature by *Staphylococcus aureus.*

Table 2: Biochemical characterization of the bacteria isolates

CAL	SPOR	CIT	IND	MOT	MR	VP	GLU	URE	COA	Gram Stain	Bacteria
+	-	+	+	+	-	-	+	+	+	+	*Staphylococcus aureus*
+	+	+	-	+	-	+	-	-	-	+	*Bacillus* sp.

Keys: CAL-Catalase; **SPOR**-spore; **CIT**-Citrate; **IND**-Indole; **MOT**-Motility; **MR**-Methyl Red **VP**-Vogues Proskauer; **GLU**-Glucose; **URE**-Urease; **COA** = Coagulase, **Gram Stain**; + = Positive, - =Negative.

Macroscopic and microscopic morphological description of the fungal isolate

Table 3 showed the macroscopic and microscopic morphological description of the fungal isolates. Macroscopic feature showed green, blue green and white gray appearance for *Aspergillus* sp. *Penicillium* sp. and *Rhizopus* sp. respectively, while microscopic showed conidiophores, hyphae, and profuse hyphae for *Aspergillus* sp. *Penicillium* sp. and *Rhizopus* sp. respectively.

Table 3: Macroscopic and microscopic morphological description of the fungal isolates

Isolates	Macroscopic morphology	Microscopic morphology	Fungi
A	Lemon green, powdery growth	Green conidiophores with a septate hypha	*Aspergillus* sp.
B	Blue-green powdery	Hyphae spread evenly	*Penicillium* sp.
C	White-gray	Profuse hyphae	*Rhizopus* sp.

Discussions

The bioaerosols in the air, as expelled by congregants showed a correlation exist. This implies the bioaerosols expelled had significant effect on the congregants, as so reported (Gallego-Cartagena et al., 2024). Basically, Gallego-Cartagena et al. (2024) pointed out the role of environmental and human related factors in shaping bioaerosols distribution in tropical urban context cannot be over emphasized. The significant effect of the expelled bacterial and fungal bioaerosols in relation to the congregation strength showed that the worship centers are likely to be in a bad state (Gajurel & Deresinki, 2021). Gajurel and Deresinki (2021) noted that 38% congregants in church developed Covid 19, hence partially in line with study carried out by Cool (2021). Cool (2021) noted that bioaerosol infections have been attributed to the numbers of congregation. Basically, viral bioaerosols are of various sizes and the viruses remain the highest in recoveries, above bacteria and fungi bioaerosols from hospitals, schools and public transportation system (Kim, 2007). Furthermore, the positive correlation that exist between the bioaerosols and the congregation population in this study is in line with Kim (2007), who noted that the prevalence of bioaerosols can be associated with certain human diseases. This implies that even if a congregant has a communicable disease, transmission could still be possible. *Staphylococcus aureus, Bacillus* sp., *Penicillium* sp., *Aspergillus* sp., and *Rhizopus* sp. in this study as identified through macroscopically and biochemically assay are well distinguished communicable disease agent of airborne origin (Agi et al., 2024). The isolated bioaerosols (bacteria and fungi) have notably, been recovered, so also communicable diseases of viral origin that have previously been repot by Milton (2020). Milton (2020) reported some communicable diseases of viral origin such as measles, influenza, mumps and hepatitis “A”. However, Gautret and Steffen (2016) previously reported meningococcal diseases caused by bacteria and till date no report of fungi airborne in church congregations exist. Basically, the report of fungal bioaerosols is a signal for congregation awareness. Again, Gajurel and Deresinki (2021) pointed out anthrax, brucellosis and cholera diseases, which are bacteria associated disease within religious rituals. Thus, the health implication of inhaling either of the bioaerosols, *Staphylococcus aureus, Bacillus* sp., *Penicillium* sp., *Aspergillus* sp., and *Rhizopus* sp. can result to blister, sore, boils and inflammatory conditions, specifically in an immuno-compromised congregant (Yusof et al., 2025: Al-Shaarani & Lorenzo, 2024).

Conclusions

The study concluded that following the varied strength of worship centers congregation, there is a significant effect in the expelled bacterial and fungal spore in relation to the congregation strength, which showed that the worship centers have likely return to the era of consciousness. *Staphylococcus aureus, Bacillus* sp., *Penicillium* sp. spores, *Aspergillus* sp. and *Rhizopus* sp. were identified and therefore regarded as communicable disease agents.

Recommendations

The study recommends total responsiveness of the congregations towards signs of communicable disease and a call for further study on an exposure limit of 60,120, 200 minutes and an increased congregational strength of 600 persons upward.

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Conflict of interest

We, Amadi-Ikpa, C. N. and Enaregha, E.B, the authors of this work hereby, declare that no conflict of interest exist with respect to this work.

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Fostering Sustainable Business Growth: Evidence from Digital Marketing Adoption, Access to Finance and Government Support

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Abstract: Limited digital capabilities, limited access to capital and inconsistent Government support are the challenges faced by small business owners in a continue basis. Grounded with resource based view (RBV), this study examines the influence of digital marketing adoption, accessibility of finance and Government support for small business owners. In this study those respondents are included who are engaged in retail, services and trading activities from the region Delhi. Total respondents collected for the study was 200 small business owners. Questionnaire was distributed to the respondents which was based on 5 Likert scale. The data was analysed using structure and equation modelling. For SEM, software Jamovi version 2.6 was used to analysis. The results presented that digital marketing adoption ($\beta = 0.256$, $p = .011$), access to finance ($\beta = 0.387$, $p < .001$) and government support ($\beta = 0.281$, $p < .001$) are each significantly and positively associated with sustainable business growth. Additionally, explaining approximately 29.6% of the variance ($R^2 = 0.296$). Access to finance emerged as the strongest predictor. The sampling technique of convenience sampling and snowball sampling technique used. Findings is helpful for the small business owners, government policy makers etc. However, for generalizability this data is not enough to process the adequate result as it is limited to Delhi only.

Keywords: Digital Marketing Adoption; Access to Finance; Government Support; Sustainable Business Growth; Small Business Owners.

Introduction

In an economy, small and micro business owner (Potluri et al., 2012) have great contribution related to employment generation, income distribution and local economic development. The small business is called when its investment will be ₹2.5 crore and turnover up to ₹10 crore (*Small Business Criteria in India - Google Search*, n.d.)and small businesses registered with Udyam registered MSME(*Home | Ministry of Micro, Small & Medium Enterprises*, n.d.). But the registration is not compulsory for all. Despite its importance, small businesses face various types of issues and challenges regarding their long term growth. In the previous studies, there are various types of factors identified related to the issues (Potluri et al., 2012) such as digital marketing capabilities, financial resources accessibility, support from government for the policies and the programs. Digital technologies (Andika et al., 2021) has transformed businesses to reach customers and digital marketing adoption enhances market reach, competitiveness, customer engagement and overall business performance among small enterprises. But if the digital marketing strategies fail due to trust then it is a big challenge for the business. Whether it is small or big, all kind of business need customer trust to build long-term relationship. At the same time, access to finance remains one of the most persistent barriers faced by small business owners. Similarly, critical external resource such as Government support, in the form of subsidies, training programs are important determinants of growing a business. Few studies have examined their combined influence on sustainable business growth (Iheanachor, 2023; Ngwu et al., 2023; Shukor et al., 2023; Singh et al., 2023) particularly among informal and semi-formal small business owners operating outside the conventional SME research context. But, a combined influence of digital marketing adoption, access to finance and government support on the sustainable growth of small businesses in Delhi is studied in this research to address the gap in previous studies.

Objectives

(i)To assess the individual effect of digital marketing adoption, access to finance and government support on sustainable business growth.

(ii) To provide insights for small business owners, financial institutions, and policymakers seeking to foster sustainable small business development.

Literature Review and Hypothesis Development

Theoretical Foundation: Resource-Based View (RBV)

The foundation of the study is the Resource-based view articulated by (*Resource-Based Theories of Competitive Advantage: A Ten-Year Retrospective on the Resource-Based View - Jay B. Barney, 2001*, n.d.), which proposes effective utilization of resources that are valuable, rare, imperfectly imitable and non-substitutable (the VRIN framework) for competitive advantage of the firm. However, the resource based view theory was applied mostly in the large business scale but the uses of resource based view in smaller scale businesses are also there.

Digital Marketing Adoption and Sustainable Business Growth

The concept of digital marketing is different from traditional concept of marketing where digital marketing deals with the digital tools and platforms such as social media, search engine marketing, online advertising etc. Digital marketing (Nesterenko et al., 2023) refers the adoption of digital platforms to promote the products and to maintain the customer engagement at the right time, at the right place. Previous empirical evidences consistently indicate that there is a positive relationship between digital marketing adoption and small business growth and it is also observed that the small business owners employ multichannel strategies. According to (Roja et al., 2023) revealed that actual usage of digital marketing significantly and positively influenced the sustainable growth of small enterprises. Based on this evidence, the following hypothesis is proposed:

H1: Digital Marketing Adoption has a significant positive influence on Sustainable Business Growth.

Access to Finance and Sustainable Business Growth

Obtaining credit loans and other financial services without having any difficulties which are necessary to investment and to expand the business operations, a small business can ease its daily operations. One of the important significant inhibitors of small business growth is the non-availability of funds which consistently slows down the day-to-day operations in the business. Recent studies also found that if there is a smooth operation in the business then the business can easily can grow and expand itself. The small businesses with having better access (Jiang et al., 2023; Saxena et al., 2023) to credit experience and the financial benefits resulted sustainable outcome among small business. Therefore, the hypothesis proposed

H2: Access to Finance has a significant positive effect on Sustainable Business Growth.

Government Support and Sustainable Business Growth

In any business government support is very important part to grow the business and its expansion. The policies, subsidies, training programs, regulatory facilitation comprises the government support (Wang & Li, 2018) which main aim is to help the business owners to overcome resource constraints. Many of the studies revealed that government initiatives with accessible financial technologies enhances small business financial empowerment and long term sustainability. Based on this discussion this hypothesis made

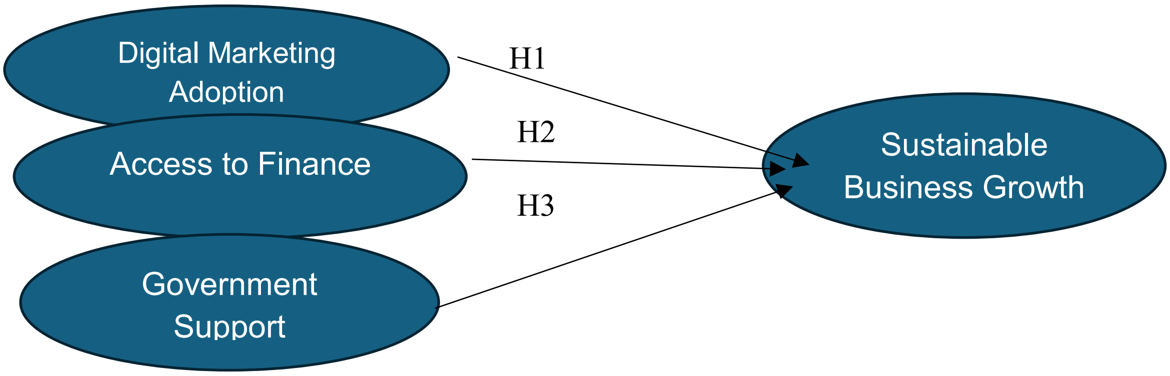
H3: Government Support has a significant positive effect on Sustainable Business

Growth.

Conceptual Framework

On the basis of resource based view the study proposes a conceptual framework (Fig 1) where the variables are digital marketing adoption, access to finance and government support each hypothesized to exert a direct positive relationship on sustainable business growth which is dependent variable.

Figure 1: Conceptual Framework



Methodology

Research Design

A quantitative cross-sectional survey was done in this study to examine the relationship among digital marketing adoption, access to finance and government support towards sustainable business growth. Using primary data collected from the small business owners some hypotheses derived from existing theory resource based view hence, it is a deductive approach and the literature were empirically tested.

Sample and Data Collection

Sampling frame: The sample size for the study is 200 respondents from Delhi who are the small business owners. 400 questionnaires were distributed but only 230 questionnaire received whereas 30 questionnaires excluded because of not filled the questionnaire completely. Through local trade association and market directions and with the help of referrals respondents were identified for the study. These business owners were belonging to retail, service oriented and trading businesses.

Sampling Technique: The sampling technique was used in the study is convenience sampling techniques targeting those respondents or small business owners whose involvement in the day-to-day operational and strategic decision making was high for the business. With the convenience sampling technique, snow ball technique was also applied to reach the respondents easily by the help of referrals.

Measurement scale: Semi structured questionnaire **of** Five Likert scale was used in the study. For clearity, reliability and validity 60 respondent's data were tested for pilot study and it found valid. Questionnaire was having 1**to 5 points (1 = Strongly Disagree, 5 = Strongly Agree).** Items measuring is adapted by the researcher (Songling et al., 2018), Digital Marketing Adoption (DMA), Access to Finance (AF), Government Support (GS), and Small Business Growth (SBG) were adapted from established scales in prior literature **Digital Marketing Adoption (DMA):** DMA1:Using digital platforms for marketing in my business. DMA2: Digital tools help to raise my sales. DMA3: On regular basis, I update my digital marketing. **Access to Finance (AF):** AF1: I can easily access business finance for my business. AF2: Financial support is sufficient for growth of my business.**Government Support (GS):**

GS1:Government schemes always support to my small business. GS2: I feel easy to access government subsidies/incentives.GS3: Government policies always encourage my small business. **Sustainable Business Growth (SBG):** SBG1: My business shows current and future sustainable growth. SBG2: My business helps local community and it is environment responsible. SBG3: I feel my business is sustainable for long-term.

Geographical coverage: Data collection was concentrated in Karol Bagh, Chandni Chowk, Lajpat Nagar of Delhi. In table 1, the demographic variable discussed where it shows out of 200 respondents, 40% were from retail, 35% from service-oriented businesses, and 25% from trading businesses. Male is 150 and female respondents were 50. From Karol Bagh 110, Chandni Chowk 50, Lajpat Nagar 40 respondents taken in this study. If we are talking about business ager then, a small business operating for at least 1 year was the inclusion criteria and businesses that had ceased operations were excluded. Here, 100 respondents have business experience less than 5 years, whereas 64 belong to in between 5 to 10 years. The least is 36 who have more than 10 years of experience in small business. Prior to questionnaire administration respondents were informed about the purpose of the study, anonymity and data confidentiality were maintained throughout the study.

Table 1: Demographic and Business Profile of Respondents (N = 200)

Category	**Sub-Group**	**Frequency (n)**	**Percentage (%)**
Business Sector	Retail	80	40.0
	Service-oriented	70	35.0
	Trading	50	25.0
Geographical Location	Karol Bagh	110	55.0
	Chandni Chowk	50	25.0
	Lajpat Nagar	40	20.0
Gender	Male	150	75.0
	Female	50	25.0
Business Age	Less than 5 years	100	50.0
	5–10 years	64	32.0
	More than 10 years	36	18.0
Total		**200**	**100.0**

Statistical tool

Jamovi software {The jamovi project (2024). *jamovi*. (Version 2.6)} has been employed (Ahmed & Muhammad, 2021; *Applied Computer Science*, n.d.) to analyse the dataset for the empirical study.

Data Analysis

Measurement Model Assessment

Before moving to the structural relationship among the variables it is very important to assess the measurement model which comprises with reliability and validity. Internal consistency reliability through Cronbach's alpha examined and found that the values exceeded the recommended threshold of 0.70 for all constructs: Digital Marketing Adoption ($\alpha = 0.850$), Access to Finance ($\alpha = 0.789$), Government Support ($\alpha = 0.843$), and Sustainable Business Growth ($\alpha = 0.819$). Ordinal alpha and composite reliability (ω) values corroborated these findings, ranging from 0.789 to 0.890, confirming that all constructs demonstrated satisfactory reliability (Table 2).

Table 2: Reliability

Reliability indices						
Variable	**α**	**Ordinal α**	**ω_1**	**ω_2**	**ω_3**	**AVE**
DMA	0.850	0.890	0.856	0.856	0.858	0.733
AF	0.789	0.835	0.789	0.789	0.789	0.717
GS	0.843	0.882	0.845	0.845	0.848	0.721
SBG	0.819	0.861	0.826	0.826	0.826	0.677

Convergent validity was assessed by Average Variance Extracted (AVE), with all constructs exceeding the minimum acceptable threshold of 0.50 (DMA = 0.733, AF = 0.717, GS = 0.721, SBG = 0.677). For all indicators, Standardized factor loadings ranged from 0.758 to 0.908 and were statistically significant ($p < .001$), further supporting convergent validity of the measurement items.
Discriminant validity, Heterotrait-Monotrait (HTMT) ratio (table 3) of correlations was tested. Most construct pairs yielded HTMT values below the conservative threshold of 0.85, supporting adequate discriminant validity. However, the HTMT value between Digital Marketing Adoption and Access to Finance touched cut-off level elevated (HTMT = 0.849), suggesting a degree of conceptual overlap between these two constructs. While this value remains close to the acceptable cut-off, it is noted as a limitation and should be considered in the interpretation part of the results.

Table 3: HTMT Ratio

Heterotrait-monotrait (HTMT) ratio of correlations				
	DMA	**AF**	**GS**	**SBG**
DMA	1.000	0.849	0.658	0.754
AF	0.849	1.000	0.661	0.783
GS	0.658	0.661	1.000	0.695
SBG	0.754	0.783	0.695	1.000

Model Fit

The structural model demonstrated a good fit (table 4) to the dataset. The chi-square test for the user model was non-significant ($\chi^2 = 33.6$, df = 38, $p = .672$) showing in table 5. Representing no significant discrepancy between the observed and model-implied covariance matrices. Further supported this conclusion with some other indices (table 4) such as the Comparative Fit Index (CFI = 1.000) and Tucker-Lewis Index (TLI = 1.001) crossed the recommended threshold of 0.95. The Standardized Root Mean Square Residual (SRMR = 0.035) fell well (table 6) below the 0.08 cut-off indicating an excellent model fit. While the robust and scaled RMSEA values (0.086–0.093) in table 6, were marginally above the threshold 0.08. Taken together, these results confirm that the hypothesized structural model provides a good and statistically sound representation of the relationships among Digital Marketing Adoption, Access to Finance, Government Support and Sustainable Business Growth.

Table 4: User model versus baseline model

	Model
Comparative Fit Index (CFI)	1.000
Tucker-Lewis Index (TLI)	1.001
Bentler-Bonett Non-normed Fit Index (NNFI)	1.001
Relative Noncentrality Index (RNI)	1.000
Bentler-Bonett Normed Fit Index (NFI)	0.996
Bollen's Relative Fit Index (RFI)	0.995
Bollen's Incremental Fit Index (IFI)	1.000
Parsimony Normed Fit Index (PNFI)	0.688

Table 5: Model tests

Label	**X^2**	**df**	**p**
User Model	33.6	38	0.672
Baseline Model	9420.1	55	<.001
Scaled User	93.4	38	<.001
Scaled Baseline	3239.6	55	<.001

Table 6: Fit indices

			95% Confidence Intervals		
Type	**SRMR**	**RMSEA**	**Lower**	**Upper**	**RMSEA p**
Classical	0.035	0.000	0.000	0.041	0.983
Robust	0.027	0.093	0.072	0.114	<.001
Scaled	0.027	0.086	0.064	0.108	0.005

Structural Model assessment

Data were analyzed using Structural Equation Modelling (SEM) in jamovi (version 2.6) (Ahmed & Muhammad, 2021). The analysis proceeded in two stages. First, the measurement model was assessed for internal consistency reliability (Cronbach's alpha, ordinal alpha, composite reliability) with convergent validity (Average Variance Extracted). Discriminant validity (Heterotrait-Monotrait ratio of correlations) was also done. Second, the structural model was estimated to test the hypothesized relationships between the three independent variables and Sustainable Business Growth.

Table 7: R^2

Variable	R^2
DMA1	0.697
DMA2	0.794
DMA3	0.708
AF1	0.744
AF2	0.690
GS1	0.674
GS2	0.824
GS3	0.665
SBG1	0.758
SBG2	0.575
SBG3	0.697

Table 8: Measurement model

				95% Confidence Intervals				
Latent	**Observed**	**Estimate**	**SE**	**Lower**	**Upper**	**β**	**z**	**p**
DMA	**DMA1**	1.000	0.0000	1.000	1.000	0.835		
	DMA2	1.067	0.0404	0.988	1.146	0.891	26.4	<.001
	DMA3	1.007	0.0477	0.914	1.101	0.841	21.1	<.001
AF	**AF1**	1.000	0.0000	1.000	1.000	0.863		
	AF2	0.963	0.0458	0.873	1.052	0.830	21.0	<.001
GS	**GS1**	1.000	0.0000	1.000	1.000	0.821		
	GS2	1.106	0.0451	1.017	1.194	0.908	24.5	<.001
	GS3	0.993	0.0491	0.897	1.090	0.815	20.2	<.001
SBG	**SBG1**	1.000	0.0000	1.000	1.000	0.871		
	SBG2	0.871	0.0435	0.785	0.956	0.758	20.0	<.001
	SBG3	0.959	0.0406	0.879	1.038	0.835	23.6	<.001

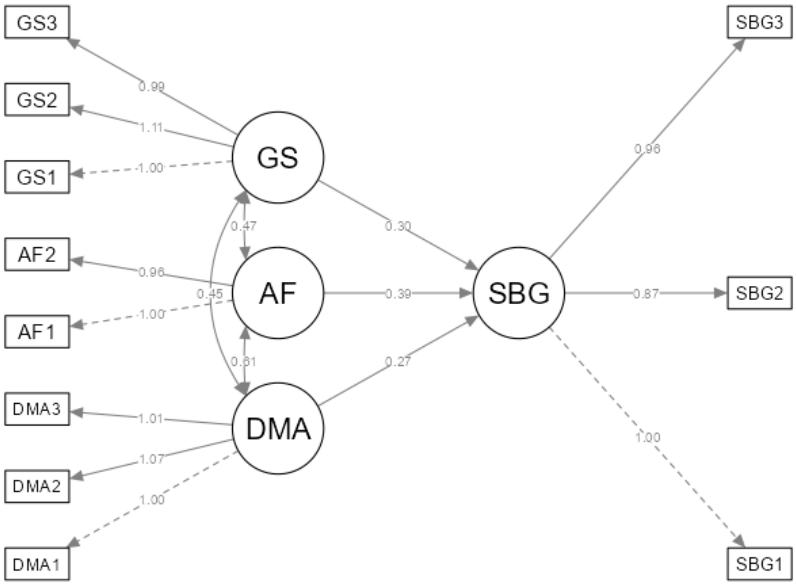


Figure 2: Path diagrams

In this study it is revealed that the three hypothesized relationships (fig 2) were statistically significant and has positive significant impact on sustainable business growth. Digital Marketing Adoption had a significant positive effect on Sustainable Business Growth (β = 0.256, p = .011), supporting H1. Access to Finance depicted the strongest influence on Sustainable Business Growth as its values are (β = 0.387, $p < .001$), supporting H2. Government Support also showed a significant positive effect on Sustainable Business Growth (β = 0.281, $p < .001$) which supported H3. Collectively, the three predictors explained approximately 29.6% of the variance in Sustainable Business Growth ($R^2 = 0.296$) in table 7, indicating a moderate level of explanatory power.

Table 9: Hypotheses Result

Hypothesis	Path	β	SE	z	p	Result
H1	DMA → SBG	0.256	0.105	2.54	.011	Supported
H2	A F → SBG	0.387	0.111	3 .53	<.001	Supported
H3	GS → SBG	0 .281	0.073	4.07	<.001	Supported

All three hypothesized relationships H1, H2 and H3 among the predictor variables and Sustainable Business Growth (SBG) are supported. **H1** proposed that Digital Marketing Adoption (DMA) positively influences SBG was supported by ($\beta = 0.256$, $z = 2.54$, $p = .011$), indicating that businesses adopting digital marketing practices experience a significant improvement in sustainable growth. However, with the effect is weakest among three paths. **H2** proposed that Access to Finance (AF) positively influences SBG. This hypothesis was strongly supported ($\beta = 0.387$, $z = 3.53$, $p < .001$) and represents the strongest predictor as it suggests that financial accessibility plays the most substantial role in enabling small businesses to grow sustainably.**H3** proposed that Government Support (GS) positively influences SBG. This hypothesis was also supported ($\beta = 0.281$, $z = 4.07$, $p < .001$), indicating that supportive government policies, subsidies and schemes meaningfully contribute to small businesses achieving sustainable growth.

Findings

By using structural equation modelling, the study examined the antecedent such as digital marketing adoption, access to finance and government support influences sustainable business growth or not in small businesses. For all the three hypotheses the result provided empirical support. Digital Marketing Adoption was found to have a significant positive effect on Sustainable Business Growth with the values ($\beta = 0.256$, $p = .011$). Access to Finance found as the strongest predictor of Sustainable Business Growth ($\beta = 0.387$, $p < .001$), followed by Government Support, which also demonstrated a significant positive influence ($\beta = 0.281$, $p < .001$). Collectively, the three predictors accounted for approximately 29.6% of the variance in Sustainable Business Growth ($R^2 = 0.296$). The measurement model disclosed satisfactory reliability (Cronbach's α ranging from 0.789 to 0.850) and convergent validity (AVE ranging from 0.677 to 0.733). In case of the structural model, it exhibited excellent fit to the data (CFI = 1.000, TLI = 1.001, SRMR = 0.035). These findings collectively indicate that financial accessibility, institutional support and digital marketing capabilities are important.

Discussion

The findings affirm that digital marketing adoption, access to finance, and government support each play a meaningful role in fostering sustainable growth among small businesses in Delhi. The small business owners who are able to access, effectively utilize resources are better positioned to sustain their operations and grow over time grounded by Resource base view theory. In literature a strong factor always identified for long is access to finance for small businesses. Small entrepreneurs often struggle because of finance which is an obstacle and cannot expand operations. For long term sustainability finance plays strongest factor for small business. Another consistent contributor is Government support such as schemes facilities, subsidies, initiative programmes, simplified regulatory process. If these are not better equipped than small business owners have to face some difficulties and it effect badly in long-term growth. Now a day all sectors are becoming digitally attached as most of the business directly and indirectly involving with technology. So it is an important part to be discussed as digital marketing adoption still significant. Simply having access of some digital tools is not enough but effectively using of these digital tools can be beneficial for small business owners. Findings suggest that sustainable growth among small businesses is rarely driven by a single factor. Instead, it appears in a package or a combination of adequate financial resources, supportive government infrastructure and evolving digital capabilities.

Conclusion

The study was conducted to investigate whether these variables such as digital marketing adoption, access to finance and govt support have significant role on sustainable growth business or not. The findings confirm that all the three factors place significant positive role in shaping sustainable business outcomes. The multidimensional nature of sustainable business growth can be highlighted here as the study is contributing multi variables for the result. Together digital marketing adoption access to finance and government support has potential influence on the sustainable business growth. All the three antecedents are equal for sustainable business growth. it is a holistic concept as it can strengthen the business operations and its decisions by the help of adopting digital marketing strategies. The external capacity to access the funds and the government support mechanisms provides significant contribution too.

Implications

Theoretical Implications

In the context resource based view (RBV) this study contributes to the literature by providing empirical evidence both internal resources and external sources for the sustainable growth of the business. The internal source the digital marketing and capabilities and the external sources financial access and government support has valuable option for non-substitutable asset and collectively these variables enhances sustainable performance. The policymakers and personal business owners can make good decision on the basis of this study. For policymakers and financial institutions, the results emphasize the need to simplify credit access mechanisms for small business owners and design it more accessible. Well-publicized government support programs, particularly can reveal the impact on sustainable business outcomes. Business development agencies such as NGOs may also consider offering digital marketing training as an intervention to strengthen small business resilience and growth.

Limitations

This study is subject to several limitations. First, the data were collected through a cross-sectional survey design ignored longitudinal research. Second, the sample was limited to 200 small business owners from a specific geographic and/or sectoral context, which may limit the generalizability of the findings to other regions, industries, or business types. Third, only Jamovi software is employed, in future other softwares such as Smart PLS and SPSS can be used.

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Conflict of Interest

Conflict of interest in NIL.

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Vegetable Gold: Eden and the Lexicon of the Commodity in Milton's Paradise Lost (1667)

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Abstract: Milton's Eden is celebrated for its abundance, yet the descriptions that carry that abundance are habitually quoted apart from the similes introducing them. Read together, they show the poem reaching twice for the East Indian spice trade to figure an approach to paradise: Satan is a merchant fleet out of Bengala and the Moluccas, and the odours of Araby reach him as they reach sailors who round the Cape and do not land. The surrounding diction is of the same kind. Eden's fruit is vegetable gold, its brooks roll on orient pearl and sands of gold, and its air carries myrrh, cassia, nard and balm, which is to say the contents of a warehouse rather than of an English garden. This paper argues that Milton registers Edenic plenty in the commodity lexicon of his century, so that Giamatti's desirability and inaccessibility are realised as the structure of a distant market. The method is a qualitative close reading of Fowler's edition, with passages selected by three stated criteria, figural, lexical and distributional, and analysed for simile vehicle, descriptive noun and focalisation. The distributional finding is the most consequential: the lexicon of value belongs to Satan and to the narrator reporting Satan's gaze, while Adam, Eve and Raphael live in the garden and never price it. Rival alchemical, formal and political readings are examined, and the limits they set on the claim are stated.
Keywords: Milton; *Paradise Lost*; earthly paradise; commodity lexicon; spice trade; early modern globalism.

Introduction

In an age in which dystopia rules the cyber culture and deadens our finer sensibility, we have grown accustomed to reading Milton's Eden as a repository of pure sensuous plenitude, a place whose fragrances and fruits compensate the reader for what the fallen world withholds. That tradition of reading is long and distinguished, and it remains the default of the classroom and the anthology. Is there, however, any good reason to read the descriptions of Eden apart from the similes that introduce them? This study proposes that the tradition, while not wrong, is incomplete in a way that current scholarship on early modern globalism allows us to specify.

Two terms used throughout require definition at the outset. By commodity lexicon this paper means the set of nouns, compounds and figures by which a seventeenth-century English text names goods that were priced, weighed, shipped and traded: spices and aromatic resins (myrrh, cassia, nard, balm, gum), precious substances used as measures of worth (gold, pearl), and the terms of carriage and exchange (merchant, cargo, trading flood, drugs in the period sense of exotic commodities). The lexicon is a matter of diction rather than of subject matter; a text employs it whenever it registers value in the vocabulary through which value was then transacted. By early modern globalism this paper means the scholarly account of the seventeenth century as a period in which English literary culture was reorganised by long-distance maritime commerce, by the chartered trading company, the Indies routes and the competition for the spice monopoly, and in which that commerce supplied writers with images, geographies and terms of value. The phrase names a critical field, not a historical thesis, and designates here the body of work running from Lim (1998) to Soon (2022).

Scholarship on Milton's paradise has developed along three lines which have rarely been brought into contact. The first and oldest is the study of the earthly paradise as a literary inheritance. Giamatti (1966) established its terms by examining the gardens of antiquity and the Renaissance and identifying their two governing attributes, desirability and inaccessibility. Stein (1953) labelled the garden's teeming growth its authorised excesses; Knott (1971) argued that Milton's central representational problem was to show nature perfected without making it unbelievable; Kermode (1960) posited that Milton required a garden of pleasure neither naturalist nor libertine, into which innocent delight had somehow to be introduced; and Empson (1935) noticed the strands of organic growth, music and odour which converge whenever Milton thinks of paradise. This body of work established the descriptive richness of Books 4 and 5 as the poem's central aesthetic achievement, but it did so by reading the descriptions largely in isolation from the similes which frame them, a habit of quotation which the anthologies have done much to encourage.

The second line is ecocritical, and it is at present the most active of the three. Hiltner (2003, 2011) and McColley (2007) shifted attention from the garden as tableau to the garden as place and as work, recovering Milton's attentiveness to husbandry, to interspecies kinship, and to the labour Adam and Eve actually perform. Cox (2023) discerns in the poem an ecological fall distinct from, though concurrent with, the human one. Barrett (2024) reads early modern epic as a genre saturated with environmental thinking, and shows how the ecological costs of extraction and warfare surface in the poem's own machinery. This scholarship has established that Eden is a site of activity rather than of static contemplation, but it has tended to treat the produce of that activity as a matter of stewardship rather than of value. What becomes of the ecocritical account, one might ask, if the yield of the garden is measured in the terms by which yield was then priced?

The third line is the least assimilated of the three. Lim (1998) opened it by placing Milton at the end of a poetics of colonialism running from Ralegh, and Morton (2000) traced the way fantasies of an ideal substance of extraordinary wealth and beauty, located in distant imaginary realms, percolated into poetic language. O'Brien (2002) took up the question of whether Milton writes for or against empire, a question which, as Dhar (2025) observes, remains genuinely open. Haydon (2017) read the poem against the politics of the trading corporation, and Soon (2022), comparing *Paradise Lost* with Richard Fanshawe's *Lusiad* of 1655, notes that Eden is scented with spices whose perfumes waft beyond its borders exactly as Sabean odours waft from Araby. This line has established that the poem is legible within the commercial history of its century, but it has concerned itself principally with the poem's politics rather than with its descriptive language, and it is there that the present paper enters.

What has not been undertaken is the meeting of the first line with the third. The paradise tradition supplies a structure of longing, the globalism scholarship a commercial history, and the descriptive lexicon of Eden, which belongs to both, has not been read as belonging to both. This study addresses that gap, and in doing so raises one question above the others. In what vocabulary does *Paradise Lost* register the abundance of Eden, and what follows for the poem's account of desire if that vocabulary should prove to be the vocabulary of trade? Put more sharply: does Milton's garden simply inherit the tradition's structure of desirability and inaccessibility, or does it reproduce that structure in the contemporary form of a distant market? The aim of what follows is to read the descriptive and figural language of Eden as an instance of the commodity lexicon of the seventeenth century, and to draw out what that language does to the poem's treatment of paradisal longing. Three narrower objectives serve that aim:

- to establish where the poem's Edenic similes find their vehicles, and what is accomplished by the particular vehicles chosen;
- to read the nouns Milton uses for Edenic produce, and the compound "vegetable gold" above all, as a fusion of the organic with the monetary;

- and to ask how that vocabulary is distributed among the poem's consciousnesses, since the question of who perceives Eden in these terms is not the same as the question of whether the terms are present.

Three conclusions may be signalled in advance. The two similes that govern the approach to paradise are both drawn from the Indies trade and both attached to Satan, so that desirability and inaccessibility are realised as the structure of a distant market. The descriptive nouns of Eden constitute a sustained commodity lexicon which the poem uses without embarrassment, reserving its condemnation for extraction rather than for value as such. And that lexicon is unevenly distributed: it belongs to Satan and to the narrator reporting Satan's gaze, and is absent from the speech of the garden's inhabitants.

Two theoretical frameworks are required, and they answer to one another. Giamatti's (1966) desirability and inaccessibility are treated here not merely as a psychological structure but as a description of the relation between a consumer and a distant source. Morton's (2000) poetics of spice arrives independently at a related position, arguing that the rhetoric of the ideal exotic substance carries an economic content into poetic language and survives there long after the arrangements which produced it have gone. Giamatti theorises from the tradition, Morton from the commodity; between them the garden may be read without forcing a choice.

Materials and method

The primary material of this study is the text of *Paradise Lost* as established in Fowler's second edition (Milton, 1667/2007), and all quotations are given in that edition's modernised spelling and cited by book and line so that any reader may verify them. Fowler's commentary is cited separately (Fowler, 2007) where the argument depends on his glosses or on the earlier criticism he records. The 1667 first edition is named in the title because the argument concerns the poem as a product of the decade of the Navigation Acts and the second Anglo-Dutch war; no substantive variant between 1667 and 1674 bears on the passages discussed.

The method is qualitative and interpretive close reading, the procedure appropriate to a claim about diction. Because such a claim can be made to look inevitable by a selective choice of passages, three criteria of selection are stated here rather than left implicit; a passage entered the corpus if it satisfied at least one.

The first criterion is figural: every simile in Books 1, 2, 4, 5 and 9 whose vehicle is drawn from maritime navigation, cargo, or long-distance trade. This yields a small and well-defined set, of which the fleet simile at 2.636–643 and the Sabean simile at 4.159–165 are the two that govern an approach to paradise.

The second criterion is lexical: every noun, compound or epithet in the descriptions of Eden that names a traded substance, whether a spice, an aromatic gum or resin, a precious metal or a precious stone, taken with its immediate context. The resulting inventory is small enough to be given entire: vegetable gold (4.220), golden rind (4.249), Hesperian fables (4.250), odorous gums and balm (4.248), orient pearl and sands of gold (4.238), and the catalogue of myrrh, cassia, nard and balm at 5.292–293. Passages of Edenic description containing none of these terms, such as the account of the four rivers, were noted as negative evidence and are not suppressed here.

The third criterion is distributional, and it converts a lexical observation into an argument. Every occurrence identified under the first two criteria was tagged for focalisation: narrator in his own person, narrator reporting what Satan sees, Satan's own speech, or the speech of Adam, Eve or Raphael. The speeches of the garden's inhabitants were then searched for the same vocabulary, so that absence as well as presence could be counted. This is the step that guards the argument against the obvious objection that a critic who looks for commercial diction in a long poem will find some.

Milton's prose is used for corroboration at one point only and is not part of the corpus. The study involves no human participants, so consent, privacy and ethical approval do not arise; nor does it require sampling procedures, tables or figures, its evidence being verbal and presented as quotation and analysis.

The earthly paradise as a structure of distance

The tradition Milton inherited had already made distance a condition of paradise. The two basic ideas which emerge from any examination of the gardens of antiquity are, according to Giamatti (1966), desirability and inaccessibility, and they mirror the predicament of being torn between what one wants and what one can have. Perhaps for that reason the very inaccessibility of the earthly paradise produced the false paradise of the Renaissance poets, which embodies the split between what a place seems and what it is.

Giamatti's formulation has been read almost exclusively as a psychological or theological structure, yet the pairing describes something else with equal precision. A commodity is desirable and inaccessible when its source lies at the far end of a trade route, and the tradition places its paradises accordingly. The classical writers held that the place existed on the other side of the earth, in the Fortunate Isles. The Garden of the Hesperides is set beyond the ocean; its name means simply "in the west." It occupies the same location as Homer's Elysium and Hesiod's Blessed Isles. Its orchards are heavily laden with fruit, and a watchful dragon guards them. The Sumerian and Babylonian myth had, like Genesis, its paradise in the bright land of Dilmun, where grain is abundant and there is neither sickness nor death. These are not only images of longing. They are also images of a place from which good things come and to which one cannot go.

The guarding is as much a part of these stories as the abundance, and it is the guarding that makes them economic as well as mythic. The Hesperides keep golden apples which only Hercules can pluck, and the difficulty of the plucking is the whole of the story; in Norse mythology a dragon guards the apple tree of immortality belonging to Idun. What is narrated in each case is not simply that a wonderful thing exists, but that it exists elsewhere and is defended. Is that not the situation of any valuable good whose source lies beyond one's reach? Men of the Middle Ages and the Renaissance continually discussed the location and nature of the blessed land, and the discussion of location is precisely what a merchant conducts.

Milton inherited this tradition without simply imitating it, alluding freely to the classical and Renaissance paradises while insisting that those were feigned and the Edenic paradise alone true. Knott (1971) notes that Milton's garden offers not a pleasance, as Dante's does, but a landscape closer to the environs of Spenser's Bower of Bliss, and that, like Spenser's false paradise, Eden is shown through the eyes of an antagonist visitor highly susceptible to its charms. The allurements of Eden are most strongly felt by a person denied entry into it. That observation, made in the vocabulary of pastoral criticism, will prove to have an economic dimension which Knott did not pursue.

Where the tradition offered Milton a structure of distance, he had available a second and far more literal version of it, one being worked out in his own century upon actual water by actual companies. It is to that version that the poem turns at the very moment it needs an image for the approach to the fictive world.

Satan as merchant fleet

The keystone of the argument stands at the end of Book 2, where the poem requires a figure for Satan's approach as he clears Chaos and first sights the created world. Milton supplies a merchantman:

> As when far off at sea a fleet descried
> Hangs in the clouds, by equinoctial winds
> Close sailing from Bengala, or the isles

> Of Ternate and Tidore, whence merchants bring
> Their spicy drugs: they on the trading flood
> Through the wide Ethiopian to the Cape
> Ply stemming nightly toward the pole. So seemed
> Far off the flying fiend. (Milton, 1667/2007, 2.636–643)

The geography of these lines is not ornamental, and each element carries a specific commercial charge. Ternate and Tidore are the Moluccas, the Spice Islands proper, and by the 1660s their names carried the whole history of Portuguese, Dutch and English competition for the clove and nutmeg monopoly, including the events at Amboyna in 1623 which had poisoned Anglo-Dutch relations for a generation. Bengala names the other pole of the same commerce. The winds are equinoctial, the route runs through the wide Ethiopian sea to the Cape, and the cargo is specified as spicy drugs, where *drug* carries its period sense of an exotic commodity rather than a medicine (Fowler, 2007, note to 2.640–641). Most tellingly, the water is not merely a sea but a trading flood. Milton is naming, with the precision of a man who had read the voyage literature and served a government with commercial ambitions, the principal commercial artery of his century, and he is using it to describe the arrival of the enemy at the world.

The effect of the simile deserves more attention than it has had. Satan is at this moment sublime, and the fleet hanging in the clouds is one of the great images of distant magnitude in English verse; yet the tenor is a fiend and the vehicle a merchantman, so that the poem has arranged for the two to illuminate one another. Is the merchant fleet ennobled by the comparison, or is Satan given a motive by it? Milton does not say, and criticism has divided upon the point, some reading the poem as an argument against empire and others as complicit with it. O'Brien (2002) has shown how much the answer depends upon which parts of the poem one privileges, and Haydon's (2017) account of the corporation suggests why the ambivalence may be structural rather than accidental: the trading company was an institution the period itself could not decide whether to admire, being at once an instrument of national wealth and a body whose conduct abroad was a standing embarrassment.

That the commercial content of the simile is not the invention of the present reading can be shown from two directions. Barrett (2024, p. 50) takes it as plain that Satan here assumes the role of a mercantile opportunist or conquistador in flight toward the newly created earth, and reads the proximity of that appetitive posture to the poem's gorgeous Edenic description as a deliberate source of unease. Fowler (2007, note to 2.636–643) records the older reading that Satan speaks in the idiom of a shrewd businessman, and observes that the fleet carries spicy drugs because Satan is going to barter for Eve's innocence the fruit of the forbidden tree. The point is not that the simile is hostile to trade, but that the poem's most careful readers, early and recent, have heard the commercial register doing figurative work rather than supplying local colour.

What the simile establishes for the reading that follows is a direction of travel. The poem has aligned the approach to paradise with the approach to a source of valuable goods, and it has done so at the structurally decisive moment, the first sighting of the created world. Everything subsequently said about Eden's produce arrives to a reader who has been given that frame.

Vegetable gold

Once the Book 2 simile is in view, the descriptive vocabulary of Book 4 changes character, because Milton's Eden is not merely fertile but fertile in commodities, and in the particular commodities then being fought over. The point can be made by working through the inventory of Edenic nouns in the order in which the poem supplies them.

Consider the trees first. The poem gives us fruit "burnished with golden rind" that hangs "amiable," then adds the guarded gloss that these are "Hesperian fables true, / If true, here only" (4.249–251). Milton is doing two things at once: asserting that the classical fable of the golden apples finds its only truth in Eden, and measuring that truth in the metal. Thirty lines earlier the tree of life stands "High eminent, blooming ambrosial fruit / Of vegetable gold" (4.218–220), a phrase of extraordinary compression which fuses the organic and the monetary into a single substance. Gold that grows, growth that is gold: the compound names exactly the fantasy Morton (2000) traced in the poetics of spice, of an ideal substance of extraordinary wealth and beauty located in a distant imaginary realm. What the Hesperides guarded, and what merchants sail to Ternate for, is here found growing.

The water of Eden is described in the same register, and this is the evidence most consistently overlooked. Milton does not say that the brooks run over stones and sand. He says that they run "from that sapphire fount," "Rolling on orient pearl and sands of gold" (4.237–238). Three of the four substantives there are trade goods, and the fourth, the epithet *orient*, is itself a commercial term: orient pearls were the pearls of the Indian Ocean fisheries, and the word functioned in the period as a grade as much as a direction. A stream bedded in pearl and gold dust is not a natural feature but a warehouse floor, and the poem arrives at it by pure description, without a simile to license the vocabulary.

The fragrance passages work in the same way, and here the inventory becomes a catalogue. Nature in Eden "Wantoned as in her prime," pouring forth more sweet, "Wild above rule or art," and what she pours is a merchant's list: Raphael comes "through groves of myrrh, / And flowering odours, cassia, nard, and balm; / A wilderness of sweets" (5.292–294). Are these the flowers of an English garden? They are the contents of the apothecary's drawer and of the East India warehouse, goods whose scarcity gave the trade its value and whose names a London reader of 1667 would have met upon a bill of lading quite as readily as in a poem. Fowler's gloss confirms the point from the other direction: *odour* in the period literally meant a substance that emits a sweet smell, a spice, so that "flowering odours" names the goods and not merely the sensation (Fowler, 2007, note to 5.292–294). The phrase "a wilderness of sweets" then repays pressure, since a wilderness is by definition unowned and uncounted while sweets, in the sense the catalogue has just established, are precisely what is counted. The phrase registers abundance as an economic impossibility as much as a horticultural marvel, and the paradox is constitutive of its beauty rather than incidental to it.

The gums repay similar pressure. Milton tells us that the groves of Eden had "rich trees" that "wept odorous gums and balm" (4.248), and the verb has always been read as pathos, the garden weeping its sweetness in anticipation of the loss to come. Yet weeping is also what a tree does when it is tapped, and gum and balm reach a seventeenth-century reader as goods rather than as effusions, carried from Arabia and the Levant and priced by the ounce. The adjective *rich* make the point without help: Fowler (2007, note to 4.248–249) records the eighteenth-century observation that the epithet sets the valuable aromatics against the merely edible fruit, and adds drily that Hesperian fruit would not come cheap either. Is the pathos of the line diminished by that recognition? It is rather deepened, since what the garden pours out freely is exactly what the fallen world will have to buy, and the fall may therefore be measured as the moment at which abundance acquires a price. Milton nowhere states this. He does not need to, having chosen his nouns.

The poem's treatment of actual gold confirms the point from an unexpected direction. Mammon was "the least erected spirit that fell / From heaven," whose thoughts even in heaven were "always downward bent, admiring more / The riches of heaven's pavement, trodden gold, / Than aught divine" (1.679–683); his followers "Ransacked the centre, and with impious hands / Rifled the bowels of their mother earth / For treasures better hid," opening in the hill "a spacious wound" and digging out "ribs of gold" (1.686–690). The passage is a sustained condemnation of extraction, and "precious bane" (1.692) compresses the judgement into two words. Barrett (2024, pp. 52–53) shows how far that judgement reaches into the poem's machinery, since the rebel angels' artillery in Book 6 is mined out of the soil of heaven and answered by a faithful terraforming that uproots its hills, so that the war becomes a study in ecological havoc rather than in heroism. What is striking is that the same poet, three books after Mammon, calls the unfallen fruit vegetable gold without apparent unease. The contrast is instructive rather than contradictory. Gold torn from the earth is theft; gold that grows upon a tree is bounty. The difference is the labour and the violence, so that the poem is not condemning value as such but distinguishing what is given from what is taken. A poet indifferent to value would have had no need of the distinction.

Counter-readings and the limits of the commodity claim

An argument of this kind is strengthened rather than weakened by the readings that resist it, and three such readings deserve direct engagement. Each takes the same evidence and construes it otherwise.

The first and most serious is the alchemical reading of "vegetable gold." Fowler (2007, note to 4.220) records that "vegetable stone" and "potable gold" were recognised varieties of the philosopher's stone credited with preserving health, and connects the phrase to Ovid's Hesperidean fruit and to Genesis 3:22, where God's concern is that the tree of life might prove an elixir to fallen Adam. On this account the compound is hermetic rather than mercantile. The objection cannot be dismissed, but two things may be said. The alchemical and the commercial senses were neighbours rather than alternatives in the seventeenth century, since the search for transmutable gold was an economic project pursued by men who wanted the metal and not merely the symbol. More decisively, the alchemical gloss accounts for one phrase and leaves the surrounding inventory untouched, having nothing to say about orient pearl, spicy drugs, the trading flood, or the catalogue at 5.292–293. The commodity reading rests on a distribution rather than on a single compound, and a rival gloss on one item does not disturb a pattern.

The second counter-reading treats the merchant simile as narrative mechanics rather than commercial content. Fowler (2007, note to 2.636–643) preserves Empson's demonstration that the vehicle corresponds to the tenor at many points at once, since the ships ply nightly because Satan has come out of darkness, hang far off like a mirage because he seems to fly, and head toward the pole because he moves toward the top of the concave wall of hell; Fowler adds that trade often figured intellectual activity for Milton. On this account the spices are chosen because a fleet must carry something. The reply is that such readings are compatible with the present one. A vehicle may be selected for its structural aptness and still import the associations it carries, and the argument here does not rest on one simile but on the poem's return to the same trade route when it needs a second image for an approach to paradise at 4.159–165. One such simile is a coincidence. Two are a habit of mind.

The third counter-reading is political rather than philological, and it cuts against any account that makes Milton a critic of commerce. Fowler (2007, note to 2.636–643) records the suggestion that the passage alludes astringently to the imperialism of Camoens, then observes that such readings may forget the imperialist thrust of the Commonwealth Milton served. Barrett (2024, pp. 50–51) presses harder, showing that the poem can endorse the exploitative arrangements it also depicts, since Michael's speech in Book 12 rehearses the curse of Ham as a warrant for enslavement. This paper therefore does not claim that Milton condemns trade. The claim is narrower: that the poem exhibits the mercantile imagination rather than merely employing it, and that the distribution of the vocabulary shows the exhibition to be deliberate. Whether Milton approved of what he exhibited is a question the poem does not settle, and this study does not need it settled.

The trader's eye

At this point the question of focalisation becomes decisive, and it is here that Milton's handling seems most deliberate. The whole of the great description of paradise in Book 4 is mediated through the baleful eyes of the intruder. We see Eden as Satan sees it, and the poem says so. The Sabean simile makes the alignment explicit, and it does so by placing the perceiving figure at a precise point on a known route:

> As when to them who sail
> Beyond the Cape of Hope, and now are past
> Mozámbic, off at sea north-east winds blow
> Sabean odours from the spicy shore
> Of Arabie the blest, with such delay
> Well pleased they slack their course, and many a league
> Cheered with the grateful smell old Ocean smiles.
> (Milton, 1667/2007, 4.159–165)

Read as a passage about scents, this is one of the loveliest achievements in the poem, and it is customarily quoted for the smiling ocean. Read as a passage about position, it is sharper. The sailors are identified by their route: past the Cape, past Mozambique, upon the run to the Indies. They do not land. They slacken their course, are cheered, and proceed, because the shore of Araby the blest is not their destination but a fragrance encountered in transit. This is inaccessibility rendered as commerce, and it is Satan's situation exactly, since he too will approach, be delayed by sweetness, and pass through without possessing. That the simile is a deliberate reprise rather than an unrelated flourish is confirmed by Fowler (2007, note to 4.159–166), who reads the second comparison as taking up the first after the intervening journey and notes the pun by which Satan, past the Cape of Hope, is a soul past hope.

The poem's own language establishes what kind of visitor this is. Satan arrives carrying his condition with him, since "within him Hell / He brings, and round about him" (4.20–21), and he arrives with the eye of a man assessing a coast, seeing a place of unguarded plenty already described in the terms by which plenty is valued elsewhere. His first speech in the garden turns upon dispossession, upon the sight of "our room of bliss thus high advanced" now occupied by "Creatures of other mould" (4.359–360), and his ruin is sharpest when he watches Adam and Eve "Imparadised in one another's arms" while he is "to hell am thrust, / Where neither joy nor love, but fierce desire" remains (4.506–509). Is the grievance not, among other things, proprietary? Milton has given the intruder the vocabulary of the trader, and has then made his ruin consist in seeing a possession he cannot hold.

The distribution of the vocabulary among the poem's speakers turns this from an impression into a finding. Adam and Eve, who live in the garden, never once describe it in these terms. Eve's account of the smells of paradise is the test case, since it is the one speech by an inhabitant that catalogues the garden's sensory goods at length, and it is conspicuously free of the lexicon: "Sweet is the breath of morn, her rising sweet, / With charm of earliest birds; pleasant the sun / When first on this delightful land he spreads / His orient beams, on herb, tree, fruit, and flower, / Glistering with dew" (4.641–645). The list is as full as the narrator's and as sensuous, but every item in it is named in ordinary English and none is priced. Even *orient*, which named a grade of pearl four hundred lines earlier, has reverted here to a direction of sunrise. Raphael, likewise, passes through the spicy forest without pricing it. The mercantile lexicon belongs to the narrator when he is describing what Satan sees, and to Satan himself. Are we to think that an accident, in a poem so exact about who says what?

Labour, yield, and the ecocritical reading

The ecocritical scholarship becomes useful at this juncture, because it has established that Eden is a place of work and has therefore prepared the ground for a question about what the work is for. Hiltner (2003) and McColley (2007) taught us to read Milton's garden as a working place rather than a static tableau, attentive to husbandry, to interspecies kinship, and to the labour the poem assigns its inhabitants. Cox (2023) has since shown how far Milton's environmental thinking extends beyond the garden wall, while Barrett (2024) situates such reading within a broader account of epic as an environmentally saturated genre.

What the commodity reading adds is a question about the object of that labour, and the poem answers it in the language of yield. Adam tells Eve that they must rise to reform the arbours and alleys "with branches overgrown, / That mock our scant manuring, and require / More hands than ours to lop their wanton growth" (4.626–629), and adds that the fallen "blossoms also, and those dropping gums" lie "bestrewn unsightly and unsmooth" and "Ask riddance" (4.630–632). The detail is remarkable: the very gums that the narrator had valued at 4.248 are here so plentiful that they are litter. Eve's proposal in Book 9 arises from the same problem, since "the work under our labour grows, / Luxurious by restraint; what we by day / Lop overgrown, or prune, or prop, or bind, / One night or two with wanton growth derides" (9.208–211), and it is that problem of yield which produces the division of labour on which the fall turns. If Eden is a place of work, it is also a place of produce, and the poem's way of praising the produce is to name what the produce is worth.

This does not convict Milton of commodifying paradise. It suggests instead that the two most powerful vocabularies available to him for describing abundance, the pastoral and the mercantile, were by 1667 no longer separable, and that a poet writing about a garden of unlimited fertility in the decade of the Navigation Acts and the second Anglo-Dutch war could not describe spice without describing trade. Hiltner's (2011) argument that the pastoral conceals its own environmental and economic conditions applies here with unusual force; Milton's pastoral conceals rather less than most. Read in this way, the celebrated fragility of Eden acquires a second explanation. The garden is vulnerable not only because Satan is malicious and Eve persuadable, but because it holds, in unguarded and unmeasured quantity, precisely the goods over which the poet's own century was conducting a naval war. The place has already been valued by the being who intends to take it.

The persistence of the longing

The commodity reading also gives a second dimension to the most familiar account of why the paradise image survives at all. Eliade (1960) singles out the nostalgia for paradise as among the most recurrent of human longings, defining it as man's repeated attempt to restore the paradisiac condition. The definition holds and may be extended, since the longing for the earthly paradise and the longing for the distant costly thing have borrowed one another's language at least since the Renaissance, and Milton is where the borrowing becomes fully visible.

The afterlife of the image bears this out. When Coleridge (1816/1912) decrees a stately pleasure dome in Xanadu and furnishes the account with incense-bearing trees, and when Pope (1713/1966) observes that the groves of Eden, vanished now so long, live in description and look green in song, the paradisal image arrives already bound up with the exotic import. Morton's (2000) argument that the rhetoric of spice supplied Romantic writing with a poetics of consumption describes a tradition which Milton had already brought to its point of maximum tension. Blake (1966) would locate paradise in moments rather than in any place, and Wordsworth (1936) proposed to find the Elysian fields and Fortunate Isles of the old poets in the common day of his Grasmere valley. Both relocations may be read as attempts to find a paradise which cannot be shipped. The nineteenth and twentieth centuries completed the movement by internalising it, until Jung (1959) could treat paradise as an archetype and Bodkin (1934) could relate it to the pleasure principle, and Kafka (1954) could reduce the whole matter to two sins, impatience and laziness, the first driving us out and the second preventing our return. What is common to these later formulations is that each relocates paradise into a domain from which it cannot be extracted and sold.

Discussion

The question with which this paper began was whether Milton's garden merely inherits the tradition's structure of desirability and inaccessibility, or whether it reproduces that structure in the contemporary form of a distant market. Each of the three objectives set out in the introduction may now be answered, and the answers converge on the second alternative.

The first objective was to establish where the Edenic similes find their vehicles, and they find them in the Indies trade. Milton figures the approach to the created world as a merchant fleet out of Bengala or the Moluccas, carrying spicy drugs upon what the poem itself calls a trading flood (2.636–643), and the approach to Eden as a landfall scented from the sea by sailors who do not land (4.159–165). The two are formally linked and both attached to Satan. The choice gives Giamatti's desirability and inaccessibility a seventeenth-century body: the paradise one longs for is positioned exactly where a cargo is positioned relative to a buyer.

The second objective was to read the nouns of Edenic produce, which constitute a consistent commodity lexicon: vegetable gold (4.220), brooks rolling on orient pearl and sands of gold (4.238), rich trees weeping odorous gums and balm (4.248), golden rind that makes the Hesperian fable true here only (4.249–251), and a wilderness of myrrh, cassia, nard and balm (5.292–294). That Milton could see the pursuit of such goods as violation is beyond doubt, since Mammon's followers rifle the bowels of their mother earth for treasures better hid (1.686–688) and the metal they raise is a precious bane. The distinction the poem draws is between value given and value taken, not between value and its absence.

The third objective was distributional, and it yields the finding on which the argument rests. The lexicon appears in the narrator's voice when he reports what the intruder sees, and in Satan's own speech, where the grievance is proprietary. It does not appear in the speech of those who live in the garden: Eve's catalogue at 4.641–649 is as sensuous as anything in the poem and contains not one term of value, and Raphael passes through the spicy forest without pricing it. Presence and absence together make a pattern an impressionistic reading could not produce.

These findings bear on each of the three bodies of scholarship reviewed at the outset. For the paradise tradition, Giamatti's pairing has served for sixty years as an account of longing; it serves quite as well as an account of a market. For the ecocritical line, the yield of Eden proves describable in terms of worth as well as of stewardship, so that the labour Hiltner and McColley recovered has an object not yet named, and the extractive violence Barrett (2024) traces through Books 6 and 12 has a descriptive counterpart in Book 4. For the globalism line, the argument shifts the evidence from the poem's explicit politics, where the question of Milton and empire has proved intractable, to its descriptive diction, where the evidence can be counted and located.

The counter-readings set the proper limits on all this. The alchemical gloss shows that no single phrase can carry the argument; the correspondence reading shows that the commercial content is additional to, not a replacement for, the simile's structural work; and the reminder that Milton served an imperially minded Commonwealth, and could excuse enslavement in Book 12, blocks any temptation to make him a critic of trade. What survives all three is the distributional finding, which none of them addresses.

Conclusion

Paradise Lost registers the abundance of Eden in the vocabulary of the seventeenth-century commodity, and it does so systematically enough that the vocabulary can be inventoried, located and assigned to speakers. The similes come from the Indies trade; the nouns name goods that were priced by the ounce; and the whole lexicon belongs to the intruder and to the narrator reporting the intruder's gaze. The consequence for the poem's account of desire is that

Edenic longing in Milton is not merely the longing of a fallen creature for an unfallen condition but, in its very diction, the longing of a buyer for a distant source. Reading that lexicon as evidence, rather than reading only the poem's explicit politics, is a procedure that other paradise writing of the period might reward.

Two limits should be acknowledged. This paper has stayed inside the poem, and Milton's prose, where trade and plantation and national wealth are discussed without the protection of figure, would either strengthen the case or complicate it in useful ways. The poem's colonial afterlife also remains untouched, and readers who encountered Eden from the far end of the trade routes described in Book 2 were positioned very differently from Milton, and from us. Neither line of inquiry would overturn what has been argued. Each would sharpen the claim that the lexicon of Eden carries an economic content, and that its poet knew what he was choosing.

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Ethical approval

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Declaration on the use of ai-assisted tools

Grammarly was used in the preparation of this manuscript. Its contribution lay in language editing. The author reviewed and verified all sources, takes full responsibility for the accuracy, originality and attribution of the content, and confirms that no AI system is listed as an author.

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Perceived government capacity and quality assurance effectiveness in higher education: evidence from Nangarhar, Afghanistan

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Abstract: Quality assurance in higher education is not just a technical process of assessing standards in the contemporary education system, but a governance process linked to the perceived capacity of government to implement policies, provide resources, and coordinate relevant institutions. In Afghanistan, despite formal policies, standards, and quality-assurance evaluations, a gap persists between these mechanisms and perceived quality in higher education. This study aims to assess the association between perceived government capacity and the effectiveness of quality assurance in higher education institutions in Nangarhar province. The study was conducted based on a quantitative, descriptive-analytical, and cross-sectional design. Data were collected from 240 selected participants via an online questionnaire between August 2025 and April 2026, yielding 149 valid responses. Data analysis was conducted using SPSS, descriptive statistics, and a chi-square (χ^2) test. The findings show that awareness of the importance of quality assurance is high (Mean=4.02), but perceptions of policy clarity, trust, human capacity, professional training, financial support, and information systems are comparatively lower. A significant relationship was found between human capacity and quality assurance effectiveness ($\chi^2(1)=9.47$, $p=.003$, Cramér's V=.252). Significant associations were also found between professional training and QA outcomes (χ^2 (1) =7.12, $p=.008$, Cramér's V=.219) and financial support and perceived QA reforms **(**χ^2 (1) =6.35, $p=.012$, Cramér's V=.206). Perceived QA effectiveness also differed significantly across low, moderate, and high levels of institutional coordination (F (2,146)=58.93, $p<.001$, $\eta^2=.447$). The study concludes that perceived QA effectiveness is associated with implementation capacity, institutional coordination, and the practical use of evaluation results. The study recommends strengthening human resources, professional training, financial and technical support, institutional coordination, and the use of QA evaluation results to shift quality assurance from formal compliance toward continuous institutional improvement.
Keywords: Higher Education Quality Assurance; Government Capacity; Institutional coordination; Policy Implementation; Nangarhar.

Introduction

The quality of higher education is a key indicator of an education system's effectiveness, as universities contribute to human capital development, scientific research, innovation, and social and economic development (Rahimi & Ayubi, 2022). Accordingly, Quality Assurance (QA) is a major policy and management priority for governments and higher education institutions. QA encompasses systematic mechanisms for assessing, maintaining, and continuously improving teaching, curricula, research, administration, faculty, learning environments, and student learning outcomes(Fahimi, 2023; Kayen et al., 2025). The effectiveness of QA depends not only on formal policies and regulations but also on the capacity to translate them into effective practice. Where QA policies and standards are developed primarily at the ministerial level and implemented by universities, the relationship between government capacity, policy implementation, institutional coordination, and perceived QA outcomes becomes particularly important. State capacity encompasses the administrative, organizational, financial, technical, and coordination capabilities required for policy design, implementation, monitoring, and evaluation(Ebrahimi et al., 2025; Jafari, 2023). From this perspective, the study does not measure the overall state capacity of Afghanistan; rather, it examines academic and administrative staff perceptions of government capacity and its relationship with QA implementation and effectiveness in Nangarhar's higher education institutions. The government contributes to QA through policy and legal frameworks, standards, accreditation, monitoring, evaluation, resource provision, and institutional coordination. A top-down policy implementation perspective is therefore relevant because national QA policies and standards are translated into institutional practice at the university level. Their effectiveness may depend on policy clarity, administrative capacity, available resources, monitoring, and coordination between ministerial authorities and universities. Where implementation capacity is limited, formal QA mechanisms may emphasize documentation and compliance rather than substantive quality improvement(Azizi et al., 2026). The problem is particularly pronounced in contexts characterized by political instability, weak governance, limited regulatory capacity, and constrained financial and human resources. In such settings, higher education may have formal institutions and regulations but lack the capacity to implement them effectively. Thus, the central issue is not merely the existence of QA policies, but the governmental and institutional capacity to implement, monitor, coordinate, and use them for quality improvement(Ahmadi et al., 2025; Auzarmi, 2023). Nangarhar provides an important context for examining the gap between formal QA policies and their practical implementation. This study aims to examine the association between perceived government and institutional capacity, institutional coordination, and perceived QA effectiveness in higher education institutions in Nangarhar. Its significance lies in highlighting the capacity and implementation conditions that shape the practical effectiveness of QA beyond the existence of formal standards. Accordingly, the study asks: How are perceived government and institutional capacity and institutional coordination associated with the implementation and effectiveness of QA in higher education institutions in Nangarhar?

Based on State Capacity Theory, Top-down Policy Implementation Theory, and Institutional Theory, this study formulates four testable hypotheses concerning the main relationships examined:

1) **H1:** There is a significant association between human capacity and perceived quality assurance effectiveness in higher education institutions in Nangarhar.
2) **H2:** There is a significant association between professional training and perceived quality assurance outcomes.
3) **H3:** There is a significant association between financial support and perceived quality assurance reforms.
4) **H4:** There is a significant difference in perceived quality assurance effectiveness across levels of institutional coordination.

THEORETICAL FRAMEWORK

QA in higher education is closely linked to institutional structures, policy implementation, state capacity, and government performance (Rohmah & Choiruddin, 2026; Zawak & Wahidi, 2026). In contexts facing political instability, limited resources, and weak governance, effective QA may depend on formal policies but also on the state's capacity to design, implement, regulate, monitor, and evaluate them (Sajid, 2026; Yunespour, 2023). Accordingly, this study draws on State Capacity Theory as its main framework, complemented by Top-down Policy Implementation Theory and Institutional Theory, particularly given the ministerial formulation and institutional implementation of national QA policies in Afghanistan.

State Capacity Theory

State Capacity Theory forms the main theoretical foundation of this study. It emphasizes that effective governance depends not only on the existence of policies and laws but also on the state's ability to formulate, implement, regulate, monitor, and evaluate them. In higher education, this capacity includes human and financial resources, administrative structures, information systems, monitoring mechanisms, and policy implementation capacity (Kayen et al., 2025; Motadi, 2025; Rahimi & Ayubi, 2022). This study uses these dimensions to examine how government capacity is associated with the effectiveness of quality assurance (QA) in higher education institutions in Nangarhar. Limited capacity may weaken the implementation of formal QA policies and reduce their contribution to substantive quality improvement (Austin & Jones, 2024; Mensah, 2022; Serrano et al., 2025).

Top-down Policy Implementation Theory

Top-down Policy Implementation Theory provides a complementary perspective for explaining how nationally formulated QA policies and standards are translated into institutional practice. The approach emphasizes the role of clear policy objectives, rules, communication, resources, administrative capacity, monitoring, and coordination between policy-making authorities and implementing institutions. In the Afghan higher education context, the Ministry of Higher Education formulates national QA policies and standards, while universities are responsible for their institutional implementation. Therefore, gaps may emerge when policy directives are unclear, resources are limited, monitoring is weak, or coordination between ministerial authorities and universities is insufficient. This perspective helps explain why the existence of formal QA policies may not necessarily lead to effective implementation and quality improvement (Buzogany & Pülzl, 2024).

Institutional Theory

Institutional Theory is a complementary perspective that emphasizes the role of formal laws, regulations, standards, procedures, and informal norms in shaping organizational behavior and performance (Bardakci et al., 2023; Shakir et al., 2026). In higher education, QA is structured through standards, accreditation, evaluation mechanisms, internal QA systems, and government oversight (Garcia & Jamias, 2023; Jami & Muharam, 2022). The theory suggests that formal QA structures are more effective when responsibilities, coordination, implementation, and accountability are clearly established. Where these conditions are weak, a gap may emerge between formal requirements and actual practice, potentially encouraging greater emphasis on documentation and compliance than substantive quality improvement(Ahmadi et al., 2025; Bardakci et al., 2023; Manning, 2024). Institutional coordination is therefore relevant to H4 because effective communication, monitoring, and coordination between policy authorities and universities may be associated with differences in perceived QA effectiveness.

Governance Failure

Governance Failure is a complementary analytical concept that explains situations in which government and institutional structures are unable to effectively perform functions such as regulation, coordination, monitoring, accountability, and decision-making (Ebrahimi et al., 2025; Manning, 2024). Motadi (2025) emphasizes the importance of coordination, accountability, and decision-making capacity for effective governance. In higher education, governance failure may occur when a gap exists between QA policy formulation and implementation, monitoring is weak, coordination is limited, and evaluation findings are not effectively used for institutional improvement (Azizi et al., 2026; Fahimi, 2023; Mensah, 2022). In this study, implementation and governance constraints are used to explain the potential gap between government capacity and perceived QA effectiveness. Where formal QA policies exist but implementation capacity is limited, a gap may emerge between policy and practice (Austin & Jones, 2024).

Accordingly, the analytical logic of this study can be presented as: Government capacity →

Policy implementation → Institutional coordination → Perceived QA effectiveness

In contrast: Weak government capacity → Policy implementation constraints → Weak monitoring and coordination → Greater emphasis on formal compliance → Lower perceived QA effectiveness

LITERATURE REVIEW

Conceptual Development of Quality Assurance in Higher Education

The concept of quality assurance in higher education has become a major topic of international educational debate since the last decades of the twentieth century(Welch & Aziz, 2022). Initially, quality was mainly associated with the concept of teaching, curriculum, academic standards, and control of educational services, but later its conceptual scope expanded to include aspects of accountability, transparency, institutional reform, continuous evaluation and learning outcomes(Zawak & Wahidi, 2026). In this sense, quality assurance is not just an assessment of the fulfillment of standards, but a continuous institutional process used to improve teaching, research, administration, and learning outcomes. QA is most effective when it is connected to internal evaluation, continuous improvement, institutional learning, and the creation of a quality culture, rather than being a mere instrument of external audit, accreditation, or administrative compliance(Sajid, 2026; Yunespour, 2023). From this perspective, perceived QA effectiveness may also be associated with the institutional and governance environment in which the system is implemented.

The role of the state in Quality Assurance (QA)

The role of the state is one of the main debates in the QA works. Wafa and Muhabat (2026) argue that the state can play a significant role in setting quality standards, establishing accountability, and monitoring the performance of higher education institutions. Conversely, Rahimi and Ayubi (2022) argue that too much direct state control can limit the institutional autonomy of universities and turn QA into a bureaucratic process. In contemporary education systems, the role of the state is largely defined as a regulator, standard-setter, and facilitator, while universities are given relative autonomy to manage internal quality(Rohmah & Choiruddin. Limited government capacity for QA implementation may create a gap between QA policy design and practical implementation. Hence, the role of the state should be analyzed not only from the perspective of “intervention” or “non-intervention”, but also in terms of the state’s organizational, administrative, financial, technical, and implementation capacity(Azizi et al., 2026; Stanikzai et al., 2025).

Institutional structures and Quality Assurance (QA)

The effectiveness of QA is related to the institutional environment in which they are implemented, in addition to formal regulations. Laws, policies, standards and procedures form the formal framework for QA, but institutional culture, professional norms, internal coordination and decision-making methods influence how this framework is implemented(Rahimi & Ayubi, 2022; Wafa & Muhabat, 2026). Zawak and Wahidi (2026) show that QA systems face problems when the focus of evaluation is on administrative compliance and documentary evidence rather than on actual quality. Stanikzai et al. (2025) also show that weak internal QA systems, limited data management capacity, and limited stakeholder participation in decision-making create obstacles to continuous quality improvement. Thus, the establishment of formal institutions is not enough for QA; effective institutional capacity and coordination are also necessary for these institutions to function.

Government capacity for QA implementation

Government capacity is essential to the effectiveness of QA because the existence of policies and laws alone does not ensure effective implementation, monitoring, and evaluation (Sajid, 2025). Perceived QA effectiveness may therefore be associated with government capacity in areas such as human and financial resources, information management, regulation, monitoring, evaluation, and institutional coordination (Fahimi, 2023; Shakir et al., 2026). Jafari (2023) argues that when QA focuses primarily on documentation and administrative compliance rather than learning outcomes, its perceived contribution to quality improvement may be reduced. Similarly, limited financial and administrative resources, weak management, and capacity constraints can undermine quality systems (Faizi, 2026). Research in Afghanistan also highlights challenges related to capacity, resources, and management in higher education (Ahmadi et al., 2025). Overall, the literature indicates that effective QA requires both appropriate standards and sufficient government and institutional capacity to implement them.

Policy Implementation Gap and Implementation and governance constraints

A key challenge for QA in weak governance and institutional environments is the gap between formal policies and their practical implementation. This occurs when QA policies and standards exist, but institutional capacity for implementation, monitoring, and improvement remains limited(Ebrahimi et al., 2025; Fahimi, 2023). Azizi et al. (2026) argue that such conditions may make QA more compliance-oriented, with universities emphasizing documentation and formal requirements rather than substantive quality improvement. Similarly, when evaluation findings are not effectively connected to policy, budgeting, management, and pedagogical reforms, the potential of QA to support institutional improvement is reduced(Faizi et al., 2026; Jami & Muharam, 2022). Thus, the policy implementation gap provides an important lens for understanding the relationship between government capacity and perceived QA outcomes.

Quality Assurance in Higher Education in Conflict-Affected and Fragile Countries

Higher education systems in conflict-affected and fragile countries face challenges including limited financial resources, shortages of professional staff, weak institutions, policy instability, inadequate infrastructure, and limited government regulatory capacity(Auzarmi, 2023; Jafari, 2023). Azizi et al. (2026) show that educational reforms in such contexts are more sustainable when adapted to local conditions and institutional capacities. Conversely, transferring foreign quality models without considering local capacities may widen the policy–implementation gap(Ahmadi et al., 2025; Kayen et al., 2025). Therefore, QA should be assessed in relation to both local governmental and institutional capacities and international standards.

Existing literature on higher education in Afghanistan has largely focused on access, funding, reconstruction, human resources, curriculum, and system development, while empirical evidence on the practical effectiveness of QA from a government-capacity perspective remains limited (Faizi, 2026; Imranullah et al., 2025; Jafari, 2023). Wafa and Muhabat (2026) further identify challenges in quality, capacity, administration, and system development. However, the relationship between government capacity, institutional coordination, and QA implementation remains understudied, particularly at the provincial level (Fahimi, 2023; Serrano et al., 2025). Three gaps are evident: limited attention to government capacity as a factor in perceived QA effectiveness, insufficient examination of the policy–practice gap in fragile contexts, and limited empirical evidence from Nangarhar. This study addresses these gaps by examining QA implementation through the lens of government capacity and policy implementation in higher education institutions in Nangarhar.

METHODOLOGY

Research Design

This study employed a quantitative, descriptive-analytical, cross-sectional survey design to assess government-led quality assurance (QA) in higher education institutions in Nangarhar and examine the relationships among government capacity, institutional coordination, and perceived QA effectiveness. Data were collected through an online questionnaire during August 2025–April 2026.

Study Area, Participants, and Sampling

The study was conducted in eight private higher education institutions in Nangarhar province, Afghanistan: Alfalah, Al-Taqwa, Amir Ali Shir Nawai, Rokhan, Tabesh, Ariana, Spin Ghar, and Khorasan universities. The target population comprised academic and administrative staff with relevant experience or direct involvement in teaching, administration, quality assurance, evaluation, or related university processes. A target sample of 240 employees was established through equal allocation of 30 employees from each of the eight participating institutions to include participants from all institutions. Purposive sampling was then used to select employees who met the study's eligibility criteria. The questionnaire was distributed through Google Forms. Of the 240 targeted participants, 149 provided complete and analyzable responses, yielding a 62.1% response rate. The final analytical sample was therefore n = 149.

Data Collection Instrument

Data were collected using a structured questionnaire developed from previous research and the theoretical literature on QA, government capacity, institutional coordination, and government oversight. The instrument covered respondent characteristics, QA policies and standards, government oversight, institutional capacity, training, information systems, internal evaluation, coordination, perceived QA effectiveness, equity, inclusion, and compliance. For analysis, Likert-scale responses were coded from 1 (strongly disagree) to 5 (strongly agree). Where categorical variables were required, the categories were formed using predefined score ranges. For the three-level coordination analysis, scores were categorized as low (1.00–2.33), moderate (2.34–3.66), and high (3.67–5.00), based on the five-point scale.

Validity and Reliability of the Instrument

Content validity was assessed through expert review by specialists in higher education, public policy, and quality assurance. Items considered insufficiently relevant were revised or removed. Internal consistency was assessed using Cronbach's Alpha, with the overall reliability coefficient of $\alpha = 0.82$, indicating acceptable reliability for social science research. Because construct-specific reliability coefficients were not retained in the available study records, only the overall Cronbach's alpha ($\alpha = 0.82$) is reported here.

Data Analysis and χ^2 Assumptions

Data were analyzed using SPSS. Frequencies, percentages, means, and standard deviations were used for descriptive analysis, while the chi-square (χ^2) test was used to examine associations between categorical variables at a 0.05 significance level. Degrees of freedom, expected cell counts, and Cramér's V were examined and reported for the χ^2 tests. Findings were interpreted using the study's State Capacity Theory, Top-down Policy Implementation perspective, and Institutional Theory. The hypotheses were tested based on the statistical significance of the corresponding associations, with $p < .05$ considered statistically significant. For the three hypothesis tests, the reported associations were evaluated using χ^2 (1), with Cramér's V used as the effect-size measure. The reported χ^2 tests yielded Cramér's V values of 0.252 for H1, 0.219 for H2, and 0.206 for H3, indicating relatively small to moderate associations. All expected cell counts met the minimum assumption for the χ^2 tests. Differences in perceived QA effectiveness across the three institutional coordination groups were examined using one-way ANOVA, with η^2 reported as the effect-size measure.

Ethical Considerations and AI Disclosure

Participation was voluntary, and respondents were informed of the purpose of the study before completing the questionnaire. Responses were treated confidentially and used for research purposes only. AI tools were used for language editing and manuscript organization. The authors remained responsible for the research design, data analysis, interpretation, and final manuscript.

RESULTS

The results provide support for all three hypotheses examined in the study. H1 was supported, as human capacity was significantly associated with perceived QA effectiveness ($\chi^2 = 9.47$, $p = .003$). H2 was also supported, with a significant association between professional training and QA outcomes ($\chi^2 = 7.12$, $p = .008$). Similarly, H3 was supported because financial support was significantly associated with perceived QA reforms ($\chi^2 = 6.35$, $p = .012$). Since all p-values were below the 0.05 significance level, the three null hypotheses were rejected.

Table 1. *Demographic Profile of Respondents (n = 149)*

Measure/Category	Description	Value / Observation
Sample Size	Total valid respondents	149 (100%)
Institution Type	Type of participating institution	Private Universities: 149 (100%)
Position	Professional position of respondents	Academic Staff: 91 (61.1%); Administrative Staff: 58 (38.9%)
Quality Assurance Experience	Years of experience in QA-related activities	Less than 5 years: 96 (64.4%); 5 years and above: 53 (35.6%)
Educational Level	Highest educational qualification	Bachelor's Degree: 116 (77.85%); Master's Degree: 21 (14.09%); Doctoral Degree: 12 (8.05%)
Total	All valid responses	149 (100%)

Table 1 shows that all 149 participants (100.0%) were from 8 private universities in Nangarhar. By job title, 91 (61.1%) were academic staff and 58 (38.9%) were administrative staff, and 64.4% of participants had less than five years of QA experience. This table summarizes the distribution of respondents across institutions and professional groups. The participants had relevant experience or direct involvement in university and quality assurance processes.

Table 2: *Awareness and Perceptions of QA Policies (n = 149)*

Measure/Category	Description	Value / Observation
Recognition of QA Importance	Participants' recognition of the importance of quality assurance	Agree: 78.5%; Neutral: 12.1%; Disagree: 9.4%; Mean = 4.02
Clarity of QA Policies	Perceived clarity of Ministry of Higher Education QA policies	Agree: 46.3%; Neutral: 28.9%; Disagree: 24.8%; Mean = 3.11
Trust in QA Effectiveness	Participants' perceived trust in the effectiveness of QA	Agree: 39.6%; Neutral: 27.5%; Disagree: 32.9%; Mean = 2.98

Table 2 shows that the perception of the importance of QA is the highest (Mean=4.02), with 78.5% of participants agreeing; however, the clarity of the ministry's QA policies is Mean=3.11, and trust in QA is Mean=2.98. These findings indicate relatively high recognition of the importance of QA alongside comparatively lower perceptions of policy clarity and trust in the existing system.

Table 3. *Institutional Capacity for Quality Assurance (n = 149)*

Measure/Category	Description	Value / Observation
Adequate Human Resources for QA	Participants' perception of whether sufficient human resources are available for QA	Yes: 32.2%; No: 67.8%
Professional Training for QA	Availability of professional training related to QA	Yes: 41.6%; No: 58.4%
Internal Quality Assessment System	Perceived availability of an internal quality assessment system	Yes: 45.0%; No: 55.0%
Information Management System	Perceived availability of an information management system for QA	Yes: 38.9%; No: 61.1%

Table 3 shows that only 32.2% of the participants confirmed the existence of sufficient human resources, while 67.8% denied it. Also, the "no" answers in the areas of professional training, internal evaluation, and information management are 58.4%, 55.0%, and 61.1%, respectively. These findings suggest perceived weaknesses in institutional and technical capacity relevant to QA implementation.

Table 4. *Hypothesis Testing: Associations and Group Differences in Perceived QA Outcomes*

Hypothesis	Relationship / Comparison	Test	Statistic	df	p	Effect Size
H1	Human capacity × perceived QA effectiveness	Chi-square	$\chi^2 = 9.47$	1	.003	Cramér's V = .252
H2	Professional training × perceived QA outcomes	Chi-square	$\chi^2 = 7.12$	1	.008	Cramér's V = .219
H3	Financial support × perceived QA reforms	Chi-square	$\chi^2 = 6.35$	1	.012	Cramér's V = .206
H4	Perceived institutional coordination × perceived QA effectiveness	One-way ANOVA	F = 58.93	2, 146	< .001	$\eta^2 = .447$

Table 4 shows significant associations between human capacity and perceived QA effectiveness (χ^2 (1) =9.47, p=.003, Cramér's V=.252), professional training and perceived QA outcomes (χ^2 (1) =7.12, p=.008, Cramér's V=.219), and financial support and perceived QA reforms (χ^2 (1) =6.35, p=.012, Cramér's V=.206). All analyses used 2×2 contingency tables, and expected cell counts were checked. These findings indicate associations rather than causal effects.

Table 5. *Government Oversight and Institutional Coordination in Quality Assurance*

Government Oversight and Coordination Indicators	Agree (%)	Neutral (%)	Disagree (%)	Mean
QA guidelines and standards are clearly communicated to higher education institutions	40.3	27.5	32.2	3.08
QA evaluation results are used in institutional and policy decision-making	35.6	28.2	36.2	2.96
Coordination between government authorities and higher education institutions is effective	38.9	26.8	34.3	3.01
There is consistency between formal QA standards and their implementation	37.6	29.5	32.9	3.04
Government provides adequate technical support for QA implementation	34.9	28.9	36.2	2.94

Table 5 shows that agreement levels across the five indicators ranged from 34.9% to 40.3%, while disagreement ranged from 32.2% to 36.2%. The results indicate mixed perceptions of government oversight and institutional coordination. The lowest mean was reported for government technical support (Mean = 2.94), followed by the use of QA evaluation results in institutional and policy decision-making (Mean = 2.96).

Table 6. *Perceived Effectiveness of Quality Assurance on Educational Outcomes*

Quality Assurance Outcome Indicators	Agree (%)	Neutral (%)	Disagree (%)	Mean
QA mechanisms have improved teaching quality	36.9	28.9	34.2	3.02
QA has contributed to improvement in research performance	36.9	30.2	32.9	2.91
QA has improved students' learning outcomes	37.6	30.9	31.5	2.88
QA has contributed to institutional improvement	38.3	29.5	32.2	3.06
QA has promoted continuous quality improvement	36.2	28.9	34.9	2.95

Table 6 shows that participants reported relatively low perceived effectiveness of QA in relation to teaching, research, and student learning outcomes, and the average scores on the relevant indicators are relatively low. The findings reflect respondents' perceptions of QA effectiveness in relation to teaching, research, learning outcomes, and institutional improvement. Overall, the findings suggest that respondents perceive existing QA mechanisms as having limited effectiveness in translating administrative evaluation into broader institutional and educational improvement.

Table 7. *Institutional Coordination and perceived Quality Assurance Effectiveness*

Level of Institutional Coordination	n	QA Effectiveness Mean	SD
Low coordination	45	2.41	0.62
Moderate coordination	52	3.07	0.71
High coordination	52	3.89	0.68
Total	149		
One-way ANOVA: $F(2, 146) = 58.93$, $p < .001$, $\eta^2 = .447$			

Table 7 shows higher perceived QA effectiveness across the three levels of institutional coordination. The mean perceived QA effectiveness score was 2.41 (SD = 0.62) among respondents reporting low coordination, 3.07 (SD = 0.71) among those reporting moderate coordination, and 3.89 (SD = 0.68) among those reporting high coordination. A one-way analysis of variance indicated a statistically significant difference in perceived QA effectiveness across the three coordination groups, $F(2, 146) = 58.93$, $p < .001$, with a large effect size ($\eta^2 = .447$). These findings indicate that perceived QA effectiveness differs significantly across coordination levels, with higher coordination associated with higher perceived QA effectiveness.

Table 8: *Equity, Access, and Inclusion in Quality Assurance*

Equity, Access, and Inclusion Indicators	Agree (%)	Neutral (%)	Disagree (%)	Mean
QA standards adequately address equitable access to higher education	34.2	28.9	36.9	2.94
The needs of disadvantaged groups are considered in QA processes	29.5	30.2	40.3	2.82
Socioeconomic differences are reflected in QA standards	31.5	29.5	39.0	2.87
QA mechanisms adequately promote inclusion	33.6	28.2	38.2	2.91
Equity and inclusion are considered in institutional evaluation	30.9	29.5	39.6	2.86

Table 8 shows that indicators related to justice, equal access, and inclusiveness received relatively lower perceptions in the existing quality assurance system. These findings represent participants' perceptions of the extent to which equity and inclusion are reflected in QA processes.

Table 9: *Formal Compliance and the Implementation of Quality Assurance*

Symbolic Compliance Indicators	Agree (%)	Neutral (%)	Disagree (%)	Mean
QA processes place strong emphasis on documentation and reporting	68.5	17.4	14.1	3.82
Institutions focus on fulfilling formal QA requirements	64.4	19.5	16.1	3.74
QA evaluations are conducted mainly to meet official requirements	61.7	20.8	17.5	3.68
Evaluation findings are rarely translated into substantive institutional reforms	63.1	21.5	15.4	3.76
QA focuses more on compliance than continuous improvement	65.8	18.1	16.1	3.78

Table 9 shows that quality assurance is perceived to place greater emphasis on documentation, reports, and meeting formal standards, while assessment results are perceived to be used to a lesser extent for improvement. The relatively high agreement percentages suggest that respondents perceive greater emphasis on formal compliance and documentation than on continuous improvement.

DISCUSSION

The findings indicate that perceived QA effectiveness in higher education institutions in Nangarhar is associated with the capacity and conditions under which formal perceived QA policies are implemented. Although participants reported high recognition of the importance of QA (Mean = 4.02), weaker perceptions were observed regarding policy clarity, human resources, training, financial support, information systems, and the practical use of evaluation results. These findings suggest that formal perceived QA policies alone may not ensure effective institutional implementation.

H1: Human Capacity and QA Effectiveness

H1 was supported, as the analysis showed a statistically significant association between human capacity and perceived QA effectiveness (χ^2 (1) = 9.47, $p = .003$, Cramér's V = .252). This finding supports the State Capacity Theory, which emphasizes adequate administrative, professional, organizational, and technical capacity for effective policy implementation. This finding is consistent with previous studies identifying human-resource and institutional-capacity constraints in Afghan higher education (Rahimi & Ayubi, 2022; Kayen et al., 2025). The present study extends this literature by providing quantitative evidence from Nangarhar that perceived human capacity is significantly associated with perceived QA effectiveness. However, because the study is cross-sectional, this association should not be interpreted as evidence that stronger human capacity causes higher perceived QA effectiveness.

H2: Professional Training and QA Outcomes

H2 was also supported, with a statistically significant association between professional training and perceived QA outcomes (χ^2 (1) = 7.12, $p = .008$, Cramér's V = .219). This finding is consistent with previous research emphasizing staff development and institutional capacity (Fahimi, 2023; Serrano et al., 2025). Training may strengthen understanding of QA standards and evaluation procedures; however, leadership, organizational culture, resources, and staff experience may also influence QA perceptions. Thus, the finding suggests that professional training is an important capacity-related condition for QA implementation, while the observed association should not be interpreted causally.

H3: Financial Support and QA Reforms

H3 was supported because financial support was significantly associated with perceived QA reforms ($\chi^2(1) = 6.35$, $p = .012$, Cramér's V = .206). This finding is consistent with evidence that financial and technical constraints can weaken QA implementation (Motadi, 2025; Austin & Jones, 2024). Adequate financial support may provide institutions with the resources needed for training, information systems, evaluation activities, and other QA-related reforms. Nevertheless, the cross-sectional design does not permit a causal conclusion that financial support directly produces perceived QA reforms.

Institutional Coordination and QA Effectiveness

Institutional coordination also supports the study's analytical framework. Perceived QA effectiveness differed significantly across the three levels of institutional coordination, with mean scores increasing from low to moderate and high coordination groups ($F(2, 146) = 58.93$, $p < .001$, $\eta^2 = .447$). This pattern is consistent with the Top-down Policy Implementation perspective, which emphasizes communication, coordination, monitoring, and feedback between policy-making authorities and implementing institutions. It also aligns with Institutional Theory, which suggests that formal rules are more effective when responsibilities and coordination mechanisms are clear. However, because the study is cross-sectional, this statistically significant difference should not be interpreted as evidence of a causal relationship between institutional coordination and perceived QA effectiveness.

CONCLUSION

This study shows that formal policies, standards, and institutional structures for quality assurance in higher education exist in Nangarhar province, but their practical effectiveness faces significant limitations. The findings of the study indicate that awareness of the importance of quality assurance is relatively high, but weak human and institutional capacity, limited professional training, weak institutional coordination, and limited use of assessment results have led to QA remaining largely oriented towards formal compliance. From the perspective of State Capacity Theory, the findings indicate that the success of quality assurance is not only related to the existence of policy, but also to the capacity of the state and universities to implement it. From an Institutional Theory perspective, weak institutional coordination may limit the effective implementation of formal standards and reduce the capacity of institutions to translate formal QA requirements into substantive quality improvement. In conclusion, to strengthen Nangarhar's quality assurance, the focus should shift from formal evaluation to capacity building, professional training, institutional coordination, information sharing, and practical application of evaluation results. In this way, quality assurance can be transformed from a compliance-oriented system to an improvement-oriented mechanism. In academic terms, research shows that the effectiveness of quality assurance in weak and conflict-affected higher education systems depends more on government capacity, institutional coordination, and local conditions than on the existence of standards.

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Preparedness of Teachers for AI-Mediated Classrooms: Gaps in Skills Confidence and Ethical Issues in Teaching with AI

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Abstract: Artificial intelligence (AI) is reshaping teaching, assessment, and professional practice, but effective classroom integration depends on teachers' preparedness. This study examined the self-reported preparedness of secondary school teachers for AI-mediated classrooms and tested the predictive associations of AI-related skills gaps, professional confidence, and ethical concerns with preparedness. A quantitative cross-sectional survey was conducted with 296 public secondary school teachers in Gusau metropolis, Zamfara State, Nigeria, selected from a population of 1,800 through multistage sampling. Data were analysed using descriptive statistics and regression. Teachers reported high overall preparedness ($M = 2.69$, $SD = 0.56$) and professional confidence ($M = 2.76$, $SD = 0.54$), alongside moderate AI-related skills gaps ($M = 2.41$, $SD = 0.58$) and ethical concerns ($M = 2.63$, $SD = 0.61$). In the combined model, professional confidence was the strongest positive predictor of preparedness ($\beta = 0.41$, $p < .001$), whereas skills gaps ($\beta = -0.29$, $p < .001$) and ethical concerns ($\beta = -0.18$, $p < .001$) were negative predictors. The model explained 46% of the variance in preparedness. The findings support professional development that integrates AI pedagogy, confidence-building, and ethical literacy for secondary teachers.
Keywords: AI in education, teacher preparedness, secondary education, professional confidence, AI ethics.

Introduction

Artificial intelligence is becoming part of educational practice through generative AI, automated assessment, learning analytics, intelligent tutoring, and other data-driven tools. These developments can support differentiated instruction, feedback, lesson preparation, and administrative work, but they also alter teachers' professional responsibilities and require new forms of judgment about accuracy, pedagogy, privacy, bias, and learner protection (Holmes et al., 2019; UNESCO, 2023; U.S. Department of Education, 2023). UNESCO's AI competency framework for teachers further emphasizes that meaningful use of AI requires a human-centred mindset, ethical competence, AI foundations and applications, AI pedagogy, and professional learning rather than basic digital literacy alone (UNESCO, 2024).

Recent evidence places teacher preparedness at the centre of responsible AI adoption. Granström and Oppi (2025), in a large survey of Estonian teachers, found that readiness and perceived usefulness were closely associated with teachers' reported use of AI, while limited training opportunities and AI-related anxiety remained barriers. A systematic review by Tan et al. (2025) similarly shows that teachers' professional development needs extend beyond tool use to pedagogical integration and continuing professional learning. Research on K-12 teachers further shows that TPACK readiness and attitudes are important when planning AI-related teacher development (Yue et al., 2024), while broader reviews of teachers' engagement with AI identify both pedagogical opportunities and implementation challenges (Celik et al., 2022). These findings make it important to distinguish what teachers can do with AI from how confident they feel about doing it and what ethical reservations shape their willingness to use it. Research on educational technology also shows that teacher technology acceptance and self-efficacy remain important conditions for classroom integration (Scherer et al., 2021; Tondeur et al., 2018).

Secondary school teachers warrant particular attention. They teach subject-specialist curricula, make frequent assessment decisions, and work with school-age learners whose data protection, academic integrity, and developmental needs heighten the consequences of inappropriate AI use. Ethical questions are especially salient in K-12 contexts, where concerns include privacy, bias, transparency, surveillance, accountability, and the protection of children's interests (Akgun & Greenhow, 2022; Gouseti et al., 2025; Wieczorek et al., 2025). At the same time, school systems in resource-constrained contexts may have uneven access to infrastructure, professional development, and institutional guidance, creating a setting in which psychological readiness can coexist with technical or ethical uncertainty. This concern is consistent with wider scholarship on AI and education, which emphasizes that AI adoption brings pedagogical opportunities alongside governance, privacy, accountability, and professional-role questions (Ouyang & Jiao, 2021; Selwyn, 2019; Williamson & Eynon, 2020).

The empirical gap is therefore not simply whether teachers are favourable toward AI. Existing literature has often considered technology acceptance, general digital competence, or broad AI opportunities, while fewer studies have examined secondary teachers' preparedness as an outcome that is simultaneously related to perceived AI-related skills gaps, AI-specific professional confidence, and ethical concerns, particularly in a Nigerian public-school context. The present study addresses that gap using data from secondary school teachers in Gusau metropolis, Zamfara State. It treats preparedness as a distinct outcome and examines the extent to which the three predictor domains are associated with it, without making causal claims from cross-sectional data. Studies of AI applications and digital transformation have documented rapid expansion of AI-related educational practices, but much of the literature has focused on applications, higher education, or general technology adoption rather than the combined preparedness of secondary teachers (Boateng et al., 2023; Chen et al., 2020; Zawacki-Richter et al., 2019).

THEORETICAL AND CONCEPTUAL FRAMEWORK

The study is guided primarily by the Technological Pedagogical Content Knowledge (TPACK) framework, which holds that effective technology integration depends on the interaction of technological, pedagogical, and content knowledge (Mishra & Koehler, 2006). In an AI-mediated classroom, this integration includes selecting appropriate AI tools, interpreting AI-generated outputs, incorporating AI into lesson planning, and evaluating whether AI use supports subject-specific learning goals. AI-related skills gaps are therefore conceptualized as perceived deficits in the technological-pedagogical competencies needed to integrate AI into instruction. The broader TPACK literature emphasizes the integration of technological, pedagogical, and content knowledge rather than isolated technical proficiency (Koehler et al., 2014).

Professional confidence is treated as an AI-specific self-efficacy construct rather than as a synonym for competence or preparedness. Bandura's (1997) self-efficacy theory provides the general theoretical basis for understanding beliefs about one's capability to perform a task; it is not used here as direct evidence about AI. Recent AI-specific empirical evidence indicates that teachers who report greater readiness and confidence are more likely to use AI tools and perceive them as useful (Granström & Oppi, 2025). In this study, professional confidence refers to teachers' belief that they can use, experiment with, and manage AI-supported instruction. Preparedness, by contrast, is the broader outcome: teachers' perceived capacity to plan, conduct, and evaluate teaching in an AI-mediated environment.

Ethical concerns constitute a third, AI-specific predictor domain. AI introduces risks that are not reducible to technical skill, including data privacy, algorithmic bias, opacity, accountability, and possible erosion of professional autonomy. The UNESCO (2024) framework positions ethics and human agency as core teacher competencies, while evidence from K-12 literature shows that ethical concerns are integral to decisions about whether and how AI should be used with school-age learners (Gouseti et al., 2025). Ethical concerns are therefore conceptualized as perceived risks and unresolved uncertainties that may constrain teachers' sense of preparedness even when confidence is relatively high.

The conceptual model consequently distinguishes four constructs. AI-related skills gaps represent perceived deficits in AI-related pedagogical competence; professional confidence represents AI-specific self-efficacy; ethical concerns represent perceived risks surrounding responsible use; and preparedness is the perceived capacity to plan, implement, and evaluate instruction in AI-mediated classrooms. The model proposes that the three predictor domains are associated with preparedness, with the direction and strength of those associations determined empirically.

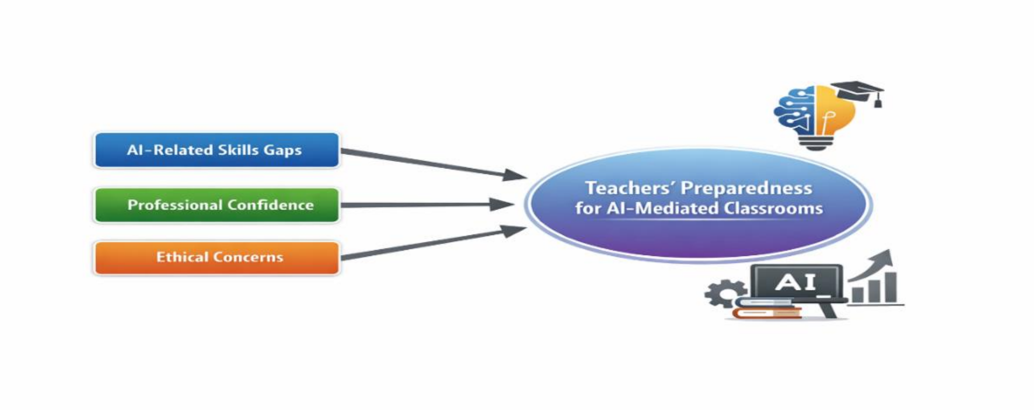

Figure 1. Conceptual framework for teachers' preparedness for AI-mediated classrooms.

In Figure 1, AI-related skills gaps, professional confidence, and ethical concerns are modelled as conceptually distinct predictors of teachers' preparedness. The framework does not assume that all predictors operate in the same direction; regression analysis is used to estimate their individual and joint predictive associations.

Research Objectives

The main purpose of the study was to examine secondary school teachers' preparedness for AI-mediated classrooms and the predictive associations of AI-related skills gaps, professional confidence, and ethical concerns with preparedness. Specifically, the study sought to:

1. determine the level of teachers' preparedness for AI-mediated classrooms;
2. determine the level of teachers' AI-related skills gaps;
3. determine the level of teachers' professional confidence in using AI for teaching;
4. determine the level of teachers' ethical concerns regarding AI-mediated teaching; and
5. examine the individual and joint predictive associations of AI-related skills gaps, professional confidence, and ethical concerns with teachers' preparedness for AI-mediated classrooms.

Research Questions

1. What is the level of teachers' preparedness for AI-mediated classrooms?
2. What is the level of teachers' AI-related skills gaps?
3. What is the level of teachers' professional confidence in using AI for teaching?
4. What is the level of teachers' ethical concerns regarding AI-mediated teaching?
5. To what extent do AI-related skills gaps, professional confidence, and ethical concerns individually and jointly predict teachers' preparedness for AI-mediated classrooms?

Research Hypotheses

H01: AI-related skills gaps do not significantly predict teachers' preparedness for AI-mediated classrooms.

H02: Professional confidence does not significantly predict teachers' preparedness for AI-mediated classrooms.

H03: Ethical concerns do not significantly predict teachers' preparedness for AI-mediated classrooms.

H04: AI-related skills gaps, professional confidence, and ethical concerns do not jointly predict teachers' preparedness for AI-mediated classrooms.

METHODS

Research Design

The study employed a quantitative cross-sectional survey design. This design was appropriate for describing teachers' self-reported preparedness, AI-related skills gaps, professional confidence, and ethical concerns at one point in time and for estimating statistical associations among those variables. Because the data were cross-sectional and non-experimental, regression coefficients are interpreted as predictive associations rather than causal effects.

Population and Sampling

The study population comprised 1,800 teachers in public secondary schools in Gusau metropolis, Zamfara State, Nigeria, and the final analytic sample comprised 296 teachers. Secondary school teachers were selected because they are directly responsible for subject-specific instruction and assessment while working with school-age learners for whom responsible data use, academic integrity, and pedagogical oversight are particularly important when AI tools are introduced. A multistage sampling procedure was used. Public secondary schools in the metropolis were first listed, the achieved sample was distributed across schools in relation to teacher population, and individual teachers were selected through simple random sampling. This procedure was intended to distribute participation across schools while reducing selection bias at the individual-teacher level. Because the available study documentation does not establish a separate a priori sample-size calculation, no unsupported claim about the derivation of the sample size is made.

Research Instrument

Data were collected with a structured questionnaire titled Teachers' Preparedness for AI-Mediated Classrooms Questionnaire (TPAIMCQ). The questionnaire operationalized four constructs that corresponded to the conceptual framework: AI-related skills gaps, professional confidence, ethical concerns, and preparedness. The skills-gap section covered areas such as selecting AI tools, integrating AI into lesson planning, interpreting AI-generated outputs, and data literacy. The professional-confidence section assessed teachers' perceived capability and comfort in using and managing AI-supported lessons. The ethical-concerns section addressed privacy, bias, transparency, and teacher autonomy. The preparedness section assessed perceived readiness to plan, integrate, and ethically manage AI-supported instruction. Items were rated on a four-point Likert scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with no neutral midpoint.

The TPAIMCQ was author-developed for this study rather than adopted as a single pre-existing scale. The initial item pool was generated from the study's conceptual definitions and the literature underpinning the four domains. Items on AI-related pedagogical skills were informed by the TPACK framework (Mishra & Koehler, 2006; Koehler et al., 2014) and AI-literacy literature (Ng et al., 2021); professional-confidence items were framed as AI-specific self-efficacy with Bandura (1997) providing the general self-efficacy foundation; ethical-concern items were informed by AI-in-education guidance and K-12 ethics literature (Akgun & Greenhow, 2022; Gouseti et al., 2025; UNESCO, 2024; Wieczorek et al., 2025); and preparedness items were generated to reflect the capacity to plan, implement, and evaluate AI-mediated instruction. The draft item pool was then subjected to expert review and pilot testing as described below.

Face and content validity were reviewed by experts in Educational Technology, Teacher Education, and Measurement and Evaluation. The review focused on clarity, relevance, alignment of items with the intended construct domains, and appropriateness for secondary school teachers; feedback was used to refine the final instrument. A pilot study involving 30 secondary school teachers was conducted to assess internal consistency. Cronbach's alpha coefficients were 0.82 for AI-related skills gaps, 0.85 for professional confidence, 0.79 for ethical concerns, and 0.83 for preparedness; the overall coefficient was 0.84. These values exceeded the commonly used 0.70 criterion for acceptable internal consistency. Because no factor-analytic validation was conducted, the present evidence supports content alignment and internal consistency rather than a definitive claim of factorial construct validity; this is acknowledged as a measurement limitation.

Data Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS). Means and standard deviations were used to answer Research Questions 1–4. Simple regression analyses were used to test H01-H03, and multiple regression was used to test H04 and answer Research Question 5. Statistical significance was evaluated at alpha = .05. Regression results are interpreted as predictive associations, consistent with the cross-sectional design.

Ethical Procedures

Ethical approval for the study was obtained from the Federal College of Education (Technical), Gusau Research and Publication Ethics Committee (Approval No. FCETG/RPEC/26/013). Permission to conduct the study was also obtained from the relevant school authorities. Participation was voluntary, informed consent was obtained from all participants, and respondents were informed that they could withdraw without penalty. Anonymity and confidentiality were maintained throughout the study, and findings were reported in aggregate form so that individual participants could not be identified.

RESULTS

Research Question 1: What is the level of teachers' preparedness for AI-mediated classrooms?

Table 1. Descriptive statistics for teachers' preparedness for AI-mediated classrooms (n = 296)

Dimension of preparedness	Mean (M)	SD	Interpretation
Instructional readiness for AI use	2.72	0.55	High
Ability to integrate AI into teaching	2.68	0.57	High
Ethical readiness for AI use	2.66	0.58	High
Overall preparedness	2.69	0.56	High

Table 1 shows a high overall level of self-reported preparedness (M = 2.69, SD = 0.56). The three dimensions were similar in magnitude, with instructional readiness recording the highest mean and ethical readiness the lowest.

Research Question 2: What is the level of teachers' AI-related skills gaps?

Table 2. Descriptive statistics for AI-related skills gaps

Skill area	Mean (M)	SD	Interpretation
Ability to select AI tools	2.38	0.61	Moderate
AI integration in lesson planning	2.42	0.59	Moderate
Interpreting AI-generated outputs	2.36	0.62	Moderate
Data literacy for AI use	2.47	0.56	Moderate
Overall skills gap	2.41	0.58	Moderate

Teachers reported a moderate overall AI-related skills gap ($M = 2.41$, $SD = 0.58$). The highest mean gap was in data literacy, while the lowest was in interpreting AI-generated outputs; all four skill areas remained within the moderate category.

Research Question 3: What is the level of teachers' professional confidence in using AI for teaching?

Table 3. Descriptive statistics for teachers' professional confidence in AI use

Confidence indicator	Mean (M)	SD	Interpretation
Confidence in using AI tools	2.78	0.54	High
Comfort experimenting with AI	2.74	0.56	High
Managing AI-supported lessons	2.79	0.52	High
Willingness to continue AI use	2.73	0.55	High
Overall confidence	2.76	0.54	High

Overall professional confidence was high ($M = 2.76$, $SD = 0.54$). Confidence in managing AI-supported lessons had the highest mean, while willingness to continue AI use had the lowest, although all indicators were classified as high.

Research Question 4: What is the level of teachers' ethical concerns regarding AI-mediated teaching?

Table 4. Descriptive statistics for ethical concerns related to AI use

Ethical concern	Mean (M)	SD	Interpretation
Data privacy and security	2.71	0.60	High
Algorithmic bias	2.64	0.63	Moderate
Transparency of AI decisions	2.59	0.61	Moderate
Loss of teacher autonomy	2.57	0.62	Moderate
Overall ethical concerns	2.63	0.61	Moderate

Teachers reported a moderate overall level of ethical concern ($M = 2.63$, $SD = 0.61$). Data privacy and security was the only individual indicator classified as high, suggesting that protection of learner information was the most salient ethical issue measured.

Hypothesis 1: AI-related skills gaps do not significantly predict teachers' preparedness for AI-mediated classrooms.

Table 5. Simple regression of AI-related skills gaps on preparedness

Predictor	B	SE	beta	t	p	R^2
Constant	1.12	0.14	—	8.00	< .001	
AI-related skills gaps	-0.46	0.05	-0.46	-9.20	< .001	0.21

AI-related skills gaps were significantly and negatively associated with preparedness ($beta = -0.46$, $p < .001$). Skills gaps explained 21% of the variance in preparedness ($R^2 = 0.21$). H01 was therefore rejected.

Hypothesis 2: Professional confidence does not significantly predict teachers' preparedness for AI-mediated classrooms.

Table 6. Simple regression of professional confidence on preparedness

Predictor	B	SE	beta	t	p	R^2
Constant	0.98	0.13	—	7.54	< .001	
Professional confidence	0.52	0.05	0.52	10.40	< .001	0.27

Professional confidence was significantly and positively associated with preparedness (beta = 0.52, $p < .001$). Confidence explained 27% of the variance in preparedness ($R^2 = 0.27$). H02 was therefore rejected.

Hypothesis 3: Ethical concerns do not significantly predict teachers' preparedness for AI-mediated classrooms.

Table 7. Simple regression of ethical concerns on preparedness

Predictor	B	SE	beta	t	p	R^2
Constant	1.35	0.16	—	8.44	< .001	
Ethical concerns	-0.31	0.06	-0.31	-5.17	< .001	0.10

Ethical concerns were significantly and negatively associated with preparedness (beta = -0.31, $p < .001$), explaining 10% of the variance ($R^2 = 0.10$). H03 was therefore rejected.

Research Question 5 and Hypothesis 4: To what extent do the three predictors individually and jointly predict preparedness?

Table 8. Multiple regression model predicting teachers' preparedness

Predictor	B	SE	beta	t	p
Constant	0.84	0.12	—	7.00	< .001
AI-related skills gaps	-0.29	0.04	-0.29	-7.25	< .001
Professional confidence	0.41	0.05	0.41	8.20	< .001
Ethical concerns	-0.18	0.05	-0.18	-3.60	< .001

The combined model was statistically significant, $R^2 = 0.46$, $F(3, 292) = 82.90$, $p < .001$, and explained 46% of the variance in preparedness. Professional confidence was the strongest predictor (beta = 0.41), followed by AI-related skills gaps in absolute magnitude (beta = -0.29) and ethical concerns (beta = -0.18). Thus, greater confidence was associated with higher preparedness, whereas larger skills gaps and greater ethical concerns were associated with lower preparedness. H04 was rejected.

DISCUSSION

The purpose of this study was to examine secondary school teachers' preparedness for AI-mediated classrooms and to determine how AI-related skills gaps, professional confidence, and ethical concerns were associated with preparedness. The results show a differentiated pattern: teachers reported high preparedness and high professional confidence, but also moderate skills gaps and moderate ethical concerns. In the combined model, confidence was the strongest positive predictor, while skills gaps and ethical concerns were negative predictors. These findings support a multidimensional interpretation of preparedness rather than a single measure of general technological optimism.

For Research Question 1, the high mean level of preparedness suggests that respondents generally perceived themselves as ready to work in AI-mediated classrooms. This should not be interpreted as evidence of demonstrated competence because preparedness was self-reported. The pattern is broadly consistent with recent teacher-focused evidence showing that many educators express openness to AI and perceive themselves as increasingly ready to use it, especially when they have prior exposure and see practical value in the tools (Granström & Oppi, 2025). In secondary education, such perceived readiness is important because teachers must integrate AI without weakening curricular goals, assessment integrity, or teacher oversight.

Research Question 2 showed moderate AI-related skills gaps, and the regression analysis indicated that larger gaps were associated with lower preparedness. This finding aligns with the TPACK perspective: teachers may be comfortable with technology while still lacking the integrated technological-pedagogical knowledge needed to select, interpret, and use AI effectively within subject teaching (Mishra & Koehler, 2006). It also accords with AI-literacy scholarship that treats effective AI engagement as involving understanding, use, critical evaluation, and ethical awareness rather than tool operation alone (Ng et al., 2021). Recent reviews likewise emphasize that teacher professional development for AI must address pedagogical integration, not simply familiarity with digital tools (Dogan, 2025; Tan et al., 2025). For secondary teachers, targeted support in evaluating AI outputs, lesson design, data literacy, and subject-specific use is therefore more relevant than generic digital-skills training alone. This interpretation is also consistent with literature showing that effective technology integration depends on more than access or basic operational competence (Hinojo-Lucena et al., 2022; Kimmons et al., 2021).

Research Question 3 found high professional confidence, and confidence was the strongest positive predictor in the multiple regression model. Bandura's (1997) theory is relevant here only as a general explanation of self-efficacy: beliefs about capability can shape persistence and willingness to engage with demanding tasks. The AI-specific empirical comparison comes from more recent studies. Granström and Oppi (2025), for example, reported that teachers who had used AI tools rated their readiness and perceived usefulness more highly than non-users. The present findings similarly suggest that confidence may be an important psychological resource for engaging with AI-mediated teaching, although the cross-sectional design cannot establish whether confidence precedes preparedness or develops alongside it. Evidence from technology-acceptance research similarly links teachers' beliefs, self-efficacy, and perceived usability with stronger intentions to integrate technology into practice (Scherer et al., 2021; Tondeur et al., 2018).

Research Question 4 identified moderate ethical concerns, with privacy and security rated most highly. Ethical concerns also had a significant negative predictive association with preparedness. This pattern is especially important in secondary schools because AI use can involve children's data, opaque automated outputs, and decisions that require continued human accountability. Gouseti et al. (2025) identify privacy, bias, transparency, surveillance, and child-centred governance as recurring ethical issues in K-12 AI literature, and Wieczorek et al. (2025) similarly document ethical concerns specifically across primary and secondary education. UNESCO (2024) places ethical judgment and human agency at the core of teacher AI competence. Ethical concern should therefore not be viewed simply as resistance to innovation; it may also reflect appropriate professional caution when clear institutional safeguards are absent. These concerns echo long-standing critiques of datafication and AI in education, particularly around opacity, privacy, accountability, and the redistribution of professional judgment (Selwyn, 2019; Williamson & Eynon, 2020).

Research Question 5 showed that the three predictors jointly explained 46% of the variance in preparedness. The order of predictive strength was professional confidence, AI-related skills gaps, and ethical concerns. This corrected interpretation is important because the negative coefficient for skills gaps was larger in absolute magnitude than the coefficient for ethical concerns. Taken together, the findings suggest that preparedness reflects both enabling and constraining conditions: confidence is positively associated with readiness, while unresolved capability gaps and ethical concerns are negatively associated with it.

Alternative interpretations should also be considered. All four constructs were measured by self-report in the same questionnaire at the same point in time. Professional confidence and perceived preparedness are conceptually related, so part of their strong association may reflect shared method variance or overlap in respondents' self-perceptions. Similarly, teachers who are generally optimistic about technology may rate both confidence and preparedness more highly. The regression model therefore identifies statistical prediction within this dataset, not causal pathways. Future studies should combine self-report with performance-based measures of AI competence, classroom observation, longitudinal designs, and stronger psychometric validation to separate these constructs more clearly.

Implications for Secondary Education

Practical Implications

Professional development for secondary teachers should combine three elements: practical AI pedagogy, structured opportunities to build confidence through guided use, and ethical decision-making. Training should be subject-sensitive and classroom-based, allowing teachers to practise evaluating AI outputs, designing AI-supported activities, protecting learner data, and preserving teacher judgment. Peer mentoring and professional learning communities may help translate general confidence into more reliable classroom competence.

Policy Implications

School leaders and education authorities should provide clear rules for acceptable AI use, data privacy, transparency, assessment integrity, and human oversight. UNESCO's AI competency framework for teachers provides a useful reference because it integrates human-centred values, ethics, AI foundations, pedagogy, and professional learning (UNESCO, 2024). In resource-constrained school systems, policy implementation should also address access to infrastructure and equitable training so that AI preparedness does not depend solely on individual teachers' personal access or initiative.

CONCLUSION

This study examined the self-reported preparedness of public secondary school teachers in Gusau metropolis for AI-mediated classrooms. Teachers reported high preparedness and professional confidence, alongside moderate AI-related skills gaps and ethical concerns. Regression results showed that professional confidence was positively associated with preparedness, whereas skills gaps and ethical concerns were negatively associated with it; together, the three predictors explained 46% of the variance. The findings do not establish causation, but they indicate that teacher preparedness is better understood as a combination of perceived capability, confidence, and responsible-use concerns than as simple willingness to adopt technology. For secondary education, professional development and policy should therefore strengthen AI-specific pedagogy while also supporting confidence, ethical literacy, learner protection, and human oversight.

Recommendations

1. Professional development for secondary school teachers should include subject-relevant AI pedagogy, output evaluation, lesson integration, and data literacy rather than focusing only on basic tool use.
2. Teacher training should include applied AI ethics, particularly data privacy, algorithmic bias, transparency, academic integrity, and maintenance of teacher autonomy and human oversight.
3. School leaders and policymakers should establish clear institutional guidelines for responsible AI use in teaching, assessment, and the handling of learner data.

4. Schools should use mentoring, peer collaboration, and professional learning communities to provide repeated practice that can convert confidence into dependable classroom competence.
5. Education authorities should support equitable access to infrastructure, approved AI tools, and continuing professional development across public secondary schools.

Limitations and Suggestions for Future Research

The study has four main limitations. First, its cross-sectional design does not permit causal inference. Second, the data were self-reported, creating the possibility of social-desirability and common-method bias. Third, professional confidence and preparedness are conceptually related, and the study did not conduct factor-analytic validation to establish their empirical distinctiveness beyond expert content review and internal-consistency estimates. Fourth, the study was conducted in one metropolitan public-school setting, which limits generalizability to other regions, school types, and education levels. Future research should use longitudinal or experimental designs where appropriate, combine self-report with performance-based measures of AI competence and classroom observation, conduct exploratory and confirmatory factor analyses of the instrument, and compare secondary teachers across regions and school contexts. Mixed-methods work could also examine how leadership support, school culture, infrastructure, and policy clarity shape the relationship between confidence, ethical concern, skills, and preparedness.

Declarations

Ethics and consent: Ethical approval was obtained from the Federal College of Education (Technical), Gusau Research and Publication Ethics Committee (Approval No. FCETG/RPEC/26/013). Permission was obtained from the relevant school authorities, participation was voluntary, informed consent was obtained from all participants, and anonymity and confidentiality were maintained.
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