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Opportunities and Challenges of Digital Transformation in Blended Learning: Insights from West African Higher Education

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Graphical Abstract

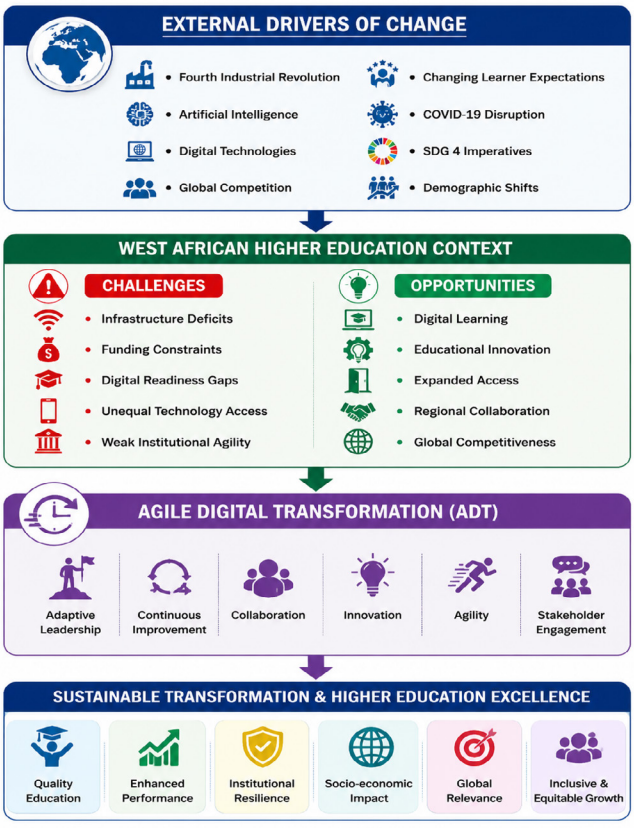
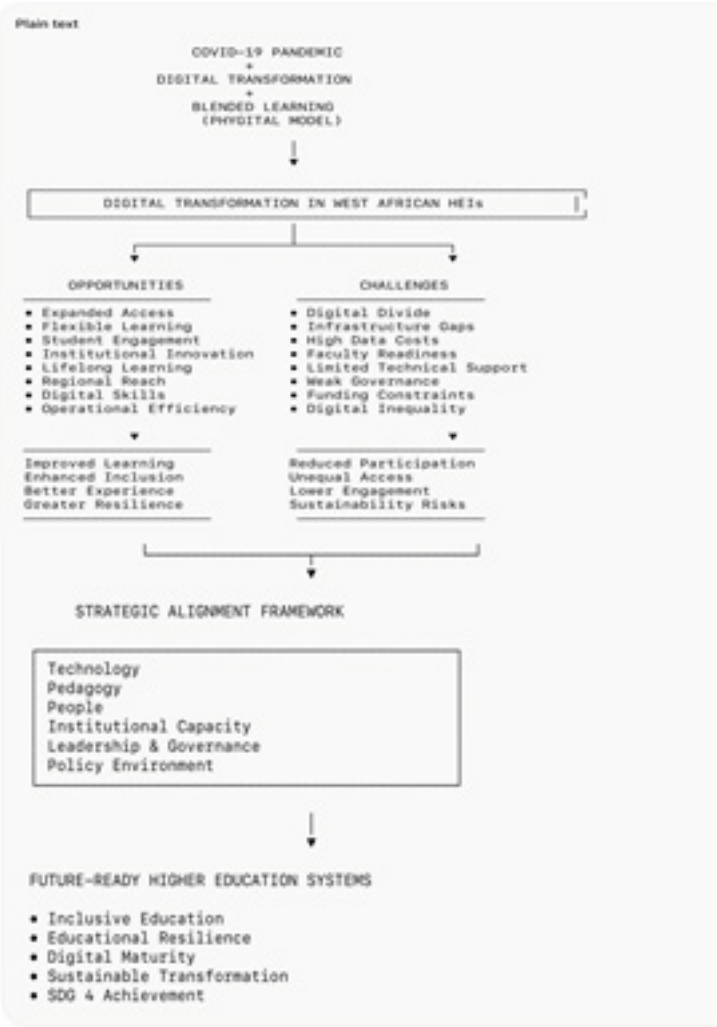


Figure GA1. Graphical Abstract: The Dual Nature of Digital Transformation in Blended Learning

This graphical abstract should become the signature visual of the article because the central contribution of the study is the proposition that digital transformation is a **dual process that simultaneously creates opportunities and reinforces constraints.**



ABSTRACT

The rapid evolution of digital technologies, combined with the systemic disruption caused by the COVID-19 pandemic, has accelerated the adoption of blended learning models in higher education globally. In West Africa, where structural constraints such as limited infrastructure, digital inequality and resource scarcity have historically shaped educational delivery, this transition has introduced both transformative opportunities and complex challenges. This study explores the opportunities and challenges associated with digital transformation in blended or "phygital", learning environments within Higher Education Institutions (HEIs) in West Africa. Drawing on a mixed-method research design, data were collected from 424 stakeholders, including students, faculty, administrators and alumni, across HEIs in the region. The analysis reveals that digital transformation has expanded access to education, enabled flexible learning models, enhanced student engagement and stimulated institutional innovation. However, these gains are constrained by persistent challenges, including the digital divide, infrastructure limitations, inadequate faculty readiness, limited technical support and inconsistent institutional preparedness. The study conceptualises digital transformation in emerging economies as a dual process characterised by simultaneous opportunity creation and constraint reinforcement. It argues that the sustainability of blended learning depends on strategic alignment between technology, pedagogy, institutional capacity, leadership and policy frameworks. The paper contributes to the education and information technology literature by providing context-specific insights into digital transformation in developing regions and offers practical recommendations for leveraging blended learning as a driver of inclusive, resilient and future-ready higher education systems.

Keywords: Blended Learning; Phygital Learning; Digital Transformation; Higher Education Institutions; West Africa; Educational Technology; Digital Divide; Student Engagement; Institutional Innovation.

1. Introduction

Higher education is undergoing a fundamental transformation driven by the convergence of digital technologies, changing learner expectations, labour market shifts, globalisation and large-scale disruptions. Among the most significant developments in this transformation is the rise of blended learning, often described as "phygital learning", which integrates physical classroom experiences with digital learning platforms.

Blended learning has emerged as a strategic response to the limitations of both traditional face-to-face education and fully online instruction. While physical learning environments support direct interpersonal engagement, mentoring, socialisation and immediate feedback, digital learning environments offer flexibility, scalability, accessibility and data-enabled personalisation. Phygital learning therefore seeks to combine the strengths of both models in ways that enhance access, quality and learner engagement.

The COVID-19 pandemic acted as a powerful accelerator of this shift. As campuses closed and physical interaction was restricted, institutions were compelled to adopt digital technologies to ensure continuity of teaching, learning, assessment and administration. In many West African HEIs, this period represented the first large-scale implementation of online and blended learning systems.

In West Africa, the adoption of blended learning has been shaped by a unique set of contextual factors. The region faces significant challenges, including inadequate infrastructure, limited internet connectivity, funding constraints, uneven access to digital devices and disparities in digital competence. At the same time, it presents substantial opportunities for innovation, regional expansion, lifelong learning and inclusive access.

The increasing availability of mobile technologies, expansion of digital networks, growing demand for higher education and rising familiarity with digital tools have created a fertile environment for new educational models. The challenge is no longer whether digital technologies will influence higher education, but how institutions can strategically harness them to improve quality, equity and competitiveness.

This paper examines the opportunities and challenges associated with digital transformation in blended learning within West African HEIs. It is guided by three research questions. First, what opportunities has digital transformation created for blended learning in West African higher education? Second, what challenges constrain the effective implementation of blended learning models? Third, how can institutions strategically align resources, capabilities and policies to maximise benefits and mitigate risks?

By addressing these questions, the study provides a comprehensive understanding of the dynamics of digital transformation in emerging higher education contexts and contributes to debates on the future of learning in West Africa.

2. Literature Review

2.1. Blended and phygital learning in higher education

Blended learning combines face-to-face instruction with online learning components. It is designed to leverage the strengths of both modalities while reducing their limitations. In higher education, blended learning can support flexibility, learner autonomy, collaborative engagement and improved access to learning resources.

The concept of phygital learning extends this idea by emphasising the deliberate integration of physical and digital learning experiences into one coherent educational ecosystem. Phygital learning is not simply the addition of online tools to classroom teaching. Rather, it requires intentional instructional design, digital pedagogy, learner support and institutional readiness.

Chaturvedi, Purohit and Verma argue that online and blended learning became essential during the COVID-19 crisis[1], but their effectiveness depends on learner engagement, technology access and the preparedness of teachers and institutions. This is particularly relevant in West Africa, where digital transformation must be understood within the realities of infrastructure, affordability and inclusion.

2.2. Digital transformation and educational innovation

Digital transformation in education involves the integration of digital technologies into teaching, learning, assessment, governance, administration and stakeholder engagement. It is a multidimensional process that requires changes in strategy, culture, leadership organisational structures and capabilities.

Matt, Hess and Benlian argue that digital transformation strategies require alignment between technology organisational processes and strategic objectives[2]. Similarly, Vial conceptualises digital transformation as a process through which digital technologies trigger significant organisational change, leading to new value creation mechanisms[3].

In the context of blended learning, digital transformation enables new forms of interaction, personalised learning, flexible delivery, digital assessment, learning analytics and data-driven decision-making. However, it also introduces complexities related to system integration, user adoption, cybersecurity, quality assurance, digital literacy and institutional sustainability.

2.3. Opportunities of digital transformation in blended learning

Digital transformation creates several opportunities for HEIs. First, it expands access by enabling institutions to reach learners beyond geographical boundaries. This is particularly important for students in remote communities, working professionals and learners constrained by cost or mobility.

Second, digital transformation enhances flexibility. Learners can access course materials asynchronously, engage in virtual discussions and balance academic work with professional and personal responsibilities. This flexibility supports lifelong learning and continuing professional development.

Third, digital transformation can improve student engagement through multimedia resources, interactive platforms, discussion forums, simulation tools, collaborative technologies and digital feedback systems. These tools can support more active and learner-centred pedagogies.

Fourth, digital transformation can improve institutional efficiency. Digital platforms can streamline registration, assessment, communication, student support and administrative workflows. When effectively implemented, blended learning can reduce operational bottlenecks and improve service delivery.

2.4. Challenges of digital transformation in emerging economies

Despite these opportunities, digital transformation in emerging economies is constrained by several structural and institutional factors. The digital divide remains one of the most significant challenges, as students and faculty do not have equal access to devices, internet connectivity, electricity or digital skills.

Infrastructure gaps also limit the effectiveness of blended learning. Unreliable internet, inadequate learning management systems, limited technical support and weak digital libraries can undermine the learning experience.

Faculty readiness is another major challenge. Blended learning requires educators to design engaging digital content, manage online interactions, use assessment technologies and support learners remotely. Without adequate training, digital platforms may simply reproduce traditional lecture methods in less effective formats.

Institutional readiness also matters. Effective blended learning requires clear strategy, quality assurance mechanisms, digital governance, data protection, financial investment and leadership commitment. In the absence of these conditions, digital transformation may become fragmented, reactive and unsustainable **(Table 1)**.

Table 1: Summary of Literature on Blended Learning and Digital Transformation.

Author	Focus	Key Findings
Matt, et al.[2]	Digital Transformation	Strategy alignment required
Vial[3]	Transformation Theory	Technology drives organisational change
Chaturvedi, et al.[1]	Phygital Learning	Engagement depends on readiness
World Bank[4]	Ed Tech Africa	Infrastructure determine success

3. Theoretical and Conceptual Framework

This study draws on digital transformation theory, blended learning theory and the Integrated Multidimensional Agile Digital Transformation (IMADT) logic developed in Baale's doctoral research. The central assumption is that digital transformation in blended learning is not merely technological; it is strategic organisational, pedagogical and cultural.

The framework views blended learning transformation through five interconnected dimensions. The first is technology, which includes platforms, infrastructure, connectivity, digital tools and data systems. The second is pedagogy, which includes instructional design, learner engagement, assessment and academic support. The third is people, which includes faculty competence, student readiness, administrative capacity and leadership capability.

The fourth dimension is institutional capacity, which includes governance, funding, strategy, quality assurance and technical support. The fifth is context, which includes the socio-economic, infrastructural and policy realities of West Africa.

This conceptual approach recognises that opportunities and challenges are not separate phenomena. In many cases, the same digital transformation process that expands access may also expose inequality. The same technology that increases flexibility may also create exclusion for learners without connectivity. The same blended model that enhances engagement may fail where faculty members are not adequately trained.

End of Section 3 (Theoretical and Conceptual Framework)

Figure 1: Conceptual Model of Opportunities and Challenges in Digital Transformation.

4. Methodology

This study employed a mixed-method research design to explore the opportunities and challenges of digital transformation in blended learning within HEIs in West Africa.

Data were collected through structured questionnaires and open-ended survey responses. The structured questionnaire captured stakeholder perceptions of opportunities, challenges, technology use, learner engagement and institutional readiness. The open-ended responses provided qualitative insight into lived experiences, contextual constraints and practical improvement priorities.

The study included 424 valid respondents drawn from HEIs in West Africa. Respondents included students, faculty members, administrative personnel and alumni. This stakeholder diversity enabled the study to capture multiple perspectives on blended learning transformation.

Quantitative data were analysed using descriptive statistics, while qualitative responses were analysed thematically. This allowed the study to identify both measurable trends and deeper explanatory insights regarding the implementation of digital and blended learning systems **(Table 2)**.

Table 2: Demographic Profile of Respondents.

Category	Frequency	Percentage
Students	170	40.1
Faculty	102	24.1
Administrators	76	17.9
Alumini	76	17.9
Total	424	100

5. Results

Best Location

Beginning of Section 5 (Results)

Figure 2: Blended Learning Transformation Pathway.

5.1. Expanded access to education

One of the most important findings is that digital transformation has expanded access to higher education. Digital platforms enabled institutions to reach learners beyond physical campuses and reduce dependence on classroom-based delivery.

For students in remote locations, working professionals and those facing mobility constraints, blended learning created new pathways for participation. This finding aligns with the broader goal of inclusive education and supports the democratisation of learning in West Africa.

However, expanded access was uneven. Learners with reliable internet, devices and digital competence benefited more than those without such resources. This confirms that access must be understood not only as institutional availability but also as learner capability to participate effectively.

5.2. Flexible learning models

The study found that blended learning improved flexibility in terms of time, location and pace. Students were able to access learning materials asynchronously, revisit recorded sessions, participate in online discussions and manage learning alongside work, family or professional responsibilities.

This flexibility is particularly significant in postgraduate and professional education, where many learners are employed adults. Flexible learning also supports lifelong learning and continuous professional development.

Nevertheless, flexibility requires strong self-regulation, digital discipline and institutional support. Without structured guidance, some learners may struggle with motivation, time management and sustained engagement.

5.3. Enhanced student engagement

Digital tools improved student engagement in several ways. Multimedia content, virtual discussion forums, collaborative platforms, online quizzes and interactive learning resources created opportunities for active participation.

The study found that digital technologies can support cognitive, behavioural, collaborative and emotional engagement when intentionally designed. This confirms that engagement is not automatically produced by technology; it depends on instructional design and facilitation quality.

In some institutions, however, engagement remained limited because online learning was treated as a direct transfer of classroom lectures to digital platforms. This reduced interaction and weakened the learner experience.

5.4. Institutional innovation

Digital transformation stimulated institutional innovation. Some HEIs adopted learning management systems, virtual classrooms, electronic libraries, online assessments, cloud-based collaboration tools and digital student support channels.

The crisis encouraged institutions to rethink traditional educational models and experiment with new ways of delivering value. It also created opportunities for partnerships with technology providers, industry actors and development agencies.

However, innovation was often uneven and reactive. Many institutions adopted digital tools quickly during the pandemic without comprehensive strategies for sustainability, integration, quality assurance or long-term transformation **(Table 3)**.

Table 3: Perceived Opportunities of Digital Transformation.

Opportunity	Frequency	Percentage	Rank
Expanded Access	386	91	1
Flexible Learning	379	89.4	2
Enhanced Engagement	364	85.8	3
Institutional Innovation	349	82.3	4
Lifelong Learning	336	79.2	5
Regional Reach	312	73.6	6
Digital Skills Development	305	71.9	7
Operational Efficiency	288	67.9	8

5.5. The digital divide

The digital divide emerged as one of the most significant challenges. Unequal access to devices, connectivity, electricity and digital skills limited participation in blended learning.

Students from disadvantaged backgrounds were particularly affected. Some could not attend live sessions consistently, download learning materials, participate in online assessments or engage fully with digital platforms.

This finding shows that digital transformation can unintentionally reinforce educational inequality if inclusion is not deliberately built into institutional strategy **(Table 4)**.

Table 4: Perceived Challenges of Digital Transformation.

Challenge	Frequency	Percentage	Rank
Digital Divide	394	92.9	1
Infrastructure Limitations	387	91.3	2
High Internet Cost	382	90.1	3
Faculty Readiness	359	84.7	4
Technical Support Limitations	331	78.1	5
Electrictity Challenges	326	76.9	6
Governance Weakness	294	69.3	7
Funding Constraints	286	67.5	8

5.6. Infrastructure limitations

Infrastructure gaps significantly constrained blended learning implementation. Respondents identified unreliable internet, high data costs, unstable electricity, inadequate platforms, limited digital libraries and insufficient technical support as major barriers.

These challenges affected both students and faculty. Even when institutions introduced digital platforms, poor infrastructure limited their effectiveness and reduced confidence in digital learning systems.

Infrastructure must therefore be treated as a core quality issue, not merely a technical concern.

5.7. Faculty readiness and digital pedagogy

Faculty readiness was identified as a major determinant of blended learning quality. Many educators had to adapt rapidly to digital teaching without sufficient preparation.

The study found that effective blended learning requires more than basic platform use. Faculty must be able to design engaging digital content, facilitate online interaction, assess learning virtually, provide timely feedback and support diverse learners.

Where faculty development was weak, digital learning became less interactive, less engaging and less effective **(Figure 3)**.

Best Location

After Section 5.7

High Opportunity	High Challenge
Expanded Access	Digital Divide
Flexibility	Connectivity Issues
Innovation	Faculty Readiness
Engagement	Infrastructure Gaps

Figure 3: Opportunity-Challenge Matrix.

Table 5: Opportunities versus Challenges Matrix.

Oppurtunity	Corresponding Challenges
Expanded Access	Digital Exclusion
Flexible Learning	Self-Discipline Challenge
Engagement	Faculty Capability Gaps
Innovation	Weak Sustainability Planning
Digital Skills	Uneven Digital Litearcy

Table 6: Stakeholder Assessment of Blended Learning.

Variable	Mean	Interpretation
Access Improvement	4.31	High
Flexibility	4.42	Very High
Enagagement	4.08	High
Innovation	4.15	High
Infrastructure Readiness	3.28	Moderate
Faculty Readiness	3.36	Moderate
Institutional Readiness	3.41	Moderate

6. Discussion

The findings highlight the dual nature of digital transformation in blended learning. On one hand, it creates powerful opportunities for expanding access, enhancing flexibility, improving engagement and stimulating institutional innovation. On the other hand, it can reinforce existing inequalities and expose weaknesses in infrastructure, faculty readiness, governance and institutional capacity[4-6].

This duality is particularly important in West Africa. Digital transformation cannot be understood simply as a linear path to progress. It is a complex process shaped by socio-economic conditions, policy environments, institutional leadership, funding realities and stakeholder readiness[7].

The study supports the argument that blended learning succeeds when technology, pedagogy and institutional strategy are aligned. Technology provides the platform, but pedagogy creates the learning value. Infrastructure enables participation, but faculty competence shapes experience. Policy provides direction, but leadership sustains execution.

The findings also suggest that institutions should avoid treating blended learning as a temporary crisis response. The pandemic may have accelerated adoption, but the future of higher education will increasingly depend on institutions' ability to develop resilient, inclusive and high-quality phygital learning ecosystems[8-10].

A key implication is that digital transformation in West African higher education must be inclusive by design. Without deliberate interventions, digitally enabled education may privilege those who already have access and disadvantage those who need flexible education most[11].

Best Location

Discussion Section

Plain text

```
PHYSICAL LEARNING
(Classrooms)
        +
DIGITAL LEARNING
(Online Platforms)
        ▼
PHYGITAL ECOSYSTEM
_____________________
Technology
Faculty
Students
Content
Support Systems
Governance
Infrastructure
_____________________
        ▼
Quality Learning Outcomes
```

Figure 4: Phygital Learning Ecosystem Framework.

Table 7: Institutional Readiness Framework.

Dimension	Readiness Indicator
Technology	LMS & Connectivity
Pedagogy	Digital Teaching Competence
People	Students & Staff Skills
Governance	Policies & Standards
Infrastructure	Platforms & Supports
Leadership	Strategic Commitment

7. Managerial Implications

7.1. Strategic investment in infrastructure

HEIs must prioritise investment in learning management systems, broadband access, cloud infrastructure, digital libraries, cybersecurity, technical support and reliable power solutions. Infrastructure is foundational to blended learning quality.

7.2. Capacity building for faculty

Institutions should establish continuous professional development programmes in digital pedagogy, instructional design, learner engagement, online assessment and educational technology use. Faculty development should be treated as a strategic priority.

7.3. Inclusive access strategies

HEIs should adopt measures to address the digital divide, including device support schemes, subsidised data partnerships, offline learning options, digital access centres and flexible participation models.

7.4. Policy and governance alignment

Digital transformation requires clear governance. Institutions should develop policies on blended learning standards, digital assessment, data protection, quality assurance, platform use and student support.

7.5. Continuous innovation and learning

HEIs should foster a culture of experimentation, feedback and continuous improvement. Blended learning systems should be reviewed regularly based on student experience, learning outcomes, faculty feedback and institutional performance data **(Figure 5)** and **(Table 8)**.

Best Location

Managerial Implications Section

Plain text

```
INFRASTRUCTURE
      |
PEDAGOGY
      |
FACULTY CAPABILITY
      |
GOVERNANCE
      |
INCLUSION
      |
LEADERSHIP
      ▼
SUSTAINABLE BLENDED LEARNING
      ▼
RESILIENT HEIs
```

Figure 5: Strategic Framework for Sustainable Blended Learning.

Table 8: Strategic Recommendations Matrix.

Challenge	Recommended Action	Expected Benefit
Digital Divide	Device & Data Support	Inclusive Access
Infrastructure	Broadband Investment	Better Learning Experience
Faculty Readiness	Continuous Training	Improved Engagement
Technical Support	Digital Helpdesks	Faster Problem Resolution
Governance	Blended Learning Policy	Sustainability

8. Contribution to Knowledge

This study contributes to knowledge in four major ways.

First, it provides empirical insight into digital transformation in blended learning from a West African higher education perspective, a context that remains underrepresented in global literature.

Second, it conceptualises digital transformation in emerging economies as a dual process that creates opportunities while reinforcing constraints.

Third, it highlights the importance of aligning technology, pedagogy, institutional capacity, leadership and policy frameworks.

Fourth, it provides practical recommendations for HEIs seeking to develop inclusive, resilient and competitive blended learning systems **(Table 9)**.

Table 9: Blended Learning Maturity Model for West African HEIs.

Level	Stage	Characteristics
Level 1	Traditional	Predominantly Face-to-Face
Level 2	Emerging Digital	Basic LMS Adoption
Level 3	Blended	Integrated Physical and Digital Learning
Level 4	Phygital Excellence	Student-Centred Digital Ecosystem
Level 5	Transformational	AI-Enabled, Data-Driven University

9. Conclusion

Digital transformation in blended learning represents a significant opportunity for higher education in West Africa. It can expand access, improve flexibility, enhance engagement, support innovation and strengthen institutional resilience.

However, its success depends on the ability of institutions to address underlying challenges, particularly the digital divide, infrastructure limitations, faculty readiness and weak institutional support systems.

The study concludes that blended learning should not be treated as an emergency substitute for physical education. Rather, it should be developed as a strategic model for the future of higher education in West Africa.

By adopting a holistic approach that integrates technology, pedagogy, governance, inclusion and leadership, HEIs can leverage digital transformation to build more accessible, resilient and future-ready education systems.

10. Limitations and Future Research

This study is limited by its regional focus and cross-sectional design. Although the findings provide useful insights into West African HEIs, future research should explore country-specific differences, institutional variations and longitudinal trends.

Further research could also examine the relationship between blended learning and student retention, academic performance, employability, faculty workload, institutional reputation and digital equity. Comparative studies between West Africa and other developing regions would also enrich understanding of digital transformation in emerging higher education systems.

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