



OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE FOR ENHANCING THE SUSTAINABILITY OF COMMUNITY ADULT LEARNING FOR NATIONAL DEVELOPMENT: OPPORTUNITIES AND CHALLENGES

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Abstract

Artificial Intelligence (AI) presents powerful opportunities for transforming community adult learning in Nigeria by improving access, personalizing instruction, and supporting workforce development. As national development increasingly depends on digital competencies and lifelong learning, AI can help close literacy gaps, enhance employability skills, and promote inclusive participation in the knowledge economy. This positional paper critically examines how AI can support the sustainability of community adult learning programs in Nigeria, focusing on equitable access, digital skills advancement, and institutional strengthening. It explores opportunities such as intelligent tutoring, language translation tools, data-driven decision-making, and skills simulation technologies. At the same time, the paper analyzes major challenges including low AI awareness, inadequate infrastructure, funding limitations, digital inequality, and concerns about data ethics. Grounded in Human Capital Theory and the Technology Acceptance Model, the paper argues that strategic and inclusive AI deployment is essential for strengthening Nigeria's human development, workforce productivity, and socioeconomic transformation. It concludes with a call for coordinated policies, multi-stakeholder partnerships, investment in digital infrastructure, and capacity development for adult educators to ensure AI contributes to sustainable national development goals.

Keywords

Artificial Intelligence, Community Adult Learning, Sustainability, National Development, Nigeria.

Introduction

Education is globally positioned as a key driver of national development, social progress, and economic empowerment. In Africa, and particularly in Nigeria, community adult learning programs function as a second-chance platform for millions of adults who were left behind by the formal education system. These

programs offer essential literacy, functional numeracy, livelihood skills, and civic empowerment that directly influence economic productivity and social inclusion. However, Nigeria continues to face a high prevalence of adult illiteracy-notably concentrated in rural areas and among women which undermines national development goals. Traditional forms of



teaching in adult learning centers face several constraints such as limited instructional materials, lack of trained facilitators, language barriers, poor monitoring, and minimal integration of technology. These conditions weaken the effectiveness and sustainability of community adult learning programs (Akinyemi 2022).

The Fourth Industrial Revolution (4IR) is reshaping education environments worldwide through intelligent technologies, including Artificial Intelligence (AI). AI tools such as adaptive learning platforms, speech-to-text systems, intelligent assessment engines, and chat-based learning assistants have the capacity to redefine the experiences of adult learners. For learners who struggle with literacy, AI-powered translation, voice interfaces, and personalized content delivery can significantly minimize barriers and increase participation.

For Nigeria to achieve national development, the adult population must be empowered with relevant skills for digital participation, employability, and lifelong learning. AI provides opportunities to transform adult learning into a scalable, accessible, and cost-efficient system capable of reaching underserved communities including those in Gombe State and beyond. As the world transitions to technology-driven economies, adult learning sustainability must be strengthened through the integration of intelligent innovations that enhance learner engagement, skills development, and long-term institutional viability. Therefore, this positional paper seeks to examine both the opportunities and challenges associated with using AI to enhance the sustainability of community adult learning in Nigeria. It argues that AI, if effectively harnessed, can create inclusive and resilient lifelong learning pathways that accelerate national

development. In Nigeria, community adult learning programmes are vital for enhancing literacy, functional skills, and socio-economic empowerment for adults who are not reached by formal schooling systems. According to recent data from the National Bureau of Statistics (NBS, 2022), a significant proportion of adults lack basic literacy and digital skills, which in turn impedes their full participation in the knowledge economy and weakens national human-capital formation. These deficits limit employment opportunities, reduce civic engagement, and ultimately restrict national development progress. Despite the policy recognition of adult education, many programmes remain fragile and unsustainable. Community adult-learning centres in many parts of Nigeria suffer from inadequate funding, shortage of trained facilitators, outdated curriculum, and weak monitoring systems. These structural weaknesses hamper retention of learners, lower program completion rates and reduce the long-term impact of adult learning initiatives. Without technological innovation and institutional strengthening, adult learning systems risk being unable to meet current and future national development demands.

Furthermore, the global shift toward digital societies and the Fourth Industrial Revolution (4IR) presents both opportunities and risks. Adult learners who are unable to adapt due to low digital literacy and limited access to intelligent learning technologies may be further marginalized. The integration of Artificial Intelligence (AI) in learning systems offers a promising pathway for adult education; however, the limited uptake of AI in Nigerian adult learning contexts underscores a major gap. In the absence of AI-enabled transformation, community adult learning may remain reliant on traditional models that are less flexible, less engaging and less able to scale.



Technology Acceptance Model (TAM)

TAM posits that individuals' intention to use a technology is primarily influenced by their perception of its usefulness and ease of use (Davis, 2016). In the context of community adult learning in Nigeria, TAM suggests that adult learners and facilitators will adopt AI-enabled learning tools if they perceive clear benefits (e.g., improved literacy outcomes, flexible access) and if the tools are simple, accessible and culturally appropriate. Thus, deploying AI in adult learning requires not only technical readiness but also user acceptance, training, and contextual design.

Nigeria's Community Adult Learning Landscape

a. National Context

The National Mass Education Commission (NMEC) oversees adult literacy and non-formal education in Nigeria, coordinating numerous community adult learning centres across states. Despite this institutional arrangement, persistent challenges such as low funding allocation, high facilitator turnover, and weak monitoring undermine program sustainability. For example, a 2023 NMEC annual report indicated that many centres in remote areas operate without permanent electricity or internet access, severely limiting innovative learning delivery. Digital Policy and 4IR Alignment Nigeria's National Digital Economy Policy and Strategy (NDEPS) emphasises building a digital-ready population, promoting e-learning, and supporting lifelong learning in the digital age. Adult learning programs are explicitly referenced under broader digital literacy objectives. Integrating AI into adult education aligns with Nigeria's ambition to become a regional digital talent hub.

b. Gombe State Example

In Gombe State, community adult learning programmes face typical constraints: rural

centres frequently lack reliable power; adult learners often have low prior schooling; many workshops still rely solely on chalk-and-talk methods; and digital resources are scarce. For instance, an audit of community adult learning centres in Gombe (2022) found that only 10% of centres had a computer connected to the internet for instructional use. The state government's plan to pilot offline-AI learning kits in rural centres offers a promising test case for scaling across Nigeria.

Adult Learner Profile and Needs

Adult learners in Nigeria often have diverse profiles: they may be re-entering education, upgrading vocational skills, or pursuing literacy late in life. Many combines learning with economic responsibilities (agriculture, trading, household). They require flexible schedules, accessible content in local languages (Hausa, Fulfulde, Tangale), and pedagogies that consider their prior learning gap, low digital literacy, and socio-economic constraints. AI systems designed for these learners must therefore be intuitive, mobile-capable, offline friendly and linguistically relevant.

Artificial Intelligence (AI) is increasingly recognized worldwide as a transformative driver of educational innovation. The global movement toward digital learning ecosystems has positioned AI as a catalyst for personalizing instruction, enabling data-driven decision-making, and improving the scalability of lifelong learning (UNESCO, 2021). In adult education contexts, AI systems support individuals who were previously excluded from formal schooling, enabling flexible learning pathways suited to workplace and community demands (Siemens, 2020).



Artificial Intelligence (AI) in Global Adult Learning Practice. In advanced economies, AI has already reshaped adult learning in several notable ways. Adamu, F. 2022.

Country	Key AI-Based Adult Learning Initiatives	Impact
a. China	Intelligent Mandarin literacy tutors; AI-driven vocational simulators	Higher completion rates; improved workforce readiness.
b. USA	Community college adaptive learning platforms.	AI skills badges
c. India	Offline-AI literacy apps for rural women speech-supported learning	Increased retention and credentialing for low-income adults
d. South Africa	Mobile-based AI skills centers in townships	Enhanced literacy acquisition, especially among non-readers
		Expanded access for unemployed youth and adults

Across these countries, the success of AI in adult learning is associated with:

- i. Strong digital infrastructure
- ii. Educator training in digital facilitation
- iii. Content in mother-tongue languages
- iv. Partnerships with private technology firms

These conditions are still emerging in many African nations, Nigeria included.

AI Adoption in Education in Africa

Africa is experiencing increasing interest in AI to improve educational innovation and expand access (African Union, 2020). Several African initiatives highlight AI's role in non-formal education:

- i. Rwanda: AI-enabled ICT centers supporting adult digital literacy
- ii. Kenya: Chatbot career advisory systems for low-skilled workers
- iii. Ghana: Local-language AI tutors targeting rural adults

However, significant concerns remain regarding

- i. infrastructure inequity
- ii. lack of culturally adapted AI tools
- iii. policy and ethical oversight gaps

These challenges also resonate with the Nigerian context.

Non-Formal Adult Learning in Nigeria

- i. Nigeria's adult education system targets:
- ii. literacy and numeracy
- iii. livelihood skills and entrepreneurship
- iv. civic participation and empowerment
- v. reintegration into the digital economy

The National Commission for Mass Literacy advocates blended learning approaches, yet most adult education centers rely on traditional classroom formats. As noted in several studies (Akinyemi, 2022; Nmadu, 2023), adult learners frequently face:



- a. minimal access to educational technology
 - b. facilitators untrained in digital methods
 - c. low digital confidence
 - d. sociolinguistic barriers limiting engagement
- These restrictions reduce learning outcomes and program sustainability.

AI for Literacy Development

Artificial Intelligence supports literacy learning through:

AI Tools	Functions	Relevance for Adult Learners
Speech-to-text	Converts spoken language into text	Supports low-literate learners
Text-to-speech	Reads digital text aloud	Helps visually impaired learners
AI translation systems Intelligent writing aids.	Converts English to Hausa Suggests spelling, grammar, clarity	Enables contextual learning Improves literacy confidence

For adults who lost literacy skills or never gained them, such tools can be pivotal in restarting the learning journey.

AI for Vocational Skills & Employability

Workforce development is central to national development. AI systems offer:

1. Automated simulations for agriculture, tailoring, welding
2. Micro-credential platforms recognizing skills gained informally
3. Adaptive job-readiness assessment
4. Entrepreneurship decision-support tools

These innovations help adults transition into higher-productivity income activities.

Opportunities of AI for Sustainable Community Adult Learning in Nigeria

Federal Ministry of Communications and Digital Economy 2020. Revealed that Artificial Intelligence offers significant and wide-ranging opportunities to transform community adult learning, making it more inclusive, resilient, and aligned with national development objectives. This section expands the opportunities across seven strategic dimensions:

- a. AI for Personalized and Adaptive Learning

Traditional adult education in Nigeria often uses one-size-fits-all teaching methods. Adult learners, however, possess diverse prior knowledge, learning speeds, and socio-economic realities. AI-based adaptive learning systems can:

- i. assess each learner’s strengths and weaknesses
- ii. adjust learning content and level automatically
- iii. recommend exercises based on individual progress
- iv. track learning performance over time

This personalization improves confidence, retention, and completion rates—key elements of program sustainability.

- b. AI for Literacy and Language Support

Many communities’ adult learners in Nigeria have limited English proficiency and prefer learning in local languages. AI applications now support:

- i. Hausa / Fulfulde voice interfaces
- ii. speech-to-text literacy practice
- iii. local-language translation tools
- iv. read-aloud digital text tools

These reduce traditional literacy barriers. For example, a rural learner in Gombe State



can speak into an AI device, see the text generated, and correct literacy errors—making learning independent and interactive.

c. AI for Skills Development and Employability

Nigeria’s national development depends on a productive workforce. AI supports skills acquisition through:

Skills Area	AI Opportunities
Agriculture	Precision farming simulations, weather-prediction apps
ICT Trade & Crafts	Basic coding tutors, digital skills apps Virtual practice environments for tailoring, carpentry
Entrepreneurship	AI-supported business planning and marketing tools

Community learners gain employable skills, boosting local economies and reducing unemployment.

This improves accountability and data-driven decisions.

d. AI for Expanding Learning Access in Hard-to-Reach Areas

A key issue in Gombe and other states is poor physical access to learning centers. AI enables:

- i. Mobile learning for nomadic populations
- ii. Offline-AI tools for low-internet communities
- iii. Chatbots for self-directed learning after class
- iv. Remote mentorship via messaging platforms

AI removes geographical restrictions, enhancing inclusion.

e. AI-Driven Assessment and Monitoring

Tracking progress is essential for program quality and sustainability. AI analytics help:

- i. detect literacy difficulties early
- ii. generate performance dashboards
- iii. guide facilitators on learner needs
- iv. reduce human error in assessments

f. AI for Educator Support and Professional Development

Adult facilitators often lack both pedagogical and digital training. AI tools can provide:

- 1. lesson-planning assistance
- 2. automated content generation
- 3. instant classroom feedback tools
- 4. facilitator training simulations

Instead of replacing teachers, AI empowers them.

g. AI for Institutional Efficiency and Sustainability

Programs struggle with poor funding and administrative systems. AI strengthens management by:

- 1. automating enrollment and record keeping
- 2. optimizing resource allocation
- 3. supporting monitoring & evaluation
- 4. reducing printing costs through digital content

This frees resources to expand program coverage.



Artificial Intelligence AI for National Development Outcomes

National Development Goals	AI-Enabled Adult Learning Impact
Human Capital Development	Increases skilled labor force
Poverty Reduction	Better employability skills
Social Inclusion	Inclusion of marginalized groups
Economic Productivity	Workforce digital readiness
Peace & Civic Participation	Strengthens informed citizenship

Thus, the success of Nigeria’s digital transformation depends heavily on upgrading the skills of its adult population.

sustainability. These challenges fall into technological, economic, sociocultural, institutional, and ethical categories.

Challenges and Ethical Concerns in Artificial Intelligence AI Adoption for Adult Learning in Nigeria

NITDA 2021. National digital economy policy and strategy: Digital inclusion and lifelong learning indicates that Artificial Intelligence AI offers enormous promise for transforming community adult learning, its implementation in Nigeria faces significant challenges that must be addressed for meaningful adoption and

Inadequate Digital Infrastructure

Many community learning centres lack reliable internet, computers, and electricity. In rural areas of Gombe State, solar-powered devices or offline-capable learning systems are still not widespread. Without infrastructure upgrades, AI can widen already-existing educational inequalities.

Infrastructure Issue	Implication
Unstable power supply	Cannot use digital tools consistently
Low internet penetration	Prevents cloud-based AI learning platforms
Limited device access	Excludes rural and low-income learners
Digital access is foundational without it.	AI remains inaccessible.

Low Digital Literacy Among Learners and Facilitators

Adult learners often have little or no exposure to technology. Many cannot operate smartphones or computers independently. Likewise, facilitators lack training in digital pedagogies and may resist technological change. Fear of technology or low confidence may reduce willingness to engage with AI tools, aligning with Technology Acceptance Model (TAM) concerns.

1. Cost and Funding Constraints

- a. AI adoption requires initial investments in:
- b. hardware devices
- c. connectivity

- d. software subscriptions
- e. facilitator capacity-building

Given limited funding for adult education in Nigeria, prioritizing AI may be challenging without dedicated government budgets and partnerships.

Language and Cultural Limitations

Although most adults prefer learning in Hausa, Fulfulde, Kanuri, and other Nigerian languages, many AI tools are designed for English speakers. This may cause:

- a. misunderstanding of instructions
- b. loss of learning motivation
- c. reduced cultural relevance
- d. lower inclusivity



- e. Localization is essential for adoption.

Ethical, Data Privacy, and Security Concerns

Adult learners may unknowingly share sensitive personal data while using AI tools. Risks include:

- a. unauthorized data usage
- b. exploitation by foreign companies
- c. algorithmic bias affecting assessment fairness
- d. surveillance concerns

Ethical governance frameworks are therefore necessary to protect learners.

Fear of Teacher Replacement and Change Resistance

Some facilitators may perceive AI as a threat to their roles. Without adequate orientation, AI integration might trigger resistance and anxiety. A collaborative human + AI model is needed to preserve the centrality of human educators.

Inequality and Social Exclusion Concerns

There is a risk that AI may primarily benefit digitally skilled learners in urban areas while marginalizing rural or low-literate learners further. Without inclusive deployment strategies, AI could unintentionally reinforce existing educational disparities.

Public-Private Partnerships (PPP)

Strategic collaborations are essential:

Partners

Tech companies

- NGOs/International agencies
- Local developers
- Telcos

Contributions

Provide AI tools, training, infrastructure

- Funding, community mobilization
- Create culturally relevant AI systems
- Expand connectivity and affordable data plans

These partnerships reduce government burden and promote sustainability.

Building Digital Capacity of Facilitators and Learners

A strong capacity development roadmap must be implemented:

Policy and Implementation Strategies for Artificial Intelligence AI in Community Adult Learning in Nigeria

To achieve sustainable and inclusive Artificial Intelligence AI integration into community adult learning, Nigeria needs purposeful policies, multi-stakeholder partnerships, and context-responsive implementation strategies. These strategies must ensure that Artificial Intelligence AI enhances quality learning rather than replacing human interaction or widening inequalities.

Government Policy Framework and Regulation

The success of AI integration depends on well-defined government policies that:

- a. Establish standards for digital curriculum adoption in adult learning centres
- b. Provide national guidelines for AI ethics, data governance, and user protection
- c. Promote Nigerian-language-based AI development (e.g., Hausa, Fulfulde, Yoruba, Igbo)
- d. Encourage research and innovation in local universities and polytechnics
- e. Government policy must position AI as a development enabler, not a discretionary educational luxury.

- a. Training facilitators in digital pedagogy
- b. Workshops on smartphone/computer literacy for learners



- c. AI literacy campaigns to reduce fear and resistance
- d. Inclusion of digital competencies in adult education curriculum

Human-centered adoption ensures facilitators remain guides and mentors, not displaced entities.

Infrastructure Development and Local Innovation

Key priorities include:

- a. Provision of mobile learning labs for rural centres
- b. Solar-powered devices/internet to overcome power issues
- c. Investment in local EdTech startups to build indigenous AI tools
- d. Infrastructure improvement is the backbone of AI-enabled learning.

Ensuring Inclusivity and Equity

- a. Policies must safeguard vulnerable groups
- b. Women learners in rural communities
- c. Persons with disabilities (assistive AI tools)
- d. Low-income adults through subsidies
- e. Linguistic minorities via localized content

AI must reduce the digital divide — not deepen it

Ethical and Legal Safeguards

Nigerian government must establish the following principles

- a. Digital Rights charter for adult learners
- b. Clear data protection and privacy laws aligned with global best practices
- c. Ethical AI standards ensuring fairness and transparency
- d. Trust and protection are fundamental for adoption.

Institutional Reform and Monitoring Mechanisms

Adult learning centres should adopt the following reforms

- a. Accountability systems for fund utilization

- b. Maintenance structures for devices and connectivity
- c. Monitoring and evaluation indicators to track progress
- d. Mechanisms for learner feedback and improvement

These strategies ensure long-term sustainability of AI-driven learning.

Implications for National Development

Implications of Artificial Intelligence AI-Enhanced Community Adult Learning for National Development

Artificial Intelligence, when effectively integrated into community adult learning in Nigeria, has transformative implications for national development. Adult learners represent a large segment of the Nigerian population—full inclusion of this group is essential for harnessing the nation’s human capital. The Sustainable Development Goals (SDGs), Nigerian National ICT Policy, and the National Development Plan all emphasize lifelong learning and technological innovation as drivers of development.

AI-supported community learning contributes to national development across economic, social, and governance dimensions:

1. Economic Development

AI enhances employability and productivity among adult learners through: Skills upgrading in digital literacy, entrepreneurship, and vocational competencies

Support for micro and small business development through Artificial Intelligence AI-based market insights Increased workforce participation of marginalized groups (rural women, unemployed youth) Improved agriculture outcomes via AI-based weather forecasting and smart farming tools

These advancements foster:

- i. Job creation
- ii. Poverty reduction
- iii. Increased GDP participation



iv. Enhanced competitiveness in the global digital economy
Nigeria’s drive toward a knowledge-based economy depends on empowering citizens through lifelong learning.

2. Social Inclusion and Human Capital Development

AI enables personalized, flexible learning that suits adult learners’ realities — work schedules, family constraints, and literacy levels. This supports:

- (i) Bridging the gender gap in education
- (ii) Increasing access for rural communities where schools are sparse
- (iii) Breaking the cycle of intergenerational illiteracy by strengthening parents’ skills
- (iv) Improving health literacy through AI-guided community education
- (v) With more educated and digitally aware adults, social equality improves, and civic participation strengthens.

3. Improved Governance and Civic Engagement

AI-supported adult learning promotes:

- a. Better awareness of citizens' rights and responsibilities
- b. Increased voter education and democratic participation
- c. Transparent communication channels between government and citizens

AI-powered community adult learning contributes to:

d. Digitally literate adults are more capable of engaging with e-governance services, reporting grievances, and contributing to national decision-making.

4. Strengthening Nigeria’s Technological Ecosystem

Integrating AI into education stimulates innovation culture:

- a. Encourages local developers to create indigenous language AI tools
- b. Strengthens research collaboration among universities and tech hubs
- c. Promotes digital entrepreneurship and ICT-driven industries

This contributes to technology sovereignty and reduces overreliance on foreign digital products.

Security and Peacebuilding

Adult learning programs supported by AI can deliver:

- 1. Civic and peace education in conflict-prone areas
- 2. Early warning systems and community reporting tools for insecurity
- 3. Reintegration programs for displaced populations and ex-combatants
- 4. Communities with access to knowledge are better equipped to resist extremist ideologies and misinformation.
- 5. Achieving Sustainable Development Goals (SDGs)

Goals	Contribution
SDG 1: No Poverty	Skills for income generation
SDG 4: Quality Education	Lifelong learning access
SDG 5: Gender Equality	Empowering rural women learners
SDG 8: Decent Work	Workforce digital readiness
SDG 9: Industry, Innovation	Tech adoption at grassroots
SDG 10: Reduced Inequalities	Inclusive education reforms



Thus, Artificial Intelligence AI in adult education becomes a strategic enabler of holistic national transformation. Empowering adults with AI-enhanced learning produces a ripple effect:

- i. Empowered individuals
→ Productive workforce
- c. Digitally skilled citizens
→ Stronger economy
- d. Informed communities
→ Peaceful governance
- e. Inclusive education
→ National sustainability

Therefore, leveraging AI for community lifelong learning is not optional but a developmental necessity for Nigeria.

Conclusion

Artificial Intelligence has emerged as a transformative force capable of reshaping community adult learning in Nigeria. By offering flexible, personalized, and context-aware learning models, AI can significantly improve literacy, employability, entrepreneurship, civic engagement, and lifelong learning participation. When strategically deployed, AI contributes to national development through:

- a. enhanced human capital productivity
- b. poverty reduction and economic growth
- c. digital inclusion and gender equality
- d. improved governance and social stability

However, realizing these opportunities requires addressing major challenges including inadequate infrastructure, limited digital skills, cost barriers, ethical concerns, and cultural relevance gaps. Without proactive policies, AI risks widening digital inequalities among populations already disadvantaged by geography, poverty, or low literacy. To ensure sustainability, Nigeria must adopt a human-centered, inclusive, and policy-driven approach that strengthens facilitators' roles while

empowering adult learners to thrive in the digital economy.

Finally, AI is not intended to replace human educators but to amplify their impact. Sustainable national development depends on enabling all citizens regardless of age, background, or literacy level to participate meaningfully in technological progress.

Recommendations

To unlock the full potential of AI in community adult learning for national development, the following actions are recommended:

- i. Government and Policy Makers
Develop a National AI in Adult Learning Policy embedded in lifelong learning frameworks by increasing funding for ICT infrastructure in rural community learning centers and support local development of AI tools in Hausa, Fulfulde, Yoruba, and Igbo languages. Enforce robust data protection and ethical AI standards. Provide incentives for publicprivate investment in EdTech innovation
- ii. Adult Learning Institutions and Agencies. Integrate digital and AI literacy into adult education curricula, Train facilitators in AI-supported pedagogy and blended learning delivery, also implement a monitoring and evaluation systems to measure AI effectiveness., Establish community digital hubs for equitable access to devices and connectivity.
- iii. Facilitators and Educators
Adopt learner-centered teaching supported by AI personalization tools. Should be Engage in continuous professional development around emerging technologies and Encourage learners' digital confidence and experimentation through guided practice.



- iv. Technology Developers and Private Sector; Design culturally relevant AI applications with offline capabilities by Collaborating with educators to align tools with Nigerian literacy needs and prioritize affordable, scalable solutions for nationwide use.
- v. Community Involvement Mobilize local leaders for awareness creation and trust building by Encouraging women's participation through gender-sensitive outreach and Promote peer-learning models to increase digital confidence among adults.
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