

TRANSFORMING WORKFORCE READINESS IN THE AI ERA THROUGH COMPETENCY-BASED AND SKILLS-FIRST EDUCATION IN KENYAN UNIVERSITIES

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Thematic Area: Higher Education, Digital Transformation and Graduate Employability | Manuscript Type: Critical Narrative Review

Article Received: 3rd May 2026, Published on: 31st May 2026

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ABSTRACT

Artificial intelligence, automation and other Fourth Industrial Revolution technologies are changing occupational structures, work processes and the competencies required of university graduates. This paper critically examines the preparedness of Kenyan universities to develop workforce-ready graduates through competency-based and skills-first education. The study used a structured critical narrative review of peer-reviewed literature, policy documents, labour-market reports and institutional publications issued mainly between 2020 and 2026. The analysis was guided by Human Capital Theory and Skills Mismatch Theory and organised around six themes: graduate employability, AI literacy, curriculum responsiveness, faculty capability, digital infrastructure, and university-industry collaboration. The evidence indicates that higher education access and digital learning have expanded, but many institutions remain constrained by theory-dominated pedagogy, slow curriculum review cycles, uneven digital infrastructure, limited practical exposure and weak employer participation in programme design. Employers increasingly value demonstrable competencies in problem-solving, critical thinking, communication, teamwork, adaptability, data literacy and responsible use of AI rather than academic credentials alone. The paper proposes an AI-Era Workforce Readiness Framework that connects policy and quality assurance with curriculum redesign, work-integrated learning, faculty development, micro-credentials, innovation ecosystems and inclusive digital infrastructure. It concludes that Kenyan universities should not treat AI readiness as the addition of isolated technology courses. Instead, workforce readiness should become a whole-institution transformation agenda that combines human capabilities, technical competence, ethical judgment, entrepreneurship and lifelong learning.

KEYWORDS: Artificial intelligence; competency-based education; skills-first education; graduate employability; digital competence; higher education transformation; Kenya.

I. INTRODUCTION

Artificial intelligence (AI), robotics, automation, machine learning, cloud computing, data analytics and other Fourth Industrial Revolution technologies are reshaping production, services and professional work. These changes affect not only which occupations grow or decline, but also how tasks are performed within existing occupations. Universities are consequently expected to prepare graduates who can work with intelligent systems, interpret data, solve unfamiliar problems, communicate across digital environments and adapt continuously as technologies evolve.

The emerging labour market is increasingly skills-sensitive. Employers continue to value disciplinary knowledge, but recruitment and progression are placing greater emphasis on demonstrable capabilities, portfolios, industry experience and transferable skills. The World Economic Forum (2025) identifies analytical thinking, resilience, flexibility, leadership, technological literacy and creative thinking among the competencies expected to remain important through 2030. These trends strengthen the case for competency-based and skills-first education, in which learning outcomes are expressed as observable capabilities and students are provided repeated opportunities to demonstrate them in authentic contexts.

In Kenya, university enrolment has expanded substantially, yet graduate unemployment and underemployment remain persistent concerns. Employers frequently report weaknesses in communication, digital literacy, problem-solving, teamwork, creativity and adaptability (BrighterMonday Kenya, 2025; Federation of Kenya Employers, 2024). The problem is therefore not merely the number of graduates produced, but the degree of alignment between university learning and changing workplace expectations.

AI also creates a broader educational responsibility. Universities must develop graduates who can use AI productively while recognising its limitations, biases, privacy implications and ethical risks. Skills-first education should therefore not reduce higher education to narrow job training. It should integrate technical competence with critical judgment, social responsibility, creativity, citizenship and human flourishing.

A. Problem Statement

Many Kenyan universities continue to rely heavily on lecture-centred, theory-dominated and examination-driven teaching. Curriculum review may take several years, whereas digital tools, job roles and employer expectations can change within months. Students may therefore complete programmes with strong conceptual knowledge but limited experience in applying that knowledge through projects, simulations, internships, digital portfolios, problem-based learning or industry challenges.

Several institutional conditions deepen this gap: uneven broadband and computing access, limited faculty development in digital pedagogy, inadequate laboratories and innovation spaces, weak employer involvement in programme design, and insufficient work-integrated learning opportunities. These constraints affect universities differently and may widen inequalities between well-resourced urban institutions and under-resourced or geographically marginal institutions.

Although graduate employability has attracted considerable policy attention, there remains a need for an integrated analysis of how competency-based education, AI literacy, curriculum reform, faculty capability, digital infrastructure and university-industry collaboration interact to shape workforce readiness in Kenyan universities.

B. Aim, Objectives and Research Questions

The aim of this paper is to evaluate how Kenyan universities can strengthen workforce readiness in the AI era through competency-based and skills-first education.

- i. Examine the changing competency requirements of AI-enabled labour markets.
- ii. Assess the nature and causes of graduate skills mismatch in Kenya.
- iii. Evaluate the preparedness of Kenyan universities in curriculum, pedagogy, infrastructure, faculty capability and industry collaboration.
- iv. Analyse the contribution of competency-based and skills-first education to graduate employability and adaptability.
- v. Propose an integrated framework and practical recommendations for higher education reform.

The review addresses three questions: Which competencies are becoming most important in AI-enabled workplaces? What institutional barriers limit the development of these competencies in Kenyan universities? Which reforms can translate skills-first principles into measurable graduate outcomes?

II. CONCEPTUAL AND THEORETICAL FRAMEWORK

A. Competency-Based and Skills-First Education

Competency-based education organises learning around clearly specified outcomes that students must demonstrate. Progress is linked to evidence of mastery rather than exposure to content alone. Skills-first education applies a similar principle to employment by focusing on what individuals can do, often demonstrated through projects, assessments, portfolios, work experience or micro-credentials, rather than relying exclusively on degrees as proxies for capability.

Within universities, a skills-first approach should retain the depth, inquiry and ethical purposes of higher education while making programme outcomes more explicit and assessable. Disciplinary knowledge remains essential, but it must be integrated with cognitive, interpersonal, digital and self-management competencies.

B. Human Capital Theory

Human Capital Theory explains education and training as investments that enhance knowledge, productivity and economic participation (Becker, 1993). It supports the expectation that universities contribute to national development by cultivating adaptable and innovative graduates. However, a narrow economic interpretation can overlook citizenship, inclusion, social justice and the intrinsic value of education. This paper therefore uses Human Capital Theory critically, recognising employability as an important but not exclusive purpose of higher education.

C. Skills Mismatch Theory

Skills Mismatch Theory focuses on the misalignment between competencies supplied by education and those required in employment (McGuinness et al., 2018). Mismatch may be vertical, where the level of education exceeds or falls below job requirements; horizontal, where the field of study is poorly aligned with the job; or qualitative, where graduates hold credentials but lack specific technical or transferable competencies.

D. AI-Era Workforce Readiness Framework

The proposed framework treats competency-based and skills-first education as the central institutional orientation. Its effects are mediated by curriculum responsiveness, faculty capability, digital infrastructure, experiential learning, assessment reform, industry collaboration and innovation ecosystems. Government policy, quality assurance, institutional leadership and financing shape implementation. Expected outcomes include graduate employability, AI literacy, adaptability, ethical judgment, innovation capacity and lifelong learning.

Table 1. AI-Era Workforce Readiness Framework

Framework dimension	Key elements	Illustrative institutional action	Expected outcome
Policy and leadership	National strategy, quality assurance, funding and governance	Adopt institutional AI and employability strategy with measurable targets	Coherent and accountable transformation
Curriculum and assessment	Competency outcomes, interdisciplinary learning and authentic assessment	Map programme outcomes to occupational and societal competencies	Relevant and demonstrable graduate capabilities
Faculty capability	Digital pedagogy, AI literacy, assessment design and industry exposure	Continuous professional development and communities of practice	Improved teaching quality and curriculum responsiveness
Digital and physical infrastructure	Connectivity, cloud platforms, laboratories, assistive technology and cybersecurity	Provide reliable access to AI-enabled learning environments	Inclusive participation in digital learning
Experiential learning	Internships, apprenticeships, projects, simulations and service learning	Require structured work-integrated learning with assessed outcomes	Practical experience and professional confidence
Industry and community partnership	Curriculum co-design, mentorship, applied research and innovation challenges	Establish programme advisory boards and co-supervised projects	Stronger labour-market alignment and social relevance
Credentials and lifelong learning	Micro-credentials, recognition of prior learning and short-cycle upskilling	Offer stackable, quality-assured credentials linked to degree programmes	Flexible reskilling and continued employability

III. MATERIALS AND METHODS

A. Review Design

The study used a structured critical narrative review and policy analysis. This design enabled the integration of theoretical, empirical and policy evidence on AI, graduate employability, skills mismatch and higher education transformation.

B. Information Sources and Search Strategy

Evidence was drawn from peer-reviewed journal articles, books, national legislation and policy documents, labour-market surveys and reports from institutions including the Kenya National Bureau of Statistics, Federation of Kenya Employers, BrighterMonday Kenya, UNESCO, OECD, World Bank and World Economic Forum. Search concepts included artificial intelligence, future of work, graduate employability, skills mismatch, competency-based education, skills-first education, digital competence, university-industry collaboration and Kenyan universities.

C. Eligibility Criteria

Priority was given to sources published between 2020 and 2026 that directly addressed higher education, workforce skills, AI or employability. Earlier foundational sources were retained for Human Capital Theory, employability and competency-based education. Sources were included when they provided a transparent methodology, recognised policy authority or directly relevant labour-market evidence.

D. Screening and Analysis

Documents were screened for relevance to the research questions and organised in an evidence matrix containing source type, geographical focus, method, principal findings and policy implications. Thematic analysis was then used to identify recurring patterns across six domains: labour-market transformation, graduate skills mismatch, curriculum responsiveness, faculty readiness, digital infrastructure and industry engagement.

E. Quality Assurance and Limitations

Evidence was triangulated across scholarly, government, employer and international sources. However, labour-market reports use different definitions and samples, and some institutional statistics are not nationally

representative. The study does not claim to measure the performance of every Kenyan university and does not substitute for primary surveys of graduates, employers and faculty.

IV. RESULTS AND TECHNICAL FINDINGS

A. Changing Workforce Competencies

The evidence consistently indicates that AI is changing tasks more rapidly than it is eliminating entire occupations. Graduates increasingly require a combination of human and technological capabilities. Analytical thinking, problem-solving, critical evaluation, communication, teamwork, resilience and creativity remain valuable because AI-generated outputs require interpretation, verification and contextual judgment.

Technical competencies are also expanding beyond specialist computing programmes. Students in business, education, health, agriculture, law and the social sciences increasingly need foundational AI literacy, data interpretation, cybersecurity awareness and responsible digital practice.

Table 2. Priority AI-era competencies for university graduates

Competency cluster	Illustrative skills	Why it matters	Suitable learning evidence
Cognitive	Critical thinking, problem-solving, systems thinking and evidence evaluation	Supports judgment where problems are ambiguous and AI outputs may be incomplete or biased	Case analysis, research projects and problem-based assessment
Digital and data	AI literacy, data analysis, cloud tools, cybersecurity and digital collaboration	Enables productive and safe participation in digital workplaces	Digital portfolio, practical examination and applied data project
Interpersonal	Communication, teamwork, leadership, negotiation and intercultural competence	Supports collaboration in distributed and multidisciplinary teams	Group project, presentation and peer assessment
Innovation and enterprise	Creativity, opportunity recognition, design thinking and entrepreneurship	Supports job creation, adaptation and value generation	Prototype, business model, innovation challenge or incubation milestone
Self-management	Adaptability, resilience, learning agility and reflective practice	Enables continuous reskilling in rapidly changing occupations	Reflective portfolio, development plan and work-placement feedback
Ethical and civic	Responsible AI, privacy, fairness, professional ethics and social responsibility	Protects individuals and institutions from harmful or uncritical technology use	Ethics case, impact assessment and policy brief

B. Graduate Skills Mismatch in Kenya

Employer reports cited in the reviewed literature identify weaknesses in digital literacy, communication, critical thinking, problem-solving, adaptability and teamwork. These are not isolated deficits; they indicate a broader mismatch between knowledge-transmission models and workplaces that require application, collaboration and independent judgment.

Graduate unemployment should nevertheless be interpreted carefully. It is influenced by economic growth, job creation, recruitment practices, regional inequality and professional entry barriers as well as university quality. Universities cannot resolve labour-market constraints alone, but they can improve graduates' ability to navigate them.

C. Curriculum Responsiveness and Assessment

Curriculum responsiveness is constrained when programme review cycles are slow and industry consultation is episodic. Adding a single AI unit is insufficient if teaching and assessment remain unchanged. AI-era curriculum reform should embed digital and transferable competencies across programmes and use authentic assessment to demonstrate application.

Assessment is particularly important because students tend to prioritise what is assessed. Competency-based reform therefore requires greater use of projects, portfolios, simulations, workplace tasks, capstones and oral defence alongside appropriate examinations.

D. Faculty Readiness

Faculty members require continuous development in digital pedagogy, responsible AI use, assessment design and disciplinary applications of emerging technologies. Professional development should move beyond one-off software demonstrations toward sustained mentoring, course redesign and peer learning.

E. Infrastructure and Inclusion

Digital transformation depends on reliable connectivity, devices, learning platforms, technical support, cybersecurity and access to specialised software or computing capacity. Unequal infrastructure can reproduce educational inequality. Institutions should therefore incorporate low-bandwidth design, assistive technologies, shared laboratories and equitable student access into digital strategy.

F. University-Industry Collaboration

Workforce readiness improves when employers participate in programme advisory boards, curriculum review, mentorship, internships, guest teaching, applied research and assessment of capstone projects. Partnerships should include clear learning outcomes, supervision standards and feedback rather than treating attachment as an unstructured placement.

Table 3. Institutional barriers and strategic responses

Barrier	Consequence	Strategic response	Suggested indicator
Theory-dominated pedagogy	Limited ability to apply knowledge	Increase problem-based, project-based and experiential learning	Proportion of units using authentic assessment
Slow curriculum review	Programmes lag behind occupational change	Use annual employer intelligence and modular curriculum updates	Time from identified skills need to approved curriculum response
Weak industry participation	Poor alignment and limited workplace exposure	Establish active advisory boards and structured work-integrated learning	Programmes with employer co-design and assessed placements
Faculty capability gaps	Inconsistent AI and digital integration	Provide continuous, discipline-specific faculty development	Faculty completing certified digital-pedagogy development
Uneven infrastructure	Exclusion and inconsistent learning quality	Invest in connectivity, devices, cloud resources and inclusive design	Student access, uptime and platform-use indicators
Limited innovation ecosystem	Weak entrepreneurship and commercialisation	Develop incubation, prototyping and applied-research support	Student ventures, prototypes, patents and community solutions
Credential rigidity	Slow reskilling and limited recognition of short learning	Introduce stackable, quality-assured micro-credentials	Micro-credentials articulated into degree pathways

V. DISCUSSION AND APPLIED IMPLICATIONS

A. Skills-First Reform Is a Whole-Institution Agenda

The findings suggest that workforce readiness cannot be achieved through isolated employability workshops delivered near graduation. It must be designed across programme outcomes, course activities, assessment, student support, career services, internships, research, innovation and alumni engagement.

Skills-first reform also requires an evidence system. Universities should track student competency development, placement quality, graduate destinations, employer feedback and equity of outcomes. These data should inform curriculum improvement rather than serve only external reporting.

B. Balancing Employability With the Public Purposes of Higher Education

A narrow skills agenda risks reducing education to immediate employer demand. Universities must also prepare graduates for ethical leadership, citizenship, democratic participation, community problem-solving and uncertain futures. AI-era education should therefore combine employability with humanistic, civic and professional values.

C. Responsible AI Integration

Universities need clear policies for acceptable AI use in learning, assessment and research. Students should learn how to verify AI outputs, acknowledge assistance, protect confidential information, recognise bias and maintain academic integrity. Assessment should increasingly test reasoning, application and reflection rather than tasks that generative AI can complete without understanding.

D. Quality Assurance and Micro-Credentials

Micro-credentials can support rapid and flexible learning, but quality assurance is essential. Each credential should have defined outcomes, workload, assessment, verification and pathways for recognition. Stackability into degree programmes can prevent fragmentation and create flexible lifelong-learning routes.

E. Equity and Institutional Differentiation

Institutions differ in mission, resources and disciplinary focus. Reform should therefore establish common graduate capabilities while allowing contextual adaptation. Public policy should avoid creating a two-tier system in which only well-resourced universities can offer meaningful AI and experiential learning.

F. Limitations and Future Research

The review depends on secondary sources and includes some employer reports whose samples and methods vary. Future research should use nationally coordinated graduate tracer studies, employer surveys and institutional readiness assessments. Longitudinal studies are also needed to determine whether competency-based reforms improve employment quality, entrepreneurship, innovation and adaptability over time.

VI. CONCLUSION AND RECOMMENDATIONS

AI and automation are changing the nature of work and increasing demand for graduates who can combine disciplinary expertise with digital competence, human judgment and continuous learning. Kenyan universities have expanded access and made progress in digital learning, but workforce readiness remains constrained by slow curriculum reform, limited experiential learning, uneven infrastructure, faculty-capability gaps and weak industry collaboration.

The required response is not simply to add technology content. It is to transform how programmes define outcomes, organise learning, assess performance and engage employers and communities. Competency-based and skills-first education can strengthen graduate employability when it is supported by ethical AI literacy, inclusive infrastructure, trained faculty, authentic assessment and accountable partnerships.

Recommendations

- i. Embed programme-level graduate competency maps that integrate disciplinary, digital, interpersonal, ethical and entrepreneurial outcomes.
- ii. Require authentic assessment through projects, portfolios, simulations, capstones and workplace-based tasks.
- iii. Integrate foundational AI literacy, data competence, cybersecurity and responsible technology use across disciplines.
- iv. Establish continuous, discipline-specific faculty development in digital pedagogy and AI-supported teaching.
- v. Strengthen structured internships, apprenticeships and industry projects with clear learning outcomes and joint assessment.
- vi. Use employer advisory boards and labour-market intelligence to support faster, evidence-based curriculum updates.
- vii. Invest in inclusive digital infrastructure, low-bandwidth learning design, laboratories, technical support and assistive technology.
- viii. Develop quality-assured, stackable micro-credentials and recognition-of-prior-learning pathways.
- ix. Expand innovation hubs, incubators and community-based problem-solving to support entrepreneurship and applied learning.
- x. Track graduate outcomes, competency attainment, employer feedback and equity indicators as part of institutional quality assurance.

VII. DECLARATIONS

Ethics Approval and Consent to Participate

This review used published literature, policy documents and publicly available reports and did not involve direct participation by human subjects.

Funding

The author received no specific grant from any public, commercial or not-for-profit funding agency for this study.

Conflict of Interest

The author declares no conflict of interest.

Data Availability

All evidence analysed in this review is available from the cited sources.

Author Contribution

Prof. Siringi M. Elijah conceptualised the study, conducted the evidence synthesis, developed the framework and prepared the manuscript.

AI and Digital Tool Disclosure

Digital tools may have been used for language refinement, formatting and reference organisation. The author reviewed the manuscript and accepts responsibility for its accuracy, interpretation and originality.

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