

Workforce Readiness in the AI Era: An Empirical Qualitative Study of Higher Education and Upskilling Among Urban Muslim Communities in Indonesia

Reza Fahmi*

UIN Imam Bonjol Padang, Indonesia

Prima Aswirna

UIN Imam Bonjol Padang, Indonesia

Adamu Abubakar Muhammad

Federal University, Kashere, Gombe, Nigeria

*Correspondence: rezafahmi@uinib.ac.id

Abstract

The rapid advancement of artificial intelligence (AI), automation, and digital technologies has fundamentally transformed labor markets and redefined workforce skill requirements. This empirical qualitative study investigates the mismatch between higher education outcomes and labor market expectations in Indonesia, focusing on stakeholders from universities, industry, and government involved in workforce development. The study aims to identify critical skill gaps, examine factors influencing workforce readiness, and develop an integrated upskilling framework for the AI era. Data were collected through semi-structured interviews, focus group discussions (FGDs), and document analysis involving lecturers, university students, human resource practitioners, vocational training experts, and government officials from higher education and employment sectors in Indonesia. Thematic analysis identified five major challenges: outdated curricula, limited adoption of innovative learning approaches, weak lifelong learning culture, insufficient industry participation in curriculum development, and slow policy adaptation to technological change. Based on these findings, the study proposes an integrated upskilling model combining industry-aligned curricula, project-based learning, micro-credentials, professional certification, and university–industry collaboration. The findings demonstrate that strengthening collaboration among higher education institutions, industry, and government is essential for improving workforce readiness and establishing a sustainable lifelong learning ecosystem capable of responding to AI-driven labor market transformation in Indonesia.

Keywords: Artificial intelligence, workforce readiness, higher education, lifelong learning, skill improvement; Indonesia.

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Introduction

Artificial intelligence (AI), automation, and digital technologies are fundamentally transforming labor markets, organizational practices, and the competencies required across nearly all economic sectors. Rather than simply replacing routine tasks, AI is reshaping the nature of work by augmenting human decision-making, accelerating knowledge production, and creating new occupational roles that require digital fluency, analytical reasoning, creativity, and continuous learning. According to the World Economic Forum (2024), technological change is expected to generate substantial shifts in employment structures, increasing demand for workers who can adapt to rapidly evolving technologies while integrating technical expertise with human-centered competencies. Consequently, higher education institutions are increasingly expected to prepare graduates not only with disciplinary knowledge but also with adaptive capabilities that enable lifelong employability. These global developments present significant challenges for developing countries, including Indonesia, where higher education plays a strategic role in supporting national economic transformation. Although universities have expanded access to tertiary education, concerns remain regarding the alignment between graduate competencies and labor market expectations. Employers increasingly seek graduates who possess applied digital skills, interdisciplinary problem-solving abilities, professional certification, and experience with AI-enabled work environments. However, university curricula often remain oriented toward theoretical instruction, with limited opportunities for authentic industry engagement or competency-based learning. As a result, graduates frequently encounter difficulties transitioning from higher education to professional employment in increasingly technology-intensive workplaces.

Previous studies have examined workforce readiness, digital literacy, lifelong learning, and human capital development in the context of technological change (OECD, 2023; UNESCO, 2024; World Economic Forum, 2024). Existing scholarship has consistently demonstrated that continuous learning and digital competencies are essential for employability in the era of Industry 4.0 and artificial intelligence. Nevertheless, much of this literature addresses these issues separately. Research on workforce readiness generally emphasizes graduate employability, while studies of lifelong learning focus primarily on adult education, and investigations of digital transformation often concentrate on technological adoption within educational institutions. Relatively few empirical studies integrate these dimensions into a comprehensive framework that simultaneously considers curriculum reform, industry collaboration, professional certification, micro-credentials, and lifelong learning as interconnected components of workforce development. This limitation is particularly evident in the Indonesian context. Existing studies have documented digital skill shortages and curriculum–industry mismatches, yet they rarely incorporate the perspectives of multiple stakeholders including university lecturers, students, human resource practitioners, vocational training experts, and government policymakers to explain how these challenges interact across the higher education ecosystem. Furthermore, despite the rapid emergence of generative AI technologies, empirical evidence remains limited regarding how Indonesian higher education institutions should redesign learning systems to prepare graduates for AI-supported workplaces. Consequently, there remains a need for research that not only identifies competency gaps but also develops an integrated framework capable of informing institutional and policy reforms.

To address this gap, the present study adopts an empirical qualitative approach to investigate workforce readiness and lifelong learning strategies in Indonesian higher education. Drawing on semi-structured interviews, focus group discussions, and document analysis, the study explores stakeholder perspectives on the competencies required in AI-driven labor markets, the institutional barriers limiting workforce preparedness, and the educational strategies needed to enhance graduate employability. By examining experiences across academia, industry, and government, the research provides a more comprehensive understanding of workforce development than studies focusing on a single stakeholder group. The principal contribution of this study lies in the development of an integrated upskilling model that differs from existing workforce development frameworks in several important respects. First, rather than concentrating

solely on digital skills training or curriculum revision, the proposed model integrates five complementary components: industry-aligned curriculum design, project-based learning, micro-credential pathways, industry-recognized professional certification, and sustained university–industry collaboration. Second, the model conceptualizes workforce readiness as a dynamic learning ecosystem in which universities, employers, policymakers, and learners share responsibility for continuous competence development. Third, unlike conventional upskilling frameworks that primarily emphasize technical competencies, the proposed model incorporates lifelong learning principles and institutional collaboration as essential mechanisms for responding to continuous technological change. This integrated perspective reflects the increasingly interconnected nature of higher education, labor markets, and AI-driven innovation.

The study is also theoretically informed by Human Capital Theory and Lifelong Learning Theory. Human Capital Theory provides a useful framework for understanding education as an investment that enhances productivity and employability through the development of relevant competencies. However, in the context of AI-driven technological change, human capital must be viewed as dynamic rather than static, requiring continuous renewal through upskilling and reskilling. Complementing this perspective, Lifelong Learning Theory emphasizes that learning extends beyond formal education and continues throughout an individual's professional life. Together, these theoretical perspectives provide a foundation for examining how higher education institutions can support sustainable workforce development under conditions of rapid technological transformation. The Indonesian context provides a particularly relevant setting for this investigation because the country is undergoing simultaneous digital transformation, higher education reform, and labor market restructuring. Strengthening workforce readiness is therefore an important component of Indonesia's broader efforts to enhance human capital quality and improve participation in the global digital economy. Understanding how educational institutions, industries, and policymakers can collaborate to develop adaptive learning ecosystems has implications not only for graduate employability but also for long-term national competitiveness and sustainable socioeconomic development.

Accordingly, this study aims to (1) identify the competency gaps between higher education outcomes and labor market expectations in the AI era, (2) examine the institutional barriers affecting workforce readiness from the perspectives of multiple stakeholders, and (3) develop an integrated upskilling model that supports lifelong learning and stronger alignment between higher education and the evolving demands of AI-driven workplaces.

Methods

This study employed an empirical qualitative descriptive design to investigate workforce readiness and lifelong learning strategies in response to AI-driven transformations in work and higher education in Indonesia. A qualitative approach was selected because the study sought to explore the perceptions, experiences, and expectations of multiple stakeholders regarding emerging workforce competencies, institutional challenges, and educational responses that cannot be adequately captured through quantitative measures alone. The research was guided by three objectives: (1) to identify competency gaps between higher education outcomes and labor market demands, (2) to examine institutional barriers affecting workforce readiness, and (3) to develop an integrated upskilling model that supports lifelong learning in the AI era.

Study Context and Participants

The study was conducted in Indonesia, where higher education institutions are undergoing curriculum reforms while responding to rapid technological change associated with artificial intelligence, automation, and digital transformation. Participants were selected using purposive sampling to ensure that individuals possessed direct experience with higher education, workforce development, or employment practices relevant to AI-driven labor market changes. A total of 30 participants were recruited from five stakeholder groups: eight university lecturers involved in curriculum development and digital learning, eight final-year undergraduate students preparing for labor market entry, six human resource practitioners representing public and private organizations,

four vocational education and professional training specialists, and four government officials from agencies responsible for higher education and workforce development. Recruitment was conducted through professional networks, university partnerships, and formal invitations sent to institutions that had implemented digital learning initiatives or workforce development programs. Participation was voluntary, and recruitment continued until thematic saturation was reached, whereby additional interviews yielded no substantially new themes. The inclusion of multiple stakeholder groups enabled the study to compare educational perspectives with labor market expectations and policy priorities, thereby providing a comprehensive understanding of workforce readiness within the Indonesian context.

Data Collection

Data were collected between January and March 2026 using three complementary qualitative methods: semi-structured interviews, focus group discussions (FGDs), and document analysis. Combining these methods enabled methodological triangulation and enhanced the credibility of the findings. Semi-structured interviews were conducted with all participants using an interview guide designed around the study objectives. The interviews explored participants' perceptions of AI-related workforce competencies, curriculum relevance, digital literacy, lifelong learning, professional certification, industry collaboration, and emerging skill requirements associated with generative AI and workplace automation. Each interview lasted approximately 45–60 minutes, was conducted either face-to-face or via secure online video conferencing platforms, and was audio-recorded with participants' permission before being transcribed verbatim. To complement individual interviews, two Focus Group Discussions (FGDs) were organized. The first involved university lecturers and students, while the second included human resource practitioners, vocational training experts, and government representatives. Each FGD consisted of 7–8 participants and lasted approximately 90 minutes. The discussions explored collective perspectives on curriculum reform, university–industry collaboration, lifelong learning ecosystems, and institutional strategies for preparing graduates to work effectively alongside AI technologies.

Document analysis was undertaken to contextualize interview findings and examine existing educational and workforce policies. Documents included national higher education policies, curriculum guidelines, reports on digital transformation in education, workforce development strategies, and publications issued by relevant ministries and international organizations. These materials provided contextual evidence regarding policy responses to AI-driven changes in employment and learning.

Data Analysis

The data were analyzed using thematic analysis following the six-phase framework proposed by Braun and Clarke (2006). First, all interview transcripts, FGD recordings, and documentary materials were read repeatedly to achieve familiarity with the data. Second, meaningful units of text relating to workforce competencies, AI readiness, curriculum reform, lifelong learning, and institutional collaboration were assigned initial codes. Third, related codes were organized into broader thematic categories reflecting recurring patterns across stakeholder groups. Fourth, preliminary themes were reviewed and refined by comparing coded extracts with the complete dataset to ensure conceptual consistency and internal coherence. Fifth, each theme was clearly defined and named according to its analytical significance. Finally, the themes were interpreted in relation to Human Capital Theory and Lifelong Learning Theory, enabling the development of an integrated explanatory framework for workforce readiness in the AI era. This analytical process produced three overarching themes corresponding to the study objectives: (1) competency gaps between higher education and labor market expectations, (2) institutional barriers affecting workforce readiness, and (3) the development of an integrated upskilling model for AI-driven lifelong learning.

Trustworthiness

Several strategies were employed to enhance the trustworthiness of the findings. Methodological triangulation was achieved by integrating interviews, FGDs, and document analysis. Data source triangulation was ensured by collecting perspectives from lecturers, students,

employers, vocational experts, and policymakers. Preliminary interpretations were shared with selected participants through member checking to verify the accuracy of the researchers' interpretations. In addition, peer debriefing was conducted among the research team to review coding decisions, resolve analytical discrepancies, and strengthen interpretive consistency throughout the analysis.

Ethical Considerations

Ethical principles were observed throughout the research process. Before participation, all respondents received detailed information regarding the study's objectives, procedures, confidentiality measures, and their right to withdraw at any stage without penalty. Written informed consent was obtained from each participant before interviews or focus group discussions commenced. To protect participant privacy, all interview transcripts were anonymized by removing personally identifiable information, and pseudonyms were used during analysis and reporting. Audio recordings and research data were stored in password-protected digital files accessible only to the research team. The study complied with the ethical standards governing social science research and respected principles of voluntary participation, confidentiality, and responsible data management.

Alignment with AI-Driven Workforce Transformation

The methodological design was specifically developed to investigate how AI-driven technological change influences workforce readiness and lifelong learning. Interview questions explored emerging competencies associated with automation, digital transformation, generative AI applications, professional certification, and AI-assisted work practices. Including participants from higher education, industry, vocational training, and government enabled the study to capture multiple perspectives on how educational institutions can respond to evolving labor market demands. Consequently, the qualitative design was well suited to generating an empirically grounded framework for understanding workforce development and informing the proposed integrated upskilling model in the context of AI-enabled work and learning.

Data Sources

The study relies on secondary data drawn from official government documents and statistics. Key sources include national and regional spatial planning regulations—such as Law No. 26 of 2007 on Spatial Planning (as amended by Law No. 6 of 2023), DKI Jakarta Provincial Regulation No. 7 of 2024, West Java Provincial Regulation No. 9 of 2022, and Bandung City Regulation No. 5 of 2022 along with population and religious statistics from the Central Bureau of Statistics (2021–2024) and the Ministry of Religious Affairs (2023). The 2023 data from the Ministry of Religious Affairs was chosen as it represents the most recent comprehensive official dataset available at the time of the study. Scholarly literature on urbanization, spatial planning, and Islamic urbanism was also reviewed. Source triangulation was applied to enhance validity by cross-checking regulatory texts, statistical data, and academic findings.

Analytical Framework

The study uses *maqashid sharia* (with its five protections: religion, life, intellect, property, and lineage) and the concept of spatial justice as the primary analytical lenses. These frameworks serve not merely as additional concepts but as core interpretive tools to evaluate the extent to which spatial planning policies support equitable access, public interest (*maslahah*), and socio-religious functions in urban settings.

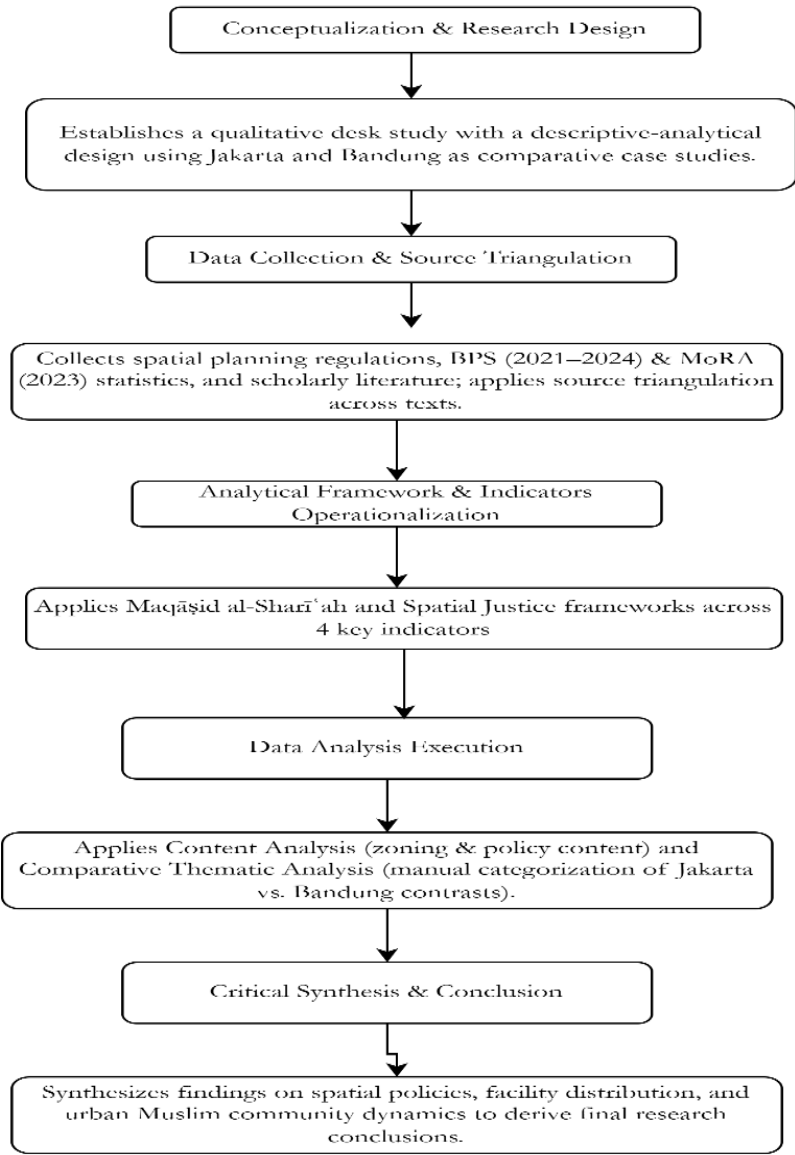


Figure 1: Research Procedure Workflow:

Indicators

The analysis focuses on the following key indicators: (1) the ratio of religious facilities to population, (2) spatial distribution patterns of religious facilities, (3) the level of integration between religious facilities and other urban functions (housing, education, economy, and transportation), and (4) the alignment between spatial planning policies and the needs of urban Muslim communities.

Analysis Procedures

Data were analyzed using two main techniques: content analysis and comparative thematic analysis. Content analysis was applied to identify policy content related to religious facilities, zoning, sustainability, and justice in spatial planning documents. Comparative thematic analysis was then used to identify patterns and contrasts between Jakarta and Bandung regarding facility distribution, urbanization challenges, and opportunities for integrating Islamic values into urban planning. Thematic categorization was conducted manually to ensure consistency and analytical depth.

Results and Discussion

The findings of this study demonstrate that workforce readiness in the AI era should be understood not merely as an issue of individual competence but as a consequence of interactions among educational institutions, labor market structures, technological innovation, and public policy. While previous research has consistently identified digital literacy and technical skills as essential determinants of employability (World Economic Forum, 2024; OECD, 2023), the present study reveals that the principal challenge in Indonesia lies in the inability of higher education institutions to adapt their educational ecosystems at the same pace as technological transformation. The competency gaps identified through interviews and focus group discussions indicate that graduates possess acceptable theoretical knowledge but remain inadequately prepared to operate within increasingly AI-enabled workplaces that require adaptability, interdisciplinary collaboration, and continuous learning.

These findings contribute to ongoing debates concerning the changing meaning of employability in the age of artificial intelligence. Traditional human capital perspectives assume that investments in education directly enhance labor productivity and economic competitiveness. However, contemporary scholarship argues that this assumption has become increasingly problematic because technological innovation shortens the relevance of acquired knowledge and continuously changes occupational requirements (Goldin, 2024; Bessen, 2023). Rather than viewing education as a one-time investment completed upon graduation, employability increasingly depends on the capacity of individuals and institutions to sustain lifelong competence renewal. Therefore, human capital should be interpreted as dynamic rather than static, emphasizing continuous adaptation instead of accumulated qualifications alone. The competency mismatches identified in this research illustrate this transformation. Industry representatives consistently emphasized practical digital competencies, AI-supported decision-making, collaborative problem-solving, and recognized professional certification as indicators of workforce readiness. Universities, in contrast, continue to rely heavily on lecture-based instruction and examination-oriented assessment systems that prioritize conceptual mastery over practical application.

This discrepancy suggests that educational institutions are evaluating learning using indicators that differ substantially from those used by employers. Consequently, graduates experience a transition gap between formal education and professional practice, requiring additional training after entering the workforce. An important contribution of this study concerns the role of *generative artificial intelligence*, which has rapidly become a defining feature of contemporary workplaces. Existing discussions on workforce preparation often focus on automation and digitalization generally, yet generative AI introduces qualitatively different challenges because it augments rather than merely replaces cognitive work. Tools such as ChatGPT, Microsoft Copilot, Google Gemini, and other large language models increasingly assist professionals in drafting reports, analyzing information, producing software code, designing educational materials, and supporting decision-making processes. Consequently, future employees require competencies that extend beyond conventional digital literacy. They must understand how to formulate effective prompts, critically evaluate AI-generated outputs, recognize algorithmic bias, verify factual accuracy, protect confidential information, and integrate human judgment with machine-generated recommendations.

The present findings indicate that these competencies remain largely absent from existing university curricula. Although many students reported familiarity with digital technologies, very few demonstrated systematic understanding of responsible AI use or AI-assisted professional workflows. This observation aligns with recent international discussions arguing that AI literacy should encompass technical, ethical, cognitive, and social dimensions rather than simple operational skills (UNESCO, 2024). Accordingly, curriculum reform should not merely introduce AI software into classrooms but redesign learning outcomes to develop critical AI competence, including ethical reasoning, transparency, accountability, and collaborative human-AI interaction.

The emergence of generative AI also challenges conventional assessment practices within higher education. Traditional written assignments can increasingly be completed with AI

assistance, raising concerns regarding academic integrity while simultaneously creating opportunities for more authentic assessment methods. Rather than attempting to prohibit AI entirely, universities may need to redesign assessment systems toward project-based learning, authentic workplace simulations, portfolio development, reflective writing, and collaborative problem-solving activities. Such approaches evaluate students' capacity to utilize AI responsibly instead of merely testing memorization or isolated knowledge acquisition. The proposed upskilling model identified in this study is therefore particularly relevant because project-based learning naturally integrates AI tools within meaningful professional contexts while maintaining opportunities for human creativity and critical reflection.

The findings further contribute to debates concerning educational governance and skills ecosystems. Contemporary literature increasingly argues that workforce development should not be understood as the responsibility of educational institutions alone but as an interconnected ecosystem involving governments, employers, professional organizations, technology providers, and learners themselves. The barriers identified in this study—including outdated curricula, limited industry participation, inadequate lecturer competencies, and weak lifelong learning cultures—reflect systemic governance problems rather than isolated institutional weaknesses.

In Indonesia, curriculum revision procedures often require lengthy bureaucratic processes, whereas technological innovation progresses at an exponential pace. AI applications evolve within months rather than years, making conventional curriculum review cycles insufficient for maintaining educational relevance. This temporal mismatch suggests that educational governance should become substantially more agile. Universities require flexible curriculum architectures capable of incorporating emerging competencies through modular learning units, micro-credentials, stackable certificates, and industry partnerships without waiting for complete program revisions. Such flexibility would enable institutions to respond rapidly to technological developments while preserving academic standards. The findings also highlight the strategic importance of industry participation throughout educational processes rather than solely during student internships. Employers possess current knowledge regarding technological developments, emerging occupational roles, and competency expectations that universities often lack. Accordingly, industry representatives should participate actively in curriculum design, guest lecturing, joint supervision of student projects, competency assessment, and micro-credential development. Such collaboration creates reciprocal benefits: universities improve educational relevance, while employers reduce recruitment and onboarding costs by accessing graduates whose competencies better reflect workplace requirements.

These implications are particularly significant within Indonesian higher education, where considerable diversity exists regarding institutional capacity, technological infrastructure, and regional economic development. Universities located in major metropolitan areas generally maintain stronger industrial networks and greater access to digital technologies than institutions operating in peripheral regions. Consequently, implementing AI-oriented educational reforms requires differentiated policy strategies rather than uniform national approaches. Government support through infrastructure investment, lecturer professional development, digital resource sharing, and equitable funding mechanisms remains essential for reducing regional disparities in educational quality.

Within the context of Islamic higher education, the findings possess additional significance because technological transformation intersects with broader educational missions emphasizing ethical development, character formation, and social responsibility. Islamic universities traditionally pursue holistic education integrating intellectual, moral, and spiritual dimensions of human development. Rather than perceiving artificial intelligence solely as a technological innovation, Islamic higher education may interpret AI as a tool requiring ethical governance guided by principles of justice (*adl*), public welfare (*maslahah*), trustworthiness (*amanah*), and accountability (*bisab*).

The concept of lifelong learning proposed in this study resonates strongly with Islamic intellectual traditions. The principle of *ṭalab al-'ilm* emphasizes that seeking knowledge constitutes

a lifelong obligation rather than an activity confined to formal education. However, the findings indicate that institutional practices frequently fail to embody this principle despite its philosophical compatibility with Islamic educational values. Universities often maintain rigid curricular structures and limited opportunities for graduates to return for competency renewal. Integrating micro-credentials, flexible certification pathways, and continuing professional education could therefore strengthen both workforce competitiveness and the civilizational objectives of Islamic education.

Furthermore, generative AI presents distinctive ethical questions particularly relevant within Islamic educational contexts. AI-generated religious content, automated fatwa systems, algorithmic interpretation of Islamic texts, and machine-assisted educational materials raise concerns regarding authority, authenticity, and accountability. Consequently, AI literacy within Islamic higher education should incorporate ethical reflection alongside technical competence. Students should learn not only how AI functions but also when human scholarly judgment remains indispensable. Such integration may distinguish Islamic higher education by producing graduates capable of combining technological proficiency with ethical responsibility.

From a theoretical perspective, the present study extends Human Capital Theory by demonstrating that educational investments generate sustainable value only when supported by institutional mechanisms enabling continuous competency renewal. Human capital should therefore be conceptualized as an adaptive process characterized by recurrent learning cycles rather than accumulated educational attainment. Similarly, the findings refine Lifelong Learning Theory by emphasizing that continuous learning depends upon systemic opportunities, institutional incentives, credential recognition, and supportive policy environments rather than individual motivation alone.

The proposed integrative upskilling model contributes to this theoretical synthesis by linking educational governance, curriculum innovation, industrial collaboration, and lifelong learning within a unified framework. Unlike many existing upskilling models that focus exclusively on technical competencies, the present framework incorporates organizational partnerships, policy support, professional certification, project-based learning, and flexible credentialing as mutually reinforcing components. This systems-oriented perspective better reflects the complexity of workforce transformation within AI-driven economies. Nevertheless, several limitations should be acknowledged. The qualitative design provides rich contextual understanding but limits statistical generalization beyond the participating institutions and stakeholders. Future research could employ mixed-methods approaches involving larger samples across multiple Indonesian provinces to examine regional variations in AI readiness and workforce development.

Comparative studies between Islamic and non-Islamic higher education institutions may also illuminate how differing educational philosophies influence AI adoption and lifelong learning practices. Finally, longitudinal investigations would enable researchers to evaluate whether proposed upskilling interventions produce measurable improvements in graduate employability, organizational performance, and national human capital development over time.

Overall, the findings suggest that preparing future workforces for the AI era requires more than curriculum revision or technological adoption. Sustainable workforce readiness depends upon transforming higher education into an adaptive learning ecosystem where universities, industries, governments, and learners continuously co-create relevant knowledge, competencies, and ethical standards. Such transformation is particularly important for Indonesia as it seeks to capitalize on demographic opportunities while navigating the profound disruptions introduced by artificial intelligence and generative technologies. Data obtained from interviews and FGDs reveal a consistent pattern of mismatch between competencies produced by higher education institutions and those demanded by industry. Five core skill domains emerged as critical indicators: digital literacy, problem-solving ability, professional certification, industry experience, and adaptability.

Most lecturers and students reported moderate exposure to digital tools; however, HR practitioners emphasized that graduates lack applied digital competencies such as data handling, AI-assisted work processes, and platform-based collaboration. Industry respondents rated digital literacy as a primary recruitment criterion, while academic stakeholders acknowledged limited curriculum

integration of advanced digital skills. Professional certification represents the widest gap. More than two-thirds of student participants indicated they had never pursued industry-recognized certification before graduation. In contrast, employers consistently identified certification as a proxy for job readiness and productivity. Similar discrepancies were observed in industry experience, where internships were often short-term and observational rather than task-oriented. The chart illustrating competency gaps shows that higher education output scores remain significantly below industry expectation scores across all five skill areas, with the sharpest differences in certification and industry experience.

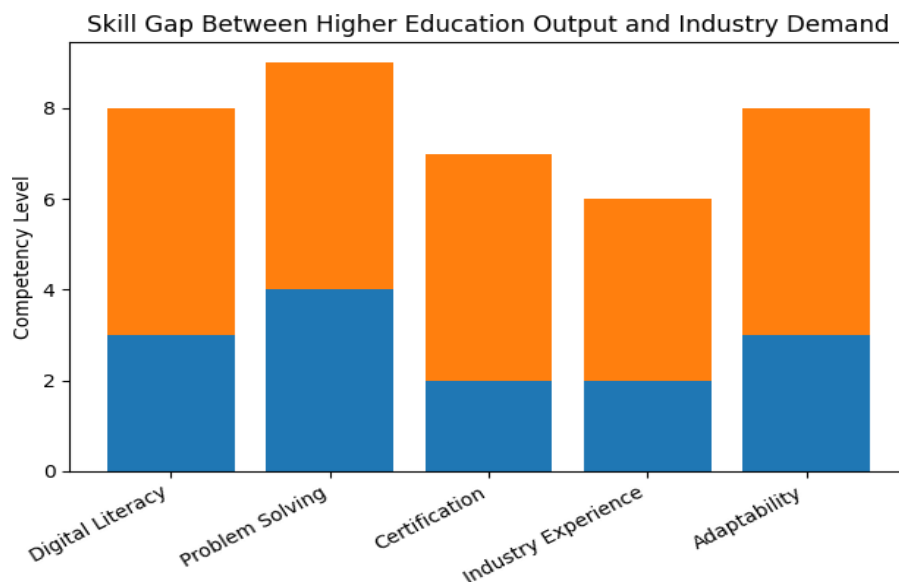


Figure 2. Skill Gap Between Higher Education and Industry Demand

The findings indicate a significant mismatch between academic curricula and industry expectations. Employers prioritize digital literacy, problem-solving skills, and professional certification, whereas universities emphasize theoretical mastery.

The findings of this study reveal a substantial mismatch between higher education outputs and industry expectations in Indonesia, particularly in the context of the AI-driven labor market. Interview data from human resource practitioners consistently indicate that employers prioritize digital literacy, complex problem-solving, adaptability, and professional certification over purely academic credentials. In contrast, most universities continue to emphasize theoretical knowledge, examinations, and discipline-based content mastery. The chart above illustrates this discrepancy by comparing perceived graduate readiness with industry expectations across five core competencies. Digital literacy, for example, is rated relatively low in higher education outcomes, while industry expectations are significantly higher. Similar gaps appear in certification and industry experience, confirming that graduates often lack recognized credentials and hands-on exposure.

Discussion

These findings align with global research showing that automation and AI increasingly favor transferable skills, applied, and continuously updated (OECD, 2023; World Economic Forum, 2024). In Indonesia, this gap is intensified by limited access to digital infrastructure and uneven quality among higher education institutions, especially outside major urban centers. From the perspective of Human Capital Theory, this mismatch signals inefficient investment in education, as learning outcomes do not translate optimally into labor market productivity. Education systems that fail to respond to technological change risk producing graduates who are structurally unemployed or underemployed despite formal qualifications.

Competency Gaps Between Higher Education and Industry Expectations

Analysis of interview transcripts and Focus Group Discussions (FGDs) revealed a consistent mismatch between competencies developed in higher education and those expected by employers in AI-driven workplaces.

Across all stakeholder groups, five competency domains emerged as the most important indicators of workforce readiness: **digital literacy, problem-solving ability, professional certification, industry experience, and adaptability to technological change**. Lecturers generally perceived that students possessed adequate theoretical knowledge and basic digital skills. However, students acknowledged limited opportunities to apply these competencies through authentic workplace experiences. Human resource practitioners consistently reported that many graduates lacked proficiency in AI-assisted work processes, collaborative digital platforms, and practical data management, despite satisfactory academic performance. Professional certification represented the largest competency gap identified by participants. More than two-thirds of student participants reported that they had not obtained industry-recognized certifications before graduation. Employers, however, viewed professional certification as an important indicator of technical competence and workplace readiness, particularly for positions involving digital technologies and AI-supported operations.

Industry experience constituted another significant area of concern. Although internship programs were widely available, participants indicated that many placements were short-term, observational, and offered limited opportunities for meaningful task participation. Consequently, graduates often entered the labor market with minimal exposure to real organizational environments or AI-enabled work systems. **Figure 1** summarizes stakeholder assessments of graduate competencies relative to industry expectations. The largest discrepancies were observed in **professional certification** and **industry experience**, followed by **digital literacy**, while smaller differences were found in **problem-solving ability** and **adaptability**. These findings indicate that practical competencies remain less developed than theoretical knowledge among higher education graduates. The table shows that spatial inequality is not merely empirical but also reflects a misalignment between spatial planning practices and the principles of justice found in both global urban theory and the *maqashid sharia* framework. In other words, the issue of religious facility distribution is not simply a technical matter of facility provision, but concerns how urban space is produced and for whom it is prioritized.

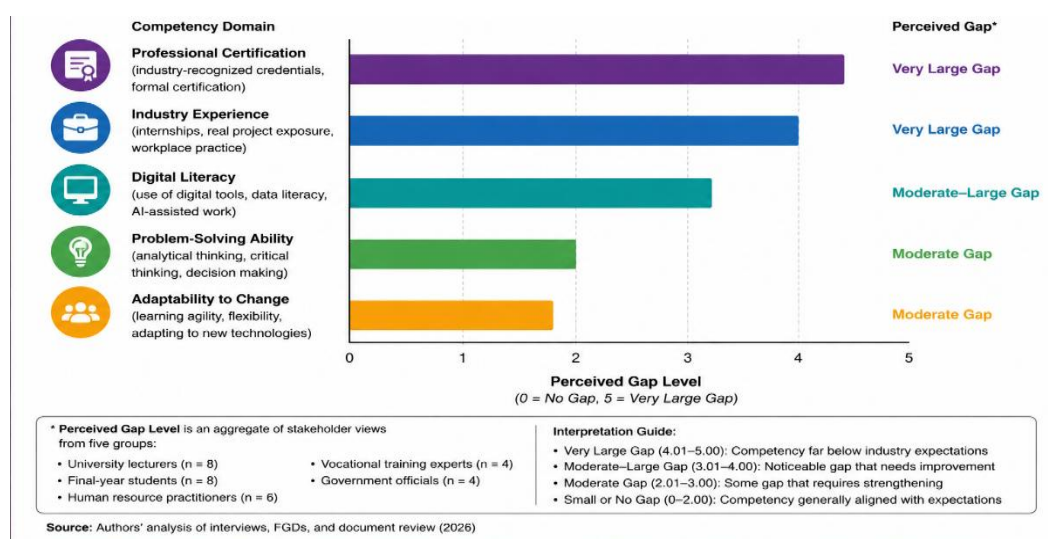


Figure 3. Competency gaps between higher education outcomes and industry expectations across five workforce readiness domains.

Institutional Barriers to Workforce Readiness

Beyond identifying competency gaps, participants consistently described several institutional factors that limit universities' ability to prepare graduates for AI-driven labor markets. Five major barriers emerged from the thematic analysis.

Outdated Curriculum Participants identified curriculum relevance as the most significant institutional challenge. Lecturers acknowledged that curriculum revisions generally occur every five to ten years, whereas technological developments related to artificial intelligence, automation, and digital platforms evolve much more rapidly. As a result, course content frequently fails to reflect current industry practices and emerging occupational requirements.

Limited Innovative Learning Approaches

Students and employers reported that teaching practices remain predominantly lecture-based and examination-oriented. Opportunities to engage in project-based learning, interdisciplinary collaboration, case studies, or AI-supported problem-solving activities were described as limited. Participants suggested that these instructional approaches reduce graduates' readiness to address complex workplace challenges requiring collaboration and critical thinking.

Weak Lifelong Learning Culture

Both academic and industry participants observed that learning is often viewed as ending upon graduation rather than continuing throughout professional careers. Human resource practitioners emphasized that rapid technological change requires continuous competency development, while lecturers acknowledged that universities provide relatively few structured opportunities for graduates to pursue continuing education through flexible learning pathways or short professional programs.

Limited University-Industry Collaboration

Participants also highlighted limited collaboration between higher education institutions and employers. Industry representatives indicated that they were seldom involved in curriculum design, competency assessment, or teaching activities. Although internship programs existed, they were often insufficiently supervised and lacked clear learning outcomes aligned with workforce competencies required in AI-enabled workplaces.

Lecturer Competency in Emerging Technologies

The final barrier concerned lecturers' preparedness to integrate emerging technologies into teaching and learning. Several participants acknowledged limited experience with AI applications, digital collaboration tools, and industry-standard software. This constraint reduced opportunities for students to acquire practical competencies directly relevant to contemporary professional environments.

Collectively, these findings demonstrate that workforce readiness depends not only on individual student capabilities but also on institutional structures that influence curriculum design, instructional practices, industry engagement, and continuing professional development.

An Integrated Upskilling Model for AI-Era Workforce Readiness

Based on the empirical findings and stakeholder recommendations, this study developed an integrated upskilling model designed to strengthen workforce readiness through coordinated educational reform. The proposed model consists of five interconnected components. The *first* component is *industry-aligned curriculum development*, in which employers participate actively in curriculum review and competency mapping to ensure that learning outcomes correspond to evolving workforce requirements. The *second* component is *project-based learning*, enabling students to apply theoretical knowledge to authentic workplace problems involving digital technologies and AI-supported tasks. Participants emphasized that experiential learning provides stronger preparation for professional practice than conventional lecture-centered instruction. The *third* component involves the implementation of *micro-credential programs* that allow learners to acquire specific competencies through flexible, modular learning pathways. Participants viewed micro-credentials as an effective mechanism for supporting lifelong learning and responding rapidly to technological developments. The *fourth* component is *industry-recognized professional*

certification. Employers consistently emphasized that certification enhances graduate credibility and provides evidence of practical competence beyond academic qualifications. Participants therefore recommended integrating certification opportunities within university programs rather than treating them as optional extracurricular activities. *The fifth component is sustained university–industry–government collaboration*. Stakeholders agreed that workforce development should involve continuous cooperation among higher education institutions, employers, professional organizations, and policymakers. Such collaboration includes joint curriculum development, internship supervision, guest lectures, collaborative research, and policy support for lifelong learning initiatives.

During the Focus Group Discussions, participants considered the proposed model both feasible and responsive to the challenges identified throughout the study. Academic participants emphasized the importance of institutional flexibility, while employers highlighted stronger alignment between graduate competencies and workplace expectations. Government representatives further noted that implementation of the model would require policy support, investment in digital infrastructure, and recognition of alternative learning pathways such as micro-credentials and professional certification.

Overall, the findings indicate that improving workforce readiness in the AI era requires coordinated institutional reform rather than isolated educational interventions. The proposed integrated upskilling model provides a framework through which universities, industry, and government can jointly strengthen graduate competencies while supporting lifelong learning and adaptation to technological change.

Conclusion

This study examined workforce readiness in the AI era by exploring the alignment between higher education outcomes and labor market expectations in Indonesia. Drawing on qualitative evidence from interviews, focus group discussions, and document analysis, the findings reveal that workforce preparedness is constrained not only by individual competency gaps but also by broader institutional and systemic challenges. Three principal findings emerged. *First*, significant discrepancies exist between graduate competencies and industry expectations, particularly in professional certification, industry experience, and digital literacy. *Second*, these competency gaps are reinforced by structural barriers within higher education, including outdated curricula, limited implementation of project-based learning, insufficient university industry collaboration, weak lifelong learning cultures, and inadequate integration of emerging AI technologies into teaching and learning.

Third, the study developed an integrated upskilling model that combines industry-aligned curricula, project-based learning, micro-credentials, professional certification, and sustained collaboration among universities, industry, and government to enhance workforce readiness in AI-driven labor markets. Beyond its empirical findings, this study contributes to the theoretical development of Human Capital Theory and Lifelong Learning Theory. The findings demonstrate that human capital should no longer be understood as a static outcome of formal education but as a dynamic process requiring continuous renewal through lifelong learning, reskilling, and upskilling. Likewise, the study extends Lifelong Learning Theory by emphasizing that continuous learning depends not only on individual motivation but also on institutional arrangements, educational governance, and collaborative learning ecosystems that enable individuals to respond effectively to rapid technological change. By integrating these perspectives, the proposed model provides a comprehensive framework for understanding workforce development in the context of artificial intelligence.

The study also offers several practical implications for higher education institutions, policymakers, and industry stakeholders. Universities should redesign curricula to incorporate competency-based learning, authentic workplace experiences, AI literacy, and industry-recognized professional certification. Educational practices should move beyond conventional lecture-centered approaches toward project-based and experiential learning that better reflects the demands of AI-enabled workplaces. Industry participation should extend beyond internship

provision to include curriculum design, competency assessment, guest teaching, and collaborative research. At the policy level, governments should facilitate stronger university–industry partnerships, support micro-credential systems, invest in digital infrastructure, and establish regulatory frameworks that recognize flexible learning pathways and continuous professional development. Such coordinated efforts are essential for developing graduates who possess both technical competence and the adaptability required in rapidly evolving labor markets.

Despite these contributions, the study has several limitations. The qualitative design provides rich contextual insights but limits the generalizability of the findings beyond the participating institutions and stakeholder groups. The research was conducted within the Indonesian higher education context, and workforce readiness challenges may differ across countries, educational systems, and industrial sectors. In addition, because AI technologies continue to evolve rapidly, stakeholder perceptions and institutional responses may change over time. Future research should extend this work by employing mixed-methods or longitudinal research designs to examine the effectiveness of integrated upskilling strategies across diverse institutional contexts. Comparative studies between public and private universities, Islamic and non-Islamic higher education institutions, or different national settings would further strengthen understanding of workforce development in the AI era.

Future studies should also investigate the educational implications of generative AI, including AI-assisted learning, assessment redesign, ethical governance, and the competencies required for effective human AI collaboration. Such research will contribute to the development of more adaptive, inclusive, and sustainable lifelong learning ecosystems capable of responding to continuing technological transformation. Overall, this study demonstrates that workforce readiness in the AI era cannot be achieved through curriculum reform alone. Sustainable preparation for future work requires an integrated ecosystem in which higher education institutions, industry, government, and learners collaboratively support continuous competence development. By proposing an empirically grounded upskilling model, this study provides both a theoretical framework and practical guidance for strengthening higher education's contribution to workforce development in an increasingly AI-driven society.

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