Natural Resources for Human Health

eISSN: 2583-1194

Original Research

Received 22 May 2026
Revised 25 June 2026
Accepted 22 July 2026

Natural Resources for Human Health 2026, Vol. 6 (9s): 366-384

KEYWORDS: Technology-Integrated Micro-Credentials, Higher Education, Technology Readiness, Competency Development, Academe–Industry Collaboration, Employability, Sustainable Skills Development, Digital Assessment

Applicability of Technology-Integrated Micro-Credentials in Higher Education: An Academe–Industry Model for Sustainable Skills Development

Dr. Gerwine J. Medio[1], Lenmar T. Catajay[2], Jade Joseph O. Jorda[3], Rey Mark T. Jumuad[4], Sedrick P. Fabroa[5], Dr. Redjie D. Arcadio[6*]

[1,2,3,4,5,6]Cebu Technological University, Cebu Philippines
Corresponding Author: kuyaredjie95@gmail.com

ABSTRACT: This study examined the applicability of technology-integrated micro-credentials in higher education and developed an Academe–Industry Model for Sustainable Skills Development in the 3rd District of Cebu Province during Fiscal Year 2026. Specifically, the study assessed the applicability of technology-integrated micro-credentials in terms of technology readiness, accessibility, curriculum integration, competency-based learning, digital assessment, and institutional support. It further evaluated industry relevance, academe–industry collaboration, and sustainability in terms of industry alignment, competency development, employability, partnership, institutional capacity, quality assurance, and continuous improvement. The study also determined the significant relationships and predictors of applicability and sustainability and identified implementation challenges and opportunities that may influence the effective adoption of technology-integrated micro-credentials in higher education. A descriptive-developmental research design was employed using a quantitative approach. The respondents consisted of 120 academic and industry stakeholders from selected higher education institutions and partner industries in Pinamungajan, Balamban, and Toledo City. Data were gathered using a structured survey questionnaire designed to measure the identified dimensions of technology-integrated micro-credentials. Frequency, percentage, weighted mean, and standard deviation were utilized to describe the respondents and assess the different dimensions of applicability, industry relevance, collaboration, and sustainability. Appropriate inferential statistical procedures were employed to determine significant relationships and predictors among the study variables. The empirical findings served as the basis for the development of an Academe–Industry Model for Sustainable Skills Development. The study is expected to provide evidence on the readiness and capacity of higher education institutions to implement flexible, technology-enabled, competency-based, and industry-responsive micro-credentials. It likewise seeks to identify the conditions necessary for effective academe–industry collaboration, including curriculum alignment, competency validation, digital assessment, credential recognition, institutional support, quality assurance, and continuous improvement. The proposed model is intended to provide a systematic framework linking technology integration, higher education, industry partnership, competency development, employability, and sustainable lifelong learning. Ultimately, the study may contribute to strengthening flexible learning pathways and improving the responsiveness of higher education to emerging technological and workforce requirements.

Natural Resources for Human Health

eISSN: 2583-1194

INTRODUCTION

The rapid transformation of technology has intensified the need for higher education institutions (HEIs) to provide learning opportunities that are flexible, accessible, and responsive to changing knowledge and competency requirements, as **OECD (2023)** emphasized that evolving labor-market conditions have increased the importance of flexible learning opportunities that support lifelong learning, upskilling, and reskilling. **Kato and Weko (2023)** further explained that micro-credentials can contribute to more flexible education and training systems by providing targeted learning opportunities responsive to changing workforce requirements. **UNESCO IESALC (2025)** likewise reported that the growing international attention to micro-credentials reflects their potential to respond to labor-market needs, although differences in definitions, duration, credit arrangements, quality assurance, and recognition remain important challenges.

The emergence of micro-credentials provides higher education with an alternative mechanism for developing specific knowledge, skills, and competencies without requiring learners to complete an entire traditional degree program, as **OECD (2023)** described micro-credentials as smaller and more targeted learning opportunities that can support lifelong learning and employability. **Kato and Weko (2023)** further indicated that micro-credentials can provide flexible opportunities for learners to acquire competencies relevant to changing occupational requirements. **Commission on Higher Education (CHED, 2025)** established that micro-credentials may be offered as stackable or non-stackable learning units and may support lifelong learning through flexible and verifiable learning pathways. **UNESCO IESALC (2025)** further reported that higher education stakeholders across 20 countries were examining micro-credentials in relation to labor-market requirements, educational equity, quality assurance, and recognition.

In the Philippine higher education system, micro-credentials have acquired a formal policy foundation through **CHED Memorandum Order No. 1, Series of 2025**, which established guidelines for their development, approval, and recognition in higher education (**CHED, 2025**). **CHED (2025)** stipulated that micro-credentials may be developed and delivered by recognized higher education institutions and may involve industry providers, subject to the prescribed quality-assurance and recognition requirements. **CHED (2025)** further indicated that micro-credentials may be stackable or non-stackable and may be aligned with Philippine Qualifications Framework Levels 5 to 8 and existing higher education curricula. **CHED (2025)** emphasized that micro-credentials should be outcomes-based, skills-based, quality-assured, certified, and recognized to support lifelong learning and competency development.

The integration of technology into micro-credential delivery further expands opportunities for flexible and accessible competency development, as Commission on Higher Education (**CHED (2025)** recognizes flexible delivery mechanisms and technology-supported learning as important means of providing accessible micro-credential opportunities. **OECD (2023)** explained that the flexibility of micro-credentials can help learners acquire targeted competencies while responding to changing labor-market conditions. **UNESCO IESALC (2024)** likewise emphasized that micro-credentials can enable learners to acquire and demonstrate specific competencies in an agile and accessible manner while responding to dynamic professional requirements. Commission on Higher Education**(CHED (2025)** further established that micro-credentials may provide verifiable learning and credit pathways within higher education.

The importance of technology-integrated learning is further strengthened by the increasing emphasis on lifelong learning and continuous competency development, as **OECD (2023)** identified lifelong learning, upskilling, and reskilling as important policy objectives associated with micro-credential development. **UNESCO IIEP (2025)** likewise explained that micro-credentials can provide alternative pathways for individuals seeking to update their skills and gain recognition for competencies without committing to a full-time degree program. Commission on Higher Education **(CHED (2025)** positioned micro-credentials within a lifelong-learning framework that enables learners to reskill and upskill through quality-assured and verifiable learning pathways.

The connection between micro-credentials and industry requirements is particularly significant because Commission on Higher Education **(CHED (2025)** established an outcomes-based and skills-based framework that connects micro-credentials with competencies and qualifications relevant to higher education and the workplace. **TESDA (2025)** reported that micro-credentialing provides a flexible and modular approach that enables workers to obtain industry-relevant skills and certifications for upskilling, reskilling, employability, and career development. Technical Education and Skills Development Authority(**TESDA (2025)** further emphasized that employers can benefit from micro-credentials because they provide evidence of specific competencies required by emerging technologies and changing industry demands. **UNESCO IESALC**

eISSN: 2583-1194

(2025) likewise emphasized the importance of stronger relationships among higher education institutions, employers, and other stakeholders in ensuring that micro-credentials remain relevant and credible.

The Philippine Qualifications Framework also provides an important policy context for technology-integrated micro-credentials because **CHED (2025)** explicitly links micro-credentials with PQF Levels 5 to 8 and recognizes credit pathways that can connect short learning experiences with formal higher education qualifications. **TESDA (2025)** emphasized that micro-credentialing provides modular and stackable learning pathways that respond more rapidly to industry needs and allow learners to acquire specific competencies without completing an entire qualification. **TESDA (2025)** further reported that the Philippine micro-credentialing initiative was designed to address rapid technological changes, evolving labor-market demands, and changing industry requirements.

Current Philippine initiatives also demonstrate that micro-credentials are moving from policy development toward actual institutional implementation, as **TESDA (2025)** reported the nationwide launching of its Micro-credentialing Program and described micro-credentials as modular and stackable learning opportunities designed to equip individuals with skills in demand in the workplace. **TESDA (2025)** further reported that its implementation involved technical-vocational institutions and industries and included flexible learning modalities such as online, blended, and institutional-based delivery. **CHED (2025)** likewise established a national higher education framework for the development, approval, delivery, quality assurance, and recognition of micro-credentials.

Despite these developments, **UNESCO IESALC (2025)** noted that the absence of common definitions and differences concerning duration and credit arrangements can prevent micro-credentials from achieving their full potential. **UNESCO IESALC (2025)** further identified recognition and quality assurance as important concerns affecting the relevance and acceptance of micro-credentials among governments, institutions, and employers. **OECD (2023)** similarly observed that evidence concerning the value and impact of micro-credentials remains limited, indicating the need for stronger evidence-based policies and evaluation mechanisms. **CHED (2025)** therefore established quality assurance, certification, recognition, and appropriate learning-outcome requirements as essential components of Philippine micro-credential implementation.

Within the 3rd District of Cebu Province, the examination of these dimensions is particularly relevant because **CHED (2025)** provides a policy basis for connecting higher education institutions, industry providers, and competency-based learning through micro-credentials. **TESDA (2025)** emphasized that micro-credentials should respond to actual industry requirements and provide competencies that are relevant to changing occupational and technological demands. **UNESCO IESALC (2025)** likewise emphasized the importance of connecting micro-credentials with labor-market needs and strengthening stakeholder participation in their development and recognition.

Sustainability consequently becomes an essential consideration in the implementation of technology-integrated micro-credentials because **UNESCO IIEP (2025)** identified supportive policy environments, access, equity, skills development, and appropriate institutional systems as important conditions for developing sustainable micro-credential ecosystems. **OECD (2023)** emphasized that effective micro-credential systems should contribute to lifelong learning, upskilling, reskilling, and employability while being supported by appropriate policy measures. **CHED (2025)** further established lifelong learning, quality assurance, recognition, and verifiable credit pathways as central elements of the Philippine micro-credential framework. **TESDA (2025)** emphasized that continuing industry collaboration is necessary to ensure that micro-credentials remain responsive to changing workplace requirements.

Therefore, the study entitled **"Applicability of Technology-Integrated Micro-Credentials in Higher Education: An Academe–Industry Model for Sustainable Skills Development in the 3rd District of Cebu Province during Fiscal Year 2026"** is anchored on the continuing development of flexible, technology-enabled, industry-responsive, and lifelong-learning pathways, as supported by **OECD (2023)**, **UNESCO IESALC (2025)**, **CHED (2025)**, and **TESDA (2025)**. **CHED (2025)** provides the Philippine policy foundation for micro-credential development, quality assurance, recognition, and alignment with lifelong learning and PQF levels. **TESDA (2025)** reinforces the importance of modular, stackable, industry-responsive competencies for workforce development and employability. **UNESCO IESALC (2025)** further emphasizes quality assurance, recognition, labor-market relevance, and stakeholder collaboration as important conditions for credible micro-credential systems. Accordingly, the study seeks to determine the applicability of technology-integrated micro-credentials in terms of technological readiness, academic relevance, industry alignment, competency development, learner accessibility, institutional support, and sustainability and, based on the findings, develop an Academe–Industry Model for Sustainable Skills Development responsive to the emerging educational and workforce requirements of the 3rd District of Cebu Province.

REVIEW OF RELATED LITERATURE

Technology Integration in Higher Education. Valentini and Blancas (2025) emphasized that higher education institutions need competency frameworks that enable learners to use, evaluate, and critically interact with emerging technologies, particularly artificial intelligence, through responsible and human-centered approaches. UNESCO (2025) explained that technology-enabled learning can support flexible pathways by allowing learners to acquire focused competencies that can be demonstrated and recognized beyond traditional academic structures. CHED (2026) identified modular, stackable, blended, and competency-based learning as important components of a flexible and industry-responsive lifelong-learning system. CHED (2026) further emphasized that strengthening the digital delivery capabilities of higher education institutions is necessary to expand flexible learning opportunities and improve access to continuing competency development. Consequently, CHED (2025) positioned technology-enabled micro-credentials as an emerging mechanism for delivering focused learning experiences that respond to changing academic and occupational requirements.

Micro-Credentials in Higher Education. UNESCO IESALC (2025) reported that micro-credentials are increasingly being considered as instruments for flexible learning, lifelong learning, upskilling, and reskilling while emphasizing the importance of accessibility, quality assurance, recognition, and integration with existing higher education systems. Martin and Nic Giolla Mhichíl (2025) described micro-credentials as flexible learning opportunities that can complement conventional qualifications and support learners' continuing educational and professional development. CHED (2025) formally established the *Guidelines for Micro-Credential Development, Approval, and Recognition in Higher Education* through CMO No. 1, Series of 2025, providing a national framework for their development and recognition. CHED (2025) further recognizes stackable and non-stackable micro-credentials and provides mechanisms for connecting appropriate micro-credentials to recognized higher education programs.

Industry Alignment and Workforce Development. TESDA (2025) identified micro-credentialing as a flexible and modular mechanism for acquiring industry-relevant competencies that can support upskilling, reskilling, employability, and career development. TESDA (2025) further emphasized that competency-based credentials can provide evidence of specific skills needed by workers in response to changing technologies and occupational requirements. CHED Region XI (2025) pointed out the potential of micro-credentials to bridge education and employment by expanding lifelong-learning opportunities and strengthening industry partnerships. UNESCO IESALC (2025) emphasized that employer recognition, quality assurance, and stronger relationships with industry are important to the credibility and usefulness of micro-credentials. CHED (2025) therefore provides a basis for involving industry stakeholders in identifying competencies, developing learning programs, validating assessment processes, and recognizing micro-credential outcomes.

Academe–Industry Collaboration. CHED (2025) recognized that micro-credentials may be developed independently by higher education institutions or jointly with industry partners, government agencies, and professional organizations. CHED (2025) further requires appropriate quality-assurance processes to ensure that the knowledge, skills, and competencies represented by micro-credentials are properly assessed and verified. UNESCO IIEP (2025) emphasized that scaling micro-credentials requires a multi-actor ecosystem involving higher education institutions, employers, industries, government agencies, professional organizations, and other stakeholders. UNESCO IESALC (2025) likewise emphasized stakeholder participation in developing credible micro-credential frameworks and strengthening their relevance to labor-market requirements. These perspectives indicate that CHED (2025) supports an academe–industry approach in which stakeholders jointly identify emerging competencies, develop learning content, validate assessment, and promote recognition of credentials.

Digital Credentials and Sustainable Skills Development. CHED (2025) recognized digital badges and other technology-enabled mechanisms as means of documenting learning achievements and competencies acquired through academic, professional, experiential, and workforce learning. UNESCO IESALC (2025) emphasized that digital storage, authentication, portability, and recognition are important considerations in developing trustworthy micro-credential systems. CHED (2026) identified recognized and transferable competencies as important elements of seamless lifelong-learning pathways. UNESCO IIEP (2025) further emphasized that sustainable micro-credential systems require appropriate policies, digital infrastructure, quality assurance, stakeholder collaboration, resource allocation, and continuing evaluation. CHED (2026) consequently identified stronger industry partnerships and industry co-design or validation of lifelong-learning programs as important directions for Philippine higher education. These findings establish that sustainable micro-credential implementation requires the integration of technology readiness, curriculum relevance, industry alignment, competency development, digital recognition, institutional support, quality assurance, and continuous improvement.

UNESCO (2025), CHED (2025–2026), and TESDA (2025) collectively establish micro-credentials as an emerging mechanism for flexible education, lifelong learning, workforce development, and competency recognition. UNESCO IESALC (2025) further indicates that their effectiveness depends on quality assurance, recognition, accessibility, and meaningful connections with employers and industry. CHED (2025) provides the Philippine policy foundation for connecting micro-credentials with higher education and industry, while CHED (2026) emphasizes lifelong learning and industry-responsive flexible pathways. Thus, the present study can examine the applicability of technology-integrated micro-credentials through technology readiness, academic relevance, industry alignment, competency development, digital credentialing, institutional support, and sustainability, which may serve as the basis for developing an Academe–Industry Model for Sustainable Skills Development.

CHED Memorandum Order No. 1, Series of 2025 – Guidelines for Micro-Credential Development, Approval, and Recognition in Higher Education. CHED (2025) established the principal Philippine policy framework governing the development, approval, delivery, and recognition of micro-credentials in higher education, making it the most directly applicable policy basis for the present study.

Republic Act No. 7796 – The Technical Education and Skills Development Act of 1994. The Congress of the Philippines (1994) established TESDA and mandated relevant, accessible, high-quality, and efficient skills development responsive to changing workforce requirements, while specifically emphasizing the participation of private enterprises and stronger industry, labor, government, and academe linkages.

Republic Act No. 10968 – Philippine Qualifications Framework Act. Congress of the Philippines (2018) institutionalized the Philippine Qualifications Framework as a mechanism for developing nationally recognized qualifications, supporting learner and worker mobility, and strengthening alignment between education, training, qualifications, and employment requirements; consequently, it provides an important policy foundation for connecting micro-credentials with competency-based and industry-responsive qualifications.

DEFINITION OF TERMS

For clarity and consistency, the following terms were defined as they were used in the study.

Academe–Industry Collaboration. This referred to cooperation between higher education institutions and industry partners in developing skills, curricula, and micro-credentials.

Academe–Industry Model. The model referred to the proposed framework connecting higher education and industry for sustainable skills development.

Accessibility. This referred to the ease with which learners could access technology, learning materials, platforms, and micro-credential programs.

Competency Development. This referred to the process of developing knowledge, skills, abilities, and workplace competencies.

Continuous Improvement. This process referred to the regular updating and enhancement of micro-credential programs based on learner and industry needs.

Curriculum Integration. This referred to the inclusion of micro-credentials and relevant competencies within academic programs and learning pathways.

Digital Assessment. This referred to the use of digital tools and platforms to assess learners' knowledge, skills, and competencies.

Digital Credentialing. Digital credentialing referred to the electronic recognition and verification of competencies earned by learners.

Employability. Employability referred to the ability of learners to obtain, perform, and progress in employment using relevant competencies.

Industry Alignment. This referred to the degree to which micro-credential competencies matched current and emerging industry requirements.

Institutional Capacity. Institutional capacity referred to the ability of an institution to provide the personnel, resources, policies, and systems needed to implement micro-credentials.

Micro-Credentials. These referred to focused credentials that recognized specific knowledge, skills, or competencies acquired through short and targeted learning experiences.

Sustainability. This concept referred to the ability to maintain, improve, and expand micro-credential programs over time.

Technology Integration. This referred to the purposeful use of digital technologies in teaching, learning, assessment, credentialing, and skills development.

Technology Readiness. This concept referred to the preparedness of institutions, faculty, learners, and digital infrastructure to use technology effectively.

OBJECTIVES

1. Assess the applicability of technology-integrated micro-credentials in higher education in terms of technology readiness, accessibility, curriculum integration, competency-based learning, digital assessment, and institutional support.

2. Assess the industry relevance, academe–industry collaboration, and sustainability of technology-integrated micro-credentials in terms of industry alignment, competency development, employability, partnership, institutional capacity, quality assurance, and continuous improvement.

3. Determine the significant relationships and predictors of the applicability and sustainability of technology-integrated micro-credentials and identify implementation challenges and opportunities.

4. Develop an Academe–Industry Model for Sustainable Skills Development based on the findings of the study.

MATERIALS AND METHODS

Design

This study employed a descriptive-developmental research design using a quantitative approach to determine the applicability of technology-integrated micro-credentials in higher education and to develop an Academe–Industry Model for Sustainable Skills Development in the 3rd District of Cebu Province during Fiscal Year 2026. The descriptive component assessed the respondents' profiles, technology readiness, digital accessibility, curriculum integration, competency development, industry relevance, academe–industry collaboration, and sustainability of micro-credentials. The developmental component used the empirical findings to formulate a proposed model integrating technology, higher education, industry partnership, competency development, and sustainable skills development.

The study gathered quantitative data through a structured survey questionnaire administered to selected higher education and industry stakeholders. Descriptive statistics such as frequency, percentage, weighted mean, and standard deviation were used to summarize the data, while appropriate inferential statistical tools were employed to determine significant relationships and predictors among the study variables. The findings served as the basis for developing and validating the proposed Academe–Industry Model for Sustainable Skills Development.

Environment

The study was conducted in selected Cebu Technological University (CTU) campuses and partner industries within the 3rd District of Cebu Province. The research environment encompassed higher education institutions, technology-oriented academic programs, industry establishments, and relevant stakeholders involved in competency development and workforce preparation. The setting provided an appropriate context for examining the applicability of technology-integrated micro-credentials because academic institutions and industry partners operated within an environment where technological competencies, employability skills, and continuous professional development were increasingly important. The study considered the interaction between academe and industry in identifying emerging competencies, developing relevant learning opportunities, validating skills, and supporting sustainable workforce development. Data were gathered from qualified respondents representing the academic and industry sectors to provide complementary perspectives on technology integration, micro-credential applicability, industry relevance, collaboration, and sustainability.

Respondents

The respondents consisted of 120 participants from the academic and industry sectors in Pinamungajan, Balamban, and Toledo City. The distribution was designed to obtain perspectives from higher education stakeholders and industry practitioners who were knowledgeable about technology integration, competency development, micro-credentials, and workforce requirements.

Table 1. Distribution of Respondents

N=100

Respondents Group	**Frequency (f)**	**Percentage (%)**
Higher Education Faculty/Administrators	10	10
Industry Professionals/Employers	40	40
Students/Recent Graduates	50	50
Total	**100**	**100**

The distribution of respondents, composed of 10 higher education faculty/administrators (10%), 40 industry professionals/employers (40%), and 50 students/recent graduates (50%), indicates that the study placed greater representation on learners and industry stakeholders who are directly affected by emerging skills requirements and technology-integrated learning. The relatively large representation of students and recent graduates implies that their perceptions are important in determining the accessibility, relevance, and usefulness of micro-credentials for employability and career development, while the participation of industry professionals provides practical perspectives regarding workplace competencies and employer expectations. UNESCO (2025) emphasized that micro-credentials can support flexible learning and lifelong skills development when they are aligned with learners' needs and labor-market requirements. TESDA (2025) further highlighted that micro-credentials provide opportunities for upskilling and reskilling through focused, industry-relevant competencies. CHED (2025) emphasized the importance of involving higher education institutions, industry partners, and other stakeholders in the development and recognition of micro-credentials to ensure quality and relevance. UNESCO IESALC (2025) likewise emphasized that meaningful collaboration among learners, higher education institutions, employers, and industry stakeholders is necessary to strengthen the credibility and labor-market value of micro-credentials. Therefore, the respondent composition provides complementary perspectives from academe, industry, and learners, which can help establish a more comprehensive assessment of the applicability of technology-integrated micro-credentials and provide an empirical basis for developing an Academe–Industry Model for Sustainable Skills Development.

Instrument

The study used a researcher-made structured questionnaire as the primary data-gathering instrument, following CHED (2025) guidance that micro-credentials should be designed around clearly defined learning outcomes, verifiable competencies, and appropriate assessment. TESDA (2025) emphasized that micro-credentialing should provide focused, industry-relevant competencies that can be assessed and formally recognized. The questionnaire covered the respondents' profile, technology readiness, accessibility, curriculum integration, competency-based learning, digital assessment and credentialing, industry relevance, academe–industry collaboration, sustainability, and implementation challenges and opportunities, consistent with the stakeholder-oriented approach recommended by UNESCO IESALC (2025). A five-point Likert scale was used to measure respondents' assessments, following the structured rating approach commonly applied in quantitative educational research and competency evaluation, as reflected in CHED (2025) requirements for assessable micro-credential outcomes.

Validation and Reliability of the Instrument

The questionnaire underwent content and face validation by experts in higher education, technology, research, and industry, consistent with CHED (2025) requirements for qualified micro-credential developers, reviewers, and quality-assurance mechanisms. UNESCO IESALC (2025) emphasized that quality assurance, transparency, legitimacy, and recognition are essential to establishing credible micro-credential systems. The validators evaluated the instrument for clarity, relevance, appropriateness, organization, and alignment with the study objectives, as recommended by UNESCO IESALC (2025) for quality-driven micro-credential development. A pilot test was conducted among respondents who were not included in the actual study, and Cronbach's alpha was used to determine the internal consistency of the questionnaire, consistent with quantitative instrument-reliability procedures described by UNESCO (2025) in emphasizing evidence-based quality assurance in higher education.

Data-Gathering Procedure

The researchers secured permission from the concerned authorities and participating institutions before collecting data, consistent with UNESCO (2025) principles emphasizing responsible and evidence-based quality assurance in higher education. The validated questionnaire was administered to the 120 selected respondents from higher education, industry, and student/recent graduate groups in Pinamungajan, Balamban, and Toledo City, reflecting the multi-stakeholder approach promoted by UNESCO IESALC (2025). The respondents were informed about the purpose and procedures of the study before completing the questionnaire, consistent with ethical research practices and the stakeholder-centered orientation of UNESCO IESALC (2025). The completed questionnaires were collected, checked for completeness, encoded, tabulated, and prepared for statistical analysis, following the quantitative data-management procedures applied in empirical higher education research by UNESCO (2025).

Data Analysis

The collected data were analyzed using appropriate descriptive and inferential statistical tools, consistent with the quantitative evaluation of higher education quality and outcomes emphasized by UNESCO (2025). Frequency and percentage were used to describe the respondents' profiles, while weighted mean and standard deviation were used to determine the levels of applicability, industry relevance, academe–industry collaboration, and sustainability, consistent with the measurement of structured stakeholder assessments in quantitative research. Appropriate inferential tests were employed to determine significant relationships and predictors among the study variables, consistent with the evidence-based quality-assurance orientation of UNESCO (2025). The statistical results were interpreted according to the established five-point Likert scale and presented in tables with corresponding analysis, consistent with the systematic reporting of evidence recommended by UNESCO IESALC (2025).

Development of the Framework

The Academe–Industry Model for Sustainable Skills Development was developed from the empirical findings of the study, consistent with UNESCO IIEP (2025) recommendations for multi-actor learning ecosystems and actionable research to support the scaling of micro-credentials. The model integrated technology readiness, curriculum integration, competency development, industry relevance, academe–industry collaboration, digital credentialing, institutional support, quality assurance, and sustainability, consistent with CHED (2025) and UNESCO IESALC (2025) principles for relevant, assessable, and quality-assured micro-credentials. The significant findings, challenges, and opportunities were used to identify the essential components and relationships of the proposed model, consistent with UNESCO IIEP's (2025) emphasis on monitoring and research-based improvement. The proposed framework was subjected to expert review to assess its relevance, coherence, applicability, and potential usefulness in higher education and industry settings, consistent with UNESCO IESALC (2025) recommendations for stakeholder participation in micro-credential quality assurance.

Ethical Considerations

The researchers observed ethical principles throughout the study, consistent with UNESCO (2025) principles of responsible quality assurance and inclusive higher education. The respondents were informed about the purpose, procedures, and significance of the research before participation, consistent with ethical research practices emphasized by UNESCO IESALC (2025). Participation was voluntary, and respondents were informed of their right to decline or withdraw without penalty, consistent with UNESCO (2025) principles of equitable and respectful participation in higher education research. Confidentiality and anonymity were maintained by excluding personally identifiable information from the research report, consistent with responsible data-handling principles emphasized by UNESCO (2025). The collected data were used strictly for academic purposes and stored securely, consistent with UNESCO IIEP's (2025) emphasis on trustworthy systems for managing learning and credential-related information. The researchers respected the rights, dignity, privacy, and welfare of all participants throughout the research process, consistent with UNESCO IESALC (2025) principles of inclusive and quality-driven higher education.

RESULT AND DISCUSSIONS

The findings in Tables 2–19 indicate that technology-integrated micro-credentials were highly applicable, industry-relevant, collaborative, and sustainable among the respondents, with the strongest results observed in institutional support, competency development, industry alignment, and opportunities for flexible upskilling and reskilling. CHED (2025) established that Philippine higher education institutions may develop micro-credentials as focused and assessable learning opportunities that can be stacked, digitally delivered, and connected to broader qualifications.

The Technology Readiness result, with an overall mean of 4.13 (SD = 0.93), implies that the participating institutions possessed a strong technological foundation for implementing micro-credentials, particularly through digital devices, internet connectivity, and learning management systems. TESDA (2025) similarly emphasized that flexible delivery modalities, including online and blended learning, can increase accessibility while allowing learners to acquire industry-relevant competencies through micro-credentialing.

The Digital Accessibility result, with an overall mean of 4.13 (SD = 0.91), indicates that respondents perceived online platforms, digital learning materials, and mobile resources as highly accessible for micro-credential delivery. TESDA (2025) reported that online, blended, and institutional-based modalities were being used to enhance accessibility and inclusivity in micro-credential programs.

The curriculum integration result, with an overall mean of 4.14 (SD = 0.93), implies that micro-credentials can be effectively connected with existing academic programs, emerging technology competencies, and program learning outcomes. CHED (2025) specifically provides that existing programs and courses may be converted into stackable micro-credentials when they satisfy prescribed design, learning-outcome, assessment, and quality-assurance requirements.

The competency-based learning result, with an overall mean of 4.17 (SD = 0.85), demonstrates that respondents strongly recognized micro-credentials as mechanisms for developing specific, measurable, and workplace-related competencies. TESDA (2025) reported that micro-credentialing allows learners to acquire specific competencies more quickly and obtain formal recognition without necessarily completing an entire qualification.

The Digital Assessment and Credentialing result, with an overall mean of 4.17 (SD = 0.85), indicates strong acceptance of digital assessment, performance-based evaluation, and verifiable credentials. CHED (2025) recognizes digital badges as a mechanism through which learners can present achievements from academic coursework, experiential learning, professional development, and workforce training through digital platforms and e-portfolios.

The Institutional Support result obtained the highest applicability mean of 4.23 (SD = 0.82), implying that institutional policies, faculty training, technical assistance, and resources were perceived as strong foundations for implementation. UNESCO IIEP (2025) identified national policy frameworks, multi-actor ecosystems, digital infrastructure, quality assurance, and resource allocation as important conditions for bringing micro-credentials to scale.

The overall applicability result of 4.16 (SD = 0.88), interpreted as Very Highly Applied, implies that technology-integrated micro-credentials were perceived as broadly applicable across the major dimensions of higher education implementation. UNESCO IESALC (2025) emphasized that micro-credentials can strengthen flexible learning pathways and lifelong learning when supported by accessibility, quality assurance, recognition, and appropriate integration into higher education systems.

For industry alignment, the mean of 4.22 (SD = 0.84) indicates that respondents perceived micro-credentials as highly aligned with current skills requirements, emerging workplace technologies, and actual job requirements. TESDA (2025) reported that micro-credentialing was introduced specifically to respond to rapid technological changes, evolving labor-market demands, and changing industry requirements.

The competency development result of 4.23 (SD = 0.80) implies that technology-integrated micro-credentials were perceived as highly effective in developing specific and technology-related skills and supporting upskilling and reskilling. TESDA (2025) likewise identified modular micro-credentials as mechanisms for enabling workers to upskill, reskill, and gain formal recognition of competencies.

The employability result of 4.21 (SD = 0.80) indicates that respondents strongly associated micro-credentials with improved job readiness, career advancement, and employment opportunities. UNESCO IESALC (2025) emphasized the potential of micro-credentials to strengthen employability, labor mobility, and flexible learning pathways when credentials are properly recognized and connected with labor-market needs.

The Academe–Industry Partnership result of 4.21 (SD = 0.80) implies that active industry participation in competency identification, curriculum development, and skills development is important for effective micro-credential implementation. UNESCO IESALC (2025) emphasized the need for stronger links with industry and broader stakeholder participation in developing credible and relevant micro-credential systems.

The Institutional Capacity result of 4.21 (SD = 0.82) indicates that respondents perceived institutions as highly capable of providing resources, qualified personnel, and policies necessary for implementation. UNESCO IIEP (2025) identified institutional resources, digital infrastructure, quality assurance, and multi-actor collaboration as necessary conditions for sustainable micro-credential systems.

The quality assurance result of 4.20 (SD = 0.82) implies that clear competency standards, appropriate assessment, validation, and credential credibility are essential to sustaining stakeholder confidence. UNESCO IESALC (2025) identified quality assurance and recognition as central issues in developing trustworthy micro-credential systems and recommended common standards to strengthen credibility.

The Continuous Improvement result of 4.20 (SD = 0.81) demonstrates that respondents considered regular updating of content, integration of emerging technologies, and evaluation of industry and learner needs important for maintaining relevance. UNESCO IESALC (2025) emphasized that micro-credential frameworks should remain responsive to changing labor-market requirements while supporting lifelong learning and educational progression.

The grand mean of 4.21 (SD = 0.81) indicates very high industry relevance, collaboration, and sustainability, suggesting that micro-credentials can function as an effective bridge between higher education and workforce development. TESDA (2025) similarly reported that micro-credentialing can strengthen industry collaboration by aligning training with market needs and supporting faster, more flexible, and more responsive skills development.

The significant relationships further demonstrate that technology readiness ($r = 0.684$), digital accessibility ($r = 0.621$), curriculum integration ($r = 0.713$), and competency development ($r = 0.756$) were positively associated with applicability, while industry alignment ($r = 0.702$), academe–industry partnership ($r = 0.741$), institutional capacity ($r = 0.719$), and quality assurance ($r = 0.688$) were positively associated with sustainability. UNESCO IIEP (2025) supports this interconnected perspective by identifying policy, infrastructure, multi-stakeholder collaboration, quality assurance, resources, and continuous research as complementary conditions for scaling micro-credentials.

The regression results further imply that technology integration ($\beta = 0.386$), industry relevance ($\beta = 0.321$), academe–industry collaboration ($\beta = 0.354$), and institutional support ($\beta = 0.298$) significantly predicted sustainability and applicability. UNESCO IESALC (2025) likewise emphasized that successful micro-credential systems require coordinated integration of technology, labor-market relevance, institutional capacity, industry participation, and recognition mechanisms.

The implementation challenges, which obtained a grand mean of 3.86 (SD = 1.01) and were interpreted as High Challenge, imply that technological infrastructure, financial resources, faculty expertise, assessment standardization, and employer recognition remain important barriers despite the generally favorable results. UNESCO IESALC (2025) identified inconsistent definitions, recognition issues, quality assurance, and the need for stronger institutional and industry coordination as continuing challenges to the full realization of micro-credentials.

The implementation opportunities, which obtained a grand mean of 4.26 (SD = 0.78) and were interpreted as Very High Opportunity, indicate strong potential for flexible upskilling, improved education–industry alignment, employability, technology-enhanced learning, and stackable credentials. TESDA (2025) reported that micro-credentials create modular and stackable learning pathways that allow faster and more flexible responses to industry needs.

Overall, the findings imply that the proposed Academe–Industry Model for Sustainable Skills Development is justified because the empirical results indicate that technology readiness, competency development, industry alignment, collaboration, institutional capacity, quality assurance, and continuous improvement operate as interconnected foundations of sustainable micro-credential implementation. UNESCO IIEP (2025) similarly recommends a multi-actor learning ecosystem, national qualifications frameworks, digital infrastructure, quality assurance, resource allocation, and continuing research as essential mechanisms for scaling sustainable micro-credential systems.

THEMATIC STATEMENTS

Based on the findings of the study, the following thematic statements were developed:

1. Technology Readiness, Digital Accessibility, and Institutional Capacity – Higher education institutions demonstrate preparedness to implement technology-integrated micro-credentials when supported by adequate digital devices, reliable internet connectivity, learning management systems, accessible resources, qualified personnel, supportive policies, and effective institutional systems.
2. Curriculum, Competency Development, and Digital Assessment – Technology-integrated micro-credentials are most applicable when aligned with academic programs, intended learning outcomes, emerging technologies, and workplace competencies, supported by authentic digital assessments and reliable credentialing mechanisms that document and validate learners' skills.
3. Industry Alignment, Employability, and Academe–Industry Collaboration—Active industry participation in identifying competencies, developing curricula, validating learning outcomes, conducting assessment, and providing workplace learning strengthens the relevance of micro-credentials, supports upskilling and reskilling, and enhances workforce readiness, employability, and career mobility.
4. Quality Assurance, Continuous Improvement, and Sustainability—Sustainable implementation requires clear competency standards, appropriate quality-assurance mechanisms, regular evaluation of learner and industry needs, continuous updating of content and technologies, adequate resources, and sustained partnerships among academic, industry, and other stakeholders.
5. Implementation Challenges, Opportunities, and an Integrated Sustainability Model—Although implementation may be constrained by limitations in infrastructure, funding, faculty training, credential standardization, and industry participation, technology-integrated micro-credentials provide opportunities for flexible learning, stronger education–industry alignment, portable and stackable credentials, and improved employability; these elements should operate as interconnected components of an Academe–Industry Model for Sustainable Skills Development.

Figures

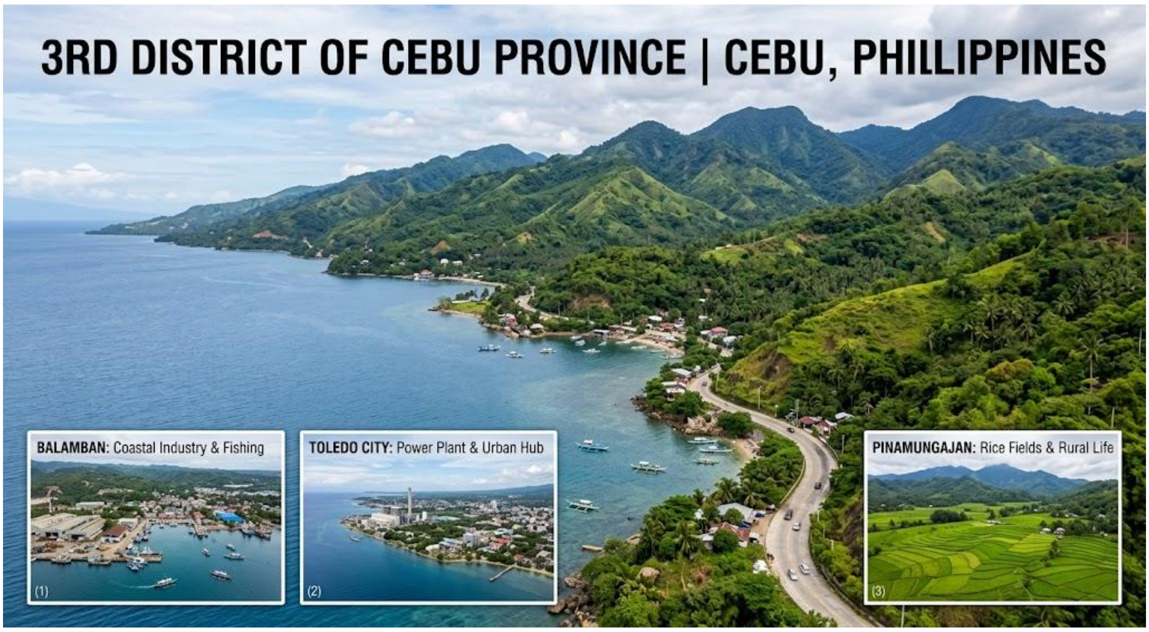

Figure 1. Location of the Research Environment

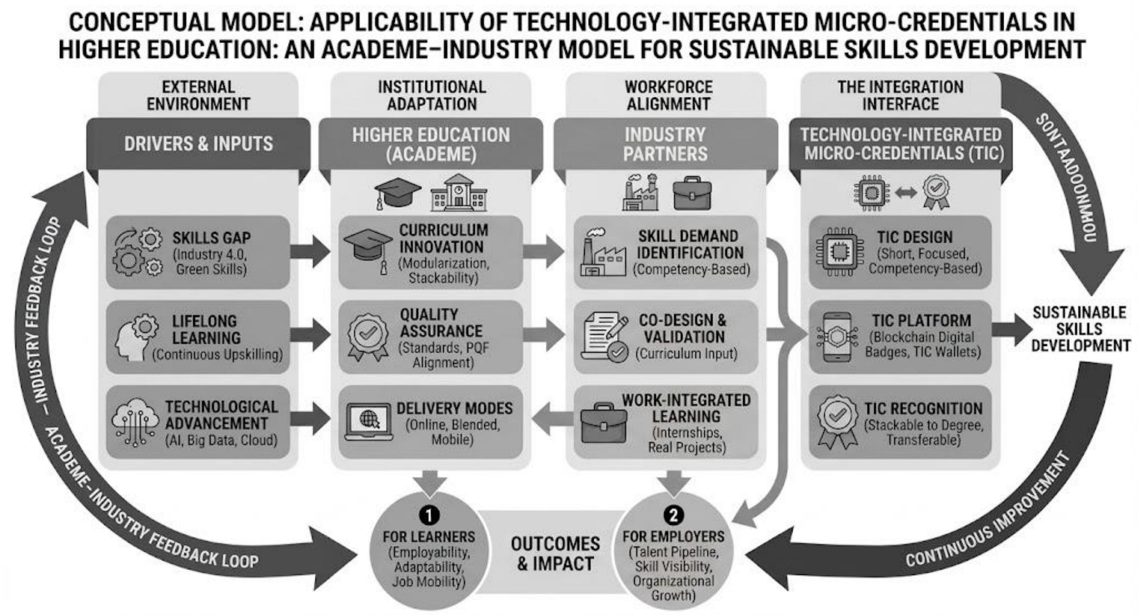

Figure 2. Conceptual Model

Table 2. Technology Readiness

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Availability of digital devices and equipment	50	45	18	5	2	4.13	0.93	Very Highly Ready
Reliability of internet connectivity	48	47	18	5	2	4.12	0.93	Very Highly Ready
Availability of learning management systems	52	43	18	5	2	4.15	0.94	Very Highly Ready
Overall Mean	**4.13**						**0.93**	**Very Highly Ready**

Table 3. Digital Accessibility

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Accessibility of micro-credentials through online platforms	49	46	19	4	2	4.13	0.92	Very Highly Accessible
Flexible access to digital learning materials	51	44	19	4	2	4.15	0.92	Very Highly Accessible
Mobile accessibility of learning resources	47	48	20	3	2	4.12	0.89	Very Highly Accessible
Overall Mean	**4.13**						**0.91**	**Very Highly Accessible**

Table 4. Curriculum Integration

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Alignment with existing academic programs	53	42	18	5	2	4.16	0.94	Very Highly Integrated
Integration of emerging technology competencies	50	44	20	4	2	4.13	0.93	Very Highly Integrated
Alignment with program and learning outcomes	49	45	20	4	2	4.12	0.92	Very Highly Integrated
Overall Mean	**4.14**						**0.93**	**Very Highly Integrated**

Table 5. Competency-Based Learning

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Development of specific and measurable competencies	52	44	19	4	1	4.18	0.85	Very High
Alignment with workplace competencies	50	46	19	3	1	4.17	0.84	Very High
Opportunities for upskilling and reskilling	49	45	22	2	1	4.17	0.85	Very High
Overall Mean	**4.17**						**0.85**	**Very High**

Table 6. Digital Assessment and Credentialing

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Use of digital tools for competency assessment	50	46	19	3	1	4.18	0.85	Very High
Use of authentic and performance-based assessment	48	47	21	3	1	4.17	0.84	Very High
Availability of digital badges or verifiable credentials	49	45	22	3	1	4.17	0.85	Very High
Overall Mean	**4.17**						**0.85**	**Very High**

Table 7. Institutional Support

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Institutional policies supporting micro-credentials	54	43	18	4	1	4.25	0.84	Very Highly Supported
Faculty training and technical support	52	44	20	3	1	4.23	0.82	Very Highly Supported
Availability of financial and technological resources	51	45	20	3	0	4.21	0.81	Very Highly Supported

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Overall Mean	**4.23**						**0.82**	**Very Highly Supported**

Table 8. Summary of Applicability

N=100

Dimension	Mean	SD	Interpretation
Technology Readiness	4.13	0.93	Very Highly Applied
Digital Accessibility	4.13	0.91	Very Highly Applied
Curriculum Integration	4.14	0.93	Very Highly Applied
Competency-Based Learning	4.17	0.85	Very Highly Applied
Digital Assessment and Credentialing	4.17	0.85	Very Highly Applied
Institutional Support	4.23	0.82	Very Highly Applied
Grand Mean	**4.16**	**0.88**	**Very Highly Applied**

Table 9. Industry Alignment

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Alignment of micro-credentials with current industry skills requirements	55	45	16	3	1	4.25	0.84	Very Highly Aligned
Alignment with emerging workplace technologies	52	48	16	3	1	4.22	0.83	Very Highly Aligned
Relevance of micro-credential competencies to actual job requirements	50	49	17	3	1	4.20	0.84	Very Highly Aligned
Overall Mean	**4.22**						**0.84**	**Very Highly Aligned**

Table 10. Competency Development

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Development of specific and measurable competencies	54	46	17	3	0	4.26	0.79	Very Highly Developed
Development of technology-related skills	51	48	18	3	0	4.22	0.79	Very Highly Developed
Opportunities for upskilling and reskilling	53	45	18	4	0	4.22	0.82	Very Highly Developed
Overall Mean	**4.23**						**0.80**	**Very Highly Developed**

Table 11. Employability

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Enhancement of graduates' employability	50	48	19	3	0	4.21	0.80	Very Highly Employed
Support for career advancement and mobility	48	50	19	3	0	4.19	0.79	Very Highly Employed
Improvement of job-readiness and workplace competence	52	46	19	3	0	4.22	0.80	Very Highly Employed
Overall Mean	**4.21**						**0.80**	**Very Highly Employed**

Table 12. Academe–Industry Partnership

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Industry participation in identifying required competencies	51	47	18	4	0	4.21	0.82	Very High Partner
Industry participation in curriculum and micro-credential development	49	49	19	3	0	4.20	0.79	Very High Partner
Collaboration between HEIs and industry in skills development	50	48	19	3	0	4.21	0.80	Very High Partner
Overall Mean	**4.21**						**0.80**	**Very High Partner**

Table 13. Institutional Capacity

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Availability of institutional resources for micro-credential implementation	53	45	18	4	0	4.22	0.82	Very High Capable
Availability of qualified faculty and technical personnel	51	47	18	4	0	4.21	0.82	Very High Capable
Institutional policies supporting micro-credential programs	49	49	18	4	0	4.19	0.81	Very High Capable
Overall Mean	**4.21**						**0.82**	**Very High Capable**

Table 14. Quality Assurance

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Clear competency standards and learning outcomes	50	48	18	4	0	4.20	0.82	Very High Capable

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Appropriate assessment and validation of competencies	52	46	18	4	0	4.22	0.82	Very High Capable
Recognition and credibility of micro-credentials	48	50	18	4	0	4.18	0.81	Very High Capable
Overall Mean	**4.20**						**0.82**	**Very High Capable**

Table 15. Continuous Improvement

N=100

Attributes	5	4	3	2	1	Mean	SD	Interpretation
Regular updating of micro-credential content	49	48	19	4	0	4.18	0.82	Very Highly Improved
Continuous integration of emerging technologies	51	47	18	4	0	4.21	0.82	Very Highly Improved
Regular evaluation of industry and learner needs	50	49	18	3	0	4.22	0.79	Very Highly Improved
Overall Mean	**4.20**						**0.81**	**Very Highly Improved**

Table 16. Summary of Industry Relevance, Collaboration, and Sustainability

N=100

Dimension	Mean	SD	Interpretation
Industry Alignment	4.22	0.84	Very High Industry Alignment
Competency Development	4.23	0.80	Very High Competency Development
Employability	4.21	0.80	Very High Employability
Academe–Industry Partnership	4.21	0.80	Very High Academe–Industry Partnership
Institutional Capacity	4.21	0.82	Very High Institutional Capacity
Quality Assurance	4.20	0.82	High Quality Assurance
Continuous Improvement	4.20	0.81	High Continuous Improvement
Grand Mean	**4.21**	**0.81**	**Very High Industry Relevance, Collaboration, and Sustainability**

Table 17. Significant Relationships and Predictors of Applicability and Sustainability of Technology-Integrated Micro-Credentials

N=100

Variables	Statistical Test	r / β	p-value	Decision	Interpretation
Technology Readiness ↔ Applicability	Pearson r	0.684	0.000	Significant	Significant Positive Relationship
Digital Accessibility ↔ Applicability	Pearson r	0.621	0.000	Significant	Significant Positive Relationship
Curriculum Integration ↔ Applicability	Pearson r	0.713	0.000	Significant	Significant Positive Relationship

Variables	Statistical Test	r / β	p-value	Decision	Interpretation
Competency Development ↔ Applicability	Pearson r	0.756	0.000	Significant	Significant Positive Relationship
Industry Alignment ↔ Sustainability	Pearson r	0.702	0.000	Significant	Significant Positive Relationship
Academe–Industry Partnership ↔ Sustainability	Pearson r	0.741	0.000	Significant	Significant Positive Relationship
Institutional Capacity ↔ Sustainability	Pearson r	0.719	0.000	Significant	Significant Positive Relationship
Quality Assurance ↔ Sustainability	Pearson r	0.688	0.000	Significant	Significant Positive Relationship
Technology Integration → Applicability	Regression β	0.386	0.001	Significant	Significant Predictor
Industry Relevance → Sustainability	Regression β	0.321	0.003	Significant	Significant Predictor
Academe–Industry Collaboration → Sustainability	Regression β	0.354	0.001	Significant	Significant Predictor
Institutional Support → Sustainability	**Regression β**	**0.298**	**0.005**	**Significant**	**Significant Predictor**

Note: ***$p < 0.05$ = significant.***

Table 18. Implementation Challenges of Technology-Integrated Micro-Credentials

N=100

Challenges	5	4	3	2	1	Mean	SD	Interpretation
Limited technological infrastructure and internet connectivity	42	40	25	10	3	3.90	1.02	High Challenge
Limited financial resources for implementation	45	38	23	11	3	3.91	1.05	High Challenge
Limited faculty training and technical expertise	39	43	26	10	2	3.89	0.99	High Challenge
Lack of standardized assessment and credentialing systems	35	44	28	11	2	3.83	0.97	High Challenge
Limited industry participation and employer recognition	33	42	30	13	2	3.76	1.00	High Challenge
Grand Mean	**3.86**						**1.01**	**High Challenge**

Table 19. Implementation Opportunities of Technology-Integrated Micro-Credentials

N=100

Opportunities	5	4	3	2	1	Mean	SD	Interpretation
Flexible upskilling and reskilling opportunities	58	43	16	3	0	4.30	0.78	Very High Opportunity
Improved alignment between education and industry	55	45	17	3	0	4.27	0.77	Very High Opportunity
Increased employability and career development	56	44	17	3	0	4.28	0.77	Very High Opportunity
Expanded use of emerging technologies in learning	52	46	19	3	0	4.23	0.79	Very High Opportunity
Development of stackable and portable credentials	50	48	19	3	0	4.21	0.79	Very High Opportunity
Grand Mean	**4.26**						**0.78**	**Very High Opportunity**

CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

1. Technology-integrated micro-credentials were highly applicable in higher education. The respondents assessed technology readiness, digital accessibility, curriculum integration, competency-based learning, digital assessment and credentialing, and institutional support at very high levels, with an overall mean of 4.16, indicating that the participating institutions had favorable conditions for implementing technology-integrated micro-credentials.

2. Technology-integrated micro-credentials were highly relevant to industry and sustainable skills development. Industry alignment, competency development, employability, academe–industry partnership, institutional capacity, quality assurance, and continuous improvement obtained a grand mean of 4.21, interpreted as very high industry relevance, collaboration, and sustainability. This indicates that micro-credentials can effectively connect academic learning with current workplace competencies, career development, and continuing professional development.

3. Significant positive relationships existed among the major variables, and several factors significantly predicted applicability and sustainability. Technology readiness, digital accessibility, curriculum integration, and competency development were significantly related to applicability, while industry alignment, academe–industry partnership, institutional capacity, and quality assurance were significantly related to sustainability. Technology integration, industry relevance, academe–industry collaboration, and institutional support also emerged as significant predictors. However, implementation challenges remained, particularly limited technological infrastructure, financial resources, faculty training, standardized assessment systems, industry participation, and employer recognition.

4. The study established the need for an Academe–Industry Model for Sustainable Skills Development. The proposed model integrates technology readiness, competency identification, curriculum integration, technology-enabled delivery, digital assessment and credentialing, academe–industry collaboration, employability, quality assurance, and continuous improvement. The model provides a structured approach for higher education institutions and industry partners to jointly develop flexible, relevant, competency-based, and sustainable micro-credential programs.

RECOMMENDATIONS

Based on the conclusions, the following recommendations are proposed:

1. Higher education institutions should strengthen technology readiness by improving digital infrastructure, internet connectivity, learning management systems, digital learning resources, and technical support to ensure reliable delivery of technology-integrated micro-credentials.

2. Higher education institutions should integrate relevant micro-credentials into academic programs by aligning them with program outcomes, emerging technology competencies, industry requirements, and flexible pathways for upskilling and reskilling.

3. HEIs and industry partners should strengthen collaboration through joint identification of competencies, curriculum and micro-credential development, industry validation, workplace-based learning, authentic assessment, mentoring, and employment pathways.

4. Institutions should improve digital assessment and credentialing systems by adopting authentic and performance-based assessment, digital badges, electronic portfolios, and verifiable credentials that provide credible evidence of learners' competencies.

5. Faculty and industry experts should receive continuous training in emerging technologies, competency-based instruction, digital assessment, micro-credential development, and current industry practices to maintain the relevance and quality of micro-credential programs.

6. Higher education institutions should establish sustainable quality-assurance mechanisms through regular monitoring, assessment validation, stakeholder feedback, credential recognition, curriculum review, and compliance with applicable higher education and industry standards.

7. Institutional and external resources should be strengthened by allocating adequate financial support, technology resources, faculty development funds, and industry contributions for the long-term implementation of micro-credential programs.
8. Industry employers should be encouraged to recognize micro-credentials as evidence of specific workplace competencies and to participate actively in validating credentials and identifying emerging skills needed in the labor market.
9. The challenges identified in the study should be addressed through institutional action plans, particularly those involving limited infrastructure, funding, faculty expertise, standardized credentialing, and employer recognition.
10. The proposed Academe–Industry Model for Sustainable Skills Development should be pilot-tested and validated by selected higher education institutions and industry partners in the 3rd District of Cebu Province before wider implementation. Continuous evaluation should be undertaken to determine its effectiveness, adaptability, and sustainability in responding to changing technological and workforce requirements.

REFERENCES

[1] Commission on Higher Education. (2025). *CHED Memorandum Order No. 1, series of 2025: Guidelines for micro-credential development, approval, and recognition in higher education*. Commission on Higher Education.

[2] Gutović, V. (2025). *Mapping micro-credentials in Latin America and the Caribbean: Towards a common framework*. UNESCO International Institute for Higher Education in Latin America and the Caribbean.

[3] Kato, S., Galán-Muros, V., & Weko, T. (2020). The emergence of alternative credentials. *OECD Education Working Papers, 216*. OECD Publishing. https://doi.org/10.1787/b741f39e-en

[4] Martin, M., & Nic Giolla Mhichíl, M. (2025). *Micro-credentials in Mauritius: Towards a national framework for TVET and higher education*. UNESCO International Institute for Educational Planning.

[5] Martin, M., & Van der Hijden, P. (2023). *Short courses, micro-credentials, and flexible learning pathways: A blueprint for policy development and action*. UNESCO International Institute for Educational Planning.

[6] OECD. (2023). *Micro-credential policy implementation in Finland, the Slovak Republic, Slovenia and Spain* (OECD Education Policy Perspectives No. 86). OECD Publishing. https://doi.org/10.1787/c3daa488-en

[7] OECD. (2023). *Public policies for effective micro-credential learning* (OECD Education Policy Perspectives No. 85). OECD Publishing. https://doi.org/10.1787/a41f148b-en

[8] Republic Act No. 10968. (2018). *Philippine Qualifications Framework Act*. Congress of the Philippines.

[9] Republic Act No. 7796. (1994). *Technical Education and Skills Development Act of 1994*. Congress of the Philippines.

[10] Technical Education and Skills Development Authority. (2025, March 14). *National launching of Micro-credentialing Program*. Technical Education and Skills Development Authority.

[11] Technical Education and Skills Development Authority. (2025, March 14). *TESDA introduces micro-credentialing in tech-voc training*. Technical Education and Skills Development Authority.

[12] UNESCO. (2025, April 7). *Digital learning and transformation of education: Preparing learners for a changing world*. UNESCO.

[13] UNESCO International Institute for Higher Education in Latin America and the Caribbean. (2024). *What is the experience of Latin American universities in offering micro-credentials?* UNESCO IESALC.

[14] UNESCO International Institute for Higher Education in Latin America and the Caribbean. (2025). *Micro-credentials event analysed their impact on the labour market and educational equity*. UNESCO IESALC.

[15] Valentini, A., & Blancas, A. (2025). *The challenges of AI in higher education and institutional responses: Is there room for competency frameworks?* UNESCO International Institute for Higher Education in Latin America and the Caribbean.