JPPIPA 12(2) (2026)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Enhancing Work Readiness Through Technopreneurship and Digital Literacy: A Study of Information Technology Students

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Received: December 26, 2025
Revised: January 17, 2026
Accepted: February 25, 2026
Published: February 28, 2026

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DOI: 10.29303/jppipa.v12i2.14411

Abstract: Digital technology has transformed labor market demands, requiring university graduates to possess comprehensive work readiness. This study analyzes the influence of technopreneurship and digital literacy on Information Technology students' work readiness at private universities. Using a quantitative approach, 307 respondents were selected through proportional random sampling. Data were collected via Likert-scale questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4.0. Findings revealed both variables significantly and positively influence work readiness, with digital literacy as the dominant factor. The R^2 value of 0.63 indicates that 63% of work readiness variance is explained by these factors. Results highlight the importance of integrating technopreneurship and digital literacy into higher education curricula to prepare graduates for digital industry demands. Universities should strengthen project-based learning, startup incubation programs, and applied digital training. This study provides empirical evidence of technopreneurship and digital literacy's simultaneous effect on work readiness in developing technological ecosystems, contributing to quality education and decent work opportunities aligned with sustainable development goals.

Keywords: Digital literacy; Technopreneurship; Work readiness

Introduction

The rapid development of digital technology in the era of the Fourth Industrial Revolution has fundamentally transformed the way humans work, communicate, and innovate. The field of Information Technology (IT) has become one of the most affected sectors by this digital transformation requiring integration of technological, pedagogical, and content knowledge in educational settings (Fajri et al., 2024; Ismail et al., 2023). Nearly all industries today integrate digital technologies into their business processes, creating a strong demand for a workforce equipped with digital competencies and high adaptability. This condition requires students, particularly those majoring in Information Technology, to possess not only technical skills but also technopreneurship defined as the ability to identify market opportunities, develop innovative technology-based solutions, and commercialize IT innovations through a startup mindset that emphasizes Problem-Solution Fit (Dewi & Gunadi, 2025). Unlike traditional entrepreneurship, technopreneurship for IT graduates encompasses not merely the sale of technology products, but the entire cycle of identifying real-world problems, designing digital solutions, and creating scalable business models through technology commercialization (Mananda & Mahadewi, 2023). This competency becomes increasingly critical as the digital economy demands graduates who can transition from being passive job seekers to active value creators and innovators in the technology ecosystem.

Although job opportunities in the IT sector continue to grow, many university graduates are still not fully prepared to enter the workforce (Lestari & Nur, 2023). The phenomenon of the skill gap remains a serious issue across many higher education institutions, including private universities in Jambi Province. This research addresses a critical gap that extends beyond

How to Cite:
Putra, Y. I., Idrus, A., Firman, & Sofyan. (2026). Enhancing Work Readiness Through Technopreneurship and Digital Literacy: A Study of Information Technology Students. *Jurnal Penelitian Pendidikan IPA*, *12*(2), 339-349. https://doi.org/10.29303/jppipa.v12i2.14411

geographical boundaries: while existing studies predominantly focus on large universities in developed regions with established startup ecosystems and robust digital infrastructure (Bomani et al., 2021; Ornellas et al., 2019), there is limited empirical evidence examining how technopreneurship and digital literacy influence work readiness in developing regions characterized by limited technological infrastructure, nascent startup ecosystems, and minimal access to venture capital and industry mentorship (Dewi et al., 2024; Halimah et al., 2023; Harefa et al., 2025). Jambi Province exemplifies such conditions, where private universities operate with constrained resources, limited industry partnerships, and significantly fewer opportunities for students to engage with real-world technology commercialization projects compared to metropolitan areas. Based on preliminary observations and interviews with lecturers and heads of IT study programs in several private universities in Jambi, it was found that many students still lack professional digital competencies and have not developed a strong technopreneurship orientation. They tend to focus primarily on academic achievements without enhancing the creative, innovative, and practical skills required by the industry (Kurniawan, 2024). Consequently, despite having solid theoretical knowledge, many IT graduates struggle to adapt to digital work environments that demand problem-solving abilities, collaboration, and the effective utilization of technology for innovation. This contextual difference makes Jambi a valuable case study for understanding how work readiness can be cultivated in resource-constrained environments findings that have implications for similar developing regions globally.

Theoretically, work readiness is defined as a combination of knowledge, skills, and attitudes that enables individuals to adapt and contribute effectively in the workplace (Caballero & Walker, 2010). Work readiness encompasses not only hard skills but also soft skills, digital competencies, and an innovative entrepreneurial orientation (Azmi & Rahmi, 2024; Mulifah et al., 2024). In this context, technopreneurship plays a crucial role in fostering students' ability to create opportunities and innovate through technology. Meanwhile, digital literacy particularly in the context of the Industrial Revolution 4.0 extends beyond the basic ability to use digital tools. It now encompasses digital fluency, which includes advanced competencies such as data literacy (the ability to analyze, interpret, and make decisions based on data), cybersecurity awareness (understanding digital threats and implementing protective measures), and critical digital thinking (evaluating the credibility and ethical implications of digital information) (Belshaw, 2012). These Industry 4.0 skills are essential for IT graduates who must navigate an increasingly complex technological landscape characterized by artificial intelligence, big data analytics, cloud computing, and Internet of Things (IoT) applications (Adima et al., 2024). Therefore, students' work readiness can be significantly improved if higher education institutions successfully integrate technopreneurship development and comprehensive digital fluency into their learning processes (Shabira & Yanti, 2024).

Several previous studies have emphasized the importance of enhancing students' work readiness through the strengthening of entrepreneurial and digital skills (Ichsan et al., 2023). For instance, Ornellas et al. (2019) highlighted that project-based and experiential learning approaches can improve students' work readiness. Bomani et al. (2021) found that technology-based entrepreneurship education strengthens self-efficacy and enhances graduates' readiness for the workforce. Similarly, Zulyusri et al. (2023) asserted that strong digital literacy enables individuals to adapt more effectively to rapid technological changes in the workplace (Saâ et al., 2024). However, most of these studies were conducted in the context of large universities or countries with more advanced digital infrastructures and well established innovation ecosystems. There remains a scarcity of research examining the relationship between technopreneurship and digital literacy in shaping the work readiness of information technology students in developing regions such as Jambi Province, where private universities face significant challenges including limited access to modern laboratory equipment, scarce industry partnerships, underdeveloped digital startup ecosystems, and minimal exposure to entrepreneurial role models and mentorship programs (Sofian et al., 2023). This constitutes the research gap addressed in this study specifically, how these two factors simultaneously influence students' work readiness within private higher education institutions operating in resource-constrained environments, and whether the positive effects observed in well-resourced contexts can be replicated or require adaptation in developing regions.

The novelty of this research lies in three key contributions: First, it provides the first empirical evidence of the simultaneous effects of technopreneurship and digital literacy (conceptualized as Industry 4.0 competencies including data literacy and cybersecurity awareness) on IT students' work readiness in a developing regional context with limited infrastructure (Nasution & Nasution, 2025; Nisyaa & Widodo, 2025; Sangaji & Pribadi, 2023). Second, it examines whether the technopreneurship mindset can be effectively cultivated even in environments lacking established startup support systems, venture capital access, and industry mentorship a critical question for understanding how to build work readiness in resource-

constrained settings (Aprilia et al., 2023; Miranda et al., 2022). Third, it offers a contextualized work readiness model specifically applicable to private universities in developing regions, thereby extending the predominantly Western centric models developed by Caballero et al. (2010) and Hidayat et al. (2024) and others to a different socio-economic and infrastructural context. This research is important because developing regions like Jambi represent the majority of higher education contexts globally, yet remain underrepresented in empirical studies. Understanding how work readiness can be effectively built in these contexts has practical significance for millions of students in similar circumstances and can inform policy interventions that are contextually appropriate rather than simply transplanted from developed economies.

This study aims to analyze the influence of technopreneurship and digital literacy on the work readiness of Information Technology students at private universities in Jambi Province. Theoretically, this research is expected to contribute to the development of an empirical model of students' work readiness in the digital era by integrating two key variables technopreneurship and digital literacy conceptualized as Industry 4.0 competencies while accounting for contextual factors such as limited infrastructure and nascent entrepreneurial ecosystems. Practically, the findings of this study can serve as input for private university administrators and higher education policymakers in developing regions to design more application-oriented and project-based learning strategies that foster students' technopreneurial mindset and digital competencies despite resource constraints. Thus, this study not only enriches the academic literature but also provides tangible, context-sensitive implications for improving the quality of graduates, enabling them to compete effectively in the dynamic digital labor market.

Method

Type of Research

This study employed a quantitative approach using an explanatory survey method, which aims to empirically examine the influence of technopreneurship and digital literacy on the work readiness of Information Technology students. The quantitative approach was chosen because it allows for the measurement of relationships among variables based on numerical data analyzed statistically (Creswell, 2015). The explanatory research design was used to explain causal relationships among variables and to provide a deeper understanding of the factors influencing students' work readiness in the digital era (Sugiyono, 2013). Figure 1 presents the overall research methodology flowchart to provide a clear understanding of the research process.

The research process follows a systematic sequence from research design through data collection to analysis, ensuring methodological rigor and validity of findings.

Population and Sample

The population of this study consisted of all active students enrolled in Information Technology programs at private universities in Jambi Province who had completed at least four semesters. This criterion was chosen because students at this stage generally possess sufficient academic experience, foundational technical skills, and exposure to digital learning environments.

The sampling technique employed was proportional random sampling, in which the number of respondents from each university was adjusted according to the proportion of active students. Given that this study utilizes Structural Equation Modeling–Partial Least Squares (SEM-PLS), the sample size was determined using the 10-times rule recommended for PLS-based SEM analyses (Indrawati & Rahmawati, 2024). According to this rule, the minimum sample size should be at least 10 times the maximum number of structural paths directed at any latent construct in the model. In this research model, the dependent variable (Work Readiness) receives paths from two independent variables (Technopreneurship and Digital Literacy), yielding: Minimum sample size = 10 × 2 = 20 respondents.

However, to ensure adequate statistical power and to account for potential data quality issues, the actual sample collected was n = 307 respondents from a total population of approximately N = 3,250 active IT students across private universities in Jambi Province. This sample size substantially exceeds the minimum requirement and provides sufficient power to detect medium-to-large effect sizes ($\beta \geq 0.30$) with a statistical power of 0.80 at $\alpha = 0.05$ (Cohen, 1988). The large sample also enhances the stability and generalizability of the PLS path model estimates (Hair et al., 2017; Sarstedt et al., 2021).

The proportional random sampling ensured that each university's representation in the sample reflected its proportion in the total population, thereby maintaining sample representativeness and reducing selection bias.

Instrument Development and Validation

Data were collected using a structured questionnaire based on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) (Budiaji, 2013). The research instrument consisted of three main constructs, namely: 1) Technopreneurship, adapted from the indicators developed by Bomani et al. (2021),

which include dimensions of innovation capability, creativity, risk-taking, and the use of technology to create business opportunities. 2) Digital Literacy, measured using the digital competence model proposed by Sriyanti (2023), which covers technical, cognitive, and socio-emotional skills in utilizing digital technology. 3) Work Readiness, adapted from the model of Caballero et al. (2010), encompassing three main aspects: hard skills, soft skills, and cognitive skills.

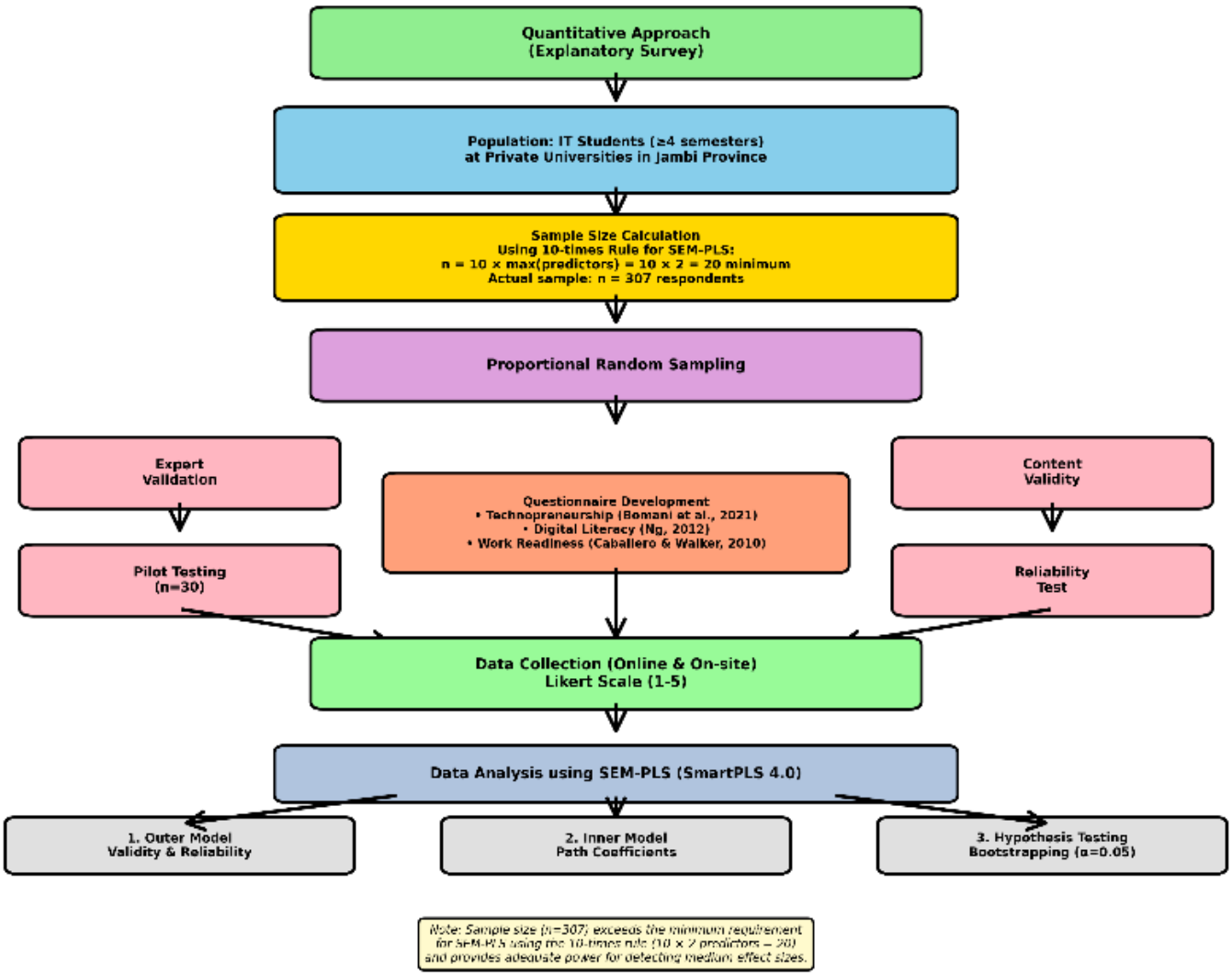

Figure 1. Research methodology flowchart

Validation Process

Before being used for primary data collection, the questionnaire underwent a rigorous validation process consisting of three stages: Stage 1: Expert Judgment. The initial draft of the questionnaire was reviewed by three experts: one professor specializing in educational measurement, one expert in entrepreneurship education, and one industry practitioner with experience in IT recruitment. Experts evaluated the content validity, item relevance, and clarity of wording. Feedback from expert judgment was used to refine item statements and ensure alignment with theoretical constructs.

Stage 2: Pilot Testing. Following expert validation, a pilot study was conducted with 30 IT students from one private university not included in the main sample. The pilot test aimed to assess face validity (whether items appeared to measure what they were intended to measure) and to identify any ambiguous or confusing items. Students' feedback was collected through cognitive interviews, and problematic items were revised or removed. Stage 3: Exploratory Factor Analysis (EFA) and Reliability Testing. Data from the pilot study were analyzed using Exploratory Factor Analysis (EFA) to examine the underlying factor structure and to ensure that items loaded appropriately onto their intended constructs. Items with factor loadings below 0.50 or with high cross-loadings (>0.40 on multiple factors) were eliminated. Internal consistency reliability was assessed using Cronbach's

Alpha, with a threshold of α ≥ 0.70 considered acceptable. After this three-stage validation process, the finalized questionnaire was distributed for primary data collection. The Confirmatory Factor Analysis (CFA) was subsequently conducted on the primary research data as part of the Outer Model evaluation in SEM-PLS (see Data Analysis Technique section).

Data Collection Technique

Data were collected using a structured questionnaire based on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) (Budiaji, 2013). The research instrument consisted of three main constructs, namely: 1) Technopreneurship, adapted from the indicators developed by Bomani et al. (2021), which include dimensions of innovation capability, creativity, risk-taking, and the use of technology to create business opportunities (Hastuti et al., 2025; Pratama & Gita, 2025). 2) Digital Literacy, measured using the digital competence model proposed by Ng (2012), which covers technical, cognitive, and socio-emotional skills in utilizing digital technology. 3) Work Readiness, adapted from the model of Caballero et al. (2010), encompassing three main aspects: hard skills, soft skills, and cognitive skills.

Before being used for the main data collection, the questionnaire underwent validity and reliability testing through Confirmatory Factor Analysis (CFA) and Cronbach's Alpha reliability testing (Darma, 2021). Items with factor loading values ≥ 0.70 and reliability coefficients ≥ 0.70 were considered valid and reliable (Sarstedt et al., 2021).

The data collection was conducted through two methods: online (via Google Forms) and on-site distribution at the participating campuses across Jambi Province. This hybrid approach ensured that a broad and representative sample of Information Technology students from various private universities could be reached effectively.

Data Analysis Technique

Data analysis was carried out through several stages, consisting of descriptive analysis and inferential analysis using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) approach with the aid of SmartPLS version 4.0 software (Amalia et al., 2024; Sarstedt et al., 2021). SEM-PLS was chosen as the analytical method because it is particularly well-suited for: 1) Analyzing models with complex latent constructs measured through multiple indicators. 2) Handling non-normal data distributions (PLS does not require multivariate normality).3) Predictive modeling and theory development (PLS maximizes explained variance in dependent variables). 3) Working effectively with medium-sized samples (Sarstedt et al., 2021).

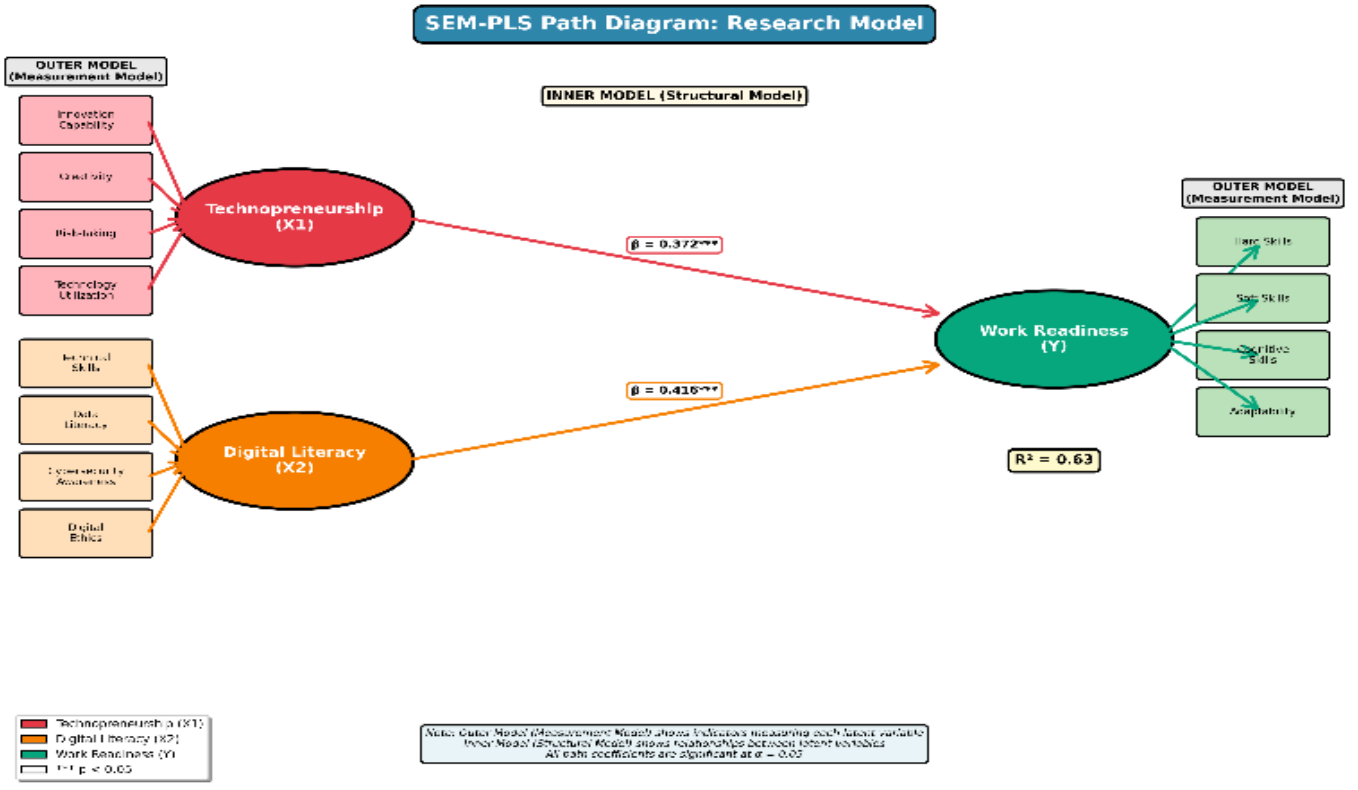

Figure 2. SEM-PLS path diagram showing measurement and structural models

Figure 2 presents the conceptual SEM-PLS path diagram illustrating the measurement model (outer model) and structural model (inner model) examined in this study. As shown in Figure 2, the Outer Model (Measurement Model) specifies how each latent variable is measured through its indicators. The Inner Model (Structural Model) specifies the hypothesized relationships between the latent variables—specifically, the direct effects of Technopreneurship (X1) and Digital Literacy (X2) on Work Readiness (Y).

Analysis Procedures

Outer Model Evaluation (Measurement Model)

The outer model was evaluated to assess the validity and reliability of the measurement instruments. The evaluation criteria included: 1) Convergent Validity: Assessed using factor loadings ($\lambda \geq 0.70$) and Average Variance Extracted (AVE ≥ 0.50). Factor loadings indicate the strength of the relationship between each indicator and its latent construct, while AVE represents the amount of variance captured by the construct relative to measurement error. 2) Discriminant Validity: Evaluated using the Fornell-Larcker criterion (the square root of each construct's AVE should exceed its correlations with other constructs) and the Heterotrait-Monotrait (HTMT) ratio (HTMT < 0.85 for conceptually distinct constructs) (Henseler et al., 2015). 3) Composite Reliability (CR): Assessed using CR ≥ 0.70, which indicates that the set of indicators consistently measures the latent construct (Hair et al., 2017). Indicators that did not meet these criteria were considered for removal to ensure the robustness of the measurement model.

Inner Model Evaluation (Structural Model)

The inner model was evaluated to examine the hypothesized relationships between latent variables. The evaluation criteria included: 1) Path Coefficients (β): Standardized regression coefficients indicating the strength and direction of relationships between constructs. Path coefficients range from -1 to +1, with larger absolute values indicating stronger effects. 2) Coefficient of Determination (R^2): Represents the proportion of variance in the dependent variable (Work Readiness) explained by the independent variables (Technopreneurship and Digital Literacy). R^2 values of 0.25, 0.50, and 0.75 are considered weak, moderate, and substantial, respectively (Hair et al., 2011). 3) Effect Size (f^2): Cohen's f^2 assesses the substantive impact of a predictor construct on an endogenous construct. Values of 0.02, 0.15, and 0.35 represent small, medium, and large effect sizes, respectively (Cohen, 1988). 4) Predictive Relevance (Q^2): Stone-Geisser's Q^2 value, obtained through blindfolding procedures, assesses the model's predictive accuracy. $Q^2 > 0$ indicates that the model has predictive relevance for the dependent variable (Setiyaningsih et al., 2024).

Hypothesis Significance Testing

Hypothesis testing was performed using the bootstrapping method with 5,000 resamples at a significance level of $\alpha = 0.05$. Bootstrapping is a non-parametric resampling technique that generates standard errors and confidence intervals for path coefficients without relying on distributional assumptions (Herbert et al., 2020; van Dinther et al., 2013). The following hypotheses were tested:

H1: Technopreneurship has a positive and significant effect on Work Readiness

H2: Digital Literacy has a positive and significant effect on Work Readiness

A hypothesis was considered supported if the path coefficient was statistically significant ($p < 0.05$) or if the 95% bias-corrected confidence interval did not include zero. The t-statistic threshold for significance was $|t| \geq 1.96$ (two-tailed test).

Note on Terminology Correction: The original manuscript incorrectly mentioned testing for "direct and indirect effects." It is important to clarify that this research model examines only direct effects, as there is no mediating variable included in the model. The model tests the direct influence of two independent variables (Technopreneurship and Digital Literacy) on one dependent variable (Work Readiness). Future research may consider incorporating mediating variables (e.g., self-efficacy or motivation) to examine indirect effects.

Summary of Analytical Approach

The combination of outer model and inner model evaluation ensures both the reliability and validity of measurements and the robustness of structural relationships. By employing SEM-PLS, this study can simultaneously assess the measurement properties of constructs and test theoretical hypotheses about their interrelationships, thereby providing comprehensive insights into the factors influencing IT students' work readiness.

Result and Discussion

Respondent Characteristics

This study involved 307 respondents who were active students in the field of Information Technology from several private universities in Jambi Province. Based on demographic data, 58.3% of the respondents were male and 41.7% were female. The majority were between 20 and 23 years old (83%), and 90% had completed at least four semesters. This indicates that the respondents possessed sufficient academic experience and exposure to technology-based learning

environments, making them appropriate representatives for assessing the level of work readiness among Information Technology students.

Results of Measurement Model (Outer Model) Analysis

The outer model was tested to ensure the validity and reliability of each construct in the study. The evaluation criteria included factor loading ≥ 0.70, Average Variance Extracted (AVE) ≥ 0.50, and Composite Reliability (CR) ≥ 0.70.

Based on Table 1, all indicators meet the criteria for convergent validity and construct reliability, indicating that the model is appropriate for further analysis.

Table 1. Summary of Outer Model Test Results

Variable	Indicator	Loading Range	AVE	CR	Description
Technopreneurship	5	0.73-0.87	0.65	0.88	Valid and Reliable
Digital Literacy	5	0.74-0.89	0.68	0.90	Valid and Reliable
Work Readiness	6	0.72-0.88	0.66	0.91	Valid and Reliable

Source**:** Data processed using SmartPLS 4.0 (2025)

Results of Structural Model (Inner Model) Analysis

The inner model analysis aims to examine the causal relationships among latent variables. The test results show that the R^2 value is 0.63, which means that 63% of the variance in students' work readiness can be explained by the variables technopreneurship and digital literacy, while the remaining 37% is explained by other variables outside the research model.

Table 2. SEM-PLS Hypothesis Test Results

Hypothesis	Path of Influence	Coefficient Path (β)	t-Statistic	p-Value
H1	Technopreneurship → Work Readiness	0.372	5.221	0.000
H2	Digital Literacy → Work Readiness	0.416	6.012	0.000

Source**:** Data processed using SmartPLS 4.0 (2025)

Discussion

The findings of this study indicate that both technopreneurship and digital literacy play significant roles in shaping the work readiness of Information Technology students. These results strengthen the work readiness model proposed by Caballero et al. (2011) which emphasizes the importance of integrating technical, innovative, and cognitive skills in preparing graduates for the workforce (Fauziah & Sukmawati, 2023).

The Influence of Technopreneurship on Work Readiness

The technopreneurship variable has a positive and significant effect on students' work readiness ($\beta = 0.372$; $p < 0.001$). This finding suggests that students who possess innovation capability, creative thinking, and the ability to identify technology-based opportunities tend to have higher levels of work readiness. They are not merely job seekers but also potential job creators through new technological ideas. This result aligns with (Bomani et al., 2021), who found that technology-based entrepreneurship education enhances self-efficacy and graduate work preparedness (Nasution & Nasution, 2025). The novelty of this study lies in its empirical evidence showing that even in regions with a developing technological ecosystem such as Jambi Province technopreneurship remains a significant factor in improving students' work readiness. This implies that a technological entrepreneurial mindset can flourish even in environments where digital infrastructure and startup support systems are not yet fully established.

The Influence of Digital Literacy on Work Readiness

Digital literacy emerged as the most dominant variable influencing work readiness ($\beta = 0.416$; $p < 0.05$). This result indicates that students' ability to understand, manage, and effectively use digital technology plays a crucial role in determining their preparedness to enter the modern workforce. Students with high levels of digital literacy tend to have a competitive advantage, as they can adapt quickly to technological changes, collaborate effectively through digital platforms, and understand key aspects of digital ethics and cybersecurity (Belshaw, 2012). This finding is consistent with (Ng, 2012) and (Ornellas et al., 2019), who emphasized that digital competence is a key prerequisite for employability in the Industry 4.0 era (Sudarsono & Pratama, 2025). However, the unique contribution of this study lies in highlighting that, within the local context, digital literacy extends beyond technical proficiency (such as operating software). It also encompasses cognitive and productive dimensions the ability to transform digital information into economic value or innovative solutions that are beneficial in the workplace.

Theoretically, this study enriches the discourse on work readiness by integrating two highly contextual variables in the digital era technopreneurship and digital literacy (Putri & Sukmawati, 2024). The

integration of these two constructs broadens the understanding that work readiness is not solely developed through formal education, but also through students' ability to adapt to technology and innovate independently (Prastyo & Inayati, 2022).

Practically, the results of this study provide strategic recommendations for Private Universities (PTS) in Jambi Province to: 1) Develop project-based learning curricula that foster creativity and digital innovation. 2) Establish on-campus technopreneurship incubators as platforms for students to develop technology-driven business ideas. 3) Enhance applied digital literacy programs, such as training in cybersecurity, data analytics, and digital system management.

These initiatives are expected to comprehensively strengthen students' work readiness, transforming graduates from mere job seekers into value creators within the digital economy ecosystem.

Conclusion

This study demonstrates that technopreneurship and digital literacy significantly and positively influence the work readiness of Information Technology students at private universities in Jambi Province. The structural equation modeling results reveal that these two variables collectively account for 63% of the variance in work readiness ($R^2 = 0.63$), indicating substantial explanatory power while acknowledging that 37% of the variance is attributable to other factors not examined in this study, such as institutional support, prior work experience, soft skills, or personal motivation. Both variables contribute significantly to work readiness, with digital literacy showing a slightly higher path coefficient than technopreneurship. This finding suggests that for IT students in resource-constrained private universities, advanced digital competencies serve as a foundational requirement for workforce entry, while technopreneurship competencies provide the differentiating factor that enables graduates to become value creators rather than merely job seekers. It is important to note that both competencies are complementary rather than competing: digital literacy provides the technical foundation, while technopreneurship cultivates the innovative mindset necessary to apply these technical skills in creating technology-based solutions and business opportunities. Theoretically, this study enriches the work readiness model proposed by Caballero et al. (2010) by incorporating technopreneurship and advanced digital competencies as determinant variables within the context of higher education in developing technological ecosystems. Practically, the findings provide evidence-based recommendations for private universities to: (1) Integrate project-based learning curricula that foster creativity and technology-driven innovation; (2) Establish on-campus startup incubation programs providing mentorship, seed funding access, and industry networking opportunities; (3) Strengthen advanced digital competencies training encompassing professional IT skills such as data analytics, cybersecurity awareness, cloud computing, and AI/machine learning fundamentals, rather than limiting development to basic digital literacy. This study has several limitations that present opportunities for future research. First, the geographical scope is limited to Jambi Province, which may not fully represent the diversity of technological ecosystems and educational contexts across Indonesia. Second, the model explains 63% of work readiness variance, indicating that other potentially important variables remain unexamined. Third, the cross-sectional design limits causal inference about the long-term development of these competencies. Therefore, future research should: (1) Expand the study to include comparative analysis across different regions with varying levels of technological infrastructure and startup ecosystem maturity; (2) Incorporate additional variables such as soft skills (communication, teamwork, critical thinking), institutional factors (industry partnerships, internship programs, curriculum quality), personal factors (self-efficacy, intrinsic motivation, career adaptability), and environmental factors (local job market conditions, access to technology); (3) Employ longitudinal research designs to track competency development trajectories and their impact on actual employment outcomes; (4) Compare work readiness patterns across different types of higher education institutions (public vs. private, research-intensive vs. teaching-focused); (5) Investigate mediating and moderating factors in the relationship between technopreneurship, digital competencies, and work readiness, such as the role of entrepreneurial self-efficacy or the moderating effect of industry exposure through internships.

Acknowledgments
Thanks are due to the Universitas Jambi all colleagues who have supported the completion of this article.

Author Contributions
Y.I.P.: conceptualization, methodology, writing–original draft preparation; A.I.: conceptualization, methodology, writing–review and editing; F.: data curation, writing–original draft preparation; S.: formal analysis, validation.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

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