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Exploring the Impact of Intellectual Capital on University Students' Digital Innovation Intentions: The Mediating Role of Digital Literacy in Indonesia

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ABSTRACT
The rapid expansion of the digital economy has increased the need for graduates who are capable of initiating digital innovation. However, educated unemployment remains a persistent challenge in Indonesia, suggesting that intellectual resources alone may not be sufficient to foster innovation-oriented intentions. This study examines the effects of knowledge and skills, networking, and opportunity recognition on the intention to start digital innovation, with digital literacy as a mediating variable. A quantitative survey was conducted among 334 university students from various higher education institutions in Indonesia. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that opportunity recognition significantly influences both digital literacy and intention to start digital innovation, while knowledge and skills significantly enhance digital literacy but do not directly affect innovation intention. Networking was found to have no significant effect on either digital literacy or innovation intention. Digital literacy significantly influences intention to start digital innovation and fully mediates the relationship between knowledge and skills and innovation intention, while partially mediating the effect of opportunity recognition. These findings highlight digital literacy as a critical capability-conversion mechanism through which intellectual capital is transformed into innovation-oriented intentions. The study extends Intellectual Capital Theory by emphasizing the role of digital literacy in converting intellectual resources into digital innovation intentions among university students.

INTRODUCTION

The rapid growth of the digital economy and ongoing technological disruption have fundamentally transformed the labor market, increasing the demand for human resources who are not only academically competent but also possess critical thinking, creativity, adaptability, and innovative capabilities (Huang & Yan, 2025). In this context, higher education institutions are expected to prepare students as strategic actors who are oriented not merely toward job seeking, but also toward job creation through digital innovation–based entrepreneurship (Dinh & Tang, 2025; Gayatri et al., 2022). However, the employment reality in Indonesia indicates that educated unemployment remains a serious concern, as reflected in the open unemployment rate among university graduates, which still reached 5.25 percent in 2024 (Badan Pusat Statistik, 2025).

Data on the Open Unemployment Rate (OUR) from *Badan Pusat Statistik* in 2025 indicate that unemployment is relatively higher among individuals with secondary and higher education compared to those with basic education. This trend is particularly evident among graduates of vocational high schools (9.01%), general high schools (7.05%), diploma programs (4.83%), and universities (5.25%). This phenomenon reflects the

persistence of educated unemployment, which is largely driven by a mismatch between graduates' competencies and labor market requirements (skill mismatch), limited work experience, and evolving labor market demands that increasingly emphasize adaptive and practical skills (Kompas.id, 2025a). Moreover, the higher selectivity of tertiary-educated graduates in choosing jobs further prolongs their transition into the labor market (Detik.com, 2025), highlighting a structural imbalance between the education system and labor market needs.

Table 1. Comparison of the Open Unemployment Rate by Educational Level in 2025

Educational Level	Open Unemployment Rate (%)
No Formal Schooling / Incomplete & Completed Primary School	2.32%
Junior High School	4.11%
General Senior High School	7.05%
Vocational Senior High School	9.01%
Diploma I/II/III	4.83%
University	5.25%

Source: (*Badan Pusat Statistik*, 2025)

In response to these challenges, the Indonesian government has launched various strategic policies to promote digital innovation and digital entrepreneurship, including "the National Movement of 1000 Digital Startups", which aims to develop a sustainable innovation ecosystem and foster technology-based young innovators (KOMDIGI, 2020). However, the intended outcomes of these policies have not yet been fully realized, as reflected in the persistently high open unemployment rates among university and diploma graduates in 2024 (Badan Pusat Statistik, 2024). This condition indicates a gap between digital economic development policies and the actual readiness of higher education graduates to capitalize on technology-based innovation opportunities (Raihan et al., 2025).

This gap indicates that educated unemployment is not solely driven by limited job opportunities or policy shortcomings, but is also closely related to graduates' internal readiness, particularly their mastery of intellectual capital relevant to the demands of the digital economy (Kompas.id, 2025b). Intellectual capital reflects individuals' capacity to manage knowledge, skills, experience, and creative as well as innovative thinking to generate value creation (Bontis, 1998; Nahapiet & Ghoshal, 1998). Opportunity recognition is not viewed as an independent resource separate from intellectual capital. Instead, it reflects the deployment of human capital in entrepreneurial contexts, where knowledge and competencies are transformed into the identification and evaluation of business opportunities (Nahapiet & Ghoshal, 1998).

However, a high level of intellectual capital does not necessarily translate into an intention to initiate digital innovation if it is not supported by adequate digital literacy. Digital literacy encompasses the ability to access, evaluate, and utilize digital information critically, creatively, and productively (Gilster & Glister, 1997; Van Laar et al., 2017). In the context of university students, digital literacy functions as a crucial mechanism that bridges intellectual capacity with innovative behavior (Citaristi, 2022), thereby enabling the transformation of knowledge and creativity into technology-based innovation activities (Ng, 2012; Van Laar et al., 2017). Therefore, a significant research gap exists in empirically examining the mediating role of digital literacy in the relationship between intellectual capital and the intention to initiate digital innovation among university students.

Recent studies consistently demonstrate that intellectual capital, encompassing knowledge and skills (Duong et al., 2024; Pham et al., 2023; Tran et al., 2024; Vu et al., 2024), social capital or networking (Al Halbusi et al., 2023; Kaur & Kaur, 2025), and cognitive capital in the form of opportunity recognition (Al-Ayed, 2024; Liang et al., 2025; Otache et al., 2024), plays a critical role in shaping individuals' intention to start digital innovation. However, the literature also emphasizes that the effect of knowledge and skills on digital innovation intention is not always direct, but rather contingent upon individuals' ability to actualize these competencies within digital practices (Agus Irawan & Cahya, 2025; Ahmadtul et al., 2024; Hidayat et al., 2024; Usman et al., 2025). In this

context, digital literacy is conceptualized as the outcome of integrating and operationalizing digital knowledge and skills into real-world activities (Hatlevik & Christophersen, 2013; Spante et al., 2018), and has been shown to be significantly influenced by digital knowledge and skills (Rudnák et al., 2025; Vodă et al., 2022; Wu et al., 2025). Other studies further indicate that digital literacy positively affects digital entrepreneurial and digital innovation intentions, both directly and indirectly through cognitive pathways such as self-efficacy and innovative attitudes (Ip, 2024; Mugiono et al., 2021; Wu et al., 2025), and functions as a mediating variable between knowledge, skills, social capital, and digital innovation intention (Liang et al., 2025; Tsai & Men, 2013).

Despite the growing body of research demonstrating the importance of knowledge and skills, networking, and opportunity recognition in fostering entrepreneurial and digital innovation intentions (Al-Ayed, 2024; Al Halbusi et al., 2023; Duong et al., 2024), the existing literature remains limited in explaining how these dimensions collectively operate as intellectual capital to stimulate digital innovation intention. Most prior studies have examined these factors independently, resulting in a fragmented understanding of the mechanism through which intellectual resources are transformed into innovation-oriented intentions. Furthermore, although digital literacy has been widely recognized as a critical capability in the digital era (Hatlevik & Christophersen, 2013; Spante et al., 2018), previous studies have predominantly treated it as an antecedent, outcome, or contextual factor rather than as an explanatory mechanism linking intellectual capital and digital innovation intention (Liang et al., 2025; Tsai & Men, 2013). Consequently, the process through which intellectual capital is converted into digital innovation intention remains insufficiently understood.

This limitation is particularly relevant in the context of university students and graduates, where the possession of knowledge, networks, and opportunity-recognition capabilities does not automatically lead to innovation-oriented intentions without the ability to effectively access, evaluate, create, and utilize digital information and technologies. Moreover, prior evidence regarding the role of social capital and networking has produced mixed findings, with some studies reporting weak or insignificant effects on digital literacy and innovation-related outcomes (Jaberian, 2023; Jung et al., 2025). Therefore, this study addresses this gap by developing an integrative framework that positions digital literacy as the capability-conversion mechanism through which multiple dimensions of intellectual capital are transformed into digital innovation intention. By doing so, the study extends Intellectual Capital Theory beyond its traditional resource-based perspective by shifting attention from the mere possession of intellectual resources toward the process through which such resources are converted into innovation-oriented intentions in digital environments.

Based on the identified research gaps, this study contributes theoretically by enriching the literature on intellectual capital and digital innovation through the development of an individual-based integrative model that incorporates knowledge/skills, social capital, and opportunity recognition within a single causal framework mediated by digital literacy. This model provides a more comprehensive understanding of how the intellectual capacities of university students and graduates can be transformed into innovative orientations and intentions to initiate digital innovation in the digital economy era. From a practical perspective, the findings of this study are expected to serve as a reference for higher education institutions and policymakers in designing more targeted strategies to strengthen students' intellectual capital and digital literacy, thereby reducing educated unemployment and fostering the emergence of competitive young digital innovators and entrepreneurs in Indonesia.

HYPOTHESIS DEVELOPMENT

Based on the theoretical framework and literature review, this study proposes hypotheses examining the effect of Intellectual Capital (IC) on Intention to Start Digital Innovation, with Digital Literacy acting as a mediating variable. Intellectual capital is conceptualized through three dimensions: Knowledge/Skills, Networking, and Ability to Recognize Opportunities. The hypotheses test both direct and indirect relationships among these variables within the context of university students and graduates in Indonesia.

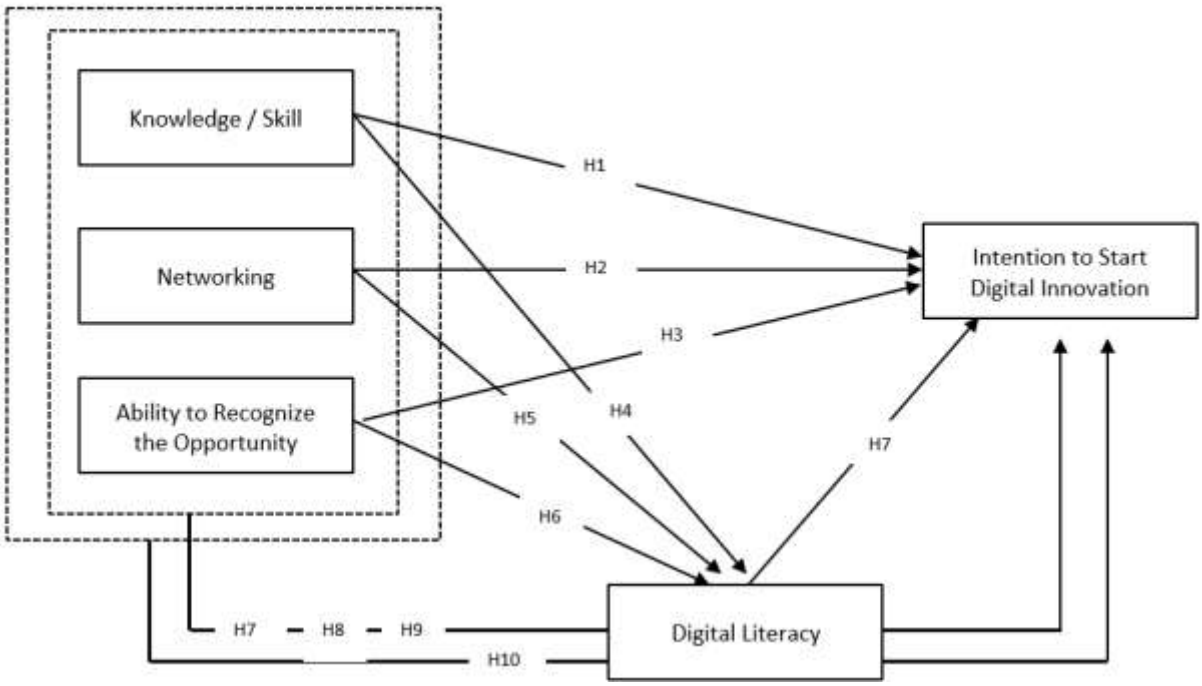

Figure 1. Conceptual Framework
Source: Researchers (2026)

Direct and Indirect Effect Hypotheses

Within the Intellectual Capital framework, knowledge/skill, networking, and ability to recognize opportunities represent essential dimensions of human, relational, and cognitive capital that contribute to entrepreneurial and innovation-related outcomes (Bontis, 1998). Knowledge and skills provide individuals with the competencies required to generate ideas, solve problems, and exploit emerging opportunities, while networking facilitates access to information, resources, and collaborative support through social and professional relationships. Likewise, the ability to recognize opportunities enables individuals to identify market gaps, emerging trends, and potential innovation prospects that can be transformed into entrepreneurial initiatives. Collectively, these intellectual capital resources strengthen individuals' confidence, readiness, and motivation to engage in entrepreneurial activities. Prior studies consistently demonstrate that knowledge/skill, networking, and opportunity recognition positively influence entrepreneurial intention and digital innovation intention (Al-Ayed, 2024; Amir et al., 2024; Chapman & Phillips, 2022; Duong et al., 2024; Duong & Vu, 2024; Liang et al., 2025). Therefore, it is hypothesized that knowledge/skill, networking, and ability to recognize opportunities positively and significantly affect the intention to start digital innovation (H1–H3).

H1: Knowledge/Skill has a positive and significant effect on the intention to start digital innovation.
H2: Networking has a positive and significant effect on the intention to start digital innovation.
H3: Ability to Recognize Opportunities has a positive and significant effect on the intention to start digital innovation.

In addition to directly influencing innovation intention, intellectual capital resources are expected to enhance individuals' digital literacy. Digital literacy refers to the ability to access, evaluate, create, and utilize digital information and technologies effectively (Ng, 2012). Individuals possessing strong knowledge and skills are more capable of understanding and applying digital technologies, while networking facilitates the exchange of digital knowledge and exposure to emerging technological practices. Similarly, individuals with strong opportunity recognition capabilities tend to actively seek information, explore digital tools, and engage with technological resources that support opportunity exploitation. Consequently, these intellectual capital dimensions contribute to the development of digital literacy. Empirical evidence indicates that knowledge/skill, networking, and opportunity recognition significantly enhance digital literacy and related digital competencies

(Jung et al., 2025; Mercader-Rubio et al., 2023; Vodă et al., 2022; Xu et al., 2023). Furthermore, digital literacy has been found to increase individuals' capability and confidence to pursue digital entrepreneurial and innovation-oriented activities (Maudina et al., 2022; Mugiono et al., 2021; Suryani & Chaniago, 2023). Therefore, it is hypothesized that knowledge/skill, networking, and ability to recognize opportunities positively and significantly affect digital literacy (H4–H6), and that digital literacy positively and significantly affects the intention to start digital innovation (H7).

H4: Knowledge/Skill has a positive and significant effect on digital literacy.
H5: Networking has a positive and significant effect on digital literacy.
H6: Ability to Recognize Opportunities has a positive and significant effect on digital literacy.
H7: Digital literacy has a positive and significant effect on the intention to start digital innovation.

Drawing upon Intellectual Capital Theory, the benefits of knowledge/skill, networking, and opportunity recognition may not automatically translate into intentions to start digital innovation unless individuals possess the capability to effectively utilize digital technologies and information. In this regard, digital literacy functions as an enabling mechanism that transforms intellectual capital resources into innovation-oriented intentions. Through digital literacy, individuals can apply their knowledge and skills in digital environments, leverage information obtained from their networks, and exploit identified opportunities using digital technologies. As a result, digital literacy enhances individuals' readiness and confidence to engage in digital innovation activities. Previous studies have shown that digital literacy serves as a significant intermediary mechanism linking intellectual resources and entrepreneurial outcomes (Duong et al., 2024; Duong & Vu, 2024; Hatlevik & Christophersen, 2013; Ivanović et al., 2025; Liang et al., 2025; Rudnák et al., 2025). Therefore, digital literacy is expected to mediate the effects of knowledge/skill, networking, and ability to recognize opportunities on the intention to start digital innovation (H8–H10).

H8: Digital literacy mediates the positive effect of Knowledge/Skill on the intention to start digital innovation.
H9: Digital literacy mediates the positive effect of Networking on the intention to start digital innovation.
H10: Digital literacy mediates the positive effect of Ability to Recognize Opportunities on the intention to start digital innovation.

METHODS

This study employed a quantitative approach using a survey research design to examine the relationships among intellectual capital (knowledge and skills, networking, and opportunity recognition), digital literacy, and intention to start digital innovation among university students in Indonesia. A survey design was considered appropriate because it enables the collection of data from a relatively large sample and facilitates statistical testing of both direct and indirect relationships among latent constructs (J. F. Hair et al., 2017; Hair Jr et al., 2021b). Data were collected through a structured self-administered online questionnaire distributed via Google Forms, allowing efficient access to respondents from diverse educational backgrounds and geographical regions (Sugiyono, 2019).

The target population comprised students enrolled in Indonesian higher education institutions at the diploma, undergraduate, master's, and doctoral levels. A purposive sampling technique was employed to ensure that respondents possessed characteristics relevant to the study objectives (Sugiyono, 2014). To be eligible for participation, respondents were required to (1) be actively enrolled in a higher education institution in Indonesia, (2) be at least 18 years old, (3) regularly use digital technologies and internet-based applications for academic, professional, or personal activities, and (4) have prior experience using digital platforms for learning, innovation-related projects, entrepreneurial activities, or other technology-enabled initiatives. These criteria were established to ensure that participants possessed sufficient exposure to digital environments and were therefore capable of evaluating the constructs investigated in this study. A total of 334 valid responses were retained for analysis, which exceeds the minimum sample size recommended for Partial Least Squares Structural Equation Modeling (PLS-SEM) (J. F. Hair et al., 2022; Hair Jr et al., 2021b). The final sample consisted predominantly of

undergraduate students from various academic disciplines, including business, social sciences, and STEM-related fields, representing both public and private universities across several regions of Indonesia.

Measurement items were adapted from established scales in prior studies and were contextually refined through expert review to ensure content validity, clarity, and suitability for the Indonesian higher education context (J. Hair et al., 2017). All constructs were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") (Hair Jr et al., 2017, 2021b; Sarstedt et al., 2014). Ethical considerations were carefully addressed: participation was voluntary, informed consent was obtained at the beginning of the questionnaire, respondents were assured of anonymity and confidentiality, and no personally identifiable information was collected. The study complied with general ethical standards for social science research.

Table 2. Research Variables and Indicators

No	Variable	Construct / Dimension	Indicator Code	Measurement Item
1	Intellectual Capital (IC)	Knowledge / Skill (Human Capital)	S/K1	I have sufficient knowledge for digital business activities.
			S/K2	I am able to apply my skills to start a digital business.
			S/K3	I utilize my academic experience to support digital business innovation.
		Networking (Relational / Social Capital)	N1	I have professional networks that support digital business activities.
			N2	I actively build relationships with mentors or entrepreneurial communities.
			N3	I leverage social relationships to access business-related resources.
		Ability to Recognize the Opportunity (ARO)	ARO1	I am able to recognize potential digital business opportunities.
			ARO2	I can identify unmet market needs in the digital environment.
			ARO3	I quickly adapt to changes in digital market trends to create business opportunities.
2	Digital Literacy	Digital Literacy (DL)	DL1	I am able to use digital devices for business-related activities.
			DL2	I can communicate and collaborate effectively in online environments.
			DL3	I am able to find, evaluate, and utilize digital information for business purposes.
			DL4	I understand how to maintain digital security and privacy.
			DL5	I am able to utilize digital platforms to identify and explore business opportunities.
3	Intention to Start Digital Innovation	Innovation to Start Digital Innovation (ISDI)	ISDI1	I intend to initiate a digital innovation within the next 1–3 years.
			ISDI2	I am committed to developing the digital innovation ideas that I have.
			ISDI3	I have a strong determination to start and successfully develop digital innovation.

Sources: Adapted and modified from H. Herlina (2025) for Intellectual Capital items, and Ng (2012)for Digital Literacy items, contextualized for digital innovation and entrepreneurship among university students. All items measured on a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable for predictive research models involving multiple latent constructs and mediation effects (J. F. Hair et al., 2019; Sarstedt et al., 2014). The sample size exceeded the minimum requirement for PLS-SEM analysis based on established methodological recommendations (Sarstedt et al., 2021). The analysis involved assessing both the measurement model and the structural model using PLS-SEM. The measurement model

was evaluated in terms of reliability and validity, whereas the structural model assessment included the examination of path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and model fit indices (SRMR). Hypothesis testing was performed using the bootstrapping procedure (Hair Jr et al., 2021b). To mitigate potential common method bias, procedural remedies were applied, including respondent anonymity, voluntary participation, and the absence of right or wrong answers in the questionnaire. In addition, common method bias was assessed using the full collinearity variance inflation factor (VIF) approach proposed by (Kock, 2015). All participants provided informed consent prior to participation, and the study adhered to ethical standards for social science research.

RESULTS AND DISCUSSION

Respondent Characteristics Based on Education and Gender

This study involved 334 respondents distributed across various regions of Indonesia. This study involved 334 respondents distributed across various regions of Indonesia, whose demographic characteristics are presented in the following table.

Table 3. Demographic Profile of Respondents

Category	Subcategory	Frequency (n)	Percentage (%)
Gender	Female	224	66.7
	Male	112	33.3
Education	Associate degree / 3-year Diploma)	26	7.7
	Bachelor Applied Degree / 4-year Diploma)	19	5.7
	Bachelor’s Degree	269	80.1
	Master’s Degree	17	5.1
	Doctoral Degree (PhD)	5	1.5
Region	Java	198	58.9
	Sumatera	47	14.0
	Sulawesi	71	21.1
	Kalimantan	12	3.6
	Bali/Nusa Tenggara	8	2.4
Age (years)	17–20	230	68.5
	20–22	92	27.4
	23–25	14	4.2
Entrepreneurial Knowledge	Moderate	26	7.74%
	High	40	11.90%
	Very high	270	80.36%

Source: Primary Data (2026)

Before testing the structural model, descriptive statistics were employed to describe the demographic characteristics and entrepreneurial knowledge levels of the respondents. The sample consisted predominantly of female students (67.1%), with males accounting for 32.9%. In terms of education, the majority held a Bachelor's degree (80.8%), followed by Diploma 3 (7.8%), Master's degree (5.4%), Diploma 4 (4.8%), and Doctoral degree (0.9%). Geographically, respondents were mainly from Java (58.7%), followed by Sulawesi (21.6%), Sumatra (14.1%), Kalimantan (2.4%), and Bali/Nusa Tenggara (2.1%), reflecting a diverse regional distribution across Indonesia, while the largest age group was 20–22 years (27.5%), followed by those under 20 years (21.0%) and 17–20 years (13.2%), indicating the dominance of early-stage university students in the sample. Regarding entrepreneurial knowledge, most respondents exhibited a very high level (80.36%), while 11.90% were categorized as having high knowledge and only 7.74% fell into the moderate category. This distribution suggests that the respondents generally possess strong entrepreneurial knowledge, providing a suitable basis for examining their digital literacy and intention to start digital innovation.

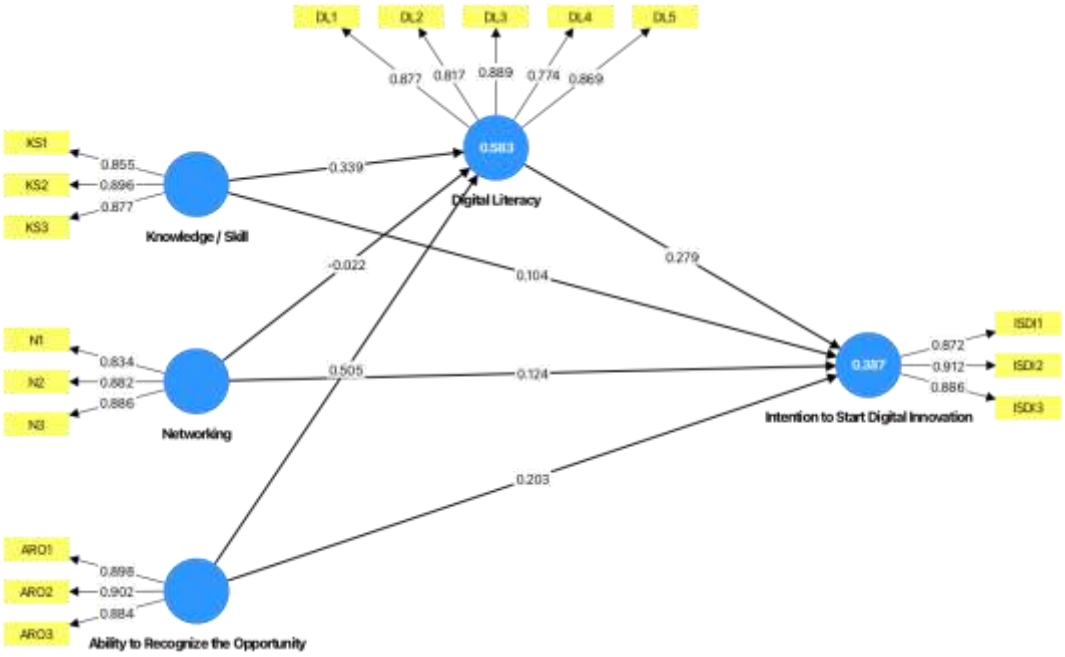

Figure 2. Outer Model from SmartPLS
Source: Processed Data (2026)

To assess the reliability of the measurement model, Cronbach's Alpha and Composite Reliability (ρc) values were examined for each construct. A construct is declared reliable if the Cronbach's Alpha and Composite Reliability values exceed 0.70, while factor loadings above 0.70 and Average Variance Extracted (AVE) above 0.50 indicate adequate convergent validity (J. F. Hair et al., 2019; Hair Jr et al., 2021b; Sarstedt et al., 2014). As presented in Table 4, all constructs meet these criteria, so it can be concluded that the measurement model has good internal consistency and reliability.

Table 4. Internal Consistency Reliability (Cronbach's Alpha & Composite Reliability)

Constructs	Indicators	Loading Factor	Cronbach's Alpha	Composite Reliability (ρc)	VE	Information
Ability to Recognize the Opportunity	ARO1	0.898	0.875	0.923	0.800	Valid & reliable
	ARO2	0.902				
	ARO3	0.884				
Digital Literacy	DL1	0.877	0.901	0.926	0.716	Valid & reliable
	DL2	0.817				
	DL3	0.889				
	DL4	0.774				
	DL5	0.869				
Intention to start digital innovation	ISDI1	0.872	0.869	0.919	0.792	Valid & reliable
	ISDI2	0.912				
	ISDI3	0.886				
Knowledge / Skill	KS1	0.855	0.848	0.908	0.768	Valid & reliable
	KS2	0.896				
	KS3	0.877				
Networking	N1	0.834	0.837	0.901	0.753	Valid & reliable
	N2	0.882				
	N3	0.886				

Source: Processed Data (2026)

Discriminant validity was assessed using the Heterotrait–Monotrait ratio (HTMT), as reported in Table 5. The HTMT values between constructs range from 0.567 to 0.814, which are below the conservative threshold of

0.85 (J. F. Hair et al., 2019; Sarstedt et al., 2014). This indicates that all constructs are empirically distinct from one another. Therefore, Ability to Recognize the Opportunity, Digital Literacy, Intention to Start Digital Innovation, Knowledge/Skill, and Networking measure different theoretical concepts, supporting adequate discriminant validity.

Table 5. Discriminant Validity (HTMT Criterion)

Constructs	Ability to Recognize the Opportunity	Digital Literacy	Intention to start digital innovation	Knowledge / Skill	Networking
Ability to Recognize the Opportunity	—	0.807	0.644	0.808	0.814
Digital Literacy	0.807	—	0.631	0.768	0.635
Intention to start digital innovation	0.644	0.631	—	0.597	0.567
Knowledge / Skill	0.808	0.768	0.597	—	0.809
Networking	0.814	0.635	0.567	0.809	—

Source: Processed Data (2026)

Table 6. representing the square root of the AVE for each construct, are higher than the correlations between constructs (J. F. Hair et al., 2019; Hair Jr et al., 2021b). This indicates that each construct demonstrates good discriminant validity, meaning it is distinct from the other constructs, and thus the discriminant validity of the measurement model has been satisfied.

Table 6. Discriminant Validity Based on the Fornell–Larcker Criterion

Construct	Ability to Recognize the Opportunity	Digital Literacy	Intention to start digital innovation	Knowledge / Skill	Networking
Ability to Recognize the Opportunity	0.895	—	—	—	—
Digital Literacy	0.726	0.846	—	—	—
Intention to start digital innovation	0.564	0.565	0.890	—	—
Knowledge / Skill	0.696	0.676	0.517	0.876	—
Networking	0.701	0.563	0.494	0.682	0.868

Source: Processed Data (2026)

Multicollinearity among the predictor constructs was assessed using the Variance Inflation Factor (VIF) prior to evaluating the structural model. Collinearity assessment is essential to ensure that predictor constructs do not exhibit excessive intercorrelations that could distort path coefficient estimates and compromise the interpretability of the structural relationships (J. F. Hair et al., 2022). Table 7 presents the inner VIF values for all predictor–endogenous construct relationships in the model.

Table 7. Multicollinearity Test Results for the Structural Model (Inner VIF Values)

Predictor Construct	Endogenous Construct	VIF
Ability to Recognize the Opportunity	Digital Literacy	2.382
Knowledge/Skill	Digital Literacy	2.268
Networking	Digital Literacy	2.296
Ability to Recognize the Opportunity	Intention to Start Digital Innovation	2.993
Knowledge/Skill	Intention to Start Digital Innovation	2.544
Networking	Intention to Start Digital Innovation	2.297
Digital Literacy	Intention to Start Digital Innovation	2.399

Source: Processed Data (2026)

VIF values ranged from 2.268 to 2.993, remaining below the conservative threshold of 3.3 and the commonly accepted threshold of 5.0 (J. F. Hair et al., 2022; Kock, 2015). These results indicate that

multicollinearity is not a concern in the structural model, suggesting that the predictor constructs provide sufficiently distinct information for estimating the path coefficients. Therefore, the structural relationships can be interpreted reliably.

Following the assessment of multicollinearity and common method bias, the structural model was evaluated to determine its explanatory power, effect size, predictive relevance, and overall model fit. In accordance with the recommendations of Hair Jr et al (2021a), the evaluation included the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2predict), and the standardized root mean square residual (SRMR). The results are presented in Table 8.

Table 8. Results of Structural Model Assessment (R^2, f^2, Q^2predict, and SRMR)

Criterion	Indicator	Value
R^2 Adjusted	Digital Literacy	0.579
	Intention to Start Digital Innovation	0.379
f^2	Ability to Recognize the Opportunity → Digital Literacy	0.257
	Ability to Recognize the Opportunity → Intention to Start Digital Innovation	0.022
	Digital Literacy → Intention to Start Digital Innovation	0.053
	Knowledge / Skill → Digital Literacy	0.122
	Knowledge / Skill → Intention to Start Digital Innovation	0.007
	Networking → Digital Literacy	0.001
	Networking → Intention to Start Digital Innovation	0.011
SRMR	Saturated Model	0.053
	Estimated Model	0.053
Q^2predict	Digital Literacy	0.570
	Intention to Start Digital Innovation	0.340

Source: Processed Data (2026)

As presented in Table 8, the model explains 58.3% of the variance in Digital Literacy and 38.7% of the variance in Intention to Start Digital Innovation. The effect size analysis indicates that Ability to Recognize Opportunity has the strongest effect on Digital Literacy ($f^2 = 0.257$), followed by Knowledge/Skill ($f^2 = 0.122$), while the remaining relationships exhibit relatively small effect sizes. Furthermore, the Q^2predict values of 0.570 for Digital Literacy and 0.340 for Intention to Start Digital Innovation indicate that the model possesses satisfactory predictive relevance. Finally, the SRMR value of 0.053 for both the saturated and estimated models is below the recommended threshold of 0.08, suggesting that the proposed model demonstrates a good overall fit.

Hypothesis Testing

Figure 3. presents the results of the structural model estimation using the Partial Least Squares – Structural Equation Modeling (PLS-SEM) approach. This model illustrates the relationship between exogenous constructs—Knowledge/Skill (KS), Networking (N), and Ability to Recognize the Opportunity (ARO) as dimensions of Intellectual Capital—with Digital Literacy and Intention to Start Digital Innovation (ISDI) as endogenous constructs. The values listed for each path represent path coefficients, while the R^2 values (0.583 for Digital Literacy and 0.387 for Intention to Start Digital Innovation) indicate the amount of variance explained by the predictor constructs in the model. All reflective indicators are displayed along with their respective loading factor values, all of which meet the minimum required threshold.

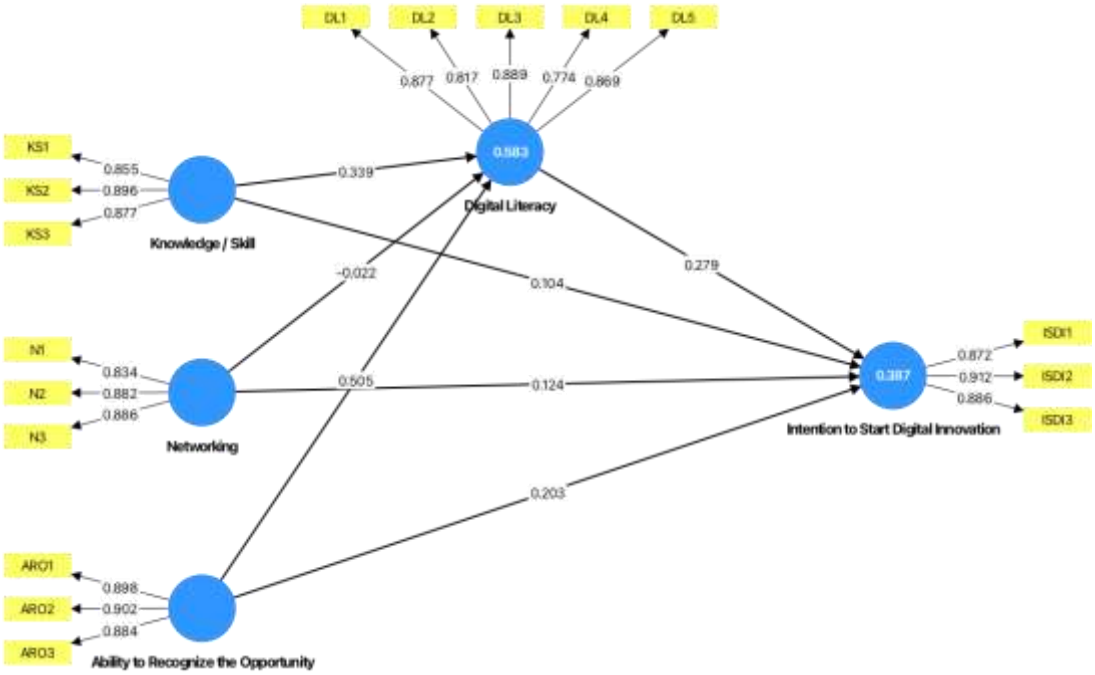

Figure 3. Direct and Indirect Effect from SmartPLS
Source: Processed Data (2026)

Following the satisfactory evaluation of the measurement model, the structural model was assessed to examine the hypothesized relationships among the study constructs. The significance of the path coefficients was evaluated using the bootstrapping procedure with 5,000 subsamples. Hypotheses were considered supported when the t-statistic exceeded 1.96 and the p-value was below 0.05. The results of the direct effects analysis are presented in Table 9.

Table 9. Results of Direct Effects Hypothesis Testing

Code	Hypothesis / Relationship Between Variables	Coefficient (β)	T-Statistic	P-Value	Decision
H1	Knowledge/Skill → Intention to Start Digital Innovation	0.104	1.148	0.251	Rejected
H2	Networking → Intention to Start Digital Innovation	0.124	1.773	0.076	Rejected
H3	Ability to Recognize Opportunities → Intention to Start Digital Innovation	0.203	2.244	0.025	Accepted
H4	Knowledge/Skill → Digital Literacy	0.339	4.937	0.000	Accepted
H5	Networking → Digital Literacy	−0.022	0.368	0.713	Rejected
H6	Ability to Recognize Opportunities → Digital Literacy	0.505	7.153	0.000	Accepted
H7	Digital Literacy → Intention to Start Digital Innovation	0.279	2.924	0.003	Accepted

Source: Processed Data (2026)

The results presented in Table 9. indicate that the ability to recognize opportunities significantly influenced the intention to start digital innovation (β = 0.203, p = 0.025), supporting H3. In contrast, knowledge/skill (β = 0.104, p = 0.251) and networking (β = 0.124, p = 0.076) did not exert significant direct effects on intention, leading to the rejection of H1 and H2. Regarding digital literacy, knowledge/skill (β = 0.339, p < 0.001) and the ability to recognize opportunities (β = 0.505, p < 0.001) showed significant positive effects, supporting H4 and H6, respectively, whereas networking did not significantly influence digital literacy (β = −0.022, p = 0.713), resulting in the rejection of H5. Furthermore, digital literacy significantly enhanced the intention to start digital innovation (β = 0.279, p = 0.003), supporting H7. Overall, the findings suggest that opportunity recognition is the strongest

intellectual capital dimension driving both digital literacy and innovation-starting intention.

To further investigate the mechanism through which intellectual capital dimensions influence the intention to start digital innovation, the mediating role of digital literacy was examined using the bootstrapping procedure with 5,000 resamples. The significance of indirect effects was assessed based on the estimated path coefficients, t-statistics, and p-values. The results of the mediation analysis are presented in Table 10.

Table 10. Results of Mediation Effects Analysis

Code	Hypothesis / Relationship Between Variables	Coefficient (β)	T-Statistic	P-Value	Decision
H8	Knowledge/Skill → Digital Literacy → Intention to Start Digital Innovation	0.095	2.459	0.014	Accepted (Full Mediation)
H9	Ability to Recognize Opportunities → Digital Literacy → Intention to Start Digital Innovation	0.141	2.517	0.012	Accepted (Partial Mediation)
H10	Networking → Digital Literacy → Intention to Start Digital Innovation	−0.006	0.334	0.738	Rejected (No Mediation)

Source: Processed Data (2026)

As shown in Table 10. digital literacy significantly mediated the relationship between knowledge/skill and intention to start digital innovation (β = 0.095, p = 0.014), supporting H8. Given that the corresponding direct effect was not significant, this result indicates a full mediation effect. Similarly, digital literacy significantly mediated the relationship between the ability to recognize opportunities and intention to start digital innovation (β = 0.141, p = 0.012), supporting H9. Since both the direct and indirect effects remained significant, the mediation can be classified as partial mediation. Conversely, the indirect effect of networking on intention through digital literacy was not significant (β = −0.006, p = 0.738), leading to the rejection of H10 and suggesting the absence of a mediating mechanism. These findings underscore the pivotal role of digital literacy in translating specific dimensions of intellectual capital into stronger intentions to initiate digital innovation.

DISCUSSION

This study investigated the relationships between intellectual capital dimensions, digital literacy, and intention to start digital innovation. The findings reveal that knowledge/skill and ability to recognize opportunities significantly influence digital innovation intention, whereas networking does not have a significant direct effect. Furthermore, digital literacy significantly mediates the relationships between all intellectual capital dimensions and digital innovation intention.

The significant positive effect of knowledge/skill on digital innovation intention is consistent with previous studies reporting that individuals possessing stronger competencies are more likely to engage in entrepreneurial and innovation-oriented activities (Duong et al., 2024; Duong & Vu, 2024; Pham et al., 2023; Rahman et al., 2023). This finding supports the central proposition of Intellectual Capital Theory that human capital constitutes a strategic resource capable of generating innovative outcomes (Bontis, 1998). However, the present study extends previous research by demonstrating that knowledge and skills remain critical even in digitally intensive environments, where innovation increasingly depends on the ability to understand and utilize emerging technologies. The findings suggest that knowledge and skills do not merely enhance individuals' competence but also strengthen their confidence in transforming digital opportunities into innovation initiatives.

Similarly, the positive effect of opportunity recognition on digital innovation intention corroborates prior findings that opportunity recognition is one of the strongest predictors of entrepreneurial behavior and innovation intention (Al-Ayed, 2024; Caniëls & Motylska-Kuźma, 2023; Elmassah et al., 2022; Otache et al., 2024). Consistent with these studies, individuals who can identify market gaps, technological trends, and unmet customer needs are more likely to perceive digital innovation as both feasible and desirable. Nevertheless, this study contributes additional evidence from the digital innovation context by highlighting that opportunity

recognition acts as a cognitive mechanism that transforms intellectual resources into entrepreneurial intentions. In rapidly changing digital environments, recognizing opportunities may become even more important because innovation often depends on the ability to identify emerging possibilities before competitors do.

A particularly interesting finding concerns the non-significant direct effect of networking on digital innovation intention. This result contrasts with previous studies that reported positive relationships between networking and entrepreneurial intentions (Chapman & Phillips, 2022; Manzoor et al., 2022; Rashid et al., 2024). One possible explanation is that digital environments have fundamentally changed how individuals access information and resources. Unlike traditional entrepreneurial settings, where networks often serve as the primary source of information and support, digital technologies now provide alternative channels through which individuals can obtain knowledge, identify opportunities, and learn entrepreneurial skills independently. Consequently, networking alone may no longer be sufficient to stimulate digital innovation intention. Instead, its influence appears to depend on whether individuals possess the capability to convert network-derived information into actionable knowledge. This finding refines existing literature by suggesting that relational capital may play a more indirect role in shaping digital innovation intentions than previously assumed

The findings further demonstrate that knowledge/skill, networking, and opportunity recognition significantly enhance digital literacy. These results are consistent with earlier studies showing that intellectual and relational resources facilitate the development of digital competencies (Jung et al., 2025; Liang et al., 2025; Vodă et al., 2022; Xu et al., 2023). Individuals with stronger knowledge bases, broader access to information through networks, and greater awareness of opportunities are more likely to engage with digital technologies and acquire digital capabilities. In turn, digital literacy significantly influences intention to start digital innovation, supporting previous studies that identified digital literacy as a critical antecedent of digital entrepreneurship and innovation behavior (Maudina et al., 2022; Mugiono et al., 2021; Suryani & Chaniago, 2023; Tristianto & Noviani, 2024).

More importantly, the mediation analysis reveals that digital literacy serves as the mechanism through which intellectual capital is translated into digital innovation intention. This finding is aligned with recent studies suggesting that digital literacy strengthens the impact of entrepreneurial competencies on innovation-related outcomes (Duong et al., 2024; Liang et al., 2025; Ta et al., 2025). However, the present study advances the literature by providing empirical evidence that digital literacy functions as a conversion mechanism linking all dimensions of intellectual capital to digital innovation intention simultaneously. While previous studies generally examined these relationships separately, the current findings demonstrate that intellectual capital resources alone are insufficient to foster digital innovation intention unless individuals possess the capability to effectively access, evaluate, and utilize digital information and technologies.

This study contributes to Intellectual Capital Theory in several important ways. First, it extends the theory by identifying digital literacy as the underlying mechanism through which human capital and relational capital influence digital innovation intention. Although Intellectual Capital Theory explains how knowledge resources create value, it provides limited insight into how these resources are transformed into innovation-oriented intentions in digital environments. The present findings address this gap by demonstrating that digital literacy acts as the capability that activates and mobilizes intellectual capital resources. Second, the study refines existing understanding of relational capital. Contrary to much of the prior literature, networking did not directly influence digital innovation intention. This finding suggests that the value of relational capital is contingent upon an individual's ability to process and utilize information acquired through networks. Therefore, networking should not be viewed as a universally effective predictor of innovation intention but rather as a resource whose effectiveness depends on complementary digital capabilities.

Third, the study contributes to the digital entrepreneurship literature by positioning digital literacy as a strategic capability rather than merely a technological skill. The findings indicate that digital literacy serves as the bridge connecting intellectual resources with innovation-oriented behavior, thereby offering a more

comprehensive explanation of how digital innovation intentions are formed in contemporary technology-driven contexts.

CONCLUSION

This study examined the roles of knowledge/skill, networking, and ability to recognize opportunities in shaping students' intention to start digital innovation through the mediating role of digital literacy. The findings reveal that digital literacy serves as a critical mechanism linking intellectual capital and digital innovation intention. While knowledge/skill influences innovation intention only indirectly through digital literacy, opportunity recognition exerts both direct and indirect effects. In contrast, networking demonstrates no significant direct or indirect influence on innovation intention. These findings extend Intellectual Capital Theory by demonstrating that intellectual resources do not automatically translate into innovation-oriented intentions; rather, their influence depends on individuals' ability to leverage digital competencies. The study further highlights opportunity recognition as the most influential dimension of intellectual capital and identifies digital literacy as a key enabling capability in fostering digital innovation intentions among university students. Several limitations should be acknowledged. First, the study relied exclusively on self-reported questionnaire data, which may be subject to common method bias, social desirability bias, and respondents' subjective perceptions. Consequently, the reported relationships may not fully reflect actual entrepreneurial capabilities and behaviors. Second, the sample was limited to Indonesian university students, which may restrict the generalizability of the findings to other educational, cultural, or industrial contexts. Third, the networking construct primarily captured general social and academic connections and may not adequately represent innovation-oriented or professional networks. Future studies are encouraged to examine this model across different countries and populations, incorporate additional contextual factors such as institutional support and entrepreneurial ecosystems, and employ longitudinal or experimental designs to better capture the dynamic development of digital innovation intentions.

AUTHOR CONTRIBUTION

Irfan Wahzudi: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Visualization, Writing – Original Draft Preparation. Kurjono: Methodology, Validation, Supervision, Project Administration, Writing – Review & Editing. All authors have read and agreed to the published version of the manuscript.

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DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request for academic and research purposes.

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COMPETING INTEREST

The authors declare that there are no financial, professional, or personal conflicts of interest that could have influenced the research, authorship, and/or publication of this article.

ETHICAL CLEREANCE

All participants were informed about the objectives and procedures of the study before their participation. Informed consent was obtained from all participants, and participation was voluntary. The anonymity and confidentiality of participants were maintained throughout the research process.

AI STATEMENT

The authors declare that Artificial Intelligence (AI)-assisted tools were used during the preparation of this manuscript to support language editing, grammar checking, and improve the clarity and readability of the text. All AI-generated suggestions were carefully reviewed, revised, and verified by the authors. AI tools were not used for data collection, data analysis, interpretation of the findings, or drawing scientific conclusions. The authors take full responsibility for the originality, accuracy, and integrity of the content of this manuscript.

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