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The Influence of Intellectual Capital on Innovation Performance: The Mediating Role of Knowledge Sharing and Innovation Culture (A Study on Startups Fostered by UNS)

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ABSTRACT: This study examines the effects of intellectual capital on innovation performance mediated by knowledge sharing and innovation culture, focusing on startups fostered by Sebelas Maret University (UNS). The study evaluates the impact of human capital, relational capital, and structural capital on innovation performance, as well as the mediating roles of knowledge sharing and innovation culture. The findings reveal that human capital has a positive but insignificant effect on innovation performance, while relational and structural capital show positive and significant effects. Human capital, relational capital, and structural capital have a positive and significant influence on knowledge sharing. In the context of innovation culture, human capital and structural capital have significant effects, while relational capital has no significant impact. Knowledge sharing serves as an important mediator in the relationship between human capital and innovation performance, although its role is weaker for relational capital and structural capital. Conversely, innovation culture shows limited mediating effects on innovation performance, with structural capital being the main contributor to fostering an ecosystem that supports an innovative culture. This study provides practical implications for startup managers, emphasizing the importance of strategically leveraging intellectual capital. Recommended strategies include developing human capital through training programs, enhancing relational capital through strategic partnerships, and strengthening structural capital by implementing flexible and collaborative systems.

KEYWORDS: intellectual capital, innovation performance, innovation culture, knowledge sharing, startup development

INTRODUCTION

Innovation is a crucial capacity for organizations to acquire and sustain competitive advantage (Castaneda & Cuellar, 2020), achieved by utilizing developed knowledge to create new products, services, or processes. The emergence of innovation stems from the continuous development of knowledge and skills aimed at enhancing organizational performance (Roxas et al., 2014). Knowledge sharing within organizations contributes significantly to the promotion of innovation, supported by the stock of knowledge and systematic processes that drive innovation performance (Yeşil et al., 2013).

Organizational competencies play a pivotal role in driving innovation by leveraging existing resources and exploring new opportunities through new knowledge and intellectual assets (Castaneda & Cuellar, 2020). Organizations lacking dynamic capabilities struggle to achieve favorable innovation outcomes, as they fail to adapt to environmental changes. Knowledge-based human resource management practices (Kianto et al., 2017), including knowledge sharing, contribute to the success of innovation by enhancing the exchange and combination of knowledge within the organization (Seidler-de Alwis & Hartmann, 2008).

Intellectual capital serves as a key determinant in innovation, acting as a source of knowledge creation essential for economic growth and organizational competitive advantage. As an intangible asset, intellectual capital enhances skills, knowledge, experience, technology, and relationships within the organization, enabling senior executives to make more strategic human resource management decisions. To optimize human resource effectiveness in a knowledge economy, organizations must incorporate intellectual capital as a core element in their strategies and human resource management practices (Allameh, 2018).

Intellectual capital is a critical resource that organizations utilize to achieve competitive advantage and sustainable profitability. This knowledge source allows organizations to develop more effective innovation strategies. Consequently, organizational performance is significantly influenced by the management of intellectual capital (Haldorai et al., 2022).

Intellectual capital is categorized into human, relational, and structural capital. Human capital encompasses the collective competencies of the workforce, while structural capital involves explicit knowledge related to the organization and its culture, alongside the capacity for knowledge creation that supports innovation. Relational capital focuses on social relationships that help organizations understand challenges and facilitate change (Ritala et al., 2021).

Sa'adah & Rijanti, (2022), define knowledge sharing as the process of exchanging information among employees to enhance individual and organizational knowledge. When organizations develop knowledge-sharing models, employees are empowered to inform one another and update their knowledge. This process contributes to innovation and the creation of new knowledge within the organization.

Innovation culture refers to the institutional culture that enables organizational members to generate and implement new ideas. A strong innovation culture can improve individual performance and encourage participation and collaboration within teams (Iranmanesh et al., 2021). Innovation is crucial for the sustainability of companies and can provide a competitive edge in the market. Organizations with a strong innovation culture can improve performance and competitiveness in the market. This culture positively influences the work infrastructure and encourages participation in the innovation process. Thus, an innovation culture is a significant factor in enhancing overall organizational performance (Fuad et al., 2022).

The Resource-Based View (RBV) theory highlights the importance of a firm's internal resources, including human and intangible assets, in achieving sustainable competitive advantage (Freeman et al., 2021). According to RBV, firms should identify and enhance their unique resources while understanding their gaps relative to high-performing competitors. This approach helps organizations create strategies that leverage strengths and address weaknesses, ultimately formulating effective long-term plans.

Research based on RBV typically examines three key concepts: firm resources, competitive advantage, and sustainable competitive advantage (Bhandari et al., 2022). Firm resources are divided into tangible and intangible assets, with competitive advantage referring to strategies and values that are difficult for competitors to imitate. Moreover, RBV emphasizes the importance of knowledge and intangible assets in human resource management, enabling organizations to improve their understanding and predictive abilities. This perspective encourages firms to differentiate themselves using intangible resources and reconfigure these resources to maintain a competitive advantage in a dynamic business environment (Rehman et al., 2022).

RBV also focuses on understanding firm growth and diversification by stressing resource heterogeneity. By applying this theory, organizations can identify risks and develop resources and capabilities to achieve sustained competitive advantage. In the RBV framework, employees are seen as human capital, whose unique skills and experiences provide a competitive edge when they are valuable, rare, and difficult to imitate. By optimizing these resources, firms can enhance their performance and efficiency, maximizing the value of employees as key organizational assets.

Intellectual capital is a critical driver of organizational performance and a source of sustainable competitive advantage in the information-based economy, given its inimitable nature. It comprises human, structural, and relational capital, reflecting the efforts of employees and managers in developing knowledge, skills, and infrastructures that support innovation. These three elements interact to create "intelligent organizations" capable of maintaining long-term growth and competitive advantage. The development of intellectual capital through human resources cultivates skilled, knowledgeable, and creative individuals essential for high productivity with minimal resources. Organizations must invest in human capabilities to improve communication, reduce errors, create flexibility in meeting customer demands, and enhance operational efficiency. With strong human capital, organizations can acquire new knowledge, improve individual skills, and adapt effectively to environmental changes.

Relational capital, as defined by Bontis, refers to the knowledge embedded in networks and relationships with suppliers, customers, and other stakeholders. Initially focused on customer relationships, it now extends beyond. This form of capital serves as a competitive advantage by enhancing efficiency through networks and cooperative behavior, helping organizations adapt to environmental shifts. Furthermore, relationships with external stakeholders allow firms to discover new ways to improve their operational processes. Structural capital, on the other hand, includes non-human assets such as databases, organizational charts, and process manuals, which provide value beyond their material worth. Structural capital aims to organize factors within the organization to improve performance, enabling firms to leverage market opportunities and develop new products or processes. It is categorized into explicit forms encoded in systems and processes, and implicit forms that depend on individual experience and perspective.

Innovation performance is central to an organization's ability to compete in the market, and innovation is generally classified into exploration and exploitation. Exploration focuses on experimentation and the discovery of new knowledge, while exploitation refines and reuses existing routines. Research indicates that organizations need to balance these two forms of innovation to achieve sustainable performance, with the development of internal capabilities and the ability to quickly respond to external changes being essential factors.

Knowledge sharing plays a crucial role in enhancing organizational learning by facilitating the exchange of information and experiences among members, customers, and partners. Organizational support, as well as communication structures that encourage both formal and informal knowledge sharing, enhances collaboration among employees and contributes to innovation and success. Knowledge-sharing practices, whether within or between organizations, are fundamental to generating value and fostering innovation, both of which are critical to an organization's survival and success. Finally, an innovation culture encompasses the values, beliefs, and symbols that support the development of new products and services, motivating employees to contribute to organizational success in complex environments. A culture of innovation, with components such as planning, participation, and openness, stimulates creativity and employee motivation, which are crucial for improving performance and responding to customer needs. Organizations with a strong innovation culture are better equipped to create new products and services, thereby achieving competitive advantage through the use of technology and fresh ideas.

Previous research has examined the impact of intellectual capital on innovation performance in the context of big data analytics (AL-Khatib, 2022). This study extends this line of inquiry by investigating the effect of intellectual capital on innovation performance, with the mediating roles of knowledge sharing and innovation culture. Whereas prior studies have focused on intellectual capital and innovation performance in the context of Jordanian commercial banks, this research explores intellectual capital and innovation performance in startup companies.

Startups are considered effective tools for economic recovery, as they contribute to innovation and job creation. Intellectual capital is particularly vital for startups, as it enables them to address growth challenges and enhance competitiveness. Innovation in startups not only improves productivity but also adds greater value to customers and overall business performance.

Startups offer opportunities for the public, especially younger generations, to learn innovation and creativity. The growth of startups in Indonesia contributes to job creation and increases per capita income. However, startup entrepreneurs must pay attention to long-term planning to avoid failure due to a lack of maturity in business plans.

Universitas Sebelas Maret (UNS) plays an active role in supporting students and alumni in entrepreneurship through various programs, including the Teaching Factory and Startup Entrepreneurship Training. UNS also organizes an annual Innovation Festival and participates in the Merdeka Campus program to help students become future entrepreneurs. Additionally, the Faculty of Economics and Business at UNS collaborates with various stakeholders to host international seminars on innovation-based startups and entrepreneurship.

METHODOLOGY

The research design employed in this study is a census approach. A census entails the examination or enumeration of all elements within a population (Sekaran & Bougie, 2016). According to Cooper and Schindler (2014), a census approach is particularly appropriate when the target population is small or when the elements within the population exhibit substantial heterogeneity. This strategy is considered suitable for this study as it facilitates the collection of comprehensive quantitative data.

The primary data for this research were directly obtained from respondents determined by the researcher (Sekaran & Bougie, 2016). Specifically, primary data were collected through the distribution of electronic questionnaires to owners and managers of startups fostered by Universitas Sebelas Maret (UNS). Secondary data were also utilized in this study and were sourced from internal management reports of UNS-affiliated startups, including data on the number of employees. Additionally, secondary data were gathered from published and unpublished materials such as statistical bulletins, organizational reports, internet sources, and

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corporate websites (Sekaran & Bougie, 2016). Relevant literature and books on organizational behavior also served as secondary data sources, providing insights related to the research problem.

The data analysis employed in this study was conducted using the Structural Equation Model (SEM) technique, specifically the Partial Least Squares (PLS) approach developed by Herman Wold in 1966. SEM-PLS is a robust analytical method that does not rely on stringent assumptions (Ghozali, 2014). PLS is advantageous for analyzing small sample sizes and accommodates latent variables measured by multiple indicators. The primary objective of employing PLS is to estimate latent variable values and provide predictions to address the research questions (Ghozali, 2014). As a flexible and powerful tool, PLS supports path modeling and offers an intermediary factor analysis framework for studies with minimal assumptions and limited sample constraints.

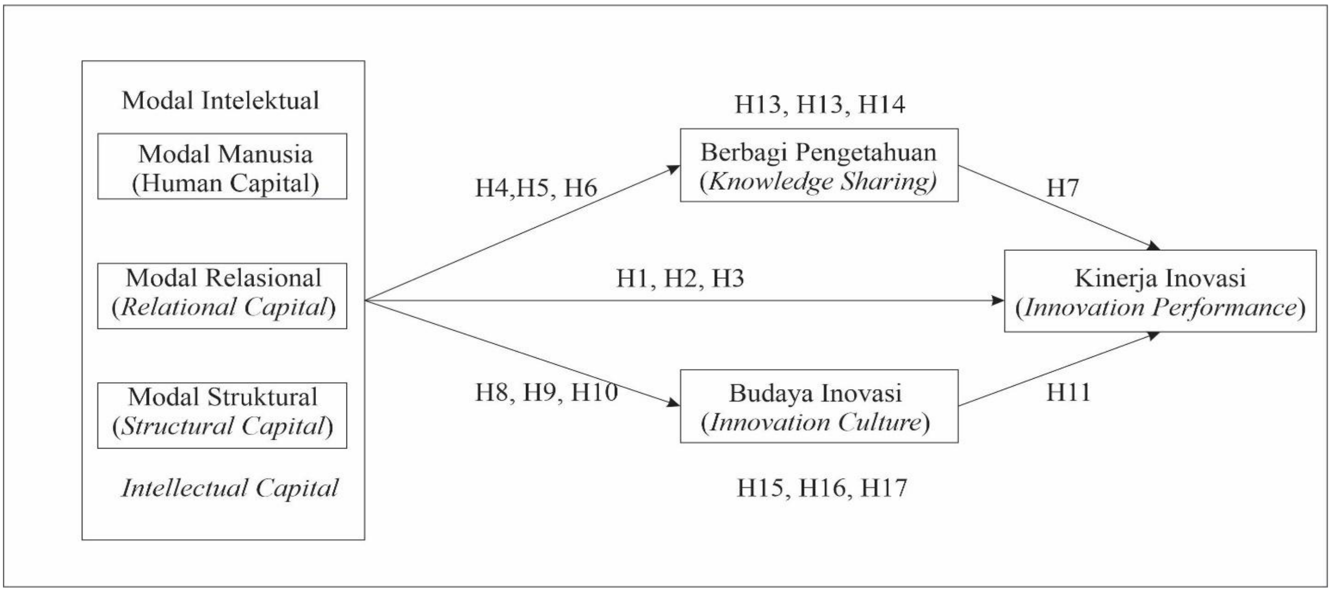

Figure 1. Research Framework

RESULT AND ANALYSIS

The descriptive analysis was employed to obtain a comprehensive understanding of respondent characteristics and their perceptions of the variables under study. Respondents completed the questionnaire based on their perceptions of intellectual capital within their respective companies. The study adopted a census design, with the sample equating to the total population, consisting of 75 startup companies fostered by Universitas Sebelas Maret. Data collection was conducted via an electronic questionnaire comprising 29 items across six variables.

The outer model (measurement model) analysis was used to evaluate the relationships between latent variables and their indicators. This analysis ensures that the measurement tools are valid and reliable. Measurement model evaluation was conducted through confirmatory factor analysis (CFA) using the Multi-Trait Multi-Method (MTMM) approach, assessing both convergent validity and discriminant validity. Reliability testing was performed using Cronbach's Alpha and Composite Reliability (Ghozali & Latan, 2015).

Table 1. Convergent Validity Test Results

Variable	Item	Loading	Description
Human Capital	HC1	0.820	Valid
	HC2	0.816	Valid
	HC3	0.794	Valid
	HC4	0.846	Valid

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Relational Capital	RC1	0.777	Valid
	RC2	0.745	Valid
	RC3	0.843	Valid
	RC4	0.877	Valid
Structural Capital	SC1	0.818	Valid
	SC2	0.819	Valid
	SC3	0.758	Valid
	SC4	0.747	Valid
Innovation Performance	IP1	0.772	Valid
	IP2	0.864	Valid
	IP3	0.835	Valid
	IP4	0.845	Valid
	IP5	0.866	Valid
Sharing Knowledge	KS1	0.763	Valid
	KS2	0.823	Valid
	KS3	0.809	Valid
	KS4	0.738	Valid
Innovation Culture	IC1	0.791	Valid
	IC2	0.779	Valid
	IC3	0.801	Valid
	IC4	0.761	Valid
	IC5	0.780	Valid
	IC6	0.762	Valid
	IC7	0.785	Valid
	IC8	0.737	Valid

Source: Output SMART PLS

Convergent validity assesses the correlation between item scores/component scores and construct scores, measured by standardized loading factors, which reflect the strength of the correlation between individual measurement items (indicators) and their constructs. Indicators are considered reflective and valid if their correlation exceeds 0.70. However, outer loading values between 0.50 and 0.60 are still deemed acceptable (Ghozali & Latan, 2015).

Based on Table 1, the results of the convergent validity test indicate that all questionnaire items were successfully extracted and achieved outer loading values greater than 0.70. This confirms that each item validly reflects its respective latent variable, demonstrating good convergent validity in the measurement model.

This testing stage is conducted to explain the extent to which an indicator (manifest) differs from one construct to another. Discriminant validity testing can be performed in two ways: by examining the cross-loading values or by comparing the square root of the average variance extracted (AVE) for each construct with the correlation values between constructs within the model. This study employs cross-loading values and AVE to assess the discriminant validity of an indicator. Cross-loading is considered better when the value of an indicator within a construct is higher than its value in other constructs. A good value is achieved when AVE > 0.50 for each construct.

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Based on Table 2, it is evident that each indicator has a higher loading value on its latent variable than on other latent variables. This indicates that each construct better explains the variance of its own indicators compared to the variance of indicators on other constructs. This satisfies one of the criteria for discriminant validity. Furthermore, when examined as a whole, the difference between the loading value of an indicator on its latent variable and its loading value on other latent variables is quite significant. This means that each indicator clearly distinguishes one construct from another. These findings further strengthen the discriminant validity of the measurement model in this study.

Table 2. *Cross Loading*

Variable	Human Capital	Relational Capital	Structural Capital	Innovation Performance	Sharing Knowledge	Innovation Culture
HC1	0,820	0,650	0,609	0,643	0,711	0,716
HC2	0,816	0,566	0,665	0,697	0,662	0,698
HC3	0,794	0,570	0,701	0,537	0,642	0,639
HC4	0,846	0,706	0,629	0,695	0,769	0,678
RC1	0,608	0,777	0,581	0,651	0,719	0,693
RC2	0,621	0,745	0,608	0,510	0,575	0,493
RC3	0,596	0,843	0,615	0,549	0,615	0,592
RC4	0,654	0,877	0,704	0,673	0,758	0,701
SC1	0,681	0,633	0,818	0,697	0,680	0,745
SC2	0,641	0,651	0,819	0,607	0,684	0,754
SC3	0,604	0,540	0,758	0,593	0,624	0,611
SC4	0,558	0,605	0,747	0,568	0,590	0,596
IP1	0,608	0,572	0,614	0,772	0,644	0,622
IP2	0,685	0,597	0,656	0,864	0,741	0,719
IP3	0,644	0,623	0,662	0,835	0,668	0,641
IP4	0,643	0,600	0,666	0,845	0,711	0,676
IP5	0,718	0,709	0,691	0,866	0,760	0,748
KS1	0,621	0,647	0,647	0,670	0,763	0,662
KS2	0,633	0,693	0,674	0,669	0,823	0,768
KS3	0,765	0,714	0,697	0,673	0,809	0,731
KS4	0,648	0,540	0,550	0,634	0,738	0,624
IC1	0,665	0,667	0,710	0,598	0,695	0,791
IC2	0,571	0,631	0,666	0,607	0,668	0,779
IC3	0,651	0,593	0,665	0,680	0,725	0,801
IC4	0,663	0,503	0,701	0,588	0,644	0,761
IC5	0,629	0,533	0,638	0,662	0,668	0,780
IC6	0,735	0,632	0,670	0,598	0,689	0,762
IC7	0,561	0,611	0,658	0,646	0,719	0,785
IC8	0,685	0,623	0,655	0,671	0,703	0,737

Source: Output SMART PLS

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Table 3. Average Variance Extracted, Cronbach's Alpha and Composite Reliability

Variable	AVE	Cronbach's Alpha	Composite Reliability
Human Capital	0,67	0,837	0,891
Relational Capital	0,66	0,827	0,885
Structural Capital	0,62	0,794	0,866
Innovation Performance	0,70	0,893	0,921
Sharing Knowledge	0,62	0,791	0,864
Innovation Culture	0,60	0,905	0,923

Source: Output SMART PLS

In addition to evaluating convergent validity through outer loadings or loading factors, it can also be assessed by examining the outer indicator loadings and the Average Variance Extracted (AVE). A model is considered to exhibit good convergent validity when the AVE exceeds 0.50, indicating that the construct explains more than half of the variance in its indicators. According to Table 3, all latent variables in this study have AVE values greater than 0.5, confirming that each latent variable explains over 50% of the variance in its respective indicators. These results suggest strong convergence between the indicators and their corresponding constructs. Specifically, the "Human Capital" variable has the highest AVE of 0.671, while the "Innovation Culture" variable has the lowest at 0.600, still above the 0.5 threshold. Overall, the findings support strong convergent validity for all constructs in the research model.

Regarding the reliability of the research instrument, it is essential to assess internal consistency. One commonly used metric is Cronbach's Alpha, which indicates how strongly the items within an instrument are positively correlated. As shown in Table 3, all latent variables have Cronbach's Alpha values exceeding 0.7, suggesting high reliability. The "Innovation Culture" variable has the highest Alpha at 0.905, reflecting robust internal consistency, while the "Structural Capital" variable has the lowest Alpha at 0.794, but still within the acceptable reliability range.

Since all constructs have Cronbach's Alpha values above the 0.7 threshold, the research instrument demonstrates excellent reliability. The latent variables are consistently and stably measured, enhancing confidence in the data's reliability for further analysis. Therefore, the evaluation of Cronbach's Alpha affirms the strong internal consistency of the research instrument, providing empirical support for the quality of the measurements in the research model.

In addition to Cronbach's Alpha, Composite Reliability (CR) is another widely used statistic to assess the reliability or internal consistency of a measurement tool. CR measures the extent to which the indicators adequately explain a construct. As observed, all latent variables have CR values above 0.7, indicating good reliability. The "Innovation Culture" variable has the highest CR of 0.923, demonstrating strong internal consistency for this construct. The "Structural Capital" variable has the lowest CR value, but it remains within the acceptable reliability range at 0.866. The CR values above the 0.7 threshold across all constructs suggest that the research instrument is highly reliable. The indicators for each latent variable consistently and accurately reflect the construct. These results further confirm that the data obtained through this instrument can be trusted for further analysis.

The reliability assessment using Composite Reliability indicates that the research instrument in this thesis has good internal consistency. Each latent construct is measured reliably by its respective indicators. These findings provide empirical support for the quality of the measurements within the research model and affirm the validity of the instrument used.

Multicollinearity testing in PLS-SEM (Partial Least Squares Structural Equation Modeling) aims to ensure that there is no excessively high correlation between predictor (independent) variables used in the model. High multicollinearity can result in biased and unstable outcomes, making it difficult to separate the influence of each predictor variable. In PLS-SEM, multicollinearity is tested by examining the Variance Inflation Factor (VIF) of the predictor variables.

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Table 4. Inner VIF Values

	Human Capital	Relational Capital	Structural Capital	Innovation Performance	Sharing Knowledge	Innovation Culture
Human Capital				4,243	3,157	3,157
Relational Capital				3,558	2,928	2,928
Structural Capital				4,582	3,286	3,286
Innovation Performance						
Sharing Knowledge				7,107		
Innovation Culture				6,835		

Source: Output SMART PLS

Based on the multicollinearity analysis results presented in Table 4, it can be observed that the Variance Inflation Factor (VIF) values for all variables are below the critical value of 10. The highest VIF value is shown by the Knowledge Sharing variable at 7.107, followed by the "Innovation Culture" variable at 6.835. Meanwhile, other variables such as Human Capital, Relational Capital, and Structural Capital have lower VIF values, ranging from 2.928 to 4.582.
According to general statistical guidelines, a VIF value greater than 10 indicates a significant multicollinearity problem. The results of this analysis suggest that there are no significant multicollinearity issues among the independent variables in this research model. This indicates that each independent variable has an acceptable level of correlation with others, and thus, will not interfere with the regression analysis results or the interpretation of each variable's effect on the dependent variable.

Table 5. R^2 Test

Variable	R-Square
Innovation Performance	0,749
Knowledge Sharing	0,821
Innovation Culture	0,814

Source: Output SMART PLS

Based on Table 5, the Innovation Performance variable has an R-Square value of 0.749, meaning that 74.9% of the variation in the dependent variable can be explained by the variation in the Innovation Performance variable. The remaining 25.1% is explained by factors outside the model. Next, the Knowledge Sharing variable has an R-Square value of 0.821, indicating that 82.1% of the variation in the dependent variable can be explained by the variation in the Knowledge Sharing variable, while only 17.9% is explained by other factors. Finally, the Innovation Culture variable has an R-Square value of 0.814, meaning that 81.4% of the variation in the dependent variable can be explained by the variation in the Innovation Culture variable. The remaining 18.6% is explained by other variables outside the model. Overall, the relatively high R-Square values (above 0.7) indicate that the regression model used has a good capacity to explain the variation in the dependent variable. However, there is still variation from other factors outside the model that also influence the dependent variable.

Table 6. F^2 Test

	Human Capital	Relational Capital	Structural Capital	Innovation Performance	Sharing Knowledge	Innovation Culture
Human Capital				0,021	0,292	0,204
Relational Capital				0,002	0,213	0,032
Structural Capital				0,027	0,100	0,394
Innovation Performance						
Sharing Knowledge				0,097		
Innovation Culture				0,011		

Source: Output SMART PLS

Table 6 reveals that Structural Capital exerts the most significant influence on Innovation Culture, with an f-square value of 0.394, indicating a strong effect. In contrast, other variables show relatively smaller effects, with f-square values ranging between 0.002 and 0.292. Human Capital has a small impact on Innovation Performance (0.021) but demonstrates a moderate influence on Knowledge Sharing (0.292). Similarly, Relational Capital has a negligible effect on Innovation Performance (0.002) and small effects on other variables. Knowledge Sharing exhibits a small influence on Innovation Performance, reflected by an f-square value of 0.097, while Innovation Culture has a very small effect on Innovation Performance, with an f-square value of 0.011. These findings suggest that although relationships exist among the variables, the strength of their effects ranges from negligible to strong.

Table 7 highlights several key indicators for evaluating the model fit. The Standardized Root Mean Square Residual (SRMR) for the estimated model is 0.073, indicating good fit as values below 0.08 generally signify an adequate model. Additionally, the d_ULS (Unweighted Least Squares Distance) for the estimated model is 2.291, suggesting better model fit. The d_G (Geodesic Distance) for the estimated model is 1.938, which is slightly lower than the saturated model's value of 1.897, further indicating a good fit. Meanwhile, the Chi-Square for the estimated model is 618.748. Although this value is higher than that of the saturated model, the difference is not statistically significant, which can be interpreted as evidence of sufficient model fit. Overall, based on the presented goodness-of-fit indicators, the estimated model demonstrates an acceptable level of fit with the data. However, further evaluation, including checks on classical assumptions, is recommended to ensure the validity and reliability of the analytical results.

Tabel 7. Goodness of Fit

	Saturated Model	Estimated Model
SRMR	0,071	0,073
d_ULS	2,199	2,291
d_G	1,897	1,938
Chi-Square	610,829	618,748
NFI	0,666	0,661

Source: Output SMART PLS

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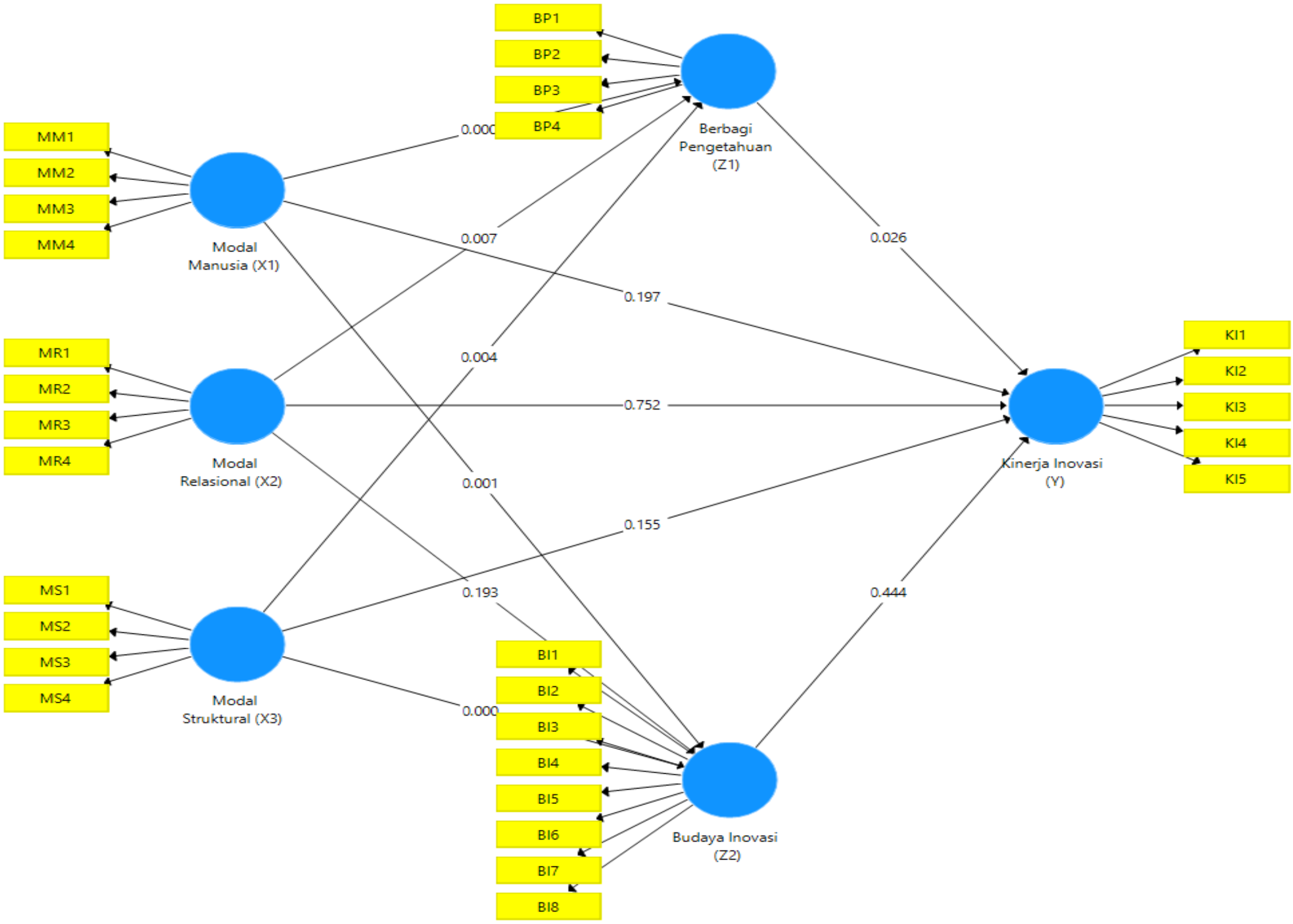

Figure 2. Research Model
Source: Output SMART PLS

Hypothesis testing aims to determine whether there is a significant influence of independent variables on the dependent variable, in line with the theory and conceptual framework used in the study. By employing path analysis or Structural Equation Modeling (SEM), the significance of path coefficients for each hypothesis can be tested. This approach allows us to assess whether the hypothesized relationships in the model are supported by the empirical data collected.

Tabel 8. Direct Effect Hypothesis Test

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statitics (|O/STDEV|)	P Values
Human Capital → Innovation Performance	0,151	0,15	0,117	1,291	0,197
Human Capital → Knowledge Sharing	0,406	0,415	0,099	4,087	0,000
Human Capital → Innovation Culture	0,346	0,35	0,108	3,205	0,001
Relational Capital → Innovation Performance	0,04	0,034	0,125	0,316	0,752
Relational Capital → Knowledge Sharing	0,334	0,323	0,123	2,723	0,007

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Relational Capital → Innovation Culture	0,131	0,134	0,101	1,304	0,193
Structural Capital → Innovation Performance	0,176	0,17	0,123	1,424	0,155
Structural Capital → Knowledge Sharing	0,242	0,246	0,084	2,894	0,004
Structural Capital → Innovation Culture	0,49	0,485	0,114	4,313	0,000
Knowledge Sharing → Innovation Performance	0,416	0,388	0,186	2,239	0,026
Innovation Culture → Innovation Performance	0,137	0,175	0,179	0,766	0,444

Source: Output SMART PLS

By thoroughly examining the results of hypothesis testing on indirect effects, researchers can identify strategic points for intervention and development to holistically strengthen an organization's innovative capabilities. This information is highly valuable for decision-makers in formulating policies and strategies related to innovation that align with specific contexts.

Tabel 9. Indirect Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statitics (|O/STDEV|)	P Values
Human Capital → Knowledge Sharing → Innovation Performance	0,169	0,156	0,082	2,047	0,041
Relational Capital → Knowledge Sharing → Innovation Performance	0,139	0,135	0,090	1,546	0,123
Structural Capital → Knowledge Sharing → Innovation Performance	0,101	0,091	0,049	2,044	0,042
Human Capital → Innovation Culture → Innovation Performance	0,047	0,063	0,070	0,679	0,498
Relational Capital → Innovation Culture → Innovation Performance	0,018	0,026	0,040	0,451	0,652
Structural Capital → Innovation Culture → Innovation Performance	0,067	0,080	0,086	0,775	0,438

Source: Output SMART PLS

The test results show that human capital positively influences innovation performance in startups fostered by UNS, although the significance value of 0.197 indicates that the relationship has not yet reached the expected level. This insignificant effect may be due to excessive experience that makes entrepreneurs more cautious, inconsistent work experience, and the complexity of innovation involving other factors such as financial resources and organizational support. Nevertheless, human capital can play a role as a moderating or mediating variable, as seen in research indicating that human capital can enhance the effectiveness of financial support and facilitate the relationship between digital infrastructure and innovation. Several studies also found that human capital serves as a mediator in the relationship between strategic innovation and SME performance, contributing to the efficiency of innovation through digital transformation and risk-taking levels.

The test results show that the effect of relational capital on innovation performance in UNS-fostered startups is low, with an average value of 0.034, indicating that despite potential, its influence is not significant in this context. This reflects the characteristics of startups still in the development stage, where internal focus is more critical than the development of external networks. Although there is a positive influence, too close relationships can hinder creativity and innovation due to a lack of diverse thinking or groupthink phenomena. Additionally, too many external relationships can increase coordination costs and the risk of knowledge leakage, which also hinders innovation. There is a possibility that the relationship between relational capital and innovation performance can be mediated by other variables such as technological orientation, boundary-crossing knowledge search, and absorptive capacity, which can all facilitate innovation in different ways.

Data analysis shows that the effect of structural capital on innovation performance in UNS fostered startups has an average of 0.170, higher than relational capital, but the P-value of 0.155 indicates that the relationship is not statistically significant. Although structural capital has the potential to enhance innovation, its impact is not strong enough to be considered a reliable predictor, possibly due to other influencing factors. Rigid structural capital may create structural inertia, hindering creativity and innovation. Therefore, startups need to find a balance in the application of structural capital, ensuring that systems and procedures are not too bureaucratic. Additionally, other variables such as the external environment, boundary-crossing knowledge search, and absorptive capacity can moderate or mediate this relationship, thus enhancing the positive effects of structural capital on innovation performance.

The significant positive influence of human capital development on knowledge sharing processes within the organization, with an original sample value of 0.406 and a sample mean of 0.415 confirming the consistency of this influence. The t-statistic value of 4.087 exceeds the significance threshold, while the standard deviation of 0.099 indicates low data variability. This finding emphasizes the importance of human capital not only for individuals but also in building a dynamic and innovative knowledge-based organization, especially in UNS-fostered startups populated by highly educated individuals. Strong human capital boosts individual confidence in knowledge sharing and strengthens knowledge sharing behaviors and knowledge creation. Research shows that human capital development contributes positively to the use of knowledge management systems and reduces knowledge hiding behaviors, which are essential for creating intellectual capital within organizations.

Hypothesis 5 analysis shows a significant positive influence between relational capital and knowledge sharing in the context of UNS-fostered startups, with an original sample of 0.334 and a sample mean of 0.323 confirming the consistency of this influence. The high t-statistic value indicates the statistical significance of this relationship, emphasizing that relational capital is a strategic component in facilitating effective knowledge sharing. Relational capital, which includes trust and shared norms, creates conditions that support the exchange of valuable information and tacit knowledge. Trust among startups in the UNS ecosystem becomes an essential foundation that encourages founders and teams to share strategic information. Research supports this finding, showing that strong, trusting relationships can improve the effectiveness of knowledge sharing and contribute to the overall performance of the organization. Relational capital functions as a strategic resource enabling employees to share knowledge more effectively.

Analysis of structural capital on knowledge sharing shows that structural capital has a significant positive influence in driving knowledge sharing activities, with an original sample value of 0.242 and a sample mean of 0.246 confirming the consistency of this influence, as well as a standard deviation of 0.084 showing low variability. This finding emphasizes that structural capital is an important foundation in facilitating knowledge sharing processes in organizations, particularly in UNS-fostered startups, which require infrastructure and systems that support collaboration. A more flexible and less hierarchical organizational structure promotes more intensive knowledge exchange, allowing employees to easily access and share information. By aligning flexible structural capital with a knowledge-sharing culture, startups can create an environment that supports innovation and maximizes the potential of knowledge resources, which is key to achieving a competitive advantage in a dynamic market. Research also shows that strong structural capital enhances collaboration and efficient information flow, supporting overall knowledge-sharing processes.

Other analysis results show that knowledge sharing has a significant positive impact on innovation performance within the organization, with an original sample value of 0.416 indicating a strong effect. The sample mean of 0.388 and a standard deviation of 0.186 show stability in estimates, while the t-statistics value of 2.239 and P-Value of 0.026 confirm the statistical significance of this relationship. This finding is highly relevant for UNS-fostered startups, as knowledge sharing is a strategic component that can enhance competitive advantage. When individuals with diverse backgrounds share information, they can create innovative ideas and enhance creativity. This process also strengthens the company's ability to integrate new knowledge with existing knowledge, thus increasing the chances of innovation success. Research supports this positive relationship, showing that both tacit and explicit knowledge sharing is crucial to driving innovation in various contexts.

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Hypothesis 8 analysis shows that human capital has a significant positive influence on innovation culture, with an original sample value of 0.346 and a sample mean of 0.350 showing consistency in the influence. The t-statistic value of 3.205 confirms the statistical significance of this relationship, indicating that human capital is a key driver in shaping the innovation culture within the organization. Employees with high skills can generate new ideas and create a work environment that supports collaboration, which in turn drives innovation. Organizations with strong human capital tend to have a continuous learning culture, improving their ability to innovate through experimentation and risk-taking. This finding provides a strong foundation for UNS-fostered startups to allocate resources to human resource development, which is essential for creating sustainable innovation and achieving long-term success. Previous research also supports this relationship, showing that investment in human capital enhances team cohesion and creates an environment conducive to innovation.

Hypothesis 9 analysis shows that the influence of relational capital on innovation culture is 0.134, slightly higher than the original sample of 0.131, but the P-value of 0.193 indicates that this relationship is not statistically significant. Although there is an indication of a positive influence, its effect is not strong enough to be relied upon, and relational capital may function more as a mediator between innovation culture and other influencing variables. UNS startup teams need to consider broader organizational factors to foster an innovative culture, as diversity of thought and perspectives is crucial for creativity. Research supports that a strong innovation culture can strengthen relational capital and enhance collaboration, while too close relationships can lead to homogeneous thinking that hampers innovation. Therefore, it is important for startups to encourage diverse interactions so that every team member can contribute fresh ideas.

Structural capital has a positive influence on innovation culture, with an original sample value of 0.490 and a sample mean of 0.485 confirming the consistency of this influence. The t-statistic value of 4.313 confirms the high statistical significance, making structural capital a key factor in forming an innovation culture within the organization. This finding provides strong evidence that the development of structural capital not only enhances operational efficiency but also creates a sustainable innovation ecosystem. Flexible systems and procedures allow employees to experiment with new ideas, while a flatter organizational structure facilitates effective communication and collaboration. Research supports that structural capital helps organizations absorb new knowledge and strengthen the innovation culture through idea-sharing platforms. By creating an environment that supports creativity, UNS startups can accelerate the innovation process and enhance each team member's contribution.

Innovation culture has a small positive influence on innovation performance, with an original sample value of 0.137 and a sample mean of 0.175, but high variability (standard deviation of 0.179) indicates instability in this relationship. The t-statistics value of 0.766 and P-Value of 0.444 show that this influence is not statistically significant, emphasizing that building an innovation culture alone is not sufficient to drive optimal innovation performance in the UNS startup ecosystem. This finding underscores the need for a comprehensive and integrated approach to innovation success, where UNS can play a strategic role in providing holistic support. Although an innovation culture encourages creativity, challenges in managing conflicting values and limited resources can hinder its effectiveness. Previous research also shows that the relationship between innovation culture and innovation performance is not always significant, particularly in SMEs with limitations, where other factors like organizational capabilities and market orientation play a greater role in determining innovation success.

The significant mediation effect of knowledge sharing in the relationship between human capital and innovation performance, with an original sample of 0.169 showing a substantial positive effect. The sample mean of 0.156 supports the consistency of this finding, emphasizing that investment in human capital not only has a direct impact on innovation performance but also strengthens knowledge sharing activities, creating a multiplier effect. Organizations that build strong human capital and facilitate knowledge sharing will have a competitive advantage in innovation. The knowledge-sharing process enables the transfer and utilization of individual expertise within the organizational context, helping learn from experiences and converting tacit knowledge into explicit knowledge. In the context of UNS-fostered startups, founders and teams need to share knowledge to avoid repeating mistakes and leverage successful experiences. Research supports that human capital drives collaboration and information sharing, which in turn improves organizational innovation performance.

The indirect effect of relational capital on innovation performance through knowledge sharing mediation has a relatively weak positive effect, with an original sample of 0.139 and a sample mean of 0.135. Although there is a positive relationship, the P-value indicates insignificance, suggesting that other factors may play a role in determining innovation performance. Strong relational capital does not always guarantee effective knowledge sharing, especially as knowledge is often tacit and difficult to transfer. The effectiveness of knowledge sharing depends on the organizational context, culture, and supporting infrastructure. While UNS startups have strong networks, the challenge lies in ensuring that academic systems and culture support the rapid and flexible innovation needs. Previous research indicates that relational capital can facilitate information exchange, but if too binding, it can hinder the exploration of new ideas. Therefore, while analysis shows a relationship between relational capital and knowledge sharing, this relationship may be more complex and needs further investigation to understand the potential negative influence and the role of knowledge sharing in strengthening this relationship.

The significant indirect effect of structural capital on innovation performance through knowledge sharing mediation, with an original sample coefficient of 0.101 and a sample mean of 0.091. The low t-statistics value indicates a real causal relationship, emphasizing the importance of organizations in developing infrastructure, systems, and procedures that facilitate the effective transfer of knowledge. The right organizational structure encourages the social interactions necessary for tacit knowledge sharing, and HR practices such as reward systems can create a social climate that supports innovation. In the context of UNS-fostered startups, it is important to pay attention to how internal structures and the broader ecosystem, including collaborations with universities and incubators, can enhance knowledge sharing. Research supports that strong structural capital correlates positively with knowledge sharing behavior, which in turn enhances innovation performance, making structural capital and knowledge sharing practices key factors in driving innovation in startup companies.

The mediating role of innovation culture in the relationship between human capital and innovation performance shows a relatively small positive effect with an original sample of 0.047 and a sample mean of 0.063, although the P-value of 0.498 indicates statistical insignificance. This finding suggests that although human capital can contribute to shaping an innovation culture, its impact is not strong enough to be a reliable predictor, and other factors may play a more significant role. High-skilled individuals often develop their own routines that may not align with the organization's innovation culture, and excessive pressure from the innovation culture can hinder.

CONCLUSIONS

Based on the analysis using Structural Equation Modeling (SEM), the startup organizations supported by Universitas Sebelas Maret demonstrate good performance in the aspects of intellectual capital, including human capital with high professional skills, relational capital in establishing relationships with stakeholders, and structural capital with adequate information systems. The innovation performance of the organization is considered fairly good, as evidenced by the ownership of patents, technical documentation, efficient process development, and innovative products. Knowledge-sharing practices have been running well through knowledge-sharing forums, mentoring new employees, technology training, and knowledge exchange with external parties. The organizational innovation culture also shows a positive assessment, reflected in the commitment to adopting the latest technology, seeking opportunities for technology integration, and developing new products and processes. Overall, the research results indicate that these startup organizations have successfully managed knowledge and innovation resources effectively to support their business continuity.

This study may be limited to the context of startup companies supported by UNS, so the results may not be generalizable to non-startup companies or countries with different characteristics. Furthermore, there may be other variables influencing innovation performance, such as economic conditions or individual motivation. This study focuses more on the causal relationship between variables, but does not explain the underlying mechanisms connecting intellectual capital with innovation performance.

Based on the research results, organizations are advised to strengthen human capital through training programs, development, and employee retention strategies, as well as improve relational capital by strengthening customer relationships and collaboration with research institutions. Optimization of structural capital can be achieved by enhancing accessibility to information systems and developing better knowledge management systems, while improving knowledge-sharing and innovation culture can be achieved through mentoring programs and policies that support experimentation. For future research, it is recommended to expand the sample by involving more companies from various industrial sectors to gain broader perspectives. Further studies could also conduct in-

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depth analysis of variables such as leadership, organizational culture, and innovation strategies in their impact on intellectual capital. Future research is also recommended to explore further the conditions that can optimize the influence of relational capital and moderating factors that affect the relationship between relational capital and innovation performance.

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