TAF

Journal of Administrative and Business Studies

JABS

2023, **9**(4): 252-267

PRIMARY RESEARCH

Riding the waves of innovation: Unraveling the impact of knowledge spillover, organizational trust, and entrepreneurial ecosystems on open innovation strategies

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Keywords

Knowledge spillover
Psychological trust
Entrepreneurial ecosystem
Open innovation
Organizational dynamics

Received: 23 May 2023
Accepted: 3 September 2023
Published: 23 November 2023

Abstract

This research investigates the interconnected relationships among knowledge spillover, psychological trust, entrepreneurial ecosystems, and open innovation within organizational contexts. The primary purpose is to empirically examine the collective impact of these constructs on open innovation practices. By integrating key elements into a unified conceptual framework, the study aims to provide a comprehensive understanding of the mechanisms driving innovation within organizations. Employing a quantitative approach, the study distributed 400 questionnaires in a Malaysian organizational context, receiving 230 valid responses. SmartPLS was utilized for data analysis. The research tested direct and mediated effects within the proposed conceptual framework, exploring how knowledge spillover, psychological trust, and the entrepreneurial ecosystem interact to influence open innovation outcomes. The findings reveal a positive and significant relationship between knowledge spillover and open innovation, emphasizing the pivotal role of external knowledge in driving innovation practices. Psychological trust is identified as a mediator, translating knowledge resources into innovative outcomes. The entrepreneurial ecosystem acts as a moderator, enhancing the impact of knowledge spillover on open innovation. This research contributes to the existing literature by integrating these constructs into a unified framework and empirically testing their collective impact. The study's significance lies in advancing theoretical models, providing actionable insights for organizational leaders, and informing policymakers on creating supportive entrepreneurial ecosystems for innovation.

INTRODUCTION

In an era characterized by rapid technology advancements, global interconnection, and increased competition, a desire for innovation has become an essential component of organizational success and longevity (Sawaean & Ali, 2020). Open innovation, which focuses on cooperation and knowledge across organizational boundaries, has become crucial for organizations aiming to remain competitive in their industries (Bukhari, Dabic, Shifrer, Daim, & Meissner, 2021). Comprehending the variables driving open innovation involves a detailed examination of the intricate relationship between spillover knowledge, psychological trust, entrepreneurial ecosystems, and the implementation of innovative strategies within organizations. This study explores the interplay between knowledge spillover, psychological trust, and the entrepreneurial ecosystem to understand their combined influence on open innovation. As organizations face the challenges of navigating a growingly dynamic and competitive environment, the need to utilize external knowledge, build trust among stakeholders, and leverage supportive ecosystems becomes a crucial strategic factor (Scaliza et al., 2022). This study aims to provide significant insights into educational scholarship and practical methods for corporate leaders by examining these essential

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constructs.

According to Becker, Roper, and Vanino (2023) research, knowledge spillover, or the unintentional transfer of knowledge across many organizational borders, is a crucial element of open innovation. The pursuit of external understanding resources by organizations will increase the significance of sharing ideas, technology, and knowledge in order to achieve innovation results (M. Wang, Wang, & Mardani, 2023). Studies indicate that knowledge spillover might help businesses innovate and solve problems by drawing in outside resources to help with their innovation projects (Chen, Jiang, Liang, & Pan, 2022; Gong, 2023). Research on belief systems in commercial settings has also attracted a lot of interest. The idea that employees of a company are moral, trustworthy, and selfless is known as psychological trust (Nyamrunda & Freeman, 2021). The results show a high correlation between participants' levels of buy-in and innovative acts. According to the (Zahoor & Adomako, 2023), open innovation flourishes in cultures of trust where people feel comfortable speaking out, trying new ideas, and collaborating. Examining the entrepreneurial ecosystem is one technique to get insight into the dynamics of entrepreneurial innovation (Ogunmokun, Eluwole, Avci, Lasisi, & Ikhide, 2020). An "entrepreneurial ecosystem" is a group of interconnected organizations that collaborate to create an atmosphere that supports business expansion and innovation within a particular sector of the economy (Wei, Lee, Jia, & Roh, 2023). An entrepreneurial ecosystem that fosters knowledge spillover multiplies the impact of innovation outcomes by giving businesses the tools they require to take use of outside data (Prencipe, Corsi, Rodríguez-Gulías, Fernández-López, & Rodeiro-Pazos, 2020; Y. Wang, Jiang, Geng, Wu, & Liao, 2022).

Many studies have been conducted on Knowledge Spillover, Psychological Trust, Entrepreneurial Ecosystems, and Open Innovation. Research on knowledge spillover in the context of open innovation has focused on the function of outside knowledge in promoting creative activities (Duan, Liu, Cheng, Chin, & Luo, 2021; Scarrà & Piccaluga, 2022). Research on the mediating role of psychological trust has also been conducted, and the results indicate that trust helps businesses turn their knowledge resources into creative results (Khan, Khan, & Bodla, 2021; Zhou, Li, Ruan, & Zhang, 2023). The most significant finding of the study is that the innovation cycle is significantly impacted by entrepreneurial settings. Higher rates of innovation inside businesses have been linked to entrepreneurial ecosystems with collaborating networks and supporting institutions (Pustovrh, Rangus, & Drnovšek, 2020; van Rijnsoever, 2020). Even said, there are still not many studies that look at these concepts in the context of open innovation as a whole. We still don't fully grasp how open innovation interacts with entrepreneurial ecosystems, psychological trust, knowledge spillover, and open innovation at the individual level, despite research demonstrating these connections. The body of research on the subject of integrating these components into a cohesive theoretical framework is severely lacking. In order to close this knowledge gap, this study examines the interactions among psychological trust, knowledge spillover, and the entrepreneurial ecosystem in order to make inferences about how these elements influence open innovation practices. In order to evaluate the underlying presumptions of past research before we can assess these linkages. Open innovation has been found to benefit from knowledge spillover, which offers a strong basis for further research (Obschonka, Tavassoli, Rentfrow, Potter, & Gosling, 2023). Theoretical and practical reasons have been recognized by research for examining the relationship between the entrepreneurial ecosystem and psychological trust as mediators of innovation outcomes (Venâncio, Picoto, & Pinto, 2023).

The main goal of this research is to provide light on the complex connections that exist between open innovation, entrepreneurial ecosystems, psychological trust, and knowledge spillover in the context of companies. To investigate the direct and mediated impacts that the conceptual framework suggests, this study uses a quantitative methodology. The goal of the study is to shed light on the mechanisms underlying open innovation efforts by dissecting the relationships between these concepts. This study has broad ramifications for business practices and scholarly education. From an academic standpoint, the study adds to the current body of literature by combining important concepts into a single, coherent framework and evaluating their combined influence on open innovation through empirical research. It is anticipated that the results push theoretical boundaries and provide a deeper understanding of the factors affecting open innovation techniques. For corporate leaders looking to promote a culture of innovation, the research provides useful insights. Leaders may strategically utilize mental belief, the entrepreneurial environment, and the position of know-how spillover to enhance open innovation processes. The significance of the study encompasses policymakers and industry stakeholders, as it provides advice on establishing entrepreneurial ecosystems that foster innovation in organizations and increase the influence of external data on it. All things considered, this study is well-positioned to pro-

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

vide insightful knowledge to both academics and the larger business community, guiding strategies for negotiating the complexity of today's innovation environments.

LITERATURE REVIEW

Open innovation challenges internal innovation in modern companies. Open innovation removes barriers and involves external stakeholders in the exchange of resources, ideas, and knowledge across organizations (Runeson, Olsson, & Linåker, 2021). Knowledge spillover, a dynamic process where skills and knowledge move across linked networks of players beyond single enterprises, is crucial to open innovation success (Gao & Yuan, 2022). Knowledge spillover is the accidental interchange of ideas, technical abilities, and expertise across businesses. This commonly happens after collaborations or research exchanges (Prencipe et al., 2020). Knowledge dispersion helps innovation by exchanging ideas and embracing other perspectives. Open innovation advocates see knowledge spillover as a catalyst that promotes creativity, speeds up problem-solving, and reveals new value-creating possibilities, not a liability or threat (Jeon, 2019). Research reveals that knowledge spillover improves open innovation results by encouraging continuous learning and adaptation and increasing the organization's absorptive capacity (Adamides & Karacapilidis, 2020). Research has consistently linked knowledge spillover to innovation performance (Sergio, Iandolo, & Ferragina, 2023). Businesses that actively use external knowledge sources show more innovation and gain a competitive edge. Organizations may gain a competitive edge and capitalize on untapped market opportunities by exploiting external knowledge networks, which give access to ideas, technology, and market knowledge (Kim, Hwang, & Yoon, 2023). Knowledge spillover helps process, business model, service, and product innovation. Open innovation and knowledge spillover may revolutionize organizations. This can affect product development, operations, and customer value (Obschonka et al., 2023). This holistic innovation strategy stresses knowledge spillover as a key factor in organizational adaptability and resilience in a complex and ever-changing corporate environment.

H1: Knowledge spillover has a significant impact on open innovation.

The complex confluence of psychological trust and knowledge spillover creates a delicate interplay in the organizational landscape where knowledge flows beyond simple knowledge interchange and into the complex domains of human relationships and company culture (Reimers et al., 2021). The underlying dynamics of psychological trust inside and across companies are significantly influenced by knowledge spillover, which is described as the unintended flow of expertise and ideas across organizational borders (Davis & Hashimoto, 2022). Knowledge spillover significantly affects psychological trust, creating an atmosphere where people and organizations may grow in mutual understanding, trust, and confidence (Xiong, Zheng, Germon, Susini, & Chang, 2021). Empirical study indicates that the link between psychological trust and knowledge spillover is complicated. Positive perceptions of knowledge spillover help employees build psychological trust with one another (Quinn, McKitterick, Tregear, & McAdam, 2021). The inherent transparency of the spillover process, together with the willingness to share knowledge and ideas, creates the groundwork for the growth of trust. Companies that proactively foster and monitor knowledge spillover are likely to understand that trust builds as a critical social capital and fosters a collaborative environment where staff members feel free to share their ideas without fear of being taken advantage of (Zahoor & Adomako, 2023). In addition to interpersonal contacts, knowledge spillover affects psychological trust throughout organizational culture. As knowledge becomes a shared resource, the spillover process's collaborative attitude fosters communal accountability and support. As a result, trust becomes the norm in a positive psychological setting (Santoro, Quaglia, Pellicelli, & De Bernardi, 2020). Knowledge spillover as a strategic tool improves innovation and fosters open communication, cooperation, and mutual commitment to common goals, which build and maintain psychological trust.

H2: Knowledge spillover has a significant impact on psychological trust.

Psychological trust and open innovation demonstrate the importance of interpersonal connections, company culture, and innovation. Risk-taking, collaboration, and knowledge-sharing organizational dynamics are affected (Woodward et al., 2023). Psychological trust is necessary for open innovation since it is founded on people's beliefs, perceptions, and expectations of others' reliability, honesty, and compassion (Terhorst, Wang, Lusher, Bolton, & Elsum, 2024). Psychological trust fosters confidence, self-assurance, and mutual respect in a company, enabling idea sharing, strategy testing, and high innovation standards. Psychological trust affects open innovation. Strong psychological trust promotes innovation-related teamwork, knowledge sharing, and risk-taking, according to research. Trust-building organizations encourage employees to speak out, question authority, and try new things (Yakimova, Owens, & Sydow, 2019). This setting fosters creativity and breakthroughs. Psychological

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

trust builds resilient, cohesive innovation teams with solidarity, mutual support, and goal responsibility. People are more inclined to apply their unique skills, viewpoints, and experiences in trust worthy workplaces, enabling collaborative efforts across hierarchical and organizational boundaries (Ogunmokun et al., 2020). Thus, psychological trust improves team flexibility, durability, and adaptation under ambiguity and uncertainty, making it ideal for open innovation. Psychological trust affects open innovation beyond human interactions, including workplace culture and surroundings (Ricci, Battaglia, & Neirotti, 2021). Establishing trust is essential in businesses that foster innovation and acknowledge it as a team effort. Leaders' interactions foster this trust culture. They model honesty, integrity, and empathy for a collaborative and inclusive innovation ecosystem.

H3: Psychological trust has a significant impact on open innovation.

Psychological trust protects pioneers from the risks and uncertainties of innovation, enhancing confidence and security (Soni et al., 2023). Because they expect their superiors and coworkers to recognize, reward, and repay their efforts, employees are more inclined to cooperate, exchange knowledge, and find innovative solutions in settings that foster trust (Bischoff, Hipp, & Runst, 2023). Knowledge spillover creates powerful ecosystems, and trust facilitates collaboration and innovation. A recent study found that psychological trust mediates the link between open innovation and knowledge spillover. Psychological trust influences knowledge sharing-virtual team performance. Psychological trust affects strategic partnership innovation performance and inter-organizational knowledge exchange. Social capital and exchange theories explain psychological trust, collaborative innovation, and knowledge spillover. Social exchange theory states that people provide support and knowledge based on perceived benefits and trust. Open innovation involves companies working with external partners and using psychological trust to improve collaboration (Shcherbakov & Silkina, 2021). Social capital theory shows how social interactions and networks may benefit organizations. Social capital relies on trust to provide access to resources and opportunities through network connections (Wu et al., 2022). High psychological trust in external networks helps organizations profit from knowledge sharing among partners, improving open innovation performance.

H4: Psychological trust mediates the relationship between knowledge spillover and open innovation.

The entrepreneurial ecosystem—industrial structures, government laws, and resource availability—affects how knowledge spillover generates innovation outputs. The entrepreneurial ecosystem filters organizational externalities to control open innovation and knowledge spillover (Scarrà & Piccaluga, 2022). Research on the entrepreneurial ecosystem's moderating role demonstrates that external contextual variables hamper open innovation and knowledge spillover (Meng et al., 2023). According to empirical studies, knowledge spillover enhances innovation in a supportive entrepreneurial ecosystem (Avnimelech & Rechter, 2023). The ecosystem promotes cooperation, resource mobilization, and product development from outside knowledge. Organizations can gain a competitive edge in gathering external knowledge sources, negotiating regulatory frameworks, and gaining resources to transform knowledge spillover into strategic innovation in nations with strong entrepreneurial ecosystems (Fuster, Padilla-Meléndez, Lockett, & del Águila-Obra, 2019). The entrepreneurial ecosystem also promotes knowledge spillover, allowing companies to adapt, integrate, and incorporate outside viewpoints into their innovation processes. Encouraged rules, well-established networks, and a dynamic industrial ecosystem allow knowledge to flow freely across organizational borders, allowing enterprises to leverage varied perspectives and ideas for new ventures (Siqueira, Fischer, Bin, & Kickul, 2023). The entrepreneurial ecosystem helps organizations keep ahead of new prospects, technical breakthroughs, and market trends, boosting open innovation activities. The entrepreneurial ecosystem also moderates non-corporate innovation. Besides assisting individual enterprises pursuing open innovation, strong entrepreneurial ecosystems foster a cooperative and competitive environment where knowledge spillover drives collective innovation and economic growth (Marra, 2022). Industry alliances, venture capital in the entrepreneurial ecosystem, government restrictions, and enterprises' ability to turn knowledge spillover into open innovation successes affect corporate innovation trajectories.

H5: Entrepreneurial ecosystem moderates the relationship between knowledge spillover and open innovation.

The theoretical basis for this study is based mostly on social exchange theory, a sociological approach that examines social behavior through the lens of reciprocity and mutual benefit. Based on this hypothesis, the study proposes that knowledge spillover, as an external resource, might improve open innovation results within firms. According to social exchange theory, trust is an essential component in building cooperative interactions, and it is suggested that psychological trust plays an important mediating role in the relationship between knowledge spillover and open inno-

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

vation (Terhorst et al., 2024). This shows that higher levels of psychological trust promote the transition of external knowledge into practical innovation by establishing a collaborative and supportive corporate environment. Building on social exchange theory, the research broadens its theoretical scope by adding the idea of the entrepreneurial ecosystem as a moderator (Fox, Muldoon, & Davis, 2023). This adaptability is consistent with the larger resource-based perspective, implying that the external environment may have a major impact on the use and efficacy of external resources, such as knowledge spillover, in generating innovation. The study proposes that the entrepreneurial ecosystem, which reflects external circumstances and support structures for innovation, moderates the link between knowledge spillover and open innovation results. Organizations operating in conducive entrepreneurial ecosystems are expected to have a stronger positive relationship between knowledge spillover and open innovation than those in less supportive environments, as external conditions facilitate the translation of external knowledge into innovative initiatives. Hence based on this, we developed the following conceptual framework (Figure 1).

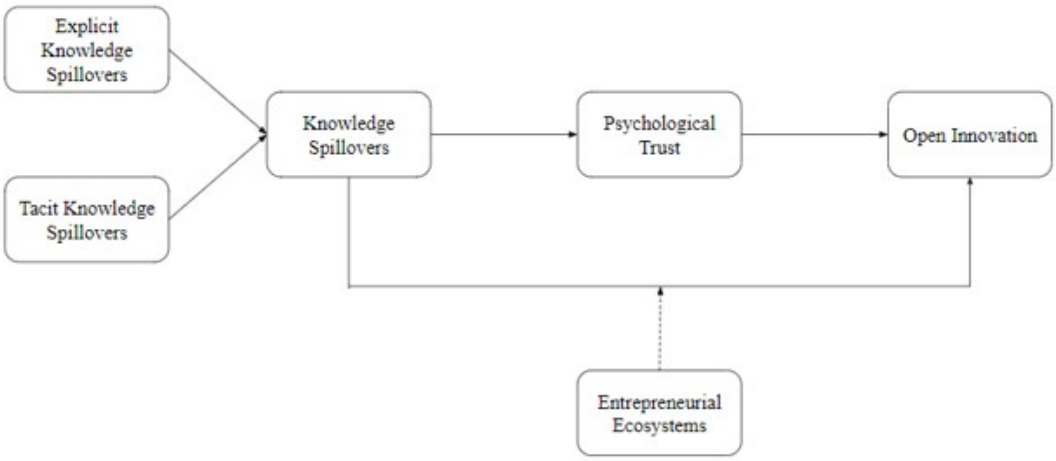

FIGURE 1. Conceptual framework

METHODOLOGY

In this study, a cross-sectional research design was employed to investigate the intricate relationships among knowledge spillover, organizational trust, entrepreneurial ecosystems, and open innovation strategies within organizations in Malaysia. The design aimed to capture a snapshot of these relationships at a specific point in time, allowing for a comprehensive exploration of the dynamic interplay among these constructs. The target population for this study comprised a diverse array of organizations across various sectors in Malaysia actively involved in innovative practices. Recognizing the need for a robust and representative dataset, a total of 400 questionnaires were distributed among these organizations. This strategic sample size aimed to achieve statistical significance and reliability in capturing the nuanced interactions between knowledge spillover, organizational trust, entrepreneurial ecosystems, and open innovation strategies. Of the 400 distributed questionnaires, 230 were collected and deemed suitable for subsequent data analysis. To enhance the external validity of the study, a stratified random sampling technique was employed. This approach involved categorizing the population based on industry sectors, ensuring proportional representation from different segments of the Malaysian business landscape. By doing so, the study sought to uncover variations in how organizations across various industries navigate and respond to the influences of knowledge spillover, trust, and entrepreneurial ecosystems. The primary method of data collection involved the use of self-administered questionnaires, a versatile tool distributed both in physical form and electronically (Appendix-A). Participants were requested to provide responses using established Likert scales, offering a quantitative means to gauge their perceptions and behaviors concerning knowledge spillover, organizational trust, entrepreneurial ecosystems, and open innovation strategies. The utilization of Likert scales facilitated the measurement of nuanced attitudes, allowing for a more granular analysis of the variables under consideration. 12-item scale adopted from Mota Veiga et al., (2023) was used to measure open innovation. Entrepreneurial ecosystem was measured by using 6-item scale adopted from Bejarano Auqui, Berrio, Anto-

ISSN: 2414-309X
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nio, and Aguado (2022). Psychological trust was measured by using 7-item scale adopted from Alshaabani, Hamza, and Rudnák (2021). Knowledge spillover was measured by using 8-item scale adopted from Ferreira, Fernandes, Veiga, and Dooley (2023). For the rigorous analysis of the collected data, SmartPLS emerged as the principal data analysis technique. Operating within the structural equation modeling framework, SmartPLS facilitated a nuanced exploration of both direct and indirect effects within the studied relationships. It allowed the research team to scrutinize path coefficients, assess significance levels, and examine goodness-of-fit indices. This comprehensive analysis provided a deeper understanding of the intricate web of relationships among knowledge spillover, organizational trust, entrepreneurial ecosystems, and open innovation strategies within the organizational fabric of Malaysia.

RESULTS

In reliability analysis, Table 1 reveals strong construct internal consistency. Cronbach's alpha coefficients for the entrepreneurial ecosystem are 0.900, indicating reliability. This means that the study's items representing the entrepreneurial ecosystem's multiple aspects consistently and properly assess the target construct. With alpha values of 0.934 and 0.929, respectively, open innovation and knowledge spillover exhibit good internal consistency. Knowledge spillover and open innovation scale items with high alpha values are internally trustworthy and regularly assess desirable features. Finally, psychological trust's Cronbach's alpha is 0.856, showing good internal consistency and organizational trust perception dependability. Strong alpha values across all variables imply solid measuring equipment, enhancing future study credibility and validity.

TABLE 1. Cronbach Alpha

	Cronbach's alpha
Entrepreneurial Ecosystem	0.900
Knowledge Spillover	0.934
Open Innovation	0.929
Psychological Trust	0.856

Each variable's composite reliability (CR) and average variance extracted (AVE) are shown in Table 2. These indicators show the study's measuring instruments' internal consistency and convergent validity. The entrepreneurial ecosystem's composite dependability is 0.923, showing that its elements accurately measure the underlying phenomena. Good convergent validity (AVE = 0.667) confirms that scale items measure the target concept. Knowledge spillover has a CR of 0.946, indicating high internal consistency. The construct's convergent validity is confirmed by the components' AVE score of 0.685, which indicates knowledge spillover variance. With a composite reliability of 0.939, open innovation measures the build reliably. The AVE score of 0.562 suggests lower convergent validity than other variables, suggesting space for improvement in capturing open innovation variation. Finally, psychological trust has strong composite reliability with a CR rating of 0.893, showing consistent assessment across its components. The AVE score of 0.549 shows moderate convergent validity, indicating that while the questions assess psychological trust sufficiently, there may be some heterogeneity in capturing the underlying construct.

TABLE 2. Composite Reliability and AVE

	CR	AVE
Entrepreneurial Ecosystem	0.923	0.667
Knowledge Spillover	0.946	0.685
Open Innovation	0.939	0.562
Psychological Trust	0.893	0.549

Table 3 and Figure 2 show each item's outer loading values for the assessed variables, revealing its strength concerning its construct. All entrepreneurial ecosystem components have outer loadings between 0.776 and 0.847. EE4 has the largest outside loading, demonstrating its significant relationship with the entrepreneurial ecosystem construct. This shows that the items capture the diversified entrepreneurial ecosystem, demonstrating the mea-

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

suring model's resilience. All items have substantial outside loadings of 0.772 to 0.863 for knowledge spillover. Items KS1 and KS5 have large outside loadings, highlighting their importance in quantifying organizational knowledge spillover. The items' reliability and efficacy in measuring knowledge spillover's many features, vital for understanding its impact on organizational innovation, are confirmed. Open innovation outer loading levels range from 0.678 to 0.829. Most items have significant outside loadings, but OI11 and OI5 have greater values, demonstrating their significant contributions to open innovation measurement. This shows that these factors capture organizational open innovation, underscoring their value in the assessment methodology. Outer loading values for psychological trust are 0.527–0.827. Most items have strong outer loadings, but PT3, PT4, PT6, and PT7 are especially important for capturing psychological trust in the organizational setting. The items' reliability and usefulness in assessing psychological trust are crucial to understanding their mediating role in the study framework.

TABLE 3. Outer Loading

Variables	Items	Outer Loading
Entrepreneurial Ecosystem	EE1	0.776
	EE2	0.810
	EE3	0.815
	EE4	0.847
	EE5	0.829
	EE6	0.823
Knowledge Spillover	KS1	0.857
	KS2	0.823
	KS3	0.838
	KS4	0.807
	KS5	0.863
	KS6	0.838
	KS7	0.822
	KS8	0.772
Open Innovation	OI1	0.787
	OI10	0.784
	OI11	0.829
	OI12	0.791
	OI2	0.764
	OI3	0.734
	OI4	0.682
	OI5	0.787
	OI6	0.718
	OI7	0.702
	OI8	0.678
	OI9	0.727
Psychological Trust	PT1	0.527
	PT2	0.580
	PT3	0.812
	PT4	0.812
	PT5	0.761
	PT6	0.803
	PT7	0.827

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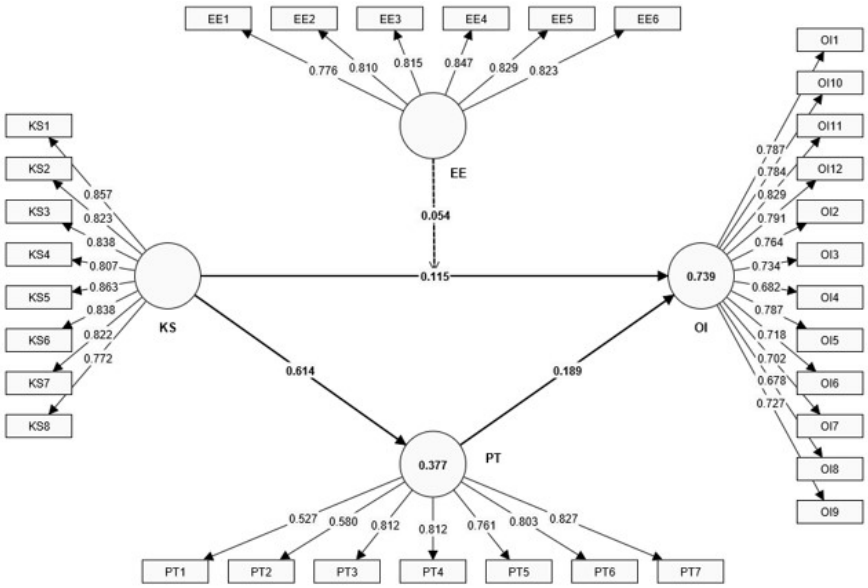

FIGURE 2. Measurement model

Table 4 shows the heterotrait-monotrait ratio of correlations (HTMT) analysis, which shows construct discriminant validity. The diagonal numbers are the square root of the average variance retrieved for each construct, whereas the off-diagonal values are HTMT ratios, which demonstrate construct discrimination. In particular, entrepreneurial ecosystem, knowledge spillover, open innovation, and psychological trust all have HTMT ratios < 0.85. Strong discriminant validity means each construct is unique enough. The HTMT ratios range from 0.546 to 0.891, confirming that the constructs are well-differentiated and add distinctive variation to the model. These findings confirm the measuring model's discriminant validity, ensuring the constructs' uniqueness and the associations' correctness in further studies.

TABLE 4. Discriminant Validity (HTMT)

	EE	KS	OI	PT
Entrepreneurial Ecosystem				
Knowledge Spillover	0.546			
Open Innovation	0.891	0.599		
Psychological Trust	0.861	0.677	0.826	

Table 5 demonstrates how much variance Open Innovation and Psychological Trust explains. Open Innovation's R2 score is 0.739, indicating that the model's assessed variables explain 73.9% of its variance. This high explanatory power suggests that the variables capture open innovation's organizational complexity. Thus, entrepreneurial ecosystem, knowledge spillover, and psychological trust substantially influence open innovation outcomes. Psychological Trust R2 is 0.377, suggesting that the included factors explain 37.7% of its variance. The chosen indicators explain organizational psychological trust variation, demonstrating the relevance of the examined dimensions in explaining observed results. Q-square (Q2) values in Table 5 show the model's predictive power. The model's Q2 Open Innovation result is 0.700, indicating predictive power. The entrepreneurial ecosystem, knowledge spillover, and psychological trust model may explain and predict open innovation. The Q2 result for Psychological Trust is 0.363, showing the model can predict psychological trust outcomes. Model predictive relevance indicates organizational psychological trust prediction. In Table 4, the model's R-square and Q-square values explain and predict open innovation and psychological trust, demonstrating the research framework's complete knowledge and predictive capacity.

TABLE 5. R-square and Q- square

	R-square	Q2
Open Innovation	0.739	0.700
Psychological Trust	0.377	0.363

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Table 6 compares the saturated and estimated models' model fit statistics to measure their goodness of fit. The saturated model, which fits perfectly, has a Standardized Root Mean Square Residual (SRMR) of 0.075, suggesting little inconsistencies between observed data and predictions. In comparison, the empirically-based Estimated model has a significantly higher SRMR of 0.123. The calculated model's SRMR is somewhat greater than the saturated model's, but it still fits the empirical data well. Lower SRMR values indicate a better model fit. The estimated model may not match the saturated model's ideal fit, but the SRMR values indicate that it properly describes the observed data, confirming its trustworthiness and application to the research.

TABLE 6. Model Fit

	Saturated model	Estimated model
SUMMER	0.075	0.123

Table 7 and Figure 3 show hypothesis-specific path coefficients, t-values, and p-values from direct path analysis. The path coefficient for hypothesis 1 (H1), which links knowledge spillover to open innovation, is 0.115 with a t-value of 2.154 and a p-value of 0.016. Knowledge spillover appears to positively affect open innovation statistically. As knowledge spillover increases, open innovation activities improve, according to the positive path coefficient. The t-value of 2.154, over the crucial threshold, supports H1 by confirming this link. In hypothesis 2 (H2), which examines knowledge spillover and psychological trust, the path coefficient is 0.614, with a large t-value of 10.607 and a p-value of 0.000. These findings substantially corroborate H2, showing that knowledge spillover increases psychological trust. Knowledge spillover boosts organizational psychological trust. This relationship's strength and statistical significance are confirmed by the high t-value, supporting H2. Finally, hypothesis 3 (H3) addresses psychological trust and open innovation. With a t-value of 2.850 and a p-value of 0.002, the path coefficient is 0.189. Psychological trust positively correlates with open innovation statistically. Organizations with more psychological trust participate in more open innovation, according to the positive path coefficient. The t-value surpassing the critical threshold and low p-value supports H3, demonstrating that psychological trust is essential for organizational open innovation.

TABLE 7. Direct Path Analysis

		Path Coefficient	t value	p-value
H1	KS -> OI	0.115	2.154	0.016
H2	KS -> PT	0.614	10.607	0.000
H3	PT -> OI	0.189	2.850	0.002

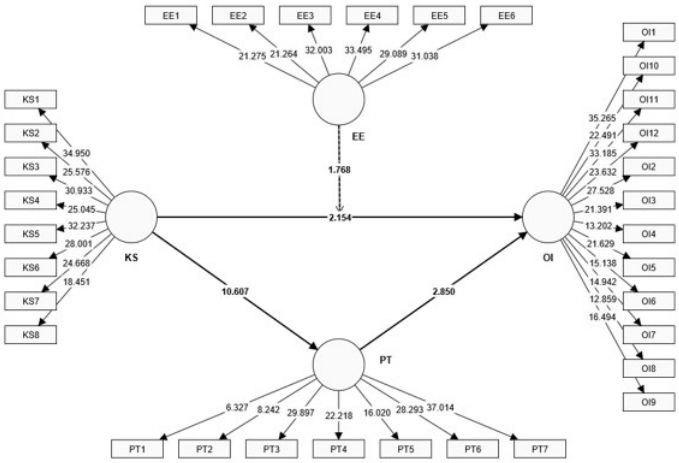

FIGURE 3. Structural Model

ISSN: 2414-309X
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Table 8 shows the mediation analysis for hypothesis 4 (H4), which examines how psychological trust mediates the indirect effect of knowledge spillover on open innovation. The indirect impact path coefficient is 0.116, with a t-value of 2.751 and a p-value of 0.003. These data strongly corroborate H4, indicating that psychological trust promotes knowledge spillover and open innovation. The positive path coefficient shows that knowledge spillover increases psychological trust, which boosts open innovation. The mediating effect's statistical significance and dependability are shown by its high t-value and low p-value.

TABLE 8. Mediation Analysis

		Path Coefficient	t value	p-value
H4	KS -> PT -> OI	0.116	2.751	0.003

Table 9 shows the moderation analysis for hypothesis 5 (H5), which examines how the entrepreneurial ecosystem moderate's knowledge spillover and open innovation. The path coefficient for the interaction term, EE x KS, is 0.054, with a t-value of 1.768 and a p-value of 0.039. Weak empirical evidence supports H5, showing that the entrepreneurial ecosystem moderates knowledge spillover on open innovation. The positive path coefficient shows that the entrepreneurial ecosystem and knowledge spillover interact to benefit open innovation, but the t-value is slightly above the critical threshold and the p-value is at the conventional significance level. While further research is needed, these findings suggest that the entrepreneurial ecosystem setting may affect how knowledge spillover leads to open innovation in enterprises. Table 8's moderation analysis allows for further study of entrepreneurial ecosystem dynamics, knowledge spillover, and open innovation.

TABLE 9. Moderation Analysis

		Path Coefficient	t value	p-value
H5	EE x KS -> OI	0.054	1.768	0.039

DISCUSSION

We discuss the empirical findings that illuminate the complex dynamics of knowledge diffusion, trust-building, and the external entrepreneurial environment, providing academically enriching and practical insights for creating innovative cultures in organizations. This study examines how knowledge spillover, psychological trust, and the entrepreneurial ecosystem affect organizational open innovation. The hypotheses reveal a complicated network of interdependencies, including direct, mediated, and moderated effects. H1 proposed that knowledge spillover significantly affects open innovation. Quantitative analysis validates this assumption and explains this relationship's complex dynamics. Open innovation and knowledge spillover are positively correlated, emphasizing the importance of knowledge dispersion in supporting innovative activities in organizations. This supports recent research Runeson et al. (2021) that emphasizes knowledge-sharing cultures for corporate innovation. The findings shed insight on the complicated relationship between knowledge spillover and open innovation, suggesting that organizations that support knowledge sharing will participate more in open innovation activities. It shows how knowledge dynamics and corporate culture foster innovation. The results suggest that organizations must emphasize knowledge exchange settings to support open innovation initiatives inside. Further, the study emphasizes the relevance of knowledge exchange in organizations and the complicated interaction between open innovation and knowledge spillover.

Knowledge sharing may change organizational dynamics, says this theory. Knowledge spillover and psychological trust are strongly correlated, supporting hypothesis H2. Knowledge sharing increases organizational trust, according to several research. Employees that share knowledge trust their teammates and the organization more Quinn et al. (2021). Openness and transparency in knowledge exchange build trustworthiness and safety. Knowledge spillover increases psychological trust. This study implies corporate community members exchanging knowledge may build trust. After that, trust is essential for cooperation and teamwork, which are essential for an innovative corporate culture. Open innovation requires teamwork, risk-taking, and knowledge sharing, which trust supports. This study substantially supports H3, indicating that psychological trust and open innovation are linked. Previous academic research has studied how trust affects or-

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

ganizational innovation. High-trust workers interact, take risks, and exchange knowledge more (Woodward et al., 2023). Team members can experiment without fear of judgment or punishment when they trust each other. The relational approach to innovation stresses social interactions and trust in corporate innovation. Psychological trust improves team and organizational stakeholder communication, idea-sharing, and problem-solving. These are essential to open innovation. Psychological trust mediates the relationship between knowledge spillover and open innovation in organizations. This hypothesis assumes trust is crucial to knowledge spillover and open innovation. This study supports hypothesis H4 by showing that psychological trust impacts knowledge spillover and open innovation. Previous study links knowledge spillover and trust. Studies show that knowledge spillover fosters transparency and collaboration inside a company, which builds trust. Research shows that trust promotes creativity and open cooperation (Lam et al., 2021). The mediation exhibited in H4 suggests that knowledge spillover increases psychological trust and organizational open innovation. This study supports social exchange theory that good actions cause positive reactions. For knowledge spillover, sharing knowledge may build corporate trust. For open innovation to thrive, individuals must trust each other and share ideas (Balinado et al., 2021). Psychological trust as a mediator is consistent with prior studies on trust in knowledge-intensive collaborations and innovation networks. This study validates hypothesis 5, indicating that the entrepreneurial ecosystem impacts knowledge spillover and open innovation. Innovation research now emphasizes external influences on innovation processes through entrepreneurial ecosystems (Prencipe et al., 2020). The ecosystem notion indicates that an organization's external environment may help or impede knowledge spillover and open innovation. Previous studies have underlined the importance of an innovation-friendly ecosystem. If funding, mentoring, and cooperative situations are available, knowledge spillover may promote creativity. The study's moderated findings underscore the relevance of external context in knowledge dynamics and open innovation. The findings support the resource-based approach, which indicates that external variables like the entrepreneurial ecosystem may influence internal resource innovation. Knowledge spillover can help or impede innovation in the entrepreneurial ecosystem.

CONCLUSION

To conclude, this study advances our understanding of organizational psychological trust, open innovation, the entrepreneurial ecosystem, and knowledge spillover. by employing quantitative methods to provide data that validated the claimed linkages and improved our understanding of innovation processes. The study shows that knowledge spillover promotes open innovation. The strong positive correlation between open innovation and knowledge spillover shows the importance of sharing knowledge to boost innovation inside organizations. If it encourages knowledge sharing, a firm is more likely to participate in open innovation projects, which employ outside knowledge to stimulate internal innovation. The findings also show how psychological trust promotes honest innovation and knowledge exchange. As knowledge spillover improves psychological trust, firms must foster a culture of trust to promote collaboration and innovation. Companies with increased employee psychological trust can overcome innovation hurdles and promote open innovation. The study also illuminates how the entrepreneurial ecosystem affects knowledge spillover and open innovation. Knowledge spillover may boost innovation results in an entrepreneurial ecosystem with help, according to the positive interaction effect. Contextual factors including networks, resources, and infrastructure help optimize knowledge spillover and foster open innovation. The mediation research reveals how knowledge spillover promotes open innovation and shows psychological trust as a key mediator. Knowledge spillover boosts psychological trust, emphasizing the relevance of trust in translating knowledge into new results. Building personal trust helps firms maximize knowledge spillover, which boosts competitiveness and innovation.

Implications

This study has practical implications and offers insights for practitioners, legislators, and organizational leaders who seek to foster innovation. The findings show that organizations must prioritize knowledge sharing. Leaders who understand the benefits of knowledge spillover for open innovation may encourage staff concept and data exchange. This might involve constructing collaborative spaces, knowledge-sharing events, or cross-functional cooperation platforms. Open communication and knowledge exchange can provide a good environment for open innovation. The study also stresses the importance of psychological trust in creative success. Organizations may actively build and sustain public trust. Team-building, leadership development, and open communication promote organizational trust. Organizations need psychological trust to foster open innovation, cooperation, and employee pleasure. A

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

productive, happy work atmosphere and company culture that encourages personnel to take initiative and offer constructive feedback require trust. The research also underlines the entrepreneurial ecosystem's role in understanding knowledge spillover and open innovation. Policymakers and organizational leaders may utilize this knowledge to promote knowledge transfer. Innovation centers, cooperative networks, and resource-sharing platforms may foster entrepreneurship and boost creativity. Leadership can build a more flexible and adaptable innovation environment by adjusting approaches to ecosystem features and understanding contextual factors that affect open innovation and knowledge spillover.

This study advances organizational behavior, innovation management, knowledge transfer, and innovation management theory. Empirical evidence enhances theoretical frameworks and illuminates complex interactions between key components. The study shows that trust bridges knowledge spillover and open innovation. This nuanced perspective enriches theoretical frameworks by considering socio-psychological factors in organizational innovation. The study also improves theoretical knowledge of the entrepreneurial ecosystem's moderating effect on open innovation and knowledge spillover. This study contributes to innovation ecosystem knowledge by showing how entrepreneurship-friendly environments might increase performance. This research enriches theoretical frameworks by emphasizing the importance of context in knowledge-related activities. Theories help us comprehend innovation by incorporating the dynamic interaction of knowledge spillover, psychological trust, and the entrepreneurial ecosystem.

Limitations and Future Direction

Despite its significant contributions and insights, this research has limitations that present opportunities for future research to better understand the complex relationships between psychological trust, open innovation, knowledge spillover, and the entrepreneurial ecosystem. The study's cross-sectional design restricts causality proof. Future research employing experimental or longitudinal methodologies to study these interactions' temporal dynamics may help us understand how temporal variations in one variable impact the others. Researchers may find feedback loops, causal links, and the dynamic nature of open innovation, psychological trust, and knowledge spillover using longitudinal studies. Another downside is that the results may only apply to a certain industry or location. Future research may examine interpersonal variations across corporate contexts using a cross-cultural or cross-industry approach. Understanding the different ways these dynamics manifest improves the findings' external validity and helps assess the conceptual framework's broad applicability. A common constraint in quantitative research is self-reported survey data. Despite efforts to verify the measures' validity and reliability, further research could benefit from triangulating findings from qualitative interviews, observations, and archival records to better understand the phenomenon. Open innovation, psychological trust, knowledge spillover, and entrepreneurial ecosystems are just a few examples of complex dynamics that might be better understood by integrating qualitative and quantitative research methodologies. The study focused on conceptual framework direct and mediated links. Given organizational dynamics' complexity, various variables may govern or modify these linkages. Future research should consider business culture, leadership styles, and technical capabilities to better understand open innovation initiatives. These qualities may be analyzed to construct a more complete framework that encompasses organizational innovation's complexity. In conclusion, the research examined the entrepreneurial ecosystem in the context of entrepreneurship, but it did not examine specific components or distinctions. To better understand how government policies, venture capital, and innovation network density affect knowledge spillover and open innovation, further research could examine specific elements of the entrepreneurial ecosystem. This comprehensive analysis may help policymakers and corporate leaders foster innovation. Future research on how blockchain and AI affect psychological trust, open innovation, entrepreneurial ecosystems, and knowledge spillover may be intriguing. Understanding how these cutting-edge technologies affect innovation processes may give firms navigating the fast-changing technology landscape valuable insights. Additional studies on how employee demographics like age, tenure, and education affect correlations between the primary variables may give greater clarity. Different demographic groups may react differently to open innovation outcomes, knowledge spillover, psychological trust, and entrepreneurial situations.

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ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5

APPENDIX-A

Knowledge Spillover

Explicit knowledge spillovers

- Engagement in intramural R&D
- Engagement in acquisition of machinery
- Expenditures in intramural R&D
- Expenditures in acquisition of machinery

Tacit knowledge spillovers

- Engagement in extramural R&D
- Engagement in acquisition of external knowledge
- Expenditures in extramural R&D
- Expenditures in acquisition of external knowledge

Psychological Trust

- I believe that the management of my company has high integrity
- I can expect my organizations' management to treat me in a consistent and predictable fashion
- My organization's management is not always honest and truthful
- In general, I believe my organizations' management motives and intentions are good
- I don't think my organizations' management treats me fairly
- My organization's management is open and upfront with me
- I am not sure I fully trust my organizations' management

Entrepreneurial Ecosystem

- Existing external sources of financing for entrepreneurs are sufficient.
- In your country, the sources of public financing for entrepreneurs support the start-up of businesses.
- A business incubator or business accelerator can realistically help an entrepreneur obtain international financing.
- Do you consider that the entrepreneurial ecosystem in your country leads enough activities to promote the entrepreneurial culture?
- Considers that the business incubation and/or acceleration programs had sufficient impact.
- It is easy to access external advisory services, accountants, lawyers, and specialists in different areas. Open Innovation
- People participate in professional association activities
- We use established processes to identify target market segments, changing customer needs and customer innovation
- We observe best practices in our sector
- We gather economic information on our operations and operational environment
- We invest in finding solutions for our customers.
- We adopt the best practices in our sector.
- We respond to defects pointed out by employees.
- We change our practices when customer feedback gives us a reason to change.
- Implementation of new kinds of management methods.
- New or substantially changed marketing method or strategy
- Substantial renewal of business processes
- New or substantially changed ways of achieving our targets and objectives

ISSN: 2414-309X
DOI: https://doi.org/10.20474/jabs-9.4.5