INTERNATIONAL JOURNAL OF eBUSINESS AND eGOVERNMENT STUDIES
Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-218) **Doi:** 10.34109/ijebeg. 202214209
Received: 21.08.2022 | **Accepted:** 27.01.2023 | **Published Online:** 28.02.2023

-RESEARCH ARTICLE-

AN INTERACTIVE EFFECT OF OPEN INNOVATION SEARCH APPROACHES AND INTENSITY OF IT USE TO PREDICT ORGANIZATIONAL CAPABILITIES AND PERFORMANCE

Silvia Ratna

Information Technology Faculty, Kalimantan Islamic University
Muhammad Arsyad Al-Banjari, Banjarmasin, Indonesia
Email: via.borneo@gmail.com
https://orcid.org/0000-0002-9123-064X

─Abstract─

Considering the significance of Information and Communication Technology (IT) in the current digital era, its operational alignment with open innovation search approaches has been proposed in the context of developing countries. Using the moderation mediation model, this study also investigates the underlying mechanism of organizational capabilities. The current study collected 288 Indonesian Small and Medium-Sized Enterprises (SMEs) responses to examine the interaction between IT use intensity, centralized and decentralized open innovation search approaches, and organizational capabilities leading to innovative performance. To validate the postulated associations, the data were analyzed using SmartPLS v.4. The findings indicate that centralized and decentralized open innovation search approaches have distinct effects on the organizational capabilities that contribute to developing and selling new products and patents and attaining competitive advantage. The findings also revealed the significance of IT utilization intensity in contingently accelerating the positive impact of open innovation search approaches on developing and enhancing organizational capabilities to engage in innovative practices. In addition, the current study is a valuable addition to the existing literature on innovation and IT use intensity, as it presents their interactions and the resulting innovative organizational outcomes regarding new patents and product developments/sales.

Keywords: Open Innovation Search Approach; Organizational Capabilities; IT Use Intensity; Innovative Performance; SmartPLS v.4

Citation (APA): Ratna, S. (2022). An Interactive Effect of Open Innovation Search Approaches and its Use Intensity to Predict Organizational Capabilities and Performance. *International Journal of eBusiness and eGovernment Studies, 14 (4), 197-218. doi:10.34111/ijebeg.202214209*

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-218) **Doi:** 10.34109/ijebeg. 202214209

1. INTRODUCTION

Organizations that seek distinct ideologies and innovation orientation are most likely to engage in an open innovation search strategy by actively advancing and accumulating knowledge beyond their institutional boundaries (Guertler & Sick, 2021). Several scholars have previously emphasized the significance of open innovation search in an organizational setting (Appleyard & Chesbrough, 2017). However, practitioners still encounter limitations and obstacles when implementing open innovation search to achieve the innovative organizational outcomes desired. An organization could, for instance, establish specialized and dedicated organizational entities to conduct the open innovation search using a centralized approach (Holloway et al., 2021). Organizations can also implement a decentralized open innovation search strategy while empowering their existing employees in various functional units to conduct routine research and development by searching for external sources of knowledge (Hashimy et al., 2021).

Despite this investigation of centralized and decentralized open innovation search strategies, their significance in reward and efficacy under various conditions is ambiguous in the existing literature. Understanding the function and adoption of information technology is essential for greater clarity (Guertler & Sick, 2021). IT tools such as enterprise applications, knowledge management tools, etc., support open innovation search to extract firms' internal and external knowledge to share quickly and easily with employees (Lioukas et al., 2016; Ravichandran et al., 2017). Prior research has focused on academic alignment and organizational strategy for such open innovation searches (Chaurasia et al., 2020; Queiroz, 2017). However, little attention has been paid to how available innovation search approaches influence organizational capabilities and the resulting innovative performance. Therefore, the present study aims to fill this void in the literature by providing a unified framework regarding the impact of centralized and decentralized open innovation search approaches on the development of organizational capabilities.

These organizational capabilities, in organizational culture and innovative capacities, are regarded as significant intangible assets that determine organizational performance (Latifi et al., 2021). In addition, organizational capabilities in opportunity recognition and learning are directly correlated with efficiency growth and revenue growth. Therefore, They are essential for an organization's innovative long-term development (Cheah & Yuen-Ping, 2021). In addition, it is predicated on the fact that an organization's culture, knowledge sharing, and openness produce a cooperative environment within that organization and its associated networks, which leads to valuable organizational outcomes. In addition to examining the direct effect of organizational capabilities on innovative performance, the current study investigates how organizational capabilities transform the centralized and decentralized open innovation search approaches into firms' innovative performances.

In addition, the existing literature raises several concerns concerning the operational alignment of information communication technology with open innovation search approaches to produce valuable organizational outcomes as a long-term strategic approach. Simultaneously, the challenges encountered by the open innovation search in IT use and adoption are explored (Guertler & Sick, 2020). Prior studies on alignment have primarily focused on the strategic alignment domain while ignoring the operational alignment that must be thoroughly investigated in open innovation search approaches (Mosteanu & Faccia, 2021). Specifically, the intensity of IT use has not been examined in conjunction with open innovation search to develop and improve extant organizational capabilities. Based on the open innovation literature and the alignment perspective, the current study theorizes that integrating the open innovation search approach and IT utilization intensity can result in high organizational capabilities. This can further contribute to the innovative performances of organizations.

In addition, this investigation was conducted among Small and Medium-Sized Enterprises (SMEs) in Indonesia. Since COVID-19, businesses, including SMEs, have confronted numerous obstacles in balancing environmental, social, and economic factors (Rashid & Ratten, 2021). Besides, SMEs impart a significant economic contribution to the economy all over the globe (Pedauga et al., 2022). Similarly, small and medium-sized enterprises in Indonesia are regarded as the economic backbone (Hidayati & Rachman, 2021). However, according to information obtained in 2021 from the Indonesian Statistics Center, a government agency, approximately 11.25 percent of SMEs could not survive the pandemic. The country has suffered a significant economic loss, which must be recovered. In the post-codified era, it is crucial to investigate the presence of SMEs, the prevailing conditions in the country, and the factors influencing their innovative performance (Rumanti et al., 2022).

In addition, the fourth industrial revolution illustrates numerous open innovation activities by SMBs in terms of competition and consumer demand (Ragazou et al., 2022). On the other hand, for SMEs to innovate where knowledge can be obtained internally or externally, certain strategies are required (Srisathan et al., 2022). Simultaneously, the current research focuses on the centralized and decentralized open innovation search approaches utilized by SMEs in Indonesia to evaluate their innovative performance. Consequently, based on the operational alignment of open innovation search approaches and IT use intensity, the purpose of the present study is to:

- Examine the direct and indirect impact of centralized and decentralized open innovation search approaches on firms' innovative performance via an underlying mechanism of organizational capabilities
- Examine the impact of organizational capabilities on innovative performance.
- Examine the contingent impact of IT use intensity between the relationship of centralized and decentralized open innovation search approaches with organizational capabilities.

This study improves our understanding of centralized and decentralized open innovation search perspectives by integrating theoretical mechanisms and empirical justification regarding organizations' use of external knowledge and the development of internal capabilities to improve innovative performances. It also contributes to the literature on innovation and IT by highlighting the contingent effect of IT use intensity on enhancing the significance of open innovation search strategies with variable innovation outcomes.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1 Open Innovation Search Approaches and Organizations' Innovative Performance

Developing a specialized unit within the research and development department to conduct a dedicated search of various external sources is known as a centralized open innovation search approach (Ebersberger et al., 2021). By utilizing this strategy, organizations investigate various external sources for their benefit. In addition, the centralized open innovation search approach assists organizations in developing new fields and extending existing domains to create or adapt new services and products (Hervas-Oliver et al., 2021). It also enabled businesses to acquire a competitive advantage based on inventiveness (Seo & Park, 2021). In addition, by utilizing internal sources, organizations foster a culture of knowledge sharing and ideation, which increases the likelihood of locating a nominal and effective repository by fostering innovative performance. Moreover, organizations can modify, diversify, and develop to meet market demands by offering new services and products through a centralized open innovation search strategy (Yulianto, 2021).

A decentralized open innovation search approach is characterized by simultaneously facilitating internal organizational collaboration and empowering external knowledge sources through routine research and development work (Grimaldi et al., 2021). The potential number of external knowledge recipients and interaction with the external environment is the most significant aspect of this decentralized open innovation search approach (Obradovi et al., 2021). In addition, the potential extent of external collaborations enhances the internal capacity of organizations to innovate new products and services. The ties and efforts of external collaboration aid organizations in accelerating the sales of new products and patents, resulting in high revenue (Walter et al., 2021). Moreover, it is hypothesized that highly empowered employees at various functional unit levels are more comfortable interacting with the external environment and exploring potential opportunities for product innovations and patent development, resulting in improved organizational performance. In light of the importance of internal alignment and external empowerment of employees to generate new ideas, the current study hypothesizes that:

H1: *There is a positive influence of a) centralized and b) decentralized open innovation search approaches on organizations' innovative performance.*

2.2 Open Innovation Search Approaches and Organizational Capabilities

The centralized approach to open innovation search enables organizations to institutionalize a structure that ensures inward knowledge flows and fluid communication. This collaborative effort can result in an innovative endeavor. In a centralized open innovation search strategy, an organization can readily connect with various knowledge sources and improve the technological expertise of its human resources, thereby accelerating innovation (Holloway et al., 2021). (Scaliza et al., 2022) The researchers have previously asserted the importance of the dedicated task force in facilitating inward knowledge transfer that leads to positive organizational outcomes. In addition, the interaction of organizational experts with external sources combines actual knowledge and generates new concepts (Jun & Kim, 2022). Therefore, this centralized open innovation search strategy can be linked to the organization's innovative performance.

In addition to utilizing a decentralized open innovation search strategy, organizations enable their employees to attend various seminars, conferences, and technological development fairs to acquire new ideas. Further, employees are encouraged to participate in experimental and exploratory initiatives (Yulianto, 2021). Based on external collaborations, knowledge sharing, and knowledge integration, organizations help their employees become more efficient at generating new ideas at various functional unit levels (Dall-Orsoletta et al., 2021). This employee empowerment encourages them to participate in such activities, enhancing the organization's overall performance. (Chen & Liu, 2018) The employees are also encouraged to partake in innovation activities for the benefit of the organizations. Consequently, it is postulated that;

H2: *There is a positive influence of a) centralized and b) decentralized open innovation search approaches on organizational capabilities.*

2.3 Organizational Capabilities and Innovative Performance

Organizational capabilities such as organizational learning and culture, opportunity recognition, and innovativeness enable employees, managers, and owners to engage in learning and scanning activities essential for improving an organization's performance (Bezerra et al., 2020). In addition, Rehman et al. (2019) found that organizations with high learning and opportunity recognition capabilities utilize their resources more efficiently and effectively to investigate and evaluate business opportunities. Moreover, organizational capabilities increase the businesses' adaptability to align with internal and external sources to generate new business-growing ideas (Kabrilyants et al., 2021). Based on integrating capabilities, organizations can accomplish internal cooperation that fosters a culture of knowledge sharing and openness, thereby enhancing the learning abilities of employees (Lam et al., 2021). In turn, these learning capabilities improve an organization's capacity to deal with a variety of challenges and gain a competitive advantage based on cost-effectiveness and differentiation (Azeem et al., 2021), as well

as its capacity to offer new products based on research and development (Engelsberger et al., 2022). Consequently, based on the preceding arguments, it is hypothesized that;

H3: *There is a positive influence of organizational capabilities on organizations' innovative performance.*

2.4 Organizational Capabilities as Mediator

Research indicates that highly committed employees with sourcing expertise and good research skills at various organizational levels continuously scan opportunities available in the external environment and extract new scientific knowledge to extract organizational benefits. Considering this conceptualization, Cui et al. (2022) "defined the centralized open innovation search approach as the strategy in which an organization's R&D department has a specialized sourcing unit to search external sources for knowledge." This specialized sourcing unit focuses on brokers' aggressive knowledge fusion, technological development, and the development of external connections that result in inventiveness (Liang & Liu, 2018). Afsharian et al. (2002) found that centralized approaches in organizations enhance and consolidate specialists' relevant abilities and skills. These organizational capabilities can be utilized for the long-term growth of the organization. This indicates that organizational capabilities can serve as a link between the centralized open innovation source approach and the innovative performance of organizations.

In contrast, decentralized open innovation search strategies do not require specialized procurement units (Yulianto, 2021). Employees instead conduct external knowledge search activities at the level of various functional divisions (Dall-Orsoletta et al., 2021). This, in turn, enables employees to communicate with the external environment, engage in knowledge exchange with experts outside their organizations, and identify potential opportunities for innovation (Ragazou et al., 2022). Consequently, the decentralized open innovation search strategy can be utilized further by developing organizational capabilities, such as learning, creative culture, knowledge sharing, etc. These capabilities can further transform an organization's strategic, innovative performance. Consequently, we hypothesize that;

H4: *Organizational capabilities mediate the association of a) centralized and b) decentralized open innovation search approach with organizations' innovative performance.*

2.5 IT Use Intensity as a Moderator

Recognizing the importance of information and communication technology in the business world, the current study examines its contingent role in the relationship between centralized and decentralized open innovation search approaches and the innovative performance of organizations. IT tools such as enterprise applications and knowledge management enhance employees' comprehension of external and internal knowledge by

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-218) **Doi:** 10.34109/ijebeg. 202214209

strengthening their relationships with external collaborators to capitalize on innovation opportunities (Shahzad et al., 2021). According to research, electronic collaborative workplace and innovation process management software stimulate organizational employees to engage in interlinked processes and inter-organizational partnerships, resulting in a culture of information sharing (Ngah et al., 2022). (Maizza et al., 2019) This information-sharing culture, in which employees have access to knowledge and communicate their knowledge internally and externally, results in positive organizational outcomes.

Despite the pervasive acceptance of the decentralized open innovation search approach, its operational alignment in IT use intensity has received the least attention. On the other hand, IT use intensity has been strongly correlated with positive organizational outcomes based on these sophisticated IT sourcing tools, such as data analytics and data mining, which have facilitated global business (Vanneste & Gulati, 2022). Simultaneously, IT intensity for external information transfers has been associated with a higher knowledge discovery rate, particularly in researching and developing new domains (Siagian et al., 2022). Consequently, the operational alignment of centralized and decentralized open innovation search strategies with IT use intensity for inward and external knowledge flow extracts the innovative benefits of both strategies. In addition, by utilizing this operational alignment at various functional units, employees can be aided in using IT tools for collaboration and knowledge exchange while performing their fundamental responsibilities, particularly those associated with social development. Consequently, based on the preceding argument and theoretical alignment, the current analysis hypothesizes that;

H5: *IT used intensity moderate the association of a) centralized and b) decentralized open innovation search approach with organizational capabilities.*

2.6 Research Model

Figure 1 presents this study's theoretical framework based on the purposive literature review and operational alignment of open innovation search approaches, organizational capabilities, and IT use intensity.

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-218) **Doi:** 10.34109/ijebeg. 202214209

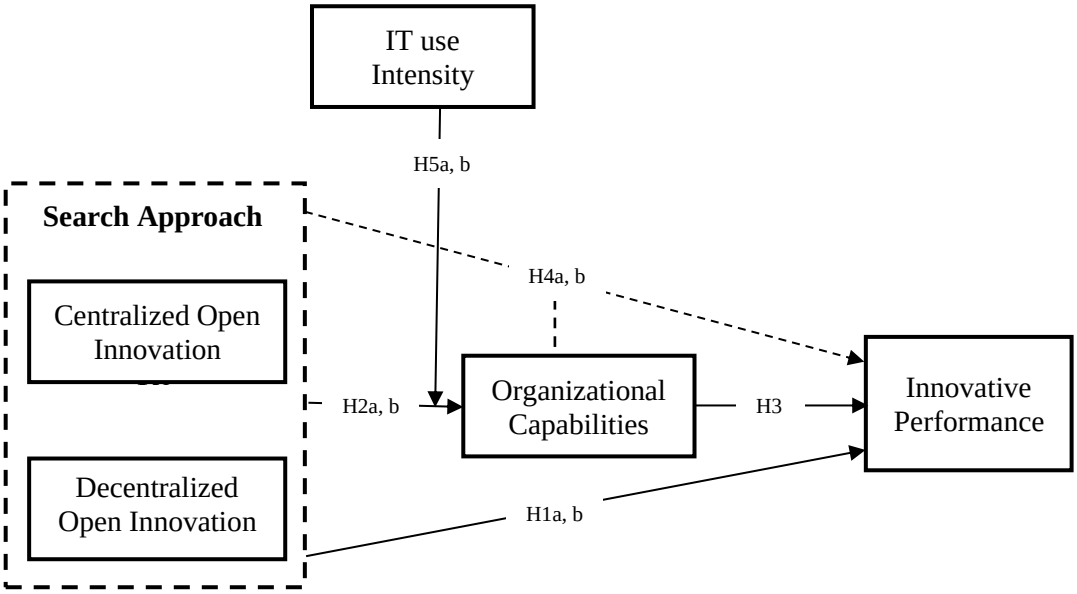


Figure 1. Theoretical Framework of the Study

3. RESEARCH METHODOLOGY

3.1 Sample and Data Collection

For the current investigation, data collection occurred in two distinct phases. The first pertains to the pilot study used to assess the reliability and validity of the measures. For this purpose, questionnaires were randomly distributed to fifty SME firms listed on the Indonesian Stock Exchange. After obtaining the responses from the selected SMEs, we made several modifications to the questionnaire based on the need to correct and modify certain questions. This enhancement was essential for respondents to comprehend the survey questionnaire better. In addition, the current study population consisted of all Indonesian Stock Exchange-listed companies. The primary criterion for selecting the SMEs was their use of information and communication technology, which was evaluated by administering a series of screening questions before distributing the survey questionnaire. In addition, we utilized a technique of purposive sampling (Andrade, 2021), selecting the SMEs based on preferable populations in consideration of time and cost savings for the researchers.

In addition, following Hair et al. (2010), we selected a sample size 10 times greater than the total number of elements on the survey questionnaire (i.e., 27 x 10 = 270). In addition, most responses were collected from SME proprietors or managing directors. The data collection process began in early 2022 and collected 310 responses from 430 distributed survey questionnaires for a 73% response rate. In addition, before utilizing software for analysis, a thorough screening of the questionnaires was conducted, during which the authors determined that 22 questionnaires had either missing values or

unengaged responses; consequently, they were excluded from the analysis, resulting in a valid data set of 288 responses. In addition, the ages of the SMEs ranged from 1 to 39 years, with a mean of 22 and a standard deviation of 7. The capacity of the SMEs ranged from 5 to 73 employees, with a mean of 40 and a standard deviation of 19. The SME industries include but are not limited to manufacturing, retail, wholesale, pharmaceuticals, apparel, footwear, commercial machinery equipment, etc.

3.2 Survey Instrument

A 27-item survey questionnaire was distributed to the SMEs to collect data. Table 1 contains a listing of all survey questionnaire measures. To measure the centralization and decentralization of open innovation search methods and intensity of IT, five and eight items, respectively, were adapted from Cui et al. (2022) were used to evaluate the centralization and decentralization of open innovation search methods. Utilizing seven items adapted from Latifi et al. (2021), organizational capabilities were measured. Each item was evaluated on a seven-point Likert scale extending from 1 = Never to 7 = Always. To assess the innovative performance of the SMBs, objective data based on the sales of new products and the issuance of new patents were utilized. Following the guidelines Tsai (2009) provided, the sales of newly introduced products were measured based on their sales over the past year. Following the recommendations of Ahuja and Katila (2001), the patents granted by SMEs in the last five years were regarded as new patents as a measure of firms' innovative performance.

4. DATA ANALYSIS AND RESULTS

4.1 Measurement Model

SmartPLS v.4 software employing Structural Equation Modelling (SEM) was used for analysis. This simulation analysis revealed that SMEs' size and age significantly impacted their innovative performance; consequently, both demographic factors were controlled for in the subsequent analysis. In addition, confirmatory factor analysis was conducted in which all factor loadings of items representing each construct were above the criterion value of 0.70, indicating that each measure belonged to its respective construct (Hair et al., 2010; Noor et al., 2010; Noor et al., 2010). The values of "Cronbach's (CA)," "Composite Reliability (CR)," and the Average Variance Extracted (AVE) were calculated concurrently to assess the convergent validity and composite reliability of the study constructs (Henseler et al., 2015; Mansoor, 2020). The results presented in Table 1 indicate that all the measures' validity and reliability were within the specified parameters, i.e., CA > 0.70 and CR > 0.70. AVEs of all latent variables were also greater than 0.50, demonstrating the "convergent validity" of the study constructs (Hartanto et al., 2021; Mansoor et al., 2021).

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) **(pp.** 197-17) **Doi:** 10.34109/ijebeg. 202214209

Table 1. Factor Loadings, Reliability, and Validity

Constructs/Items	FL	AVE	CR	CA
Centralized Open Innovation Search Approach		**0.628**	**0.894**	**0.821**
For your company's open innovation search activities for external partners or knowledge, please rate your extent of conducting the following open innovation search activities;				
COI1: A dedicated and specialized unit does our open innovation search activities.	0.768			
COI2: We have specialized external sourcing staff to drive open innovation search activities in our company.	0.830			
COI3: Our company has assigned specialized external sourcing staff, focusing on external partners and knowledge search activities.	0.822			
COI4: We have centralized external contact points through specialized external sourcing staff.	0.772			
COI5: We take a centralized view of company-wide open innovation search needs and leverage external sourcing staff in a dedicated and specialized unit.	0.769			
Decentralized Open Innovation Search Approach		**0.615**	**0.889**	**0.813**
For your company's open innovation search activities for external partners or knowledge, please rate your extent of conducting the following open innovation search activities;				
DOI1: Employees in various functional units do our open innovation search activities.	0.776			
DOI2: Our employees in various functional units are empowered to drive open innovation search activities in our company.	0.795			
DOI3: Our employees in various functional units have the autonomy to search for a potential partner or useful knowledge externally proactively.	0.769			
DOI4: We have different external contact points in various functional units.	0.793			
DOI5: We take a decentralized view of company-wide open innovation search needs and leverage across various functional units	0.787			
Organizational Capabilities		**0.590**	**0.909**	**0.793**
OC1: Managers encourage employees to think outside the box	0.755			
OC2: Our corporate culture is focused on constant innovation	0.732			
OC3: Our enterprise shows perseverance in turning ideas into reality	0.807			
OC4: Our enterprise can identify new opportunities	0.818			
OC5: Our enterprise aims to create multiple innovations annually	0.771			
OC6: Our enterprise introduces innovations that are completely new to the market	0.773			
OC7: Creating more than one innovation at the same time is common practice in our enterprise	0.713			
Innovative Performance		**0.618**	**0.764**	**0.727**
IP1: New product sales	0.778			
IP2: Number of patents	0.795			
IT Use Intensity		**0.619**	**0.929**	**0.827**
For your company's IT use for open innovation search, please rate your extent of usage of the following IT tools;				
ITUI1: Data mining tools	0.768			
ITUI2: Data analytics	0.798			
ITUI3: Web-based toolkits	0.784			
ITUI4: Open innovation online platforms	0.750			
ITUI5: Innovation process management software	0.806			
ITUI6: Knowledge management tools	0.819			
ITUI7: Enterprise applications	0.777			
ITUI8: Electronic collaborative workplaces	0.791			

Note: FL= Factor loadings AVE=Average Variance Extracted; CR=Composite Reliability; CA= Cronbach's Alpha.

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-17) **Doi:** 10.34109/ijebeg. 202214209

In addition, "the Fornell and Larcker Criterion" was used to establish discriminant validity to overcome the possibility of multicollinearity among the study constructs (Henseler et al., 2015; Mansoor et al., 2022). As researchers (Henseler et al., 2015; Mansoor et al., 2021) indicated in the Fornell-Larcker Criterion, the square roots of the AVEs of constructs should be greater than their intercorrelation with other variables. Table 2 demonstrates that the Fornell and Larcker criterion is satisfied in this study, thereby establishing the discriminant validity of the variables/constructs under investigation.

Table 2. Fornell and Larcker Criterion

Constructs	**1**	**2**	**3**	**4**	**5**
Centralized Open Innovation Search Approach	**0.792**				
Decentralized Open Innovation Search Approach	0.523	**0.784**			
Organizational Capabilities	0.501	0.559	**0.768**		
Innovative Performance	0.498	0.476	0.456	**0.785**	
IT Use Intensity	0.538	0.507	0.398	0.491	**0.786**

"**Note**: The square roots of AVEs of the constructs are shown in bold in diagonal."

Where: COI = Centralized Open Innovation Search Approach; DOI= Decentralized Open Innovation Search Approach; OC= Organizational Capabilities; IP= Innovative Performance; ITUI= IT Use Intensity

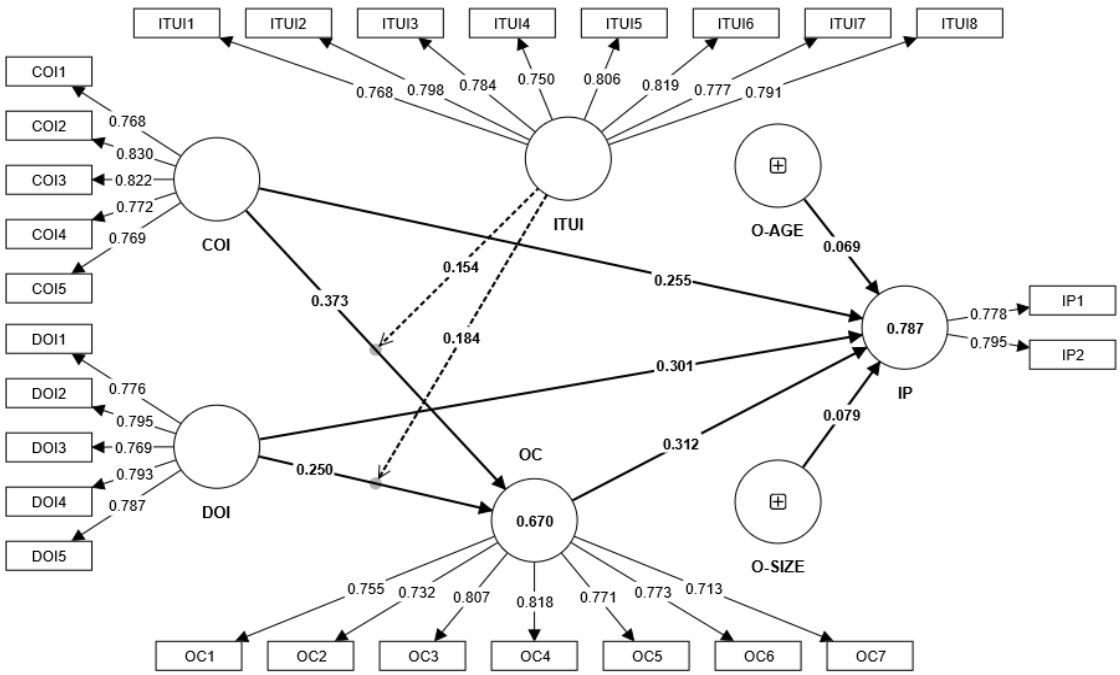


Figure 2. Full Measurement Model

4.2 Structural Model

The structural model in SmartPLS v.4 examined the hypothesized links. For this purpose, "*ß* -coefficient, *p*-value, and *t*-value" were calculated to confirm the proposed relationships. "the Coefficient of Determination (R2)" was also assessed to establish the overall proposed models' fitness. The R2 change of 78.7% in the SMSs innovative performance was revealed based on the direct and indirect influence of all the exogenous, mediating, and moderating variables reflecting a good model fitness of the current study.

4.3 Direct Hypotheses

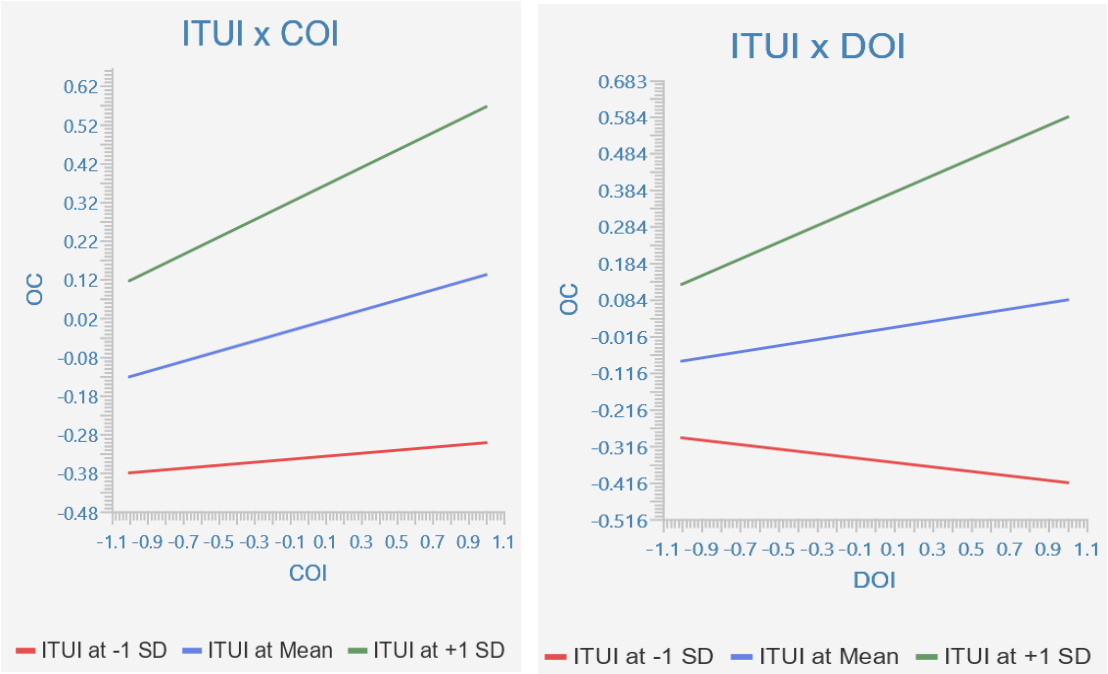
The current study's findings suggest a significant impact of the *centralized open innovation search approach (ß = 0.255**, t = 5.180)* and the *decentralized open innovation search approach (ß = 0.301***, t = 6.823)* on SMEs' *innovative performance.* Similarly, the results revealed a significant positive influence of the centralized open innovation search approach (ß = 0.373***, t = 7.786) and decentralized open innovation search approach (ß = 0.250**, t = 4.811) on SMEs' organizational capabilities. At the same time, SMEs' organizational capabilities were found to be positively associated with their *innovative performance (ß = 0.312***, t = 6.975).* These results support hypotheses *H1 a and b, H2a and b, and H3,* as shown in Figure 2 and Table 3. Additionally, the level of significance is evident in Figure 4.

4.4 Mediations Hypotheses

The study findings also supported the mediation hypotheses H4 a and b. The indirect influence of the *centralized innovation search approach (ß = 0.267***, t = 5.869)* and decentralized *innovation search approach (ß = .291***, t = 6.102)* on SMEs' *innovative performance* via the mediatory role of organizational capabilities was evident by the findings as presented in Table 3.

4.5 Moderation Hypotheses

To test the contingent impact of IT used intensity between the association of *centralized and decentralized open innovation search approaches with organizational capabilities*, the interaction terms, i.e., ITUI*COI and ITUI*DOI, were made by applying the product indicator approach in PLS-SEM v.4 software. The results given in Table 3 depict the significant influence of *ITUI*COI (ß = 0 .154**, t = 3.877)* and *ITUI*DOI (ß = 0 .184**, t = 4.054)* on organizational capabilities. At the same time, R2 for the effect of *centralized and decentralized open innovation search approaches on organizational capabilities* of SMEs in Indonesia increased from 47% to 67% based on the moderating rule of IT used intensity, reflecting an increase of 20% explanatory power of exogenous constructs and organizational capabilities. The moderation results are presented in Figures 3 a and b as plotted graphs.



Figures 3. a and b Interaction Plots of ITUI*COI and ITUI*DOI

Green lines in Figures 3 a and b reflect higher values of IT use intensity with steeper gradients than red lines, which reflect lower IT use intensity while integrating with centralized open innovation search approach and decentralized open innovation search approach to increase their impact on organizational capabilities. These findings further illustrate the significance of various technological tools provided to employees to operationalize their use with centralized and decentralized open innovation approaches to enhance employee capabilities in an organization. These employees' abilities comprise the organizational capabilities essential for innovating new products and services.

Table 3. Hypothesis Testing Results

	Hypotheses	Std. Beta	t-Value	p-values	Supported
H1a	COI→IP	0.255	5.180	0.001	Yes
H1b	DOI →IP	0.301	6.823	0.000	Yes
H2a	COI→OC	0.373	7.786	0.000	Yes
H2b	DOI →OC	0.250	4.811	0.002	Yes
H3	OC→IP	0.312	6.975	0.000	Yes
H4a	COI→OC→IP	0.267	5.869	0.000	Yes
H4b	DOI →OC→IP	0.291	6.102	0.000	Yes
H5a	ITUI*COI→OC	0.154	3.877	0.007	Yes
H5b	ITUI*DOI→OC	0.184	4.054	0.006	Yes

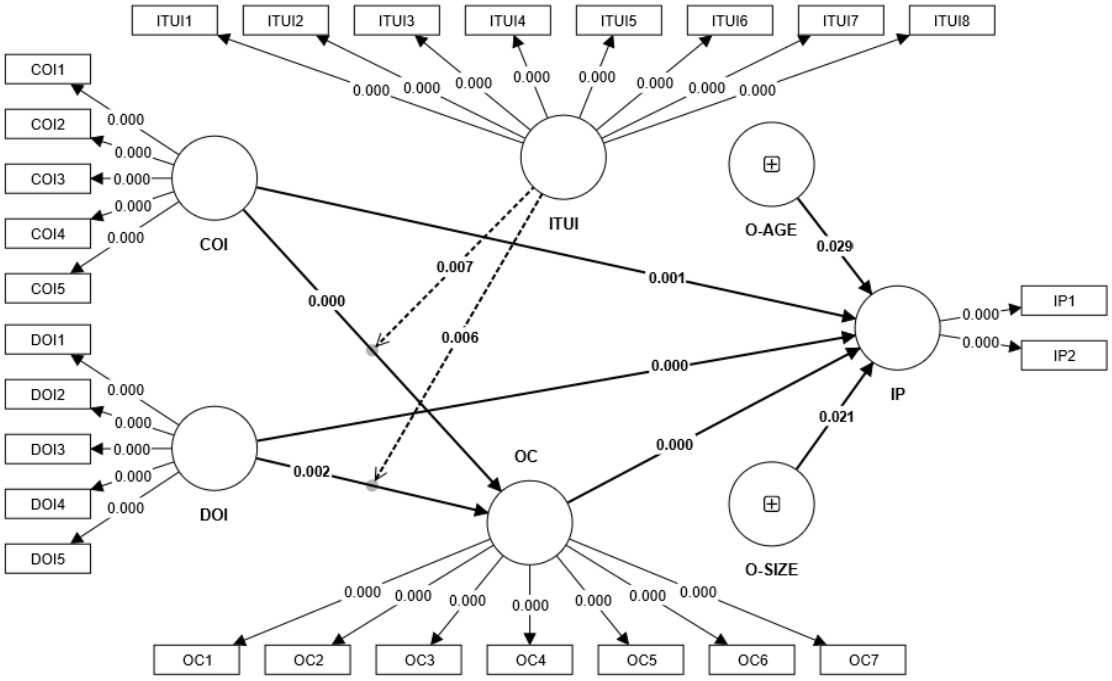


Figure 4. Full Structural Model

5. DISCUSSIONS

5.1 Key Findings

Establishing the operational alignment of information technology and centralized and decentralized open innovation search approaches, this study proposes the underlying mechanism of organizational capabilities for small and medium-sized enterprises (SMEs) in a developing nation to develop and sell new products and patents. The results demonstrated that centralized and decentralized open innovation search approaches significantly affect organizational capabilities. The centralized open innovation search approach had a significantly greater effect on organizational capabilities than the decentralized open innovation search approach. This further demonstrates that when organizations provide their employees with the facilities in the form of training as part of employees' development programs and other important leverage to communicate and collaborate with their peers, their capabilities increase, enhancing organizational capabilities. Enabling employees to communicate internally and externally with experts regarding their designated tasks simultaneously increases their innovative capabilities.

Moreover, the difference in impact size demonstrates that centralized open innovation search approaches are optimal for enhancing organizational capabilities because they primarily depend on employee participation and communication. In addition, these findings are consistent with those of Ebersberger et al. (2021) and Hashimy et al. (2021).

Scholars consider organizational resources and learning capabilities organizational capabilities (Chaurasia et al., 2020; Srisathan et al., 202). They hypothesized the significance of various open innovation approaches in developing and enhancing organizational resources and learning capabilities.

The findings also imply that open innovation search approaches significantly affect organizations' innovative performance. Nevertheless, contrary to the results mentioned above regarding the greater impact of open innovation search approaches on organizational capabilities, we observe the following: A decentralized, open innovation search strategy had a greater impact on the innovative performance of organizations. This further demonstrates that for employees to be innovative in products and services, they require broader networks through which they can access the external environment and profit from experts' opinions to extract new ideas from a larger pool. Therefore, it is advantageous for organizations to enable their employees to freely communicate with the external environment to gather new ideas to obtain a competitive advantage and create new products and services. In addition, the results revealed a significant relationship between organizational capabilities and SME creative performance. This further demonstrates that when organizations develop internal capabilities in learning, resource management, research and development, and resource allocation, they can better offer patents and innovative products and services. These findings are consistent with previous research highlighting the significance of organizational capabilities in business development and productivity (Khattak, 2022; Rashid & Ratten, 2021).

In conclusion, the findings of this study demonstrate for the first time the contingent influence of IT use intensity on the impact of centralized and decentralized open innovation search strategies on organizational capabilities. These findings also suggest that organizations that embrace new technologies and assist their employees in quickly adapting to them by employing centralized and decentralized open innovation search strategies are more effective at developing their employees' capabilities in enhanced learning and idea generation. These findings are associated with previous studies. They asserted the importance of IT intensity in transmitting open innovation search strategies to organizations' innovation pursuits through exploratory and exploitative innovations. These findings can also be related to the work of Rumanti et al. (2022), which demonstrates the significance of various open innovation approaches in determining an organization's capacity to generate new ideas and obtain a competitive advantage. Moreover, in terms of a developing nation, it can be asserted that organizations support their employees on multiple levels and equip them with the necessary information and technology tools for their various work units. They can better utilize these tools and integrate them with the internal and external environment to generate valuable organizational capabilities that result in positive organizational outcomes.

Vol: 14 **No:** 4 **Year:** 2022 **ISSN**: 2146-0744 (Online) (**pp.** 197-218) **Doi:** 10.34109/ijebeg. 202214209

5.2 Theoretical Significance of the Study

The current study combines the literature associated with open innovation search approaches, information and communication technology, and organizational capabilities to improve innovative organizational performance as measured by developing and selling new products and patents. In other words, the current study presents a framework that integrates three distinct organizational strengths, namely IT, capabilities, and open innovation search approaches, to predict innovative performance. Before this study, researchers analyzed the operational alignment of IT and available search approaches to determine organizations' exploitative and explorative innovation pursuits in developed nations. Whereas the current study extends previous research in a developing nation context by examining the contingent impact of IT use intensity on SMEs' organizational capabilities, which contribute to their innovative performance, the current research is limited to the contingent effects of IT use intensity. In addition, the current study evaluated the performance in terms of the development and sale of products and patents, which are the most significant revenue drivers for an organization. In addition, the current study is unique in presenting both the direct and indirect effects of two distinct open innovation search approaches, namely centralized and decentralized, on the innovative performance of SMEs via an underlying mechanism of organizational capabilities. Further determination of these capabilities was based on the employees' capabilities, which depend on the various facilities, leverages, and development programs.

6. PRACTICAL CONTRIBUTION

In addition to its numerous theoretical implications, the current study benefits academics, practitioners, and governments. First, in presenting the significance of centralized and decentralized open innovation search approaches, the findings suggest that managers and practitioners should empower their employees at various strategic unit levels to communicate with the external environment and facilitate their employees' internal execution of existing innovative ideas. Through frequent interactions with experts and professionals outside their organizations, this empowerment enhances the learning capabilities of employees, allowing them to modify existing theories and develop new ones to gain a competitive edge and develop new products and services for the long-term productivity of an organization. In addition, based on the greater influence of the decentralized open innovation search approach on the innovative performance of organizations, employees must be encouraged to attend seminars, webinars, and educational talks organized outside their organizations to acquire new ideas and benefit from the expertise of others. In addition, managers must understand the operational alignment of open innovation search strategies with technological tools. There is a need to integrate and align the organization's available information and communication tools with open innovation search strategies to facilitate a continuous flow of information that benefits organizational productivity over the long term. Developing specialized units to

collect a centralized view of the employees conducting open innovation inquiries at the organizational level can facilitate this. Simultaneously, the results demonstrated the importance of building and enhancing employee capabilities by providing ample opportunities to learn and implement new technologies. For this reason, those in charge of IT infrastructure and IT managers must constantly contact all employees to address their concerns regarding IT adoption and effectively implement open innovation search approaches. Concurrently, the relevant employees must be equipped with the necessary IT skills and resources, such as data mining, to be more vigilant while conducting their routine organizational duties. This can be accomplished during the recruitment process and through continuous provision of training in order to establish a network of collaborative, open, and adaptable employees for the organization's benefit.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

In addition to recognizing the substantial contribution of the present study in terms of operational alignment of open innovation search approaches and IT use, the present study has a few limitations. First, only small and medium-sized enterprises were considered for data collection purposes. For more generalized results, future research must focus on larger organizations, particularly manufacturing, agriculture, and industrial sectors. Second, the current study has only considered the operational congruence of IT with the open search approaches. In contrast, other external approaches, such as the organizations' centrality and network density, can also significantly impact their innovative performance. Therefore, future researchers must consider such external approaches to provide valuable insights regarding SME innovative performance predictors in developing nations. In addition to using self-reported measures for data collection, the current study employed a cross-sectional research design. In contrast, future research can engage time-lagged or longitudinal studies by collecting data from multiple sources, such as annual reports and published data sources, and by considering a comprehensive inventory of public sector companies to extract more valuable results.

REFERENCES

Afsharian, M., Ahn, H., & Harms, S. G. (2021). A Review of DEA Approaches Applying a Common Set of Weights: The Perspective of Centralized Management. *European Journal of Operational Research*, 294(1), 3-15. doi: https://doi.org/10.1016/j.ejor.2021.01.001

Ahuja, G., & Katila, R. (2001). Technological Acquisitions and the Innovation Performance of Acquiring Firms: A Longitudinal Study. *Strategic Management Journal,* 22(3), 197-220. doi: https://doi.org/10.1002/smj.157

Andrade, C. (2021). The Inconvenient Truth About Convenience and Purposive Samples. *Indian Journal of Psychological Medicine,* 43(1), 86-88. doi: https://doi.org/10.1177/0253717620977000

Appleyard, M. M., & Chesbrough, H. W. (2017). The Dynamics of Open Strategy: from Adoption to Reversion. *Long Range Planning,* 50(3), 310-321. doi: https://doi.org/10.1016/j.lrp.2016.07.004

Azeem, M., Ahmed, M., Haider, S., & Sajjad, M. (2021). Expanding Competitive Advantage Through Organizational Culture, Knowledge Sharing and Organizational Innovation. *Technology in Society,* 66, 101635. doi: https://doi.org/10.1016/j.techsoc.2021.101635

Bezerra, M. C. D. C., Gohr, C. F., & Morioka, S. N. (2020). Organizational Capabilities Towards Corporate Sustainability Benefits: A Systematic Literature Review and an Integrative Framework Proposal. *Journal of Cleaner Production,* 247, 119114. doi: https://doi.org/10.1016/j.jclepro.2019.119114

Chaurasia, S. S., Kaul, N., Yadav, B., & Shukla, D. (2020). Open Innovation for Sustainability Through Creating Shared Value-Role of Knowledge Management System, Openness and Organizational Structure. *Journal of Knowledge Management,* 24(10), 2491-2511. doi: https://doi.org/10.1108/JKM-04-2020-0319

Cheah, S. L.-Y., & Yuen-Ping, H. (2021). Commercialization Performance of Outbound Open Innovation Projects in Public Research Organizations: The Roles of Innovation Potential and Organizational Capabilities. *Industrial Marketing Management,* 94, 229-241. doi: https://doi.org/10.1016/j.indmarman.2021.02.012

Chen, Q., & Liu, Z. (2018). How Does Openness to Innovation Drive Organizational Ambidexterity? The Mediating Role of Organizational Learning Goal Orientation. *IEEE Transactions on Engineering Management,* 66(2), 156-169. doi: https://doi.org/10.1109/TEM.2018.2834505

Cui, T., Tong, Y., & Tan, C. H. (2022). Open Innovation and Information Technology Use: Towards an Operational Alignment View. *Information Systems Journal,* 32(5), 932-972. doi: https://doi.org/10.1111/isj.12375

Dall-Orsoletta, A., Romero, F., & Ferreira, P. (2022). Open and Collaborative Innovation for the Energy Transition: An Exploratory Study. *Technology in Society,* 69, 101955. doi: https://doi.org/10.1016/j.techsoc.2022.101955

Ebersberger, B., Galia, F., Laursen, K., & Salter, A. (2021). Inbound Open Innovation and Innovation Performance: A Robustness Study. *Research Policy*, 50(7), 104271. doi: https://doi.org/10.1016/j.respol.2021.104271

Engelsberger, A., Halvorsen, B., Cavanagh, J., & Bartram, T. (2022). Human Resources Management and Open Innovation: The Role of Open Innovation Mindset. *Asia Pacific Journal of Human Resources,* 60(1), 194-215. doi: https://doi.org/10.1111/1744-7941.12281

Gómez, J., Salazar, I., & Vargas, P. (2017). Does Information Technology Improve Open Innovation Performance? An Examination of Manufacturers in Spain. *Information Systems Research,* 28(3), 661-675. doi: https://doi.org/10.1287/isre.2017.0705

Grimaldi, M., Greco, M., & Cricelli, L. (2021). A Framework of Intellectual Property Protection Strategies and Open Innovation. *Journal of Business Research*, 123, 156-164. doi: https://doi.org/10.1016/j.jbusres.2020.09.043

Guertler, M. R., & Sick, N. (2021). Exploring the Enabling Effects of Project Management for SMEs in Adopting Open Innovation–A Framework for Partner Search and Selection in Open Innovation Projects. *International Journal of Project Management*, 39(2), 102-114. doi: https://doi.org/10.1016/j.ijproman.2020.06.007

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis – A Global Perspective (7 ed.).* Upper Saddle River, NJ: Pearson Prentice Hall.

Hartanto, D., Agussani, A., & Dalle, J. (2021). Antecedents of Public Trust in Government During the COVID-19 Pandemic in Indonesia: Mediation of Perceived Religious Values. *Journal of Ethnic and Cultural Studies*, 8(4), 321-341. doi: https://doi.org/10.29333/ejecs/975

Hashimy, L., Treiblmaier, H., & Jain, G. (2021). Distributed Ledger Technology as a Catalyst for Open Innovation Adoption Among Small and Medium-Sized Enterprises. *The Journal of High Technology Management Research*, 32(1), 100405. doi: https://doi.org/10.1016/j.hitech.2021.100405

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling. *Journal of the Academy of Marketing Science,* 43(1), 115-135. doi: https://doi.org/10.1007/s11747-014-0403-8

Hervas-Oliver, J.-L., Sempere-Ripoll, F., & Boronat-Moll, C. (2021). Technological Innovation Typologies and Open Innovation in Smes: Beyond Internal and External Sources of Knowledge. *Technological Forecasting and Social Change,* 162, 120338. doi: https://doi.org/10.1016/j.techfore.2020.120338

Hidayati, R., & Rachman, N. M. (2021). Indonesian Government Policy and SMEs Business Strategy During the Covid-19 Pandemic. *Niagawan*, 10(1), 1-9. doi: https://doi.org/10.24114/niaga.v10i1.21813

Holloway, C., Morgado Ramirez, D. Z., Bhatnagar, T., Oldfrey, B., Morjaria, P., Moulic, S. G., . . . Massie, J. (2021). A Review of Innovation Strategies and Processes to Improve Access to AT: Looking Ahead to Open Innovation Ecosystems. *Assistive Technology,* 33(sup1), 68-86. doi: https://doi.org/10.1080/10400435.2021.1970653

Jun, Y., & Kim, K. (2022). Developing an Open Innovation Attitude Assessment Framework for Organizations: Focusing on Open Innovation Role Perspective and Locus of Activity. *Behavioral Sciences,* 12(2), 46. doi: https://doi.org/10.3390/bs12020046

Kabrilyants, R., Obeidat, B., Alshurideh, M., & Masadeh, R. (2021). The Role of Organizational Capabilities on E-Business Successful Implementation.

International Journal of Data and Network Science, 5(3), 417-432. doi: https://doi.org/10.5267/j.ijdns.2021.5.002

Khattak, A. (2022). Hegemony of Digital Platforms, Innovation Culture, and E-Commerce Marketing Capabilities: The Innovation Performance Perspective. *Sustainability*, 14(1), 463. doi: https://doi.org/10.3390/su14010463

Lam, L., Nguyen, P., Le, N., & Tran, K. (2021). The Relation Among Organizational Culture, Knowledge Management, and Innovation Capability: Its Implication for Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity,* 7(1), 66. doi: https://doi.org/10.3390/joitmc7010066

Latifi, M.-A., Nikou, S., & Bouwman, H. (2021). Business Model Innovation and Firm Performance: Exploring Causal Mechanisms in SMEs. *Technovation*, 107, 102274. doi: https://doi.org/10.1016/j.technovation.2021.102274

Liang, X., & Liu, A. M. (2018). The Evolution of Government Sponsored Collaboration Network and its Impact on Innovation: A Bibliometric Analysis in the Chinese Solar PV Sector. *Research Policy*, 47(7), 1295-1308. doi: https://doi.org/10.1016/j.respol.2018.04.012

Lioukas, C. S., Reuer, J. J., & Zollo, M. (2016). Effects of Information Technology Capabilities on Strategic Alliances: Implications for the Resource-Based View. *Journal of Management Studies,* 53(2), 161-183. doi: https://doi.org/10.1111/joms.12179

Maizza, A., Fait, M., Scorrano, P., & Iazzi, A. (2019). How Knowledge Sharing Culture Can Become a Facilitator of the Sustainable Development in the Agrifood Sector. *Sustainability*, 11(4), 952. doi: https://doi.org/10.3390/su11040952

Mansoor, M. (2021). Citizens' Trust in Government as a Function of Good Governance and Government Agency's Provision of Quality Information on Social Media During COVID-19. *Government Information Quarterly*, 101597. doi: https://doi.org/10.1016/j.giq.2021.101597

Mansoor, M., Awan, T. M., & Paracha, O. S. (2021). Predicting Pro-environmental Behaviors of Green Electronic Appliances' Users. *International Journal of Business and Economic Affairs*, 6(4), 175-186. Retrieved from http://ijbea.com/ojs/index.php/ijbea/article/view/221

Mansoor, M., Saeed, A., Rustandi Kartawinata, B., & Naqi Khan, M. K. (2022). Derivers of Green Buying Behavior for Organic Skincare Products Through an Interplay of Green Brand Evaluation and Green Advertisement. *Journal of Global Fashion Marketing,* 1-16. doi: https://doi.org/10.1080/20932685.2022.2085597

Mosteanu, N. R., & Faccia, A. (2021). Fintech Frontiers in Quantum Computing, Fractals, and Blockchain Distributed Ledger: Paradigm Shifts and Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(1), 19. doi: https://doi.org/10.3390/joitmc7010019

Ngah, R., Azman, N. A., & Khalique, M. (2022). The Impact of Innovation, Organizational, Technological Capital on Innovation Performance of SMEs: The

Mediating Effect of Innovative Intelligence. *International Journal of Business and Society,* 23(1), 427-443. doi: https://doi.org/10.33736/ijbs.4623.2022

Noor, U., Mansoor, M., & Rabbani, S. (2021). Brand Hate and Retaliation in Muslim Consumers: Does Offensive Advertising Matter? *Journal of Islamic Marketing,* 13(6), 1395-1413. doi: https://doi.org/10.1108/JIMA-10-2020-0316

Obradović, T., Vlačić, B., & Dabić, M. (2021). Open Innovation in the Manufacturing Industry: A Review and Research Agenda. *Technovation*, 102, 102221. doi: https://doi.org/10.1016/j.technovation.2021.102221

Pedauga, L., Sáez, F., & Delgado-Márquez, B. L. (2022). Macroeconomic lockdown and SMEs: The Impact of the COVID-19 Pandemic in Spain. *Small Business Economics,* 58(2), 665-688. doi: https://doi.org/10.1007/s11187-021-00476-7

Queiroz, M. (2017). Mixed Results in Strategic IT Alignment Research: A Synthesis and Empirical Study. *European Journal of Information Systems*, 26(1), 21-36. doi: https://doi.org/10.1057/s41303-016-0024-z

Ragazou, K., Passas, I., Garefalakis, A., & Dimou, I. (2022). Investigating the Research Trends on Strategic Ambidexterity, Agility, and Open Innovation in SMEs: Perceptions from Bibliometric Analysis. *Journal of Open Innovation: Technology, Market, and Complexity,* 8(3), 118. doi: https://doi.org/10.3390/joitmc8030118

Rashid, S., & Ratten, V. (2021). Entrepreneurial Ecosystems During COVID-19: The Survival of Small Businesses Using Dynamic Capabilities. *World Journal of Entrepreneurship, Management and Sustainable Development*, 17(3), 457-476. doi: https://doi.org/10.1108/WJEMSD-09-2020-0110

Ravichandran, T., Han, S., & Mithas, S. (2017). Mitigating Diminishing Returns to R&D: The Role of Information Technology in Innovation. *Information Systems Research,* 28(4), 812-827. doi: https://doi.org/10.1287/isre.2017.0717

Rehman, S.-U., Mohamed, R., & Ayoup, H. (2019). The Mediating Role of Organizational Capabilities between Organizational Performance and its Determinants. *Journal of Global Entrepreneurship Research*, 9(1), 1-23. doi: https://doi.org/10.1186/s40497-019-0155-5

Rumanti, A. A., Rizana, A. F., Septiningrum, L., Reynaldo, R., & Isnaini, M. M. r. (2022). Innovation Capability and Open Innovation for Small and Medium Enterprises (SMEs) Performance: Response in Dealing with the COVID-19 Pandemic. *Sustainability*, 14(10), 5874. doi: https://doi.org/10.3390/su14105874

Scaliza, J. A. A., Jugend, D., Jabbour, C. J. C., Latan, H., Armellini, F., Twigg, D., & Andrade, D. F. (2022). Relationships Among Organizational Culture, Open Innovation, Innovative Ecosystems, and Performance of Firms: Evidence from an Emerging Economy Context. *Journal of Business Research*, 140, 264-279. doi: https://doi.org/10.1016/j.jbusres.2021.10.065

Seo, R., & Park, J.-H. (2022). When is Interorganizational Learning Beneficial for Inbound Open Innovation of Ventures? A Contingent Role of Entrepreneurial

Orientation. *Technovation*, 116, 102514. doi: https://doi.org/10.1016/j.technovation.2022.102514

Shahzad, M., Qu, Y., Zafar, A. U., & Appolloni, A. (2021). Does the Interaction between the Knowledge Management Process and Sustainable Development Practices Boost Corporate Green Innovation? *Business Strategy and the Environment,* 30(8), 4206-4222. doi: https://doi.org/10.1002/bse.2865

Siagian, H., Tarigan, Z., Basana, S., & Basuki, R. (2022). The Effect of Perceived Security, Perceived Ease of Use, and Perceived Usefulness on Consumer Behavioral Intention Through Trust in Digital Payment Platform. *International Journal of Data and Network Science,* 6(3), 861-874. doi: https://doi.org/10.5267/j.ijdns.2022.2.010

Srisathan, W. A., Ketkaew, C., Jitjak, W., Ngiwphrom, S., & Naruetharadhol, P. (2022). Open Innovation as a Strategy for Collaboration-Based Business Model Innovation: The Moderating Effect Among Multigenerational Entrepreneurs. *PloS One,* 17(6), e0265025. doi: https://doi.org/10.1371/journal.pone.0265025

Tsai, K.-H. (2009). Collaborative Networks and Product Innovation Performance: Toward a Contingency Perspective. *Research Policy,* 38(5), 765-778. doi: https://doi.org/10.1016/j.respol.2008.12.012

Vanneste, B. S., & Gulati, R. (2022). Generalized Trust, External Sourcing, and Firm Performance in Economic Downturns. *Organization Science,* 33(4), 1599-1619. doi: https://doi.org/10.1287/orsc.2021.1500

Walter, C. E., Polónia, D. F., Au-Yong-Oliveira, M., Miranda Veloso, C., Santos Leite, R. Â., & Aragão, I. (2021). Drivers of Innovation Capacity and Consequences for Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 140. doi: https://doi.org/10.3390/joitmc7020140

Yulianto, E. (2021). The Role of Inbound and Outbound Open Innovation on Firm Performance in Environmental Turbulence Era: Mediating of Product and Marketing Innovation. *Management Science Letters,* 11(9), 2347-2358. doi: https://doi.org/10.5267/j.msl.2021.5.006