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# How the Innovation Climate and Open Innovation Practices Contribute to Firm Innovativeness in Small- and Medium-Scale Enterprises? An Empirical Analysis

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**Abstract**

Open innovation has emerged as a crucial strategic element for enhancing the efficiency and commercialization of innovation among large companies. However, the potential applicability of this concept to small- and medium-scale enterprises (SMEs) in Indonesia, particularly those based on digital technology, remains relevant. Although research on open innovation for SMEs has yielded important insights, it is relatively limited in scope, with a focus on inbound innovation activities and little consideration for medium- or small-scale enterprises, even though they are often seen as radical innovators in their fields. To address this gap, it is necessary to examine the potential of SMEs in the process of business innovation through digital platforms, with special attention given to their better specialization capabilities than larger companies. This specialization is more profitable when the market is open to innovative activities and when innovation is supported by SME owners–managers who create an innovation climate. Empirical analysis is required to answer the key research questions. The first question pertains to the extent of SME innovativeness, particularly in terms of their capacity to utilize internal, external, and hybrid knowledge sources in open innovation. The second question pertains to the extent to which the innovation climate supports SME owner–manager efforts to find creative ways to exploit and explore innovation sources. The ultimate goal of this study is to develop an extensive framework that elucidates the link between the innovation climate, open innovation, and firm innovativeness in the context of SMEs.

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**Keywords**

Innovation climate • SMEs • Open Innovation • Inbound • Outbound • Firm innovativeness

## 10.1 Introduction

Globalization is now significantly more complex and rapid; however, its interconnectedness may be a pathway for business sector growth. The digitization of business, shorter product life cycles, and greater consumer connectedness are some of the hallmarks of globalization. In a world that is growing more interconnected, globalization has posed new challenges on organizations to innovate in order to achieve competitive advantages and ensure their long-term survival (Tidd and Bessant 2020). As a consequence of this rivalry, there have been suggestions and practices in the field of innovation management for a change from closed innovation toward an open innovation paradigm (Chesbrough et al. 2014; Chesbrough 2012).

In a dynamic environment influenced by social change and technological evolution, innovation assumes relevance in determining economic growth, creating competitive advantage, and organizational sustainability. Innovation can be understood as a learning process that results in the exploration of new ideas for the future, which can be incorporated into new products or services, processes, or methods to improve company performance. The current paradigm shift demands new ways to organize internal processes and trigger the emergence of open and collaborative models of innovation. The evolution of new communication technologies, the growing mobility of highly skilled workers, and the need to save costs have consequences for the optimization of internal operations and integration of external activities.

The concept of open innovation (OI) in this context proposes that firms, individuals, and the general public collaborate, which encourages the creation of new products and services. The innovation process has been facilitated by the rapid development and deployment of several web-based ICT, which have simplified interactions among stakeholder groups and led to the rise of new forms of network collaboration (Hutter et al. 2013). According to a 2008 McKinsey report, 60–70% of large, established companies have integrated customers and external expertise into their enterprise innovation processes. Most scholarly investigations into OI have exclusively concentrated on large-scale enterprises, primarily in high-tech industries (Hutter et al. 2013). However, it has been suggested that an OI approach might have both benefits and advantages for SMEs, particularly those enabled by web-based technologies (Hossain 2015; Bianchi et al. 2010).

Although crowdsourcing, co-creation, and user innovation communities have been discussed in the context of OI in SMEs, previous research has neglected to consider the benefits of Web 2.0, technologies, or platforms (Parida et al. 2012; Lasagni 2012; Su et al. 2015). However, despite these significant contributions to

management theory and practice, further research is needed to fill the gaps in the current knowledge of OI models, as they apply to SMEs (Colombo et al. 2012).

The challenge of OI is relevant to increasing market intrusion into business innovation, where SME have better specialization abilities than large companies, and this specialization is more profitable when the market is more open to innovative activity processes. Likewise, SME owner-manager initiatives that promote an innovation climate (IC) are more profitable with the continuation of OI practices. Thus, this study focuses on the main issues, the first of which is related to FI in SMEs, particularly in terms of utilizing internal, external, and hybrid knowledge sources for OI. Second, to what extent does IC apply to SME company owners' efforts to find creative ways to exploit and explore sources of innovation? Thus, this study investigates the expansion of the framework linking the innovation climate (IC), open innovation (OI), and firm innovativeness (FI) among SMEs.

## 10.2 Literature Review

### 10.2.1 Open Innovation (OI)

Current challenges in business include increasing the costs of technology development, shorter product life cycles, and customers who are more connected than ever before owing to the fast-paced flow of information (Chesbrough 2006, 2017). As a result, businesses have shifted their focus toward OI, which involves utilizing both internal and external sources of knowledge to enhance the innovation process and expand the market for external innovation (Chesbrough 2017).

OI can be broadly classified into two categories: the exploration and exploitation of innovation opportunities. Outbound innovation refers to the application of technology through external commercial channels, while inbound innovation refers to the process of identifying and mobilizing external sources of knowledge for business growth (Chesbrough et al. 2014).

Overall, businesses must embrace OI to keep up with the rapidly evolving market landscape. They should seek to leverage external knowledge sources to improve internal innovation and take advantage of external opportunities to enhance their market positions. By adopting an OI strategy, businesses can better navigate the challenges of the current economy and remain competitive in the long run.

Small- and medium-scale enterprises can greatly benefit from adopting the OI paradigm, which has been shown to lead to enhanced innovation profitability, expansion or enhancement of the knowledge base, and increased customer satisfaction. In particular, the use of web-based apps and other types of information and communication technology (ICT) has become increasingly important in the OI process (Bianchi et al. 2010).

The rapid evolution of ICT provides SMEs with a range of interactive, low-cost options to facilitate access to external ideas and to identify new market prospects for current ideas. This technology can be used in two ways: first, to help SMEs access external ideas and knowledge and second, to help identify new

market opportunities for their current ideas. The specific use of ICT depends on the business context, including factors such as the use of social networks and virtual communities to support a company's OI process (Hutter et al. 2013).

In summary, the OI paradigm can provide numerous benefits for SMEs, including increased innovation profitability, a wider knowledge base, and greater customer satisfaction. The use of ICT, including web-based apps and social networks, can help facilitate the OI process by providing SMEs with access to external ideas and knowledge, as well as identifying new market opportunities.

### 10.2.2 Innovation Climate (IC)

In the current highly competitive global business environment, it is crucial for organizations to encourage innovation, differentiate themselves from competitors, and provide value to customers. One effective way to promote innovation is to cultivate an internal innovative work climate (Newman et al. 2020).

According to Najar and Dhaouadi (2020), CEOs can act as agents of change to overcome organizational resistance and foster an innovative climate. They argue that positive attitudes toward OI from leaders are essential in reducing employee resistance, and that both factors are equally important in OI practice. Popa et al. (2017) identified three main determinants of an innovation climate (IC), including commitment-based human resources, connectedness between departments, and centralization of decision-making. Hoang et al. (2019) highlighted the importance of leaders in creating a climate for innovation, by mobilizing organizational resources and motivating individuals to work toward creative outcomes.

Najar and Dhaouadi (2020) further describe IC as a working climate characterized by a clear vision, shared concern for excellence in task performance, an interpersonal atmosphere that provides opportunities to participate, and support for innovation characterized by an open work environment and support.

Overall, developing an internal innovative work climate is essential for organizations to remain competitive and drive innovation. CEOs can act as change agents, and positive attitudes toward OI are crucial for reducing resistance and fostering an innovative culture. IC can be further enhanced by factors such as commitment-based human resources, connectedness between departments, and centralization of decision-making, as well as by leaders who motivate and mobilize organizational resources..

Najar and Dhaouadi (2020) have highlighted that bold, proactive, and risky decisions are necessary for organizations to adopt OI and create an IC. While individuals can generate innovative ideas, their willingness to do so depends on the climate within the organization (Hoang et al. 2019). To achieve an IC at the corporate level, firms must create an atmosphere that promotes knowledge sharing and collaboration across departments (Najar and Dhaouadi 2020). Innovative companies are often characterized by a climate that supports OI, which sets them apart from their competitors (Hoang et al. 2019). However, the adoption of OI

requires a new mindset and strong aspirations from owners and managers (Najar and Dhaouadi 2020).

Popa et al. (2017) suggest that firms with supportive internal IC are more likely to encourage lateral thinking, calculated risks, and exploration of external knowledge sources. Such firms may explore beyond their borders and expand their expertise, especially when operating within an open inbound innovation ecosystem. Therefore, it is reasonable to assume that the climate of innovation is significantly correlated with OI.

### 10.2.3 Innovation and SMEs

The adoption of OI by large companies to develop new products and services using web platforms has been well established, with at least 70% implementing such initiatives, as reported by McKinsey in 2008. However, it is also worthwhile to explore the transferability of these ideas to small- and medium-scale enterprises, as they tend to innovate differently from large firms and can benefit from OI processes to achieve innovation outcomes (Parida et al. 2012).

The subject of innovation in SMEs is of increasing interest due to its significant contribution to economic growth and employment opportunities. SMEs are a major source of employment, foster an entrepreneurial spirit, and possess the ability to innovate, thereby enhancing business competitiveness. SMEs with customer-centricity, adaptability, and capability to promptly identify innovation opportunities determine their performance, setting them apart from large enterprises and enabling them to adjust more rapidly to changes in market circumstances and customer demands (Bigliardi and Galati 2018).

SMEs have a unique advantage in fostering an innovative culture due to their flat hierarchies, efficient communication, and minimal bureaucracy (Bocconcelli et al. 2018). Small and medium-scale enterprises typically have expertise in a particular field or product line and are closely connected to the local community due to their limited service area, allowing them to tailor their offerings to meet the specific needs of their market while also streamlining the innovation process (Davis and Bendickson 2021; Bianchi et al. 2010).

However, SMEs often encounter difficulties in managing the entire innovation process, particularly in terms of commercialization, as they lack the necessary complementary assets for marketing and promoting innovation effectively (Purchase and Volery 2020). Although SMEs are proficient in generating innovative ideas, they frequently lack the resources and know-how to bring them to the market successfully (Bianchi et al. 2010).

### 10.2.4 Open Innovation in Small and Medium-Scale Enterprise

The success rate of innovations that have increased the chances of survival of SMEs ranges from only 22%, highlighting the need for SMEs to overcome the

constraints that limit their ability to innovate effectively (Golovko and Valentini 2011; Keupp and Grassmann 2009). OI offers a viable option for SMEs to enhance their innovation performance and profitability, thereby ensuring their competitiveness and survival (Hutter et al. 2013). However, SMEs face greater challenges in adopting OI compared to larger firms, such as being less involved in strategic alliances with other companies, resulting in a lower propensity to collaborate with external partners of all kinds (Ebersberger et al. 2010, 2012).

According to scholarly literature, the size of a company is a crucial factor to consider when implementing OI approaches (Adam and Alarifi 2021; Keupp and Grassmann 2009). Despite the size of the company and a lack of internal commitment, obstacles to applying OI practices primarily relate to cultural and organizational issues (Hutter et al. 2013). SMEs face particular challenges in implementing OI due to a lack of knowledge and awareness among managers or business owners (Parida et al. 2012), as well as a limited ability to disseminate risk, which leads them to be hesitant to experiment with OI activities. Ramirez-Portilla et al. (2017) outline how SME companies often implement OI practices through three main types of activities: inbound, outbound, and coupled. Despite implementing inbound or outbound practices, companies are not precluded from establishing internal innovations (Ramirez-Portilla et al. 2017). Based on these insights, we propose the following hypotheses:

H1: The innovation climate has a significant correlation with firm innovativeness.

H2: The innovation climate has a significant correlation with open innovation.

H3: Open innovation has a significant correlation with firm innovativeness.

H4: The innovation climate indirectly correlates with firm innovativeness through open innovation.

## 10.3 Research Method

The present study adopts a descriptive and empirical research design, with a focus on exploring the variables of IC, OI practices, and FI. Through a descriptive approach, the study seeks to provide a comprehensive account of these variables, while an explanatory approach is employed to test a hypothesis related to the relationship among them. Causality is a key consideration in this study, as it aims to establish a causal link between the variables under investigation. A cross-sectional time horizon is employed, whereby data is collected directly from business owners and managers of SMEs in Medan, North Sumatera, Indonesia, to examine the phenomenon over a specific period. The unit of analysis is the business owners and managers of SMEs. To measure the variables, the study adopts and adapts four measurement instruments for IC from the study by Popa et al. (2017), and eight instruments from their studies to measure OI practices. Additionally, the measurement instrument used to assess FI is adapted from the study by Ramirez-Portilla et al. (2017).

**Population and Sample**

The population in research refers to a group of individuals, events, or objects that researchers are interested in investigating. The sample, on the other hand, is a subset of the population that is selected to represent the population as a whole. The unit of analysis in this study was small and medium-scale enterprises registered with the Cooperatives and SMEs Office of Medan City. The sample size was determined based on analytical methods, such as structural equation modeling (SEM), to test the hypotheses. Following the rule of thumb for the sample size in SEM, a minimum ratio of 5 to 15 respondents for each parameter in the study is required. Therefore, with 18 parameters, the minimum sample size for this study was 216. The study added approximately 30% to account for potential sample dropouts and response rates, resulting in a total sample size of 281. Data were collected using a structured questionnaire consisting of statements adopted and modified from previous literature and studies. The questionnaire limited respondents' responses to a set of predetermined answers.

## 10.4 Data Analysis

**Descriptive and Inferential Statistics**

A descriptive analysis was conducted for each study variable to provide an overview of the unit of analysis. It is essential to define the scope of research analysis units, specifically SMEs, and to describe their contributions and roles. The average score for each variable was computed and interpreted according to this classification.

Statistical analysis was performed using structural equation modeling (SEM), specifically the Smart Partial Least Squares (PLS) program. SEM-PLS was used because it allows a more in-depth investigation of complex statistical models. It does not make any distributional assumptions when predicting causation or estimating the parameters. Therefore, there was no need for significant testing procedures. The SEM-PLS was used to assess both the outer and inner models. The outer model is a measurement model that predicts the relationship between the estimated indicators or parameters and their latent variables, while the inner model predicts the relationship between the latent variables and which one causes the other.

In research models that use multidimensional constructs in the form of constructs formed from dimensions and indicators that form dimensional latent constructs, analysis involves two phases. The first phase is the analysis of first-order constructs or lower-order constructs, which are dimensional latent constructs that are reflected or shaped by their indicators. The second phase is the analysis of second-order or higher order constructs, which are constructs that are reflected by or formed by dimensional latent constructs.

### Model Evaluation

#### Measurement and Structural Model

In order to test a causal relationship prediction model, it is necessary to subject the research model to the purification stage of the measurement model. To assess construct validity and instrument reliability, a measurement model was employed. Two approaches, convergent and discriminant validity, were used to evaluate construct validity. Measuring reliability can be done using either Cronbach's alpha or composite reliability. While Cronbach's alpha measures the lower limit of a construct's reliability value, composite reliability estimates the construct's actual reliability value and is ideal for assessing internal consistency. However, even when construct validity is achieved, the assessment of internal consistency is not absolute, as a construct's reliability is not always indicative of its validity.

Inner model analysis was used to evaluate the path coefficients or t-values that are linked to the study variables. The path coefficient measures the correlation between exogenous and endogenous variables, and the size of the standardized path coefficient is indicated by the latent variable relationship arrows. A standardized path coefficient of less than 0.1 indicates that the influence of exogenous variables on endogenous variables is statistically significant. The t-statistic value can also be used to evaluate the path coefficient score. To test the hypothesis at a significance level of 5%, the result must exceed 1.96 for the two-tailed hypothesis and 1.64 for the one-tailed hypothesis (Hair et al. 2014).

Bootstrap or non-parametric methods were utilized to determine the final results of testing the structural model and the significance of the model, as PLS does not assume normal distribution of the data (Hair et al. 2014). The significance test results were used to test the hypotheses. The coefficient of determination ($R^2$) was used to determine the size of the influence and relationship between the latent variables in the study.

#### Coefficient of determination ($R^2$)

The coefficient of determination is an indicator of the effectiveness of the model or independent variables in explaining the dependent variable. The coefficient of determination is evaluated using criteria such as 0.75, 0.5, or 0.25, which represent model assessments that can explain the data well, moderately, or weakly, respectively. When assessing exogenous variables with different measurements or an unequal number of observations, adjusted $R^2$ is used instead of standard $R^2$ (Hair et al. 2014).

## 10.5 Results

Subsequently, the data collected from small and medium-scale enterprises (SMEs) owners–managers in Medan, North Sumatera were sorted according to respondent profiles. The distribution of 281 questionnaires was based on predetermined target

respondents. Of these, 217 were successfully completed, resulting in a response rate of 77.22%.

### 10.5.1 Respondent Profile

Table 10.1 presents the profile of the respondents as follows:

According to the findings presented in Table 10.1, it can be observed that 99 out of 217 SME owner-managers who participated in the study were women, accounting for 45.62% of the respondents. Men, on the other hand, constituted the majority, with 118 respondents, accounting for 54.37% of the sample. The distribution of respondent profiles by business type was as follows: 57 of the respondents were owners or managers of cafes and restaurants, accounting for 26.23% of the sample, while 57 individuals were in retail, representing 23.96%. The fashion business had 47 participants (21.66%) and 42 respondents were in the furniture business, accounting for 19.35% of the sample. The remaining 19 individuals were involved in other types of enterprise, accounting for 8.76% of the sample. In terms of educational attainment, 82 respondents had high school education, representing

**Table 10.1** Profile of respondents

| | Frequency | Proportion (%) |
|---|---|---|
| *Gender* | | |
| Woman | 99 | 45.62 |
| Man | 118 | 54.37 |
| *Type of business* | | |
| Furniture | 42 | 19.35 |
| Fashion | 47 | 21.66 |
| Cafes and restaurants | 57 | 26.27 |
| Retail | 52 | 23.96 |
| Other | 19 | 8.76 |
| *Education* | | |
| High school or equivalent | 82 | 37.79 |
| Diploma | 37 | 17.05 |
| Bachelor | 72 | 33.18 |
| Postgraduate | 26 | 11.98 |
| *Operating revenues* | | |
| Below IDR 500 million | 99 | 45.62 |
| IDR 501 million to IDR 1.5 billion | 74 | 34.10 |
| IDR 1.51 billion to IDR 2.5 Billion | 41 | 18.89 |
| Above IDR 2.5 billion | 3 | 1.38 |

37.79% of the sample, while 37 individuals had a diploma (17.05%), 72 individuals had a bachelor's degree (33.18%), and 26 individuals had a postgraduate degree (11.92%). Regarding business income, 99 SME owner–managers had a business income below IDR 500 million (45.62%), 74 individuals had a business income between IDR 501 million and IDR 1.5 billion (34.1%), 41 individuals had a business income between IDR 1.51 billion and IDR 2.5 billion (18.89%), and 3 individuals had a business income above IDR 2.5 billion (1.38%).

### 10.5.2 Descriptive Statistical Analysis

Descriptive statistics offer a concise overview of the respondents' answers to each instrument used to measure the study variables of IC, OI practices, and FI. The instruments employed a five-point Likert scale and consisted of specific statements that assessed each variable using a questionnaire. Participants indicated their level of agreement or disagreement with the statements. The focus of descriptive statistics is on the description of participants' responses rather than making general inferences. Table 10.2 presents the participants' responses to the aforementioned variables.

Table 10.2 presents an overview of the results of the study, which measured the IC, OI practices, and FI among SMEs. The findings reveal that SMEs have a positive overall IC with an average score of 3.67 out of 5.00. Additionally, SMEs showed a favorable attitude toward OI practices, with an average score of 3.73 out of 5.00. The data further indicate that FI among SMEs is rated as good with a score of 3.70 out of 5.00.

### 10.5.3 Inferential Statistical Analysis

This study's inferential statistical analysis was conducted utilizing the structural equation method. The partial least squares (PLS) approach is used to complete structural equations due to the complexity of the research model, the usage of second-order constructs, the non-normal distribution of the data, and the exploratory nature of the effects between variables. The PLS analysis is conducted by examining the consistency of the constructs and validating the indicators of each construct using outer model analysis. If the research model fits the requirements for a good outer model, the study continues by investigating the relationship between variables using the inner model analysis. The data analysis was facilitated by the statistical application SmartPLS version 3.0.

### 10.5.4 Measurement Model Analysis

This study was conducted to identify a fit model for each indicator on each construct, such that the estimate of the inner model is not biased. Analyzing the

**Table 10.2** Descriptive statistics for each variable

| | Total | Means | Classification | |
|---|---|---|---|---|
| | F | % | | |
| *Innovation climate* | | | | |
| IC. 1 | 217 | 100 | 3.67 | Good |
| IC. 2 | 217 | 100 | 3.66 | Good |
| IC. 3 | 217 | 100 | 3.64 | Good |
| IC. 4 | 217 | 100 | 3.69 | Good |
| Innovation climate | | | 3.67 | Good |
| OI Practices | | | | |
| OI. 1 | 217 | 100 | 3.73 | Good |
| OI. 2 | 217 | 100 | 3.75 | Good |
| OI. 3 | 217 | 100 | 3.73 | Good |
| OI. 4 | 217 | 100 | 3.72 | Good |
| OI. 5 | 217 | 100 | 3.76 | Good |
| OI. 6 | 217 | 100 | 3.68 | Good |
| OI. 7 | 217 | 100 | 3.71 | Good |
| OI. 8 | 217 | 100 | 3.76 | Good |
| OI practices | | | 3.73 | Good |
| *Firm innovativeness* | | | | |
| FI. 1 | 217 | 100 | 3.76 | Good |
| FI. 2 | 217 | 100 | 3.67 | Good |
| FI. 3 | 217 | 100 | 3.65 | Good |
| FI.4 | 217 | 100 | 3.70 | Good |
| FI. 5 | 217 | 100 | 3.68 | Good |
| FI. 6 | 217 | 100 | 3.77 | Good |
| Firm innovativeness | | | 3.70 | Good |

reliability of each indicator on each construct and the validity of all indicators in assessing each construct constitutes the outer model analysis. To assess the constructs' reliability, composite reliability was used. The indicators' validity was evaluated using convergent and discriminant validity. Referring to the research method, indicator criteria and constructs are considered reliable and valid; if reliability and validity criteria are not fulfilled, the model is adjusted by eliminating problematic indicators from the construct. If the reliability criteria are not met, the analysis will not proceed to the outer model's measurement validity step.

Convergent validity is a component of the measurement model, which is also called the "outer model" in SEM-PLS. Two criteria must be met to determine whether the measurement model meets the convergent validity requirements for the reflective construct: (1) the loading must be greater than 0.7, and (2) the *p*-value must be significant (<0.05). However, in some cases, frequently, standards

for loading more than 0.70 are not met, especially for newly developed surveys. Therefore, indicators with loadings below 0.40 should be removed from the model. Indicators with loadings less than 0.40 should thus be eliminated from the model. It is ideal to investigate the influence of deleting indicators with loadings between 0.40 and 0.70 on AVE and composite reliability.

Indicators with a loading between 0.40 and 0.70 may be deleted if they raise AVE and composite reliability above their respective thresholds. The AVE limit value is 0.50, and composite reliability is 0.7. Another factor to consider when removing indicators is the effect on the construct's content validity. Low loading indicators can be kept because they contribute to the construct content validity. Table 10.3 presents the tabulation of the measurement model results.

Table 10.3 presents the validity test of factor loading, which shows that all factor loading values are greater than 0.7. This means that in the second order, the validity measure based on the loading value has met the validity requirements. Likewise with the validity requirements based on AVE in the second order, indicating that all AVE values are greater than 0.5. This confirms that the overall AVE value meets the validity requirements. Furthermore, the reliability measure is based on CR at the second-order stage, which shows that the overall CR value is greater than 0.7. This result means that it meets the reliability requirements based on CR.

**Tabel 10.3** The measurement model results

| Constructs | Item | Item-loading | AVE | CR rho _a | CR rho _c | CA | Discriminant Validity | $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Innovation climate | IC1 | 0.856 | 0.674 | 0.840 | 0.892 | 0.838 | 0.699 | |
| | IC2 | 0.809 | | | | | | |
| | IC3 | 0.807 | | | | | | |
| | IC4 | 0.809 | | | | | | |
| Open innovation | OI1 | 0.742 | 0.561 | 0.888 | 0.911 | 0.888 | 0.744 | 0.365 |
| | OI2 | 0.753 | | | | | | |
| | OI3 | 0.763 | | | | | | |
| | OI4 | 0.791 | | | | | | |
| | OI5 | 0.730 | | | | | | |
| | OI6 | 0.759 | | | | | | |
| | OI7 | 0.736 | | | | | | |
| | OI8 | 0.714 | | | | | | |
| Firm innovativeness | FI1 | 0.778 | 0.581 | 0.855 | 0.892 | 0.855 | 0.720 | 0.493 |
| | FI2 | 0.780 | | | | | | |
| | FI3 | 0.797 | | | | | | |
| | FI4 | 0.765 | | | | | | |
| | FI5 | 0.717 | | | | | | |
| | FI6 | 0.731 | | | | | | |

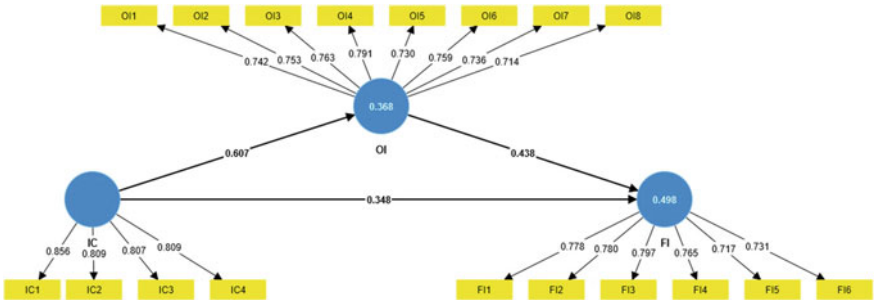


**Fig. 10.1** Validity testing based on second-order factor loading. *Source* Author's research output

Similarly, the calculation of Cronbach's alpha on the second order shows that all CA values are greater than 0.7. This result can be interpreted as meaning that the results of reliability testing based on Cronbach's alpha have fulfilled the reliability requirements. Testing the discriminant validity using the Fornell-Larcker approach for the second order shows that the correlation value between a latent variable and other latent variables is less than the square root of the AVE for that latent variable. These results lead to the conclusion that the calculation of the test meets the requirements of discriminant validity. Furthermore, the *R*-Square presented in Table 10.3 shows that the *R*-Square value of FI is 0.493. The results of this acquisition explain that the IC and OI practices can influence FI by 49.3%. The *R*-squared value of OI practices is 0.365. This means that the IC can influence OI practices by 36.5% (Fig. 10.1).

### 10.5.5 Structural Model Analysis

The significance of the influence test and the path coefficient are summarized in the results of the measurement model in Table 10.4.

Table 10.4 shows that the results of each hypothesis's significance test are as follows: With *p*-values of (0.000 < 0.05), IC has a significant correlation with FI. This confirms that the proposed hypothesis (H1) is accepted. With *p*-values of

**Table 10.4** Structural model results

| | Correlation | Original | Mean | Std. deviation | *t*-value | *p*-value | Support |
|---|---|---|---|---|---|---|---|
| H1 | IC → FI | 0.613 | 0.616 | 0.069 | 8.897 | 0.002 | Supported *** |
| H2 | IC → OI | 0.607 | 0.610 | 0.074 | 8.239 | 0.000 | Supported *** |
| H3 | OI → FI | 0.438 | 0.444 | 0.109 | 4.011 | 0.000 | Supported *** |
| H4 | IC–FI (indirect effect) | 0.266 | 0.271 | 0.078 | 3.400 | 0.001 | Supported *** |
| ***$p$-value < 0.01 | | | | | | | |

(0.000 < 0.05), IC has a significant correlation with OI practices. This confirms that the proposed hypothesis (H2) is accepted. With *p*-values of (0.000 < 0.05), OI practices have a significant correlation with FI. This confirms that the proposed hypothesis (H3) is accepted. With *p*-values of (0.000 < 0.05), OI practices significantly mediate the correlation between IC and FI. This confirms that the mediation hypothesis (H4) is proven and accepted.

## 10.6 Discussion

*The significance of the correlation between IC and FI*

The present study yields empirical evidence that highlights the significance of the IC in relation to FI. The analysis revealed a strong correlation between the two variables, with a path coefficient of 0.613 and a significance level of 0.000. A favorable IC is characterized by the active participation of employees who allocate their resources and time to generate innovative solutions, which may include knowledge sharing or exchange. Consequently, the contributions of such employees can enhance the company's ability to produce more innovative products or processes. Notably, innovative firms typically exhibit traits such as reduced costs associated with new product development, time, and cost efficiency in reaching target markets. The current findings reinforce prior research, particularly the arguments posited by Popa et al. (2017), who suggest that an innovative organizational climate encourages a culture of innovation. This culture is shaped by shared values, beliefs, and assumptions that facilitate the innovation process (Martín-de Castro et al. 2013; Popa et al. 2017). Our study's results further strengthen Popa et al.'s (2017) empirical findings, revealing a positive relationship between the IC and OI in SMEs. For instance, SMEs benefit from an organizational climate that promotes innovation as it enhances their problem-solving capabilities, fosters a greater willingness to take risks, and improves their ability to leverage external knowledge. In light of these findings, it is evident that SMEs with a supportive IC are more likely to expand beyond their current boundaries and enrich their knowledge base.

*The significance of the correlation between IC and OI practices*

The present study has revealed a statistically significant correlation between IC and OI practices, as attested by a path coefficient of 0.607 and a significance level of 0.000. The findings have demonstrated that organizations endowed with a favorable IC and the capacity to guide their personnel toward collaborative work are more likely to embrace OI. This empirical evidence corroborates the previous work of Popa et al. (2017), who have established that SMEs exhibiting a robust IC are more prone to harness inbound innovation to augment their collective knowledge. The results of this study have further validated the importance of IC in determining a company's commitment to outbound innovation, as manifested in the management system for the exploitation of technical knowledge through patents or intellectual property rights. Therefore, nurturing a conducive IC is of utmost significance.

*The significance of the correlation between OI practices and FI*
The study has established a significant correlation between OI practices and FI, with a path coefficient of 0.438 and a significance level of 0.000. This finding bolsters the existing body of research emphasizing the importance of enhancing SMEs innovation by adopting OI practices (Ramirez-Portilla et al. 2017). The study also supports prior findings indicating that not all innovation practices are equally impactful on innovation outcomes, with inbound innovation (such as purchasing technical services, conducting technology prospecting, and external personnel training) having a greater effect on OI practices than outbound innovation. Additionally, selling technical or scientific services based on company experience is deemed more important than open (outbound) innovation. These results further corroborate that SMEs utilize search, acquisition, and knowledge sourcing activities as well as knowledge sharing practices to augment their level of innovation (Ramirez-Portilla et al. 2017).

*The significance of indirect relationship between IC and FI*
This study has provided empirical evidence that OI practices mediate the relationship between the IC and FI, with a path coefficient of 0.266 and a significance level of 0.001. This finding underscores the significance of an innovative corporate climate, characterized by skilled and competent employees connected by OI practices in promoting innovative firms. Specifically, SMEs tend to rely heavily on the contributions of external partners by promoting open (inbound) innovation, which involves direct engagement with external partners to generate innovation. This is exemplified by utilizing research and development results from external partners for new and innovative products, systems, or services. Conversely, companies adopting open (outbound) innovation tend to derive greater benefits from their innovation results by seeking to sell trading licenses to external parties such as a particular brand, recipe, or process. The study's findings further corroborate prior research positing that a firm's IC is a critical determinant of its innovation performance (Popa et al. 2017). Therefore, the stronger a company's focus on innovation, the more significant the impact of IC improvement, with OI practices bridging the relationship between the two.

## 10.7 Conclusion

This study has significant implications for both academic and practical circles, as small- and medium-scale enterprises (SMEs) cannot generalize the results of previous empirical research on OI practices as they pertain to large firms (Lee et al. 2010; Spithoven et al. 2013). Instead, SMEs may promote innovation by using both inbound and outbound OI practices, supported by the firm's IC. This study contributes to the existing empirical findings on OI in SMEs and empirically tests a research extension model to evaluate the impact of IC on FI as well as the mediating role of inbound and outbound OI practices.

The study results indicate that SME owners and managers must be aware of the significance of creating a conducive IC to enhance the company's emphasis on innovation, complemented by OI practices. It is also important for SMEs to be aware that OI strategies are becoming more prevalent, and adapting to them is necessary to remain competitive. However, this study has some limitations that must be addressed in future research. First, the results cannot be generalized as they are based on a sample of SMEs from only one city and province. Future studies should include larger sample sizes and different regions, either within a country or across nations. Second, this study only provides a cross-sectional overview of the causes and outcomes of OI practices, and timing changes cannot be explained. Therefore, a longitudinal investigation may be necessary to corroborate these results. Including these recommendations in future research could improve the accuracy and generalizability of the results.

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