THE IMPACT OF EXTERNAL KNOWLEDGE, INTERNAL INNOVATION AND R&D ON THE PERFORMANCE OF OPEN INNOVATION IN AN ORGANIZATION: EMPIRICAL EVIDENCE FROM INDONESIAN SMES

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ABSTRACT

The aim of this paper is to investigate the impact of external knowledge and internal innovation on the performance of open innovation in small and medium enterprises (SMEs) in Indonesia. In addition, this paper also examined the impact of R&D as a mediator between variables. The research method used in this study is quantitative research using a 5 point Likert scale measurement. Samples were taken by distributing questionnaires in April-May 2020 to 204 CEOs of SMEs in Indonesia and the data were analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The results obtained showed that the external knowledge, internal knowledge, and R&D all has a positive and significant impact on the performance of open innovation in an organization.

KEYWORDS: Open Innovation, Firm Performance, External Knowledge, Internal Knowledge, R&D, SMEs

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1. INTRODUCTION

In any organization, innovation has been known as a key success (Gómez, Salazar, & Pilar, 2017) that lead to competitive advantage and improve firm performance (Berliandaldo, M., & Hidayat, 2017; Forsman & Temel, 2011; Szabo & Csontos, 2016). The importance of innovation itself can be trace back from the theory of economic by Schumpeter (1911) where innovation is the “creative destruction” that drives the creation of new businesses to replace old ones.

In the past, innovation was carried out internally (Wynarczyk, Piperopoulos, & McAdam, 2013), and was considered as an important strategic asset that creates a barrier in an industry (H. Chesbrough, 2003; Hossain, 2012). Dependence on internal R&D strength is not enough to face tight competition and volatile environment (H. Chesbrough, 2003), where technology and products are becoming more complex (Ali, 2019; Frizziero, Donnici, Francia, Caligiana, & Gaddoni, 2019) with the increasing cost of innovation (Porter & Heppelmann, 2014). Hence, organizations must move from the concept of closed innovation to open innovation, which involves the use of internal and external knowledge to be able to develop and integrate new ideas optimally (Chesbrough, H., Vanhaverbeke, W., & West, 2006).

Previously, the concept of open innovation was widely used in large-scale technology-based companies such as IBM and Intel (Chesbrough, H. W., & Appleyard, 2007). However, currently this concept has been used by various organizations, including small and medium enterprises (SMEs) to be able to overcome resource constraints and improve business performance (Scott, G., & Chaston, 2013).

The object of this research is SMEs in Indonesia, because based on data from the (Ministry of Cooperatives and Small and Medium Enterprises (2018), SMEs in Indonesia are 64,194,057 from a total of 64,199,606 business units, in other words SMEs dominate 99.99% of the total business units in Indonesia. Moreover, SMEs in Indonesia have a very large and important role in employment and economic stability, where SMEs have been proven to be able to withstand the economic crisis that occurred in 1997-1998 (Hamdani & Wirawan, 2012; LPPI & BI, 2015). Even though open innovation is a very important concept for SMEs in Indonesia, but the research is still very limited. So, this research will conduct empirical tests on the influence of the role of each of the main components of open innovation (external knowledge, internal innovation, and R&D) on the performance of open innovation in Indonesian SMEs.

2. LITERATURE REVIEW

2.1 Open Innovation

According to (Trott, P., & Hartmann, 2009) the basic concept of open innovation that collaborates strengths from within a company with outside sources to gain knowledge and improve competitiveness actually existed more than 50 years ago. This was proven through research conducted by Allen & Cohen (1969) who examined the flow of information in R&D laboratories, where one of the information streams was obtained from "technological gatekeepers", who communicated with external parties to obtain information from outside the organization. Later this concept was repackaged with the term "open innovation" by H. Chesbrough in 2003. The term is then widely used by many researchers and organizations to be able to increase their competitive advantage. The basic concept of open innovation is the use of external and internal knowledge through R&D activities to increase overall innovation. So this research will focus on the relationship between these three variables to measure the performance of open innovation.

2.2 External Knowledge

In line with the concept of open innovation, some previous studies have found that external knowledge has a positive influence on innovation (Caloghirou, Kastelli, & Tsakanikas, 2004; Cassiman & Veugelers, 2006; Hameed et al., 2018; Ritala, Olander, Michailova, & Husted, 2015). According to Escribano, Fosfuri, & Tribó (2009) external knowledge can be managed better and more efficiently in companies that have a higher level of absorptive capacity and R&D that are managed internally (Cohen, W. M., & Levinthal, 1989; Mowery, 1983). On the other hand, some research also found that external knowledge can reduce company efficiency (McKelvie, Wiklund, & Brattström, 2018), by making the product development process longer and higher costs (Praest Knudsen & Bøtger Mortensen, 2011; Tranekjer & Søndergaard, 2013). Hence, based on above discussion, hypotheses 1 is stated as follow:

H1. External knowledge has a positive influence on the performance of open innovation.

2.3 Internal Innovation

Although the concept of open innovation is the use of various sources of knowledge and external resources to enhance innovation and internal development (Chesbrough, H., Vanhaverbeke, W., & West, 2006; West, J., & Gallagher, 2006), but to be able to get maximum performance results the organization also must improve its internal capabilities (Caloghirou et

al., 2004). In his research, McKelvie et al. (2018) found that companies that were more focused on internal knowledge were more active in innovation. On the other hand, although internal innovation and knowledge are very important, Menon & Pfeffer (2003) found that managers value external knowledge better than internal knowledge. Hence, the hypotheses are as follows:

H2. Internal innovation has a positive influence on the performance of open innovation

H6. External knowledge has a positive influence on internal innovation.

2.4 R & D

The basis of open innovation is the awareness that a company's competitive advantage cannot only depend on internal R&D knowledge and capability, but must utilize the inventions of others to remain competitive in business competition (Henry Chesbrough & Crowther, 2006). The R&D function itself can be carried out internally or externally. With the concept of openness, the R&D function can be outsourced (Henry Chesbrough & Crowther, 2006) in order to increase efficiency. Moreover, it is also proven that the higher the company's dependence on external R&D, innovative performance will also increase (Berchicci, 2013). In carrying out its functions, R&D must be able to combine internal innovation and external knowledge to be able to increase innovation (Cassiman & Veugelers, 2006). According to Love & Mansury (2007), external knowledge sources can be obtained from customers, suppliers and strategic alliances; supported by highly qualified workforce to increase open innovation performance. So, hypotheses relate to R&D are as follows:

H3. External knowledge has a positive influence on the R&D.

H4. Internal knowledge has a positive influence on the R&D.

H5. R&D has a positive influence on the performance of open innovation

H7. External knowledge has a positive influence on the performance open innovation through mediating effect of R&D.

H8. Internal innovation has a positive influence on the performance open innovation through mediating effect of R&D.

The conceptual, measurement and structural model of this research can be seen as in figure 1 and figure 2 respectively

Figure 1: Conceptual Model

Figure 2: Measurement and Structural Model

Measurement Equation Model			
$X_1 = \lambda_{x11} \xi_1 + \delta_1$	$Y_1 = \lambda_{y11} \eta_1 + \varepsilon_1$	$Y_4 = \lambda_{y42} \eta_2 + \varepsilon_4$	$Y_7 = \lambda_{y73} \eta_3 + \varepsilon_7$
$X_2 = \lambda_{x21} \xi_1 + \delta_2$	$Y_2 = \lambda_{y21} \eta_1 + \varepsilon_2$	$Y_5 = \lambda_{y52} \eta_2 + \varepsilon_5$	$Y_8 = \lambda_{y83} \eta_3 + \varepsilon_8$
$X_3 = \lambda_{x31} \xi_1 + \delta_3$	$Y_3 = \lambda_{y31} \eta_1 + \varepsilon_3$	$Y_6 = \lambda_{y62} \eta_2 + \varepsilon_6$	$Y_9 = \lambda_{y93} \eta_3 + \varepsilon_9$
Structural Equation Model			
$\eta_1 = \gamma_{11} \xi_1 + \zeta_1$			
$\eta_2 = \gamma_{21} \xi_1 + \beta_{21} \eta_1 + \zeta_2$			
$\eta_3 = \gamma_{31} \xi_1 + \beta_{31} \eta_1 + \beta_{32} \eta_2 + \zeta_3$			

3. METHODOLOGY

A quantitative approach has been used in this study. Questionnaires were adopted from previous research with a total of 12 questions adopted from Hameed et al. (2018). The measurement scale uses a 5 point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The total respondents of this study were 204 CEOs from SMEs in Indonesia, and the sample was selected using the purposive sampling method. The analytical method used in this research is Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis using SmartPLS 3.0 software.

4. RESULTS AND DISCUSSIONS

4.1 Reasons for Engaging in Open Innovation

One of the biggest obstacles in SMEs in Indonesia is a lack of capital, which results in limited innovation activities. Hence, 78% of respondents believed that open innovation is able to reduce their R&D costs. Adopting knowledge from external source will finally improve the innovation performance in the firm. In addition, another reason is because open innovation is believed to be able to open new revenue streams (12%), increase differentiation in the market (7%), and reduce risk (3%).

4.2 Validity and Reliability Analysis

4.2.1 Validity Analysis

There are 2 (two) tests in validity analysis, namely: convergent validity analysis and discriminant validity analysis. In order to be convergently valid, the minimum standard of loading factor is 0.60. From table 1 column 3, it is clear that all

indicators are valid, with the highest and lowest value of 0.912 for RD3 and 0.711 for RD1, respectively.

Figure 3: Measurement Model Assessment.

Table 1: Convergent Validity, Composite Reliability, and AVE

Construct	Indicators	Loadings	Cronbach's Alpha	Composite Reliability	AVE
External Knowledge	EK1	0.851	0.829	0.898	0.745
	EK2	0.872			
	EK3	0.867			
Internal Innovation	II1	0.891	0.797	0.881	0.713
	II2	0.869			
	II3	0.769			
R&D	RD1	0.711	0.776	0.869	0.690
	RD2	0.856			
	RD3	0.912			
Open Innovation Performance	OIP1	0.834	0.799	0.882	0.714
	OIP2	0.867			
	OIP3	0.832			

Table 2: Cross Loading

Indicators	External Knowledge	Internal Innovation	Open Innovation Performance	R&D
EK1	0.851	0.700	0.559	0.545
EK2	0.872	0.813	0.530	0.502
EK3	0.867	0.726	0.571	0.511
II1	0.824	0.891	0.620	0.564
II2	0.710	0.869	0.515	0.490
II3	0.645	0.769	0.510	0.450
OIP1	0.407	0.390	0.711	0.320
OIP2	0.513	0.541	0.856	0.472
OIP3	0.641	0.652	0.912	0.636
RD1	0.528	0.475	0.486	0.834
RD2	0.514	0.556	0.515	0.867
RD3	0.483	0.481	0.513	0.832

Second test for validity is discriminant validity analysis. This can be done by measuring the Average Variance Extracted (AVE). The construct is said to be valid if AVE is equal to or greater than 0.5. Table 1 column 6 shows the lowest AVE value is 0.690 for R&D. Therefore, it can be concluded that all constructs are valid. In addition, another measurement in discriminant validity analysis is cross loading, where the loading value on the intended construct must be greater than the value of loading with the other construct. Based on Table 2, it appears that all indicators have a higher correlation with their own latent variables compared to other latent variables. Hence, it can be concluded that this research model is good.

4.2.2 Reliability Analysis

Reliability can be defined as the precision of a measuring instrument in a measurement procedure. There are 2 (two) tests in reliability analysis, namely: composite reliability and Cronbach's alpha. The acceptable value of composite reliability is between 0.70 and 0.90. Value greater than 0.90 means that the construction is redundant or measuring the same phenomenon. From Table 1 column 5, it can be seen that all values are acceptable, with the highest and lowest value of 0.898 for external knowledge and 0.869 for R&D, respectively. The second test in measuring reliability is Cronbach's alpha. The expected value is between 0.60 and 0.90. From table 1 column 4, all values are in the expected range, with the highest value of 0.829 for external knowledge and the lowest value of 0.776 for R&D.

4.3 Coefficient of Determination (R^2)

The coefficient of determination is used to measure the ability of the model to explain variations in the dependent variable. Table 3 shows that the highest value of R^2 is internal innovation (75%) and the lowest value is R&D (36.8%). Furthermore, by including all constructs, the overall model can influence the performance of open innovation by 50.3%.

Table 3: R-Square

Latent Variable	R Square
Internal Innovation	0.750
Open Innovation Performance	0.503
R&D	0.386

4.4 Hypothesis Testing

Hypothesis testing in this study using a one-tailed T-statistical calculation with a significance of 95% (T-significance = 1.6524). The acceptable value of T statistic is above the value of T-significance, with P value less than 0.05. Table 4 column 3 shows that the external knowledge has a positive influence on the performance of open innovation, with p values of 0.031 and T statistics (1.874) greater than T-significance (1.6524). This study is in line with several previous studies, such as Caloghirou et al. (2004), Cassiman & Veugelers (2006), Ritala et al. (2015), and Hameed et al., (2018). In addition, external knowledge also contributes positively (table 4 column 3) and significantly (table 4 column 6 and 7) to internal innovation in Indonesian SMEs. This happens because most SMEs have limited resources and abilities, so in order to remain relevant; managers value external knowledge to improve their internal innovation. This is in line with the aim of open innovation stated by H. Chesbrough (2003).

Moreover, like external innovation, internal innovation also contributes a significant and positive effect on the performance of open innovation. Although SMEs in Indonesia have limited capacity for internal knowledge, internal innovation also plays an important role in supporting overall open innovation performance. This is in line with McKelvie et al. (2018), who argues about the importance of internal knowledge to support innovation activities.

As already explained before, the most important part of the innovation process is the role of R&D, which acts as a gatekeeper in absorbing external knowledge and combining it with internal innovation to contribute to open innovation performance (Allen & Cohen, 1969). Some SMEs in Indonesia are outsourcing their R&D functions to remain efficient. For direct effect relationships, as seen in table 4, it is clear that all relationships related to R&D (H3-H5) are positive and significant (p values below 0.05). This finding is supported by several previous studies (Berchicci, 2013; Cassiman & Veugelers, 2006).

Figure 4: Measurement Model Assessment.

Table 4: Structural Model Assessment (Direct Effect)

Hypothesis	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Decision
H1	EI → OIP	0.202	0.199	0.108	1.874	0.031	Accepted
H2	II → OIP	0.301	0.301	0.111	2.716	0.003	Accepted
H3	EI → R&D	0.337	0.339	0.121	2.791	0.003	Accepted
H4	II → R&D	0.306	0.308	0.129	2.372	0.009	Accepted
H5	R&D → OIP	0.296	0.302	0.070	4.227	0.000	Accepted

The indirect effect of the structural model assessment (table 5) shows that H7 and H8 are both significant, with P values of 0.014 and 0.022, respectively. Therefore, it can be concluded that R&D mediates the relationship between external knowledge and internal innovation with open innovation performance.

Table 5: Structural Model Assessment (Indirect Effect)

Hypothesis	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Decision
H7	EK → R&D → OIP	0.100	0.103	0.045	2.199	0.014	Mediation
H8	II → R&D → OIP	0.091	0.093	0.045	2.012	0.022	Mediation

5. CONCLUSIONS

In conclusion based on the results obtained, this research provides empirical evidence of the role of external knowledge, internal innovation and R&D in improving the open innovation performance in Indonesian SMEs. There are 8 (eight) hypothesis tested in this study, and all relationships between variables have been proven to be positive and significant. The role of external knowledge is very important in increasing internal knowledge; because SMEs in Indonesia have limited resources and capabilities. This research also shows that R&D mediates the relationship of external knowledge and internal

innovation to improve open innovation performance. Further research can be done by adding several other variables that affect the process of open innovation.

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