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Implementation of Open Innovation and Its Influence on Innovation Performance in Small and Medium Enterprises in Indonesia

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ABSTRACT

This research aims to analyze the influence of open innovation implementation on innovation performance in small and medium enterprises (SMEs) in Indonesia. Open innovation is seen as an important strategy for SMEs in the face of market dynamics and increased global competition. This research uses a quantitative approach with a population of all SMEs in Indonesia that apply innovation in their business activities. Sampling techniques were carried out by purposive sampling, and data were obtained through questionnaires distributed to SME actors in various sectors. Data analysis was performed using multiple linear regression to examine the relationship between the variables of open innovation implementation and innovation performance. Results show that the application of open innovation has a positive and significant effect on improving the innovation performance of SMEs, especially through external collaboration, knowledge exchange, and the use of digital technology. These findings indicate that openness to resources and ideas from outside the organization can strengthen the competitiveness of SMEs in Indonesia. It is hoped that this research will serve as a reference for SME actors and policy makers in designing sustainable innovation strategies.

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DOI Articles: 10.63901/ijebam.v3i4.145

INTRODUCTION

The business world is currently experiencing an increasingly sharp increase in competition with evidence of the increasing number of new businesses entering the market. Companies need to innovate sustainably so that they can provide added value to customers so that the company is able to survive and excel in competition. Implementation of innovation not only for large companies but also in the small and medium enterprise (SME) sector. New SMEs are always present and introduce their products, so SMEs must be able to keep pace with the dynamics of change business, competition, and adapting to technological advances.

SMEs are one of the sectors that greatly contribute to economic growth in Indonesia. This is proven by macro data on SMEs published by the Ministry of Cooperatives and SMEs which shows the contribution of SMEs in creating national added value in 2013 amounted to 60.34 per cent of Gross Domestic Product (GDP). With a very large role to play in a country's economy, SMEs should be encouraged to be able to innovate so that they can survive and adapt to existing changes (Bianchi et al., 2010)

Innovation is indispensable for SMEs to grow and develop, however, there are still many SMEs that do it innovation approach traditionally or is closed. Traditional or closed innovation approaches done with manage everything independently from developing, building, marketing, distributing, providing services to managing their own finances. Innovation is closed, encouraging companies to become independent because no one can ensure the quality, availability and ability of other people's ideas (Chesbrough, 2003)

Related to knowledge as a source of input into innovation, there are several elements that can be used external sources of knowledge. Some literature states that there are two groups of external knowledge sources, namely market-based and science-based (Amara & Landry, 2005) ; (Lefebvre et al., 2015). Consumers, competitors, suppliers and other companies are part of external sources of knowledge market-based, meanwhile, external sources of knowledge science-based it consists of universities, public or private research institutes, and consultants (Lefebvre et al., 2015)(Amara & Landry, 2005). Although many companies have internal sources of knowledge, especially R&D, that can be used to develop their innovations, external collaboration is still very necessary and important for reducing the costs of innovation, technology development, time efficiency, minimizing risks, exploring new ideas, and for solving common problems. Therefore, many companies are changing their innovation strategies from closed innovation to open innovation

Apart from internal and external sources of knowledge, external cooperation or collaboration activities can also increase company innovation. External collaboration is an effective mechanism for increasing a company's innovation capacity (Faems *et al*., 2005). External cooperation is collaborating with several organizations such as customers, suppliers, competitors, universities, consultants, government and research and development (r&d) private.

According to Whitehead (2001), cooperation can be carried out for long-term or long-term interests which must start from the trust of both parties. The benefits of cooperation are resisting environmental shocks, improving economic performance and survival possibilities, gaining access to complementary resources, learning new skills, absorbing technology, having control over relationships with other companies, staying up to date with competitors and increasing efficiency (Ahuja, 2000). In addition, access to the base technology through cooperation or alliances between companies has been shown to help companies redefine and position themselves in the market in terms of technology.

Product innovation performance what is produced is an indicator companies to see innovation done company. According Ebersberger & Herstad (2013) performance innovation

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
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yang produced company can measured based on sales of innovative products, sales growth yang good, and the number of patents generated over the past time set. Innovation performance can be defined as sales records product innovative in the company. Sales product innovative companies can be divided into radical innovation which is the company's effort to sell new products to the market, and incremental or additional innovation which is the company's effort to create innovation and product sales has been introduced to the market by competitors but is new to company (Van Beers & Zand, 2014).

One of the research themes in the field of innovation is the interrelationship of product innovation performance and the implementation of open innovation. In general, research on open innovation in SMEs in developed countries has much done, however, in the context of developing countries, it tends to be limited. Some research on the implementation of open innovation in the context of developed countries is as follows. Other researchers, (Ahn et al., 2017) also conducts open innovation research on 306 SMES in Korea. Meanwhile, (Bogers et al., 2017) conduct case studies on the challenges of implementing open innovation in the innovation ecosystem in SMEs in Denmark. In the context of SMEs in Italy, Santoro *et al.,* (2019) conducted a case study on the challenges and factors of open innovation practices implemented by SMEs.

There has also been a lot of research on open innovation in Indonesia, but there is still little research on the topic of the relationship between open innovation and innovation performance in SMEs. In addition, research addressing the topic of SMEs by linking factors of collaboration, internal as well as external sources of knowledge, open innovation and innovation performance is also limited. Therefore, there is no accurate understanding of the role of open innovation in Indonesian SMEs in involving collaboration factors, external and internal sources and their influence on innovation performance in SMEs. So that research on the implementation of open innovation in SMEs in Indonesia by linking this practice to internal, external sources of knowledge and collaboration activities and testing it on product innovation performance becomes interesting to carry out.

Although research on open innovation and innovation performance has been carried out in Indonesia, but this research focuses more on large companies. An example is research conducted by Hermawan (2019) yang examining the relationship between open innovation, use of management systems and performance of pharmaceutical companies in Indonesia. Besides, (*Fadhilah, S. (2018)* examining the influence of an open innovation approach on the innovation performance of companies in Indonesia. The implementation of open innovation and its influence on innovation performance in manufacturing companies in Indonesia has also been researched by (Hartono et al., 2018)

Several previous studies have explored internal and external sources of knowledge in product innovation. Saiful (2019) shows that external market-based knowledge sources positive and significant influence on product innovation. This indicates that the higher the orientation of the external source market-based owned by the organization will increase the innovation of the products created. The results of this study confirm previous research, that external sources market-based positively influence product innovation (Buwana & Nursyamsiah, 2018); (Lefebvre et al., 2015); Beregheh *et al.,* 2012; (Najib & Kiminami, 2011); and Capitanio *et al.,* 2010) and science-based external sources did not significantly influence product innovation.

Research by Singaporewoko & Hartono (2020) shows that on the second link activity *knowledge transformation* as a series of *innovation value chain* (IVC), external knowledge of the market (i.e. suppliers, customers and competitors) and open source (association of firms) positively influence innovation. As for research from (Laursen & Salter, 2006) who argue that a company's ability to exploit external knowledge is critical to innovation performance.

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
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Apart from research on internal and external sources of knowledge in product innovation, collaboration factors have also been researched. Such research shows that external cooperation is positively related to innovation.

Although the themes of research on internal and external sources of knowledge and collaboration have been widely practiced in other developed and developing countries. However, in Indonesia, research themes related to the implementation of innovation are open and their influence on innovation performance is still limited. So, the main aim of this research is to narrow the research gap that to determine the influence of market-based internal and external knowledge sources, science, *open source* (open), and collaboration on product innovation on SME innovation performance (measured using product sales innovative, both radical and incremental) in the Indonesian service and manufacturing sectors.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Open Innovation

Open innovation is an innovation activity that uses ideas that not only come from within the company, but also use external company ideas. So it can be said that open innovation is a process where companies look for and commercialize innovative ideas or are of interest to the market that come from within and outside the organization.

Product Innovation

Product innovation according to Kotler & Armstrong (2007) is a combination of several existing processes and relationship between one product and another. A innovation is not a new idea, but development of new markets, but innovation is an overview of the various existing processes.

Innovation Performance

A company's innovation performance is defined as the number of new products it produces in a certain period (Katila & Ahuja, 2002). One of the company's innovative capabilities is the ability to create new products which is a critical mechanism by which organizations diversify and adapt (Schoonhoven, Eisenhardt, & Lyman, 1990).

Internal Knowledge Sources

Employee abilities really represent the importance of new knowledge, so it is necessary to organize internal company education and training programs to further develop and improve the knowledge base internal. Company on generally can using R&D internal them and develop knowledge of the influence of using approaches innovation is open to performance (*Fadhilah, S. (2018)* and their technology alone.

External Knowledge Sources

According (Van Beers & Zand, 2014) external sources of knowledge are a way to add or incorporate the latest ideas to innovate companies. External knowledge allows companies to obtain information as a complement to the internal knowledge needed from various sources. The strategy for obtaining external sources of knowledge of the company involves relationship directly with supplier, customer, competitor, institution research public or private and university (Hartono et al., 2018)

Collaboration

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According to Lai (2011), collaboration is joint involvement in coordinated efforts to solve problems together. Collaborative interaction is characterized by a common goal, a symmetrical structure with a high degree of negotiation through inter-activity and the existence of interdependence.

Product Collaboration and Innovation

Collaboration between companies is a factor that drives innovation (Batista Franco, 2003) Collaborative activities with R&D companies are opportunities to generate profits because the use of R&D partnerships is able to provide wider expansion in generating knowledge about innovation. Therefore, companies are highly motivated to find cooperation partners use develop external knowledge in the form of organizational or corporate alliances (Lefebvre et al., 2015). Cooperation involving consumers plays a very important role in product innovation so that it can influence purchasing decisions and satisfy consumers. So in this case a fairly broad identification is needed to market events and opportunities, customer involvement highly profitable in product innovation (Tsai, 2009).

Product Innovation and Innovation Performance

Tjiptono (2008) states that innovation is the practical application of an idea to a new product or process. Laraswati's research (2020) entitled the broad influence of shared creativity on innovation performance through product innovation and knowledge sharing as mediation variables (case study on silver craft SMEs in the Kotagede Yogyakarta area) states that there is a positive and significant influence of product and process innovation on innovation performance. In line with research (Najib & Kiminami, 2011) based on the results of the analysis and discussion regarding product innovation and SME innovation performance, it can be concluded that the research describes the innovative characteristics of SMEs which have a positive and significant relationship between product innovation and innovation performance.

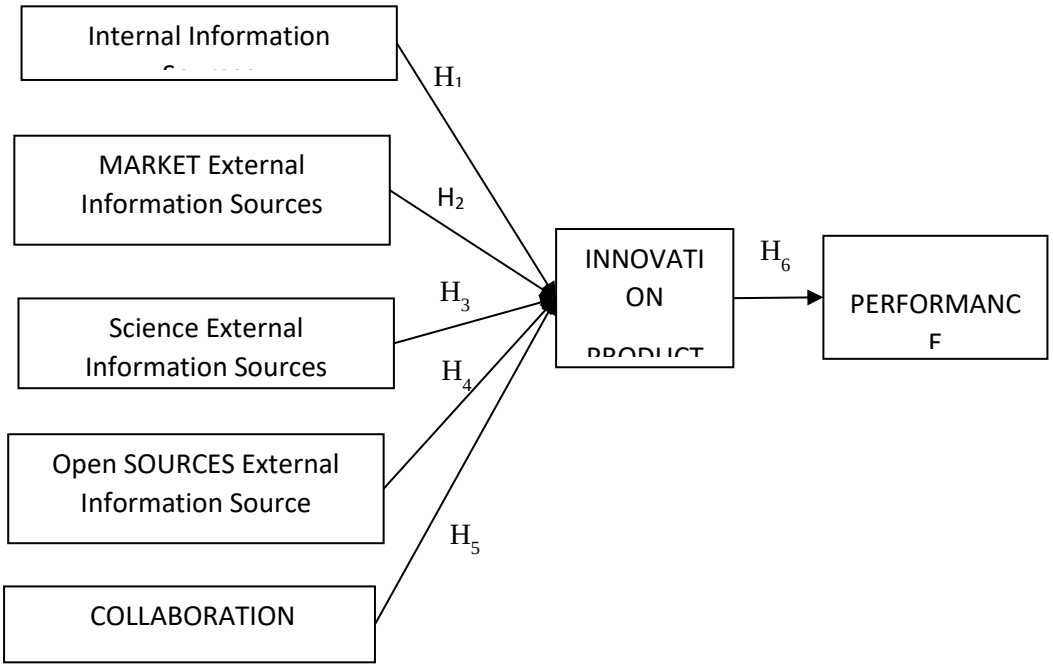


Figure 1. Research Framework

Source: Processed by Author (2025)

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

Image description:
H1: Internal knowledge sources positively influence innovation product.
H2: Market-based external sources of knowledge have a positive effect towards product innovation.
H3: Science-based external sources of knowledge have a positive effect towards product innovation.
H4: Based external knowledge sources *open source* influential positive for product innovation.
H5: Collaboration/cooperation has a positive effect on product innovation.
H6: Product innovation has a positive effect on innovation performance.

RESEARCH METHODS

The population in this research includes all small and medium enterprises (SMEs) in Indonesia which have certain characteristics in accordance with the research objectives. This population was chosen because SMEs play an important role in national economic growth and are a relevant object to be studied regarding innovation and improving business performance. According (Sugiyono, 2017), population is a generalized area consisting of objects or subjects that have certain characteristics to study and draw conclusions from. In this context, the population of SMEs forms the basis for the generalization of research results in order to enable the findings obtained to describe the real conditions on the ground.

The study samples were taken using techniques *multi-stage random sampling*, namely a random, gradual sampling method from several groups. This technique is part of *simple random sampling*, where each population unit has an equal chance of being elected. The choice of this method was made so that the research results were more representative and reduced the potential for bias. The sampling process is carried out based on the criteria of companies operating in the manufacturing and service sectors, especially those carrying out collaborative activities and utilizing internal and external knowledge sources in the product innovation process and improving innovation performance.

This type of research is quantitative research that uses secondary data. Secondary data is data that researchers collect from existing sources, such as official institutions and related scientific literature. The main source of data in this study comes from *Indonesian Innovation Survey 2014* carried out by PAPPIPTEK (Research Center for Scientific and Technological Development) LIPI. This survey is part of a national innovation survey conducted in three waves, namely 2008, 2011 and 2014. The 2014 data was chosen because it is the most up-to-date data available, with the data collection process carried out from 2011 to 2013 at manufacturing and service companies in Indonesia.

Methods of data collection in such surveys include questionnaires and measurement scales. The questionnaire was prepared in the form of written questions accompanied by alternative answers and given to respondents, namely small and medium-sized companies. The questionnaire instrument refers to *Oslo Manuals* developed by OECD and Eurostat (2005), namely international guidance in the implementation of surveys and interpretation of innovation results which are widely used by developed countries in Europe.

Next, a measurement scale is used to determine the type of data attached to each study variable. This scale functions as a reference in the measurement process so that the data results are

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

quantitative and can be processed statistically. Based on the characteristics of the questions in the survey, two types of scales are used, namely binary scales (yes/no) for qualitative variables, and ordinal scales for variables that have certain levels or sequences. According to Irianto (2015), the ordinal scale describes the order of levels from high to low (or vice versa), but the differences between levels do not have fixed intervals. The use of this scale allows researchers to measure the perception and degree of involvement of SMEs in innovation activities in a more structured and measurable way.

DATA ANALYSIS RESULTS & DISCUSSION

This research aims to determine the influence of open innovation implementation, both from market-based internal and external knowledge sources, science and *open source* implemented by SMEs during the product innovation process and the influence of product innovation on SME innovation performance.

The data used in this research are secondary data obtained from the results of a survey conducted by the Research Center for Scientific and Technological Development (PAPPIPTEK). The survey was conducted in 2014 with a sample of 833 and there were 564 small companies or 67.7% and medium-sized companies with 269 or 32.2%. The results of sample distribution are shown in table 4.1.

Table 4.1 SME Sample Distribution Results

Company Size	Amount	Percentage
Small (<20 Employees)	564	67.7%
Intermediate (20 - 99 Employees)	269	32.2%

Source: Secondary Data, 2021.

Validity Test

The variables tested for validity were internal and external sources of information with rocks *SPSS software* version 25 for windows. In conducting validity tests, the techniques used are *product moment correlation technique* where each item or indicator can be declared valid if it has an r count of ≥ r table, and conversely if r counts < r table then it is declared invalid. Validity testing uses a significant standard of 5% or 0.05. The following are the results of the validity test calculations in table 4.2 below:

Table 4.1 SME Sample Distribution Results

Variable	Items	Correlation Coefficient	r table	Description
Internal Knowledge Sources	R&d Staff	.913	0.068	Valid
	Marketing department	.946	0.068	Valid
	Production department	.923	0.068	Valid
	Management staff	.932	0.068	Valid
	Other R & D units within the same group of companies	.867	0.068	Valid
Market-based External Knowledge Sources	Supplier of equipment, materials, components, or *software*	.913	0.068	Valid
	Client or customer	.934	0.068	Valid
	Competitors or other companies	.930	0.068	Valid

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

	consultant	.857	0.068	Valid
	Commercial laboratories or R & D institutes private	.852	0.068	Valid
Science-based External Knowledge Sources	University or institution of higher education others	.942	0.068	Valid
	Polytechnic	.951	0.068	Valid
	R&d Institute government	.962	0.068	Valid
	R&d Institute nonprofit.	.952	0.068	Valid
Based External Knowledge Sources *Open Source*	Conference or trade show	.889	0.068	Valid
	Scientific journals and trade/engineering publications	.893	0.068	Valid
	Investors (banks, capital, ventures, etc)	.889	0.068	Valid
	Industry association	.899	0.068	Valid
	Internet	.899	0.068	Valid
	Experienced entrepreneur	.913	0.068	Valid

Based on table 4.5 it can be concluded that the results of the correlation coefficient in all research variable items have a value (r count) > r table. So that all question items contained in the research instrument can be declared valid.

Reality Test

The reliability test in the SPSS used is *Cronbach Alpha*, where is the assessment if *Cronbach Alpha* > 0.60 then the variable is declared reliable or consistent and if *Cronbach Alpha* < 0.60 then the variable is declared unreliable or inconsistent (Ghozali, 2018). The following are the results of the reliability test calculations in table 4.3 below.

Table 4.3 Results of SME Sample Distribution

Variable	Alpha Crobach	Critical value	Description
Internal Knowledge Sources	0.951	0.7	Reliable
Market Based External Knowledge Sources	0.932	0.7	Reliable
Science Based External Knowledge Sources	0.965	0.7	Reliable
Based External Knowledge Sources *Open Source*	0.948	0.7	Reliable

Goodness of Fit Test (Model Precision Test)

The results of the tests in the study, indicators on *goodness of fit* shows that the measurement model used is acceptable. Results of each test on *goodness of fit* can be seen in table 4.4.

Table 4.4 SME Sample Distribution Results

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

Goodness of fit	Cut – off Value	Fit Summary Model Value	Description
X^2 – Chi Square	It is expected that the value will be small (9,488)	8,392	
Probability	$\geq$ 0.05	0.136	Good Fit
Cmin/DF	$\leq$ 2	1,678	Good Fit
GFI	$\geq$ 0.90	0.997	Good Fit
RMSEA	$\leq$ 0.08	0.029	Good Fit
AGFI	$\geq$ 0.90	0.984	Good Fit
TLI	$\geq$0.90	0.998	Good Fit
CFI	>0.90	0.999	Good Fit
PGFI	$\geq$ 0.60	0.178	Marginal Fit
PNFI	$\geq$0.60	0.238	Marginal Fit

X value^2- Chi Square has a significance level of 0.00 < 0.05 which indicates that H_0 stated that there was no difference between the sample covariance matrix and the estimated population covariance matrix was rejected. This means that the sample covariance matrix with the estimated population covariance matrix is not the same, and the model is stated to be marginal fit. Results of the analysis on *goodnes of fit* – GFI is used to explain the overall level of model fit. The GFI value from the analysis results in the model was obtained at 0.997 while the value *cut-off value* what is expected is a GFI > 0.90 so that the GFI value is 0.997 > 0.90, which means the fit assessment model. The results of the analysis showed that the AGFI value was 0.984 whereas *cut-off value* what is expected is > 0.90 so the results show an AGFI value > 0.90, which means this shows that the fit assessment model.

Tucker Lewis Index is alternative *incremental fit index* which compares the model tested with *baseline.* The results of the study show that the TLI value is 0.998 while the TLI value used as a benchmark for a good level of conformity is $\geq$ 0.90. This means that it can be stated that the level of conformity is on good criteria. *Comparative Fit Index* is an index of conformity *incremental* who compares models tested with null models. CFI recommended values $\geq$ 0.90. Meanwhile, the CFI value produced in this test is 0.999. so that the test results can show that the assessment model is good.

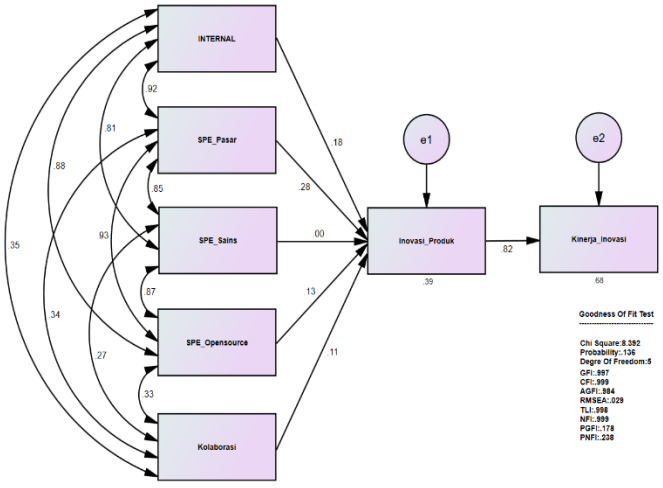
E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

The minimum Discrepancy Funcion Sample is parsimonious fit index that measures relationships *goodnes of fit* model and the number of estimated coefficients expected to reach the level of conformity. Results showed that the CMIN/DF value was less than the recommended CMIN/DF value 1,678 < 2.0 so that it explains that the assessment model falls within the criteria *good fit.*

The Root Mean Square Error of Approximation is an index used to compensate for Chi Square Statistics in a large sample. The RMSEA value indicates *goodnes of fit* which can be expected if the model is estimated in the population. Recommended acceptance value ≤ 0.08, while based on the test results, an RMSEA value of 0.029 was found, which means that the assessment model is included in the criteria *good fit.* So based on the results of the conformity analysis, the model has shown that overall the test parameters meet the criteria *goodness of fit.*

Hypothesis Testing.

Hypothesis testing using SEM Analysis obtained the following pathway results:



Images. 2 Model test results Product innovation

Based on figure 4.1, it can explain the results of the first hypothesis to hypothesis six. Meanwhile, the estimated results of SEm analysis can be shown in table 4.8.

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

Table 4.5 SME Sample Distribution Results

Relationships Between Variables	Results	Innovation Performance
Internal Knowledge Sources →Product Innovation	0.184 (0.008)	
Market Based External Knowledge Sources →Product Innovation	0.276 (0.002)	
Science Based External Knowledge Sources →Product Innovation	0.003 (0.955)	
Based External Knowledge Sources *Open Source* →Product Innovation	0.132 (0.095)	
Collaboration → Product Innovation	0.112 (0.000)	
Product Innovation → Innovation Performance		0.822(***)

Based on table 4.5 shows the variables of internal knowledge sources regarding product innovation obtaining path coefficient results (*Standardized*) of 0.184 with a level *probability* (p-value) of 0.008 or smaller than 0.05. This explains that H_0 rejected so that it can be stated that there is a significant influence regarding internal knowledge sources on product innovation. Thus, the first hypothesis stating that "H1: Internal sources of knowledge positively influence product innovation.", is accepted.

The results of testing variables for market-based external knowledge sources on product innovation based on analysis will obtain the results of path coefficients (*Standardized*) of 0.276 with a level *probability* (p-value) of 0.002 or less than 0.05. So it can be concluded that H_0 rejected so that it can be stated that there is a significant influence regarding external market-based knowledge sources on product innovation. Thus, the second hypothesis which states that "H2: Market-based external sources of knowledge positively influence product innovation.", is accepted.

The results of testing science-based external knowledge source variables for product innovation based on analysis will obtain the results of path coefficients (*Standardized*) of 0.003 with a level *probability* (p-value) of 0.955 or greater than 0.05. So it can be concluded that H_0 accepted so that it can be stated that there is no significant influence regarding external science-based knowledge sources on product innovation. Thus, the third hypothesis which states that

E-ISSN: 2988-0211 | Vol. 03, No. 04, 2025, pp. 39-52
DOI Articles: 10.63901/ijebam.v3i4.145

"H3: Science-based external sources of knowledge do not have a positive effect on product innovation.", is rejected.

Results of the test of variables of external knowledge sources based *open source* regarding product innovation based on analysis, the results of the path coefficient are obtained (*Standardized*) of 0.132 with a level *probability* (p-value) of 0.095 or greater than 0.05. So it can be concluded that H_0 accepted so that it can be stated that there is no significant influence regarding external knowledge-based sources *open source* towards product innovation. Thus, the fourth hypothesis states that "H4: Source of external knowledge is based *open source* does not have a positive effect on product innovation", rejected.

The results of testing collaboration variables for product innovation based on analysis will obtain the results of path coefficients (*Standardized*) of 0.112 with a level *probability* (p-value) of 0.000 or less than 0.05. So it can be concluded that H_0 rejected so that it can be stated that there is a significant influence regarding collaboration on product innovation. Thus, the fifth hypothesis which states that "H5: collaboration has a positive effect on product innovation", is accepted.

The results of testing product innovation variables on innovation performance based on analysis will obtain the results of the path coefficient (*Standardized*) of 0.822 with a level *probability* (p-value) of 0.000 or less than 0.05. So it can be concluded that H_0 rejected so that it can be stated that there is a significant influence regarding product innovation on innovation performance. Thus, the sixth hypothesis which states that "H6: Product innovation has a positive effect on innovation performance", is accepted.

RESULTS & CONCLUSION

Based on the analysis and discussion related to the influence of internal, external knowledge sources and collaboration on product innovation and the influence of product innovation on innovation performance, it can be concluded that SMEs that use internal knowledge sources can significantly influence product innovation. This shows that utilizing internal knowledge sources is able to contribute to SMEs in innovate their products. SMEs using external market-based knowledge sources can significantly influence product innovation.

This shows that the use of external market-based knowledge sources is able to contribute to SMEs in innovating their products. SMEs using science-based external knowledge sources are not significant in influencing product innovation. This shows that the use of science-based external knowledge sources has not been able to contribute to SMEs in innovating their products. SMEs using external knowledge sources based on *open source* insignificant in influencing product innovation. This shows that the utilization of external knowledge sources is based *open source* have not been able to contribute to SMEs in innovating their products.

SMEs that collaborate or collaborate can significantly influence product innovation. This shows that cooperation has been able to contribute to SMEs in innovating their products. Product innovation has a positive effect on the innovation performance of SMEs. This shows that the higher SMEs are able to implement open innovation to innovate products, the higher the innovation performance produced. And if SMEs do not implement open innovation, it will reduce innovation performance.

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