

The role of inbound and outbound open innovation on firm performance in environmental turbulence era: Mediating of product and marketing innovation

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ABSTRACT

Open innovation has been identified as two dimensions, the flow of knowledge obtained from outside and processed within the organization and has a role as a key business responsiveness to prevent any risks that will be faced. From this knowledge flow is a successful approach to new product development featuring outbound and inbound knowledge that is managed with the aim of getting out of the bounds of risk. Therefore, this study investigates and explains the causal relationship between the variables used, such as inbound and outbound open innovation, product innovation, marketing innovation, firm performance, and environmental turbulence as moderating variables. This study uses a quantitative approach and designs a questionnaire that has been distributed to 115 SMEs owner / managers as a sample. In the process of formal data collection, a random sample was used in this study which was distributed to the owner / manager of SMEs. While the processing, analysis, and hypothesis testing process of this study uses PLS-SEM which is a statistical tool for applying all data scales, does not require many assumptions, and confirms relationships. The findings in this study indicate that what has a positive and significant effect is the relationship of inbound open innovation to product innovation, product innovation to marketing innovation, marketing innovation to firm performance. In addition, the moderating effect of environmental turbulence in a positive way is only product innovation on firm performance. Further explanation of the implications of the findings has been discussed and confirmed.

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1. Introduction

The literature that discusses open innovation has developed rapidly in the background of environmental changes that are increasingly dynamic and fast (Hung & Chou, 2013; Chesbrough & Bogers, 2014; Lichtenthaler, 2009). The sectors that drive the economy, namely SMEs who are most vulnerable when faced with environmental changes must be more open, responsive, and adaptive in responding to this (Garriga et al., 2013). The flow of knowledge obtained from outside and processed within the organization is the key to responsive business to prevent any risks to be faced (Chesbrough, 2003; Liao et al., 2020). Meanwhile, several previous studies described Open Innovation into two processes, consisting of external technology acquisition (ETA, also called open-entry innovation) and external technology exploitation (ETE, also called open-out innovation) (Chesbrough, 2003; Chesbrough & Crowther, 2006; Lichtenthaler, 2008; Spithoven et al., 2010). From this knowledge stream, Chesbrough & Bogers (2014) have also emphasized a successful approach to new product development featuring outbound and inbound knowledge that is managed with the aim of getting out of the limits of risk (Stanko et al., 2017). As in previous studies, open innovation has highlighted increasing company performance but also highlighting the importance of considering various possibilities, for example environmental turbulence (Hung & Chou, 2013). In addition, knowledge resources that are classified as intangible assets are a strength for companies in capturing external knowledge and managing internal knowledge to achieve superior company performance. In relation to open innovation, several studies have proven company benefits through the absorption and exploitation of knowledge (Zobel, 2017; Liao et al., 2020; Tang et al., 2021).

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Therefore, this study is based on the role of open innovation in the SMEs sector which is most vulnerable to disruption and environmental turbulence, so that the role of the knowledge gained can respond both in terms of product innovation and marketing innovation to company performance. First objective implies inbound and outbound open innovation towards product innovation. Thus, this emphasizes the role of the flow of knowledge (in terms of inbound and outbound) which can have a significant effect on the innovations created, especially product innovation (Aksoy, 2017; Hung & Chou, 2013; Buenechea-Elberdin; 2017). Knowledge which is then processed through involvement in knowledge exploration and exploitation results in the ability to identify, acquire and utilize knowledge for the innovation process (Naqshbandi & Tabche, 2018). Thus, strengthening the innovative aspects and knowledge of SMEs presents great opportunities, because innovation is the key to long-term competitiveness and promises further benefits related to private sector performance and economic development (Buenechea-Elberdin, 2017). From the flow of knowledge management, it will be able to capture the value required by the relevant market from the product. While this innovation output increases options for new product development and the evolution of new effective product processes (Bravo et al., 2017). These efforts help companies experiment and engage in more product innovation beyond the current company boundaries (Tzokas et al., 2015), thus allowing for more profit from external inputs, and ultimately improving performance (Stanko et al., 2017). External search activities can enrich the knowledge pool in the SME sector and increase the introduction of new product innovations by recombining knowledge (Gentile-Lüdecke et al., 2020). In line with this, previous research has discussed and proven that inbound and outbound open innovation has a positive and significant effect on product innovation (Aksoy, 2017; Expósito et al., 2019; Han et al., 2020; Sok et al., 2016; Park, 2018).

Furthermore, investigating product innovation against marketing innovation, where marketing innovation helps product commercialization activities. Marketing innovation can be described as a company's ability to approach the market, effectively use communication channels, and deliver products and services to capture potential or existing customers (Gupta et al., 2016). With product innovation that has been created, marketing innovation will work to connect the value of the product to the market (Junge et al., 2016). Through the use of channels from marketing innovation and communication tools (for example, social media, websites, and perhaps e-commerce) it becomes more effective marketing activities. This has a strong relationship with product commercialization activities (Aarikka-Stenroos & Sandberg, 2012; Chen, 2006). The integration of product and marketing innovation creates the ability to commercialize products into higher demand (Medrano & Olarte-Pascual, 2016). Moreover, the existence of intense competition forces companies to carry out innovative marketing activities to determine customer needs and increase customer satisfaction and retention has become a necessity in changing marketing methods (Expósito et al., 2019). Marketing innovation plays a role in reducing product demand uncertainty and influencing customers to make product purchases. This marketing innovation serves as a distribution of value to the market and knows market demand through the channels and communication tools used. Previous research used marketing innovation as the commercialization of product radical and incremental innovation (Kyriakopoulos et al., 2015; Srinivasan et al., 2009), type innovation on firm performance (Hanaysha, 2020; Rajapathirana & Hui, 2018). From the previous research, there was a research gap in the placement of marketing innovation (Aksoy, 2017; Lee et al., 2019; Hanaysha, 2020; Rajapathirana & Hui, 2018). However, in this study, marketing innovation plays a mediating role between product innovation and firm performance.

In the context of the turbulence currently occurring due to the Covid-19 pandemic, many SMEs are experiencing difficulties in responding and acting (Zheng et al., 2021). There are SMEs who experience losses and eventually go bankrupt and close, some are still surviving by reducing costs by firing their employees (Dimson et al., 2020; Baum & Hai, 2020). This condition, of course, for SMEs who have weaknesses in knowledge management will soon close their business (Breier et al., 2021; Clark et al., 2020). However, there are still many SMEs that must survive in a more open way to receive knowledge which is then processed to make changes and adjustments (Craven et al., 2020; Hock-Doepgen et al., 2020; Ritter & Pedersen, 2020). Both developed and developing countries have launched programs to overcome these problems for economic stabilization (Albaz et al., 2020a; 2020b). Even in developing countries, especially Indonesia, the SMEs sector makes a major contribution to the Indonesian economy. So that the turbulence that is happening right now is good in terms of technology, market, and environment (which is correlated with the Covid-19 pandemic) SMEs are tested and required to open innovation (Kraus et al., 2020; Micheli et al., 2020). The goal is to be able to make changes by creating products and through marketing innovation as a step to transition from offline to online. Due to changes in market behavior under the pretext of the Covid-19 pandemic, customers are reluctant to make offline purchases (Craven et al., 2020; Lee & Trimi, 2021). By utilizing technology and the internet of things, customers prefer shopping online rather than offline (Craven et al., 2020). Of course, this will have a big effect on SMEs to make changes. In line with several previous studies, this study discusses environmental turbulence which is used as a moderating effect between product innovation on marketing innovation and firm performance (Cheah et al., 2020; Ghahremanpour et al., 2020; Turulja & Bajgoric, 2019).

2. Literature Review

2.1 Open Innovation on Product Innovation

In forming the capabilities and ability to absorb knowledge, it depends on SMEs for open innovation. Chesbrough (2003) has introduced the concept of open innovation which is fed by inbound and outbound knowledge, so that with the existence of knowledge assets, SMEs can be more developed and competitive (Expósito et al., 2019). The emphasis of the concept of open

innovation lies in the company not being able to rely solely on the use of internal capabilities and resources to innovate, but on knowledge gained from externals (Chesbrough & Crowther, 2006; Chesbrough & Bogers, 2014). The flow of knowledge in and out can accelerate SMEs to innovate internally as well as expand the market for the use of external innovation (Chesbrough, 2003; 2006; Fahmi & Yulianto, 2021). This view of open innovation shows openness relevant to the exploration of innovation and exploitation of external knowledge (Popa et al., 2017; Freel & Robson, 2017). For instance, SMEs can respond to rapidly changing market demands with a knowledge base of creating product innovation (Park, 2018). Based on the characteristics of open innovation, several studies have discussed its relationship with product innovation on SMEs. As in research from Xie & Wang (2020), which investigates the role of open innovation in product innovation progress by taking four innovative companies as a case study that identifies six modes of open innovation ecosystems. Furthermore, Xie & Wang (2020) emphasize the findings of their research showing that open innovation ecosystem contributes to the value creation process in product innovation through inbound and outbound knowledge collaboration. In addition, Expósito et al. (2019) further explain collaboration from inbound and outbound in producing innovation outcomes which include process / method, organizational, marketing and product innovation. The tendency of SMEs to involve the process of absorbing knowledge from external and internal has a stronger effect on creating product innovation (Expósito et al., 2019; Spithoven et al., 2013). In line with Han et al. (2020) involves open innovation as a moderation between network linkages and incremental innovation capability and shows open innovation strengthens the relationship between network linkages and incremental innovation capability. Meanwhile, Park (2018) describes open innovation which affects the efficiency of innovation, especially product innovation that is produced. Based on the foundation of previous research, this study proposes the following hypotheses:

H₁: *Outbound Open Innovation influences positively and significantly on Product Innovation.*

H₂: *Inbound Open Innovation influences positively and significantly on Product Innovation.*

2.2 Product Innovation on Marketing Innovation

The effect of the availability of information accessed, SMEs have the opportunity to innovate their products to update the value of existing products. In line with Ganzer et al. (2017) have explained that innovation is classified based on dimensions and is seen as an evolving process in which a new or significantly improved product or process replaces existing ones. Product innovation has implications for changes in the new value proposition specified in market affordability (Najafi-Tavani et al., 2018; Mitrega et al., 2017). The existence of product innovation can increase the success rate of new product development, but in different ways (Evanschitzky et al., 2012; Zaefarian et al., 2017). This refers to the development and marketing of products related to value distribution to increase customer satisfaction (Ganzer et al., 2017). Thus, SMEs need to consistently develop product innovation through controlled management of resources. This is an emphasis because the ability to develop and produce innovative and unique products determines the competitiveness of a company (Soto-Acosta et al., 2016; Popa et al., 2017; Falahat et al., 2020). Therefore, marketing works by distributing this value to the market through available channels (including social media, e-commerce, websites, etc.) (Chen, 2006; Aksoy, 2017). Although SME marketing techniques are informal as well as traditional which are reactive and spontaneous in nature (Gilmore et al., 2007), there is a considerable gap between marketing activities in typical SMEs and best practices put forward by marketing theory (Parrott et al., 2010). In line with various previous studies that discuss product innovation on marketing innovation, this study designs the following hypothesis:

H₃: *Product Innovation influences positively and significantly on Marketing Innovation.*

2.3 Product Innovation on Firm Performance

Product innovation has been known to be the key to success in the performance of a company's product and is the novelty of existing products (Rijsdijk et al., 2011; Rubera & Kirca, 2012). Meanwhile, Lee et al. (2019) stated that product innovation also contributes to the company market, although there are conflicting results regarding how the level of product innovation affects company performance. Thus, product innovation can include improving existing products through developing new products to improve company and market performance. Therefore, it is important to understand how spending on new product development can improve company performance in the long run (Evanschitzky et al., 2012; Zaefarian et al., 2017). Some of the existing literature regarding product innovation on firm performance emphasizes that to get a competitive advantage and a superior market position, company product innovation must be successful (Astuti et al., 2020; Lee et al., 2019; Rajapathirana & Hui, 2018; Bustinza et al., 2018). Companies in carrying out product innovation certainly aim to renew the product lifecycle (Cristensen, 2011) and meet market needs based on the new values created in product innovation (Cheng et al., 2014; Fahmi & Yulianto, 2021). Therefore, companies are faced with strong and sophisticated competition, which can easily provide the same or similar products in the market (Artz et al., 2010; Lin et al., 2013). Simultaneously, consumers also change their habits and expect additional benefits from the product purchased. As a result, companies need to continue to provide new products or improve existing products. With that, companies need to continue to innovate and have new or better products in the market, cooperate with other companies, join different networks, and become more internationally oriented (Ramadani et al., 2019). In line with various previous studies that discuss product innovation on firm performance, this study designs the following hypothesis:

H₄: *Product Innovation influences positive and significant on Firm Performance.*

2.4 Marketing Innovation on Firm Performance

Marketing innovation is a new way in terms of marketing both in terms of packaging design of a product and even the use of digital marketing channels which are now increasingly being used to distribute value to customers. Whereas in the existing literature, marketing innovation refers to the process carried out by companies to adapt products to specific customer needs, improve their functionality and innovate in customer management (Anning-Dorson, 2017; Wadho & Chaudry, 2018). The combination of marketing innovation increases the complexity of managing competencies required at the company level as well as the complexity of producing new products for customers (Kocak et al., 2017). In addition, the ability of marketing innovation leads to greater differentiation (Damanpour et al., 2009; Ostrom et al., 2010) and such capabilities are an alternative way to take advantage of opportunities that come from adjusting to market needs (O'Casey and Ngo, 2012). This is based on a combination of external knowledge obtained by customers and company capabilities, which together will not only adjust what is offered to meet customer expectations but also form new routines (Charterina et al., 2016). Therefore, various marketing activities launched by companies will affect product brand equity (Yoganathan et al., 2015; Godey et al., 2016) and then develop brand trust and loyalty (Šerić et al., 2020; Jung et al., 2020). Marketing activities also affect customer loyalty to products (Jung et al., 2020). Marketing activities and consumer initial market responses assist the formation and innovation of new technologies (Šerić et al., 2020; Kocak et al., 2017; Fahmi & Yulianto, 2021). Thus, marketing innovation helps reduce information asymmetry and establishes products as brands in the market (Charterina et al., 2016). Brand equity once enhanced by innovative marketing methods will help in creating brand loyalty and trust and subsequently increasing customer loyalty and company performance (Godey et al., 2016; Gupta, 2021; Šerić et al., 2020; Jung et al., 2020). Thus, this study designed the following hypotheses:

H₅: *Marketing Innovation influences positively and significantly on Firm Performance.*

2.5 Moderating Effect of Environmental Turbulence

Environmental turbulence is a phenomenon that is difficult to predict and understand when it occurs and often in various sectors (even though business and public) cannot catch it and even rarely (Deng & Zhang, 2018; Deng et al., 2020). In line with Dost et al. (2019), environmental turbulence is often seen as a distinct, prominent and unpredictable environmental event such as significant technological changes and significant changes in the economy. In addition, various literatures that explain environmental turbulence (Boyne & Meier, 2009; Kraus et al., 2020) are the most important features of the contemporary business environment and not just a dynamic environment because the rate of change is unpredictable. Thus, the bigger the unexpected change, the greater the negative impact and its effect on company performance. Regarding the discussion of environmental turbulence, various literatures highlight the frequently used market and technology and turbulence factors in the business sector, especially SMEs (Ottesen & Grønhaug, 2004; Ngamkroekjoti & Speece, 2008; Deng et al., 2019; Dost et al., 2019). However, with the current conditions (the impact of the Covid-19 pandemic), several studies attribute it to turbulence (Ilinova et al., 2021; Kraus et al., 2020; Micheli et al., 2020) because it has been proven to disrupt the stability of the performance of the business sector. Meanwhile, market turbulence refers to continuous changes in customer preferences / demands, in the price / cost structure, and in the composition of competitors (Ojha et al., 2020). Furthermore, technology turbulence implies the rate of change of products and / or process technology used to convert inputs into outputs (Ojha et al., 2020).

In overcoming environmental turbulence, in the literature study innovation is the main key in surviving and remaining competitive (Ogbeibu et al., 2020). In a highly dynamic and volatile environment, SMEs are forced to increase innovation to attract new and existing customers by offering a wider choice of choices (Dost et al., 2019) and, in conditions of high competition, customers have many alternatives to choose from. So that SMEs carry out a future strategy to get customer acquisition through product innovation and marketing innovation that might be able to convey information to customers (Deng & Zhang, 2018; Ojha et al., 2020). Through innovation it also increases the need for SMEs to simultaneously create and deliver new products in quick succession, which goes beyond solving routine problems and the efficiency of existing products (Alhussan et al., 2017). Meanwhile, environmental turbulence could encourage the acceleration of technology adoption as a resource for innovation. Meanwhile, competition accelerates the adoption of new technologies to drive internal efficiency and to create product variety and marketing innovation (Liu et al., 2019; Ottesen & Grønhaug, 2004; Deng et al., 2019). This is because products can easily become obsolete, therefore, SMEs must continuously integrate new technology to allow the introduction of innovation products to reduce the threat of obsolescence (Liu et al., 2019). Meanwhile, marketing innovation works to deliver information on the value of a product to the market, thereby increasing the company's financial side (firm performance) (Ogbeibu et al., 2020; Deng & Zhang, 2018; Ojha et al., 2020). With this innovation strategy, environmental threats other than market and technology, which are the result of the Covid-19 pandemic which caused the SMEs economic crisis to survive and control the stabilization of their business in the midst of a health and economic crisis (Kraus et al., 2020; Micheli et al., 2020). Based on these discussions, this study designed the following hypotheses:

H₆: *Environmental Turbulence positively moderates the relationship between Product Innovation and Marketing Innovation.*

H₇: *Environmental Turbulence positively moderates the relationship between Product Innovation and Firm Performance.*

H₈: *Environmental Turbulence positively moderates the relationship between Marketing Innovation and Firm Performance.*

3. Method

Based on the focus of the theoretical framework used as a rationale, namely the role of open innovation in SMEs and its influence on creating and adopting product innovation and its role in marketing innovation in dealing with environmental turbulence on firm performance. Thus, this study uses a quantitative approach to explain the causal relationship between variables which can be used as justification for empirical explanations. Several previous studies have explained that inbound and outbound open innovation has an effect on innovation. However, this study adds the environmental turbulence variable as a moderation for innovation and firm performance. Therefore, this study has designed a questionnaire and distributed it to 115 SMEs owner / managers as a sample. In the process of formal data collection, a random sample is used in this study which is distributed to SMEs in Malang City, Indonesia by using data from the Department of Cooperatives, Industry, and Trade. Following the suggestions of several previous studies, this study processed and analyzed data using PLS-SEM. As recommended by Hair et al. (2019), PLS-SEM is a causal modeling approach and aimed at maximizing the explained variance of the dependent latent constructs. Furthermore, due to the explanatory nature of this study, this study used variance-based-PLS-SEM estimation with the primary objective of explaining variance in the structural equation model's next dependent construct. PLS-SEM is a potent statistical tool because it can be applied to all data scales, does not require many assumptions, and confirms relationships that do not yet have a strong theoretical foundation (Hair et al., 2014). In addition, PLS is also used to develop or construct hypotheses, predict complex situations, and a feature that facilitates multivariate data analysis; it differs with previous SEM based on proof of theory with parametric assumptions that must be met (Hair et al., 2019). As a recommendation that has been proven by Hair et al. (2019) regarding measurement of reliability in PLS-SEM use Cronbach's α and composite reliability with standardized indicator loading 0.70, while the validity uses average variance extracted (AVE) with value of acceptable more than 0.50. This study designed questionnaires based on previous research in similar contexts and adopting the measures of construct. For instance, inbound and outbound open innovation was measured from five and four items that were developed by Fu et al. (2019). Product innovation was measured from three items that were developed by Mamun (2018). Marketing innovation was measured from four items that were developed by Nieves & Diaz-Meneses (2016). Environmental turbulence was measured from six items and had modified that developed by Liu et al. (2019). Finally, firm performance in this study was measured from four items that were developed by Hanaysha (2020).

4. Result and Analysis

This study presents descriptive data of respondents based on demographics (see Fig. 1) obtained from the results of distributing questionnaires in 115 SMEs and shows that most of the respondents were men ($n = 87$; 75.65%) and 28 women filled out (24.35%). While overall respondents have the latest education classification with the lowest minimum education are elementary school ($n = 15$; 13.04%), junior high school ($n = 27$; 23.48%), senior high school ($n = 57$; 49.57%), and diploma / first graduate ($n = 16$; 13.91%), but none has a postgraduate classification. With this education classification, we can actually find out the knowledge that is owned, although it is not an absolute measure. Meanwhile, the number of employee ownership can be classified as a small, medium, or large group of employees, which is based on Law Number 20 of 2008 concerning Business, Small and Medium Enterprises (UKM), such as less than 10 people ($n = 71$; 80.8%), 11 to 50 people ($n = 43$; 18.4%), and more than 100 people ($n = 1$; 0.8%). From these data, it can actually be seen in this study that the majority of those who fill in are the types of SMEs in the small and medium classifications.

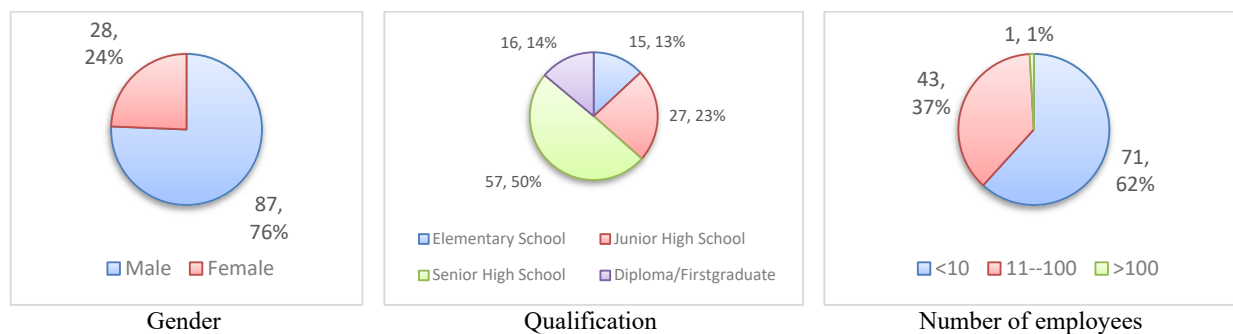


Fig. 1. Respondents' profile

This study also measures the validity and reliability assumptions which form the basis of the feasibility and validity of the data in the quantitative approach, through PLS-SEM which is used to confirm these assumptions. According to Hair et al. (2014), the use of PLS-SEM is recommended because composite reliability and Cronbach's α are determined reliability, then for all items should be greater than 0.70. Therefore, this research data has been processed and shows that all of variable possess high composite reliability value more than 0.9: Inbound open innovation (0.935), outbound open innovation (0.919), product innovation (0.936), marketing innovation (0.937), environmental turbulence (0.938), and firm performance (0.913). Furthermore, Cronbach's α for all of variable possess value more than 0.8: Inbound open innovation (0.914), outbound open innova-

tion (0.883), product innovation (0.897), marketing innovation (0.909), environmental turbulence (0.921), and firm performance (0.873). Thus, all of these values were considered to be acceptable and confirm an adequate reliability. Nevertheless, this study ensures validity indicates that a set of indicators represents the same underlying construct, which can be demonstrated through their unidimensionality. The validity of the discriminant variables was proven by calculating the average value of extraction (AVE) and the value obtained between variables (Hair et al., 2019). In this study, it has shown that the overall variables of AVE value are higher than 0.7: Inbound open innovation (0.744), outbound open innovation (0.740), product innovation (0.829), marketing innovation (0.788), environmental turbulence (0.716), and firm performance (0.726). According Chin (1998) had explained about AVE as a measure of communality for each latent variable and indicated adequate result as all of the variance show exhibit value above 0.50 respectively. Thus, the construct measurements of this research are indicated to be robust.

Table 1
Construct measurement

<i>Variable</i>	<i>Item</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Cronbach's α</i>	<i>Composite Reliability</i>	<i>Average Variance Extracted (AVE)</i>
Inbound	Inbound1	4.313	0.999	0.914	0.935	0.744
	Inbound2	3.957	0.898			
	Inbound3	3.800	0.737			
	Inbound4	3.800	0.725			
	Inbound5	4.043	0.917			
		3.982				
Outbound	Outbound1	3.783	0.743	0.883	0.919	0.740
	Outbound2	3.791	0.797			
	Outbound3	4.026	0.955			
	Outbound4	3.878	0.836			
		3.869				
Product Innovation	PI1	4,113	0.882	0.897	0.936	0.829
	PI2	4,304	0.925			
	PI3	4,052	0.863			
		4.156				
Marketing Innovation	MI1	3,983	0.844	0.909	0.937	0.788
	MI2	3,991	0.829			
	MI3	3,974	0.839			
	MI4	3,861	0.756			
		3.952				
Environmental Turbulence	ET1	3,878	0.815	0.921	0.938	0.716
	ET2	3,965	0.874			
	ET3	3,878	0.748			
	ET4	4,226	0.875			
	ET5	3,974	0.785			
	ET6	3,904	0.697			
		3.970				
Firm Performance	FP1	3,852	0.772	0.873	0.913	0.726
	FP2	3,974	1.008			
	FP3	3,922	0.748			
	FP4	3,861	0.756			
		3.902				

This study has done bootstrapping analysis with PLS-SEM and has eight hypotheses which are relevant tested. Thus, it could determine for model-fit and path coefficient as magnitude were used in determining overall relationship effect in the model. While regarding sequential partial models were determined for running the statistical analysis. Therefore, the first hypothesis, the effect of inbound open innovation, was tested with product innovation resulting in a coefficient of determination (R^2) of 0.744. Based on that result, the relationship between inbound open innovation on product innovation showed positive and significant effect ($PI = 0.713$; p -value < 0.05) and hence H1 was accepted. Second hypothesis tested the relationship between outbound open innovation on product innovation showed positive but not significant ($PI = 0.164$; p -value > 0.05) with that result H2 was rejected. Furthermore, in the third hypothesis the relationship between product innovation and marketing innovation showed positive and significant ($MI = 0.645$; p -value < 0.05) and hence H3 was accepted. In addition, in the fourth hypothesis, the relationship between product innovation and firm performance showed positive and insignificant ($FP = 0.048$; p -value > 0.05) so that H4 was rejected. The direct relationship between marketing innovation and firm performance showed positive and significant results ($FP = 0.520$; p -value < 0.05) so that H5 was accepted. This study also tested the role of environmental turbulence as a moderation between product innovation on marketing innovation, product innovation on firm performance, and marketing innovation on firm performance. In each of these hypothesis testing results it had shown that environmental turbulence moderated positively only on product innovation towards firm performance ($\beta = 0.036$) and H7 was accepted. Furthermore, other moderating roles given their influence from environmental turbulence showed negative results for product innovation and marketing innovation ($\beta = -0.094$) as well as marketing innovation and firm performance ($\beta = -0.162$), therefore H6 and H8 were rejected. Table 2 below had been presented as a whole in more detail and also included the mediating role of product innovation, whose implications would also be discussed afterwards.

Table 2
Statistical Effect and Hypotheses Testing

Variable	Direct Effect (β)	Moderating Effect (β)	Indirect Effect (β)	T Score	P Values	Conclusion
Inbound OI → PI	0.713			7.402	0.000	Accepted
Outbound OI → PI	0.164			1.555	0.120	Rejected
PI → MI	0.645			6.309	0.000	Accepted
PI → FP	0.048			0.749	0.454	Rejected
MI → FP	0.520			5.955	0.000	Accepted
ET×PI → MI		-0.094		1.281	0.201	Rejected
ET×PI → FP		0.036		0.576	0.565	Accepted
ET×MI → FP		-0.162		2.594	0.010	Rejected
Inbound OI → PI → FP			0.034	0.748	0.455	Rejected
Outbound OI → PI → FP			0.008	0.585	0.559	Rejected
PI → MI → FP			0.335	3.931	0.000	Accepted

N = 115

R² = PI (0.744); MI (0.815); FP (0.906)

*Sig. p-value < 0.10; **Sig. p-value < 0.05; ***Sig. p-value < 0.01

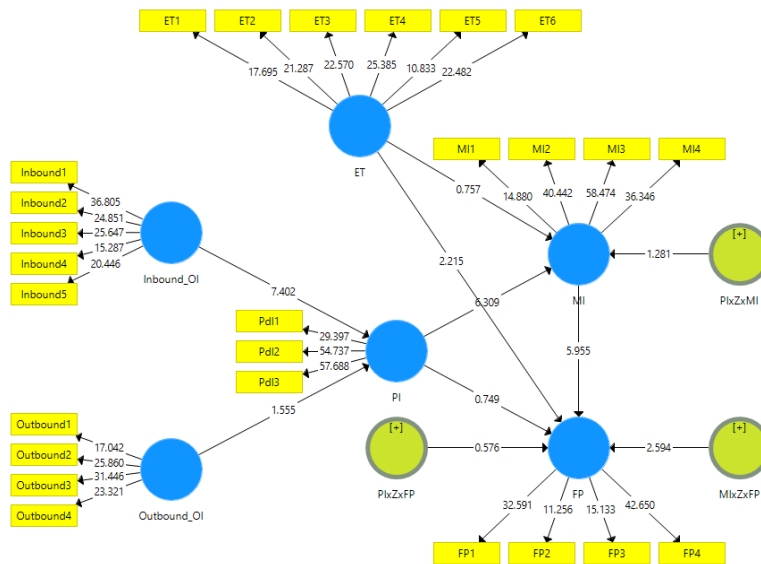


Fig. 2. Outer Model

5. Discussion

Knowledge is a resource that is still needed for various organizations, because knowledge underlies the organization's ability to carry out a series of activities and in particular can provide solutions to a problem (Fahmi & Yulianto, 2021). Organizations not only need knowledge from their internal, but organizations must be more open to receiving knowledge from outside which will enrich knowledge so that the organization is more agile. On this basis, open innovation discussed by Chesbrough (2003; 2006) provides a paradigm for organizations to innovate through knowledge obtained from outside which is then processed and utilized internally as an intangible resource. Therefore, this study was conducted with the aim of explaining the role of open innovation (which includes inbound and outbound knowledge) on the ability of innovation in terms of products to stimulate firm performance. In addition, this is accompanied by increasingly dynamic environmental conditions (market and technology) due to various factors, one of which is the correlation with the impact of the crisis as a result of the Covid-19 pandemic. Through the knowledge that the company, especially SMEs, can respond to the resilience of its business to be able to get through difficult times, sales have dropped significantly, production costs and employee salaries continue to be incurred, and business revenues have decreased significantly or even minus. Since the Covid-19 pandemic in the early 2020 quarter until now, various SMEs have had difficulty responding, but some have chosen to survive by making innovations because consumer behavior has also shifted due to their anxiety about the transmission of the Covid-19 virus. This should be captured and responded to by the business sector by innovating both incremental and radical innovation.

Based on the background of the discussion, this study has tested the relationship between inbound open innovation and product innovation ($\beta = 0.713$; $R^2 = 0.744$; $p\text{-value} = 0.000$) which is positive and significant. The implication is that inbound open innovation has provided positive benefits and encouragement for companies to carry out product innovation (Chesbrough, 2003; 2006). Inbound open innovation strategies owned by the company can be managed well within the company which includes the flow of knowledge aimed at exploring and capturing new knowledge and technology from external sources (Chesbrough & Crowther, 2006; Chesbrough & Bogers, 2014). Although the internal mechanism in the relationship between inbound open innovation and product innovation performance is still unclear, and existing research has not concluded the role

of absorption in this relationship (Xie & Wang, 2020). However, it can be understood from these results that in addition to being proven to have a positive and significant effect (Lu et al., 2020), inbound open innovation has been well managed by the internal company to carry out product innovation both radically and incrementally (Park, 2018; Expósito et al., 2019; Han et al., 2020). Changes that occur in terms of new products to old products (which may be outdated) provide novelty and uniqueness from new products (Spithoven et al., 2013; Xie & Wang, 2020). At least companies are carrying out product innovation as a strategic step to survive in the midst of intense competition, developing technological advances, and an environment that is hit by a crisis due to the Covid-19 pandemic. SMEs can increase the value of their investment through product innovation to increase their ability to increase their ability to acquire, assimilate, and apply knowledge (Fahmi & Yulianto, 2021; Popa et al., 2017). The role of knowledge is what is called an intangible asset for SMEs in understanding the perceived internal company due to decreased sales, less competitive products in the market, and decreased income (Expósito et al., 2019; Freel & Robson, 2017).

Meanwhile, the results of testing the relationship between outbound open innovation and product innovation showed positive and insignificant ($\beta = 0.164$; p -value = 0.120). In contrast to inbound practices, outbound open innovation refers to the exploitation of internal ideas or technological knowledge that flows out of the company through licensing, patents or contractual agreements to obtain monetary benefits from non-monetary money (Chesbrough, 2006). SMEs who practice entry and exit are more likely to gain greater value from technological knowledge and abilities (Chesbrough & Crowther, 2006). Outbound open innovation involves external exploratory learning behavior that allows a company to see beyond its boundaries, enriching its own knowledge pool (Popa et al., 2017; Freel & Robson, 2017). In this regard, companies that practice entry can benefit from new ideas and a combination of knowledge, new market opportunities, and renewed problem-solving capabilities on the external (Expósito et al., 2019; Spithoven et al., 2013). This may occur when it does not significantly affect product innovation, which is reflected in the ability of absorptive capacity which can be said to be still low and not sufficiently influential for SMEs to carry out product innovation (Lu et al., 2020; Park, 2018). Whereas the positive effect of open innovation strategy on innovation performance depends on the company's potential and realized absorption capacity (Chesbrough & Bogers, 2014). Absorption potential can facilitate broadly positive effects on the innovation performance of SMEs and the realized absorption capacity is very helpful in transforming external knowledge obtained from open innovation into innovation outcomes (Expósito et al., 2019; Han et al., 2020; Park, 2018; Xie & Wang, 2020). Therefore, the application of open innovation in SMEs must focus on developing their absorption so that it can have a significant impact in terms of innovation.

On the other hand, to support product innovation success and performance, marketing innovation is a channel that contributes to distributing the value of products to customers (Mitrega et al., 2017). The hypothesis regarding the relationship of product innovation's influence on marketing innovation ($\beta = 0.645$; $R^2 = 0.815$; p -value = 0.000) has shown positive and significant results. Intense competition forces SMEs to carry out innovative marketing activities to determine customer needs and increase customer satisfaction and retention (Evanschitzky et al., 2012; Falahat et al., 2020). As a field of practical and scientific knowledge, marketing disciplines cannot ignore this change because technological advances and intense competition have significantly changed customer behavior and needs (Najafi-Tavani et al., 2018). This marketing innovation is part of their strategy to better meet consumer needs. The efforts and resources dedicated by companies to introduce new sales methods into their current business are as marketing innovations and as important as technological innovation in terms of increasing the competitiveness of companies (Ganzer et al., 2017; Popa et al., 2017; Aksoy, 2017). Chen (2006) argues that marketing innovation refers to market research, pricing strategies, market segmentation, promotion, distribution channels and marketing information systems. With that, marketing innovation has a positive and significant influence on the success of product innovation performance (Aksoy, 2017; Zaefarian et al., 2017; Parrott et al., 2010). At the same time, it can be discussed to support the results of the hypothesis that include product innovation on firm performance ($\beta = 0.048$; p -value = 0.454) and marketing innovation on firm performance ($\beta = 0.520$; p -value = 0.000). Through marketing innovation, SMEs can achieve competitive advantage and competition in a tight market (Soto-Acosta et al., 2016; Fahmi & Yulianto, 2021). The channels currently available are very diverse and make it easier for SMEs to access the target markets and segments. So that the success of SMEs in carrying out product innovation depends on the performance of marketing innovation which can improve firm performance (Najafi-Tavani et al., 2018; Mitrega et al., 2017). Without marketing innovation, only product innovation has not been able to provide an increase in firm performance (Chen, 2006; Astuti et al., 2020; Falahat et al., 2020; Zaefarian et al., 2017). This can be seen in table 3 which also presents the results of the mediating role of marketing innovation on product innovation and firm performance.

However, an increasingly dynamic environment can be a disruption to the stability of SMEs that may not be able to respond quickly and adjust well (Deng et al., 2020; Kraus et al., 2020). Environmental turbulence is not only from the market and technology (Dost et al., 2019), although both of them provide pressure and difficult adaptation for SMEs, crisis conditions can even have a tremendous impact on the stabilization of SMEs performance (Kraus et al., 2020; Micheli et al., 2020). Especially for the Covid-19 pandemic that is currently hitting, at the beginning of the Covid-19 pandemic, SMEs were unable to respond and ended up in loss and bankruptcy (Craven et al., 2020; Dimson et al., 2020). However, with the external knowledge obtained, SMEs began to slowly take strategic steps to survive and rise in the midst of a crisis (Han et al., 2020). Of course, with the various existing literature, innovation is a key defense that will save SMEs in the face of bankruptcy (Ogbeibu et al., 2020). However, there are not many innovations that must be created with the ability and knowledge of SMEs as enough to carry out product innovation and marketing innovation (Liu et al., 2019; Deng et al., 2020). In product innovation,

SMEs creates and delivers new products in quick succession, which goes beyond solving routine problems and the efficiency of existing products and impacts on improving firm performance (Ottesen & Grønhaug, 2004). The role of product innovation in dealing with environmental turbulence is to reduce the threat of obsolescence, compete in the market, and have a novel value compared to previous products (Astuti et al., 2020; Fahmi & Yulianto, 2021). A new value proposition, SMEs can control the stabilization of their business to continue to exist in the market (Ogbeibu et al., 2020; Deng & Zhang, 2018; Ojha et al., 2020). This assumption has explained the results of the hypothesis that environmental turbulence moderates positively between product innovation and firm performance ($\beta = 0.036$). While other results, environmental turbulence moderates negatively between product innovation on marketing innovation ($\beta = -0.094$) and marketing innovation on firm performance ($\beta = -0.162$). This can occur in several possibilities, 1) SMEs are late in adopting marketing innovation, so they cannot work and have a positive impact on firm performance (Deng & Zhang, 2018; Ojha et al., 2020); 2) there is a change in customer behavior that has not been captured by SMEs (Craven et al., 2020); and 3) the segmentation targeted by SMEs has not been on target, which causes new marketing activities to not work well enough (Liu et al., 2019). SMEs need to move quickly to respond to all possibilities that occur in marketing activities in order to further increase the surplus points in their marketing innovation strategy (Alhussan et al., 2017). Because marketing innovation works to deliver information on the value of a product to the market, it will be able to improve the company's financial side. In addition, marketing innovation refers to the processes carried out by companies to adapt products to specific customer needs, improve their functionality and innovate in customer management (Anning-Dorson, 2017; Wadho & Chaudry, 2018).

6. Conclusion

This research emphasizes and highlights the role of open innovation in the era of environmental turbulence and the crisis caused by the Covid-19 pandemic. Therefore, this study is based on the role of open innovation in the SMEs sector which is most vulnerable to disruption and environmental turbulence, so that the role of the knowledge gained can respond both in terms of product innovation and marketing innovation to firm performance. Through innovation it also increases the need for SMEs to simultaneously create and deliver new products, which goes beyond solving routine problems and the efficiency of existing products (Alhussan et al., 2017). Meanwhile, environmental turbulence could encourage the acceleration of technology adoption as a resource for innovation. Moreover, competition accelerates the adoption of new technology to drive internal efficiency and to create product variety and marketing innovation. Therefore, this study investigates and examines the role of inbound and outbound innovation on product innovation, marketing innovation, and their implications for the era of environmental turbulence. Based on the results of hypothesis testing in this study, it can be seen that what has a positive and significant effect is the inbound relationship of open innovation to product innovation, product innovation to marketing innovation, marketing innovation to firm performance. However, this research has shortcomings that other researchers can do in the future, namely the need to add absorptive capacity and knowledge management capability variables. This is when firms are more open in receiving information and conducting collaborative activities with other partners, absorptive capacity plays a role in capturing the ability to absorb knowledge and knowledge management capability as the processing of knowledge obtained in the form of innovation outcomes and their implications for firm performance.

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