

Product innovation, firm performance and moderating role of technology capabilities

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Abstract

Purpose – This research aims to provide evidence that firms that create product innovations (PROINVs) can improve the performance of firms in Indonesia. And then this research also provides evidence that firms with high technological capabilities can moderate the impact of PROINV on firm performance in Indonesia.

Design/methodology/approach – Based on the firm that disclosure research and development expenditures, the number of samples in this study is 261 annual reports for the period 2015–2020. Researchers used an estimate of Moderation Regression Analysis (MRA) with STATA 14.0.

Findings – The results showed that PROINV significantly affected firm performance, while technology capabilities (TECHCAP) did not. Then TECHCAP can moderate the impact of PROINV on the performance firm. This research showed that TECHCAP are pure moderation, whereas TECHCAP can weaken the impact of PROINV on firm performance.

Research limitations/implications – This research can provide empirical results that firms in Indonesia must adapt to meet the needs of society in creating PROINVs and technological innovations to maintain a sustainable national economy. And then, this research provides the understanding that high TECHCAP can create sustainable PROINVs that can affect firm performance.

Originality/value – The novelty in this study researchers added variable moderation of technological capabilities to the model of the effect of PROINV on firm performance. A firm with high technological capabilities will be balanced with good research and development activities to create a long-term and sustainable firm orientation.

Keywords Firm performance, Product innovation, Technology capabilities, High-low capabilities

Paper type Research paper

1. Background

Industry 4.0 is known as the fourth industrial revolution, an advanced manufacturing sector and integrated advanced information technology to be adapted to the needs of the field of human resources (Javaid *et al.*, 2020). Indonesia is currently ranked 14th out of 17 countries in South East Asia, East Asia and Oceania (SEAO) region and ranked 85th out of 131 countries in the world in the 2020 Global Innovation Index. This index shows the firm's ability to use resources owned to compete between countries. GII emphasizes measuring economic performance in a country always to experience the development of innovation progress (Kemenko-Marves, 2021). The role of firms in Indonesia is encouraged to produce renewable



innovations from research and development activities to contribute to harmony between economic, social and environmental aspects. OECD (2018) also reveals that investing in research and development is crucial for boosting economic growth and development. That also proves that research and development activities are essential to do.

Technological innovation in the firm focuses on improving processes and increasing the use of technology (Dosi, 1982; Nelson, 2009). The firm's research and development is one of the critical constituents in economic growth (Alam *et al.*, 2019; Brown *et al.*, 2009; Rajapathirana and Hui, 2018). Research and development investments in firms are used as a source of competitive advantage, long-term growth and technological advancement to achieve improved firm performance (James and McGuire, 2016; Patel *et al.*, 2018; Ruiqi *et al.*, 2017). Previous research studies show a positive relationship between investment research and development to firm performance (Ramadani *et al.*, 2019; Un and Asakawa, 2015; Yeh *et al.*, 2010).

Research and development investment is one of many firm's efforts to adapt to change. The main objective of research and development activities is to develop a product's existing or new core competencies (Matheson *et al.*, 1998). Resource-based view theory considers the firm a collection of all dynamic resources and capabilities (Peteraf *et al.*, 2013; Teece and Leih, 2016; Teece *et al.*, 1997). Firms classified as innovation firms will face external financing and agency conflicts, which contribute to the firm's lack of efficiency of research and development investments (Xiao, 2013). That is supported by research from Hillier *et al.* (2011), showing the possibility of limited profit levels by investing in research and development and having high-risk properties.

Previous research shows that research and development intensity also positively affects firm performance. The results of the study were revealed by several researchers da Silva *et al.* (2015), Gu (2016), Jaisinghani (2016), Mulero Mendigorri *et al.* (2016), Vithessonthi and Racela (2016) explained to the industry that carrying out research and development activities is positively related to stock returns in research and development firms that actively carry it out. Jaisinghani (2016) and Mulero Mendigorri *et al.* (2016) stated that one of the research and development companies has positive research and development on the firm performance when it is at a moderate to a high level of earnings persistence, this is due to the company's ability to try to improve the quality of its innovation and technology. Product innovation (PROINV) can improve the competitiveness of the firm, PROINV can also increase the efficiency of resource utilization, increase investment and sales profits, develop the latest market and improve the firm image (Dangelico and Pujari, 2010; Jaisinghani, 2016; York, 2009). Other research shows that research and development investments support corporate productivity and improve firm performance (Hashi and Stojčić, 2013; Raymond *et al.*, 2015).

Previous research studies showing PROINV that has a positive effect on firm performance is from Dangelico and Pujari (2010), Lee *et al.* (2019), Rajapathirana and Hui (2018) and Ramadani *et al.* (2019) show PROINV can improve the efficiency of resource utilization of firms, increase return on investment and sales, develop new markets and increase corporate value. Piening and Salge (2014), Li * (2005) and Dehning *et al.* (2007) show that PROINV is positively associated with a diversity of firm's financial performance, such as sales growth and improved profit margins. Jones and Butler (1988) stated that the regulation in the firm technological innovation process could help firms expand their products' scope and provide the primary conditions for PROINV. When a firm has enough capabilities to invest in technological innovation, PROINV will be more likely to meet the needs of consumers (Lee *et al.*, 2019). High-tech firms collaborate on innovation between firms for technology development and commercialization (Laursen and Salter, 2014; Wang *et al.*, 2015). High-tech firms are more enduring and more active in the face of global competition by conducting technology alliances in creating an innovation (Rosenkopf and Schilling, 2007)

Firms with high technological capabilities usually use research and development activities for long-term orientation and allocate costs to support research and development

investments (Clausen *et al.*, 2011; Parisi *et al.*, 2006). In contrast to firms with low technological capabilities, usually focusing on non-research and development activities and having a low-value chain system shows poor internal innovation (Heidenreich, 2009; Rammer *et al.*, 2009). The results of this study are supported by subsequent research by Andries and Czarnitzki (2014) and Britton (1989). Differences in firm capabilities need to be considered in implementing innovations to improve firm performance (Rubera and Kirca, 2012). A pattern of innovation tailored to the technological capabilities possessed, namely high-tech and low-tech firms (Lee *et al.*, 2019; Santamaría *et al.*, 2009). The role of technology owned by the firm and the size of the firm became a driving factor in resulting in PROINV (Brouwer and Kleinknecht, 1999; Hashi and Stojčić, 2013; Wang *et al.*, 2015).

This research is expected to contribute to the addition of literature related to innovation activities carried out by companies by integrating technological capabilities as a competitive advantage to improve company performance. This research confirms the resource-based view that companies' research and development investments can accelerate adaptation to meet the community's needs. In addition, companies can play a role in creating PROINV and technological innovation to streamline the use of resources to reach sustainable companies. Companies' research and development activities can increase the risks that will be faced, and the level of uncertainty is high so that the company must apply the principle of a conservatory in reducing agency conflicts that may occur. Companies that present research and development expenses on annual reports are used as research samples for 2015–2020. Researchers use these characteristics to see the alignment of companies in Indonesia that innovate products based on research and development costs and distinguish them from their technological capabilities.

The next part of this paper is arranged as follows. Part 2 describes the literature review and development of research hypotheses. Part 3 describes the research methodology and research data. Sections 4-6 present empirical results and discussions. Last part 7 concludes this paper.

2. Literature review and hypothesis development

2.1 Product innovation, technology capabilities and firm performance

The resource-based view considers the firm a dynamic collection of all resources and capabilities (Peteraf *et al.*, 2013; Teece and Leih, 2016; Teece *et al.*, 1997). The firm's role of technology and the firm's size became a driving factor in PROINV (Brouwer and Kleinknecht, 1999; Hashi and Stojčić, 2013). Schmidt and Rammer (2007) and Lee *et al.* (2019) the firm technology categories, namely high technology and low technology, can moderate the impact of PROINV on firm performance. A pattern of innovation tailored to the technological capabilities possessed, namely high-tech and low-tech firms (Jiang *et al.*, 2020; Santamaría *et al.*, 2009; Zhou *et al.*, 2017). The integration of knowledge derived from internal and external firms will create synergies and construct complex systems to achieve the firm's innovation goals.

Jha and Bose (2016) provide empirical evidence that intramural and pure research and development activities have a positive and significant effect on developing new products or services in European firms. Research and development investments in firms are used as a source of competitive advantage, long-term growth and technological progress to improve firm performance (James and McGuire, 2016; Patel *et al.*, 2018; Ruiqi *et al.*, 2017). Then PROINV can also improve the diversity of firm financial performance, such as sales growth, expanding the market, increasing customer satisfaction and increasing profit margins (Dehning *et al.*, 2007; Li*, 2005). Research and development activities carried out by the firm can produce PROINV and develop the market so that it can increase the firm performance (Dangelico and Pujari, 2010; James and McGuire, 2016; Jha and Bose, 2016; Lee *et al.*, 2019;

Ruiqi *et al.*, 2017). Resources and capabilities are the basis for understanding how firms create and configure internal and external activities in building the ability to innovate. Companies with high and low technology are a form of effort to achieve innovation that will be carried out by companies by adjusting their technology capabilities (Lee *et al.*, 2019; Santamaria *et al.*, 2009). Innovations made by firms are usually to achieve economic goals. Firms with low technological capabilities usually focus on non-research and development activities and have low-value chain systems that show poor internal innovation (Heidenreich, 2009; Rammer *et al.*, 2009) (Rubera and Kirca, 2012). Santamaria *et al.* (2009) and Schmidt and Rammer (2007) show that technological capabilities affect firm performance.

The urgency of research and development activities carried out by firms is one of the critical constituents in economic growth. Several researchers revealed the results of the study, namely, da Silva *et al.* (2015), Gu (2016), Jaisinghani (2016), Mulero Mendigorry *et al.* (2016), Vithessonthi and Racela (2016) explained to the industry that carrying out research and development activities is positively related to stock returns in research and development firms that actively carry it out. Research works by Schmidt and Rammer (2007) shows that it can moderate PROINV levels on firm performance. Differences in firm capabilities need to be considered in implementing innovations to improve firm performance (Jiang *et al.*, 2020; Rubera and Kirca, 2012; Santamaria *et al.*, 2009). Firms that can invest in technological innovation and PROINV will be more likely to meet the needs of consumers (Lee *et al.*, 2019). Firms with high technological capabilities usually use research and development activities for long-term orientation and allocate costs to support research investment and development (Clausen *et al.*, 2011; Parisi *et al.*, 2006; Rosenkopf and Schilling, 2007). In contrast to firms with low technological capabilities, usually focusing on non-research and development activities and having a low-value chain system shows poor internal innovation (Heidenreich, 2009; Lee *et al.*, 2019; Rammer *et al.*, 2009). Based on this description, the research hypothesis is as follows:

- H1. PROINV has a positive effect on firm performance
- H2. Technology capabilities (TECHCAP) positively affect firm performance
- H3. TECHCAP moderate the impact of PROINV on the firm performance

3. Research methods

The sample in this study consisted of firms registered with the Indonesia Stock Exchange for 2015–2020. The background of the researchers determined the sample period was based on the trend of the Global Innovation Index/GII, where Indonesia's ranking in 2015–2020 showed a significant increase, namely in 2015 showed a rating of 97 out of 129, then in 2020 showed a ranking of 85 out of 131 (Kemenko-Marves, 2021). This increase is the selection of the sample period to see the contribution of companies in Indonesia in creating innovations to adapt to become a continuous company. Researchers determine the sample by using the purposive sampling method. Then, the researchers determined the sample selection criteria: First, the firm presents complete data related to the research variables for the period 2015–2020, both firms that present the burden of research and development in the annual report—the number of samples that have been determined as many as 261. The study used a Moderation Regression Analysis (MRA) model. Researchers use STATA 14.0 software to process research data. Based on hypotheses that researchers have developed, the regression model equations used in the study are as follows:

$$ROA_{it} = \alpha + \beta_1 PROINV_{it} + \beta_2 TECHCAP_{it} + \beta_3 FIRMSIZE_{it} + \beta_4 AGE_{it} + \beta_5 LEV_{it} + \beta_6 ROE_{it} + \epsilon \quad (1)$$

$$ROA_{it} = \alpha + \beta_1 PROINV_{it} + \beta_2 TECHCAP_{it} + \beta_3 PROINV_{it} * TECHCAP_{it} + \beta_4 FIRMSIZE_{it} + \beta_5 AGE_{it} + \beta_6 LEV_{it} + \beta_7 ROE_{it} + \varepsilon \quad (2)$$

where return on asset is a measure to calculate the firm's effectiveness in obtaining profits through assets, firm performance is projected by net income divided by the total firm assets. Then the independent variable, PROINV, is projected by research and development expenditure divided by sales (Jaisinghani, 2016; Vithessonthi and Racela, 2016; Wadho and Chaudhry, 2018). Furthermore, the moderation variable in this study is TECHCAP. TECHCAP are the resources and capabilities of firms related to technological characteristics (Schmidt and Rammer, 2007). TECHCAP are measured using dummy variables. Where the score is 1 if the firm has high technical characteristics, while 0 if the firm has low technology characteristics (Schmidt and Rammer, 2007). While the control variables in this study are, the firm's size is measured by the natural logarithm of the total assets (Kao *et al.*, 2018; Rodriguez-Fernandez, 2016). Furthermore, the age of the firm is measured by the logarithm of the current firm age (Ilaboya and Ohiokha (2016), Sardo and Serrasqueiro (2018). Then leverage, which measures the spending of firms financed with debt. Leverage is measured using total debt as the total firm assets. Lastly, return on equity is measured by net income as the total firm equity.

4. Results and discussions

4.1 Baseline result

We presented the results of descriptive statistical tests and Pearson correlation in Table 1, and the table showed that the mean value of the firm performance of 0.298 and std. dev. of 0.407, so that there was a difference in industry classification in Indonesia as a whole in the sample showed almost the same level of firm performance. Furthermore, the mean PROINV value of 0.004 and the value of std. dev. of 0.010 show that firms in Indonesia understand how important the research and development aspects for corporate sustainability are. As for TECHCAP that show a mean value of 0.60 and a dev. std. value of 0.490, firms in Indonesia are still relatively small in their use of technology for activities related to the research and development of the firm.

Table 2 shows the results of the linear regression analysis for the first equation model; the results of regression analysis are as follows:

Table 2 shows that PROINV has a significant positive effect on firm performance, with a *p*-value of 0.000 and a coefficient of 18.434 indicating that if there is an increase in PROINV on firm performance (ROA). While TECHCAP do not affect firm performance, a *p*-value of 0.135 and a coefficient of 0.057 indicate that if there is an increase in TECHCAP not be ed to firm performance (ROA). The following table shows the results of MRA for the second equation model; the results of regression analysis are as follows:

Table 3 shows that TECHCAP moderate PROINV against firm performance, having a significant negative effect, with a *p*-value of 0.052 and a coefficient of -4.422. Based on Table 3 shows the results of MRA that the moderation variable in this study, namely TECHCAP, can moderate the impact *f* PROINV on firm performance (ROA). TECHCAP are classified as pure moderators or pure moderators. That corresponds to Sharma *et al.* (1981), first, estimates of moderation variables to dependent variables show no significant effect. That statement is supported by the results of an analysis that shows that the *p*-value of TECHCAP is 0.135. The second criterion, the estimation of the interaction between independent and moderation variables against the dependent variable, indicates a significant negative. This statement is supported by the results of MRA tests that show that the interaction between technology capabilities*product innovation (PROINV*TECHCAP) has a

	Obs	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) ROA	261	0.29899	0.40789	1.000						
(2) PROINV	261	0.00431	0.01073	0.522***	1.000					
(3) TECHCAP	261	0.60	0.49080	0.015	-0.031	1.000				
(4) SIZE	261	21.461	1.6518	-0.006	0.022	-0.173***	1.000			
(5) AGE	261	36.1	16.403	0.238***	0.354***	-0.109*	0.485***	1.000		
(6) LEV	261	0.39951	1.2186	0.502***	-0.039	-0.032	-0.111*	-0.093	1.000	
(7) ROE	261	2.1887	3.2830	0.268***	0.166***	-0.008	-0.270***	-0.010	0.181***	1.000

Note(s): This table descriptive statistics and correlation coefficients of the variables used in our main analysis. All variables are winsorized at the 1st and 99th percentiles. Values with asterisks *, ** and *** indicate significance at the 10, 5 and 1 % levels, respectively (2-tailed)

Table 1.
Summary statistics

Table 2.
Regression analysis

	Predict sign	ROA	p-value	ROA	p-value
(1) PROINV	+	18.434***	0.000(***)		
(2) TECHCAP	+			0.057	0.135
(3) SIZE	+	0.005	0.677	−0.010	0.428
(4) AGE	+	0.003**	0.023(**)	0.008***	0.003(***)
(5) LEV	+	0.178***	0.000(***)	0.174***	0.000(***)
(6) ROE	+	0.013	0.162	0.021	0.198
Year FE		Yes		Yes	
R ²		0.575		0.382	
N		261		261	

Note(s): This table reports regression results on the relation product innovation and technological capabilities on firm performance. Detailed definitions of variables are provided in research method section. All regressions control for year fixed effects. Standard errors clustered at the firm and year and *t*-statistics are reported in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively

Table 3.
Moderating regression
analysis

	ROA	p-value
PROINV*TECHCAP	−4.422*	0.052(*)
SIZE	−0.011	0.404
AGE	0.008***	0.002(***)
LEV	0.174***	0.000(***)
ROE	0.022	0.186
Year FE	Yes	
R ²	0.381	
N	261	

Note(s): This table reports Moderating Regression Analysis (MRA) results on the technological capabilities moderated in relation product innovation on firm performance. All regressions control for year fixed effects. Standard errors clustered at the firm and year and *t*-statistics are reported in parentheses. ***, ** and * denote significance at the 1, 5 and 10% level, respectively

p-value of 0.052 more minor than the significance level of 0.05 but negatively affects firm performance (ROA).

4.2 Discussion

4.2.1 Product innovation on firm performance. Based on the statistical analysis results, PROINV has a significant positive effect on the performance firm, with a significance level of 0.000 (<0.05). The firm's innovation activities aim to create the firm's competitive advantage by conducting research and development as one of the determinants of business activity strategy. This statement is supported by (Hashi and Stojčić, 2013; Raymond *et al.*, 2015), stating that research and development support corporate productivity and performance improvement. The results of this study follow the resource-based view theory (Barney, 1991). Innovation in the firm is closely related to the performance of the firm.

PROINV results from innovation activities or research and development processes carried out by the firm. PROINV is usually related to changes in product characteristics to meet market needs, both old and new products. This statement follows the research of (Clark, 1987; Isogawa *et al.*, 2012; Kaplan, 1999) that PROINV can change its old product to change consumer behavior and reshape the previous market. The results of this study are following the research Andries and Czarnitzki (2014), Bustinza *et al.* (2019), James and McGuire (2016)

(Patel *et al.*, 2018), Ruiqi *et al.* (2017), and Rajapathirana and Hui (2018) which states that research and development activities that produce innovation in the firm are used as a source of competitive advantage, long-term growth and technological progress to achieve improvements in firm performance.

4.2.2 Technology capabilities on firm performance. Based on the statistical analysis results, TECHCAP do not affect firm performance, with a significance level of 0.135 (<0.05)—the difference in technological capabilities by the firm's characteristics. Firm characteristics relate to the firm's ability to integrate technology to achieve business goals. The difference between firms with high technology and low TECHCAP has no impact on the achievement of firm performance. This statement does not conform to the resource based-view (Peteraf *et al.*, 2013; Teece and Leih, 2016; Teece *et al.*, 1997) This is because the firm has performance achievements that are tailored to business objectives so that the stretched resources will adjust to the needs.

Bettis and Hitt (1995) and Henderson and Clark (1990) stated that the firm capabilities related to technology could not be easily replicated to aim as a competitive advantage. That is due to whether the firm's effectiveness can manage its ability to obtain the expected return on financial performance. The statement shows that not all firms pay attention to their technological capabilities in achieving firm performance, but rather how firms use other resources to maximize firm performance. The results of this study are supported by Henderson and Clark (1990), Rubera and Kirca (2012), Santamaría *et al.* (2009), Lee *et al.* (2019) and Bag *et al.* (2020) showed that TECHCAP are based on differences in the characteristics of using firm technology in achieving business goals and firm performance.

4.2.3 Technology capabilities and product innovation on firm performance. TECHCAP can moderate the effect of PROINV on firm performance. The interaction between technology capabilities*product innovation has a p -value of 0.000 but negatively affects firm performance. This interaction can weaken firm performance. That is related to differences in the classification of technological capabilities and research and development activities that cannot be attributed to each other in achieving business goals. The firm has performance achievements tailored to business objectives so that the stretched resources will adjust the needs. Differences in firm capabilities still need to be considered in implementing innovations to improve firm performance (Rubera and Kirca, 2012). This statement follows resource-based view theory (Peteraf *et al.*, 2013; Teece and Leih, 2016; Teece *et al.*, 1997)

Research studies by Schmidt and Rammer (2007) show that it can moderate PROINV levels on firm performance. A pattern of innovation tailored to the technological capabilities possessed, namely high-tech and low-tech firms (Santamaría *et al.*, 2009). Utterback and Abernathy (1975), states that PROINV is defined as unrelated to the technology firms use to meet market needs. Technological innovations carried out by firms do not aim to produce PROINV, so, on the contrary, PROINV is not always produced by the change in technology used (Shao *et al.*, 2020). Technological innovation leads to more standardization of the production process, reduction and efficiency. While PROINV further changes its old products to change consumer behavior and reshape the previous market.

TECHCAP, which are pure moderation in research, show that TECHCAP can weaken the impact of PROINV on firm performance. That is because PROINV and technological innovation should not be generalized with the firm innovation process and the resulting improvement in firm performance. Firms with technological capabilities aim to produce PROINV because firms use the technology needed to facilitate business activities. Technological innovation in the firm has more impact on process innovation or system innovation, while PROINV is d by research and development activities carried out by the firm. This study supported by Schmidt and Rammer (2007) showed that TECHCAP could moderate the impact of PROINV on firms' performance, but in this study, empirically proven TECHCAP can weaken the impact of PROINV on firm performance firms. Utterback and

Abernathy (1975) and Shao *et al.* (2020) that firms in implementing technological innovation do not aim to produce PROINV, that PROINV is not always produced by changes in the technology used by the firm.

5. Additional analysis

We use additional analytics to deepen the impact of PROINV and TECHCAP with high-firm and low-firm performance. Researchers do the basis of determination with summary tests to see the mean value of firm performance (ROA). Table 4 shows that firms that have ROA_HIGH are affected by PROINV and TECHCAP with a *p*-value of 0.000 and 0.004, respectively. That shows that research and development costs incurred and TECHCAP owned can improve firm performance relatively high. Then firms that have ROA_LOW are affected by PROINV with a *p*-value of 0.001 each in the negative direction. That shows that incurred research and development costs are not effective or mistargeted, affecting low-performance decline. We highlighted the moderation results of the two that showed significant differences, where firms with high-performance levels do not show TECHCAP to strengthen the impact of PROINV on firm performance. The reason that may occur is that firms that are relatively high to determine long-term orientation are done based on the number of costs and activities from research and development carried out, not derived from the technology used. This statement is supported by previous research studies (Lee *et al.*, 2019; Un and Asakawa, 2015). Then the moderation relationship of TECHCAP strengthens PROINV in low-firm performance. Previously the results of the analysis showed that PROINV had a negative effect, so the conclusion that TECHCAP strengthen to reduce the level of firm performance. That means that firms with low-performance levels have not allocated research and development costs for long-term orientation, then TECHCAP are used as business activities as usual, not for supporting firms to conduct research and development. This statement is supported by previous research studies (Lee *et al.*, 2019; Rammer *et al.*, 2009; Shao *et al.*, 2020).

6. Conclusion

This research aims to prove that firms that create PROINVs can improve firm performance in Indonesia. Then provide evidence that firms with high TECHCAP can moderate the impact of

	ROA_HIGH	<i>p</i> -value	ROA_LOW	<i>p</i> -value
PROINV	20.772***	0.000(***)	-15.337***	0.0001(***)
TECHCAP	0.182***	0.004(***)	-0.024	0.105
PROINV*TECHCAP	20.522	0.382	17.567***	0.000(***)
SIZE	-0.007	0.824	0.005	0.370
AGE	0.003	0.285	0.002***	0.000(***)
LEV	0.154***	0.000(***)	-0.000	0.963
ROE	0.033	0.137	0.001	0.201
Year FE	Yes		Yes	
R ²	0.784		0.179	
N	78		183	

Note(s): This table reports additional regression results on the relation product innovation and technological capabilities on High_ROA and Low_ROA. High_ROA measured using the highest average value of the mean value in descriptive statistics, and Low_ROA measured using the low average value of the mean value in descriptive statistics. All regressions control for year fixed effects. Standard errors clustered at the firm and year and *t*-statistics are reported in parentheses. ***, ** and * denote significance at the 1%, 5%, and 10% level, respectively

Table 4.
Additional analysis

PROINV on firm performance in Indonesia. The results showed that PROINV had a significant positive effect on firm performance. The firm's innovation activities aim to create a competitive advantage by carrying out research and development as one of the determinants of business activity strategy. Furthermore, TECHCAP do not affect firm performance. Firm characteristics relate to the firm's ability to integrate technology to achieve business goals. TECHCAP can moderate the effect of PROINV on the performance firm. This interaction can weaken firm performance. That is related to differences in the classification of technological capabilities and research and development activities that cannot be attributed to each other in achieving business goals.

This research adds empirical evidence that firms' TECHCAP can improve firm performance. Technological innovation leads to the standardization of the production process, the reduction and the efficiency of business activities are likely related to value-added activity rather than the increase in firm profits. Then add empirical evidence that TECHCAP in firms in Indonesia can weaken the innovation activities carried out by firms in improving firm performance. Product and technological innovation should not be generalized by the firm innovation process and the results. This research is inseparable from the limitations caused; the first firm in Indonesia is still reluctant to disclose research and development expenditure information in the annual report, thus affecting the needs of independent variables in this study. TECHCAP should be classified to fit the industry classification in Indonesia. Advice for further researchers, first classify TECHCAP into high technology and low technology.

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