JASF | Journal of Accounting and Strategic Finance
Vol.5 No.1 June 2022, pp. 22-39.

ISSN 2614-6649 (online)
http://jasf.upnjatim.ac.id

Board Gender Diversity and Corporate Innovation: Evidence from Indonesian Family Firms

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DOI: https://doi.org/10.33005/jasf.v5i1.224

***Received**: October 14, 2021. **Revised:** February 22, 2022. **Accepted:** March 02,2022*

Abstract

The study examines the relationship between board gender diversity and corporate innovation. A Quantitative method with OLS analysis technique, using an 868 samples data observation of Indonesia public companies listed from 2010-2019. This study found that board gender diversity has increased corporate innovation. Furthermore, using a family firm as a moderating variable, this study suggests that a family firm has weakened the positive relationship between board gender diversity and corporate innovation. Therefore, this study implies that board gender diversity is important to increase corporate innovation. In addition, this study provides that the gender diversity of CEOs in high family ownership companies can decrease corporate innovation. There are several research limitations. First, innovation, measured by R&D investment, does not particularly determine corporate innovation, as it can be measured in several other forms of intangible assets such as patents, trademarks, copyright, and franchises. Second, gender diversity association with corporate innovation was measured merely by the number of women and did not do further investigate the other factors such as their business ties, social ties, and educational background. Third, the sample only consists of companies listed on the Indonesia Stock Exchange, leaving out the other companies that did not go public.

***Keywords:** Board gender diversity, Innovation, Family Firms, Indonesia.*

How to cite (APA 7th style)
Harymawan, I. & Nismara, K. (2022). Board Gender Diversity and Corporate Innovation: Evidence from Indonesian Family Firms. *Journal of Accounting and Strategic Finance*, *5* (1), 22-39.

INTRODUCTION

Significant changes in the industrial environment occurred due to the issue of the industrial revolution 4.0. For this reason, decision-makers are required to adapt by developing innovations and creating meaningful changes that are able to make companies survive in the long term quickly. When compared to other Southeast Asian countries, based on the 2020 Global Innovation Index, Indonesia is still ranked lower (85th) than Singapore (8th), Malaysia (33rd), Vietnam (42nd), Thailand (44th), Philippines (50th), and Brunei Darussalam (71st) (WIPO,

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2020). If we compare with the index one until two years in advance, Indonesia has a stuck position in 85th ranked of GII. It also mentions in the Global Innovation Index that Indonesia is lower in three pillars of innovation, like institutions, human capital & research, and Business sophisticated.

Furthermore, WIPO (2020) states that one of the weak indicators of Indonesia in the Global Innovation Index 2020 is global R&D companies that place 42nd ranked, lower than other countries. As we know that innovation is one of the critical drivers of a country's development, Indonesia needs more effort and action to increase its innovation in various fields, especially in developing businesses sophisticated. In the context of business sophistication and firm competitiveness, Innovation is one of the key factors in increasing the value of firms, so the company's purpose will be achieved (Griffin et al., 2021). In addition, an innovation developed within the company is crucial to achieving the desired profit, and innovation itself can be measured by the number of funds spent on research and development (Salehi et al., 2018).

The expansion of the scope of research and development activities is exacerbated by rapid economic development (Salehi et al., 2018). As stated in Harymawan et al., (2020), "R&D investment is the key to a company's competitive advantage". According to the OECD Oslo Manual (Development, 1992), company innovation can be measured by R&D investment (Hall et al., 2012). So, in this industrial 4.0 era, the key to the company's competitive advantage can be maintained through R&D investment. On the other hand, R&D expenditures are also considered expensive and risky (Chen et al., 2017, Canarella & Miller, 2022), influencing decision-making. According to Harymawan et al., (2020), companies want to achieve high profits today, but they ignore long-term value by ignoring Research and development activities. As time goes by, the existence of women as leaders has become worth considering. In the last few decades, women's emancipation and gender equality have slowly become major issues globally, especially in Indonesia. High-profile failures of companies in the past decade have been brought under scrutiny regarding the significance of good corporate governance, especially board gender diversity (Issa & Fang, 2019). In the light of these circumstances, women's representation in leadership positions has drawn the attention of policymakers. Heemskerk & Fennema, (2014) believe that women's representation on corporate boards is a sign of democratization of elite social networks.

One of the six cultural dimensions developed by Geert Hofstede mentions masculinity-femininity is one of them. Femininity tends to have a lower score than Masculinity. Developed countries such as France (Galia & Zenou, 2012), the Netherlands (Heemskerk & Fennema, 2014), Sweden (Bjuggren et al., 2018), and Spain (Hernández-Lara & Gonzales-Bustos, 2019) are countries of feminism, Which is driven by the value of protection. At the same time, the masculine country tends to elevate the power of their society. However, Indonesia is a country that has a lower femininity score than other Asian countries, such as China with a score of 66 and Japan with a score of 95.

As stated by Harymawan et al., (2020), "The components of public companies listed on the Indonesian stock exchange consist of 68% of family companies". For this reason, this study considers the use of family company variables for interaction. In addition, this consideration is

due to the increasing involvement of female directors in family firms. Firm performance increases significantly in family firms when the firm is led by female directors (Magnanelli et al., 2019). This statement is reinforced by the research findings of Bjuggren et al., (2018), which state that the involvement of a female board of directors is associated with a significant increase in performance in family firms compared to non-family firms. On the other hand, a study conducted by Darmadi, (2013) revealed that the financial performance of companies in Indonesia declined when women occupied the top management position.

Diversity of directors can be created by gender differences, namely the position of women on the board (Hernández-Lara & Gonzales-Bustos, 2019). Based on resource dependence theory, expansion of corporate and information channels increased decision-making capabilities, and innovation creation can be realized if there is a diversity of boards within the company. Moreover, based on Strydom et al., (2017) show the result that the earning quality of the company has associated with board diversity in the u-shape and it concludes that companies with high gender diversity have lower price volatility. It is also mentioned in Galbreath (2018) that firm performance also will increase if board gender diversity is high. In addition, some previous research state that a high number of female director can increase companies' innovation (Jun et al., 2020; Leszczyńska & Thénot, 2021; Saggese et al., 2021; Vafaei et al., 2021; Wu et al., 2021).

New perspectives, resources, and opportunities for increasing R&D investment (Midavaine et al., 2016; Rossi et al., 2017) and innovation (Miller & Triana, 2009; Galia & Zenou, 2012) can be achieved if firms have board uniformity. However, in terms of decision-making, female directors tend to choose to avoid high risks (Jianakoplos & Bernasek, 1998). Hernández-Lara & Gonzales-Bustos, (2019) also suggest that a higher proportion of women interlocking negatively affects innovation. In addition, another finding from Terjesen et al., (2009) states that female directors in family firms have a significant negative relationship with innovation because women are less independent. This statement is reinforced by Chen & Hsu, (2009) who state the same thing. On the other hand, the contradictory statement stated by Harymawan et al., (2020) Long-term investment in the form of R&D increases in proportionate family firms. From the previous research findings, the formulation of the problem proposed in this study is 1) Does having more women on the board increase the company's innovation? 2) do family firms negatively moderate the relationship between board gender diversity and firm innovation.

From the arguments that have been built above, this study aims to examine the relationship between board gender diversity and innovation in Indonesian family firms. The dependent variable is innovation, as measured by the amount of R&D expenditure. Meanwhile, the independent variable is the gender diversity board, and the moderating variable is a family company in Indonesia. Data were obtained from all public companies listed on the IDX from 2010-2019, with 868 observations using a quantitative approach. This study finds that board

gender diversity is associated with a significant increase in firm innovation. However, family ownership weakens the link between gender diversity and innovation.

This research contributes in several ways. First, this study adds to the literature related to the issue of board gender diversity and innovation. Female directors have more mature planning with a better set of ideas and solutions, and this increases their role in creating innovation. Second, related to the family ownership literature, this study provides empirical evidence regarding the role of family firms in weakening the relationship between female boards of directors and innovation. Third, this research focuses on developing countries, especially Indonesia. For this reason, this study fills the gaps in previous research that discussed the relationship between female directors and innovation moderated by family companies.

The resource-based view argues that resources help a firm make use of opportunities and nullify threats. This theory asserts that the mix, type, amount, and nature of a firm's internal resources must be considered first in formulating a strategy to gain and sustain competitive advantage. Sustained competitive advantage is stretched resources that are valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991). This theory considers the meaning of managing strategically as developing, preserving, and strengthening those resources. It is beneficial to pursue a strategy that any competing firm is not implementing. When other firms cannot duplicate a particular strategy, a firm has devised a strategy that can lead to a sustainable competitive advantage.

Innovation is a tool for transforming knowledge into something substantial to generate profit. (Salehi et al., 2018). It is what creates the difference between the performances of a company and one another. Therefore, innovation has become an essential strategy for gaining a competitive advantage. Because it is critical to a firm, the number of studies examining the association between corporate governance and innovation has also increased (Miller & Triana, 2009).

The Industrial Revolution and rapid development of technology have challenged decision-makers to innovate. Firms have no option but to continuously produce new and upgraded products to meet the environmental demands still. As a response to this volatile environment, the resource-based view suggests that firms must consider their internal resources first to gain competitive advantages, in which research and development are essential. A managerial team is a firm internal resource that can promote sustained competitive advantages, as they can understand and describe the economic performance potential of a firm's endowment (Barney, 1991). As stated in Hillman et al., (2009), the size and composition of firm boards are not arbitrary; they are instead a form of organizational responses assembled in specific ways to adapt and make the best of the environment. Board is "a tool for monitoring and controlling opportunistic behavior of managers, hence its size and composition have a key role in mitigating agency conflicts and influencing a firm's value" (Rossi et al., 2017). Besides the number, the type of directors on board also matters (Hillman et al., 2009).

Midavaine et al., (2016) stated that board diversity gives rise to disagreement and conflict, which was backed by Chen et al., (2005), who argues that conflict was a significant antecedent of effective top management, therefore board diversity enhances the alternatives

available for problem-solving to be considered by the firm. Diversity in the board also provides the firm with a broader range of critical resources that can help the board create ideas, distribute resources, and obtain opportunities, thereby increasing innovation (Galia & Zenou, 2012). As also cited in Rossi et al., (2017), Chen et al., (2005) found that heterogeneous corporate boards appear to impact innovation positively.

Hernández-Lara & Gonzales-Bustos, (2019) stated that women on boards create a board's diversity. Women on boards can bring new perspectives, experiences, working styles, knowledge, and expertise compared to their male counterparts which will help identify new innovative opportunities (Galia & Zenou, 2012). Having women onboard positively impacts innovation input, but only when they reach critical mass (Saggese et al., 2021). Miller & Triana, (2009) believe gender diversity on the board can increase innovation. Midavaine et al., (2016), who conducted a study about board diversity and R&D investment, found that gender diversity makes firms invest more in R&D. Thus, the author proposes the following hypothesis:

H1: Board gender diversity is positively related to corporate innovation

The author considers Indonesian family firms to be a variable in this research because in Harymawan et al., (2020), there is a statement "68% of all firms in Indonesia are family firms (Claessens et al., 2000)". Furthermore, the type of ownership is also related to the firm degree of risk-aversion. Hence it can affect the decision-making process (Chen & Hsu, 2009), and family ownership tends to discourage risky long-term investments, such as R&D. Kuo et al., (2018), who investigated the moderating effect of family involvement on the association between R&D investment and directors education states that family firms tend to protect family wealth to pass on the business to their heirs, and are assumed to have lower agency conflict than other firms. However, according to Chen & Hsu, (2009), the family-owned firms and R&D investment may be related negatively because family managers are more prone to risk-aversion, more focused on stability and survival, and consider new ventures as a latent hazard that can threaten the status quo and family's welfare, therefore urging to ensure firm longevity. Consequently, family firms can be skeptical and risk-averse in deciding on R&D investment (Harymawan et al., 2020).

Several studies mentioned in Gonzales-Bustos et al., (2020) state that family firms tend to appoint women on board, especially family members. Board gender diversity positively influences innovation as long as women are independent (Terjesen et al., 2009), while in the case of family firms, women are unlikely to be independent since they were appointed under the influence of their male family counterparts. According to the discussion above, the author is proposing the following hypothesis:

H2: Family firms negatively moderate the relationship between board gender diversity and corporate innovation

RESEARCH METHOD

The research will apply the ordinary least square technique to answer the hypothesis, the data are secondary data collected from annual reports to be later processed and tested for the hypothesis testing. The sample will include all companies listed on the Indonesia Stock Exchange from 2010 to 2019. The data is gathered from the OSIRIS database, Indonesia Stock Exchange website, and corporate website.

Table 1. Operational Definition of Variable

Variable	Definition	Data source
Independent		
Board gender diversity		
Female board members	Number of female commissioners and directors on board (Issa & Fang, 2019)	Annual Report
Dependent		
Innovation		
R&D investment	The firm's R&D expenditure is divided by the firm's total assets (Harymawan et al., 2020)	OSIRIS
Moderating		
Family firms	Measured using dummy variables. 1 for family firms and 0 for non-family firms	Annual Report
Control		
Board size	Measured by the number of directors and commissioners on board (Hernández-Lara & Gonzales-Bustos, 2019)	Annual Report
% of an independent commissioner	Measured as an independent commissioner divided by the total commissioner	Annual Report
Firm size	Measured using the natural logarithm of total assets (Hernández-Lara & Gonzales-Bustos, 2019)	Annual Report
ROA	Measured as the firm's net income divided by total asset	Annual Report
Leverage	Measured as the total debt divided by total assets (Hernández-Lara & Gonzales-Bustos, 2019)	Annual Report

Source: Secondary data, processed

The independent variable in this research is board gender diversity. Issa & Fang, (2019) measure board gender diversity using the number of female directors. Nevertheless, according to Law No. 40 the Year 2007 about Limited Liabilities Company, Indonesia adopts a two-tier board system. Hence, BGD will be ascertained using the total number of female directors and female commissioners. The dependent variable in this study is innovation. Innovation will be measured using R&D investments (Hernández-Lara & Gonzales-Bustos, 2019) through R&D expenditure

divided by total assets because it reflects a steadier measurement than R&D expenditure divided by total sales (Harymawan et al., 2020).

The moderating variable in this study is family firms. Family firms will be measured using dummy variables, 1 for family firms and 0 for non-family firms. Family firms have more than 5% of family ownership and more than one member of the same family is assigned to be commissioner or director (Harymawan et al., 2020). There are five control variables used. Those are the size of the board, percentage of the independent commissioner, firm size, leverage, and ROA. Board size will be measured by the number of directors and commissioners on the board (Hernández-Lara & Gonzales-Bustos, 2019). The percentage of independent commissioners will be measured as independent commissioners divided by the total commissioner. The firm size will be measured using the natural logarithm of total assets (Hernández-Lara & Gonzales-Bustos, 2019). ROA will be measured as net income divided by the total asset. Finally, leverage will be measured as the total debt divided by total assets. It is included in the model because innovation requires financial support usually provided by debt (Hernández-Lara & Gonzales-Bustos, 2019).

Table 2 shows the distribution of all the subjects in this research, consisting of all the companies listed in IDX except for the banking and financial services industries (code SIC 6) from 2010 to 2019. The sample includes agricultural, mining, manufacturing, transportation, communications, forestry, fisheries, construction, wholesale trade, and health services. Thus, the total sample in this research is 868 observations.

Table 2. Sample Distribution

SIC	YEAR										
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
0	4	4	4	4	4	5	5	4	4	14	52
1	13	13	14	14	14	15	15	14	14	65	191
2	7	7	9	10	11	11	11	10	11	121	208
3	6	6	6	6	5	6	5	5	7	72	124
4	7	8	8	9	9	9	9	8	9	81	157
5	2	2	2	2	2	2	2	2	1	42	59
7	2	2	2	2	2	2	2	0	1	47	62
8	0	0	0	0	0	0	0	0	0	15	15
Total	**41**	**42**	**45**	**47**	**47**	**50**	**49**	**43**	**47**	**457**	**868**

Source: Secondary data, processed

RESULTS AND DISCUSSION

Result

Descriptive Statistic Analysis

In this research, descriptive statistics help describe the characteristics of a sample, whether it is the dependent variable (INNO), independent variable (FBOARD), moderating variable (FF), or control variables (INDCOMPER, BSIZE, FSIZE, ROA, LEV). Based on the result author provides a table for the mean, median, minimum, and maximum values of each variable. The result of descriptive statistics can be seen in table 3

Table 3. Sample Distribution

No	Name	Mean	Median	Minimum	Maximum
1	INNO	0.002	0.000	0.000	0.248
2	FBOARD	0.952	1.000	0.000	9.000
3	FF	0.194	0.000	0.000	1.000
4	INDCOMPER	0.360	0.333	0.000	1.333
5	BSIZE	9.760	10.000	4.000	23.000
6	FSIZE	29.241	29.417	24.703	32.922
7	ROA	6.682	5.010	-26.760	55.510
8	LEV	0.503	0.501	0.032	1.648

Source: Secondary data, processed

According to table 3, the mean for innovation is 0.002, and the median is 0.000. The minimum value implies that there are firms that have zero research and development expenditure. The maximum value implies that R&D expenditure is 0.248 of total assets. PT Unilever Indonesia Tbk owned the maximum value of innovation in 2011. We can conclude from the same table that the mean for board gender diversity is 0.952, and the median value of 1.000. The minimum value implies that there are firms with no female board members at all. In 2019, PT Tempo Scan Pacific Tbk held the maximum value for board gender diversity, with nine women's representations sitting on the firm board. A higher number of women's leadership positions means the firm is the most diverse (gender) of all the observed firms. Since family firms use dummy variables, 1 for family firms and 0 for non-family firms, the minimum value is 0.000, and the maximum value is 1.000. There are 175 family firms included in the observations.

Pearson Correlation

Pearson correlation indicates the strength and significance of the relationships among all variables in a sample. Table 4 represents Pearson's correlation model of innovation with the other variables. Its correlation with the independent variable, board gender diversity, is positive and significant at 1%. Meanwhile, its correlation with family firms and firm size are negative and positive, respectively, at a significance level of 10%. In addition, three control variables have a

positive relationship with innovation at a significance level of 1%; they are the percentage of the independent commissioner, the board size, and the return on assets. Lastly, the model shows that the correlation between innovation and leverage is not significant.

Table 4. Pearson Correlation

	[1]	[2]	[3]	[4]
[1] INNO	1.000			
[2] FBOARD	0.215***	1.000		
	(0.000)			
[3] FF	-0.055*	0.073**	1.000	
	(0.100)	(0.029)		
[4] INDCOMPER	-0.189***	-0.094***	-0.007	1.000
	(0.000)	(0.005)	(0.831)	
[5] BSIZE	0.137***	0.099***	-0.061*	-0.131***
	(0.000)	(0.003)	(0.067)	(0.000)
[6] FSIZE	0.058*	-0.048	-0.063*	-0.034
	(0.081)	(0.148)	(0.059)	(0.302)
[7] ROA	0.395***	0.061*	-0.094***	-0.097***
	(0.000)	(0.069)	(0.005)	(0.004)
[8] LEV	0.032	-0.066**	0.047	0.025
	(0.343)	(0.048)	(0.159)	(0.455)
	[5]	**[6]**	**[7]**	**[8]**
[5] BSIZE	1.000			
[6] FSIZE	0.720***	1.000		
	(0.000)			
[7] ROA	0.281***	0.190***	1.000	
	(0.000)	(0.000)		
[8] LEV	0.028	0.125***	-0.227***	1.000
	(0.403)	(0.000)	(0.000)	

*p-values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Source: Secondary data, processed

Model Analysis and Hypothesis Testing

Board Gender Diversity and Innovation

The main regression equity of the relationship between board gender diversity and corporate innovation

$$\mathbf{INNO} = \beta 0 + \beta 1 FBOARD + \beta 2 FF + \beta 3 BSIZE + \beta 4 INDCOMPER + \beta 5 FSIZE + \beta 6 LEV + \beta 7 ROA + \varepsilon$$

INNOV = β0 + 0.003FBOARD - 0.004FF - 0.020INDCOM - 0.000BSIZE - 0.000FSIZE + 0.001ROA - 0.000LEV

The results of the regression are shown in Table 5 Model 1 represents the regression result of the relationship between board gender diversity and corporate innovation. It reveals that the positive relationship between board gender diversity and corporate innovation is significant at 1%. Hence, hypothesis 1 which proposes the positive relationship between board gender diversity and corporate innovation is supported. In addition, ROA and LEV both have a positive relationship with innovation. Meanwhile, the percentage of independent commissioners and family ownership has a negative relationship with innovation.

Table 5. Regression

	INNOV	
	(1)	**(2)**
FBOARD_FF		-0.005***
		(-3.22)
FBOARD	0.003***	0.004***
	(3.54)	(3.53)
FF	-0.004***	0.001
	(-3.41)	(1.07)
INDCOM	-0.020**	-0.020**
	(-2.56)	(-2.58)
BSIZE	-0.000	-0.000
	(-0.65)	(-0.60)
FSIZE	-0.000	-0.000
	(-0.89)	(-1.05)
ROA	0.001***	0.001***
	(3.69)	(3.72)
LEV	-0.000*	-0.000**
	(-1.87)	(-2.00)
_cons	0.016	0.017
	(1.35)	(1.41)
Year FE	Included	Included
Industry FE	Included	Included
r2	0.229	0.239
r2_a	0.208	0.217
N	868	868

*t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01*

Source: Secondary data, processed

Family Firms on the Relationship between Board Gender Diversity and Innovation

INNO = β0 + β1FBOARD_FF + β2FBOARD + β3FF + β4BSIZE + β5INDCOMPER + β6FSIZE + β7LEV + β8ROA + ε

INNOV = β0 - 0.005FBOARD_FF + 0.004FBOARD + 0.001FF - 0.020INDCOM – 0.000BSIZE - 0.000FSIZE + 0.001ROA - 0.000LEV

Table 6. CEM

Panel A: Summary		
	INNOV = 0	**INNOV = 1**
All	374	494
Matched	239	192
Unmatched	135	302
Panel B : Result of CEM		
	(1)	**(2)**
FBOARD_FF		-0.001**
		(-1.98)
FBOARD	0.001**	0.001**
	(2.04)	(2.19)
FF	-0.001*	-0.000
	(-1.70)	(-0.32)
INDCOM	-0.001	-0.001
	(-0.69)	(-0.68)
BSIZE	-0.000	-0.000
	(-0.78)	(-0.87)
FSIZE	0.000	0.000
	(0.80)	(0.78)
ROA	0.000**	0.000**
	(2.19)	(2.17)
LEV	0.001*	0.001*
	(1.94)	(1.93)
_cons	-0.004	-0.004
	(-0.83)	(-0.80)
Year FE	Included	Included
Industry FE	Included	Included
r2	0.146	0.148
r2_a	0.098	0.097
N	431	431

t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01

Source: Secondary data, processed

The analysis results of the interaction between family firms and board gender diversity with innovation are shown in Model 2 of Table 5. It shows that the relationship between board gender diversity in family firms and innovation is negative at a significance level of 1%. Therefore, hypothesis 2 that proposes "family firms negatively moderates the relationship between board gender diversity and corporate innovation" is supported. Meaning, that family firms weaken the relationship between board gender diversity and corporate innovation.

This study uses the CEM (Coarsened Exact Matching) as shown in the Table 6 test to remove biased results to answer the endogeneity issue. Panel A shows the summary of matching from 7 strata of variable control. There are 239 from 374 observations that do not have innovation and 192 from 494 observations that have innovation give consistent results with the main result, which is that a female director has a significant positive relationship with innovation. Furthermore, family firms weaken the relationship between female directors with innovation significantly. Therefore, it can be concluded from those results that this study's main result is robust.

Discussion

The main objective of this research is to examine whether having more women on board will increase corporate innovation and whether family ownership negatively moderates the relationship between board gender diversity and corporate innovation. Board gender diversity was measured by the number of women directors and commissioners on board because Indonesian law adopts a two-tier system. Corporate innovation can be measured using many measurements like such as patents, trademarks, copyright, and franchises. However, in this study, corporate governance is the variable of interest in this research, measured using R&D investments through R&D expenditure divided by the total asset. Thus, it reflects a steadier measurement than R&D expenditure divided by total sales. The first hypothesis the author proposes is that board gender diversity has a positive relationship with corporate innovation. The second hypothesis is the interaction between board gender diversity and family firms and their antagonistic relationship with corporate innovation. The results obtained regarding the board gender diversity, family firms, and corporate innovation have confirmed the hypothesis.

The initial population includes all companies listed on Indonesia Stock Exchange from the period 2010 to 2019. Most of the required data for calculating research variables were extracted from the annual reports of the firms. The program STATA 14 helped eliminate the observations that did not meet the criteria, and 868 firms were selected as the sample of this research. The highest frequency was for SIC 2 with 208 companies, and the lowest frequency was for SIC 8 with 15 companies. The author also winsorized the data because winsorization limits the extreme values in statistical data and reduces the chance of any possible outliers that can distort the results. The data analysis techniques include descriptive statistics, Pearson's correlation, and ordinary least square regression.

The selected sample confirms that board gender diversity has a positive and statistically significant relationship with corporate innovation, thus supporting hypothesis 1: board gender

diversity is positively related to corporate innovation. It means that the higher level of board gender diversity in the company will increase the expenditure of R&D significantly. In addition, as mentioned in Griffin et al., (2021), a more diverse gender with more female directors inside of the company, may increase their focus to concern the long-term performance. R&D has the main role of the company to develop and increase the company's value. Furthermore, the obtained result of this research supports the assumption of the resource-based view, which contends that internal resources play more important roles for a firm than external factors in gaining and maintaining competitive advantage. These resources include a range of organization, social, and individual phenomena within firms. Eventually, firms cannot expect to "purchase" sustained competitive advantages on open markets. Still, it must be found in the firm's rare, imperfectly imitable, non-substitutable resources already controlled (Barney, 1991).

This research is also under some previous findings that board gender diversity has a positive relationship with innovation and R&D investment (Galia & Zenou, 2012; Gonzales-Bustos et al., 2020; Miller & Triana, 2009; Midavaine et al., 2016; Rossi et al., 2017). As stated in Hillman et al., (2009), the size and formation of a board are indicators of the board's ability to provide critical resources to the firm, and firms look for linkages with the most beneficial resources on the corporate board (Terjesen et al., 2009). Meaning that the more diverse the board is, the richer it is in terms of resources. With richer resources, which can be in the forms of skills, experiences, information, ties, and backgrounds, the board can provide many options in decision-making and alternatives in problem-solving that favor innovation. Greater gender diversity on board also positively influences social performance (Orazalin & Baydauletov, 2020), and environmental performance (Burkhardt et al., 2020; Orazalin & Baydauletov, 2020), and environmental innovation (Nadeem et al., 2020). Despite that, this result contrasts with previous findings such as Jianakoplos & Bernasek, (1998), who state that women are relatively more prone to risk-aversion in financial decision-making than men.

Regarding the relationship between board gender diversity in family firms and innovation, the result shows a negative relationship at a significance level of 1%. This result supports hypothesis 2: family firms negatively moderate the relationship between board gender diversity and corporate innovation. Furthermore, the result supports that family ownership weakens the positive relationship between board gender diversity and corporate innovation. This is in line with Gonzales-Bustos et al., (2020) finding that the positive influence of gender diversity on innovation is lower in family firms. This result is also supported by Chen and Hsu (2009), who state that family ownership is negatively associated with R&D investment, and the higher the level of family ownership, the more likely the firms are to reduce the amount of R&D investment. On the contrary, Harymawan et al., (2020) believe that firms with higher family ownership are more likely to invest in R&D than those with lower family ownership. Albeit the hostile relationship with corporate innovation, board gender diversity in family firms positively correlates with firm performance (Magnanelli et al., 2019; Bjuggren et al., 2018) and corporate environmental performance (Cordeiro et al., 2020).

Innovation requires financial support usually provided by debt (Hernández-Lara & Gonzales-Bustos, 2019), hence the significant positive relationship between leverage and innovation. With an increased amount of R&D investment, there is an amount of debt increasing. Independent commissioners are likely to discourage R&D investment as a form of innovative activities. Meanwhile, board size and firm size play no role in their relationship with innovation, which means that apparently, more prominent firms and boards do not seem to be aware of the importance of research and development.

CONCLUSIONS

This study aims to examine the relationship between board gender diversity and corporate innovation. Using a sample of 868 firm-year observations from 2010 – 2019, the author obtains a result that supports previous findings on the positive relationship between board gender diversity and corporate innovation. Here, we can conclude that female representation on board is related to investment decisions, such as R&D. This research also provides empirical support for the negative relationship between board gender diversity in family firms with corporate innovation.

There are several research limitations. First, innovation (INNO), measured by R&D investment, does not particularly determine corporate innovation, as it can be measured in several other forms of intangible assets such as patents, trademarks, copyright, and franchises. Second, gender diversity association with corporate innovation was measured merely by the number of women. The author did not do further investigate the other factors such as their business ties, social ties, and educational background.

Third, the sample only consists of companies listed on the Indonesia Stock Exchange, leaving out the other companies that did not go public. The relationship between board gender diversity, family ownership, and corporate innovation might differ if the research uses different samples. Their influence on corporate innovation might be impacted by specific cultural, institutional, and periodical dimensions that can be explored for further analysis. From several limitations mentioned above, there are some suggestions for future research. Other than R&D investment, corporate innovation can use various measurements such as patents, trademarks, copyright, and franchises in future research. They are investigating the board gender diversity more broadly and deeply and the total number of women sitting on board. From a practical perspective, Boards may adjust their composition as suggested in the findings, depending on the ownership of the firms.

List of Abbreviations

IDX: Indonesia Stock Exchange; CEO: Chief Executive Officer; R&D: Research and Development.

Authors' Contribution
I.H. provided direction for the entire project, develop research ideas, supervise data collection, analyse and contribute to the writing of articles. K.N. developed research ideas and provided input on proposed research, as well as performed data processing and developed article writing.

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Funding
Authors does not received any research grant for this research.

Conflicts of Interest
The authors declare no competing interests.

Availability of Data and Materials
Data are available from the public sources cited in the text.

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