

CEO EDUCATION, INSTITUTIONAL OWNERSHIP, BOARD GENDER DIVERSITY AND MARKET UNCERTAINTY ON R&D INVESTMENT

Hendy Rizky Rummenigge^{1*}, Sri Rahayu², Sundjoto³
^{1,2,3} Sekolah Tinggi Ilmu Ekonomi Mahardhika Surabaya

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E-mail:

hendy.rizky@gmail.com
rahayu.mahardhika@gmail.com
sdjt5133@gmail.com

ABSTRACT

To create a competitive advantage, companies must innovate by investing in R&D. R&D investment must be made to increase consumer interest and sustain the company's business growth. Investment in R&D is influenced by various internal and external factors of the company, internal factors that are also related to corporate governance are CEO education, institutional ownership and board gender diversity, while external factors are market uncertainty. This study uses a quantitative approach that aims to determine the effect of CEO education, institutional ownership, board gender diversity and market uncertainty on R&D investment. The dependent variable is R&D investment, the independent variables are CEO education, institutional ownership, board gender diversity and market uncertainty, while the control variables are company size, ROA, and DAR. The research object is a manufacturing company listed on the Indonesia Stock Exchange for the period 2020 – 2022. The research sample is 30 manufacturing companies. The sampling technique used was purposive sampling. The analysis technique used is multiple regression. The results showed that CEO education and board gender diversity had a significant positive effect on R&D investment, while market uncertainty had a significant negative effect on R&D investment. Meanwhile, institutional ownership has no significant effect on R&D investment.

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1. INTRODUCTION

Advanced companies must have a large R&D budget. This is done as part of the effort to maintain business growth. R&D is also the most important part of making a product or service of a company. Nasdaq reported that Amazon is the company with the largest R&D expenses in the world in 2020. Most of Amazon's R&D costs are spent on artificial intelligence, cloud computing, and virtual assistants [1]. The order of global companies by R&D budget according to Amazon is Alphabet (Google), Huawei, Microsoft, Apple, Samsung and then Facebook (Meta).

As for Indonesia, which is a country with a population that ranks fourth in the world and is 16th economically, R&D spending is only 105th according to the Global Innovation Index. R&D spending as a share of GDP in Indonesia is less than 0.1%, compared to 1.26% in Malaysia and 2.19% in Singapore. In recent years, the Indonesian government has developed a national research master plan (RIRN 2017-2045) to strengthen the national research sector and increase the contribution of research to national economic development. The goal is to increase R&D investment to 1% of GDP, with a significant increase in funding of R&D activities in both the public and private sectors [2]. To achieve this, every company must continue to innovate and create competitive advantages. One way for companies to make profits in the future is to invest in new technology and knowledge, which is related to transforming the efficiency of the production process by maximizing resources.

The purpose of R&D investment is to be able to produce or innovate new products to increase consumer interest, thereby increasing the quantity and loyalty of consumers to the company, and ultimately having an impact on increasing Company profits. R&D is a strategic decision of the company that plays an important role because through R&D investment, innovation can be obtained and the company can compete better with competitors [2]

According to the World Economic Forum (WEF), Indonesia's low R&D funding in 2019 was followed by a decline in Indonesia's competitiveness ranking. Indonesia is ranked 50 out of 141 countries or has decreased by 5 (five) ranks compared to the previous year [3]. The WEF-based assessment evaluation indicators are based on 12 (twelve) pillars, one of which is the innovation capacity pillar. WEF

indicates that Indonesia is still limited in terms of innovation capacity, where Indonesia is still low in terms of innovation with the smallest score among other indicators with a score of 37.7. The low score of Indonesia's innovation capacity is partly due to Indonesia's low R&D budget [3].

R&D investment is the most fundamental decision of a company's top managers. Therefore, CEO characteristics are very influential in determining the company's efforts to innovate. The personal characteristics of top-level executives can affect fundamental beliefs and values, these beliefs can affect the level of strategic decisions. In particular, according to dependency theory, this implies that the CEO's personal attributes may influence the firm's R&D investment [4]. One of the individual characteristics that can influence is education, as it is closely related to innovation. R&D projects are generally risky and expensive, so it is important for CEOs to have a strong outlook and higher cognitive skills. Therefore, education is an important factor in innovation decisions. A higher level of CEO education correlates with higher management and innovation skills, the ability to adapt and learn new technologies, the ability to collect, manage, and analyze information and the ability to solve problems by solving R&D problems [4].

Ownership of public companies in Indonesia is still controlled by institutional owners with an average of 58% [1]. So it can be said that almost every company that goes public gets its capital from investments in other companies and the percentage of ownership by institutions is usually higher. The existence of institutional ownership provides better supervisory skills for managers to manage the company better. According to [5], R&D intensity is the strength of the company that arises from R&D activities which are expected to provide the ability to improve financial performance in the future. Therefore, the presence of institutional investors can be an added value in making investment decisions in R&D.

Institutional ownership is the percentage of share ownership by an institution to the number of shares outstanding. According to [6] institutional ownership can minimize conflicts that arise between principals and agents or managers (agency problem). Institutional ownership increases the ability to monitor managers to carry out opportunistic behavior because more shares are owned by institutions [7]. The existence of external supervision makes managers comply with the interests of shareholders. In addition, through institutional ownership, companies have better opportunities, resources and expertise to evaluate managers' actions and performance. Institutional ownership has a high interest in building a higher corporate reputation. Management monitoring can be done better if the company has more institutional ownership. The management of company assets will also be more efficient when institutional ownership is greater, because it can prevent waste that can be committed by management [8].

2. LITERATURE REVIEW

Resource Dependence Theory

Resource dependence theory states that organizations do not always have the resources and capabilities needed to achieve their desired goals. To achieve organizational goals therefore requires resources and actions from other organizations, and outside the control of the organization. The actions taken by an organization and the interdependencies that occur between the organization and other entities will therefore shape the output results expected by the organization. So it is very important for companies to find resources for innovation for companies [9].

According to resource dependence theory, ownership is a source of power that can be used to prevent management from being too concentrated to abuse its authority. The ownership structure has a key role in corporate governance and emphasizes that the corporate governance system can be better developed to make policies. Essentially, the ownership structure serves to improve company performance. Institutional ownership is an ownership structure that can positively influence company management. Institutional ownership can monitor management in a perspective that is in line with stakeholders. According to resource dependence theory, companies with institutional ownership that can contain professional people who have expertise and experience will be able to maximize shareholder interests because of their professionalism and expertise, so that companies are encouraged to always innovate [10].

According to the perspective of resource dependence theory [11], the CEO plays an important role in innovation. The CEO plays a role in strategic decisions for the benefit of the company. So through a CEO with a high level of education will be able to bring innovation to the company and build a solid organizational culture. A highly educated CEO will bring about changes in company leadership that contribute to changing the mindset of all members of the organization for the better and be able to adapt to changes in the business environment. CEOs with high education tend to bring changes in strategic

policies that are in accordance with organizational behavior in companies with dynamic business environments.

CEO Education

CEO (Chief Executive Officer) is the top leader of an organization. The Chief Executive Officer (CEO) is the highest managerial position responsible for setting company policies and strategies and making decisions that affect the achievement of the organization's vision [12]. On the basis of echelon theory, the CEO's education level is decisive in making strategies to achieve company success. [13] state that CEOs with high education levels will have better social relationship skills. This CEO education factor plays an important role as a strategy to improve company performance. Higher education is important for the CEO because he is in charge of making crucial decisions for the company that can have an impact on company performance. The CEO successfully leads the company if he has the ability to utilize and use his knowledge to process information for the benefit of improving company performance [14].

Institutional Ownership

Institutional ownership is an institution or institution that owns shares in a company [15]. Institutions that own shares can be private, government, foreign or domestic institutions. Institutional ownership can also be defined as ownership of company shares by financial institutions, foreign institutions, legal entities, governments, trust funds and other types of institutions [16]. Institutional ownership can be seen from the percentage of shares owned by an institution such as private companies, investment companies, insurance companies, banks, and NGOs [16].

Institutional investors are considered investors who have more experience when compared to individual investors. The existence of institutional investors is expected to have the ability to carry out more effective monitoring to control decisions taken by management [16] Monitoring can be more optimal if the company is owned by institutional investors so that management performance will be better. Because share ownership shows the holder of power. If institutional investors have greater ownership, the greater the power to control management and direct management to improve company performance in order to increase company value.

Gender Equality

One of the keys to gender equality in institutions is women's participation in the labor market. Women who enjoy equal access to the labor market, from the lower to the upper levels, are more likely to reach the highest echelons of corporate boards. For this reason, women must be able to advance their careers starting from lower-level positions and then work hard to reach higher levels of administrative roles by mastering managerial, technical and financial skills [17].

There are work-related institutional mechanisms that can help women to reach top-level board positions. Many companies adopt "codetermination" policies (also referred to as "copartnership" or employee participation) that make employees participate in work councils, such as consulting on labor issues and board duties within the company. Through codetermination policies companies consider a wide range of issues and adopt policies that help all employees, including women to contribute to the company, with the potential to become the upper echelons of the company [17].

Previous Research

Wang, Wei, and Song (2017) [18] examine the effect of uncertainty on R&D investment. The study aims to examine the effect of policy and market uncertainty on R&D investment, whether or not politically connected firms are more sensitive to policy uncertainty than firms without political connections, or non-politically connected firms are more sensitive to market uncertainty than firms with political connections, and whether the negative effect of policy or market uncertainty on R&D investment in firms is higher in firms with low government subsidies. The study was conducted on 1868 companies in China listed on the Shanghai (SSE) and Shenzhen (SZSE) capital markets in the 2002 - 2012 time period. The analysis technique used is multiple regression analysis. The results show that both policy and market uncertainty have a negative significant effect on R&D investment. Political connections have different effects on R&D investment for both policy and market uncertainty contexts. Specifically, only policy uncertainty has an influence on R&D investment for firms with political connections, but no effect on firms without political connections. Market uncertainty only has an effect on firms without political connections, but no effect on firms with political connections. The negative effect is also more pronounced for firms that receive lower subsidies from the government.

Almor et al. (2019) [19] examined the duality effect of board gender diversity on R&D investment. The study examines how board gender diversity affects investment in R&D, in order to evaluate the nature of ambidexterity in the firm. The research sample was 18,881 companies from 44 countries in the world. The analysis technique used was multiple regression analysis. The results showed that boards with high gender diversity produce more complex organizational outputs with regard to R&D investment. The research findings suggest that gender-diverse boards encourage ambidexterity. On the one hand, increasing gender diversity has a direct negative influence on R&D. However, by positively influencing equity-based remuneration, gender-diverse boards will indirectly encourage R&D investment that correlates better with organizational goals. Hence, gender diversity in the board will encourage organizational behaviors that enhance conditions with higher ambidexterity for developers over time by encouraging exploitative behaviors as well as explorative behaviors.

Harymawan et al. (2020) [20] examined the effect of CEO (Chief Executive Officer) and CFO (Chief Financial Officer) education levels on R&D investment in Indonesia. The research sample used 368 observations from 150 companies listed on the Indonesia Stock Exchange in the period 2010 - 2015. The analysis technique used is multiple linear regression. The results showed that CEOs with higher education levels invested more in R&D. CFOs with accounting certification invest less in R&D, which is consistent with the risk-taking nature of the accounting profession which is less risk-taking and more conservative.

Zulkarnain and Nurdianti (2022) [21] examined the effect of institutional ownership, bank ownership and founder ownership on R&D intensity. The research sample consisted of 156 observations from 52 manufacturing companies listed on the Indonesia Stock Exchange in the period 2017 - 2019. The sampling technique used purposive sampling method. The analysis technique uses panel data regression. The results showed that institutional ownership has a significant positive effect on R&D intensity, while bank ownership and founder ownership have no significant effect on R&D intensity.

3. METHOD

This type of research uses a quantitative approach. Based on its objectives, this research is categorized as explanatory research because it is in accordance with its research objectives, where there is a test of the relationship between hypothesized variables, namely the effect of CEO Education, institutional ownership, board gender diversity and market uncertainty on R&D investment of manufacturing companies listed on the IDX in 2020 to 2022.

Variable Identification, Operational Definition and Measurement

The variables used in this study are:

1. Independent variables, namely:
 - a. CEO Education (CEOE).
 - b. Institutional ownership (KI).
 - c. Board gender diversity (BGD).
 - d. Market uncertainty (KP)
2. The dependent variable is R&D investment (IRD).
3. Control variables used to strengthen the influence of the main variables, namely:
 - a. Company size (UP).
 - b. Profitability (ROA) (ROA)
 - c. Leverage (DAR) (DAR).

The type of data in this study uses quantitative data, namely data in the form of numbers. The data source in this study is secondary data from the Indonesia Stock Exchange data documentation, where the data used is data on manufacturing companies listed on the IDX for the period 2020 - 2022. Only data up to 2022 is used, because in 2020-2021 it was still a pandemic period so that this extraordinary event had a major effect on economic conditions and also had an impact on the condition of the company. Data is obtained from the Annual Report and Annual Financial Statements on the Indonesia Stock Exchange (IDX) website and the websites of each manufacturing company listed on the IDX. The source of R&D data is obtained from the annual financial statements of each manufacturing company.

The data collection method is carried out using the documentation method. The documentation method is data collection that comes from writing [22]. Documentation is looking for data about things or variables in the form of transcripts, notes, books, research results and others. Documentation is used to re-discover if needed for analysis or other comparison purposes.

Population is a unit on the basis of what research is conducted and for whom the conclusions of the research results are applied [23]. The population in this study are all manufacturing companies listed on the IDX for the period January 1, 2020 to December 31, 2022. The reason for choosing manufacturing companies as the object of research is because manufacturing companies are one of the business sectors that continues to experience growth along with the increase in population and in general has considerable investment expenditure in R&D. In addition, manufacturing companies also have a multiplier effect on the overall condition of the Indonesian economy. So the research will be conducted on manufacturing companies listed on the Indonesia Stock Exchange.

4. RESULT AND DISCUSSION

Overview of Research Objects

The main activity of the manufacturing industry is to process resources into finished goods through a manufacturing process. Therefore, the activities of companies classified as manufacturing industries have at least three main activities, namely activities to obtain or store inputs or raw materials, processing or manufacturing activities, as well as assembling raw materials into finished goods, and activities to store or market finished goods.

Technically, manufacturing is the processing of raw materials through chemical and physical processes that aim to change the shape, properties, and appearance of the product. Manufacturing activities include the process of assembling several components into a complete product. Economically, manufacturing is the process of transforming raw materials into a value-added form through one or more assembly processes, so that the expected end result is the formation of a product that has a selling value. In general, manufacturing has several stages of operation and each stage of operation brings raw materials closer to the final form.

The manufacturing industry is divided into several types of companies engaged in various fields such as, basic and chemical industries, various industries and various consumer goods. Companies classified as basic and chemical industries are companies engaged in the production of cement, ceramics, porcelain, metals, chemicals, plastics, animal feed, wood and its processing, paper and so on. Companies classified as miscellaneous industries are companies engaged in machinery and heavy equipment, automotive and its components, textiles and garments, footwear, cables and electronics. Companies included in the consumer goods industry include companies engaged in the production of food and beverages, cigarettes, pharmaceuticals, cosmetics and household appliances.

Data Analysis Results

Normality Test

Normality testing in the regression model tests whether the confounding or residual variables are normally distributed or not [24]. The regression model requires that the residual value must meet the normality criteria. If this assumption is not met, statistical testing will be invalid. Kolmogorov Smirnov analysis was performed to test the normality of the data distribution. If the residual has a significant value (error probability value or sig.) higher than 0.05, the data is declared normally distributed.

Tabel 1. Hasil Uji Normalitas

	<i>Unstandardized Residual</i>
N	90
<i>Kolmogorov- Smirnov- Z</i>	0,089
<i>Asymp.Sig.(2 tailed)</i>	0,078

Source: Appendix of Normality Test

Based on the table above, the Kolmogorov Smirnov test results show that the residual has a significance value higher than 0.05, which is 0.078, this shows the suitability of the criteria for testing the normality of the data distribution [24].

Multicollinearity

Multicollinearity testing is a test to see whether the independent variables are correlated or not. Generally, if the correlation value is perfect or close to perfect (close to the value of one), it can be said that multicollinearity conditions occur. If multicollinearity occurs in the regression model, it will have the following consequences:

1. It is difficult to detect or distinguish the effect of each variable.

2. The increase in exogenous variables causes an increase in the standard error of estimation.
3. The null hypothesis (H₀) has a greater significance value, or there is no effect.
4. The probability of hypothesis acceptance error is higher.
5. The value of t statistics becomes very low because the standard error value of each regression coefficient is higher.

To test for multicollinearity, it can be seen by looking at the VIF (Variance Inflation Factor) value [24]. If the VIF value exceeds 10, the indication of multicollinearity is high. Table 5.4 shows the results of the multicollinearity test on the regression model.

Table 2. Multicollinearity Test

Variabel	VIF	Keterangan
CEOE	1,528	Tidak terjadi multikolinearitas
KI	1,447	Tidak terjadi multikolinearitas
BGD	1,325	Tidak terjadi multikolinearitas
KP	1,186	Tidak terjadi multikolinearitas
UP	1,315	Tidak terjadi multikolinearitas
ROA	1,393	Tidak terjadi multikolinearitas
DAR	1,173	Tidak terjadi multikolinearitas

Based on Table 2, it can be seen that the VIF value of all research variables meets the requirements with a critical value of VIF less than 10. So it can be concluded that all research variables in the regression model do not experience symptoms of multicollinearity.

Autocorrelation

Autocorrelation testing is carried out to evaluate whether there is a correlation or relationship between confounding errors. The consequences of autocorrelation in a regression model are as follows:

1. The sample variance cannot reflect the population variance.
2. The resulting regression model cannot be used to estimate the value of the dependent variable from the value of certain independent variables.
3. The coefficient variance is not minimal (inefficient), so the estimated coefficient obtained is no longer accurate.
4. The conclusion of the t test is wrong, if the test results are still used then the conclusion obtained is wrong.

According to Algifari [25] the autocorrelation problem in the regression model can be seen in the magnitude of the Durbin - Watson (D - W) value, which has the following testing criteria:

1. Detection of Positive Autocorrelation:
 - a. If the DW value, $0 < d < d_L$, there is positive autocorrelation.
 - b. If the DW value, $d_L < d < d_U$, it cannot be concluded.
2. Negative Autocorrelation Detection:
 - a. If the DW value, $4 - d_L < d < 4$, there is negative autocorrelation.
 - b. If the DW value, $4 - d_U < d < 4 - d_L$, it cannot be concluded.
3. No positive or negative autocorrelation:

If the DW value, $d_U < d < 4 - d_U$

Through the regression analysis results, the Durbin - Watson test value is 2.284. Based on the D-W value testing criteria, it can be seen that the D-W value of 2.284 is between 1.563 and 2.437 which is in accordance with the criteria $d_U < d < 4 - d_U$, so it can be concluded that there is no autocorrelation in the regression model.

Discussion

Effect of CEO Education on R&D Investment

The results showed that the level of CEO education has a significant positive effect on R&D investment in manufacturing companies that go public on the Indonesia Stock Exchange. This shows that the higher the level of CEO education of the company, the higher the possibility of the company to invest higher in R&D. Manufacturing companies are dominated by CEOs with S1 education, but there are also CEOs with S2 or Master and S3 education, and the least is with Diploma education. Higher education

makes CEOs more broad-minded and dare to innovate and face higher business challenges in the future. CEOs with higher education are able to make better strategic decisions and are more adaptable in a changing business environment. A high level of CEO education makes the CEO have high intellectual capital and broad knowledge and is more innovative and has good managerial skills. So to improve company performance better CEO will encourage a greater level of investment to adapt to the business environment in the future. The level of education has a positive effect on investment even though most of the company's CEO education level is dominated by the S1 education level, only about 28% with S2 education, and 2% with S3 education, but when examined from the company's CEO profile, most of them have qualified experience in leading the company, because they have also led other companies. In addition, many CEOs' undergraduate education was also taken abroad. This makes the CEO richer in experience and has broader insights, thus encouraging better R&D investment.

The results of the study are in line with the research of [2] that CEOs with higher levels of education tend to invest more in R&D. So it means that the CEO's education level has a positive effect on R&D investment decisions. Because they have broad knowledge, are more innovative, have good managerial skills, are able to adapt, are willing to apply new technology, and have better problem-solving skills.

Effect of Institutional Ownership on R&D Investment

The results showed that institutional ownership has no significant effect on R&D investment. This shows that large institutional ownership cannot guarantee that companies make large investments in R&D. Institutional share ownership, which represents a source of power, has the power to influence the company, especially agency conflict problems caused by manager behavior. Because through higher institutional ownership, the monitoring mechanism for manager behavior is more effective. However, institutional ownership support for R&D investment also depends on the characteristics of the company. If the condition of the company does not allow it to have the opportunity to invest, institutional ownership does not encourage companies to invest in R&D. If the company's cash flow is high but the company's growth rate is not good, institutional ownership will not encourage R&D investment, because it may be misused for management's own interests. However, if the R&D investment opportunity has a good chance and the company also has a good growth rate, institutional ownership will encourage R&D investment. Companies with high free cash flow but poor growth rates make the possibility of agency problems higher so that institutional ownership does not agree to invest in R&D. So it can be concluded that large institutional ownership does not guarantee that companies make high investments in R&D, because it depends on the condition of the company and the investment opportunity. The existence of large institutional ownership makes the company more closely monitor investments that are likely to have a major impact on the company. Institutional ownership does not have a significant effect also because most institutional ownership is owned by domestic institutions, where domestic institutional ownership tends to have a preference for maintaining investment in the company, and less daring to act speculatively and challenging to make investments. Because the cost of investing in R&D tends to be very high and consumes a lot of funds, domestic institutions tend to maintain investment by keeping the company's operations safe and not making investments that have uncertain results in the future. Institutions tend to be more protective not to make long-term investments such as R&D and are more inclined to the stability of the company's operations.

The results are in line with the opinion of [26], that domestic institutional ownership has no significant effect on R&D investment. This is because domestic institutional ownership tends to have an orientation towards the stability of the company's operations in the long term. Domestic institutions protect the long-term condition of the company, because investment in R&D which is generally long-term and requires large funding is still full of uncertainty, and can affect the stability of the company's operations if there is an investment failure. Domestic institutions are more risk-averse and may incur losses in the future.

Effect of Board Gender Diversity on R&D Investment

The results show that board gender diversity has a significant positive effect on R&D investment, which is not in line with the hypothesis stating that the effect is negative. This means that gender diversity does not completely negatively affect R&D investment, but can have a positive effect on R&D investment in manufacturing companies. The positive effect of gender diversity is also due to the fact that the proportion of gender diversity is still low, which is only 18% on average, when compared to the ideal gender diversity of 50%. This shows that the board of directors is still largely dominated by men. The

research evaluation data shows that the percentage of male directors out of total board members is 86.79%, while the percentage of female directors out of total members is only 13.21%. It appears that the percentage of female board members is still very low in manufacturing companies. This causes the decisions taken to be more likely to be dominated by male directors, because the number of female gender is still low. This causes the decision making taken by female directors to still have a low influence in determining investment decisions, because the number of female board members is still low, less dominant than male board members. Therefore, the decisions made are also mostly determined by male members, whose proportion is higher, so they are willing to take risks and support R&D investments. The decisions taken tend to be more challenging.

The results of the study are consistent with [27] research that female directors tend to be risk-averse than male directors, thus avoiding investment. This happens when the proportion of women is balanced with men, so that it can influence decision making. However, if the proportion of men dominates, the decision tends to be dominated by the decision making of male directors, so they are more willing to take investment risks. The votes held by female directors tend to be less dominant than those of male directors, if the proportion of gender diversity does not reach 50%.

Effect of Market Uncertainty on R&D Investment

The results showed that market uncertainty has a significant negative effect on R&D investment. This shows that if market uncertainty is higher, companies will tend to delay or reduce investment in R&D. If market uncertainty is higher, the company is more difficult to operate, because access to the resources needed is hampered and can lead to instability in the company's operations. The company's supply chain is disrupted so that it can have a negative impact on the investment made. So companies tend to reduce R&D investments that are long-term in nature due to high uncertainty conditions. Because mistakes in making investment decisions under conditions of high market uncertainty will result in higher additional costs and cannot generate returns in the short term. So companies tend to delay investment to reserve their funds to deal with the uncertainty that occurs. Therefore, high market uncertainty will prevent companies from investing in R&D. The negative effect of market uncertainty on R&D investment appears in the evaluation results. In general, the market uncertainty of all companies is in the range of 20%. The proportion of this uncertainty is quite high, so it has an impact on overall R&D investment which only reaches a proportion of 0.73%. This shows that R&D investment is still very low. The highest R&D investment only reached 5%. This shows that companies do not dare to take risks on the uncertainty experienced so as to minimize the cost of R&D investment or postpone it.

The results are consistent with the research of [18] that market uncertainty has a negative effect on R&D investment decisions. Companies that face high market uncertainty tend to retain their funds for funding that is more important for the benefit of the company's operations. The company will tighten investment because it is more likely to maintain its financial condition if market uncertainty is higher. So the company will postpone investment when market uncertainty is higher.

5. CONCLUSION

CEO education has a significant positive effect on R&D investment. So the higher the level of CEO education, the greater the level of R&D investment made by the company. Because CEOs with a better level of education make strategic decisions, have broad knowledge, tend to be more innovative, have better adaptability, and have better problem solving skills. Institutional ownership has no significant effect on R&D investment. This means that the amount of institutional ownership does not guarantee the amount of investment in R&D. This is because it still depends on the condition of the company, if the company grows well with good cash flow, and has good investment opportunities, institutional ownership can encourage investment in R&D. However, if the company is not growing well and does not have good investment opportunities, then institutional ownership will avoid investing in R&D. Board gender diversity has a positive significant effect on R&D investment, contrary to the proposed hypothesis which has a negative effect. This means that gender diversity can still increase investment in R&D. This is because even though gender diversity is high with the number of female directors almost balanced with men, but with equity-based compensation that encourages directors for long-term goals which can also benefit directors because they get a share of compensation, high gender diversity will still support R&D investment which is beneficial for future company performance. Market uncertainty has a significant negative effect on R&D investment. This means that the higher the market uncertainty that occurs, the company will reduce the amount of R&D investment or delay investment. This is because market uncertainty will be able to disrupt the stability of the company's operations so that companies tend to

reserve their funds for the benefit of company operations and delay investment in R&D, to maintain the continuity of company operations.

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