CEO & CFO Education and R&D Investment in Indonesia

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Abstract

This study examines how the research and development (R&D) investments of listed companies in Indonesia are influenced by the educational characteristics of their CEOs and CFOs. This study uses 368 observations from 150 listed companies on the Indonesian Stock Exchange for the period 2010 to 2015. We find that CEOs with higher educational levels invest more in research and development. This is consistent with more education instilling a longer-term perspective on corporate managers. We also find that CFOs with accounting certifications invest less in R&D, consistent with the risk-adverse nature of the accounting profession. For companies and shareholders, our findings indicate the need for a greater understanding of the factors associated with R&D investments in Indonesia and other developing markets. Particularly, factors related to the background experience of CEOs and other executives, whose characteristics can have a real impact on the R&D investment decisions of firms. Our results show that the education of CEOs and CFOs is associated with their investment decisions in research and development. Thus, different education backgrounds create a bias for or against R&D investment in Indonesian firms.[6]

***JEL classification**:* M40

Keywords: CFO, CEO, Education, R&D Investment

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[6] **Acknowledgment:** This project has received funding from the Faculty of Economics and Business, Universitas Airlangga, in 2017

INTRODUCTION

Indonesia is the fourth most populous nation in the world and the 16th largest economy, yet is ranked only 105th in terms of research and development (R&D) spending by the Global Innovation Index.[7] 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 government of Indonesia has developed a Master Plan of National Research (RIRN 2017-2045) to strengthen the national research sector and increase the contribution of research to national economic growth. The goal is to increase R&D investment to 1% of GDP, with significant increases expected in both public and private funding of R&D activities. In this study, we examine the investments that listed companies are making in R&D in Indonesia and how the characteristics of CEOs and CFOs influence R&D investment decisions.

A company is established in order to succeed in both the short and long term. To meet both of these needs, companies have to make continuous innovations and create competitive advantages (Bayus et al. 2003; Calantone et al. 2006; Pauwels et al. 2004). One of the innovations companies can make to gain more profit in the future is to invest in research and development activities. R&D investment can be considered as investment in new technology and knowledge, which can then be transformed into more efficient production methods for available resources (Tuna et al. 2015). R&D aims to create a new product or develop an existing product in order to attract consumers, resulting in an increase in the number of consumers and their loyalty to the company, and ultimately will have an impact on increasing profit for the company. R&D is an important strategic decision for the company as it can help the company improve its competitiveness and innovation capability.

The board of directors and the top management team are the core of corporate governance and play an important role in corporate decision making (Jensen & Murphy 1990; Simeon 2001). The two top executives who play the most important role in corporate decision-making are the Chief Executive Officer (CEO) and Chief Financial Officer (CFO). The CEO is the senior manager who is responsible for overseeing the activities of the entire company. While the CFO is the senior manager who is responsible for overseeing the financial activities of the company. Furthermore, CEOs often make decisions about major investing and financing within the company, which requires the approval of the board (Ganor 2011). In this case, the CFO contributes to CEO considerations that may influence the decision. Academic studies report that CFOs often collect the necessary data, perform financial analysis and provide recommendations to the CEO in making decisions. As a result, the decisions taken may reflect some of the characteristics of both the CEO and CFO (Barker & Mueller 2002; Malmendier & Tate 2005; Campello et al. 2010; Graham & Harvey 2001; Johnson 2015).

R&D investment is one of the most fundamental investment decisions made by top managers of companies (Barker & Mueller 2002). Therefore, the characteristics of CEOs and CFOs are very influential in determining the company's efforts to innovate. Hambrick and Mason (1984) suggest that visible personal traits of top executives could be used to infer their basic beliefs and values and that these conviction systems could influence firm-level strategic decisions. More specifically,

[7] https://oxfordbusinessgroup.com/news/indonesia-seeking-greater-funding-rd

resource dependency theory implies that the personal attributes of CEOs and directors can influence a company's R&D investment (Barker & Mueller 2002; Cazier 2011; Lin et al. 2011).

One of the prominent individual characteristics of executives to consider is education, because it is closely related to innovation. R&D projects are usually risky and expensive, so it is important for CEOs and CFOs to have stronger insights and higher cognitive skills. Thus, education is one of the important factors in innovation decisions. Previous studies have discussed the impact of executive education on decisions related to R&D investment. These studies have concluded that a higher manager education level is correlated with stronger innovation and managerial capabilities (Lin et al. 2011), capability to adapt and learn new technology (Dalziel et al. 2011), capability to gather, handle and analyze information (Escriba et al. 2009) and capability to solve problems caused by R&D issues (Balkin et al. 2000; Wincent et al. 2010). Therefore, a firm whose CEO has a higher education level is expected to invest more in R&D.

In addition, managers' professional backgrounds also influence their view of innovation. Barker and Mueller (2002) argue that CEOs' professional experience in various functions is also important in corporate R&D decisions, as their perceptions of new technology will be biased by their professional experience. Koo (2019) states that CEOs with strong firm-specific human capital have a significant long-term influence on firm innovation. For example, executives with career experience in R&D/engineering and marketing/sales will favour innovative strategies because these business functions emphasize growth through discovering new products and markets.

In contrast, CEOs and CFOs with career experience in accounting and finance tend to work at improving the efficiency of the organization and to avoid uncertainty and risk (Finkelstein & Hambrick 1996; Helliar et al. 2002). For example, Matsunaga and Yeung (2008) find that firms managed by former CFOs tend to have more accrual-based income that indicates the use of more conservative accounting policies. Aier et al. (2005) show that CFOs with advanced degrees and CPA certifications are more conservative in their accounting choices and therefore have fewer earnings restatements. Thus, CEOs and CFOs with an accounting background are expected to be associated with more conservative corporate decisions, such as investing less in long-term and risky projects.

This study examines how the education of CEOs and CFOs affect firm decisions on research and development investments in Indonesia, a nation where R&D is of growing importance. This study uses 368 firm-year observations from companies listed on the Indonesia Stock Exchange for the period from 2010 to 2015. We find that CEOs with higher educational levels invest more in research and development. This is consistent with more education instilling a longer-term perspective on corporate managers. We also find that CFOs with accounting certifications invest less in R&D, consistent with the conservative, risk-adverse nature of the accounting profession. The results suggest that companies in Indonesia need to improve their board's understanding of factors related to R&D investment in order to maintain their long-term company sustainability.

Newness of the Study

This study makes three contributions to the growing literature on R&D investment. First, in contrast to previous research, which focuses on the characteristics of CEOs, this study also takes

the characteristics of the CFO into account. Thus, we examine the impact of both CEO and CFO characteristics in shaping firm-level R&D investments. Second, prior studies have focused on the relationship between R&D activities and the technical backgrounds of executives from the perspective of science/engineering/innovation experience. We investigate the relationship between accounting certifications and R&D activities, as we believe the accounting profession promotes risk aversion, which is expected to be associated with less investment in risky R&D activities.[8] Third, the majority of prior literature examines R&D issues in developed markets. A number of recent studies have examined R&D investment in China, but there is still limited research on R&D activities in other developing markets. This study therefore adds to the investigation of factors related to R&D investment in developing markets, such as Indonesia (Aminullah et al. 2019).

THEORETICAL FOUNDATION

Based on upper-echelons theory, this paper proposes that firm-level R&D investment varies with the characteristics of top executives, while controlling for other firm-level factors (Hambrick & Mason 1984; Barker & Mueller 2002; Hambrick 2007). We assume that R&D investment is a decision under the control of top executives, and due to its risky nature we expect that CEOs and CFOs actively monitor R&D investments and adjust the level of R&D activities based on their preferences. We acknowledge that CEOs have the greatest organizational power to influence R&D investments (Zahra & Pearce 1989), but also consider the role that CFOs play in monitoring and advising the CEO about R&D activities. Consistent with prior studies utilizing upper-echelons theory, we propose that the education level and background expertise of top executives is related to their corporate decision-making, in the context of R&D investments.

HYPOTHESIS DEVELOPMENT

The CEO is an executive who not only acts as a decision maker but also the executor, so that the CEO's cognitive, values and insights, influenced by CEO characteristics, such as educational and professional background, are key factors influencing organizational strategy (Hambrick & Mason 1984). CFOs are financial managers of companies whose responsibilities include overseeing financial reporting, managing internal controls and ensuring compliance with accounting rules. However, CEOs and CFOs are two interconnected parties. The contribution of CFOs to CEO considerations can influence major corporate decisions (Campello et al. 2010; Graham & Harvey 2001; Johnson 2015).

Upper-echelons theory states that innovation strategies are influenced by the personal characteristics of top managers, such as education level and professional background (Barker & Mueller 2002; Daellenbach et al. 1999). Prior research has concluded that a higher level of CEO education is correlated with stronger innovation and managerial skills (Lin et al. 2011), ability to adapt and learn new technologies (Dalziel et al. 2011), the ability to collect, handle and analyze information (Escriba et al. 2009) and ability to solve problems caused by R&D problems (Balkin et al. 2000; Wincent et al. 2010). Lin et al. (2011) indicates that the educational level of CEOs, professional backgrounds and political connections is positively associated with innovation

[8] This study also complements recent work on the role accountants play in business activities in Indonesia (Gaffikin and Lindawati 2012; Lindawati and Smark 2015).

efforts. Wen & Hu (2009) find that the level of education and professional experience of CEOs is significantly positively related to R&D expenditures in China.

R&D activities are usually associated with new technologies and new products. Higher educated executives tend to have greater cognitive density to assimilate new ideas, thereby increasing the likelihood of R&D investment (Barker & Mueller 2002). Education is positively associated with cognitive abilities (Finkelstein & Hambrick 1996) and higher-educated managers are better able to generate new and creative solutions to problems (Bantel & Jackson 1989). Education can help to broaden horizons, improve the quality and way of thinking, and increase insight. CEOs and CFOs with different levels of education have different values, abilities and insights. Because R&D projects are highly risky, CEOs and CFOs need to have stronger insights, higher cognitive abilities and a longer term perspective. Based on this, we propose the following hypothesis:

> *H1. CEOs and CFOs with higher educational levels invest more in research and development.*

The backgrounds of CFOs and CEOs should also be important in their acceptance of innovative ideas and activities, because professional experiences can influence organizational decisions. Tyler and Kevin (1995) find that CEOs with technical work experience, such as R&D/engineering, are consistent with progress, discovery and improvement in the high-tech sector. Conversely, a CEO with career experience in accounting/finance, administration and law functions will improve organizational efficiency (Finkelstein & Hambrick 1996). Matsunaga and Yeung (2008) find that firms managed by former CFOs tend to have more accrual-based income that indicates the use of more conservative accounting policies. Aier et al. (2005) show that CFOs with advanced degrees and CPA certifications produce better quality financial reports and less earnings restatements.

Accounting careers and related experience in finance may affect the performance of CFOs and CEOs. Extensive accounting knowledge can help with financial reporting. Equally important, training and experience in accounting also tend to shape the CEO and CFO's attitude toward risk and decisions when faced with uncertainty. Accounting training and standards are often written in conservative terms and favour risk aversion (Brief 1975). Consistent with this view, previous research has found that CPAs are usually risk averse and that accounting managers are more risk averse than other managers (Newton 1977; Helliar et al. 2002; Aier et al. 2005). To summarize, previous research has shown that executives with accounting backgrounds tend to be more risk averse in their decision-making. Based on these findings, we propose that CEOs and CFOs with accounting certifications will also exhibit higher levels of risk aversion when performing responsibilities beyond financial reporting. Their preference for risk avoidance is expected to manifest itself in lower R&D investment. Thus, we propose the following hypothesis:

> *H2. CEOs and CFOs with accounting certifications invest less in research and development.*

DATA AND VARIABLES

Sample

The initial sample consists of all companies listed on the Indonesia Stock Exchange (BEI) for the period 2010-2015. Sources of data in this study include company annual reports and the ORBIS database. Financial data was obtained from the ORBIS database. Data about CEOs (generally called President Directors in Indonesia) and CFOs (generally called Finance Directors in Indonesia), including their education level and professional certifications, and data for corporate governance variables, were obtained from company annual reports. These datasets were merged and the following sample selection criteria were applied. First, all companies from the finance, insurance and real estate industries (SIC 6) were excluded because of the different nature of their financial statements. Second, any observations without complete data were excluded from the sample. After applying the sample selection criteria, the final sample includes 368 firm-year observations.

Variable Definitions

The variables of interest in this study include the education level of the CEO (EDUCATION-CEO) and CFO (EDUCATION-CFO). This is measured using a highest-level education variable, 0 for CEOs/CFOs who have a Diploma, 1 for CEOs/CFOs who have a Bachelor degree, 2 for CEOs/CFOs who have a Master degree, and 3 for CEOs/CFOs who have a Doctoral degree (Chen 2014; Kouaib & Jarboui 2016; Kuo et al. 2017). Another variable of interest is the accounting certification of the CEO (ACCERTIFIED-CEO) and CFO (ACCERTIFIED-CFO). This is measured using a dummy variable, 1 for CEOs/CFOs who have an accounting certification (e.g. CPA) and 0 for CEOs/CFOs who don't have an accounting certification.

R&D investment (R&D) is the dependent variable and is measured by two proxies for R&D intensity, R&D expense divided by total sales (R&D/SALES) and the natural logarithm of R&D expense (Ln_R&D). If R&D expense is zero, Ln_R&D is set to zero. These R&D intensity variables have been the most widely used R&D measures (Cohen & Klepper 1996; Balkin et al. 2000; Lee & O'Neill 2003; Coles et al., 2006; Aier et al. 2005).

Referring to previous research (Lin et al. 2011; Hoitash et al. 2016; Dalziel et al. 2011; Chen 2014; Purkayastha et al. 2016; Faleye et al. 2018) the control variables used in this study include: gender of the CEO (GENDER-CEO), gender of the CFO (GENDER-CFO), board size (BOARDSIZE), percentage of independent commissioners (INDEPENDENT), number of internal commissioners (INTCOM), number of external commissioners (EXTCOM), firm age (FIRMAGE), firm size (FIRMSIZE), firm leverage (LEVERAGE), current ratio (CURRENT), return on assets (ROA), operating cash flow (OCF), and firm intangible assets (INTANGIBLE). See the Appendix for full details of variable definitions.

METHODOLOGY

This study uses an OLS regression model with fixed year and industry effects, and clustered standard errors (Petersen 2009). To test the hypotheses in this study, the following regression models are used. We expect the coefficients on EDUCATION-CEO and EDUCATION-CFO to be positive and ACCERTIFIED-CEO and ACCERTIFIED-CFO to be negative.

$$R\&D_{i,t} = \beta_0 + \beta_1 EDUCATION - CEO_{i,t} + \beta_2 ACCERTIFIED - CEO_{i,t} + \beta_3 GENDER - CEO_{i,t} + \beta_4 BOARDSIZE_{i,t} + \beta_5 INDEPENDENT_{i,t} + \beta_6 INTCOM_{i,t} + \beta_7 EXTCOM_{i,t} + \beta_8 FIRMAGE_{i,t} + \beta_9 FIRMSIZE_{i,t} + \beta_{10} LEVERAGE_{i,t} + \beta_{11} CURRENT_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} OCF_{i,t} + \beta_{14} INTANGIBLE_{i,t} + YEAR_{i,t} + INDUSTRY_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$R\&D_{i,t} = \beta_0 + \beta_1 EDUCATION - CFO_{i,t} + \beta_2 ACCERTIFIED - CFO_{i,t} + \beta_3 GENDER - CFO_{i,t} + \beta_4 BOARDSIZE_{i,t} + \beta_5 INDEPENDENT_{i,t} + \beta_6 INTCOM_{i,t} + \beta_7 EXTCOM_{i,t} + \beta_8 FIRMAGE_{i,t} + \beta_9 FIRMSIZE_{i,t} + \beta_{10} LEVERAGE_{i,t} + \beta_{11} CURRENT_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} OCF_{i,t} + \beta_{14} INTANGIBLE_{i,t} + YEAR_{i,t} + INDUSTRY_{i,t} + \varepsilon_{i,t} \quad (2)$$

EMPIRICAL ANALYSIS

Descriptive Statistics and Univariate Analysis

Table 1 (below) contains the sample distribution by industry sector and CEO and CFO education. Panel A shows the distribution for the education level of the CEO. Out of a total of 368 observations, the highest level of education for CEOs is a Diploma (24), Bachelor degree (160), Master degree (176) and Doctoral degree (8). The Total column shows that the distribution across industries ranges from a low of 16 observations in SIC 8 to a high of 99 observations in SIC 4. Panel B shows the distribution for the education level of the CFO. Out of a total of 368 observations, the highest level of education for CFOs is a Diploma (19), Bachelor degree (200), Master degree (143) and Doctoral degree (6). In summary, the most common education level for CEOs is a Master degree and for CFOs is a Bachelor degree.

Table 1: Firm Distribution by Industry and CEO & CFO Education

Panel A: Chief Executive Officer (CEO)

Industry	Education								Total	%
	Diploma	%	Bachelor	%	Master	%	Doctoral	%		
(SIC 0) Agriculture, Forestry and Fisheries	5	21.74	15	65.22	3	13.04	0	0.00	23	100
(SIC 1) Mining	2	3.17	20	31.75	40	63.49	1	1.59	63	100
(SIC 2) Construction Industries	5	6.25	44	55.00	31	38.75	0	0.00	80	100
(SIC 3) Manufacturing	1	3.70	7	25.93	19	70.37	0	0.00	27	100
(SIC 4) Transportation, Communications and Utilities	4	4.04	39	39.39	51	51.52	5	5.05	99	100
(SIC 5) Wholesale & Retail Trade	4	11.11	14	38.89	16	44.44	2	5.56	36	100
(SIC 7) Service Industries	3	12.50	11	45.83	10	41.67	0	0.00	24	100
(SIC 8) Health, Legal, and Educational Services and Consulting	0	0.00	10	62.50	6	37.50	0	0.00	16	100
Total	24	6.52	160	43.48	176	47.83	8	2.17	368	100

Panel B: Chief Financial Officer (CFO)

Industry	Education								Total	%
	Diploma	%	Bachelor	%	Master	%	Doctoral	%		
(SIC 0) Agriculture, Forestry and Fisheries	2	8.70	15	65.22	6	26.09	0	0.00	23	100
(SIC 1) Mining	5	7.94	23	36.51	32	50.79	3	4.76	63	100
(SIC 2) Construction Industries	3	3.75	51	63.75	25	31.25	1	1.25	80	100
(SIC 3) Manufacturing	0	0.00	18	66.67	9	33.33	0	0.00	27	100
(SIC 4) Transportation, Communications and Utilities	4	4.04	55	55.56	40	40.40	0	0.00	99	100
(SIC 5) Wholesale & Retail Trade	3	8.33	23	63.89	10	27.78	0	0.00	36	100
(SIC 7) Service Industries	1	4.17	9	37.50	14	58.33	0	0.00	24	100
(SIC 8) Health, Legal, and Educational Services and Consulting	1	6.25	6	37.50	7	43.75	2	12.50	16	100
Total	19	5.16	200	54.35	143	38.86	6	1.63	368	100

Notes: This table shows the sample distribution of CEO and CFO Education based on industry characteristics of 368 companies listed on the IDX in 2010-2015.

Table 2 (below) shows the descriptive statistics. The mean values for R&D/SALES and Ln_R&D are 0.283 and 0.703. The mean values for EDUCATION-CEO and EDUCATION-CFO are 1.457 and 1.370. Of the firms, 1.1% have a CEO with an accounting accreditation and 7.1% have a CFO with an accounting accreditation. The proportion of companies with male CEOs is 90.2% and male CFOs is 76.6%. The average board size is 9.845 directors and commissioners. The average proportion of independent commissioners is 37.264%. The average number of the internal and external commissioners are 2.927 and 1.755. The average company has total assets of IDR 978,316.016, leverage of 50.4%, current ratio of 94.5%, ROA of 0.047, operating cash flow of 6.8% of total assets, and intangible assets of IDR 69,088.205.

Table 2: Descriptive Statistics

	Mean	Median	Minimum	Maximum
R&D/SALES	0.283	0.000	0.000	8.286
Ln_R&D	0.703	0.000	0.000	10.696
EDUCATION-CEO	1.457	1.500	0.000	3.000
ACCERTIFIED-CEO	0.011	0.000	0.000	1.000
EDUCATION-CFO	1.370	1.000	0.000	3.000
ACCERTIFIED-CFO	0.071	0.000	0.000	1.000
GENDER-CEO	0.902	1.000	0.000	1.000
GENDER-CFO	0.766	1.000	0.000	1.000
BOARDSIZE	9.845	10.000	4.000	21.000
INDEPENDENT	37.264	33.333	0.000	100.000
INTCOM	2.927	3.000	0.000	7.000
EXTCOM	1.755	2.000	0.000	5.000
FIRMAGE	27.386	24.000	2.000	114.000
FIRMSIZE	978,316.016	341,511.643	11,141.875	17,827,606.266
LEVERAGE	0.504	0.507	0.054	1.193
CURRENT	0.945	0.702	0.059	5.847
ROA	0.047	0.036	-0.271	0.316
OCF	0.068	0.064	-0.251	0.367
INTANGIBLE	69,088.205	2,802.520	0.222	2,105,789.922

Notes: This table shows descriptive statistics for the main variables used in this study. The sample includes 368 companies listed on the IDX in 2010-2015.

Table 3 displays the Pearson correlations between the measures of R&D and the CEO and CFO variables. The correlations between R&D investment and CEO education are positive and significant at the 1% level. The correlations between R&D investment and CFO education are both positive but only one is significant at the 5% level. The correlations between R&D and CEO accounting certification are insignificant. However, there is a significant negative correlation between R&D investment and CFO accounting certification. The gender of the CFO is unrelated to R&D investment, but there is some evidence that male CEOs are associated with lower R&D investment.

Table 3: Pearson Correlations

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
[1] ***R&D/SALES***	1.000							
[2] ***Ln_R&D***	0.742***	1.000						
	(0.000)							
[3] ***EDUCATION-CEO***	0.194***	0.245***	1.000					
	(0.000)	(0.000)						
[4] ***ACCERTIFIED-CEO***	-0.026	-0.037	0.007	1.000				
	(0.615)	(0.483)	(0.893)					
[5] ***GENDER-CEO***	-0.089*	-0.042	0.034	0.035	1.000			
	(0.090)	(0.419)	(0.512)	(0.509)				
[6] ***EDUCATION-CFO***	0.042	0.124**	0.172***	-0.021	-0.010	1.000		
	(0.417)	(0.018)	(0.001)	(0.693)	(0.841)			
[7] ***ACCERTIFIED-CFO***	-0.069	-0.097*	0.018	0.073	0.019	-0.080	1.000	
	(0.186)	(0.064)	(0.724)	(0.160)	(0.711)	(0.123)		
[8] ***GENDER-CFO***	-0.062	0.002	0.082	-0.004	0.056	0.040	0.127**	1.000
	(0.234)	(0.976)	(0.118)	(0.938)	(0.285)	(0.444)	(0.015)	

Notes: This table shows the Pearson Correlation test results from 368 firms listed on the IDX 2010-2015 with *t > 1.645, ** t > 1.960, *** t > 2.326, significance at 10%, 5% and 1%.

CEO Education and R&D Investment

Table 4 shows the results of model 1, relating R&D investment to the education of CEOs. We hypothesize a positive relationship between the education level of CEOs and R&D investment, and a negative relationship between accounting certification of CEOs and R&D investment. There are three specifications using R&D/SALES and another three using Ln_R&D as the measures of R&D investment. Across all specifications, the coefficients on EDUCATION-CEO are positive and significant at the 1% level. These results are consistent with Hypothesis 1 and indicate that CEOs with higher educational levels invest more in research and development.

The coefficients on ACCERTIFIED-CEO are negative and significant in specifications 2 and 5, but are insignificant in the full models (specifications 3 and 6). Thus, once the education level of CEOs is taken into account, there is no remaining relationship between CEO accounting certification and R&D investment. This indicates that Hypothesis 2 is not supported for CEOs. The results for the control variables indicate that R&D investment is higher in bigger firms, firms with lower leverage, lower current ratios and less intangible assets. There are no significant relationships between board governance variables and R&D investment, but there is evidence that male CEOs are associated with less R&D investment.

Table 4: CEO Education and R&D Investment

	R&D/SALES			***Ln_R&D***		
	(1)	(2)	(3)	(4)	(5)	(6)
EDUCATION-CEO	0.445***		0.452***	0.917***		0.926***
	(4.38)		(4.44)	(5.23)		(5.27)
ACCERTIFIED-CEO		-0.421**	-0.350		-0.728*	-0.637
		(-1.98)	(-1.22)		(-1.93)	(-1.14)
GENDER-CEO			-1.326*			-1.824**
			(-1.70)			(-1.99)
BOARDSIZE	-0.023	-0.026	-0.016	-0.035	-0.041	-0.025
	(-0.73)	(-0.78)	(-0.49)	(-0.54)	(-0.60)	(-0.38)
INDEPENDENT	-0.000	-0.003	0.000	0.000	-0.005	0.001
	(-0.04)	(-0.36)	(0.03)	(0.02)	(-0.31)	(0.07)
INTCOM	0.075	0.073	0.059	0.146	0.140	0.125
	(0.73)	(0.70)	(0.63)	(0.65)	(0.61)	(0.57)
EXTCOM	0.084	0.104	0.044	0.089	0.133	0.033
	(0.56)	(0.75)	(0.30)	(0.29)	(0.48)	(0.11)
FIRMAGE	-0.027	0.005	0.011	-0.048	0.018	0.004
	(-0.37)	(0.06)	(0.13)	(-0.29)	(0.10)	(0.02)
FIRMSIZE	-0.042	-0.080	-0.037	0.268**	0.192	0.274**
	(-0.82)	(-1.41)	(-0.71)	(2.37)	(1.62)	(2.45)
LEVERAGE	-0.594**	-0.574**	-0.570**	-1.145**	-1.099**	-1.114**
	(-2.51)	(-2.42)	(-2.50)	(-2.41)	(-2.25)	(-2.36)
CURRENT	-0.114**	-0.077	-0.106**	-0.117	-0.042	-0.104
	(-2.29)	(-1.62)	(-2.02)	(-1.27)	(-0.43)	(-1.11)
ROA	-0.162	-0.065	-0.289	1.232	1.430	1.061
	(-0.26)	(-0.11)	(-0.48)	(0.84)	(0.89)	(0.73)
OCF	-0.174	0.271	0.180	-0.259	0.666	0.220
	(-0.39)	(0.63)	(0.33)	(-0.28)	(0.71)	(0.22)
INTANGIBLE	-0.021	-0.000	-0.018	-0.105**	-0.063	-0.101**
	(-0.93)	(-0.01)	(-0.79)	(-2.36)	(-1.35)	(-2.26)
CONSTANT	0.818	1.404	0.644	-2.236	-1.033	-2.474
	(0.89)	(1.46)	(0.69)	(-1.29)	(-0.59)	(-1.42)
Year Dummies	Included	Included	Included	Included	Included	Included
Industry Dummies	Included	Included	Included	Included	Included	Included
R-squared	0.157	0.104	0.203	0.203	0.130	0.230
N	368	368	368	368	368	368

Notes: This table shows the results of multiple linear regressions between CEO education and R&D Investment of 368 companies listed on the IDX 2010-2015 with $^{*}t > 1.645$, $^{**}t > 1.960$, $^{***}t > 2.326$, significance at 10%, 5% and 1%.

CFO Education and R&D Investment

Table 5 shows the results of model 2, relating R&D investment to the education of CFOs. We hypothesize a positive relationship between the education level of CFOs and R&D investment, and a negative relationship between accounting certification of CFOs and R&D investment. When R&D/SALES is used as the measure of R&D investment the coefficients on EDUCATION-CFO are insignificant. However, when Ln_R&D is the dependent variable, the coefficients on EDUCATION-CFO are positive and significant at the 5% level. Thus, there is partial support for Hypothesis 1 for CFOs.

Across all specifications, the coefficients on ACCERTIFIED-CFO are positive and significant. These results are consistent with Hypothesis 2 and indicate that CFOs with accounting certifications invest less in research and development. The results for the control variables are similar to the previous model, and indicate that R&D investment is higher in bigger firms, firms with lower leverage and lower current ratios. There is no relationship between CFO gender and R&D investment.

Table 5: CFO Education and R&D Investment

	R&D/SALES			***Ln_R&D***		
	(1)	(2)	(3)	(4)	(5)	(6)
EDUCATION-CFO	0.114		0.100	0.416***		0.378**
	(1.39)		(1.20)	(2.65)		(2.44)
ACCERTIFIED-CFO		-0.286**	-0.221*		-0.781***	-0.619***
		(-2.51)	(-1.85)		(-3.50)	(-2.76)
GENDER-CFO			-0.217			-0.243
			(-1.36)			(-1.12)
BOARDSIZE	-0.027	-0.020	-0.023	-0.044	-0.025	-0.032
	(-0.82)	(-0.61)	(-0.69)	(-0.67)	(-0.38)	(-0.48)
INDEPENDENT	-0.004	-0.003	-0.005	-0.007	-0.005	-0.009
	(-0.42)	(-0.38)	(-0.57)	(-0.42)	(-0.33)	(-0.50)
INTCOM	0.062	0.062	0.052	0.111	0.115	0.092
	(0.59)	(0.61)	(0.50)	(0.48)	(0.51)	(0.41)
EXTCOM	0.122	0.111	0.139	0.187	0.147	0.208
	(0.85)	(0.81)	(0.96)	(0.66)	(0.54)	(0.73)
FIRMAGE	-0.001	0.013	0.015	-0.004	0.040	0.026
	(-0.02)	(0.17)	(0.19)	(-0.02)	(0.23)	(0.15)
FIRMSIZE	-0.078	-0.087	-0.085	0.195*	0.170	0.175
	(-1.40)	(-1.52)	(-1.50)	(1.65)	(1.43)	(1.49)
LEVERAGE	-0.582**	-0.556**	-0.561**	-1.145**	-1.059**	-1.106**
	(-2.51)	(-2.37)	(-2.40)	(-2.39)	(-2.16)	(-2.28)
CURRENT	-0.081*	-0.077	-0.070	-0.050	-0.038	-0.031
	(-1.75)	(-1.63)	(-1.49)	(-0.52)	(-0.38)	(-0.31)
ROA	-0.080	-0.146	-0.079	1.389	1.217	1.296
	(-0.13)	(-0.23)	(-0.13)	(0.86)	(0.75)	(0.78)
OCF	0.211	0.361	0.330	0.400	0.889	0.637
	(0.47)	(0.82)	(0.71)	(0.43)	(0.94)	(0.67)
INTANGIBLE	-0.002	0.003	0.006	-0.068	-0.053	-0.053
	(-0.09)	(0.13)	(0.27)	(-1.49)	(-1.15)	(-1.17)
CONSTANT	1.314	1.406	1.460	-1.351	-1.021	-1.161
	(1.39)	(1.47)	(1.50)	(-0.78)	(-0.59)	(-0.68)
Year Dummies	Included	Included	Included	Included	Included	Included
Industry Dummies	Included	Included	Included	Included	Included	Included
R-squared	0.106	0.106	0.114	0.143	0.138	0.152
N	368	368	368	368	368	368

Notes: This table shows the results of multiple linear regressions between CFO education and R&D investment of 368 companies listed on the IDX 2010-2015 with $^{*}t > 1.645$, $^{**}t > 1.960$, $^{***}t > 2.326$, significance at 10%, 5% and 1%.

Robustness Checks

Since CEOs and CFOs do not make decisions in isolation, we repeat our analysis including both the CEO and CFO variables in the same model. Table 6 presents these results. We find that the coefficients on EDUCATION-CEO are still positive and significant at the 1% level. The coefficients on ACCREDITED-CEO are insignificant. The coefficient on EDUCATION-CFO is only significantly positive in the second specification. In addition, the coefficient on ACCREDITED-CFO is only significantly negative in the second specification. These results are consistent with those previously reported and indicate that the education level of both CEOs and CFOs are positively related to R&D investment, consistent with Hypothesis 1. With respect to Hypothesis 2, there is also evidence that CFOs with accounting certifications are associated with lower R&D investment.

To further investigate the relationship between CEO and CFO education levels and R&D investment, we separate the education variables into individual level indicators. CEOBACHELOR is a dummy variable equal to one for CEOs with a Bachelor degree. CEOMASTER is a dummy variable equal to one for CEOs with a Master degree. CEODOCTORAL is a dummy variable equal to one for CEOs with a Doctoral degree. The unidentified group is CEOs with a Diploma. We also construct similar variables for CFOs (CFOBACHELOR, CFOMASTER and CFODOCTORAL). If higher education is associated with more R&D investment, then we would expect increasingly higher positive coefficients on the Bachelor, Master and Doctoral variables.

Table 6: CEO & CFO Education and R&D Investment

	R&D/SALES	***Ln_R&D***
EDUCATION-CEO	0.443***	0.881***
	(4.27)	(5.19)
ACCERTIFIED-CEO	-0.335	-0.546
	(-1.09)	(-0.83)
EDUCATION-CFO	0.058	0.286**
	(0.73)	(1.99)
ACCERTIFIED-CFO	-0.182	-0.542**
	(-1.36)	(-2.19)
GENDER-CEO	-1.302	-1.829*
	(-1.64)	(-1.96)
GENDER-CFO	-0.186	-0.210
	(-1.14)	(-0.97)
BOARDSIZE	-0.013	-0.017
	(-0.40)	(-0.27)
INDEPENDENT	-0.001	-0.002
	(-0.14)	(-0.10)
INTCOM	0.047	0.091
	(0.50)	(0.41)
EXTCOM	0.069	0.089
	(0.44)	(0.29)
FIRMAGE	0.021	0.017
	(0.24)	(0.10)
FIRMSIZE	-0.044	0.253**
	(-0.83)	(2.26)
LEVERAGE	-0.562**	-1.121**
	(-2.44)	(-2.35)
CURRENT	-0.095*	-0.085
	(-1.81)	(-0.85)
ROA	-0.287	0.963
	(-0.47)	(0.64)
OCF	0.232	0.246
	(0.42)	(0.25)
INTANGIBLE	-0.012	-0.089**
	(-0.55)	(-2.02)
CONSTANT	0.731	-2.489
	(0.75)	(-1.43)
Year Dummies	Included	Included
Industry Dummies	Included	Included
R-squared	0.210	0.245
N	368	368

Notes: This table shows the results of multiple linear regressions between CEO & CFO education and R&D investment of 368 companies listed on the IDX 2010-2015 with $^{*}t > 1.645$, $^{**}t > 1.960$, $^{***}t > 2.326$, significance at 10%, 5% and 1%.

Table 7 presents the results of this analysis. We find that the coefficients on CEOBACHELOR, CEOMASTER and CEODOCTORAL are increasingly positive and significant. This is consistent with our expectations and indicates that the higher the education level of CEOs the greater the positive effect on R&D investment. For CFOs we find that the positive relationship between CFO education and R&D investment is only significant when CFOs have a Master degree. R&D investment is also still lower when CFOs have accounting certifications. Thus, the results for CFOs are more specific to the type of education, rather than the overall education level.

Table 7: CEO & CFO Education Level and R&D Investment

	CEO		CFO		ALL	
	R&D/SALES	***Ln_R&D***	***R&D/SALES***	***Ln_R&D***	***R&D/SALES***	***Ln_R&D***
CEOBACHELOR	0.249*	0.530**			0.269*	0.627**
	(1.65)	(2.10)			(1.68)	(2.48)
CEOMASTER	0.709***	1.369***			0.725***	1.396***
	(3.49)	(4.67)			(3.46)	(4.73)
CEODOCTORAL	1.628***	4.030***			1.596***	3.885***
	(3.79)	(3.19)			(3.52)	(3.08)
ACCERTIFIED-CEO	-0.321	-0.582			-0.351	-0.530
	(-1.13)	(-1.12)			(-1.18)	(-0.85)
CFOBACHELOR			0.161	0.021	0.237	0.120
			(1.28)	(0.08)	(1.49)	(0.42)
CFOMASTER			0.298**	0.582**	0.304**	0.532*
			(2.23)	(2.00)	(2.08)	(1.75)
CFODOCTORAL			-0.116	0.083	-0.339	-0.316
			(-0.73)	(0.16)	(-1.29)	(-0.51)
ACCERTIFIED-CFO			-0.221*	-0.607***	-0.166	-0.493**
			(-1.82)	(-2.75)	(-1.21)	(-2.10)
GENDER-CEO	-1.332*	-1.871**			-1.348*	-1.925**
	(-1.69)	(-2.02)			(-1.68)	(-2.02)
GENDER-CFO			-0.230	-0.265	-0.205	-0.230
			(-1.42)	(-1.21)	(-1.21)	(-1.04)
BOARDSIZE	-0.010	-0.010	-0.024	-0.035	-0.011	-0.010
	(-0.32)	(-0.16)	(-0.73)	(-0.52)	(-0.33)	(-0.15)
INDEPENDENT	0.001	0.004	-0.005	-0.010	-0.001	-0.001
	(0.14)	(0.20)	(-0.62)	(-0.59)	(-0.10)	(-0.07)
INTCOM	0.052	0.112	0.048	0.087	0.035	0.076
	(0.56)	(0.54)	(0.46)	(0.38)	(0.38)	(0.36)
EXTCOM	0.015	-0.045	0.147	0.221	0.049	0.038
	(0.10)	(-0.14)	(1.00)	(0.77)	(0.31)	(0.12)
FIRMAGE	0.021	0.047	0.028	0.042	0.051	0.083
	(0.26)	(0.27)	(0.35)	(0.23)	(0.59)	(0.46)
FIRMSIZE	-0.042	0.246**	-0.088	0.170	-0.052	0.220*
	(-0.86)	(2.17)	(-1.54)	(1.44)	(-1.04)	(1.93)
LEVERAGE	-0.552**	-1.088**	-0.606**	-1.148**	-0.615**	-1.184**
	(-2.42)	(-2.30)	(-2.54)	(-2.33)	(-2.59)	(-2.45)
CURRENT	-0.102*	-0.082	-0.057	-0.022	-0.072	-0.044
	(-1.86)	(-0.85)	(-1.24)	(-0.21)	(-1.41)	(-0.44)
ROA	-0.273	1.215	-0.042	1.269	-0.201	1.164
	(-0.44)	(0.84)	(-0.07)	(0.75)	(-0.32)	(0.77)
OCF	0.227	0.296	0.310	0.597	0.256	0.254
	(0.43)	(0.30)	(0.66)	(0.63)	(0.47)	(0.26)
INTANGIBLE	-0.018	-0.095**	0.005	-0.054	-0.013	-0.084*
	(-0.77)	(-2.08)	(0.24)	(-1.17)	(-0.58)	(-1.85)
CONSTANT	0.807	-2.052	1.439	-0.774	0.745	-1.947
	(0.84)	(-1.24)	(1.47)	(-0.45)	(0.73)	(-1.15)
Year Dummies	Included	Included	Included	Included	Included	Included
Industry Dummies	Included	Included	Included	Included	Included	Included
R-squared	0.208	0.247	0.117	0.157	0.220	0.264
N	368	368	368	368	368	368

Notes: This table shows the results of multiple linear regressions between CEO & CFO education level and R&D investment of 368 companies listed on the IDX 2010-2015 with $^{*}t > 1.645$, $^{**}t > 1.960$, $^{***}t > 2.326$, significance at 10%, 5% and 1%.

Discussion of the Results

The analysis in this paper highlights two consistent results. The first is a positive relationship between CEO education levels and R&D investment. The second is a negative relationship between CFO accounting certifications and R&D investment. These results are summarized in Table 8 and discussed in more detail below.

Table 8: Summary of the Results

	Hypothesized Relationships	*Results for CEO*	*Results for CFO*
Education level & R&D investment	+	+	
Accounting certification & R&D investment	-		-

In all specifications of our analysis, we find that higher levels of CEO education are associated with higher R&D investment. The results in Table 7 also indicate that the magnitude of this relationship increases as the level of CEO education increases. The magnitudes roughly double from bachelor to master levels, and again from master to doctoral levels of CEO education. These results are consistent with Hypothesis 1 and suggest that CEOs with higher education levels have stronger insights, higher cognitive abilities and a longer term perspective, which result in greater investment in R&D activities.

The relationship between CFO accounting certification and R&D investment is also consistently negative across nearly all specifications. This is consistent with Hypothesis 2 and suggests that CFOs with accounting certifications have higher levels of risk aversion, even when performing responsibilities beyond financial reporting. Their preference for risk avoidance also manifests itself in lower R&D investment.

The results for CFO education levels and R&D investment are positive and significant in some models, particularly for CFOs with a Master degree. However, the results for this relationship are not as consistent as those reported above. We also find very limited evidence that CEOs with accounting certifications invest less in R&D activities. The predominant result here is an insignificant relationship.

In summary, the results of this research provide useful information to policymakers in Indonesia and other developing markets in their efforts to promote R&D investment and increase the productivity of the R&D sector. Firms with more highly educated CEOs invest more in R&D activities. Firms also need to be wary of the risk-adverse nature of CFOs with accounting certifications to ensure our documented negative effect on R&D is abated.

CONCLUSION

This study investigates whether research and development investments by listed firms in Indonesia are related to the educational backgrounds of their CEOs and CFOs. We find that CEOs with higher educational levels invest more in research and development. This is consistent with more education

instilling a longer-term perspective on corporate managers, resulting in greater investment in R&D. We also find that CFOs with accounting certifications invest less in R&D, consistent with the conservative nature of the accounting profession.

Contributions of the Study

This study contributes to the existing literature on R&D investment in a number of ways. This paper is the first to focus on how the characteristics of both CEOs and CFOs influence firm-level R&D activities. In addition, prior studies have focused on the relationship between R&D activities and the technical backgrounds of executives from the perspective of science and innovation experience. This research investigates the relationship between accounting certifications and R&D activities, as we believe the accounting profession promotes risk aversion, which is expected to be associated with less investment in risky R&D activities. Finally, the majority of prior literature examines R&D issues in developed markets. There is limited research on R&D activities in developing markets, such as Indonesia. This study therefore adds to the investigation of factors related to R&D investment in developing markets, where R&D investment is of increasing importance.

Implications of the Study

For companies and shareholders, our findings indicate the need for a greater understanding of the factors associated with firm's R&D investments. Particularly, factors related to the education and experience of CEOs and other executives, whose characteristics can have a real impact on the R&D investment decisions of firms. In this study, we show that different education backgrounds create a bias for or against R&D investment in Indonesian firms. We find that more highly educated CEOs spend more on R&D investment. Thus, firms looking to increase their R&D investment should be looking to hire or retain a CEO with a higher education level (Master or Doctorate).

We also find a negative relationship between R&D investment and CFOs with accounting certifications. We attribute this to the conservative and risk averse nature of the accounting profession. Thus, firms looking to increase their R&D investment need to be wary of the risk averse nature of some of their top executives and devise a strategy to ensure it does not overly influence their R&D activities.

Limitations and Future Research

Since Indonesia has a growing focus on boosting its research and development capabilities, it is important for researchers to continue to examine factors related to R&D investment and successful R&D outcomes. This research can provide useful information to policymakers in Indonesia and other developing markets in their efforts to promote R&D investment and increase the productivity of the R&D sector. This study examines a limited number of characteristics of two members of the top management team. More work is needed to study other relevant characteristics and to investigate the effect of all parties involved in R&D investment decisions.

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Appendix: Variable Definitions

Variable	Definition	Source
Dependent:		
R&D/SALES	R&D expense divided by total sales	ORBIS
Ln_R&D	Natural logarithm of R&D expense (set to zero if R&D expense equals zero)	ORBIS
Independent:		
EDUCATION-CEO	Education variable, 0 for CEOs who have Diploma, 1 for CEOs who have a Bachelor degree, 2 for CEOs who have a Master degree, and 3 for CEOs who have a Doctoral degree	Annual Report
ACCERTIFIED-CEO	Dummy variable, 1 for CEOs who have an accounting certification (e.g. CPA)	Annual Report
CEOBACHELOR	Dummy variable, 1 for CEOs who have a bachelor degree	Annual Report
CEOMASTER	Dummy variable, 1 for CEOs who have a master degree	Annual Report
CEODOCTORAL	Dummy variable, 1 for CEOs who have a doctoral degree	Annual Report
EDUCATION-CFO	Education variable, 0 for CFOs who have a Diploma, 1 for CFOs who have a Bachelor degree, 2 for CFOs who have a Master degree, and 3 for CFOs who have a Doctoral degree	Annual Report
ACCERTIFIED-CFO	Dummy variable, 1 for CFOs who have an accounting certification (e.g. CPA)	Annual Report
CFOBACHELOR	Dummy variable, 1 for CFOs who have a bachelor degree	Annual Report
CFOMASTER	Dummy variable, 1 for CFOs who have a master degree	Annual Report
CFODOCTORAL	Dummy variable, 1 for CFOs who have doctoral degree	Annual Report
Controls:		
GENDER-CEO	Dummy variable, 1 for male CEOs and 0 for female CEOs	Annual Report
GENDER-CFO	Dummy variable, 1 for male CFOs and 0 for female CFOs	Annual Report
BOARDSIZE	Natural logarithm of the number of members of the board of directors and board of commissioners in the company	Annual Report
INDEPENDENT	Percentage of the number of independent commissioners in the company	Annual Report
INTCOM	Number of internal commissioners in the company	Annual Report
EXTCOM	Number of external commissioners in the company	Annual Report
FIRMAGE	Natural logarithm of the number of years since the company was founded	ORBIS
FIRMSIZE	Natural logarithm of total assets	ORBIS
LEVERAGE	Total debt divided by total assets	ORBIS
CURRENT	Current assets divided by current liabilities	ORBIS
ROA	Net income divided by total assets	ORBIS
OCF	Net cash flows from operating activities divided by total assets	ORBIS
INTANGIBLE	Natural logarithm of intangible assets	ORBIS