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Impact Top Management Education Background And Innovation on Firm Performance

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***Abctract*:** *Current business developments require companies to sustain made innovations and supported from top-level management. For this reason, this study tries to examine role director educational background and innovation on firms performance as well as proposed new innovation calculation as a research novelty. Using 56 observations from 2021 - 2023 in companies that report ESG risk score, it is concluded that innovation and directors with engineering / technology education background improve firms performance. This study also proves that presence of these directors strengthens the effect of innovation on firms performance. Last, novelty of innovation calculation is proven better than previous formula.*

***Keywords*:** *technology, education, innovation*

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1. Introduction

Current business developments require business entities innovation to meet stakeholders expectations including customers in line with companies desire to improve their performance through generate profit. For this reason, maximum support is needed, especially from top-level management. The expertise and capabilities are inseparable from their experience and educational background because both of them play a significant role in the progress and companies sustainability

In banking industry, innovation is not only centered on internal conditions but shifts to customer or consumer side known as FinTech (Financial Technology) through transformation by PT Bank Central Asia, Tbk (BBCA). 97% of their transactions has been digitalized (Susilawaty & Nicola, 2020). Likewise in manufacturing industry. PT Enseval Putera Megatreding, Tbk launched the EMOS (Enseval Mobile Order System), application to provide stock availability and also made consumers easier to order (Yuliana et al., 2019). In transport industry, PT Blue Bird, Tbk (BIRD) innovate through launch of a special service for disabled known as Lifecare Vehicle. In addition, this

company launched an environmentally friendly fleet through an electric car known as Silverbird Tesla (Arwani et al., 2022).

All companies efforts to innovate are certainly obtaining maximum performance. Four studies show that innovation can increase sales and profits in medium and large companies (Do et al., 2023), increase energy and material efficiency then strengthening competitive advantage (Liu et al., 2024), increase consumer interest in companies products (Amalia, 2023) and improve companies productivity rather than focusing on cost-cutting (Su & Tang, 2017).

The Board of Directors as an internal party must provide full support to achieve this maximum performance. The ability of the directors can be analyzed from their educational background. CEOs with a scientific research education background can enrich level of digitalization (Luo et al., 2024) coupled with a CEO who has overseas experience (Xu & Hou, 2024). CEOs who have an engineering education background are able to deliver the best innovation performance (Moon, 2017) because they characteristics are considered to give companies space to grow (Celikyurt & Donmez, 2017).

Above discussion show innovation and director educational background contribute maximally to companies achievements, but previous research is still carried out separately. This study tries to combine director educational background and innovations produced by companies. It is to find out whether both of them have a significant impact to firm performance. Secondly, this study also refines previous innovation measurement and contribute literature review in accounting field.

The paper also offers recalculation of innovation as research novelty. This measurement include earnings variable for highlight innovation contribution to firm profitability. There are two contribution of this paper. First, engineering / technology education background should be as consideration when appointing directors. This suggestion is important because educational background could matching with innovation to provide best firm performance. Second, technology training should be increase for all employees for sustainable innovation.

2. Literature Review

2.1. Knowledge Management Theory

Knowledge is a combination of experiences, values, contextual information and views from experts that provide a framework for evaluating and integrating new experiences and information. It includes three concepts: intellectual capital, intellectual property and knowledge economy. Intellectual capital is assets such as trademarks, customer loyalty that give companies strength in marketplace. Intellectual property refer to legal power and ethical issues of knowledge owned by company for example, copyright, patents, trade secrets and others, while knowledge economy is knowledge owned by company but comes from professional support related to its analysis of

internal market conditions, production, distribution so on (Baskerville & Dulipovici, 2006).

This theory is used to explain innovation variable because it is closely related to the knowledge management owned by company, which is included in intellectual property rights.

2.2. Resources-based theory

This theory was developed by Penrose in 1959. For him, the essence of the company's power lies into pool of productive resources and use selected in accordance with administrative decisions (Warnier et al., 2013). This theory also suggests that to get maximum performance, companies can use tangible and intangible assets effectively and efficiently (Hadiwijaya & Rohman, 2013).

This theory is used to explain director technological educational background because educational background is part of resources and can be used by the company to the fullest.

2.3 Innovation

Various sources explain innovation definition but in simple terms innovation is implementation of a creative idea or concept in an organization, including the development of products, processes, administrative measures, managerial processes and organizational structures (Dwivedi et al., 2023). Three previous studies show innovation can provide positive benefits for companies through environmental improvement innovations (Liu et al., 2024; Nuryakin & Maryati, 2022) and product innovation (Su & Tang, 2017).

Innovation can be measured in a variety of ways, for example through questionnaires to employees. (Su & Tang, 2017), entrepreneur (Rianawati et al., 2024) and patent held by company (Liu et al., 2024; Wildan & Yulianti, 2021) but this research uses a different measurement, namely contribution of intangible assets to profits.

2.4 Director educational background

Director background has received a lot of attention regarding its impact to companies. Directors with a technology education background have a significant positive effect on the number of patents received, meaning they increase innovation produced (Li et al., 2019) because they able to create companies space to growth (Celikyurt & Donmez, 2017) as well as able to detect latest technological developments and opportunities to be converted into valuable products (Moon, 2017).

Directors' backgrounds are measured in a variety of ways, for example, categorization based on their education (Moon, 2017) dummy variable (Berlian et al., 2022; Luo et al., 2024; Yavuz & Iacoviello, 2023), total director and percentage director compare to total director (Li et al., 2019).

2.5 Hypothesis development

Innovation is one of company's efforts to improve performance. Three previous studies show innovation can improve company performance because will gain a competitive advantage (Agustia et al., 2022), will be a differentiate with others (Maldonado-guzm et al., 2023) and increase future cash flow (Rahman & Howlader, 2022). Presence director with technology educational background could increase firm performance because their established companies space to grow (Celikyurt & Donmez, 2017), increase patent held (Li et al., 2019) and better understand technology trends, identify company's technology needs, recruit prospective employees and develop alliances more effectively (Yavuz & Iacoviello, 2023).

From above studies, it is concluded that innovation and directors with a technological education background make a positive contribution to companies so proposed hypothesis are:

- H1: innovation has a positive impact on firm performance
- H2: directors with technology / engineering background have a positive impact on firm performance
- H3: director with technology / engineering background moderate innovation significance to firms performance.

This study also tries to test innovation relevance measurement by comparing it with previous study so additional hypothesis proposed is:

- H4: current innovation measurement used is better than previous formula.

The conceptual framework above hypothesis is as follows:

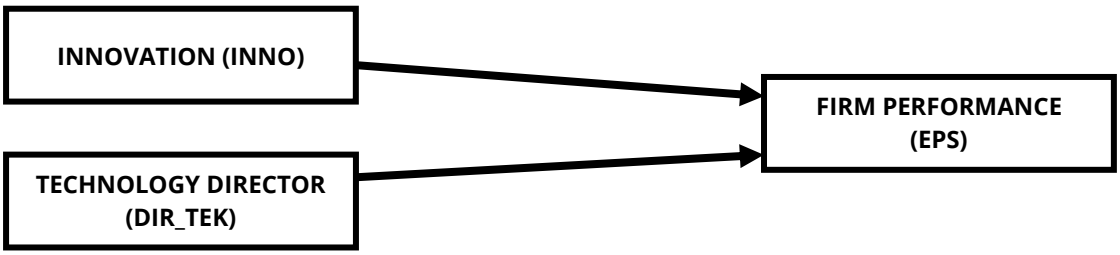


Figure 1. Conceptual framework

3. Methods

This research used purposive sampling with two criteria. First, company release ESG (Environment, Social, Governance) risk score. This criteria was chosen to complement previous studies that has examined ESG risk score with firm performance and value (Indriani, 2024) and firm size (Bolibok, 2024). Second, it stated intangible assets value in balance sheet. For this reason, samples used was 20 companies.

This study uses secondary data derived from financial reports and ESG risk score reports that refer to Morningstar Sustainanalytics (Indriani, 2024) from 2021 - 2023. The method used is quantitative with panel data and processed using Eviews software version 10.

This study uses two independent variables and one dependent variable. The first independent variable is innovation. This variable is measured by dividing total amount of intangible assets by total assets multiplied by total earning. This measurement is different from previous study stated by Wildan & Yulianti, (2021) without involving total earning. The second variable is director technology / engineering education background. This variable is measured by summing directors who have an engineering / technology education background in accordance with the study of Li et al., (2019). The dependent variable is firms performance measured using year-end Earnings Per Share (EPS). Detail variable measurement stated as follow Table 1.

Table 1. Detail variable measurement

No	Variable	Definition	Measurement
1	**Independent** A. Innovation (New) Innovation (previous)	Contribution innovation to earnings Innovation produced	$\frac{Total\ intangible\ assets}{total\ asset} \times earnings$ $\frac{Total\ intangible\ assets}{total\ asset}$
2	**Independent** B. Director education background	Total director with technology / engineering education background	Number of director with technology / engineering education background
3	**Dependen** Firms performance	Total earnings based on outstanding common stock	$EPS = \frac{Total\ earnings}{Outstanding\ share}$

4. Result

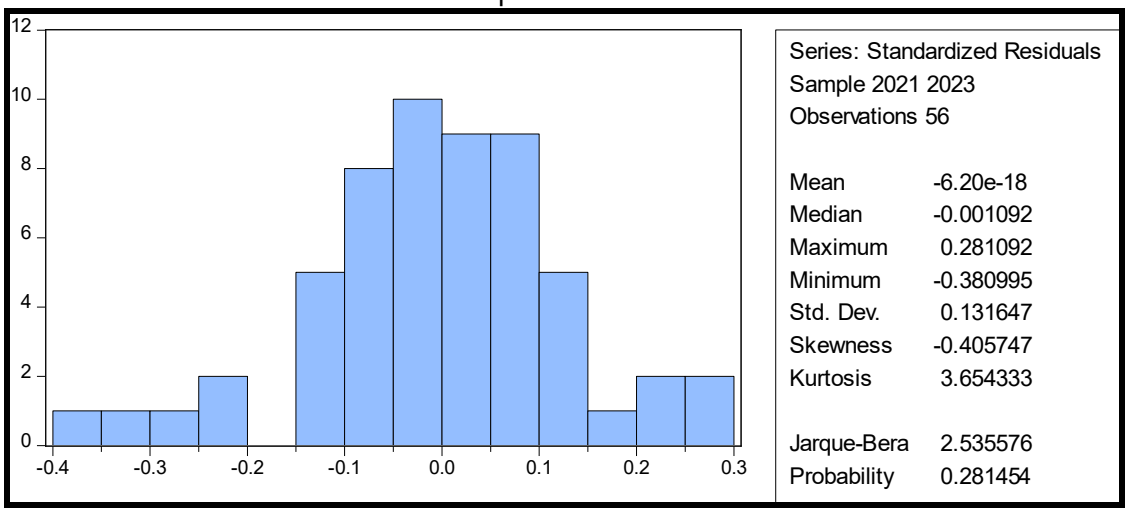
This research was conducted with three tests, namely model test, classical assumption test and hypothesis test. Result of model test provides as follow Table 2. Table 2 shows based on model test, fixed effect model choose.

Table 2. Result model test

Method	Test	Value	Result
Chow	*Common effect vs Fixed effect*	Prob : 0,000	*Fixed effect*
Haustman	*Fixed effect vs Random effect*	Prob : 0,007	*Fixed Effect*

Sources : proceed (2025)

Second test is classic assumption test and result as follow :



Picture 2. Normality test. Sources : proceed (2025)

Picture 2 shows *Jacque-berra* 2,535576 > 0,1 and probability 0,281454 > 0,05 mean distributed data is normal.

Table 3. Heteroscedasticity test

Variable	t-statistic	*Probability*	Result
INNO	-0.490332	0.6270	No heterosdecasticity
DIR_TEK	0.164610	0.8702	No heterosdecasticity

Sources : proceed (2025)

Table 3 shows probability innovation (INNO) and director technology (DIR_TEK) above 0,05 mean heterosdecasticity problem doesn't occurred.

Table 4. Multicoliniearity test

	INNO	DIR_TEK
INNO	1.0000	-0.311400
DIR_TEK	-0.311400	1.0000

Sources : proceed (2025)

Table 4 shows independent variable correlation under 0,8 mean multicolinearity problem doesn't occurred.

Table 5. Autocorrelation test

Test	Value
Durbin Watson	2,766837

Sources : proceed (2025)

Table 4 above shows *Durbin Watson* 2,766837 > 4-D_L mean autocorrelation problem occurred but ignored because autocorrelation only suitable for data time series (Basuki & Prawoto, 2017).

5. Discussion

Table 6 displays all hypothesis result including a comparison of adjusted R square values to determine relevance of innovation measurement value to firm performance with explanation as follow.

Table 6. Hypothesis result

H	Variable	Coefficient	Prediction	Significant	Result
	Constanta				
H_1	INNO	0.200176	+	0.0123**	Significant
H_2	DIR_TEK	0.919779	+	0.0184**	Significant
H_3	INNO	0.633999	+	0.0709***	Significant
H_3	DIR x INNO	0.079370	+	0.0365**	Significant
H_4	INNO	1.961426	+	0.0632***	Significant
H_4	DIR_TEK	0.203499	+	0.0155**	Significant
	Adjusted R Square H_1 & H_2			0.972207	
	Adjusted R Square H_3			0.971212	
	Adjusted R Square H_4			0.127299	
	Dependent Variable : Firm performance				
	Significant level : 1% (*), 5% (**), 10% (***)				

Sources : proceed (2025)

First, innovation and the presence of directors with technology/engineering education background have a significant positive effect on firms performance **(H_1 and H_2 accepted)**. This result is in line with previous study states that if innovation gives company a competitive advantage (Agustia et al., 2022), makes an entity different from others (Maldonado-guzm et al., 2023) also increase future cash flow (Rahman & Howlader, 2022). Director with engineering / technology education

background give company space for growth (Celikyurt & Donmez, 2017), support increase patent held (Li et al., 2019) because they understand how to develop current technology trends, expert to identify technology needs as well as being great to makes alliances with other parties. (Yavuz & Iacoviello, 2023).

Second, innovation embed by directors are also significantly positive to firm performance **(H_3 accepted)**. It mean directors support innovation better, efficiently and effectively to achieve maximum firms performance. This result also shows that innovation occurs is more dominated by technology in line with director education background.

Third, new innovation measurement used is more relevant than previous measurement (**H_4 accepted**), indicated by adjusted R square value of new measurement which is greater than the previous measurement (0.972207 > 0.127299). This result shows that earnings makes innovation contribution become clearly to firm performance which not explained well before.

From third conclusions above, it shows that directors with a technology / engineering education background have a role in innovation while at the same time can improve firm performance. This educational background role as foundation to produce changes, provide ideas and suggestions. This study lso reveal that companies which reported ESG risk score have made innovations and have directors with an engineering / technology education background.

6. Conclusion

This study tries to explain the role of directors with a technology / engineering education background on performance both partially and simultaneous with innovation. This research was conducted between 2021 until 2023 in companies which report ESG risk score. As a result, innovation and directors with a technology / engineering education background can improve firms performance. These directors are also moderate innovation variable on firms performance. In addition, this study also proves that the proposed new innovation measurement is better than previous because it involves earnings as an additional element.

This study has at least two limitations. First, innovation is measured using intangible assets value in balance sheet which has a bias because only consists limited explanation such as software, license and patents that have not comprehensively explained all innovation do by company. Second, the role of directors with an engineering / technology education background has not fully explained its significance to all innovations produced because only proxies by number.

For this reason, further research as follow. First, adding innovation measurement variables, for example, number of new products launched, number of applications implemented and others. Second, measurement of director role can be added with their experience in technology field including number of technology training and seminars.

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