# ผลกระทบของระดับการเปิดเผยข้อมูลการวิจัยและพัฒนากับความสามารถในการทำกำไร: หลักฐานเชิงประจักษ์จากกลุ่มอุตสาหกรรมเทคโนโลยี

## The Effect of Disclosure Level of Research and Development on Profitability: Evidence from Technology Industry

ปิยาภิศักดิ์ เจียรสุคนธ์
Piyaphisak Jearasukon
Corresponding author, E-mail : Rsu_18@hotmail.com

Received : *February 17, 2023*
Revised : *May 2, 2023*
Accepted : *May 29, 2023*

## บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อวิเคราะห์ผลกระทบของระดับการเปิดเผยข้อมูลการวิจัยและพัฒนาที่มีต่อความสามารถในการทำกำไร ผู้วิจัยทำการเก็บรวบรวมข้อมูลจากรายงานประจำปี (พ.ศ. 2017 ถึง 2021) ของกลุ่มอุตสาหกรรมเทคโนโลยี จำนวน 295 ตัวอย่าง และวิเคราะห์ข้อมูลด้วยโปรแกรมทางสถิติ ผลการวิจัยพบว่า 1) กลุ่มอุตสาหกรรมเทคโนโลยีมีระดับการเปิดเผยข้อมูลเกี่ยวกับการวิจัยและพัฒนาในรายงานประจำปี จำนวน 3,476 คำ และใช้รายงานประจำปีเป็นช่องทางในการสื่อสารการเปิดเผยข้อมูลการวิจัยและพัฒนา 2) ขนาดกิจการมีผลกระทบเชิงบวกต่อระบบการเปิดเผยข้อมูลการวิจัยและพัฒนาอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 3) ระดับการเปิดเผยข้อมูลการวิจัยและพัฒนามีผลกระทบเชิงบวกอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.01 ต่อความสามารถในการทำกำไร โดยวัดค่าจากอัตราผลตอบแทนต่อสินทรัพย์รวมและอัตราผลตอบแทนต่อส่วนของ ผู้ถือหุ้น ดังนั้นบริษัทจดทะเบียนในตลาดหลักทรัพย์แห่งประเทศไทยควรให้ความสำคัญกับการเปิดเผยข้อมูลด้านการวิจัยและพัฒนามากขึ้นเพื่อเป็นการให้ข้อมูลที่เป็นประโยชน์ต่อการตัดสินใจแก่นักลงทุนและองค์กรสนับสนุนการวิจัยและพัฒนา

**คำสำคัญ:** การวิจัยและพัฒนา, ความสามารถในการทำกำไร

## Abstract

The purpose of this research is to effect analysis of disclosure level of research and development on profitability. The data were collected from annual reports (2017 - 2021) of 295 technology industry, and using a statistical program for analysis. The research found that: 1) technology industry have a disclosure level of research and development in annual reports is 3,476 words, and use annual reports is first alternation in communication related to disclosure level of research and development is 2,576 words; 2) firm-size has a positive effect on disclosure level of the research and development statistically significant at the 0.01 level;

คณะวิทยาการจัดการและเทคโนโลยีสารสนเทศ มหาวิทยาลัยนครพนม
Faculty of Management Sciences and Information Technology, Nakhon Phanom University

3) The disclosure level of research and development has a positive effect and statistically significant at 0.001 on profitability measured by return on asset and return on equity. Therefore, the companies listed in the stock exchange of Thailand should focus on disclosure of research and development more to provide useful information on investors and organizations for research and development support.

**Keywords:** Research and Development, Profitability

## Introduction

At present, the business environment has changed quickly due to the advancement of technology and innovation. This change affects many businesses that need operation model development for the need of customers. Therefore, it is necessary to create a competitive advantage. (Choorat & Jiajanpong, 2022) However, research and development investment are a key indicator and shows the possibility of innovations. and will help the country increase its economic income. (Fortune and Shelton, 2012). After, the announcement of Model "Thailand 4.0" in 2016, intended by the administrators of the country required the adjust the structural economy to the economic system driven by "innovation" and "technology" that makes the cost proportion of research and development of the private sectors increase consistently (Figure 1). Obviously, in 2020, the expenses for research and development were equal to 208,010 million baht or 1.33 (Figure 2) of the domestic gross domestic product (GDP) value with an increasing proportion.

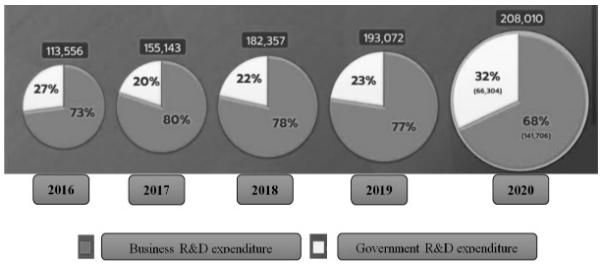


**Figure 1** Show R&D expenditures of Thailand
**Source:** Office of National Higher Education Science Research and Innovation Policy Council

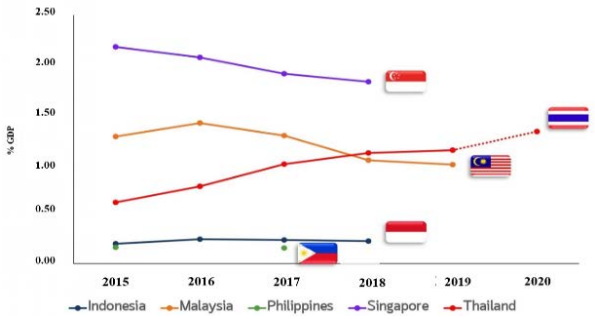


**Figure 2** Show R&D expenditures between Thailand and ASEAN
**Source:** IMD, World Competitiveness Yearbook 2021

However, ASEAN countries has most expenses for research and development investment is Singapore were equal to 1.83 percent of the domestic gross domestic product (GDP). The world intellectual property organization (WIPO) shows global innovation index 2022 rankings found that Singapore is innovation-driven country and have a high-income group (Table 1) While, Thailand in the upper middle-income Group (Global Innovation Index Database, WIPO, 2022)

Although, technology skills of Thailand have ranked higher than Indonesia and Philippines but below Singapore and Malaysia. (Figure 3)

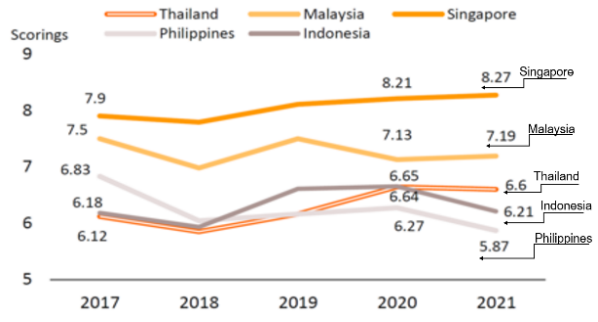


**Figure 3** Show score for digital / technological skills
**Source:** The world competitiveness ranking 2021, Institute for management development (IMD)

**Table 1** Show the high-income countries group

| GII rank | Economy | Score | Income rank | Region rank |
|---|---|---|---|---|
| 1 | Switzerland | 64.6 | 1 | 1 |
| 2 | United States | 61.8 | 2 | 1 |
| 3 | Sweden | 61.6 | 3 | 2 |
| 4 | United Kingdom | 59.7 | 4 | 3 |
| 5 | Netherlands | 58.0 | 5 | 4 |
| 6 | Republic of Korea | 57.8 | 6 | 1 |
| 7 | Singapore | 57.3 | 7 | 2 |
| ↓ | ↓ | ↓ | ↓ | ↓ |
| 43 | Thailand | 34.9 | 5 | 9 |

**Source:** Information out global innovation index database of 132 countries, WIPO, 2022.

However, technology industry has high research and development investment that will be success in the world. (Table 2)

Table 2 shows the ten most Innovative Companies of 2022 in the world.

| 10 Most innovative Companies | Rank |
|---|---|
| Apple | 1st |
| Microsoft | 2nd |
| Amazon | 3rd |
| Alphabet | 4th |
| Tesla | 5th |
| Samsung | 6th |
| Moderna | 7th |
| Huawei | 8th |
| Sony | 9th |
| IBM | 10th |

**Source:** BCG most innovation companies (MIC) report 2022.

Environmental Social and Governance Concept (2022) suggest information disclosure guidelines that business should be disclosed related to sustainability for stakeholders to know continually through various channels sure as an annual report, sustainability report, financial statements, and notes to financial statements. Information disclosure will attract more investors to the company (Nekhili et al., 2016).

The financial standard guideline related with research and development adhere to the accounting standard No. 38, entitled intangible assets passage indicates which requires the company to know and disclose research and development cost as installment expense, and allows the development investment as intangible asset (Federation of Accounting Professions under the Royal Patronage, 2018), make research and development disclosure mandatory through accounting standard which supports the private sector to increase expense in R&D and get juristic person tax relief according to Governing Exemption of Taxes (No. 598) (2016) and by request from the National Science and Technology Development Agency (NSTDA) through the Securities and Exchange Commission, Thailand to have all listed companies disclose R&D cost in the annual 56-1 item form from 2017 onwards. (Lim-U-Sanno, 2021) and it can be disclosed in the management discussion and analysis (MD&A) that reflects potential and value of the companies. Jones and Merkley (2014) find that the executives of leading corporations focus on information disclosure or policies relevant to research and development to allow the investors to follow the changing update on the corporation's performance through the disclosing channel in the annual report (Form 56-1). The consistent with that of the study of Enache and Hussainey (2020) and Bozzolan et al. (2003), which found that industrial groups must use high technology to be information disclosures of research and development more than other industrial groups. The research of Karjalainen (2006) and Growe et al., (2014), find that the information disclosure of investment in research and development has a positive effect on the profitability of a firm as well as credibility for investors.

In conclusion, the disclosures in the financial statements are valuable for stakeholders who used economic decision and is important in allowing the financial statement's user to know the company's performance in the past period. if the revealed information good quality, it will reflect transparent management and good corporate governance that can further boost confidence in financial statement users and it will contribute to profitability. However, the study on this issue appears to be limited to a few, even in the ASEAN regions. Therefore, this research will be a top priority. The researcher will study the disclosure level of research and development on the profitability of technology industry in listed companies in the Stock Exchange of Thailand.

These results will be of both direct and indirect benefit to relevant organizations, such as 1) the research department of the Stock Exchange of Thailand and the Securities and Exchange Commission to guide the issuance policy of the R&D disclosure practices in the annual registration statement (56-1) of all listed companies; 2) the tax authorities to guide the formulation of tax incentive policies for R&D expenditures; and 3) the country's R&D promotion agencies as a guideline for formulating policies to encourage the private sector to invest more in research and development to stimulate the competitiveness and add value to the listed companies.

**Research Questions**

This study aims at finding out the answers of the following research questions:

1) How does disclosure level of research and development of the technology industry of the stock exchange in Thailand?
2) The size and debt ratio has effect on disclosure level of the research and development?
3) How does the disclosure level of research and development have a direct effect on profitability?

**Research Objectives**

1) To study the level of disclosure of research and development of technology industry in Stock Exchange of Thailand (SET).
2) To analysis effect of the size and debt of company on disclosure level of research and development.
3) To analysis effect of the disclosure level of research and development on profitability.

## Literature Review

The investment in research and development to find "innovation" is necessary for increasing value and profitability of the company in the age. when technology and innovation have constantly changed. It is necessary to use diverse strategies and emphasize research and development processes that can make things change and is the key to future success (Hottenrott & Lopes-Bento, 2016). Nevertheless, good disclosure is a beneficial factor in operating a company with continuous operation, generating investor confidence in the company (Lim-U-Sanno, 2021).

Signaling theory of Spence (1973) explain that the executives have more internal news and information than the investors. As a result, investment decisions or changes to novel things are such a signal delivery to investors to acknowledge the tendency and direction of future firms. Such firms usually feel confident about the potential performance that it should be in a good orientation. Thus, sending a signal by disclosing research and development information will lead to an increase in the values and profitability of firms in the future. This theory is consistent with that of the research of Bozzolan et al. (2003), found that the company that decided to disclose the research and development information had better performance than the company that did not choose to disclose the information and the study of Garcia-Meca et al., (2005) found that the information, disclosure of research and development is a strategy that can construct the reliability to investors (Zheng and Stangeland, 2007; Heijnen and Van, 2012).

Like, Stakeholder theory is a view that stresses the interconnected relationships between a business and its customers, investors, and others who have a stake in research and development process of the organization. The theory argues that a firm should create value for all stakeholders, not only shareholders. (Freeman, 1984)

**The Accounting Standard Concept involved in Research and Development Disclosure**

The Accounting Standards Board of the Australian Accounting Research Foundation (AARF) (1983) defines that, "Research means planned investigation undertaken with the hope of gaining new scientific or technical knowledge and understanding which will be useful in developing a new product or service (hereinafter "product"), or a new process or technique (hereinafter "process"), or in bringing about a significant improvement to an existing product or process" and "development means the translation of research findings or other knowledge into a plan or design for a new product or process or for a significant improvement to an existing product or process". The Eurostat Manuals and guidelines in ESA (2010) define "research and development as "creative work undertaken on a systematic basis to increase the stock of knowledge and use of this stock of knowledge for the purpose of discovering or developing new products, including improved versions or qualities of existing products, or discovering or developing new or more efficient processes of production." Frascati Manual of the Organization for Economic Cooperation and Development (2020). defines that, research and development (R&D) is about creative work that is conducted in a structured and systematic way with the goal of enhancing human knowledge and to come up with innovative solutions (OECD, 2020).

The information disclosure guidelines for research and development adhere to the accounting standards from various versions, starting from the accounting standard, No. 14, entitled accounting for research and development, which has been canceled and substituted by accounting standard, No. 51, entitled intangible assets, announced on December 7, 2007. The contents are similar to the international accounting standard No. 38, entitled Intangible Assets (IAS no. 38). Later, the federation of accounting professions under the patronage of H.M. the King developed and brought the Accounting Standard, No. 38 (Revision 2552) entitled Intangible Assets, to substitute and cancel No. 51. There has been an adjustment until today that is upholding Accounting Standard No. 38, entitled

Intangible Assets (Thailand Federation of Accounting Professions, Financial Reporting Standard, 2022).

The Accounting Standard No. 38, entitled Intangible Assets, passage 54 and 57, determines that the enterprise shall not acknowledge the expenses regarding the research as an asset. The expenses involving development can be known as such assets if they meet the criteria in Accounting Standard No. 38, entitled Intangible Assets. Furthermore, Passage 126 indicates that the enterprise should reveal the total expenses relating to research and development as periodic expenses. Likewise, the Securities and Exchange Commission determines the guidelines of information disclosure on research and development that involve the financial position or performance results of enterprises in the future (Forward Looking). The contents include the enterprise having the project or research relating to the financial position or performance result within a year's time, which shall display the details of that project or research. According to previous evidence, executives who adhere to the policy of disclosing information or expenses related to research and development in the annual report will see a change in performance results in a positive direction (Han & Manry, 2004). For example, the study by Bozzolan et al. (2003) found that corporations in Canada disclose research and development information involving technologies more than corporations in France. Furthermore, it has a statistically significant impact on positive results toward the financial position or the performance result of the business. It is concordant with the research of Garcia-Meca et al. (2005), Enache and Hussainey (2020), and Hottenrott and Lopes-Bento (2016). They studied the information disclosure of the research and development of the listed companies on the Stock Exchange. They found that disclosing information about research and development affects business performance positively. Moreover, it is concordant with numerous studies, such as Jeanjean (2006), Basta and Bertilsson (2009), Guthrie and Petty (2000), Cordazzo (2007), and Bosworth and Rogers (2001). However, there was still some research that contradicts the mentioned research, such as the research of Nord (2011), Penman and Zhang (2002), Cuozzo et al. (2017), and Brennan (2001). Overall, they realize that the information disclosed might become the channel that makes the rivals acknowledge the business movement. (Anne & Jeanjean, 2006).

**Hypothesis Development**

**Agency theory** defines an agency relationship as a contract under which one or more persons (principals) engage another person (agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent (Jensen & Meckling, 1976). this theory claims that conflicts are expected to arise when there is incomplete and asymmetric information between principal and agent in a company. This problem could be minimized by providing more information. according to voluntary disclosure theory is defined in the accounting literature as information to the public through the company's financial statements both financial and non-financial relating to the financial position and performance of the company. (Bravo et al., 2010) Corporate disclosures consist of two categories, namely: mandatory disclosures and voluntary disclosure (Shehata, 2014) but the focus of this study is voluntary disclosure. Wherewith, a number of scholars also make reference to the credibility of voluntary disclosure in corporate reporting. The research of Ho and Taylor (2013) found that voluntary disclosure can create positive effects on business performance, and firms' value based on the managers' attitude to disclosing additional information. But some determinants of voluntary information that have been commonly associated to the agency problem are size and debt of company.

**1) Size of company and disclosure level of the research and development**

The larger firms carry out a greater number of contracts which are more complex than smaller firms, agency costs depend on company size (Rodríguez Perez, 2004). Larger firms are expected to reveal

more voluntary information to reduce these costs. Most studies found that company size has positive effect on disclosure level of the research and development (R&D). Such as the research of Xie et al., (2019), Nigri and Baldo (2018) found that firm size has a positive relationship with the disclosure level of research and development. Nekhili et al., (2016) found that large companies also have better resources and operational capabilities. Thus, quality of disclosure depends directly on size and performance of the company and Lucia and Panggabean (2017) found that discovered positive relationship between size of the listed company and disclosure of financial information. Therefore, a hypothesis is formed:

**Hypotheses 1:** The size company affects on disclosure level of the research and development

**2) Debt of company and disclosure level of the research and development**

Agency costs are higher when the proportion of debt increases. Agency theory predicts that agency costs are higher when the proportion of debt increases. Agency theory predicts that debt has an affecting the company's ability to make a plan by increasing the business activities to generate future added values. As a result, it is likely that such a company will disclose more research and development information than other companies in order to project a trustworthy and positive image to investors. Therefore, the following hypothesis is formulated:

**Hypotheses 2:** The debt company affects on disclosure level of the research and development

**Profitability**

A good performance assessment system should provide forecasting function. In this research, Balanced Scorecard Concept (BSC) has been used to performance evaluation in view of profitability.

According to Kaplan and Norton (1992) the Balanced Scorecard (BSC) is a strategic measurement system including both non-financial and financial measures adopted by academic scholars and practitioners to measure the performance of a business organization. It is distinct from other strategic measurement systems in that it is more than collection of financial and non-financial measures. Furthermore, BSC is intended not only as a strategic measurement system but also as a strategic control system, which can align departmental and personal goals to overall strategy. BSC translates the vision and strategy of a business unit into objectives and measures in the financial, customer, internal-business-process and learning and growth perspectives. The crux of BSC is the linking together of the measures of four areas in a causal chain, which passes through all four perspectives (Figure 1).

Most prior studies have shown that the balanced scorecard (BSC) is an appropriate model for measuring R&D performance in an organization to get a comprehensive overview. such as, the research of Le (2018). study balance scorecard integration: an approach to measure overall R&D performance. And Valderrama, Mendigorri and Bordoy (2008). study a balanced scorecard framework for R&D.

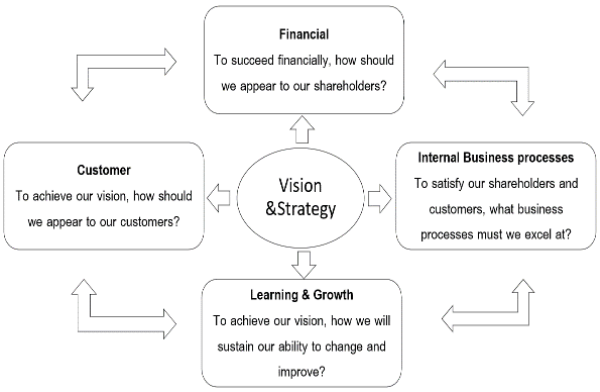


**Figure 4** Show key performance indicators
**Source:** Kaplan and Norton (1996:)

However, this research measures of only a financial perspective due to research and development organizations cannot continue to survive without generating profits and funds for research and development. Which, objectives of a research and development organization from financial perspective are:

**1. Scope of activities of research and development organization pertaining innovation and learning**

1.1) Business creation

1.2) Funds requirement

1.3) Sources of funds

**2. How financial position be perceived?**

2.1) Adequate profits

2.2) Self sustaining

2.3) Adequate liquid position

2.4 Good will in market

**3. Key areas to be focused**

3.1) Focus on key areas of business

3.2) Availability of supporting business

3.3) Good Liaisons with the customers

3.4) Good liaisons with the government funding agencies

3.5) Accountability of fund utilization

**4. Performance Indicators**

4.1) Financial position in terms of profit

4.2) Return on Investment

4.3) Self-financing of research and development

4.4) Business created from the output of research and development

4.5) Royalties, fees obtained from licensing of patents

**Profitability Indicators**

The indicators of profitability can be measured using return on assets (ROA) and return on equity (ROE) to measure overall performance of the company (Enache & Hussainey, 2020).

The research of Mondal and Sarkar (2020) study Impact of research and development Investment on firms' profitability found that research and development investment have a positive relationship on return on asset, return on equity;

Suttipun and Saefu (2017) found that the disclosure level of research and development not only responds to the policy of the government but also acquires good returns back to the organization;

Freihat and Kanakriyah (2017) the study of the Impact of research and development expenditure on financial performance this research found that research and development expenditure have a positive effect on profitability as measured by return on assets (ROA), return on equity (ROE);

Mishra (2018) found that research and development cost on firms' profitability, Bouaziz (2016) found that investment in research and development has a positive effect on the competence level of the company's profitability;

Ghaffar and Khan (2014) explored the effects of research and development investments on firm performance. found that research and development investments have a positive effect on return on equity and Ayaydin and Karaaslan (2014) found that research and development expenditures have a positive and significant effect on asset profitability. Therefore, the following hypothesis is formulated:

**Hypotheses 3:** The disclosure level of research and development affects on profitability (ROA and ROE)

**Conceptual Framework**

The conceptual framework of this research has links to the theories as follows; the firm-size and debt variable of the company were explained with the Agency theory of Jensen and Meckling (1976), The disclosure level of the research and development (R&D) was explained based on The signaling theory of Spence (1973), the Stakeholder theory of Freeman (1984), and according to accounting standards involved in research and development disclosure, and The profitability variable was explained based on the balanced scorecard Concept (BSC) of Kaplan and Norton (1992) and includes three research hypotheses, as shown in Figure 5.

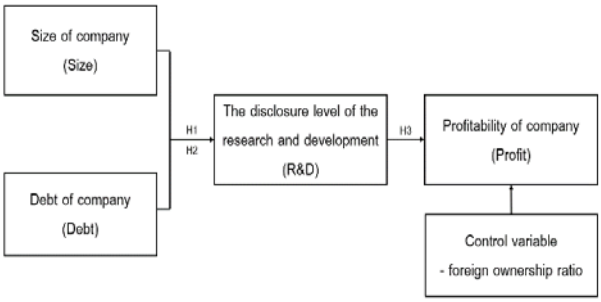


**Figure 5** Conceptual Framework

**Research Methodology**

**Population and Data Collection** There are 59 firms in the technology business group of the Stock Exchange of Thailand. The information was gathered for the years: 2017 to 2021. The final sample included 59 firms; therefore, there are 295 firm-year observations (59 firms multiply 5 yeas). The researcher used a research instrument to collect data from annual reports, one-report 56-1, and financial statements found on the internet at www.sec.or.th, the companies' websites, and SETSMART Moreover, the researcher uses a text analysis method related to disclosure level of research and development from six scope index on the concept of Robb et al. (2001).

**Measurement Variables**

1) Independence Variables

1.1) The firm size, it is calculated by using the natural log (ln) of sales (Salawu, 2014)

1.2) The debt ratio, it is calculated by total debt on total equity that explained the total debt and total equity, by restructuring the leverage in asset and growth opportunity and future of the company using R&D. (Nekhili et al., 2016).

1.3) The disclosure level of research and development (R&D) It is measured by six a list of items of forward-looking information from the 56-1 form, show in table 1 as follows: First, the Input is disclosure level of research and development Second, the output is success of research and development Third, the disclosure of future expenditure of research and development Fourth, the disclosure of financing for research and development Fifth, the disclosure of accounting and financial data of research and development Sixth, the disclosure of strategy of research and development The value of the index for a particular company is obtained by dividing the number of information items disclosed by that company by the total number of information disclosure items that might be disclosed. By Robb et al. (2001). A higher value is assigned to quantitative information (Botosan, 1997). The quantitative information is more specific (Bhojraj, 2003). Furthermore, narrative information is more easily manipulated (Balata and Breton, 2005). The categories are not weighted, but the score of each item ranges from 0 points if there is no forward-looking information of that type, 0.5 points if the information provided is narrative and 1 point if the information is quantitative.

**2) Dependence Variables** is profitability; it is measured return on assets (ROA) and return on equity (ROE) that is a profitability metric that measures the efficiency at which a company can utilize its assets to generate more net earnings. Which, ROA is calculated using wherein a company's net income is divided by its average total assets. ROE is calculated using wherein a company's net income is divided by its shareholders' equity. (Enache & Hussainey, 2020; Bischoff & Christiansen, 2017).

**3) Control Variables** is foreign ownership ratio. Policymakers often pursue an industrial strategy of incentivizing foreign-owned subsidiaries to increase their R&D activities, either through direct subsidies or tax incentives, in anticipation of reaping economic gains (Kwon and Park, 2018)

**Empirical Models** Cross-sectional OLS linear regression models are used to examine whether the firm size affects on disclosure level of the research and development (R&D) (H1), as shown in model equations. (1); debt ratio affects on disclosure level of the research and development (R&D) (H2), as shown in model equations. (2); the disclosure level of research and development (R&D) affects on return on asset (ROA) and return on equity (ROE)) (H3), as shown in model equations. (3 and 4)

$$R\&D = \beta_0 + \beta_1 (FS) + \varepsilon \quad (1)$$
$$R\&D = \beta_0 + \beta_1 (DR) + \varepsilon \quad (2)$$
$$ROA = \beta_0 + \beta_1 (R\&D) + \varepsilon \quad (3)$$
$$ROE = \beta_0 + \beta_1 (R\&D) + \varepsilon \quad (4)$$

**Ethics in Human Research** This research has been considered ethical in human research by the Ethics Research Committee, Research and Development Institute, Nakhon Phanom University, number IC 4/65.

**Data Analysis** The data analysis was done by a statistical program consisting of the analysis of descriptive statistics (average and percent) used to describe the disclosure level of research and development. The analysis of correlation was used to measure the relationship between variables. The analysis of multiple regressions is used to hypothesize (H1 and H3).

## Research Findings

**Table 3** The research and development disclosure level of 59 firms

| The six list for disclosure level of research and development (R&D) | The disclosure level of research and development | | | |
|---|---|---|---|---|
| | Words | Average | Percentage | Level |
| 1) the Input is disclosure level of research and development | 960 | 1.66 | 27.62 | H |
| 2) the output is success of research and development | 861 | 1.49 | 24.77 | H |
| 3) the disclosure of future expenditure of research and development | 264 | 0.46 | 7.59 | M |
| 4) the disclosure of financing for research and development | 165 | 0.28 | 4.75 | L |
| 5) the disclosure of accounting and financial data of research and development | 214 | 0.37 | 6.16 | L |
| 6) the disclosure of strategy of research and development | 1,012 | 1.75 | 29.11 | H |
| **The overall of research and development disclosure** | **3,476** | **1.00** | **100.00** | **H** |

**Note:** If the level of R& D is > 0.65, it is considered "highest" (H); 2) if the level of R& D is between 0.45 – 0.65, it is considered "medium"(M); and 3) if the level of R&D < 0.45, it is considered "low" (L) (Wallance, 1998).

Table 3 shows the disclosure level of research and development from six keywords. The research finding was as follows: First, the disclosure of the strategy of research and development (keyword 6) is 1,012 words. Second, the disclosure level of research and development (keyword 1) is 960 words. Third, the disclosure of future expenditure on research and development (keyword 3) is 861 words.

**Table 4** The communication channels at the R&D level

| The communication channels | Words | Average | Percentile | level |
|---|---|---|---|---|
| Annual reports | 2,576 | 0.74 | 74.10 | Highest |
| Financial statements | 136 | 0.04 | 0.39 | Low |
| One - report 56-1 | 764 | 0.22 | 21.97 | Low |
| **Total** | **3,476** | **100.00** | **100.00** | **Highest** |

Table 4 shows three alternations in communication. The 59 firms that use annual reports is first alternation in communication related to disclosure level of research and development is 2,576 words at the highest level.

**Table 5** Pearson Correlation Matrix

| Variables | R&D | DR | FS | ROA | ROE | INS | VIF |
|---|---|---|---|---|---|---|---|
| D&R | ***1.000*** | | | | | | |
| DR | 0.110 | ***1.000*** | | | | | **1.068** |
| FS | 0.562** | 0.091 | ***1.000*** | | | | **1.744** |
| ROA | 0.571** | 0.107 | **0.965**** | ***1.000*** | | | **1.000** |
| ROE | 0.553** | 0.238 | 0.280* | 0.312** | ***1.000*** | | **1.000** |
| INS | 0.013 | -0.132 | 0.119 | 0.136 | -0.093 | | **1.000** |

Note: 1) R&D is disclosure level of research and development 2) DR is debt ratio 3) FS is firm size 4) ROA is return in asset 5) ROE return on equity 6) INS is foreign ownership ratio * Correlation is significant at the .01, ** Correlation is significant at the .01

Table 5 shows the results of the pearson correlation matrix of all variables. The largest correlations are between D&R and TAX (coef. = 0.733) and between FS and ROA (coef. = 0.965) but their VIF values are lesser than the threshold of 10. (Hair et. al., 2020). Consequently, there are no significant multicollinearity problems. and thus, making the data eligible for multiple regression analysis with statistical significance

**Table 6** Simple Regression Test of hypotheses 1 and 2

| Hypo. | Detections | Constant | Durbin Test | F Model | AdjR² | Un Coef. | Stan Coef. | t | p-value | Test results |
|---|---|---|---|---|---|---|---|---|---|---|
| **The firm-size affects on disclosure level of the research and development** | | | | | | | | | | |
| H1 | FS | 11.430 | 1.823 | 13.136 | 0.295 | 0.713 | 0.139 | 5.123 | 0.000** | Accept |
| | INS → R&D | | | | | 0.036 | 0.115 | 0.312 | 0.756 | |
| **The debt ratio affects on disclosure level of the research and development** | | | | | | | | | | |
| H2 | DR | 26.313 | 1.612 | 0.027 | -0.035 | 0.237 | 0.025 | 0.182 | 0.856 | Reject |
| | INS → R&D | | | | | -0.017 | -0.016 | -0.119 | 0.906 | |
| **The disclosure level of research and development affects on profitability (ROA and ROE)** | | | | | | | | | | |
| H3 | R&D | 9.729 | 1.882 | 13.199 | 0.296 | 0.450 | 0.560 | 5.081 | 0.000** | Accept |
| | INS → ROA | | | | | -0.061 | -0.073 | -0.663 | 0.510 | |
| | R&D | 5.778 | 1.634 | 39.494 | 0.570 | 0.700 | 0.764 | 8.870 | 0.000** | Accept |
| | INS → ROE | | | | | -0.032 | -0.034 | -0.390 | 0.698 | |

Note: 1) R&D is disclosure level of research and development 2) DR is debt ratio 3) FS is firm size 4) ROA is return in asset 5) ROE return on equity 6) INS is foreign ownership ratio *Correlation is significant at 0.05, ** Correlation is significant at 0.01, *** Correlation is significant at 0.001

Table 6 shows the result of multiple regression analysis. found that:

1) The Adjusted R Square is 0.295 that explains the fixed value (constant) of 11.430, Unstandardized coefficients of firm-size (FS) is 0.713. that has statistically significant at the 0.01 level. Model equations can be written as follows:

$$R\&D = \beta_0\ (26.313) - \beta_1\ (DR)\ (0.713) + \varepsilon \qquad (1)$$

2) The Adjusted R Square is - 0.035 that explains the fixed value (constant) of 26.313, Unstandardized coefficients of debt ratio (DR) is 0.237 that do not have conclusive information to summarize statistical effects on disclosure level of the research and development (R&D).

$$R\&D = \beta_0\ (11.430) - \beta_1\ (FS)\ (0.237) + \varepsilon \qquad (2)$$

3) The Adjusted R Square is 0.296 that explains the fixed value (constant) of 9.729, Unstandardized coefficients of R&D is 0.450. that has statistically significant at the 0.01 level. Model equations can be written as follows:

$$ROA = \beta_0\ (9.729) + \beta_1\ (R\&D)\ (0.450) + \varepsilon \qquad (3)$$

In addition, The Adjusted R Square is 0.570 that explains the fixed value (constant) of 5.778, Unstandardized coefficients of R&D is 0.700. that has statistically significant at the 0.01 level. Model equations can be written as follows:

$$ROE = \beta_0\ (5.778) + \beta_1\ (R\&D)\ (0.700) + \varepsilon \qquad (4)$$

## Discussion

The disclosure level of the research and development have an important role as they display future growth opportunities in company performance. This result found that: 1) the firm-size (FS) has a positive effect on disclosure level of the research and development (R&D) due to the big company, the investors usually emphasize, and it causes pressure on its rivals all the time. Therefore, a big company always tries to create and develop innovations or inventions to increase reliability for the investors and push such a company itself to become the leading technology company that leads to competitive advantages. The consistent with research of Kumpirarusk & Rohitratana (2018) and Nigri & Baldo (2018) which found that larger companies have an advantage in economy of scale regarding making and disclosing the data and Xie et al. (2019) found that large companies had higher R&D investment potential than smaller companies and thus able to draw more investors. **Accept the hypothesis 1**

2) the debt ratio (DR) did not have effect on disclosure level of the research and development (R&D), due to companies with high R&D expenditures take higher risks to increase profits is the reason not to disclose such information. Concurring with Lucia & Panggabean (2018) which also found that companies with high leverage are less likely to disclose information compared to those with lower leverage because capital from the debtor must be repaid which affected performance. However, This finding conflicts with Agency theory of Jensen & Meckling (1976). **Reject the hypothesis 2**

3) the disclosure level of the research and development (R&D) has a positive effect on return in asset (ROA) and return on equity (ROE). Most studies report a positive relationship between R&D investments and profitability such, the research of Suttipun and Saefu (2017) found that the disclosure of research and development information has a positive effect on profitability. Furthermore, Basso et al., (2013) found that a company that uses high technology will invest in research and development, and it has the disclosure on the performance to let external people follow the novel innovation all the time to create value for the enterprise. Moreover, Growe et al., (2014) Lazar, (2016) found that voluntary information disclosure had a positive relationship with profitability. and consistent with the other researcher as Mondal and Sarkar (2020), Bouaziz (2016), Mishra (2018), Ghaffar and Khan (2014), Ayaydin and Karaaslan (2014) and Freihat and Kanakriyah (2017) all research found that the disclosure level of the research and development has a positive relationship on profitability and dimensions of profitability (return on asset (ROA) and return on equity (ROE)),

However, this finding consistent with the signaling theory of Spence (1973) and balanced scorecard concept (BSC) of Kaplan and Norton (1992). **Accept the hypothesis 3**

### Theoretical Contributions

Out of the literature review, that can understand and integration of new concepts and theories based on agency theory, signaling theory, stakeholder theory and balanced scorecard Concept (BSC) to develop a conceptual framework and link to show the relationship between disclosure level of the research and development and profitability. This research show factor that is firm-size affects disclosure level of the research and development with firm-size can explain the disclosure level of the research and development at 29.50 precent. This result confirms according to agency theory. However, the relationship between disclosure level of the research and development with profitability was found to be higher in return on equity (ROE) that can explain the profitability at 57.00 precent than return in asset (ROA) that can explain the profitability at 29.60 precent. While debt ratio and foreign ownership ratio did not have effect on disclosure level of the research and development and profitability.

### Managerial Implications

The study provides an informative summary for regulators to study corporate governance practices, encourage businesses to disclose research and development information at an appropriate level. However, to disclose information appropriately and qualitatively, in addition to such entities, they must obtain cooperation from publicly listed companies, in particular, those in the SET group, who have the greatest influence on the level of R&D disclosure. If the company discloses appropriate R&D information, it will achieve a number of positive results, such as: 1) the business can reduce tax costs to a reasonable level without affecting the reduction in accounting profitability, which is considered the profitability of the business; 2) investors have expectations and can monitor the ongoing operation. Having more investors follow and invest in more companies will also result in an increase in the company's share price. All of these are due to the company's adequate level of R&D disclosure.

### Conclusion Limitations and Future Research

The disclosures in the financial statements are valuable for stakeholders who used economic decision and is important in allowing the financial statement's user to know the company's performance in the past period. If the revealed information is of good quality, it will reflect transparent management and corporate governance that can further boost confidence in financial statement users.

Even though, the trend in the amount of research and development disclosure in annual reports and 56-1 one report of the companies in Thailand during the past period may have made the data unclear, Thailand should focus on research and development disclosure more to provide useful information and create awareness of innovation-driven economic development.

However, this research study only technology business groups, Therefore, future research should be studied as follows: 1) the disclosure level of research and development information comparison of the technology business group in ASEAN to get in-depth. information 2) Regarding COVID-19, the study scope will be expanded to include other industries, including the health industry, hospital business, as well as the vaccine manufacturing industry and 3) The study and testing of qualitative data, such as in-depth interviews with government and private managers of the research and development departments for the acknowledgment of issues and other factors.

# เอกสารอ้างอิง


Anne. J., & Jeanjean, T., (2006). The negative impact of research and development capitalization: a value relevance approach. **European Accounting Review**. 15(1), 37–61.

Ayaydin, H., & Karaaslan, I. (2014). The effect of research and development investment on firms' financial performance: evidence from manufacturing firms In Turkey. **Bilgi Ekonomisi Ve Yönetimi Dergisi**. 9(2), 43-59.

Balata, P. & Breton, G. (2005). Narratives versus numbers in the annual report: are they giving the same message to investors?. **Review of Accounting and Finance**. 4(3), 5-25.

Basso, L., Feitosa, E., Bido, D., & Kimura, H. (2013). The existence and disclosure of Intangibles versus corporate financial performance in France. **Proceedings of the international conference on intellectual capital. Knowledge management & organizational learning**, Washington, DC, USA. 63-73.

Basta, M., & Bertilsson, R. (2009). **Innovation and internal reporting of Intellectual capital an empirical study**. Retrieved February 11, 2022, from https://gupea.ub.gu.se/bitstream/gupea_2077208911.pdf

Bhojraj, S., & Sengupta, P. (2003). Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. **The Journal of Business**. 76(3), 455-475.

Bischoff, C., & Christiansen, F. J. (2017). Political Parties and Innovation. **Public Management Review**. 19(1), 74-89.

Bong H. H., & David M. (2004). The value-relevance of R&D and advertising expenditures: Evidence from Korea. **The International Journal of Accounting**. 39(2), 155-173.

Bosworth, D., & Rogers, M. (2001). Market value, R&D and intellectual property: an empirical analysis of large Australian firms. **Economic Record**. 77(239), 323-337.

Botosan, C. A. (1997). Disclosure level and the cost of equity capital. **The Accounting Review**. 72(3), 323-349.

Bouaziz, Z. (2016). The impact of R&D expenses on firm performance: empirical witness from the best technology index. **Journal of Business Theory and Practice**. 4(1), 51.

Bozzolan, S., Favotto, F., & Ricceri, F. (2003). Italian annual intellectual capital disclosure: an empirical analysis. **Journal of Intellectual Capital**. 4(4), 543-558.

Bravo, F., Trombetta, M., & Abad, U. (2010). Disclosure theories and disclosure measures. **Revist a Espanola- de Financiering Contabilidad**. 39(147), 393-420.

Brennan, N. (2001). Reporting intellectual capital in annual reports: evidence from Ireland. **Accounting, Auditing & Accountability Journal**. 14(4), 423-436.

Choorat, P., & Jiajanpong, A. (2022). The Adaptation of Thailand's Northeastern Local Media Toward Business Survival and News Services in The Digital Age. **The Journal of Social Communication Innovation**. 10(1), 85-86.

# เอกสารอ้างอิง


Cordazzo, M. (2007). Intangibles and Italian IPO prospectuses: a disclosure analysis. **Journal of Intellectual Capital**. 8(2), 288-305.

Cuozzo, B., Dumay, J., Palmaccio, M., & Lombardi, R. (2017). Intellectual capital disclosure: a structured literature review. **Journal of Intellectual Capital**. 18(1), 9-28.

Enache, L., & Hussainey, K., (2020). The substitutive relation between voluntary disclosure and corporate governance in their effects on firm performance, **Review of Quantitative Finance and Accounting**. 54(2), 413-445.

Fortune, A., & Shelton, L. (2012). R&D Effort, Effectiveness and Firm Performance in the Pharmaceutical Sector. **Journal of Business and Management.** 18(1), 97-115.

Freeman, R. E. (1984). **Strategic management: A stakeholder approach**. Boston: Pitman

Freihat, A. R. F., & Kanakriyah, R. (2017). Impact of R&D expenditure on financial performance: Jordanian evidence. **European journal of Business and Management**. 9(32), 73-83.

Garcia-Meca, E., Parra, I., Martinez, I., & Larran, M. (2005). The explanatory factors of intellectual capital disclosure to financial analysts. **European Accounting Review**. 14(1), 63-94.

García-Valderrama, T., Mulero-Mendigorri, E. & Revuelta-Bordoy, D. (2008). A Balanced Scorecard framework for R&D. **European Journal of Innovation Management**. 11(2), 241–281.

Ghaffar, A., & Khan. A. (2014). Impact of research and development on firm performance. **International Journal of Accounting and Financial Reporting**. 4(1), 356-367.

Growe G., DeBruine M., Lee J. Y., & Tudón Maldonado J. F. (2014). The profitability and performance measurement of U.S. regional banks using the predictive focus of the 'fundamental analysis research'. In Epstein M. J., & Lee J. Y. (Eds.), Advances in management accounting. **Advances in Management Accounting**. 24, 189-237.

Guthrie, J., & Petty, R. (2000), **The Annual Reporting of Intellectual Capital in Australia's Largest Companies**. Australian CPA.

Hair Jr, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. **Journal of Business Research**. 109, 101-110.

Heijnen, P., & Van der Made, A. (2012). A signaling theory of consumer boycotts. **Journal of Environmental Economics and Management**. 63(3), 404-418.

Ho, L. P., & Taylor, G. (2013). Corporate governance and different types of voluntary disclosure: Evidence from Malaysian listed firms. **Pacific Accounting Review**.25(1), 10-11.

Hottenrott, H., & Lopes-Bento, C. (2016). R&D Partnerships and innovation performance: can there be too much of a good thing?. **Journal of Product Innovation Management**. 3(6), 773-794.

Hyeog U. K. & Jungsoo P. (2018). R&D, foreign ownership, and corporate groups: Evidence from Japanese firms. **Research Policy**. 47(2), 428-439.

# เอกสารอ้างอิง


Jeanjean, T., (2006). The negative impact of R&D capitalization: a value relevance approach. **European Accounting Review**. 15(1), 37-61.

Jensen, M.C., & Meckling, W.H. (1976) Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. **Journal of Financial Economics**. 3, 305-360.

Jones, D. A. (2007). Voluntary disclosure in R&D-intensive industries. **Contemporary Accounting Research**. 24(2), 489–522.

Kaplan, R.S., & Norton, D.P. (1996). Strategic learning & the balanced scorecard. **Strategy & Leadership**. 24(5),18-24.

Karjalainen. P. (2006). R&D investments: The effects of different financial environments on firm profitability. **Journal of Multinational Financial Management**. 8(12), 79-196.

Kumpirarusk, P., & Rohitratana, K. (2018). Industry 4.0: Future Industries of Thailand. **WMS Journal of Management**. 7(3), 52–64.

Lazar, S. (2016). Determinants of firm performance: evidence from Romanian listed companies. **Review of Economic and Business Studies**. 9(1), 53-69.

Le, Q. (2018). **Bakance Scorecard Integration: An Approach to Measure Overall R&D Performance**. ProQuest Dissertations and Theses.

Lim-U-sanno, K. (2021). The effects of company characteristics on R&D disclosure of listed companies in stock exchange of Thailand. **Academy of Strategic Management Journal**. 20(3). 1-8.

Lucia, L., & Panggabean, R. (2017). The effect of firm's characteristic and corporate governance to sustainability report disclosure. **Social Economics and Ecology International Journal**. 2(1), 18–28.

Mishra R. (2018). Influence of Research and Development (R&D) cost on profitability: A study of Indian pharmaceutical sector. **Journal of Economics and Finance**. 9(2), 63-68.

Mondal, P., & Sarkar, C. S. (2020). Impact of Research and Development Investment on Firms' Profitability: A Study on Selected Automobile Companies in India. **International Journal of Multidisciplinary Studies**. 1(V), 9-18.

Nekhili, M., Chakroun, H., & Chtioui, T. (2016). Women's leadership and firm performance: Family versus nonfamily firms. **Journal of Business Ethics**. 153(2), 291-. 316.

Nigri, G., & Baldo, M.D. (2018). Sustainability reporting and performance measurement systems: How do small-and medium sized benefit corporations manage integration?. **Sustainability**. 10(4499), 1-17.

Nord, L. (2011). R&D investment link to profitability: a pharmaceutical industry evaluation. **Undergraduate Economic Review**. 8(1), 25-57.

Penman, S. H., & Zhang, X. J. (2002). Accounting conservatism, the quality of earnings, and stock returns. **The Accounting Review**. 77(2), 237-264.

Perez, R. G. (2004). Factores explicativos de la revelación voluntaria de información sobre fuentes de ventaja competitiva empresarial. **Revista Española de Financiación y Contabilidad**. 23(122), 705-739.

Robb, S. W. G., & Single, L. E., & Zarzeski, M. T. (2001). Nonfinancial disclosures across Anglo-America countries. **Journal of International Accounting**. 10(1), 71-83.

Salawu, R.O. (2014). Determinants of Working Capital Management: Case of Nigerian Manufacturing Firms. **Journal of Economics and Sustainable Development**. 5(14), 49-56.

Shehata, N. (2014). Theories and determinants of voluntary disclosure. **Accounting and Finance Research**. 3(1), 18-26.

Suttipun, M., & Saefu, S. (2017). Investigation of sufficiency economy philosophy reporting in Thailand. **DLSU Business & Economics Review**. 26(2), 53-65.

Thailand Federation of Accounting Professions (TFAC). (2022). **TFRS 38 financial instruments**. Retrieved December 13, 2022, from https://www.tfac.or.th/upload/9414/a5rsT5U51f.pdf.

The Accounting Standards Board of the Australian Accounting Research Foundation (AARF) (1983). **Accounting for research and development costs**. Retrieved December 10, 2022, from https://www.aasb.gov.au/admin/file/content102/c3/ACCPS1_8-93.pdf

The Eurostat Manuals and guidelines in ESA. (2010). **Manual on measuring research and development in ESA 2010**. Retrieved December 10, 2022, from https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-gq-14-004.

The OECD. (2020). **Research and development (R&D)**. Retrieved April 27, 2023, from https://www.oecd-ilibrary.org/industry-and-services/research-and-development-r-d/indicator-group/english_09614029-en.

Xie, J., Liu, R., Luttrell, J., & Zhang, C. (2019). Deep learning-based analysis of histopathological images of breast cancer. **Frontiers in Genetics**. 10(80), 1-19.

Zheng, S.X., & Stangeland, D.A. (2007). IPO Underpricing, firm quality, and analyst forecasts. **Financial Management**. 36(2), 45-64.