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The role of absorptive capacity, technological capability, and firm performance in Indonesia's high-tech industry

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Abstract

The aim of this research is to examine the role of Absorptive capacity as an important ability to absorb technology and as a key to the firm's innovation capabilities. Technological capability is an important resource that companies must own to increase competitiveness because with these core resources and technology competencies, the firm can create values. Technological capabilities can be developed from internal or external sources. This study focuses on the external source in the form of royalty expense by presenting foreign experts/technology/copyrighted works/trademark/formulas to obtain technology and knowledge transfer. The research uses Large and Medium-scale Manufacturing Survey data that is taken from the Indonesian Central Bureau of Statistics (CBS). This is descriptive research that aims to produce an accurate mechanism of process relationship among variables. The results show that royalty expenses have a different relationship with firm performance. Some industries like electrical equipment and motor vehicles, as well as trailers and semi-trailers, have a very high royalty expense accompanied by the firm's performance which is also the highest among all industries in the high-tech industry. This proves that several firms in the high-tech industry in Indonesia have a high absorptive capacity. However, different findings are seen in the chemicals and pharmaceutical industry. Firms do not spend above the industry's average on royalty expenses, but their performance remains above the average performance of the high-tech industry in Indonesia.

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1. Introduction

Technological capabilities are core resources and specified competencies that enable companies to create their values. They are considered the main driver for competitive advantage and multiple profits along with a superb performance of the firms (Lin & Lai, 2021). Therefore, these capabilities are crucial for a firm's international success (Lejpras, 2019). Technological capabilities can come from either internal or external sources. The internal source can come from research and developmental activities however, the previous research has been shown for creating positive influence on the firm's sales, including expanding the firm's market share to the global market (Singh, 2009). Meanwhile, the external sources of technological capabilities present foreign experts/technology/copyrighted works/trademarks/formulas with the aim to aware local workers about the knowledge and technological expertise of foreign experts. Thus, technology transfer occurs from external parties, whereas previous research resulted in different findings between companies that have or do not have R&D units (Mursitama, 2006).

Technological capability enables firms to produce new products and attract customers from international markets, increasing the firm's revenue growth (Zahra, 2020). The firm's technology resources in the form of

technological capabilities can be assessed based on the firm's royalty expenses. The existence of royalty expenses within the firm shows the firm's concern in adapting, improving, and making organizational changes with knowledge of external sources. Royalty is another technological resource that is used to obtain information and knowledge from technology experts outside the firm, usually from foreign markets by paying a certain amount of money. In developing countries, companies incur a certain amount of royalties for creating innovation. (Mursitama, 2006). Zahra (2020) Other researchers also state that the royalty system has proved efficient in driving performance from the perspective of firm innovation (Hwang, Jun, Chang, & Kim, 2018). The firm's success in entering the global market is also determined by its absorptive capacity in both potential and realized absorptive capacity (Liu, Henley, & Mousavi, 2021). The firms with strong capabilities in transforming and exploiting external knowledge indicate their absorptive capacity which develop competitive advantages and exploit their absorptive capacity at home markets as well as international in markets. Absorptive capacity as knowledge-based capabilities of entrepreneurial firms in transition economies positively moderate the innovation in international market (Bahl, Lahiri, & Mukherjee, 2021). This highlights the importance of knowledge-driven resources and capabilities for growth and performance of firms. The ability to absorb knowledge and technology owned by the firm will increase the firm's production ability. Innovation is positively affected by absorptive capacity that is knowledge transformation and knowledge exploitation. Innovative processes promote superior performance and play an important role in mediation the correlation between absorptive capacity and business performance (Cruz-Ros, Guerrero-Sánchez, & Miquel-Romero, 2021). The royalty expense of a firm is a form of strategy in increasing the technological capabilities of the firm based on considerations of the firm's market scale as it becomes a priority when it is cheaper in terms of costs compared to other strategies that are issued by the firm (Hong, Zhao, Hu, & Song, 2015). The research using the firm's royalty expenses as a proxy for technological capabilities shows that it significantly affects the firm's competitiveness (Franco & Sasidharan, 2010; Rentala, Anand, & Shaban, 2014). However, in other studies, some findings show a negative influence depending on the firm's condition (Mursitama, 2006; Siddharthan & Nollen, 2004). The results of the automotive industry in Indonesia, suggest that further strengthening is needed to support a high-tech industrial environment to stimulate higher technological capabilities (Rasiah, Shahrivar, & Amin, 2016). The role of technological capabilities becomes crucial when it comes to how companies can improve their competitiveness in the era of industrial revolution 4.0. In Indonesia, the manufacturing sector is highly encouraged in transforming its industrial value chain digitally. Such times of transformation must be utilized by Indonesia because of advantages in terms of a solid institutional framework, and good global trade and investment (Ministry of Industry, 2022).

From previous research on the role of royalty expense, little has been done, especially in developing countries like Indonesia. This condition makes the role of royalty expense as a part of the firm's technological capabilities intriguing and how further research can be done in this field. The focus of this research highlights that the high-tech industry is the primary concern of making Indonesia 4.0 roadmap. The government launches it by focusing on five main sectors: automotive, chemical, electronics, food and beverage, textile, and clothing. Of these five main sectors, three are classified as high-tech industries: automotive, chemical, and electronics. The significance of the high-tech industry can also be seen in the establishment of government policies that state, to support the growth of manufacturing in Indonesia, a program and evaluation of the manufacturing industry's performance is established by strengthening the med-high-tech product that can encourage exports (Central Bank of Indonesia, 2020).

2. Literature Review

2.1. High-Tech Industry

High-tech industry is production processes which deploy knowledgeable workers with their expertise based on STEM (Science, Technology, Engineering, Mathematics), R&D activities, and producing high-tech products as output (Goldschlag & Miranda, 2020). As such, the operationalization of the High-Tech industry includes the classification of economic activities based on the use of high technology for both production inputs and outputs. Table 1 presents those two methods used widely across the literatures.

Table 1. Identification of high-tech industries.

Input-based:
R&D intensity (Direct, indirect).
STEM (Science, technology, engineering, mathematics) employment.
High-tech production process.
Output-based:
Production of high-tech products

Source: Business dynamics statistics of high-tech industries – (Goldschlag & Miranda, 2020).

The manufacturing sector is included as a high-tech industry in the ISIC (International Standard Industrial Classification), and a reference for several countries worldwide, including Indonesia, to maximize production functions. ISIC is a national classification system in the business field, a single unit used to support various efforts to analyse and collect statistical data. The grouping of industries based on the intensity of

technology using the International Standard Industrial Classification (ISIC) rev 4 United Nations – Industrial Development Organization (UNIDO) is divided into three groups, namely : (1) Medium-high and High Technology; (2) Medium technology; (3) Low technology (UNIDO, 2022).

2.2. Royalty Expense to Increase Technological Capability

Regarding royalty expense, Lin and Lai (2021), in their research on the key factors that affect technological capabilities with the construct of knowledge sharing, enrichment of employee knowledge, cooperative relationships, innovation, and government supports proves that technological capabilities can improve firm performance. Research conducted by Chen, Vanhaverbeke, and Du (2016) finds that internal research and development activities and external knowledge sources positively influence firm performance. The strength of this capability also increases the influence on value chain engagement and corporate networks. Combining sources of technological capability, both external and internal knowledge is very important in the industry in developing countries.

Other researches also state that the firm's technological capabilities are positively related to performance, where companies with high technological capabilities tend to cooperate with external partners in firm development. In contrast, companies with lower technological capabilities tend to choose internal development (Wu, Gu, Ji, Guo, & Fan, 2020). In addition, there are also findings that technological capabilities affect firm's performance indirectly through the firm's innovative practices (Valdez-Juárez & Castillo-Vergara, 2020).

2.3. Firm Performance in High-Tech Industries

The main objective of the firm's strategic management is to achieve competitiveness (Venkatraman & Ramanujam, 1986). It results from a process achieved by the firm's set targets within a certain period (Venkatraman & Ramanujam, 1986). Sustainable firm performance is a multi-dimensional concept that can be measured directly and requires some indicators to assess firm performance (Gualandris, Golini, & Kalchschmidt, 2014).

There are many studies related to firm performance and its factors. For example, Carney, Estrin, Liang, and Shapiro (2019) and D'Angelo, Majocchi, Zucchella, and Buck (2013) highlight the factors affecting firm performance which can be categorized as external and internal factors, these include ownership, firm resources, technology, innovations made by the firm, and other factors such as the characteristics of the firm's operations. Furthermore, Safari and Saleh (2020) suggest that external and internal factors can be further developed and considered as potential mediators for measuring the firm performance.

Firm performance in the high-tech industry is defined as the result of the firm's ability to achieve its goals and to increase the firm's competitiveness. It has been measured by the firm's added value. The output value is the output of industrial activities in the form of everything sold by the firm (revenue), which consists of (1) Goods produced, (2) Electric power sold, (3) Industrial services received from other parties, (4) Other revenues from non-industrial services, and (5) The difference in the value of the stock of semi-finished goods. Meanwhile, input costs are everything that the firm buys for industrial activities (Noerlina, Alamsjah, & Mursitama, 2020; Noerlina, Mursitama, Simatupang, & Bandur, 2021; Noerlina, Tjhin, Mursitama, Simatupang, & Bandur, 2021).

3. Research Methodology

The data used to support the quantitative dimensions in this study is the data on manufacturing firms in the high-tech industry category in Indonesia. The data in this study is secondary data taken from official government publications, which are the results of a survey from the Indonesian Central Bureau of Statistics (CBS). CBS published statistics for Large and Medium-scale Industry which is a classification of the manufacturing industry based on the number of workers in the firm of at least 20 people, where the coverage of high-tech industries is included in the group. According to CBS data, there are 4.903 companies in the high-tech industry category in Indonesia in 2017.

The use of secondary data from CBS survey results has been widely used in national and international research by individual researchers and institutions. Several studies using CBS secondary data with a focus on firm performance and its international value have been published in well-known international publishers, either Scopus Q1, Q2 and other reputable international publications, including research conducted by Blalock and Gertler (2004); Esquivias and Harianto (2020); Mursitama (2006); Ni and Kurita (2020); Rachbini (2020); Sabri, Nachrowi, Soetjipto, and Panennungi (2018); Sjöholm and Takii (2008).

The research data used in this study is in the form of cross-sectional data obtained from the CBS for the manufacturing industry in 2017. The time of data collection is one shot cross-sectional, which means that the data is only taken once in a certain period to answer research questions (Sekaran & Bougie, 2016). Descriptive research is intended to obtain a comprehensive picture in describing each variable's conditions, including Royalty Expense and Firm Performance. Descriptive research aims to produce an accurate picture of the mechanism of a process and or relationship among variables that provide basic information about a relationship and describe the stages or processes.

4. Result and Discussion

4.1. Conditions of Royalty Expense in the High-Tech Industry in Indonesia

Royalty expense is an expense paid by the firm to increase the firm's capability to adapt, improve, and make organizational changes with external knowledge sources to innovate the corporate value. Royalty Expense is carried out to obtain information and knowledge from technology experts outside the firm by paying a certain amount of money. The condition of royalty expense in the high-tech industry in Indonesia can be seen in the following figure and tabulation. Figure 1 exhibits average royalty expense per ISIC in million rupiah. ISIC 27 (electrical equipment) shows the highest royalty expense whereas ISIC 29 (motor vehicle, trailers and semi-trailers) is in the second place. Table 2 depicts an observed variable, royalty expense has an average value of Rp. 3.386 million. The size of the standard deviation indicates a large spread of data (data points are farther than the mean). Data processing results show the large variation in royalty expense data in the high-tech industry. This is because not all companies in this industry focus on implementing strategies to involve external technology experts within the firm.

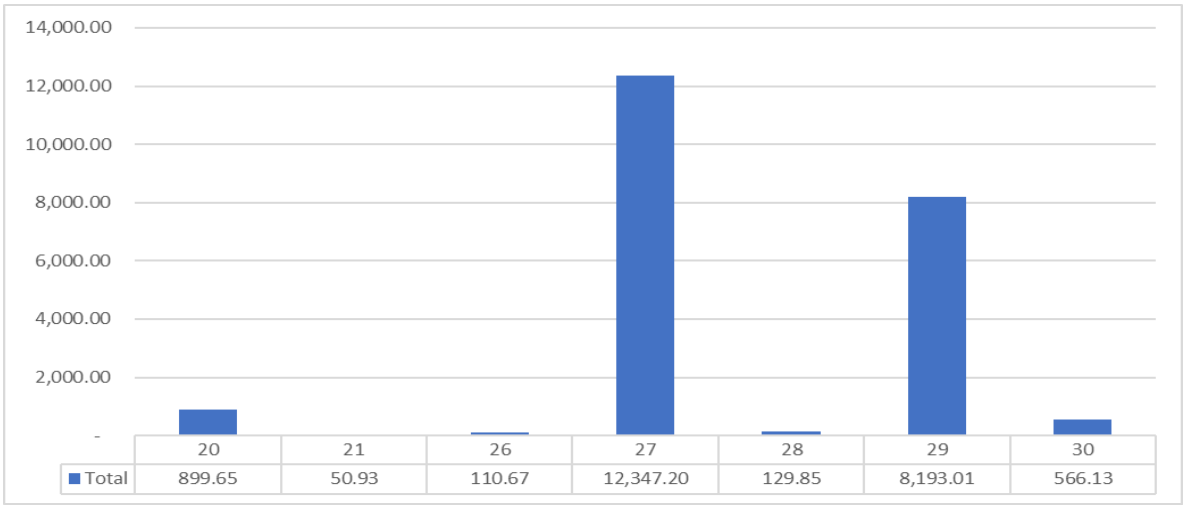

Figure 1. Average royalty expense per ISIC.

The big difference occurs in royalty expense in the high-tech industry, wherein the electrical equipment industry and the motor vehicles, trailers, and semi-trailers industry, there is a very high royalty expense (±Rp.12 million and ±Rp.8 million) compared to other industries. Meanwhile, royalty expenses are very low in the pharmaceutical industry, the computer industry, the electronic and optical products, and the machinery and equipment industry.

4.2. Conditions of Firm Performance in the High-Tech Industry in Indonesia

Firm performance results from the firm's ability to achieve its goals by using its resources to increase its competitiveness. The proxy of Firm Performance used in this study is Value Added which is obtained from the value of the output produced by the firm minus the input costs paid by the firm.

The firm performance condition in Indonesia's high-tech industry is described and tabulated as follows. As an observed variable, firm's Performance has an average value of Rp. 245,8 billion. Data processing results show a large variation in firm's performance in the high-tech industry.

Table 2. Descriptive analysis of royalty expense.

ISIC	Industry	N	Mean (Million Rp.)
Royalty expense		2578	3386.68
Division 20	Chemicals and chemical products	776	899.65
Division 21	Pharmaceuticals	192	50.92
Division 26	Computer, electronic and optical products	244	110.66
Division 27	Electrical equipment	289	12347.20
Division 28	Machinery and equipment	252	129.85
Division 29	Motor vehicles, trailers and semi-trailers	515	8193.01
Division 30	Other transport equipment except ships and boats	310	566.12

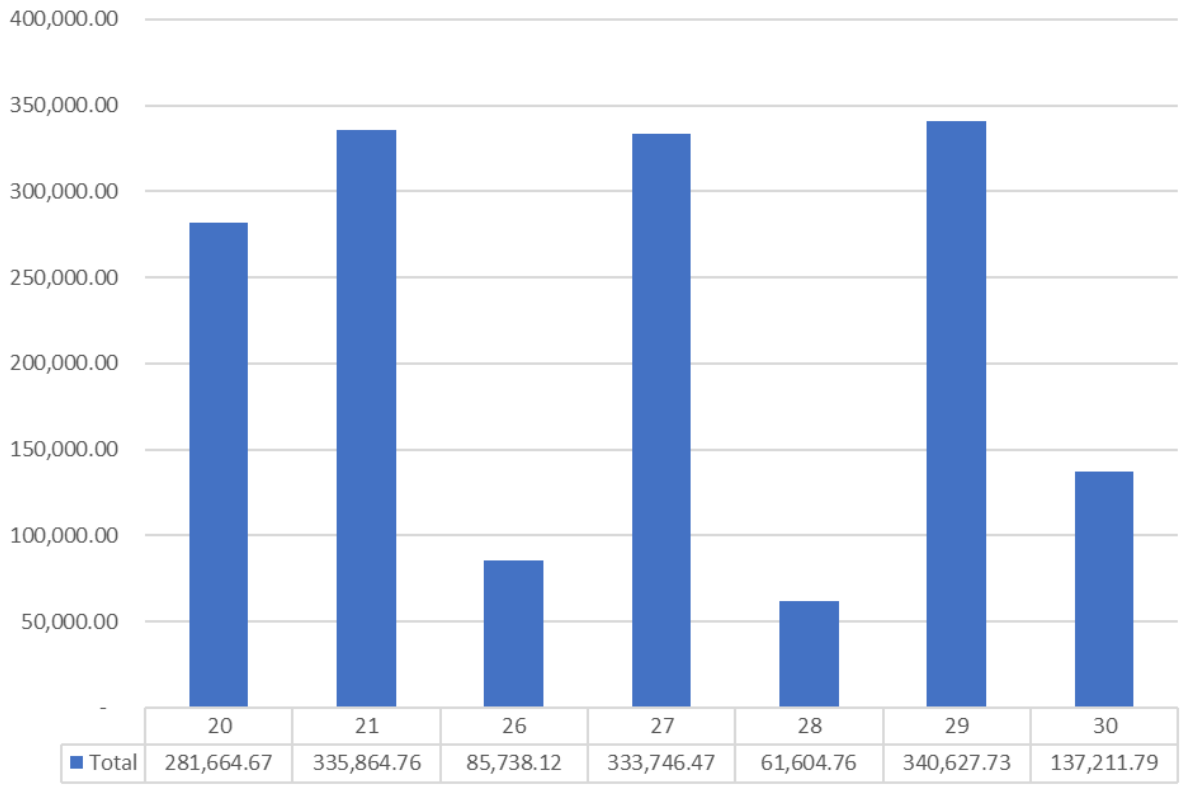

Figure 2. Average firm performance per ISIC.

Firm Performance with the firm's value-added proxy obtained from the added value of output minus input costs. Figure 2 shows the highest achievement occurred in the pharmaceuticals industry (average ±Rp. 335 billion), electrical equipment industry (average ±Rp.333 billion), as well as motor vehicles, trailers, and semi-trailers industry (average ±Rp.340 billion). The lowest Firm Performances are in the computer, electronic, and optical products industry (average ±Rp. 85 billion) and the machinery and equipment industry (average ±Rp.61 billion). Table 3 presents more detail data on ISIC, industry and number of companies and industry average for each ISIC.

Table 3. Descriptive analysis of firm performance (Billion Rp.)

ISIC	Industry	N	Mean
Firm performance		2,578	245.89
Division 20	Chemicals and chemical products	776	281.66
Division 21	Pharmaceuticals	192	335.86
Division 26	Computer, electronic and optical products	244	85.73
Division 27	Electrical equipment	289	333.74
Division 28	Machinery and equipment	252	61.60
Division 29	Motor vehicles, trailers and semi-trailers	515	340.62
Division 30	Other transport equipment except ships and boats	310	137.21

4.3. Royalty Expense and Firm Performance

Based on the above-mentioned descriptive statistics, a crosstab analysis was carried out to determine the relationship between royalty expense and firm performance by dividing the matrix into nine quadrants. The purpose of this crosstab analysis is to answer whether companies that use foreign experts/technology/copyrighted works/trademarks/formulas by paying royalty expenses will have better firm performance than firms that do not use it.

Figure 3 exhibits a very interesting picture of the Indonesia's high-tech industry based on the crosstab analysis. Out of nine quadrants, there are four quadrants that are focused. The first is the upper right quadrant as the highest quadrant from this matrix which is called "the high achiever". The highest quadrant is in green, where the firm's royalty expense is above the average industry value (Rp 3.3 billion), with firm performance also above the average industry value (Rp 245 billion). The high achiever quadrant consists of firms with high performance above the industry average and implementing the strategy involves foreign experts/technology/copyrighted works/trademarks/formula from outside. As high achiever firms, they are able to maximize learning the outside technology, utilize external knowledge and materialize it into greater performance by paying a sum of money in the form of royalty expense (Mursitama, 2006).

The industries included in this quadrant are ISIC 27 electrical equipment and 29 motor vehicles, trailers, and semi-trailers with the highest performance and the largest royalty expense. Industry of electrical equipment and motor vehicles in Indonesia as industries that is in the high achiever category quadrant has the characteristic of changing very quickly following technological developments especially in the face of the industrial revolution 4.0. This type of industry includes those operating in the manufacturing industry of automotive components and parts as well as motor vehicles. Most of the types of goods produced by this industry are original spare parts for certain vehicle brands. Firms like this are also called original equipment manufacturers (OEM).

Firms usually have high capital capabilities and they can produce high quality products. They are also the main supplier or subcontractor for the automotive industry in Indonesia or abroad. With characteristics like these, generally firms in this industry are producers which are exclusively or part of their management under the supervision of foreign firms. The presence of foreign firms will bring in experts who will be involved in production and managerial processes, so royalty expense is needed in the context of technology transfer. Based on conditions in Indonesia, high royalty spending in this industry also has a positive impact on firm performance so that the firm has a high performance above the industry average. But this industry needs better support and commitment because the current condition is still dependent on imported components. Examples of firms in this industry are Samjin Ltd., Hitachi Astemo Ltd., and others.

The second is the lower left quadrant as "the poor achiever" which consists of firms with performance below the industry average and there are no activities that require royalty payments to obtain foreign experts/technology/copyrighted works/trademarks/formula. The lowest quadrant is coloured in red, where the firm's royalty expense and performance are below the average industry value. Industries included in this quadrant are computer, electronic, and optical products, machinery and equipment, and other transport equipment. In addition to the constraints of high raw material prices, container and logistics problems have resulted in very high industrial costs. Current condition in 2022, this industry is still facing this obstacle and has not yet recovered from its pre-pandemic conditions. Another problem is that the average imported electronic raw material components are still high, in the range of 60% to 70% (Kontan.co.id). Examples of firms in this industry are Siemens, Panasonic, and others.

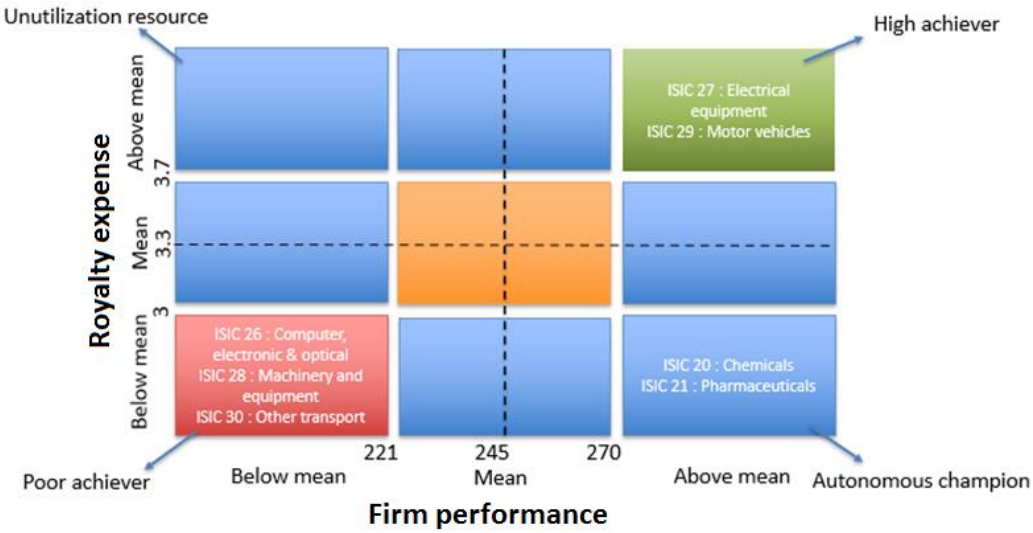

Figure 3. Crosstab analysis of royalty expense and firm performance (Billion rp.).

However, there are also industries that do not focus on using foreign experts/technology/copyrighted works/trademarks/formula by paying some royalty payments but still perform above the industry average. Firms with excellence performance but have royalty spending below average is called "the autonomous champion". The autonomous champion lies in the lower right quadrant with blue colour. It demonstrates that although royalty expenses appear to improve business performance on average, there are firms with below average royalty expense can produce high performance. ISIC 20 Chemicals and ISIC 21 Pharmaceuticals are included in this industry category. There are three possible interpretations of these condition. First, the firm's internal resources, which are the local experts, existing technology, can meet the firm's needs in these two industries. This type of firms has no or very limited royalty expense. Second, firms in this quadrant use the existing common technology that has been available in the market for long time with the cheaper price. Third, the firms have been able to access foreign experts/technology/copyrighted works/trademarks/formulas with lower price due to higher bargaining power of the firms towards supplier or technology provider.

The chemical industry is an upstream industry which is the foundation of the national industry and suppliers of raw materials for intermediate and downstream industries. Utilization in this industry has not yet optimal, only 60% meanwhile the pharmaceutical industry is one of the most stringent industries due to its

products have a critical impact on human life. The pharmaceutical industry in Indonesia uses a "me too" approach in the production process by reproducing products using drug patents that have expired, so that it does not require a lot of royalty payments to get formula for drugs even most of them are free (Manager of Indonesia's Leading Pharmaceutical Firm Interview, 2021). These two industries with the highest growth during the 2020 pandemic (Central Bureau of Statistics, 2020). Examples of firms in this industry are Kalbe Farma, Sambe Farma, Chandra Asri etc.

From absorptive capacity perspective, the results of this study prove that several firms in the high-tech industry in Indonesia have a high absorptive capacity. Previous firm absorptive capacity research stated that a firm's competitive advantage not only depends on internal knowledge but also from external knowledge, where the firm learning process is directed to explore and exploit external knowledge (Elidjen, Pertiwi, Mursitama, & Beng, 2022). The presence of foreign experts in the firm provides an opportunity for the firm to improve its performance by absorbing knowledge, skills and expertise from foreign workers which are paid by the company through royalty expense.

Finally, no firm is included in "unutilized resource" which lies in upper left quadrant. In this category, firms characterized by above industry average royalty expense with poor firm performance. In other words, firms in Indonesia's high-tech industries have been very successful in utilizing external technology and knowledge that increase the firm performance.

5. Conclusion

This study has successfully examined the role of royalty expense on firm performance in Indonesia's high-tech industries. By creating four different quadrants, this study distinguished high performing firms with high royalty expense above industry average (the high achiever) as well as below royalty expense (autonomous champion). The electrical equipment industry and the motor vehicles, trailers, and semi-trailers industry rely heavily on foreign experts and technology. These types of industries prove a high ability to absorb knowledge, skills, and expertise from foreign experts, which means that several firms in the high-tech industry in Indonesia have a high absorptive capacity. Those firms can be acknowledged as having high absorptive capacity. In addition, there are firms included in "poor achiever" as most of them are failed to materialize absorptive capacity that led to poor firm performance.

It has been established that not all businesses in Indonesia's high-tech sector enhance their technological capabilities by paying a set sum of money as a royalty expense to hire overseas professionals for knowledge and technology transfer, utilizing external technology, copyrighted works, trademarks, and formula etc. In general, this study results find that royalty expense has the effect of increasing firm performance. However, this does not apply equally to all industrial categories in the Indonesia's high-tech industry. For the chemicals and pharmaceuticals industry, the presence of foreign experts/technology/copyrighted works/trademarks/formula affect firm's performance differently due to the quality of firm's internal resources, the local experts, can meet the firm's needs.

For further research, there are two areas that can be examined in the future. First, it is necessary to conduct empirical tests on the effect of royalty expense on firm performance across different quadrant and over time. In addition, to increase the firm's technological capabilities, apart from implementing a strategy of involving foreign experts/technology/copyrighted works/trademarks/formulas in the firm through royalty expense, it is necessary to investigate further the role of research and development (R&D) activities in high-tech industrial companies. Companies must develop themselves with solid research and development (R&D) because it is considered the proper strategy. However, in the context of emerging economies like Indonesia, the path of technological development seems to be different comparing to firms in developed economies. Therefore, they can conduct their research and development according to the firm's capacity and conditions in Indonesia to increase their advantages because they can create their own technology and sell it to other companies.

Second, it is important to conduct research on the relationship between technological capabilities and financial stability as well as political stability (e.g. (Loganathan, Streimikiene, Mursitama, Shahbaz, & Mardani, 2018; Yakubu et al., 2020)) that affects firm performance in the context of emerging economies like Indonesia and ASEAN countries (Permatasari, 2020).

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