An Overview of Characteristics and Condition of High-Tech Industry in Indonesia

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Abstract. This research aims to better understand the high-tech industry in Indonesia so that business owners and the government can determine the best strategy for utilizing their resources. It use a descriptive and qualitative analysis approach, presenting a general profile of industry data and characteristics through national news and information. Indonesia's high-tech industry generally relies heavily on imported components or raw materials (chemicals, pharmaceuticals, computers and electronics, electrical equipment, machinery and equipment, motor vehicles, and other transportation equipment). The chemical industry significantly contributes to the economy because it can absorb large amounts of capital, create jobs, and generate added value. Because of the enormous domestic market opportunities, the pharmaceutical industry tends to build a national value chain. The electronic, optical, and electrical industries all favor indigenous innovation. To address the issue of global warming and climate change, the machinery and equipment industry must emphasize sustainable innovation by utilizing the latest technology. In contrast, the transportation industry must focus on optimizing integrated transportation services, transportation safety, and developing environmentally friendly sustainable transportation. Following the pandemic, the development of the high-tech industry began to show growth, indicating that the Indonesian economy would recover.

1 Introduction

High-tech Industry is an industry with a classification of economic activity based on the use of high-tech processes for inputs such as STEM (Science, Technology, Engineering, Mathematics)-based labor, R&D activities, and the use of high-tech production methods or producing high-tech products as output. The modern market economy can be divided into two groups based on the reallocation of corporate resources from low-productivity, low-value-added activities to high-productivity, high-value activities. Businesses in the high-tech industrial sector play an important role by introducing new products and services that impact the economy as a whole [1].

The productivity growth of companies in East Asia, including Indonesia, was divided into three categories: traditional businesses, basic businesses, and high-tech businesses. According to this study, traditional and basic industries in Indonesia are more productive than high-tech industries, and companies in the high-tech industry category require more technological knowledge than just the availability of labor and capital. [2].

Industry grouping based on technological intensity using the International Standard Industrial Classification (ISIC) rev 4 United Nations – Industrial Development Organization (UNIDO) is divided into three groups based on 2 ISIC digits. The grouping consists of (1) Medium-high and High Technology; (2) Medium technology; and (3) Low technology. For the high technology industry category (medium-high and high technology) consists of 7 divisions, namely divisions 20, 21, 26, 27, 28, 29, and 30, as shown in the following table.

Table 1. High-tech Industry based on ISIC technology intensity

Division 20	Chemicals and Chemical Products
Division 21	Pharmaceuticals
Division 26	Computer, electronic, and optical products
Division 27	Electrical equipment
Division 28	Machinery and equipment
Division 29	Motor vehicles, trailers, and semi-trailers
Division 30	Other transport equipment except for ships and boats

The urgency of this research is based on data from the country level. It can be seen that Indonesia's competitiveness in the Global Competitiveness Index (GCI) has been downgraded, and in terms of economic growth based on Gross Domestic Product (GDP), where the industrial sector contributes the most, this sector becomes important to study in order to increase competitiveness. The high-tech industry sector is specifically mentioned in the IV Indonesia National Medium-Term Development Plan (RPJMN) for 2020-

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2024 as an industry that plays an important role in nation-building. The high-tech industry is also a focal point of the Making Indonesia 4.0 roadmap, which serves as Indonesia's Industrial Revolution 4.0 strategy.

2 Methodology

The research design employs a descriptive analysis approach as well as qualitative analysis. Descriptive analysis aims to display the general profile of research data and understand the characteristics of research data. This section will provide an overview of the high-tech industry in outline and conditions per industry. Descriptive analysis is a common method of organizing, summarizing, and presenting data in an informative form [3]. The qualitative analysis was carried out using industrial growth conditions obtained from national news and information from the Indonesian Ministry of Industry.

The descriptive analysis stages in this study are as follows: (1) descriptive statistics derived from industrial data and explanations of industrial developments, and (2) qualitative analysis based on information obtained from national media.

3 High-Tech Industry di Indonesia

The modern market economy can be split into two categories based on the reallocation of corporate resources from low-productivity, low-value-added activities to high-productivity, high-value activities. Businesses in the high-tech industrial sector play an important role in this regard by introducing new products and services that impact the economy as a whole. [1].

Table 2. Identification of High-Tech Industries

Method	References
Input based:	
R&D intensity (direct, indirect). STEM (science, technology, engineering, mathematics) employment. High-tech production process.	US Statistical Agency (2004) D.Hecker (1999), D.E.Hecker (2005), Hathaway (2013), Haltiwanger, Hathaway, & Miranda (2014, Hatzichronoglou (1997), OECD (2007), NSF (2010)
Output based: Production of High-Tech Products	NSF (2002), Hatzichronoglou (1997)

The high-tech industry in Indonesia is one of the industries that are the mainstay of economic growth and is the focus of development, as stated in the National Medium Term Development Plan (RPJMN 2020-2024). With ever-increasing global competition, Indonesia must implement a strategy to form technology-intensive industries (high-tech industries) supported by its resources.

The modern economic market has the characteristics of a reallocation of less productive resources, and less valuable economic activities become more productive and valuable. The high-tech industry is important in reallocating resources by introducing new products or services with a significant economic impact [1]. High-tech industries that constantly innovate and conduct scientific research on their resources will be able to keep their competitive advantage [4].

Another factor that plays a very important role in supporting the competitiveness of the high-tech industry in Indonesia is interfirm networks [5] and other company resources. Therefore, the purpose of this research is to understand more deeply how the condition of this industry in Indonesia is so that companies and the government can determine the right strategy for utilizing their resources.

Based on data from the

Central Statistics Agency (BPS), conditions in Indonesia related to industrial growth show that the number of industries registered in 2017 was 33,577 companies. Data is displayed in the form of company groupings based on technology intensity using the International Standard Industrial Classification (ISIC).

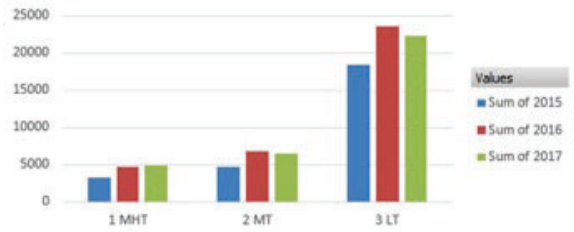

Fig. 1. The number of companies in the industrial group based on technology intensity in Indonesia

Source: Processed from BPS data (2020)

The condition of the high-tech industry and government policies in advancing this industry are discussed in the following sub-chapters.

3.1 Chemicals and Chemical Products and Pharmaceuticals Industry

This industry experienced the highest growth during the Covid-19 pandemic because people focused on basic needs and health (2020 – 2021). However, utilization in this industry is not optimal because most of the raw materials that can be produced locally are still imported because they are cheaper. Nevertheless, the chemical industry significantly contributes to the economy by absorbing large amounts of capital, creating jobs, and generating added value. However, the national chemical industry is also heavily reliant on imported materials, contributing to a significant trade deficit in Indonesia. The main challenge for the national chemical industry is the high import of fossil-based raw materials, which impacts the trade balance, the environment, and the chemical industry's sustainability. As a result, it is critical to convert fossil-based raw materials into bio-products and optimize the use of biological resources. Furthermore, integrated chemical industry policies from upstream to intermediate to downstream, combined with the Circular Economy, can be implemented to increase

added value and achieve the anticipated economic growth [6].

The pharmaceutical industry builds a national value chain due to the opening of large domestic market opportunities, while the chemical industry tends towards indigenous innovation [7].

Fig. 2. Trend data on the growth of Chemicals and Pharmaceuticals and Traditional drugs in Indonesia

Source: https://www.dataindustri.com

Bar chart = Gross industrial product of the industry

Line chart = Industry growth

According to data from www.dataindustri.com, the annual performance of Indonesia's chemical, pharmaceutical, and traditional medicine industries until the third quarter of 2022 (y on y) has increased by 11.8 percent compared to the same period in 2021. Furthermore, in terms of quarterly performance (q on q), Indonesia's chemical, pharmaceutical, and traditional medicine industry sector grew by 0.4 percent in the third quarter of 2022 compared to the second quarter of 2022. The graph above shows annual and quarterly trend data on the growth of Indonesia's chemical, pharmaceutical, and traditional medicine industries from 2011 to 2022 [8].

The pharmaceutical and medical device industries have been designated as strategic sectors in implementing Industry 4.0. When Covid-19 entered Indonesia, the demand for vitamins, supplements, and medicines to boost immunity increased. In line with the high demand for this sector, the government added the medical device and pharmaceutical sectors to the priority sectors in Making Indonesia 4.0 [9].

3.2 Computer, electronic, optical products, and electrical equipment industry

Because the Indonesian electronic market is still dominated by imported products, including computer and optical products, the government and business actors must be concerned about the electronics industry, which is a focus of the Making Indonesia 4.0 roadmap launched by the government to enter the industrial revolution 4.0 era. The challenge in this industry is that its reliance on imported components remains high, at around 60%. During the pandemic, there was an increase in exports, particularly for hygiene and health electronic products such as air purifiers and sterilizers, because these products became a community need during the pandemic. The electronic, optical, and electrical industries all favor indigenous innovation [7]

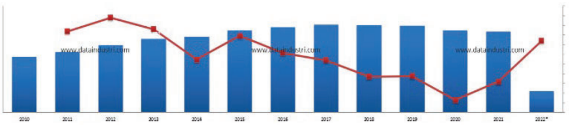

Fig. 3. Trend data on the growth of the metal goods industry, computers, electronics, optics, and electrical equipment in Indonesia

Source: https://www.dataindustri.com

Bar chart = Gross industrial product of the industry

Line chart = Industry growth

According to the graph above, the industrial sector's annual performance (year on year) of metal goods, computers, electronic goods, optics, and electrical equipment increased by 6.4 percent. After a decline in performance in 2020 and 2021, this positive growth performance provides a reason for optimism [8].

3.3 Machinery and Equipment Industry

As an industry that supports the production process to produce quality products, the machinery and equipment industry must emphasize continuous innovation by utilizing the latest technology. As a result, this field necessitates a high level of knowledge and expertise to increase the value of a production process chain from a technological standpoint. According to previous research, the ability of companies in the High-Tech Industry to absorb and implement technology, also known as Absorptive Capacity and technological capability, is a critical factor in supporting company performance in the High-Tech Industry [10]. However, the current reliance on imported components is still very high in this industry.

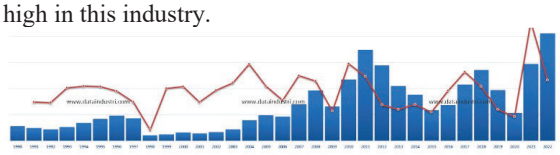

Fig. 4. Trend of heavy equipment sales data in Indonesia

Source: https://www.dataindustri.com

Bar chart = Gross industrial product of the industry

Line chart = Industry growth

Based on the figure above, it can be concluded that heavy equipment sales in Indonesia in 2022 will increase by more than 30% over sales in 2021. Moreover, heavy equipment sales performance has begun to improve since 2021. The automotive and electronics sectors and other equipment are the largest users of the machinery and equipment production industry.

3.4 Motor vehicles, Other transport equipment Industry

In 2022, the Indonesian transportation industry experienced positive growth and began to recover from the effects of the Co-19 pandemic. However, Indonesia's transportation sector faces several challenges, including

import dependence, limited government budgets, increasing infrastructure needs, optimizing integrated transportation services, raising transportation safety awareness, and developing environmentally friendly sustainable transportation to address the issue of global warming and climate change.

The transport equipment industry tends to build a national value chain because of the large opportunities opened up in the country [7]. Other studies state that the high-tech environment requires strengthening in the future to stimulate higher technological capabilities in the automotive industry in Indonesia [11]. Another distinguishing feature of the motor vehicle and other transportation equipment industries is that they serve as upstream producers, producing goods to support other industries [12].

Fig. 5. Car sales data trends in Indonesia

Source: https://www.dataindustri.com

Bar chart = Gross industrial product of the industry

Line chart = Industry growth

Based on the figure above, it can be concluded that in 2022 the vehicle industry, especially cars, showed growth of 18.1 percent compared to the same period in 2021. The increase in car sales is due to the impact of the Covid 19 pandemic, which has headed for recovery, thus making Indonesia's business and economic performance grow. However, companies and governments must still address energy needs with a sustainable energy and environment approach [13].

4 Challenges

One of the main characteristics of the high-tech industry is the heavy dependence on imports in all sectors. The challenge is how import activities can encourage technology transfer and learn from intermediate inputs containing high technology or learning from importing [14]. The second challenge is expanding the import substitution industry, which involves determining how to strengthen the domestic industry, which has previously relied on imported goods so that the supply chain is more secure and supporting industries can grow domestically. Learning from importing increases technology transfer at the same time. This learning resource reflects the company's Absorptive Capacity.
The High-Tech Industry must be directed toward achieving Sustainable Development Goals, beginning with inclusive investments, that is, investments that seek to increase profits and consider the environment and the welfare of society and workers. The future challenge will be to create a more favorable investment climate while also paying attention to industrial environmental factors. Furthermore, the government must promote a more favorable industrial climate/industrial policy and macroeconomic policies that encourage the development of a competitive industry and the establishment of a national innovation system, which will encourage companies to innovate actively.

5 Conclusion

In Indonesia, the high-tech industry is one of the mainstays of economic growth and the focal point of national development. The High-Tech Industry is made up of seven industries. It is possible to conclude that the industry relies heavily on imported components or raw materials (chemicals, pharmaceuticals, computers and electronics, electrical equipment, machinery & equipment, motor vehicles & other transport equipment). Following the pandemic, the development of the high-tech industry has begun to show positive growth. The future challenge in this industry is to increase company capabilities through internal and external learning resources [5], [15] so as to increase competitiveness in supporting Indonesia's economic growth.

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