## Industry Overview

- **A printed circuit board (PCB) is a base sheet made of an insulating material coated with copper (copper laminated), which has electrical circuit patterns created on its surface to support the connection and installation of various electronic components.** The PCB industry is of paramount importance to Thailand's economic system, as PCBs are indispensable basic components of all types of electronic devices. They serve as a foundation for developing high-value target industries, including electric vehicles, telecommunications, medical equipment, smart appliances, computers, automation systems, robotics, and aerospace technology. Moreover, the PCB industry plays a crucial role in supporting Thailand's transition towards Industry 5.0 and a new economic system driven by technology and innovation.
- **In 2023, the PCB market value is expected to decline to approximately THB 133.8 billion, contracting by 8.0%YoY due to the impact of the economic slowdown in major trading partner countries, which is in line with the global economy that continues to face several challenging factors, resulting in a decline in purchase orders.** In terms of market structure, it is found that the Thai PCB industry is a highly concentrated market, **with large players holding 99% of the total market share.** This is because the PCB industry requires advanced technology and a significant amount of investment, which is a major limitation for small players to enter the market.

**Figure 1: Thai PCB Market Value**

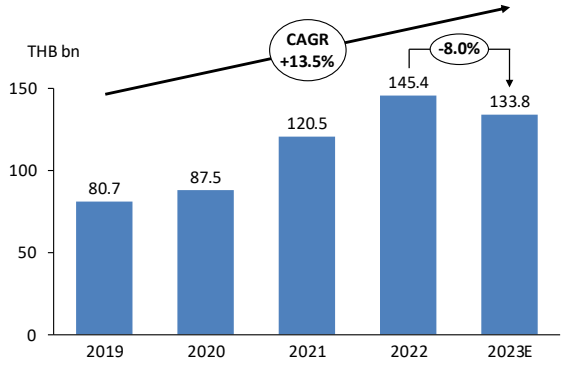
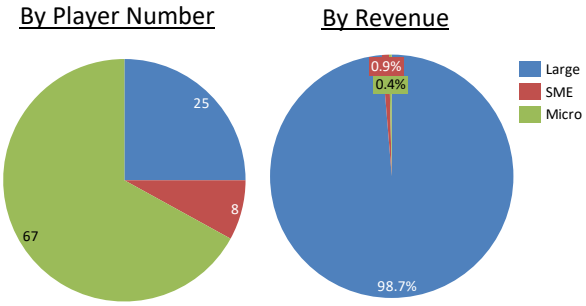



**Figure 2: PCB market share**

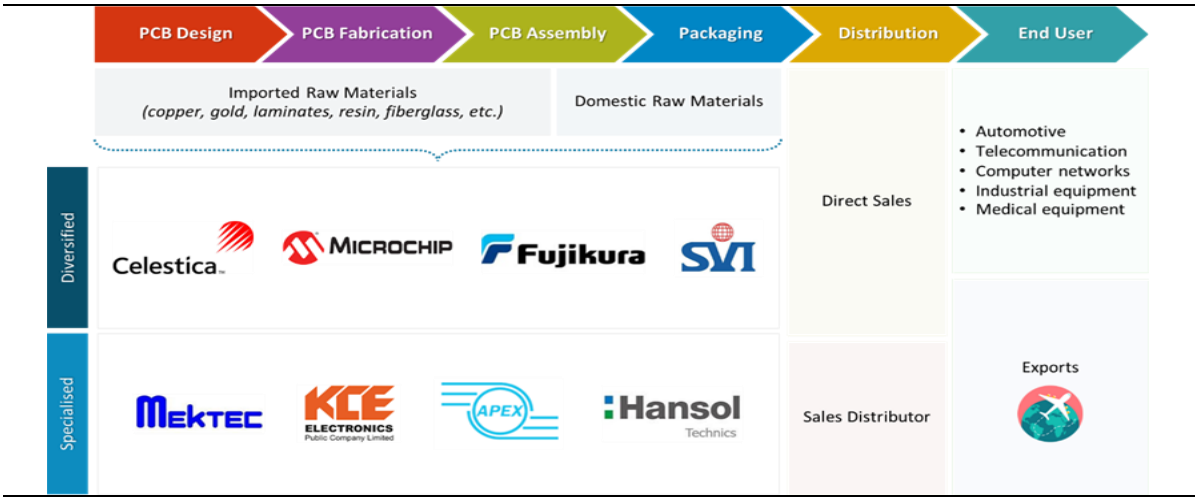



Source: LH Bank Business Research based on data from the Department of Business Development

- **The Thai PCB industry begins with the design of bare circuit boards, with the main raw materials used in this stage, such as laminate sheets, copper and gold, mostly imported from abroad.** The bare PCBs are then assembled with various electronic components, both imported and domestically produced, including integrated circuits (ICs), transistors, and diodes. The fully assembled printed circuit boards are then sold to final product manufacturers in various industries.
- **Most PCB manufacturers in Thailand provide printed circuit board assembly (PCBA) services,** which can be categorized into two main types: specialized manufacturers that focus solely on PCB production and diversified manufacturers that produce both PCBs and other electronic components at the same time. **Most of the large companies in Thailand's PCB industry are foreign-owned, mainly from countries such as Japan, Canada, the United States, Taiwan, and South Korea,** which have advantages in terms of technology and capital. However, **Thailand's PCB industry is experiencing an increasing trend of investment from Chinese and Taiwanese companies due to geopolitical tensions** and the need to improve production efficiency.

- **PCBs can be classified into different types based on their physical characteristics and applications. They can be categorized into two main types according to the rigidity and flexibility of the circuit board: rigid PCBs, which are built on a solid base that cannot be bent, and flexible PCBs, which are pliable and can be bent, twisted, and folded.** Rigid PCBs are suitable for use in large, stable products such as televisions and computers, while flexible PCBs are ideal for devices that require high flexibility, such as smartphones and wearables. Furthermore, **PCBs can be classified into three types based on the complexity of the PCB structure: 1) single-sided PCBs, which have a conductive material on only one side; 2) double-sided PCBs, which have conductive materials on both sides; and 3) multilayer PCBs, which consist of three or more layers laminated together. As the number of layers increases, the complexity of the PCB and its ability to support the operation of high-performance devices also increases.** Multilayer PCBs are commonly used in products that require extensive data processing, such as smart phones and GPS systems. Single-sided PCBs, on the other hand, are often used in less complex products such as cameras, audio equipment and calculators, while double-sided PCBs are suitable for products that require a moderate level of complexity, such as vending machines, telephone systems and industrial control systems.

**Figure 3: Thai PCB Industry Supply Chain**




Source: LH Bank Business Research based on data from Uzabase

- **Thailand is one of the largest PCB exporters of the world. In 2023, Thailand ranked eighth globally and third in ASEAN in terms of PCB export value, accounting for about 2.5% of the total global PCB export value.** However, compared to its competitors in ASEAN, Thailand's competitiveness in PCB production has been declining since 2019, while the competitiveness of Malaysia and Vietnam has been increasing. This is reflected in Thailand's export ranking, which has fallen from seventh to eighth, while Malaysia and Vietnam's export rankings have risen to sixth and seventh, respectively. These changes are consistent with Thailand's declining Revealed Comparative Advantage Index (RCA)[1][2], while Malaysia's and Vietnam's RCA indices have increased. In particular, Vietnam has always been disadvantaged in

[1] The Revealed Comparative Advantage (RCA) index is an indicator of a country's comparative advantage in exporting a particular product compared to the share of global exports of that product. An RCA value greater than 1 implies that the country has a higher advantage in exporting that product than the world average. Moreover, the higher the RCA value, the greater the country's advantage in exporting that particular product.

[2] LH Bank business research calculated using import-export data from the Trade Map database

PCB exports, but in 2022, its RCA index exceeded 1, indicating a comparative advantage in exporting this product. This shift is the result of the continued expansion of investment by foreign companies with production bases in Vietnam, especially Samsung Electronics, which has played a significant role in the rapid upgrading of Vietnam's PCB industry.

**Table 1: Top 10 PCB Exporting Countries (Value)**

| Ranking | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| 1 | China | China | China | China | China |
| 2 | Hong Kong | Hong Kong | Hong Kong | Hong Kong | Hong Kong |
| 3 | Taiwan | Taiwan | Taiwan | Taiwan | Taiwan |
| 4 | Korea | Korea | Korea | Korea | Korea |
| 5 | Japan | Japan | Japan | Japan | Japan |
| 6 | USA | Thailand | Thailand | Malaysia | Malaysia |
| 7 | Thailand | USA | Viet Nam | Viet Nam | Viet Nam |
| 8 | Germany | Viet Nam | Germany | Thailand | Thailand |
| 9 | Malaysia | Germany | USA | USA | Germany |
| 10 | Viet Nam | Malaysia | Malaysia | Germany | USA |

**Table 2: RCA Index of PCB Exporter Country**

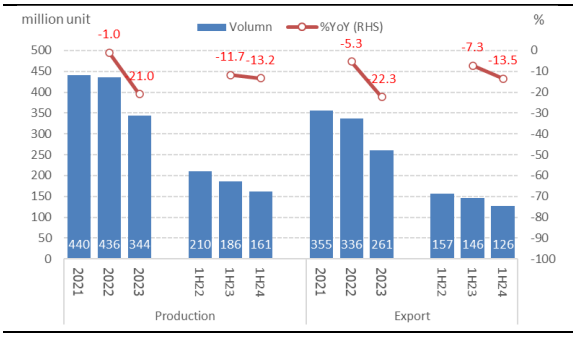
| Country | 2018 | 2019 | 2020 | 2021 | 2022 | Trend |
|---|---|---|---|---|---|---|
| China | 1.14 | 1.16 | 1.15 | 1.24 | 1.18 | |
| Hong Kong | 2.11 | 2.00 | 1.87 | 1.80 | 1.78 | |
| Taiwan | 2.42 | 2.27 | 2.11 | 1.91 | 1.86 | |
| Korea | 1.63 | 1.98 | 2.05 | 1.84 | 1.90 | |
| Japan | 1.66 | 1.65 | 1.75 | 1.58 | 1.82 | |
| Malaysia | 0.81 | 0.81 | 0.51 | 0.48 | 0.78 | |
| Viet Nam | 0.56 | 0.73 | 0.68 | 0.74 | 1.31 | |
| Thailand | 1.48 | 1.40 | 1.57 | 1.62 | 1.42 | |
| Germany | 0.41 | 0.41 | 0.41 | 0.41 | 0.42 | |
| USA | 0.45 | 0.40 | 0.41 | 0.35 | 0.38 | |

Source: LH Bank Business Research based on data from Trade Map

- **According to data from the Office of Industrial Economics (OIE), Thailand produced 161 million PCBs in the first six months of 2024, down 13.2%YoY,** in line with the decline in export volume. **This is because 80% of Thailand's PCB production is for export.** The decrease in PCB export volume is mainly due to the economic slowdown of major trading partners, especially the Chinese market, which contracted by 25.8% YoY. The decline in PCB exports to China is also a result of internal factors in China, which is still affected by the real estate crisis, affecting consumer confidence and domestic investment. In addition, the ongoing trade war between China and the United States has affected China's exports of electronic products to the U.S., which is one of its key markets.
- Furthermore, **the global economic slowdown remains a significant factor affecting Thailand's PCB exports, mainly due to interest rate hikes by central banks in major economies to control inflation. This has resulted in higher borrowing costs, affecting consumption and investment worldwide.** In addition, persistently high energy costs resulting from prolonged geopolitical conflicts, particularly in Ukraine and the Middle East, continue to put pressure on production and transportation costs. These factors have collectively contributed to a decline in global purchasing power, which has had a direct impact on the demand for electronic products and PCBs in the global market. **However, the expansion of the electric vehicle (EV) industry and investments in digital infrastructure may serve as positive factors supporting PCB demand in the medium to long term.**
- Despite the recent downward trend in Thailand's PCB production and export volumes, **the US-China trade war is expected to have a positive impact on Thailand's PCB industry due to the relocation of manufacturers with production bases in China.** According to a data analysis report by Speeda, **since 2021, several Taiwanese PCB manufacturers, such as Unimicron Technology, Wus Printed Circuit, Compeq Manufacturing, and Dynamic Electronics, have announced their intention to invest in Thailand, and some companies have already started building factories. Similarly, Chinese companies such as Aoshikang Technology, China Eagle Electronics Technology, Jove Enterprise, and Fuji Electronics Technology have also announced plans to expand their businesses in Thailand.** This is consistent with data from the Board of Investment (BOI), which shows that from

January 2021 to July 2024, there have been 52 approved PCB manufacturing projects with a total investment value of over THB 13,000 million. This indicates a significant increase in foreign investors' interest in Thailand's PCB industry. These investments are expected to strengthen the supply chain, upgrade production technology, and create opportunities for skills development in Thailand's electronics industry in the future.

**Figure 4: Thai PCB Production and Export (amount)**




Source: LH Bank Business Research based on data from OIE

**Table 3: Thai PCB Export Value by Country**

| Country | Value (USD mn) | | | Change (%YoY) | | Share (%) |
|---|---|---|---|---|---|---|
| | 2022 | 2023 | 1H24 | 2023 | 1H24 | |
| Japan | 187.2 | 161.3 | 88.5 | -13.8 | 8.1 | 13.9 |
| USA | 189.5 | 178.2 | 86.1 | -6.0 | -1.0 | 13.6 |
| China | 246.1 | 207.2 | 79.8 | -15.8 | -25.8 | 12.6 |
| Vietnam | 156.6 | 124.2 | 58.0 | -20.7 | -5.3 | 9.1 |
| Korea | 66.3 | 81.4 | 40.4 | 22.8 | -2.2 | 6.4 |
| Others | 631.6 | 563.5 | 282.6 | -10.8 | -0.1 | 44.5 |
| **Toal** | **1,477.3** | **1,315.9** | **635.5** | **-10.9** | **-4.0** | **100.0** |

Source: Ministry of Commerce

## Government Policy Support

- **The Board of Investment (BOI) has introduced measures to promote investment in semiconductor and related industries.** The key components of these measures are: 1) tax incentives (corporate income tax exemption), 2) land ownership rights, and 3) support for workforce skills development. **Investments in the upstream semiconductor industry, including electronics design, silicon wafer production and wafer fabrication (wafer FAB), will be granted corporate income tax exemption for a period of 10 years. Investments in the downstream semiconductor industry, including printed circuit board (PCB) manufacturing and printed circuit board assembly (PCBA), are granted an income tax exemption for a period of 5-8 years, depending on the amount of investment in machinery.** In addition, the BOI has introduced measures to encourage research and development. Companies that invest at least 1% of their total sales in research and development within the first three years, or a minimum of THB 200 million, are eligible for additional incentives in the form of an additional corporate income tax exemption for up to 5 years. These measures aim to attract investment in the semiconductor and related industries and to promote research and development in Thailand. This will lead to the enhancement of technological capabilities and value addition in the country's electronics industry.

- **In the first six months of 2024, the electrical and electronics industry received the highest investment promotion approvals among the targeted industries in terms of both the number of projects and investment value.** The Board of Investment (BOI) approved a total of 181 investment promotion projects (+85% YoY), representing an investment value of THB 140 billion (+30%YoY).

Table 4: BOI's investment promotion measures in the semiconductor and related industries

| Tax incentives | Semiconductor | | Advanced Printed Circuit Board (PCB) | Printed Circuit Board Assembly (PCBA) |
|---|---|---|---|---|
| | Front-end | Back-end | | |
| Products | Electronics design, Silicon Wafers, Wafer FAB | Wafer SORT, Assembly, Die Bank, IC Testing | PCB FAB, FA lab, SMT, PTH, PCBA Test | Box build, Product Test, Pack/Ship |
| Corporate Income Tax Exemption on machinery investment | 10 Years | 5-8 Years<br>8 years if machinery investment of at least 1.5 billion baht<br>5 years if machinery investment of less than 1.5 billion baht | 5-8 Years<br>8 years if machinery investment of at least 1.5 billion baht<br>5 years if machinery investment of less than 1.5 billion baht | 5-8 Years<br>8 years if machinery investment of at least 500 million baht<br>5 years if machinery investment of less than 500 million baht |
| Corporate Income Tax Exemption on R&D investment | Additional corporate income tax exemption up to 5 years (depends on the amount of R&D investment) | | | |

Source: Board of Investment (BOI)

## Industry Outlook

- **In 2024, Thailand's PCB industry experienced a decline in production and export volumes in the first half of the year. This was due to the slowdown in the global economy and the economies of major trading partners such as China and the US. In addition, Thailand's competitiveness decreased compared to rival countries such as Vietnam and Malaysia,** which have advantages in labor costs and more advanced production technologies. These factors led to a reduction in orders and higher production costs, particularly for electricity and imported raw materials. **However, signs of recovery are expected to emerge in the second half of the year as the domestic electric vehicle (EV) industry begins production, supporting an increase in PCB demand. Furthermore, the impact of foreign PCB manufacturers relocating their production bases to Thailand is starting to take effect.**

- **In the year 2025, Thailand's PCB industry is expected to start recovering and show an upward growth trend. This is due to the improving recovery of the global economy and international trade volume, coupled with the increasing global demand for electronic devices to be used in the development and transition of infrastructure to support the Internet of Things (IoT) technology,** which is a current trend in global development. In addition, **the domestic EV and smart electronics industries are expected to continue their positive growth trajectory, resulting in increased demand for PCBs. Furthermore, investments from foreign PCB manufacturers relocating their production bases to Thailand due to trade war issues will start to have a significant impact,** which will enhance the potential of Thailand's PCB industry in terms of both production and exports. However, there are still risk factors that require caution, such as intense competition from rival countries, especially Vietnam, which has rapidly increased its competitiveness; issues related to the development of production technology and workforce skills to keep pace with market demands; geopolitical conflicts that may cause volatility in raw material costs; and the demand for consumer electronics devices, which may slow down due to increased memory capacity and durability.

- **Looking ahead, other risk factors for the PCB industry include the slowing trend of vehicle sales both in Thailand and globally,** which will affect the demand for PCBs in the automotive industry, one of the major industries using PCBs. This will significantly affect manufacturers with a high proportion of revenue from the automotive industry. **Raw material shortages may occur if the trade war between the US and China intensifies and disrupts the global**

**supply chain.** This will affect Thailand's PCB production as the country relies mainly on imported raw materials, especially from China. **The appreciation of the Thai baht due to the slowdown in the US economy** may lead the Federal Reserve to cut interest rates more than expected. Although a stronger currency benefits raw material imports, it also makes exported products more expensive when converted into other currencies, which may lead to a reduction in foreign orders. **The increase in the minimum wage will raise production costs for PCB manufacturers in Thailand,** affecting their price competitiveness against foreign competitors, particularly Vietnam. **Factory closures due to structural problems in Thailand's manufacturing sector, especially factories producing downstream products that use PCB components as key raw materials,** such as automotive assembly plants, smartphone factories, or other electronic device manufacturers, will directly impact domestic demand for PCBs and cause a significant decline.

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