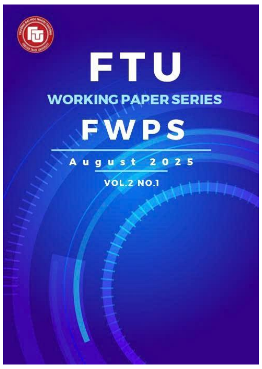

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ẢNH HƯỞNG TỪ CÁC CHÍNH SÁCH CỦA DONALD TRUMP ĐỐI VỚI CHUỖI CUNG ỨNG BÁN DẪN TOÀN CẦU: ĐỀ XUẤT NHẰM NÂNG CAO SỰ THAM GIA CỦA VIỆT NAM

CỦA VIỆT NAM

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Tóm tắt

Chuỗi cung ứng chất bán dẫn toàn cầu đang chịu tác động mạnh từ các chính sách thương mại dưới thời Donald Trump, bao gồm chính sách thuế quan linh kiện và áp thuế lên chip sản xuất tại Đài Loan. Nghiên cứu này tập trung phân tích những tác động của các chính sách trên lên chuỗi cung ứng bán dẫn toàn cầu và đánh giá tiềm năng của Việt Nam trong ngành. Bằng phương pháp nghiên cứu định tính, nghiên cứu đã làm rõ tác động của những chính sách này, bao gồm sự đứt gãy và dịch chuyển chuỗi cung ứng toàn cầu cũng như leo thang căng thẳng địa chính trị giữa các nước liên quan. Từ đó, nghiên cứu đề xuất các giải pháp chiến lược nhằm nâng cao vị thế Việt Nam trong ngành công nghiệp bán dẫn toàn cầu đặc biệt trong việc củng cố vai trò là trung tâm OSAT (lắp ráp, đóng gói và kiểm định) và mở rộng sản xuất để tham gia sâu hơn vào chuỗi cung ứng bán dẫn.

Từ khóa: chuỗi cung ứng bán dẫn toàn cầu, chính sách của Donald Trump, ngành bán dẫn Việt Nam sản xuất chip, sản xuất chip, thuế quan

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THE INFLUENCE OF DONALD TRUMP'S POLICIES ON THE GLOBAL SEMICONDUCTOR SUPPLY CHAIN: RECOMMENDATIONS FOR ENHANCING VIETNAM'S PARTICIPATION

Abstract

The global semiconductor supply chain has faced repercussions due to Donald Trump's trade policies, including component tariff policy and tariff on Taiwanese-made chips. This study aims to analyze the effect of Donald Trump policies on the global semiconductor supply chain and evaluates the potential of Vietnam's participation in this industry. By using qualitative research methods, the paper has unpacked the influences of these measures, including the disruption and restructure of the global supply chain and intense economics and geopolitical tensions among the stakeholders. Thereby, the research proposes some

recommendations to strengthen Vietnam's position in the global semiconductor supply chain, especially enhancing its position as an OSAT (assembly, packaging, and testing) hub while also developing manufacturing facilities to build a more integrated supply chain.

Keywords: chip manufacturing, Donald Trump's policies, global semiconductor supply chain, tariffs, Vietnam semiconductor industry

1. Introduction

In recent years, there is no denying that the global semiconductor supply chain is a critical component of modern economies, which enables developments in a wide range of industries from consumer electronics to automotive manufacturing. However, this supply chain is currently vulnerable to face significant disruptions due to geopolitical tensions, technological advancements, and policy changes—particularly those introduced by Donald Trump. His administration's trade policies, including tariffs on semiconductor components, restrictions on Taiwanese-made chips áre forecasted to reshape global supply chain dynamics, hence, significantly facilitate both challenges and opportunities for countries who seek to expand their role in this vital industry, like Vietnam. Currently, Vietnam has become a promising destination in the global semiconductor supply chain. With our strategic location, competitive labor costs, and a growing number of manufacturing sectors, Vietnam has attracted a great deal of investments from leading technology companies such as Intel, Samsung, and Amkor. The country has also currently emerged as a key player in semiconductor assembly, testing, and packaging which importantly contributes to its economic growth and technological development. Nevertheless, Vietnam's semiconductor industry still faces challenges in terms of technological capacity, skilled workforce, and infrastructure, which limit its ability to move up the value chain into more advanced stages of semiconductor production. With ongoing global changes and supply chain disruptions, Vietnam needs to find ways to seize emerging opportunities and address existing challenges to strengthen its position in the global semiconductor market. This report will analyze the current global semiconductor supply chain, Donald Trump policies's impacts on it, and implications for Vietnam's semiconductor industry to enhance our participation in the global semiconductor supply chain.

2. Theoretical base

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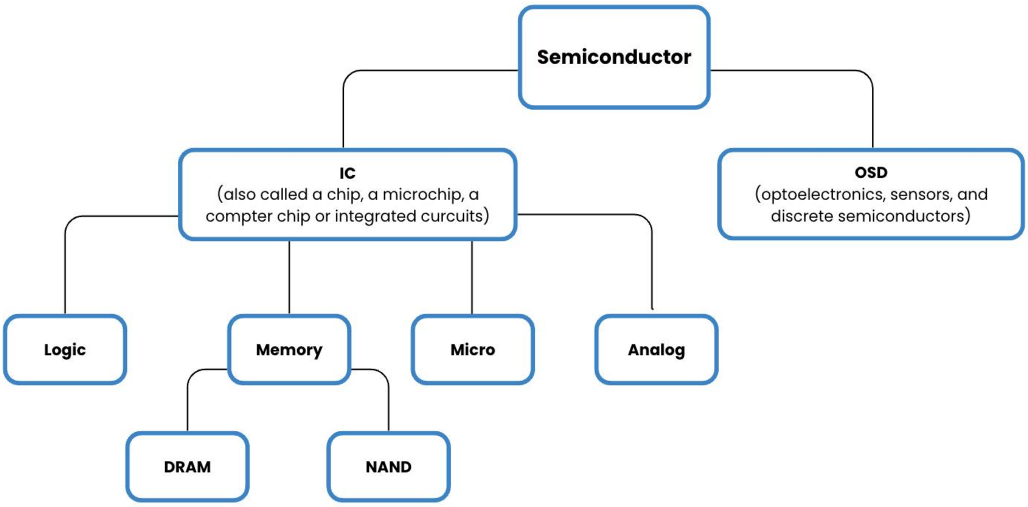
2.1. Semiconductor and its value chain

2.1.1. Definition of Semiconductor

Semiconductors, also referred to as "integrated circuits" or "computer chips," are the brains of electronic equipment which are able to store data, execute logical operations enabling modern devices such as smartphones, computers, and servers to perform efficiently. Electronic devices typically contain multiple semiconductors set up within circuit boards, each designed for specific tasks, including central processing units (CPUs), memory storage, graphics rendering, audio processing, and power management.

Figure 1: *Semiconductor categories*



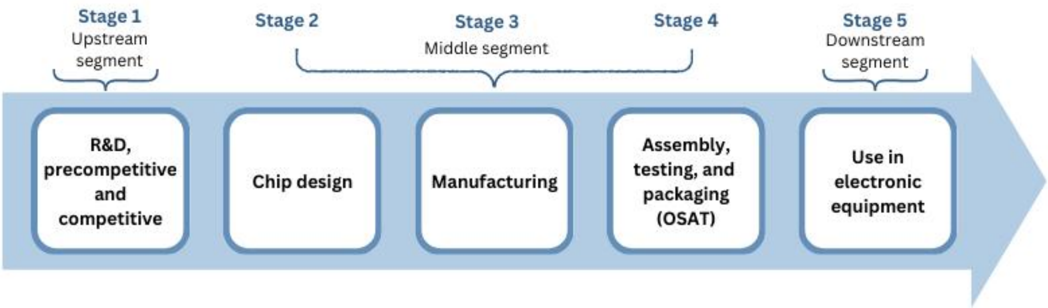
Source: Author's compilation

The semiconductor industry categorizes its products into two main types: (i) integrated circuits (ICs) and (ii) optoelectronics, sensors, and discrete semiconductors (OSD). The OSD segment accounts for less than 20% of the total semiconductor market, primarily serving light-based applications such as LED lighting, solar panels, and cameras. Integrated circuits represent the largest and most advanced segment of the semiconductor market. They typically are divided into four main types: logic devices, memory chips, micro and analog components, with logic devices holding the greatest economic significance. Despite differences in complexity and function, products in all four categories have short life cycles, often lasting only a few months, as manufacturers try to keep up with rapid technological advancements and consumers' growing expectations for faster, more reliable products.

2.1.2. Semiconductor value chain

The semiconductor value chain is complex and operates on a global scale, as producers have to depend on extensive networks of suppliers and contractors to perform specialised tasks at various stages. This leads to the reliance of the semiconductor industry on the free cross-border flow of parts, machines, services, knowledge, and talent which makes this industry even more vulnerable to supply chain disruptions. The semiconductor value chain is particularly divided into three broad segments, including distinct stages and processes.

***Figure 2:** Semiconductor value chain*



Source: Author’s compilation

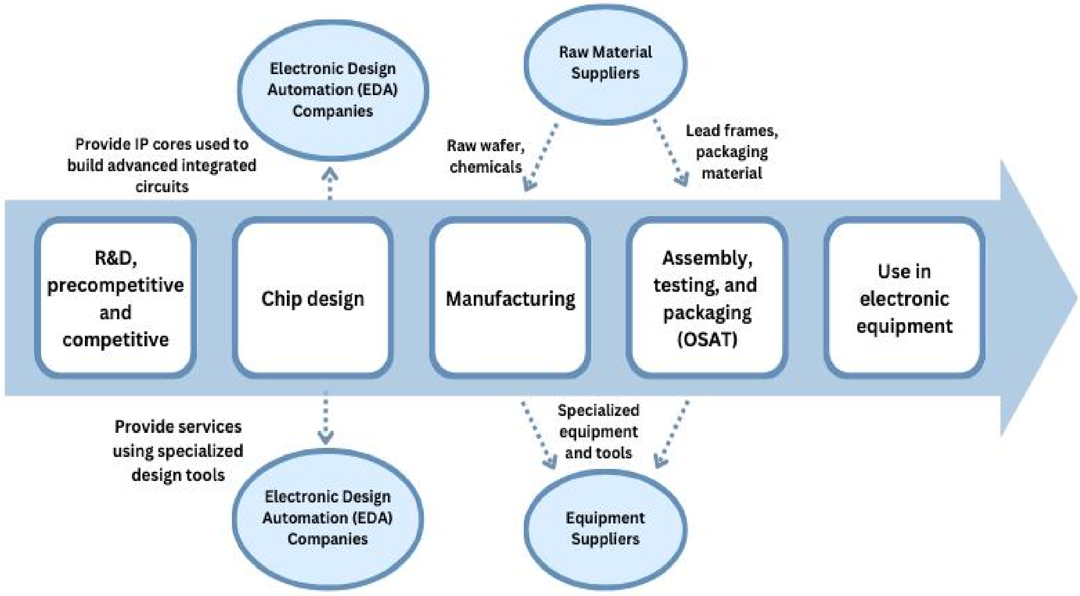
- *Upstream segment (Research and Development):*

This is the initial stage of the semiconductor value chain when private companies, academic institutions, and government agencies are invested in research and development of chips, new components, modern technologies—often through collaborative efforts—to generate foundational knowledge that businesses use to drive innovation and maintain competitive advantages. During this stage, it is crucial for firms to constantly seek solutions to increase the processing capability or the speed of semiconductor devices while reducing their cost. McKinsey referred to R&D as the "lifeblood of the semiconductor industry”, highlighting that the sector's R&D expenditure accounted for 16% in 2021 of total company revenue (IC insights) and is even expected to noticeably increase to nearly 20% in some following years.

- *Middle segment (production process)*

This stage is also known as the production process for semiconductors which follows a multi-step process: (i) designing of chips; (ii) fabricating them in specialized facilities known as "foundries" or "fabs”; (iii) assembling, testing, and packaging the finished chips.

***Figure 3:** Semiconductor value chain resources*



Source: Author's compilation

(i) The semiconductor production process begins with the design phase which relies heavily on expertise and knowledge. Therefore, skilled talent and intangible assets play a key role, supported by upstream research, pre-designed intellectual property (IP) cores and specialized software, known as Electronic Design Automation (EDA). During this phase, engineers use computer-aided design software to draw a detailed map of the numerous electronic components that make up an integrated circuit (ICs). It results in a code file, typically formatted in GDSII, which includes all the technical specifications manufacturers require to produce a semiconductor.

(ii) Semiconductor production requires a code file with product specifications and a steady supply of materials, primarily high-purity silicon wafers. Silicon is extracted from raw quartz, purified, molded into ingots, and sliced into ultra-thin wafers before undergoing cleaning, polishing, and oxidation.

Photolithography is a process that uses ultraviolet light to print and etch circuits directly onto the surface of a silicon wafer. This process begins with the creation of a "photomask" fabricated based on the code file from the design stage which allows light to pass through specific areas, imprinting circuit patterns onto the wafer that forms the semiconductor. A reducer lens is also used to minimize these patterns. This process also involves various chemicals and gases that manufacturers use to adjust the wafer's light sensitivity and improve its electrical properties, a technique known as "doping."

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(iii) After fabrication, semiconductor chips are cut and separated from their wafers. Each chip then undergoes packaging and a final round of testing before being used in electronic devices. During the packaging process, manufacturers typically encase individual chips in protective lead frames and an outer resin shell. Following packaging, chips are subjected to additional testing to verify their functionality and ensure they are ready for integration into electronic equipment.

- *Downstream segment (Distributing)*

Once semiconductor devices have been assembled and tested, companies distribute the packaged semiconductors for integration into electronic devices such as smartphones and servers. Demand for these devices directly influences the derived demand for semiconductors, shaping production volumes and market dynamics. Key players at this stage include semiconductor manufacturers such as Intel, Samsung, and TSMC, as well as distributors like Arrow Electronics and Avnet, and sales companies such as Jabil and Flex.

2.2. Overview of the global semiconductor supply chain

2.2.1. Definition

The supply chain in the semiconductor industry includes all activities related to the production, processing, distribution and consumption of semiconductor products. This is a complex system that includes many steps from extracting the necessary raw materials, manufacturing semiconductor components, to assembling and testing the final product before it goes to market.

2.2.2. The Foundation of the global semiconductor supply chain

The chip manufacturing industry, like many others, initially relied on a centralized production model, with chips fabricated entirely within a single facility. This paradigm shifted in 1961 when Fairchild Semiconductor, founded in 1957 and based in San Jose, relocated its assembly and testing processes to Hong Kong to leverage lower labor costs. This trend of supply chain fragmentation accelerated as chip complexity increased and the industry's scale expanded. Consequently, numerous manufacturing processes were outsourced to specialized contract firms, resulting in a diverse landscape of supply chain configurations.

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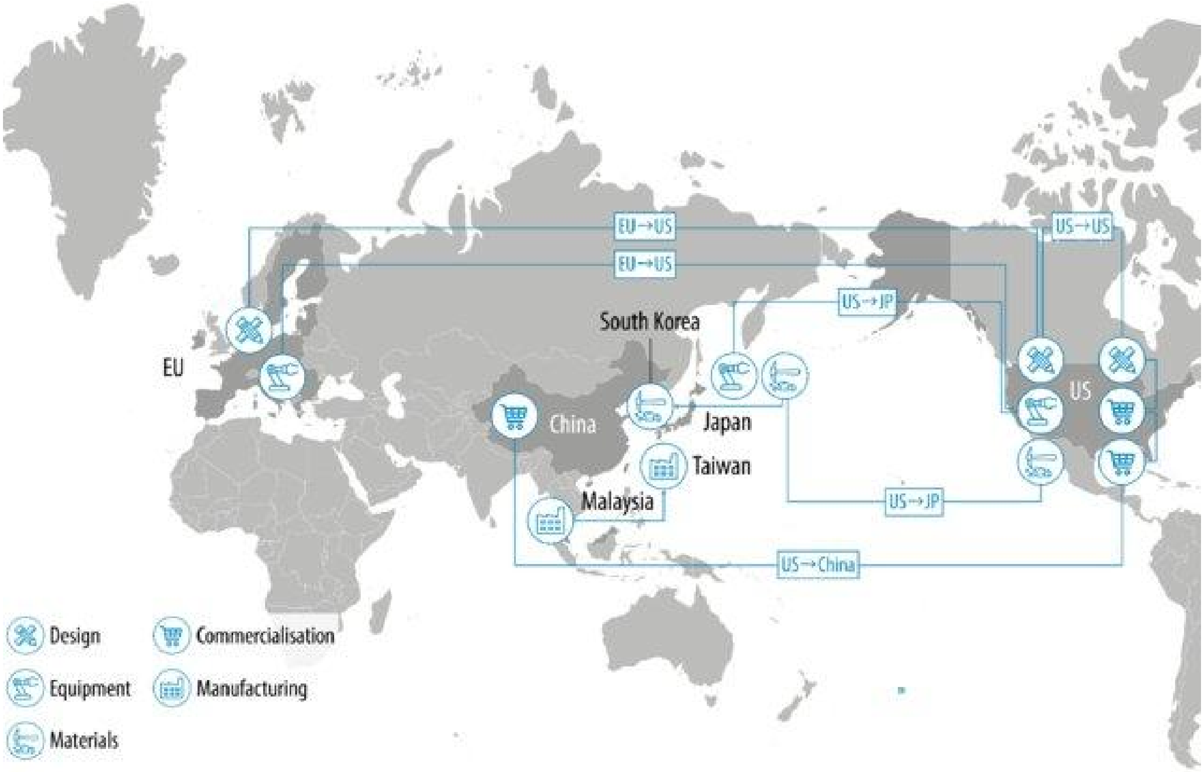
Figure 4: *Global Semiconductor Semiconductor Supply Chain Flow*



Source: Kjeld van Wieringen

2.2.3. Characteristics of semiconductor supply chain

Several characteristics of the products and the manufacturing process directly impact the structure of semiconductor supply chains and the problems arising in managing them.

- *Strong economies of scale*

Semiconductor supply chains benefit from significant economies of scale due to the capital-intensive nature of production facilities. The integration of various subsystems in manufacturing involves complex processes, often not well understood, leading to high development costs and increased operational uncertainty.

Wafer fabrication requires expensive cleanroom environments and strict environmental monitoring due to toxic substances. Early production processes were mostly manual and low-cost, but the growing complexity of devices now requires advanced testing equipment, raising capital requirements. Additionally, the technological intricacies of products and processes necessitate a skilled workforce of engineers, technicians, and scientists, resulting in substantial fixed costs, particularly during industry downturns.

- *Pervasive Uncertainty in the Supply Chain*

A critical factor in semiconductor manufacturing is yield, the percentage of raw materials that complete all manufacturing stages as saleable devices. Yield can vary significantly over time, across facilities, and different technologies. Despite industry advancements in increasing yields, the complexity of production processes and incomplete scientific understanding remain concerns. The industry also faces significant business cycles, with shipment growth fluctuating between 70% and -40% from 1958 to 2007.

- *Short Product Life Cycles*

Yield uncertainty peaks during the introduction of new products or processes into high-volume production. Even with well-understood unit processes, new product complexity can lead to poor yields. New manufacturing processes raise risks for all devices produced. However, continuous product and process innovation is essential for long-term competitiveness, as new products enhance functionality or reduce costs. Intel's 'tick-tock' approach mitigates risks by ensuring product and process introductions do not coincide. This need for constant innovation results in short product life cycles, limiting time for debugging and yield improvement.

- *Global Nature*

The semiconductor industry has had a global presence since its early days. The search for low-cost manufacturing led many European and US firms to establish facilities in regions like South Asia and Eastern Europe in the 1970s. Governments view this industry as vital for national economies, providing support in countries like Japan, South Korea, Taiwan, and more recently, China. Consequently, semiconductor supply chains often span multiple continents, facing varied tax laws, import controls, and local regulations.

2.2.4. Current situation of global semiconductor supply chain

- *Global Semiconductor Market Trends and the Push for Domestic Production*

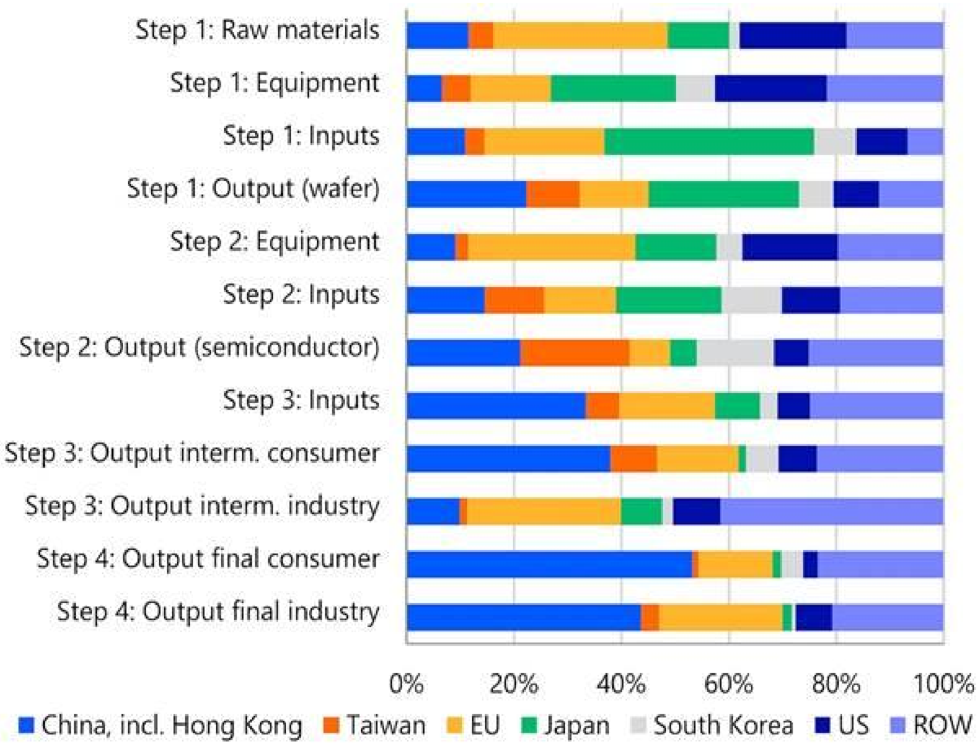
According to Gartner, global semiconductor revenue is projected to reach $626 billion in 2024, an 18.1% increase from 2023, with 80% of chips produced in East Asian countries. This concentration exposed supply chain vulnerabilities, prompting the U.S. and Europe to invest over $100 billion in domestic production. The U.S. aims to produce 30% of chips by 2030, while the EU targets 20%, but decentralization may reduce labor efficiency and require significant ATP workforce expansion.

- *Different Regions Dominate Different Parts of the Global Supply Chain*

The semiconductor supply chain is complex and stretches across the world. No region can produce all types of critical semiconductor components. Instead, the semiconductor value chain has emerged through close collaboration across regions. IDM models are becoming fewer and fewer and shifting to specializing in each stage because of increasing complexity and high resource needs including capital and skilled labor in the production process.

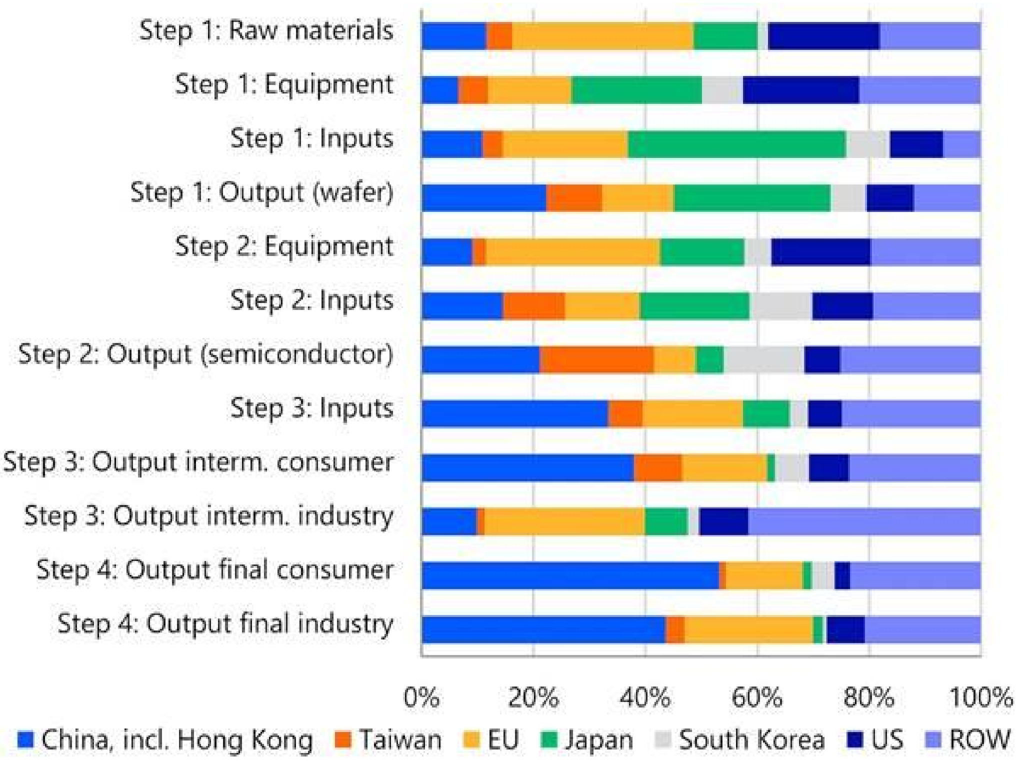
These figures show how the exports and imports per step are divided among various regions or countries. In general, we find that the EU, Japan, and the US are more involved in the upstream segments of the supply chain. Taiwan and South Korea are in the middle segment of the supply chain, and China is in the downstream segment.

***Figure 5**: Shares of exported goods in the semiconductor global supply chain*



Source: BACI (2021), RaboResearch

***Figure 6:** Shares of imported goods in the semiconductor global supply chain*



Source: BACI (2021), RaboResearch

Overall, the U.S. semiconductor industry holds 50% of the global market share, driven by dominance in high-value segments like EDA, core IP, and chip design. It captures over 40% of the global EDA, core IP, and design market, followed by South Korea at 20%. Major U.S. firms such as Cadence, Synopsys, and Intel lead in EDA and core IP, reinforcing the country's competitive edge. Additionally, the U.S. holds the largest share of the semiconductor manufacturing equipment (SME) market.

- *Taiwan is the world's leader in terms of semiconductor fabrication and ATP.*

Although fabs are scattered in some regions namely US, China, Taiwan, South Korea, Japan, and Southeast Asia, over 60% of the global fabrication comes from Taiwan. This is largely due to the work of Semiconductor Manufacturing Co. (TSMC) which singlehandedly manufactured roughly 59% of the world's semiconductors as of 3Q23. Unlike semiconductor manufacturers such as Samsung or Intel, which produce semiconductors for use in their own products, TSMC manufactures semiconductors for many other companies, including Apple, AMD, Nvidia, and Qualcomm.

For supply, Taiwan captured the largest slice of the materials market while the US, Japan, and the Netherlands dominate the supply of SME Materials such as minerals (rare earth elements, germanium, gallium, copper) silicon wafers, photomasks, and photoresists, along with wet chemicals (acetic acid, phosphoric acid, sulfuric acid) are necessary inputs across the semiconductor manufacturing process. The market for materials is concentrated in Taiwan, China, South Korea, and Japan. Taiwan captured the largest slice with a quarter of the global materials market share. As of 2021, US firms alone occupied more than 40% of the global SME market share, followed by Japanese companies at 29%. Together with the Netherlands, the three countries dominate the supply of the SME market. However, the production of the lithography equipment is concentrated in the Netherlands and Japan, with Dutch firm ASML the only firm in the world that produces EUV lithography machines necessary to manufacture advanced chips less than 7nm.

3. The impact of Donald Trump’s policy on the global semiconductor supply chain

3.1. Components Tariff Policy

As mentioned earlier, tariffs on chips were previously imposed considering the location of finishing the product, or the place of assembling components of the chips in other words. Such policy, however, was not enough to achieve the goal of defending chip manufacturers in the US, especially when most of the chip components are made in China. Components Tariff

Policy, in contrast, has changed the target of the tax from the place where chips are completed to the origin of what is inside them. This policy is equivalent to the fact that imported chip components made in China or countries specifying in producing chips will be subject to high tariffs, regardless of where the product is subsequently assembled.

The essence of this Components Tariff Policy is to reduce the dependence on other countries, especially China to manufacture chips, and to promote the production of components in the US. Besides, under the implementation of this policy, technological enterprises may switch their factories to other potential countries in Southeast Asia, namely Vietnam, Indonesia or Singapore to avoid the high tax. President Trump believes that, instead of providing huge subsidies for chip enterprises, tariff policies would be more effective and could be a game changer in promoting domestic chip production

3.2. Tariffs on Taiwanese - made chips

Taiwan is a significant player in the semiconductor checkerboard, especially TSMC (Taiwan Semiconductor Manufacturing Company), the dominant company in the production of semiconductor chips. To specify, Taiwanese chip companies produce about 60 percent of the world's chips, but more than 90 percent of leading-edge chips, including Nvidia's data center GPUs. Most of the US chips are also made in Taiwan. The US President, despite his latest announcement of a 25 percent tariff, still wanted to restore US semiconductor chip production from Taiwan by proposing to increase tariffs levied on semiconductors made in Taiwan up to 100 percent.

This policy, like the Component Tariff Policy, also aims at reducing dependence on the only supply, and also driving Taiwanese semiconductor and electronics firms back to America as well. He believed that the supply of money for chip production businesses like the former President Joe Biden did in his presidency is not as feasible as giving them an incentive to build factories with their own money in the US, of course, not having to pay an exorbitant amount of tax.

3.3. Effects on the global semiconductor supply chain

3.3.1. Global semiconductor market split: U.S. and allies vs. China

The U.S. restrictions on the export of advanced semiconductors have led to a deepening polarization in the global semiconductor industry, dividing the market into two distinct ecosystems. The U.S. and its allies, including Taiwan, Japan, South Korea, and Europe, have imposed strict control measures, preventing companies such as TSMC, Samsung, Intel, and

ASML from supplying China with cutting-edge semiconductor technology. This has forced China to accelerate investments in its domestic semiconductor industry to reduce dependence on foreign technology.

In response to these restrictions, China has launched massive investments, including the establishment of the third phase of its CICF - China Integrated Circuit Industry Investment Fund, worth approximately $47.5 billion, to boost domestic chip production and reduce reliance on foreign semiconductor suppliers. However, due to its lack of access to advanced chip manufacturing equipment from ASML and TSMC, China has focused on producing older-generation chips to ensure supply for critical industries.

As tensions between the U.S. and China escalate, Japan, South Korea, and Europe have also implemented strategic policies to secure their positions in the global semiconductor supply chain. Japan, a key player in the semiconductor materials sector, has tightened export controls on fluorinated polyimide, photoresists, and hydrogen fluoride—critical materials needed for semiconductor production. This move aligns with U.S. efforts to curb China's access to advanced technology while reinforcing Japan’s dominance in high-tech materials. Additionally, Japan has committed to increasing semiconductor investments, including partnerships with U.S. firms to establish next-generation chip production facilities.

Meanwhile, South Korea, home to leading semiconductor giants Samsung and SK Hynix, has walked a delicate line between the U.S. and China. While complying with U.S. export restrictions, South Korea has secured waivers that allow its chipmakers to continue supplying certain products to Chinese factories to protect its market share. Simultaneously, the South Korean government has introduced tax incentives and subsidies under its K-Chip Act to strengthen its domestic semiconductor industry and reduce dependency on Chinese markets.

In Europe, the European Union has launched the European Chips Act, aiming to mobilize €43 billion ($47 billion) in public and private investments to double its global market share in semiconductor production by 2030. ASML, the Dutch leader in extreme ultraviolet (EUV) lithography machines, has restricted shipments of its most advanced technology to China, in compliance with U.S. policies, further limiting China’s access to leading-edge chip manufacturing. European nations are also pushing for increased chip production within the EU to mitigate risks of supply chain disruptions caused by geopolitical tensions.

As a result of these actions, two separate semiconductor ecosystems have emerged: one in which the U.S. and its allies dominate high-end semiconductor technology, and another where China develops an independent supply chain, albeit with less advanced capabilities.

This polarization is expected to escalate geopolitical tensions, particularly as China continues to push for the reunification of Taiwan, home to TSMC—the world's leading semiconductor manufacturer. Moreover, Japan, South Korea, and Europe's efforts to diversify supply chains and strengthen domestic semiconductor industries indicate a long-term shift toward greater regional self-sufficiency and reduced reliance on China, further solidifying the global divide in semiconductor technology.

3.3.2. Higher production costs and supply chain disruptions

The U.S. tariffs on imported chips from Taiwan, coupled with escalating tensions in the Chip War with China, have significantly increased production costs and disrupted the global semiconductor supply chain. TSMC's decision to build a chip fabrication plant in Arizona—part of a broader strategy to reduce dependence on Taiwan—has resulted in over 30% higher production costs compared to manufacturing in Asia due to higher labor and operational costs in the U.S. The increase in costs directly impacts major U.S. technology companies such as Apple, Nvidia, and Qualcomm, which are key customers of TSMC. As chip production costs rise, these companies face higher expenses per chip, ultimately leading to increased product prices. For example, according to reports, some high-end AI chips from Nvidia can cost up to $25,000 per chip, creating a significant financial burden for companies looking to invest in AI.

Furthermore, China has retaliated against U.S. export restrictions by limiting exports of gallium and germanium, two critical raw materials used in semiconductor production. This move has particularly affected companies in Europe, Japan, and South Korea, compelling them to adjust their supply chains to reduce reliance on Chinese raw materials. In response, Western countries are ramping up efforts to mine and recycle these essential materials to ensure a stable supply.

Japan has expressed deep concerns over China's latest export restrictions. These restrictions not only affect domestic supply but also impact Japanese companies exporting to the U.S., as they must comply with reporting requirements imposed by the Chinese government. This move is seen as a form of "economic warfare," with the potential to disrupt the global supply chain. Previously, Japan experienced an 85% decline in gallium imports from China following earlier restrictions, and the situation has worsened as China continues tightening control in response to new U.S. tariffs. Compliance with these regulations presents a major challenge due to difficulties in tracking the final use of these materials. This shift has led to a sharp increase in gallium prices and created instability for suppliers and manufacturers worldwide.

At the midst of the chaos, Vietnam is facing significant challenges due to rising production costs and disruptions in the global supply chain. According to reports, 90% of businesses in Vietnam were affected by high inflation in 2023, with 58% reporting increased operational costs and 57% struggling with surging raw material prices, leading to a 45% decline in profits for many businesses. Industries such as real estate, restaurant services, and technical manufacturing have been hit the hardest.

Supply chain disruptions, originating from the COVID-19 pandemic, the U.S.-China trade tensions, and the conflict in Ukraine, have further exacerbated the situation. Vietnam, with its open economy and heavy reliance on imported raw materials (accounting for approximately 37%), is under significant pressure as rising material costs directly impact the competitiveness of domestically produced goods.

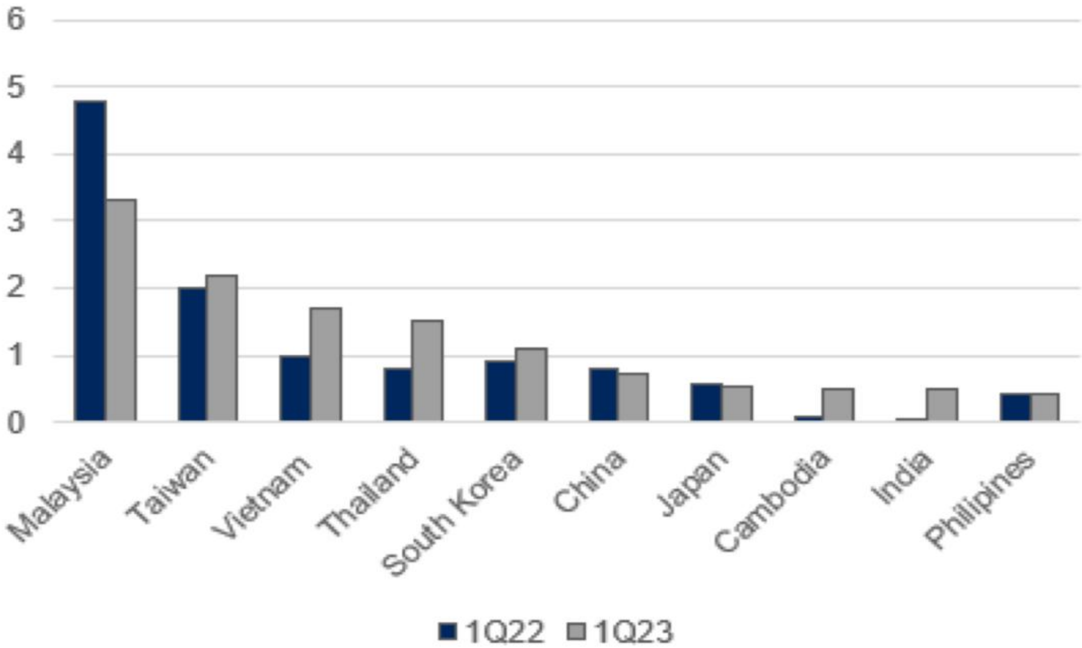
As a result of these policies, the cost of semiconductors is expected to rise significantly, driving up the prices of consumer technology products such as smartphones, AI systems, electric vehicles, and computers. Disruptions in the supply chain and increased costs could force tech companies to shift investments or seek alternative solutions, further intensifying the economic division between semiconductor-producing nations.

4. Recommendations for Vietnam to enhance its participation in the global supply chain

4.1. Current situation of Vietnam in the global semiconductor supply chain

Vietnam's semiconductor industry is experiencing significant growth, with the potential to become a key player in Southeast Asia’s semiconductor supply chain. According to Statista, revenue in Vietnam’s semiconductor market is projected to reach $21.45 billion in 2025, with an annual growth rate (CAGR 2025-2029) of 9.99%. Moreover, in the first quarter of 2023, Vietnam ranked third among Asian countries exporting chips to the U.S, responsible for 11% of US chips import value.

***Figure** 7: Asia of chip export value to the US in 1Q23 (unit US$bn)*



Source: VNDirect Research, US Census, Bloomberg

Most of Vietnam's semiconductor sector is driven by foreign enterprises. Vietnam has received a huge support from FDI, there are currently 174 registered FDI projects in the semiconductor sector, with a total investment of nearly $11.6 billion.

The local industry is primarily led by two key players: FPT Semiconductor and Viettel. These companies, while smaller than their multinational counterparts, represent the ambitions of Vietnam's homegrown technology sector.

However, Vietnam still has to face a major challenge: the shortage of a highly skilled workforce. According to the National Science and Technology Portal, Vietnam currently has around 5,000 semiconductor engineers, primarily specializing in design and testing, while the market demands around 10,000 new engineers each year. This means domestic human resources are meeting only about half of the annual demand, creating a significant talent gap.

4.2. Vietnam's participation in global semiconductor supply chain

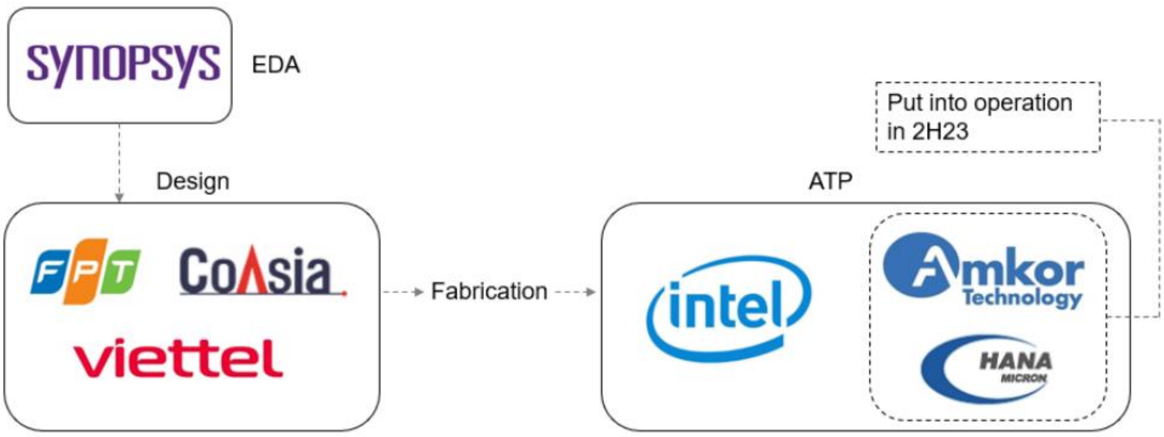
Vietnam's semiconductor industry is currently concentrated in Back-End Assembly, Packaging, and Testing (OSAT - Stage 4), while lacking domestic Manufacturing (Stage 3) foundries. Additionally, Research & Design (Stages 1 and 2) remain in the early development phase, meaning there is no fully "Made in Vietnam" chip at present.

In Stage 1 & 2 (Research & Design), in addition to prominent foreign companies like CoAsia (South Korea) and Synopsys (U.S), Viettel and FPT are two key local players. Viettel is focusing on telecommunications and defense-related semiconductors, while FPT Semiconductor has introduced "Make in Vietnam" chips for IoT and AI applications. However, these efforts are still in early stages and have yet to reach large-scale production.

In Stage 3 (Manufacturing), Vietnam currently has no wafer fabrication facilities, forcing the country to depend on foreign manufacturers in Taiwan (TSMC), South Korea (Samsung), and China for advanced chip production.

In Stage 4 (OSAT - Assembly, Packaging, and Testing), Intel, Amkor and Hana are the main key players. These firms use fabricated chips from foreign countries mainly from China, Taiwan, Korea, Japan then conduct assembly, testing and packaging in Vietnam. Chips assembled and packaged are then used in downstream electronic equipment or mainly exported to third countries, most notably the U.S., which is currently Vietnam's largest semiconductor export market.

Figure 8: *Major players in the Vietnam's semiconductor industry*



Source: VNDIRECT

4.3. Opportunities and Challenges for Vietnam Semiconductor industry under Donald Trump's policies

Donald Trump's Components Tariff Policy and Tariffs on Taiwanese-made Chips have significantly reshaped the global semiconductor industry, leading to a divide between the U.S. and its allies vs. China, as well as causing higher production costs and supply chain disruptions. These shifts present both opportunities and challenges for Vietnam.

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On the positive side, the realignment of supply chains has encouraged greater foreign direct investment (FDI) from the U.S., Japan, South Korea, and Europe, as these countries seek to diversify the suppliers to reduce dependence on China. Companies like Intel, Amkor, and Samsung have expanded operations in Vietnam, strengthening its role in assembly, packaging, and testing (OSAT - Stage 4). Moreover, as Taiwanese-made chips face tariffs, some manufacturers may relocate certain production steps to Vietnam to offset rising costs.

However, Vietnam faces challenges from rising import costs as it relies heavily on imported semiconductor materials and equipment, such as wafers, photomasks, and advanced equipement. Higher tariffs on China and Taiwan could further increase costs for assembly, packaging, and testing (OSAT - Stage 4). Additionally, supply chain disruptions and price fluctuations, making it more expensive for Vietnam to scale its semiconductor industry. With limited domestic production, Vietnam must seek alternative suppliers from the U.S., Japan, and South Korea, which often come at higher costs and longer lead times.

4.4. Recommendations to enhance Vietnam's participation in the global semiconductor supply chain

- *Strengthen Government Policies to Attract FDI*

The Government should thoroughly implement *Decision No. 1018/QD-TTg*, which outlines the Vietnam Semiconductor Industry Development Strategy until 2030 and Vision 2050. This strategy aims to establish Vietnam as a key semiconductor hub, attract foreign direct investment (FDI), and develop domestic chip design and manufacturing capabilities. Vietnam should reduce trade barriers, introduce tax incentives, and enhance infrastructure and high-tech industrial zones to attract FDI from major semiconductor firms looking to diversify operations and mitigate geopolitical risks.

- *Focus on building a highly skilled workforce*

The government should accelerate plans to train 50,000 engineers by 2030, expanding partnerships with global universities like the University of Arizona to offer advanced chip design and fabrication training. As part of the U.S.-Vietnam Comprehensive Strategic Partnership, the U.S. has pledged $2 million to support Vietnam's semiconductor workforce development, reinforcing efforts to build a talent pipeline and strengthen industry collaboration. Industry-academic partnerships, such as Synopsys' collaboration with Vietnam's National Innovation Center (NIC) to establish a chip design incubation center, should be expanded to ensure a steady supply of skilled engineers. Vietnam should effectively utilize these supports to develop a highly skilled yet cost-efficient workforce, creating a competitive edge in the global semiconductor supply chain.

- *Reinforce Vietnam's Role in OSAT (Assembly, Testing, and Packaging)*

Vietnam has the potential to become a leading hub for OSAT (Outsourced Semiconductor Assembly and Testing) thanks to the cost advantages, skilled workforce, and central location in Southeast Asia. Expanding high-tech industrial zones, such as Saigon Hi-Tech Park, Hoa Lac Hi-Tech Park, and Danang Hi-Tech Park, will create an integrated ecosystem for semiconductor firms. The government should actively promote Vietnam's OSAT capabilities to global semiconductor firms looking for alternative production sites outside China and Taiwan.

- *Developing Domestic Semiconductor Manufacturing*

Vietnam is currently absent from Stage 3 manufacturing—wafer fabrication, which is a critical gap in its industry. To address this, the government should introduce incentives to encourage private-sector investment in semiconductor-grade material production, such as silicon wafers and photomasks. Additionally, the Ministry of Industry and Trade should allocate R&D funding to establish green domestic rare earth refining facilities, utilizing Vietnam's position as the world's second-largest holder of rare earth reserves.

- *Expanding Trade Relations and Strengthening Global Partnerships*

As geopolitical tensions escalate, Vietnam can maintain its neutral stance and strengthen its Comprehensive Strategic Partnership with the U.S. to secure technology transfers, trade benefits, and investment support. Fostering this relationship will help mitigate the impact of rising component tariffs on Vietnamese semiconductor exports to the U.S., ensuring that the U.S. remains Vietnam's largest semiconductor export market. At the same time, expanding semiconductor trade ties with Japan, South Korea, and the EU through free trade agreements will reduce reliance on a single export market, enhancing Vietnam's long-term stability and competitiveness in the global semiconductor supply chain.

- *Advancing R&D and Chip Design Innovation*

Vietnamese high-tech firms such as FPT, VinGroup, and Viettel should scale up their chip design and AI semiconductor R&D efforts. The government should introduce grants and tax breaks for local companies developing chiplet technology, AI chips, and automotive semiconductors. Establishing a national semiconductor research center will help Vietnam move beyond assembly and packaging and develop expertise in high-value semiconductor design and manufacturing. These initiatives will pave the way for Vietnam to produce its first fully "Made in Vietnam" chip, reducing reliance on foreign suppliers and becoming a critical link in the global semiconductor supply chain.

5. Conclusion

The global semiconductor supply chain has been profoundly impacted by geopolitical tensions, trade policies, and supply chain disruptions, particularly those introduced under Donald Trump's administration. His policies, including tariffs on semiconductor components and restrictions on Taiwanese-made chips, have exacerbated the divide between the U.S. and its allies versus China, leading to higher production costs, supply chain fragmentation, and increased investment in domestic semiconductor production across multiple regions. As a result, countries such as Japan, South Korea, and the European Union have strengthened their semiconductor policies, while China has accelerated efforts to build a self-sufficient chip industry. Vietnam has benefited from global supply chain realignment, positioning itself as a key hub for semiconductor assembly, testing, and packaging. However, technological limitations, workforce shortages, and infrastructure constraints hinder its ability to move up the value chain into higher-end semiconductor production. To fully capitalize on shifting supply chains, Vietnam must enhance domestic manufacturing capabilities, attract high-tech investment, and develop a skilled workforce. By addressing these challenges, Vietnam can transition from a supporting role to a major semiconductor hub in Southeast Asia, securing a stronger foothold in the evolving global semiconductor industry.

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