International Strategies and Marketing: An Analysis of Semiconductor Internationalization to Japan

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Abstract:

This study aims to analyze the risks and potentials of the semiconductor sector, specifically in the development of compact microchips in Japan, as well as factors that may limit the profitability of this activity. Therefore, a global expansion plan and an operation method in the target country have been outlined, seeking to overcome the challenges identified during the sector analysis and to ensure the success of the initiative in the country.

Key words: Compact Chips; Development; Japan; Threats; Opportunities; Profitability; Operation; Internationalization Strategy.

I Presentation of the Activity, Destination Country, and Risk

1. Introduction to the Semiconductor Industry

The semiconductor sector, also known as integrated circuits, microchips, or simply "chips," drives the digital economy. Containing thousands of miniature electronic components all interconnected, they are regarded as the "brain" of technological innovations, from consumer products such as televisions, laptops, and mobile phones to more sophisticated equipment used in aerospace, business operations, and national defense (SEMICONDUCTOR INDUSTRY ASSOCIATION (SIA), 2021).

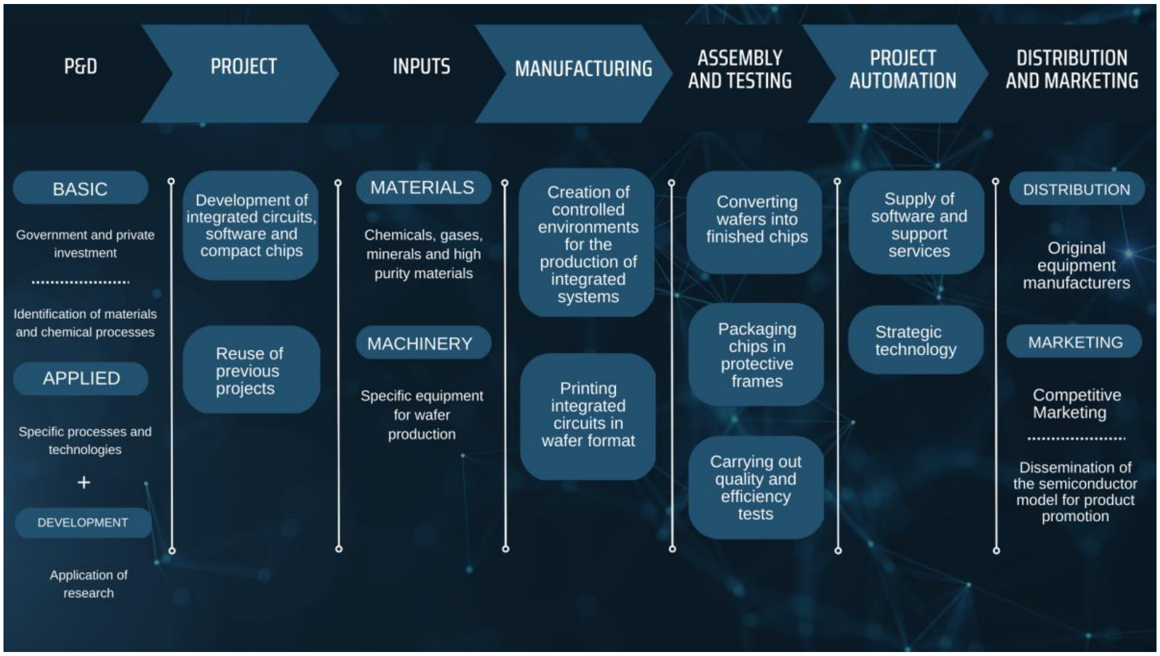
Similar to the complex and interconnected nature of the chip itself, the industry is characterized by a remarkably specialized value chain and global dispersion, marked by an interconnection that drives economic growth. This industry has made a significant contribution to the global economy, accounting for 20% of global GDP growth from 1995 to 2015, equivalent to a contribution of $11 trillion. Although the global semiconductor shortage has come to the forefront, it is projected that the industry will maintain a compound annual growth rate (CAGR) of 9.9% until 2026, increasing from $576.5 billion to $841.1 billion. This shortage was driven by the COVID-19 pandemic (2020-2022), which affected production and the supply chain globally, but recovery is currently underway. An interesting aspect is that the market has varying degrees of specialization worldwide: while East Asia exhibits exponential growth in cutting-edge development, North America serves as a hub for innovation and leadership, the Asia-Pacific region focuses on large-scale production, and Western Europe specializes in precision cuts (VARAS, VARADARAJAN, et al., 2021).

In addition to differences in specialization, chips are popularly known for their nanometric (nm) capabilities, referred to as scales. The Gate-All-Around (GAA) scale is the most advanced transistor technology, providing a 25% improvement in energy efficiency, along with a 12% increase in performance, while reducing the chip area by 5%. In contrast, the Planar-FET and Fin-FET scales are older technologies, with Fin-FET representing an advancement over Planar-FET by allowing 3D scaling to enhance performance and energy efficiency, although not achieving the same advancements as GAA (METI, 2022). Given that specialization and efficiency dictate new trends across the semiconductor sector's global value chain (GVC), the internationalization plan focused on the compact chip segment has been adopted.

2. Structure of the Global Value Chain for Chips

When analyzing the value chain of chips, it is evident that the development of integrated circuits represents the highest added value, accounting for 40% of the Input-Output structure. This stage of compact chip creation originates in the United States and extends to Japan, the country selected for this venture. This activity stands out for its critical importance within the value chain, as companies invest between 12% and 20% of their annual revenues in R&D to drive innovation. In this context, the internationalization strategy focuses on operational efficiency, aiming to maximize the benefits of scale and scope. Thus, the development of compact chips in the U.S. for the Japanese market is essential. The following figure illustrates the compact chip activity, highlighting the flow and activities that contribute to value creation within the sector (SIA, 2021; PALMA, VARADARAJAN, et al., 2022; ACUMEN RESEARCH AND CONSULTING, 2023) (FIGURE 1).

Figure 1: Input-Output Structure of the Semiconductor Sector



Source: Prepared by the author based on data from the Semiconductor Industry Association (SIA) (2021).

Additionally, to mitigate the rising semiconductor prices due to market shortages, the initial design phase of the activity was prioritized. At this stage, the focus is placed on product specialization rather than its final price, aiming to optimize capacity and efficiency before considering costs. This critical phase demands high specialization and significant investment, accounting for 65% of R&D, 13% of CAPEX, and 53% of the value added to the GVC, according to SIA (2021). It involves the meticulous creation of integrated circuit layouts, which are essential for the functionality and efficiency of the chips. The use of advanced design software, such as Cadence and Synopsys, is crucial for designing complex chip systems and optimizing layouts, ensuring that the product's manufacturing is not only technically viable but also as cost-effective as possible (PALMA, VARADARAJAN, et al., 2022; ACUMEN RESEARCH AND CONSULTING, 2023).

For example, Intel's strategic decision to expand its chip production to Vietnam reflects a broader trend among U.S. tech companies, driven by the need to manage large volumes of data and improve operational efficiency with lower risk. With an initial cost of $300 million and a return of $1 billion, Intel demonstrates confidence in the viability and growth potential of the Asian market. This move, highlighted by Kawamata (2022), is significant for U.S. companies seeking to internationalize compact chips in East Asia, benefiting from tax incentives such as a four-year corporate tax exemption and a reduced rate for the following nine years (HOLLWEG, SMITH, and TAGLIONI, 2017).

3. Benefits of Chip Internationalization in Japan

After a thorough analysis of the risks that could affect the activity, Japan was chosen as the ideal destination for international expansion due to its lower exposure to risks and greater benefits compared to South Korea. The factors that made Japan stand out include economic, fiscal, political, and competitive environment risks. Therefore, Japan presents a more favorable scenario for the internationalization of compact chip development.

The choice of Japan over South Korea was based on its greater political-economic stability and superior operational efficiency—placing the country among the global leaders in these aspects. This decision is reinforced by the expected 1.2% annual growth in operational efficiency in the B2B market and projected annual CAGR growth of 2.6% until

2027, facilitating the microchip development process within Japan (MIZUHO BANK, 2023).

Moreover, the Japanese semiconductor industry has focused more on high-tech niches that are less sensitive to price fluctuations, indicating lower price elasticity of demand. Demand for these products tends to be more inelastic, meaning that price changes have less impact on the quantity demanded. On the other hand, income elasticity of demand remains relevant, as an increase in global income can stimulate demand for advanced technologies, where Japan specializes (LIMA, 2018; WU, 2023).

Although the Japanese market offers several opportunities, the risk analysis for the integrated circuit sector identified notable challenges for companies seeking to internationalize to Japan. These obstacles include legal regulations, such as anti-corruption and transparency laws, as well as a complex business infrastructure. To mitigate these risks, strategies such as hiring specialized legal firms in corporate ethics and compliance, and establishing partnerships with foreign cutting-edge technology companies, were suggested. These measures form the foundation for companies aiming to successfully navigate the challenges of the semiconductor sector in Japan.

II Sector Mapping at the Destination

As semiconductor technology advances towards 2-nanometer (nm) precision (GAA), a decrease in wafer production costs is anticipated compared to the 7 nm scale technology (Fin-FET). This cost reduction is a consequence of the efficiency and innovation enabled by extreme ultraviolet lithography (EUV), a technology in which Japan excels globally. The use of EUV allows for more precise manufacturing with fewer performance-related errors (SHIVAKUMAR, WESSNER, and HOWELL, 2023).

Therefore, as new dynamics of competitiveness emerge in the advanced chip activity in the target market, the current generation of computing platforms is being driven by advancements in more specialized semiconductors for applications in artificial intelligence (AI), autonomous vehicles, smart factories, and robotics. Atsuyoshi Koike, president of Rapidus, states that it has been decades since Japanese companies stood out in cutting-edge chip manufacturing processes. To address this, by 2027, the new semiconductor consortium, supported by the Japanese government and large conglomerates, plans to leapfrog several generations. According to Koike, the new B2B project aims to serve the world's leading tech giants, not only chip consumers, but also to secure more beneficial contracts through sector partnerships (EGUCHI; SHILOV, 2023).

Thus, the following evaluation will focus on analyzing the competitiveness of compact chip activities in Japan through Porter's Five Forces (1989), considering: rivalry among competitors, the threat of new entrants, the bargaining power of suppliers, the bargaining power of buyers, and the threat of substitute products.

1. Porter's Five Forces Analysis

1.1. Rivalry Among Competitors

1.1.1 Large Number of Competing Companies

The rivalry among competing companies in this activity is expressed through more than 15 organizations operating in Japanese territory, presenting a high-risk degree to the profitability of the activity. In Japan, Sony Semiconductor Solutions, Mitsubishi Electric Corporation, and Rapidus lead chip production innovation, with significant support from the Leading-edge Semiconductor Technology Center (LSTC) and collaboration from companies like Shinko Electric Industries, Panasonic Smart Factory Solutions, and Ebara Corporation. These entities, along with others from the Jisso Open Innovation Network of Tops 2 (JOINT2), are at the forefront of compact chip development (CHIANG and HSIAO, 2023) (TABLE 1).

Table 1: Number of Wafer Manufacturers by Capacity and Location

Wafer Size (nm)	USA	Japan	Taiwan	Korea	China	Total
2	10	5	19	2	49	85
3	20	4	3	0	9	36
4	63	36	19	8	57	183
5	5	15	3	2	14	39
6	84	74	30	9	64	261
8 (200 nm)	61	53	26	12	36	188
12 (300 nm)	33	29	44	32	41	179
Total	276	216	144	65	270	971

Source: Compiled by the author from Thadani and Allen (2023) data.

1.1.2 Competitors with Similar Size, Influence, and Product Offerings

Analyzing the production capacities and market strategies of Sony, Renesas, or Rapidus compared to companies within the same sector reveals a differentiated approach, presenting high risk to profitability. Notably, Rapidus is innovating in the development of more advanced chips, with a clear intention to lead in cutting-edge technology rather than volume production. The significant support from the Japanese government, evidenced by a ¥260 billion (around USD 1.8 billion) investment, positions Rapidus and Renesas as some of the only entities with considerable investment capacity. However, Atsuyoshi Koike, president of Rapidus, acknowledges that "several trillion yen" will be needed to initiate pilot production, indicating that while the initial investment is robust, the company may seek additional private financing for future expansion (THADANI and ALLEN, 2023).

In terms of differentiated products, Rapidus' partnership with IBM to license more specialized technology and collaboration with IMEC to focus on key enabling technologies, such as EUV lithography essential for modern semiconductor manufacturing, demonstrate a commitment to innovation and product differentiation. The connection with Advanced Semiconductor Materials Lithography (ASML), the exclusive supplier of EUV equipment, is also a key point, ensuring access to the most advanced manufacturing technology available, reinforcing Rapidus' profile as a cutting-edge technology company rather than a direct competitor in the mass production of common devices (THADANI and ALLEN, 2023).

1.1.3 High-Priced Products and Infrequent Demand

Examining the demand for activities in the country and the prices of available products shows that both represent low risk to profitability. In this context, the exceptional competence of companies like Tokyo Electron (TEL) and SCREEN Semiconductor Solutions in developing crucial tools and materials for advanced chip production stands out, together controlling 96% of the market. TEL, in turn, is globally recognized as a leader in extreme ultraviolet (EUV) lithography equipment and its innovative techniques for stacking advanced chips on wafers. With demand for these specialized products projected to increase by 52.5% between 2020 and 2027, reaching a CAGR of 1.4% and an index of

148 compared to the base year of 2019, according to the Mizuho Bank report (2023), a market with specialized demand and limited price options becomes evident.

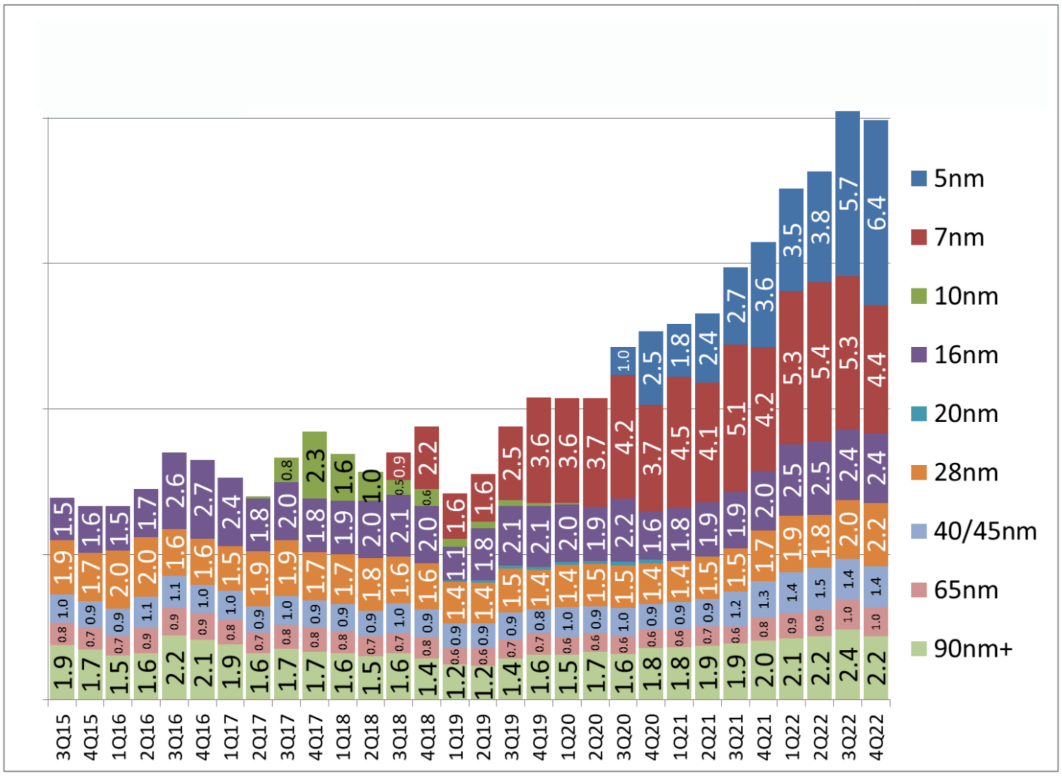
1.1.4 Large-Scale Added Capacity

Large-scale added capacity, in turn, can be considered a high-risk factor for profitability. This means that the existing factories and assembly lines are operating at full capacity in Japan, and they are capable of producing enough compact chips to meet all customer demands. For instance, the production capacity of compact chips is projected to accelerate by 25.4%, with a CAGR of 1.2% and an index of 127 in the base year of 2019, on average, among sector competitors in Japan (THADANI, ALLEN; CHIANG and HSIAO; MIZUHO BANK, 2023).

1.1.1.5 Slow Industrial Growth and Decline

Graph 1, below, indicates that there is low risk in terms of profitability concerning sector growth. It was observed that recent average growth exceeded the historical annual average rate, signaling an acceleration in this segment's expansion. Specifically, the Japanese industry shows a faster growth trend in advanced microchips. For instance, the demand stands out for more advanced scales (CAPRI, 2020) (GRAPH 1).

Graph 1: Revenue Generated from Compact Chips, by Type, from 2015 to 2022



Source: Compiled from Mordor Intelligence data (2023).

In Japan, the demand for specialized compact chips, particularly those made from Gallium Nitride (GaN), is projected to significantly surpass that of conventional chips. This segment is expected to witness substantial growth, with a CAGR of 59% by 2027, soaring from USD 126 million to USD 2 billion. This increase is especially pronounced in the automotive sector, where the CAGR may reach up to 97%, underscoring the potential for expansion and the growing relevance of these advanced chips in the market. Another factor to consider is the contribution to employment indices. It is estimated that the major compact chip companies will require at least 40,000 semiconductor professionals over the next decade. The regional distribution is as follows: Hokkaido/Tohoku 6,000 professionals, Kanto 12,000 professionals, Chubu 6,000 professionals, Kinki 4,000 professionals, Chugoku/Shikoku 3,000 professionals, and Kyushu 9,000 professionals. Therefore, it can be concluded that the sector has shown a rapid and sustained growth trend, with no signs of significant slowdown or contraction in recent or upcoming years (SEMICONDUCTOR TODAY; JAPAN'S MINISTRY OF ECONOMY, TRADE, AND INDUSTRY, 2023).

1.1.1.6 High Exit Costs

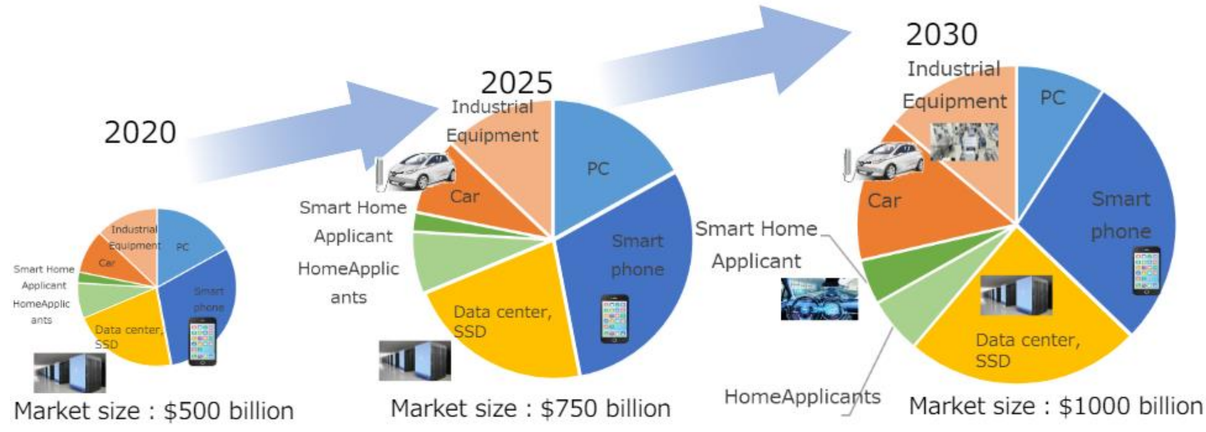
Exit costs represent a high risk to profitability in the internationalization initiatives of American compact chip companies to Japan. Essentially, a strategic balance between investment quality and effective risk management is crucial. This balanced approach allows companies to leverage economies of scale and advanced technologies without incurring excessive costs, which would amplify the risk profile. Similarly, despite the absence of substantial government support in a context of significant state support already in place, it is anticipated that semiconductor companies will achieve positive cash flow within approximately five years of internationalization. Well-planned investments enable the exploitation of the advantages of large-scale production, optimizing labor productivity and reducing per-wafer costs without succumbing to the high fixed costs associated with more robust investment strategies. Integration into industrial clusters offers a pathway to further reduce operational costs through resource sharing, logistics, and access to a broad talent pool, as highlighted by McKinsey (2023).

1.1.2 The Threat of New Entrants

1.1.2.1 Few Low-Cost Advantages Based on Scale

In the Japanese industrial context, competitors focused on scale production are perceived as low risk, primarily due to the numerous advantages conferred by the mass production strategy. This approach dilutes fixed costs and enhances operational efficiency, leading to a significant reduction in unit product costs. This economy of scale allows companies to achieve a sharper product specialization, shifting the focus from mere price competition to the optimization of production capacity and efficiency, which are fundamental factors for sustainable growth and business profitability. Additionally, the compact microchip market, vital for various sectors—including applications for smart homes, the automotive industry, appliances, data centers, industrial equipment, PCs, and smartphones—is projected to grow from USD 500 billion to USD 1 trillion by 2030 (PALMA, VARADARAJAN, et al., 2022; JAPAN'S MINISTRY OF ECONOMY, TRADE, AND INDUSTRY, 2023) (GRAPH 2).

Graph 2: Expansion of Compact Chip Activity in Major Industrial Sectors in Japan, by Market Size, 2020-2030



Source: Compiled from Japan's Ministry of Economy, Trade, and Industry data (2023).

On the other hand, despite having many scale advantages, the presence of few suppliers for critical inputs, such as high-performance photoresists for compact chips—light-sensitive polymers that, when exposed to ultraviolet radiation, change their solubility, allowing the precise transfer of patterns and being widely used in layout optimizations across major industrial sectors—where Japanese companies like Shin-Etsu Chemical and SUMCO control 75% and 60% of the global market, respectively, may limit new entrants' ability to negotiate prices, ensure adequate supply, or cope with natural disasters, which can disrupt the supply chain and slow down production scaling, according to Thadani and Allen (2023). For instance, the explosion at Sumitomo Chemical's factory in 1993 affected 60% of the global resin supply. In 2021, the fire at Renesas' factory contributed to the global chip shortage, particularly in the automotive market, as the sector depended on approximately 30% of different types of microchips, according to Varas, Varadarajan, et al. (2021). This concentration, while increasing efficiency and scalability, creates a highly competitive and restrictive environment for new entrants seeking to produce at scale.

1.1.2.2 Few Low-Cost Advantages Not Based on Scale

Benefits or agreements that are not solely based on economies of scale can be interpreted as low risk to profitability, as they allow cost reductions through other competitive advantages, such as technological innovations or government incentives. Japan's emerging strategy in the compact microchip sector, detailed in June 2021 by the Ministry of Economy, Trade, and Industry (METI), indicates fertile ground for development and significant benefits in semiconductor production costs. For example, the Japanese government’s commitment to subsidize up to one-third of the capital costs incurred by domestic and foreign manufacturers or developers to produce designated types of semiconductors with higher specialization and materials, alongside the condition of domestic production for at least 10 years, demonstrates a direct and substantial benefit in scale costs. These subsidies are particularly attractive and relatively accessible, as they are conditioned on contributing to the domestic supply chain, which is strategic for Japan, especially in times of global shortages. These initiatives reflect a highly favorable environment for the development of compact chips in Japan, enhancing their competitiveness and capacity to produce at scale more economically (THADANI, ALLEN; MCKINSEY, 2023).

1.1.2.3 Insufficient Product Differentiation in the Industry

In Japan's semiconductor industry, there are a variety of options and differentiated products, which can be interpreted as a high risk to profitability. The partnership with TSMC to build chip manufacturing plants in Japan indicates the development of production lines covering 22 and 28-nanometer chips, with the potential to expand to 2 to 12-nanometer technologies, with 45,000 wafers per month by the end of 2025. This diversity reflects Japan’s commitment to innovation and the ability to offer products that meet emerging market needs, such as autonomous vehicles and advanced driver assistance systems (RYUGEN, 2024).

Additionally, the Japanese government is supporting the domestic production of a range of devices, including power devices, microcontrollers, and analog devices, with subsidies covering up to half of investment costs. This demonstrates not only a broad range of products but also a strategy to make production more viable and accessible, encouraging a broader supply that is critical to the country’s digital and economic infrastructure (RYUGEN, 2024).

1.1.2.4 Low Risk of Retaliation Among Competitors

The rivalry in the compact chip market presents a high risk to profitability. In the history of Japanese competitors in semiconductor production, a pattern of substantial and recurring investments can be observed. Companies like Renesas have channeled considerable resources into R&D, aiming not only to keep pace but also to lead the transition to 2nm microchip technology. TSMC's entry into Japan, with plans to build a 2nm integrated circuit factory, intensifies this competition, pressuring local competitors to accelerate their own expansion plans and technological innovation (KELLY, FREIFELD, and SUGIYAMA, 2023).

The market is steadily growing thanks to progress in digitalization and government industrial policies. Global competition intensifies with the entry of new participants from other industries and the emergence of companies from developing countries. This intensifies due to the entry of new participants and the prolonged decoupling between the US and China (MIZUHO BANK, 2023).

Competitors' responses to strategic moves in the Japanese market are not limited to increasing production capacity; they also manifest in competitive maneuvers such as potential price wars and disputes over patents and talent. However, price wars are less prevalent in the more advanced semiconductor segment due to the high entry cost and the technological specialization required. Companies focus more on securing contracts with large clients and investing in greater sector innovation (KELLY, FREIFELD, and SUGIYAMA, 2023).

1.1.2.5 Lack of Government Policies Restricting or Discouraging New Entrants

Japan has historically adopted a protective stance in key sectors of its economy, including advanced technology and semiconductors, which is considered a medium risk to profitability. The current measure, which restricts the export of 23 types of compact chip equipment, can be seen as a barrier that hinders but does not completely prevent trade. This is because Japan is not applying the US "presumption of denial" rule, which almost completely denies exports to certain companies, and intends to allow exports whenever possible. This suggests a more balanced approach, which seeks to protect national interests without completely closing the doors to international trade, so as not to harm the domestic market (KELLY, et al, 2023; RYUGEN, 2024).

1.1.3 Bargaining Power of Suppliers

1.1.3.1 Small Number of Suppliers

The table below highlights the main inputs, suppliers, and impacts on the operations of compact microchip production in Japan, a dynamic that demonstrates a high degree of risk to profitability. This classification reflects the high market concentration in the hands of a few specialized suppliers who may threaten to raise prices and dominate critical segments of the microchip supply chain (TABLE 2).

Table 2: Chip infrastructure in Japan, relevant suppliers, and their respective market shares

Inputs	Suppliers	Impact
EUV Lithography	Tokyo Electron (TEL)	Almost 100% for in-line coaters/developers for EUV
Chip Stacking	TEL and IBM	Pioneering chip stacking operations on wafers up to 10 nm
Photomasks	JEOL and NuFlare	91% of the global market for EUV masks
Resist Processing	TEL and SCREEN	96% of the global market for resist processing equipment
High-Performance Photoresists	Shin-Etsu Chemical, Tokyo Ohka Kogyo, JSR, Fujifilm,	75% of global production of high-performance photoresists for chipmaking
Wafer Crystal Machinery	Accretech, Okimoto, Toyo, Disco, Rorze, Daifuku	95% for wafer crystal machinery, 88% for wafer handling equipment
Chemical Materials	Various, led by Japan	Largest global producer with over 50% in 14 critical materials like Si, GaAs, Ge
3D Chip Packaging	Nissan Chemical, Showa Denko	Significant investments in development and production
Silicon Wafers	SUMCO and Shin-Etsu Chemical	60% of the global market

Source: Prepared by the author from data by Thadani and Allen (2023).

Regarding EUV lithography, resist processing, and wafer crystal machinery, companies like Tokyo Electron (TEL), JEOL, NuFlare, and SCREEN hold significant global market shares ranging from 91% to 96%. This suggests a level of specialization and dominance that limits the number of suppliers. Even though costs are being reduced in compact chip development, this concentration among a few players could increase final prices. For instance, TEL nearly monopolizes the market for in-line coaters for EUV, and along with SCREEN, controls 96% of the market for resist processing equipment, demonstrating a clear limitation in the availability of alternative suppliers (THADANI and ALLEN, 2023).

When it comes to high-performance photoresists and silicon wafers, it is possible to observe that although more suppliers are listed, such as Shin-Etsu Chemical, Tokyo Ohka Kogyo, JSR, Fujifilm Electronic Materials, and Sumitomo Chemicals, the concentration remains high, with these companies holding significant shares of 75% and 60% of the global market, respectively. The situation is similar for wafer crystal machinery and 3D chip packaging, where a small group of Japanese suppliers dominates most of the market. This underscores the presence of exclusive suppliers with specialized capacity to meet the industry's needs, while also highlighting the difficulty of price hikes, which could force longer supply timelines and shorter payment terms (THADANI and ALLEN, 2023).

1.1.3.2 Supply of Unique, Differentiated Products

From the presented Table 2, we can infer a high risk to profitability due to little specialization and differentiation between suppliers of inputs and services for the semiconductor industry.

There are suppliers with inputs or services that are vastly different from other available suppliers. Each company mentioned specializes in a specific and unique stage of the chip development process, from silicon wafer manufacturing (SUMCO and Shin-Etsu Chemical), wafer crystallization (Accretech, Okimoto, Toyo, Disco, Rorze, Daifuku, Muratech), to EUV lithography (Tokyo Electron - TEL), and the development of 3D chip processing (Nissan Chemical and Showa Denko). This specialization indicates that suppliers offer inputs and services that are not only distinct but are also critical for different phases in modern semiconductor production, reflecting the limited diversity within the industry.

Another relevant aspect involves chemical materials, where various suppliers, mainly from Japan, lead the market, holding over 50% of the market in 14 critical materials such as Si, GaN, etc. This suggests that while some suppliers have very specific and dominant roles, it indicates a lack of diverse supply options for semiconductor manufacturers (THADANI and ALLEN, 2023).

1.1.3.3 Particular Firm Is Not an Important Client of Suppliers

Companies in the microchip sector in Japan appear to be significant and representative clients for the listed suppliers, representing low risk to profitability.

The analysis of the aggregate values of clients in different nanometer specifications provides a clear perspective on the importance and representativeness of these companies for supplier revenues. Companies such as Samsung, IBM, Intel, and TSMC, with aggregate values ranging from 4.9% to 13.3% for 2nm chips, and Nvidia and Qualcomm, with 14.8% and 12.2% respectively for 3-7nm chips, are not only leaders in innovation and production but also crucial clients for input suppliers such as Tokyo Electron, JEOL, NuFlare, and Shin-Etsu Chemical. These latter companies, holding significant portions of the market in their specialties — almost 100% for in-line coaters/developers for EUV in the case of TEL, for example — are highly dependent on the orders from these major clients to sustain their operations and investments in research and development.

Furthermore, specialized Japanese companies, such as Kyocera and Renesas, leading in 16-28nm segments with substantial aggregate values of 24.8% and 15.5%, respectively, highlight Japan's role not only as a supplier of inputs but also as a heavyweight competitor in the semiconductor market. Meanwhile, Chinese companies such as SMIC and Hua Hong, with an impressive aggregate value of 27.5% and 19.4% for 28-45nm chips, illustrate the growing impact of Japan's inputs on their added values. The interdependence between suppliers and these clients is evident, with the revenue and growth of the suppliers being intrinsically tied to the success and demands of their clients, who are relevant in the Japanese market (VARAS, VARADARAJAN, et al., 2021;

SEMICONDUCTOR INDUSTRY ASSOCIATION, 2022; MCKINSEY, 2023; BLOOMBERG; STATITA, 2024).

1.1.3.4 Suppliers Willing and Capable of Promoting Forward Vertical Integration

Vertical integration in the integrated circuits sector can be characterized as low risk to profitability, as there are no cases of suppliers with forward integration. Table 2 suggests that the Japanese semiconductor market is highly specialized and dominated by companies with a strong presence in specific niches. Forward integration, which is a process by which a supplier expands its activities to take over processes previously performed by its clients in the production sector, seems to be a challenging task in this environment.

The high market shares in the Japanese semiconductor industry reflect the deep specialization and established positions of suppliers, making it difficult for new entrants or existing suppliers to diversify their activities. For instance, Tokyo Electron (TEL) almost exclusively dominates the EUV lithography and resist processing segments, demonstrating the high level of specialization required. For a new competitor to enter the market or for an existing supplier to expand its operations into chip production, significant investment would be necessary, not only in financial terms but also in advanced technical knowledge, patents, and the development of innovative technologies. Considering companies like Kioxia, Sony, Soft Bank, Denso, Toyota, NEC, NTT, and MUFG Bank, each investing US$1 billion, except for MUFG Bank, which invested US$0.3 billion, the cost to enter advanced chip production exceeds US$7.3 billion. This amount underscores the financial and technical barriers to entering or expanding in the sector, according to a report from Japan's Ministry of Economy, Trade, and Industry (METI) (2023).

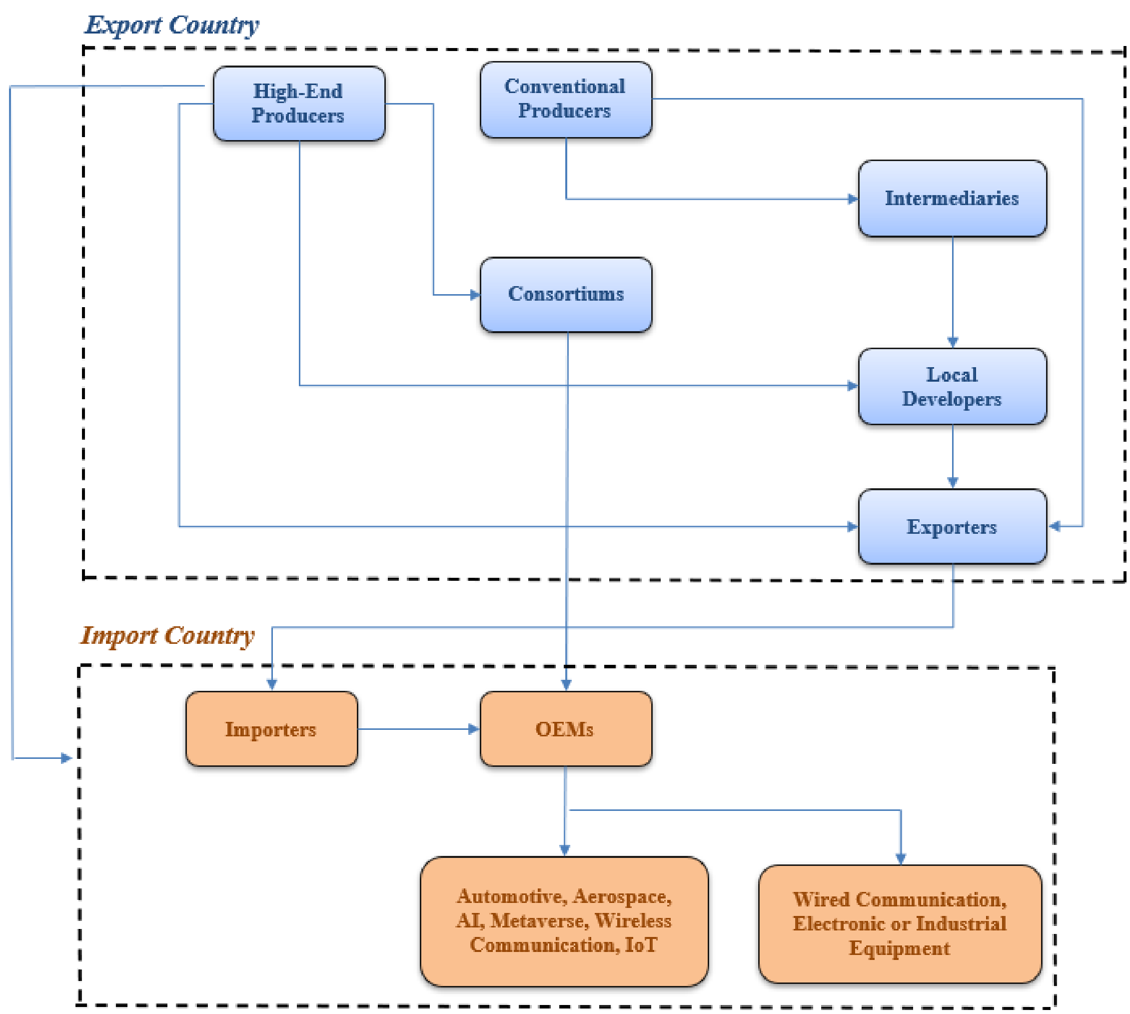
1.1.4 Bargaining Power of Buyers

1.1.4.1 Small Number of Buyers

The buyer market dynamics in Japan, especially for advanced technology products like chips, indicate a trend towards low risk to profitability. This is due to the data represented in Figure 2, which shows the distribution of chip buyers and how different industries contribute to the demand for compact microchips over time. For instance, in 2020, the main buyers were the automotive sector (20.83%), PCs (12.5%), industrial equipment (16.67%), smart homes, data centers, and SSDs (13.89%), and smartphones

(22.22%). Projections for 2025 and 2030 show an increase in market size, suggesting that the automotive sector (36.11%) and industrial equipment (8.33%) will remain major buyers, while the PC (25%) and smartphone sectors will also maintain significant presence. Data centers and SSDs are also expected to grow in terms of market share (27.78%) (MINISTRY OF ECONOMY, TRADE AND INDUSTRY OF JAPAN, 2023). This reinforces the notion of a diversified market with multiple buyers across key industrial sectors in Japan. The figure below illustrates the flow of activities in the semiconductor sector, where the direct relationship between OEMs in sales channels can be highlighted.

Figure 2: Distribution Channels in the Chip Sector in Japan



Source: Created by the author based on the Ministry of Economy, Trade and Industry of Japan (2023).

Figure 2 above illustrates how the channel structure for customers, primarily advanced semiconductor producers, can join together in consortiums or with local developers. It is important to understand that OEMs are companies that do not manufacture chips, so the product will be distributed by original equipment manufacturers (OEMs) to meet the demand of companies that do not manufacture chips. These buyers, by establishing significant contracts and strategic partnerships, stand out for their ability to add substantial value to Japan's sector (EGUCHI; SHILOV, 2023).

Among these sectors, the following stand out in this order: automotive (Auto), wireless communications (CSF) (including 5G technology and infrastructure, smartphones, and other mobile devices), cloud computing/data centers (CND), Internet of Things (IoT), artificial intelligence (AI), consumer electronics (EC), industrial equipment (EI), wired communications (CCF), personal computing (COP), and the metaverse (Me). The information contained here is based on a survey conducted by KPMG (2023), involving 151 senior executives from global semiconductor companies, covering a diversity of company sizes: under $100 million (30%), between $100 million and $999 million (19%), and over $1 billion (51%) (KPMG, 2023).

Samsung Electronics and Preferred Networks (PFN) have formed a strategic consortium to develop and produce artificial intelligence (AI) chips, positioning themselves at the forefront of technological innovation. This pioneering agreement not only reinforces Samsung's commitment to leadership in advanced manufacturing processes but also highlights PFN's role as an innovative force in AI development in Japan. Production is expected to begin in 2025, and the project promises to deliver chips with 25% better energy efficiency and a 12% size reduction, addressing the demand for more compact and powerful devices. This consortium will not only expand PFN's technological capabilities but also strengthen its presence in the advanced chip market (NUSSEY and URANAKA, 2024).

Another relevant aspect is the consortium between TSMC and Japan through 2027, a strategic move to further strengthen the semiconductor industry on a global scale. TSMC, already an established giant in semiconductor manufacturing, is helping Japan increase its global market share by 3% to gain greater preference for purchasing modern chips, with a monthly capacity of 100,000 12-inch wafers. This synergy not only benefits Japan in terms of increased capacity and expertise but also solidifies a network of mutual support essential for continued technological advancement (NUSSEY and URANAKA, 2024).

1.1.4.2 Products Offering Little Economic or Quality of Life Improvement

Japan’s advanced semiconductor products symbolize significant economic savings and an increase in quality for customers when compared to alternatives, suggesting low risk to profitability. These advantages can be justified by two main aspects.

Advanced microchips use envelope transistors and gallium nitride (GaN), allowing the development of more powerful and efficient chips. This includes reducing energy and water consumption, minimizing waste production, and adopting renewable energy to improve energy efficiency in both manufacturing processes and the chips themselves. As a result, the final costs of these products tend to decrease, and another factor is the positive impact on the economy, where the energy and telecommunications sectors are expected to accelerate at a CAGR of 56% and 69%, respectively, generating over 40,000 jobs in the country (SEMICONDUCTOR TODAY, 2022).

This indicates that Japan is prepared to offer semiconductor products that are not only competitive in terms of cost but also performance, meeting the needs of major technology giants and contributing to a more robust economy through beneficial contracts (EGUCHI; SHILOV, 2023).

Secondly, technological evolution encompasses highly functional supercomputers and edge devices, focusing on the integration of low-power and high-functionality semiconductors. This is particularly important for energy savings, as more efficient chips result in lower operating costs and reduced environmental impact. Research and development efforts are focused on areas such as ultra-fast optical networks and quantum computing, which are vital for national security and disaster response. These advancements ensure that end customers will benefit from safer, faster, and more efficient devices, justifying the investment in cutting-edge technology (MINISTRY OF ECONOMY, TRADE AND INDUSTRY, 2022).

1.1.4.3 Buyers Acquiring Standardized Products, Without Differentiation, from Specific Companies

In the context of chips, it is evident that buyers are interested in differentiated products and are willing to pay for this differentiation, indicating low risk to profitability.

For example, the automotive (Auto) and wireless communications (CSF) sectors, including 5G technology, infrastructure, smartphones, and other mobile devices, are at the forefront of demand for specialized semiconductor chips, particularly those manufactured with cutting-edge technologies. This demand is driven by the need for high performance, energy efficiency, and advanced processing capabilities to support the growing requirements of advanced driver assistance systems (ADAS), enhanced connectivity, and AI applications in vehicles, as well as to manage increasing data traffic and deliver improved user experiences on mobile devices. Although there are higher initial costs associated with the development and manufacturing of these advanced chips, the continuous demand from these sectors, along with the promise of cost reduction through technological advancements and production scaling, justifies the investment (TRENDFORCE; NUSSEY and URANAKA, 2024).

On the other hand, the cloud computing and data center (CND), Internet of Things (IoT), and artificial intelligence (AI) sectors also seek more specialized chip technologies, driven by the need for large-scale data processing, energy efficiency, and the ability to perform complex AI tasks more effectively. The ability to offer high-performance computing and storage in cloud environments, along with the proliferation of smart IoT devices and AI applications, creates a robust market for advanced chips. These sectors are willing to pay for innovations that offer significant competitive advantages, such as lower energy consumption and greater processing capacity, while benefiting from the trend of cost reduction as chip manufacturing technologies mature and become more accessible (TRENDFORCE; NUSSEY and URANAKA, 2024).

1.1.4.4 Buyers in Financial Distress

If the main buyers are in financial distress, this factor can be understood as low risk to profitability. In the current scenario, analysis of the profile of major buyers reveals a predominantly stable financial condition, with less than 20% facing significant financial difficulties. This statistic suggests that most buyers are financially sound entities. For instance, overall, evaluating ROA, ROE, and ROCE data, companies in the sector maintain good profitability and efficient capital use. Sony, Kyocera, Toshiba, Sharp, and Renesas are notable examples within the group, demonstrating above-average performance in terms of return while maintaining a controlled level of risk (BLOOMBERG, 2024).

1.1.4.5 Buyers Willing and Able to Promote Vertical Backward Integration

The transition to vertical backward integration in the semiconductor sector is a complex maneuver, reflecting low risk to profitability due to the absence of precedents in the sector. This is because the shift from a customer role to a producer one is not trivial, requiring substantial investments in research and development, acquiring cutting-edge technology, and building advanced industrial facilities. Developing compact chips is a highly specialized process requiring advanced technical know-how, capital intensity, and a well-established supply chain, representing a significant barrier to vertical backward integration in the Japanese market (SEMICONDUCTOR INDUSTRY ASSOCIATION, 2018).

1.1.5 The Threat of Substitute Products

1.1.5.1 Substitutes from Other Industries with Superior Quality and Functionality Compared to Existing Products in the Industry

In the context of substitutes and superior functionalities to the industry's products, this factor presents a low degree of risk to profitability. This is because the compact semiconductor sector in the Japanese market is unique, possessing various companies with a high degree of specialization, for instance, in GAA, extreme ultraviolet (EUV) lithography, or wafer crystal machinery.

For example, Tokyo Electron (TEL) holds an exclusive position in the extreme ultraviolet (EUV) lithography market, controlling 100% of the segment, meaning there are currently no available alternatives capable of replicating this technology in integrated circuit design. The application of EUV on silicon wafers is an innovation milestone, reducing semiconductor production costs while simultaneously enhancing quality. The high precision of the EUV process minimizes manufacturing errors and drives operational efficiency, despite the increasing complexity of manufacturing procedures, as highlighted by Shivakumar, Wessner, and Howell (2023). Therefore, EUV technology is irreplaceable in compact chip processing, remaining the predominant solution in the market.

1.1.5.2 Low Cost of Switching to Substitutes

The low cost of switching to substitutes indicates a low degree of risk to profitability. The replacement of products in the dynamic Japanese compact semiconductor market, though seemingly viable at first glance, typically demands specific adjustments. The use of alternative products from other sectors is rarely a seamless process, given the high degree of specialization and the rapid technological evolution characteristic of this field. Semiconductors are designed to perform highly specialized functions, and even seemingly similar substitutes may require technical modifications or software updates to integrate into existing operations.

Japanese companies, led by innovators such as Toshiba, are advancing the frontiers of nanometer-scale technology. This continuous progression in innovation means that industry customers often anticipate the need for adjustments to incorporate technological advancements. While these adaptations may be necessary, they tend to be scalable and integrable, without imposing disproportionate financial or operational challenges on companies (SEMICONDUCTOR INDUSTRY ASSOCIATION, 2018; SHIVAKUMAR, WESSNER, and HOWELL, 2023).

1.1.5.3 Conclusion

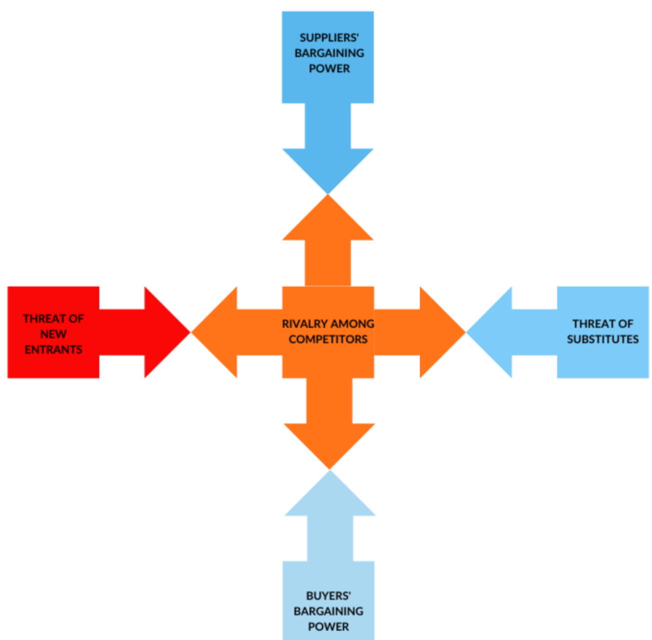
Force	Intensity	Comment
Rivalry among competitors	Medium	There is a vast number of competitors, a strong production capacity, and high exit costs for companies in the sector, which potentially increases the risk to profitability. However, the industry is driven by rapid growth, and rivalry is mitigated by the absence of a price war, allowing companies to compete more on innovation and operational efficiency.
Threat of new entrants	Medium	Economies of scale pose a challenge due to the specialization required and the influence of a few dominant suppliers. Production costs do not favor newcomers, but government policies and the constant innovation landscape promote an environment where differentiation and quality prevail over more protectionist policies regarding the import or export of compact chip materials.
Bargaining power of suppliers	Medium	The concentration in the hands of a few specialized suppliers in Japan increases the risk to profitability for customers, as these suppliers hold the power to dictate prices and control the availability of crucial inputs.
Bargaining power of buyers	Low	Demand is concentrated on highly specialized products. The quality and innovation of semiconductors become crucial factors, along with the broad distribution channels, balanced by the fact that the market is characterized by specific buyers seeking advanced technological solutions, without significant variation in terms of suppliers.

Threat of substitute products	Low	The threat is perceived as low, as technologies like extreme ultraviolet lithography (EUV), essential for the production of advanced chips, have no equivalents in other sectors, ensuring a unique position for suppliers that dominate these techniques. This level of innovation and specialization makes substitution by alternatives from other fields not only impractical but also, for those attempting to use similar products, requires adjustments in their business.

Source: Developed by the author based on Porter (1989).

Thus, when examining the industry's structure through the different lenses influencing each competitive force, it is possible to conclude that the compact semiconductor sector in Japan presents forces of moderate intensity. However, as previously mentioned, within each competitive force, there are various factors that can act as barriers to a company's success in this sector, requiring vigilance and the formulation of strategies to overcome them. To visually illustrate the challenges posed by each competitive force to a company operating in this field, a diagram was developed based on Porter's Five Forces model (1989). This diagram highlights the impact of each force, with the most significant threats indicated by darker shades and lesser threats by lighter shades.

Figure 4: Porter's Five Forces applied to the chip sector in Japan



Source: Developed by the author based on Porter (1989).

2. Strategic Groups

2.1.1 Strategic Groups for Chip Internationalization in Japan

In evaluating strategic groups, a methodology encompassing two distinct criteria is adopted: the degree of innovation and operational efficiency. The 12 selected companies account for 88.4% of compact chip revenues in Japan, representing USD 38.37 billion out of a total of USD 43.42 billion (Kewell, 2021). The degree of innovation is measured through indicators such as Patent Cooperation Treaty (PCT) applications, the total number of patents related to chip upgrades, the number of innovation awards received, and R&D intensity, according to the World Intellectual Property Organization (2023). This normalization establishes a comparative innovation scale, providing a quantitative means to assess each company's engagement in technological advancement.

In the evaluation of operational efficiency, the methodology employs a scoring scheme where companies' products are meticulously assessed against a set of predefined efficiency standards, such as energy competence, speed/performance, and chip area reduction. As established by the Mordor Intelligence report (2024), products that fully meet these standards are awarded a score of (0.6-1). Products that partially satisfy the criteria are rewarded with (0.1-0.5). Products that do not meet the criteria are not awarded any points (0) (Tables 3 and 4).

Table 3: Degree of Innovation for Compact Chip Activity in JapanTabela 3: Grau de inovação para a atividade de chips compactos no Japão

Companies	Index
KIOXIA CORPORATION	21,87
SONY SEMICONDUCTOR SOLUTIONS CORPORATION	55,95
RENESAS ELECTRONICS CORPORATION	45,34
ROHM CO., LTD	15,55
KABUSHIKI KAISHA TOSHIBA	38,85
NICHIA CORP.	11,27
MITSUBISHI ELECTRIC CORPORATION	55,67
SANKEN ELECTRIC COMPANY	12,61

FUJI ELECTRIC CO., LTD.	20,11
SOCIONEXT INC.	4,13
KYOCERA CORPORATION	25,85
HITACHI POWER SEMICONDUCTOR DEVICE, LTD.	34,68

Source: Developed by the author using data from Kewell (2021), Clarivate; World Intellectual Property Organization; PwC (2023), and Harrity (2024).

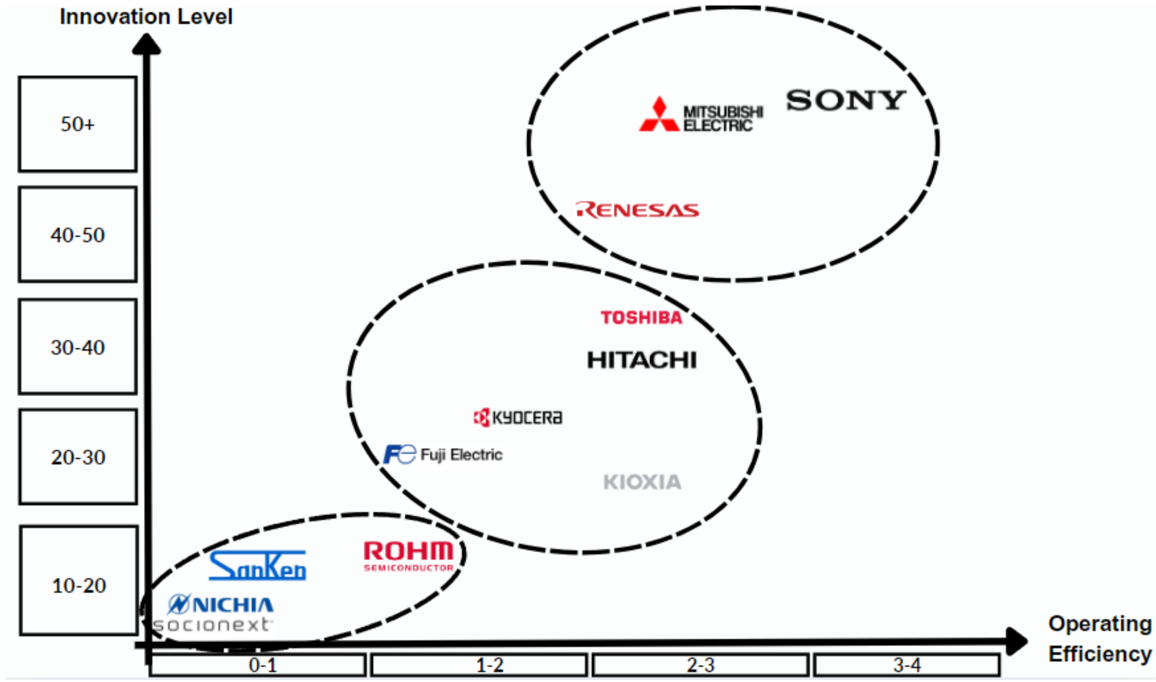
Table 4: Degree of Operational Efficiency for Compact Chip Activity in Japan

Companies	**Energy Efficiency**	**Speed/ Performance**	**Chip Area Reduction**	**Total**
KIOXIA CORPORATION	0,8	0,8	0,7	2,3
SONY SEMICONDUCTOR SOLUTIONS CORPORATION	1	1	1	3
RENESAS ELECTRONICS CORPORATION	0,7	0,7	0,6	2
ROHM CO., LTD	0,4	0,4	0,3	1,1
KABUSHIKI KAISHA TOSHIBA	0,7	0,7	0,6	2
NICHIA CORP.	0,2	0,2	0,1	0,5
MITSUBISHI ELECTRIC CORPORATION	0,9	0,9	0,8	2,6
SANKEN ELECTRIC COMPANY	0,3	0,3	0,2	0,8
FUJI ELECTRIC CO., LTD.	0,5	0,5	0,4	1,4
SOCIONEXT INC.	0,1	0,1	0,1	0,3
KYOCERA CORPORATION	0,6	0,6	0,5	1,7
HITACHI POWER SEMICONDUCTOR DEVICE, LTD.	0,7	0,7	0,6	2

Source: Developed by the author using data from Mordor Intelligence (2024).

The results of the strategic group analysis are presented below:

Figure 3: Map of Strategic Groups for Compact Chip Activity in Japan



Source: Developed by the author based on Porter (1989).

Following a thorough study of the compact semiconductor market in Japan, it was observed that Sony Semiconductor Solutions, Mitsubishi Electric, and Renesas stand out as leaders, representing 39.5% of the added value in compact chip revenues in the country (Kewell, 2021). These companies demonstrate superior capacity in terms of innovation and efficiency, criteria that are crucial for classifying their products as advanced chips. Data analysis indicates that these companies not only meet but exceed the necessary standards to be recognized as innovators in advanced semiconductor development.

III Internacional Identification of International Operating Strategy

The theoretical model proposed by Bartlett and Ghoshal (1989) serves as a landmark in understanding internationalization strategies, emphasizing the necessity for companies to balance global efficiency with local responsiveness. International strategies, therefore, are defined by the degree of pressure for global integration—driven by the pursuit of efficiency through economies of scale—and by the need for local adaptation, where attention to the specificities of each market is crucial. This results in distinct strategic approaches, such as Transnational, Global, International, and Multidomestic, based on the interaction between global integration and local responsiveness (Bartlett and Ghoshal, 1989; Cavusgil, Knight, and Riesenberger, 2010).

Thus, in the compact chip activity in Japan, a significant reduction in production costs through economies of scale can be achieved, particularly when considering the market specialization and the predominance of a few suppliers in Japan—even if the focus lies on product specialization rather than its final price, aiming to optimize capacity and efficiency before considering costs. According to Palma, Varadarajan, et al. (2022), up to 65% of companies seek the lowest possible cost, increasing their production scale capacity. Companies such as Shin-Etsu Chemical and SUMCO, which control a substantial share of the market for essential inputs like photoresists and silicon wafers, exemplify this scenario. The predominance of these suppliers limits the bargaining power of new entrants in the compact chip market. While established companies may benefit from economies of scale, market concentration can inflate input prices and restrict new competitors' capacity to reduce production costs, thereby challenging their competitiveness.

In terms of demand for compact chips, strategies such as consortia among large companies and specialization in products for sectors such as automotive and wireless communications indicate a search for high-performance and energy-efficient chips. These trends reveal that while there are patterns in some demands, consumer needs vary considerably depending on factors such as application sector and regional specificities (KPMG, 2023).

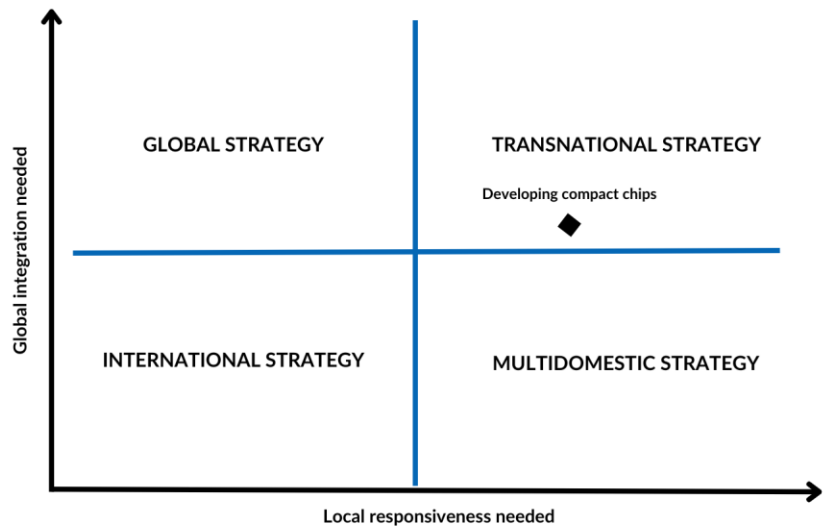
The preference of leaders in the automotive, aerospace, and artificial intelligence sectors for Japan, according to SIA (2021) and KPMG (2023), highlights Japan's leadership in the manufacturing of high-performance semiconductors. In October 2021, the partnership between TSMC and Sony Semiconductor Solutions resulted in the establishment of Japan Advanced Semiconductor (JASM) in Kumamoto. Planning to commence production before the end of 2024, JASM represents the country's solid commitment to innovation, addressing global demands for more advanced and efficient components, particularly in critical sectors such as automotive and high-performance computing (TrendForce, 2024).

Thus, global sourcing is a well-established practice among customers seeking cutting-edge technology and efficiency on a global scale. The acquisition of TSMC by JASM demonstrates that global competitors operate in a country with competitive conditions to meet these demands, adapting products to better satisfy local needs and preferences.

In this way, the Japanese market plays a central role in local resources, holding a dominant position, as approximately two-thirds of global suppliers of essential inputs for this industry are based in the country, which brings multiple significant benefits to the industry. Leadership in critical areas such as EUV lithography, chip stacking, photomasks, resist processing, silicon wafers, etc., ensures a stable and high-quality supply base, essential for manufacturing advanced electronic components. This is because the Japanese have focused more on high-tech niches that are less sensitive to price variations, indicating a lower price elasticity of demand. Demand for these products tends to be more inelastic, meaning that variations in prices have less impact on the quantity demanded. This structure is emphasized by the direct relationship between OEMs and sales channels, indicating an optimized and efficient supply chain that may differ significantly from distribution practices in other countries. Thus, the need for local responsiveness is classified as high.

Another perspective to note is that companies must ensure continuous compliance with all relevant laws and regulations, including the Economic Security Promotion Act (ESPA) in Japan, which imposes additional requirements related to economic security. This implies regular and detailed reporting on company operations, emphasizing the importance of preventive measures against economic and technological vulnerabilities. Non-compliance with these regulations may lead to severe penalties, such as fines or sanctions, affecting companies' ability to operate in the Japanese market (Khan, Mann, and Peterson, 2021; SIA, 2022; Allen, Wang, and Ma, 2023) (Figure 4).

Figure 4: Internationalization Strategy in Compact Chip Development for Japan



Source: Developed by the author based on Cavusgil (2010).

The suggested internationalization strategy emphasizes the importance of each subsidiary operating with a high degree of autonomy, allowing them to make local decisions and customize products to meet specific local market requirements. This approach prioritizes intense local responsiveness, aiming for operational efficiency and maximizing gains through economies of scale and scope. However, in the context of global sourcing and global competition, it is crucial to maintain a certain level of strategic alignment among subsidiaries to avoid increased local rivalry. This balance between multinational flexibility and global standardization is essential for achieving effective internationalization, thereby optimizing operational efficiency while remaining relevant and competitive in various local markets.

IV Analysis and Guidance on the Mode of Operation

After understanding the dynamics of the compact chip sector in Japan and analyzing the interaction between the different market participants while identifying the factors that limit or facilitate the entry of foreign companies, it was possible to determine the most appropriate international strategy, taking into account the strategic internationalization objectives and the peculiarities of the sector in the target country. With this foundation, the next step in formulating an internationalization plan is to establish the most effective mode of operation, aligning the elements of the desired business model with the characteristics observed in the dynamics of the sector in the chosen country.

In analyzing the sector in the target country, we identified two crucial elements that influence the choice of entry mode and operation in Japan. Firstly, the threat of new entrants was assessed as a moderate force, indicating that the existing barriers do not completely prevent entry into the country's microchip sector. Secondly, the intensity of competition among current market participants is determinant in defining the ideal mode of operation. High rivalry or the existence of few competitors with high entry barriers, such as exclusive contracts, suggests that forming joint ventures may be an effective strategy. This is because, in an environment with a concentrated market and difficult access, a partnership through a joint venture can offer significant competitive advantages, facilitating access to consumers, suppliers, and other critical resources.

When considering entry into the Japanese market for the development of compact chips, which demands specialization and efficiency, as well as the provision of highly innovative products, meticulous attention to local trends and peculiarities becomes essential. In this context, the transnational strategy emerges as the most advantageous and aligned with the proposed business model, characterized by its local responsiveness. Adopting this approach implies establishing a direct presence in the country while maintaining full control over operations. This local presence not only enhances the understanding of the dynamics of the Japanese market but also facilitates agile and effective adaptations to its requirements. This strategy is exemplified by Intel’s expansion with new subsidiaries in East Asia, as seen in the case of Vietnam, demonstrating how local control can improve adaptability and responsiveness in a foreign market.

Another crucial aspect in defining the mode of operation in the target country is the characteristics of the distribution activity. It was observed that companies acting as intermediaries in distribution for original equipment manufacturers (OEMs) do not produce chips; thus, distribution is carried out by the OEMs themselves to meet the demand from companies that do not manufacture. Moreover, all chipsets provide customized experiences for their customers, as seen in the automotive and aerospace sectors. For activities such as transportation and delivery of goods, these companies typically rely on specialized logistics partners. For instance, the operations of Renesas Electronics can be cited, which collaborates with local logistics partners such as Yamato or Sagawa.

Therefore, considering that the compact chip segment in Japan is characterized by moderate rivalry among competitors and a moderate threat of new players entering the market, the transnational strategy was chosen for its ability to combine local responsiveness with global integration. Aligned with the specific needs of a developer company's business model, it was decided to open a subsidiary or commercial office in Japan. This step involves foreign direct investment focused on development and operational efficiency, strengthening the company's presence in the Japanese market and enhancing its competitive capabilities.

A significant opportunity was identified for the implementation of a contractual operation for the transportation and storage of compact chips, offering advantages in terms of cost reduction and leveraging local expertise in Japan. Another favorable factor for outsourcing storage is the relatively low volume of chips traded, as these products, due to their high specialization and added value, have concentrated demand primarily in specific industrial sectors such as technology and automotive, often located in densely populated urban areas. While constructing a proprietary distribution center may not be necessary, it is crucial to maintain an adequate stock of chips to ensure efficiency and speed in deliveries, promptly meeting demand. Furthermore, by outsourcing logistics, the company can concentrate its efforts on the development and marketing of compact chips, adopting a more strategic and direct approach to serve the Japanese market.

According to Peng (2008), companies are not restricted to choosing a single entry method into the market. One advantage of opting for a wholly-owned subsidiary, especially in the context of compact chips, is the proximity to markets and consumers, which significantly influences local demands. Additionally, full ownership ensures greater control over operations, which is crucial for key processes in the semiconductor sector, such as component traceability. This approach aligns with the transnational strategy, which seeks to integrate global operations with a strong capacity to respond to the needs and specificities of the local Japanese market.

V Conclusion

After evaluating the global value chain of the semiconductor sector, a significant opportunity was identified in the compact chip segment, driven by consistent growth and market trends that emphasize advanced specialization, continuous innovation, and operational optimization. As a key competitive factor, product differentiation was highlighted, as it adds value and meets the increasing demands of the market. To achieve this differentiation, it is essential for companies to invest heavily in both basic and applied research and development. The compact chip segment, despite its expansive growth, is characterized as a niche market where innovations are crucial for leadership. Therefore, the internationalization plan is oriented towards the pursuit of greater efficiency.

Thus, considering that Japan prioritizes product specialization over final pricing, with the aim of maximizing capacity and efficiency before solely considering costs, the demand for these products tends to be more inelastic; that is, price variations impact the quantity demanded less. As noted by Kawamata (2022), there is a notable new trend of American companies seeking internationalization towards East Asia in order to take advantage of favorable agreements and regulatory frameworks in the sector. In light of this, the internationalization phase will initially focus on product development, aiming to mitigate price fluctuations caused by geopolitical chip shortages while simultaneously adding greater value.

Having defined the activity to be internationalized, Japan and South Korea emerged as attractive potential destinations. Following a detailed assessment of the risks that could impact the operation, Japan was chosen as the most suitable destination for international expansion due to its lower vulnerability to risks and superior benefits compared to South Korea. This country stands out for its political-economic stability and operational efficiency, being ranked among the global leaders in these aspects. The factors that differentiated Japan include lower economic, fiscal, and political risks, as well as a less aggressive competitive environment. Thus, Japan offers a more favorable scenario for the internationalization of compact chip development.

After defining Japan as the target country, an analysis of the sector's threats and opportunities was conducted using Porter’s five forces methodology (1989). This assessment revealed that the sector presents moderate forces, facilitating entry and operation in the country. An additional contributing factor is the low level of threats requiring attention, such as the threat of substitute products. The Japanese market stands out for its uniqueness, housing several highly specialized companies, for example, in Gate-All-Around (GAA) architecture, extreme ultraviolet (EUV) lithography, and wafer crystal equipment. Furthermore, EUV technology is irreplaceable in the processing of compact chips, establishing itself as the dominant solution in the market. Concurrently, there is a trend among major chip manufacturers to expand their operations in the compact microchip segment, maintaining significant local presences in various countries through the capitalization of knowledge. Companies, therefore, continuously innovate and share knowledge and skills among their global units, absorbing market variabilities to enhance and continuously innovate their operations.

Regarding rivalry among competitors within the sector, there is a potential for congestion in the segment in the future. Currently, there are few suppliers of compact chips in Japan, a situation primarily driven by the increasing demand for these products in the country. Although the segment is in constant expansion, it is challenging to make room for new suppliers, largely due to the strong concentration of critical inputs necessary for production. Additionally, the presence of numerous competitors in the market highlights another critical issue: the need for differentiation. When investigating and evaluating potential competitors in the sector, a high degree of distinction among them was noted, indicating that differentiation becomes a crucial element for standing out, beyond the intrinsic characteristics of the products.

After analyzing the sector, it was possible to identify which international operating strategy best aligns with the proposed business model. Given the specific characteristics of the compact chip segment, the transnational strategy was chosen. This choice is justified by the need for high local responsiveness in operations, which is crucial in a segment that values specialization and market efficiency.

Finally, to determine the best way to enter Japan, the particularities of the compact chip segment were considered, such as the moderate rivalry among competitors and the threat of new entrants, as well as the transnational strategy that emphasizes local responsiveness combined with global integration. Moreover, the competitors' approach in the target market was analyzed. Thus, it is recommended to open a commercial office in Japan focused on development and operational efficiency. Concurrently, collaboration with a local partner is suggested to manage storage, transportation, and delivery activities. This combination of in-house operations and partnerships ensures effective market engagement, reduces logistical costs, and leverages the specialized expertise of each involved party.

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