

# IDM Innovation: A Case Study of Intel's Acquisition of Tower Semiconductor

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**Abstract.** In the rapidly changing landscape of the semiconductor industry, IDM manufacturers like Intel are making adjustments. This article will discuss how companies adapt their strategies based on market changes, using the case of Intel's acquisition of Tower Semiconductor as a focal point and incorporating various data changes and market shares in the semiconductor market. The article will illustrate that, during times of significant market changes, acquisitions should align with the company's long-term strategic objectives and plans, effectively providing the company with strategic advantages. Furthermore, it will emphasize that when market demands evolve, companies should focus on using current acquisitions to synergize with subsidiary companies, transforming their products to match market changes and yield greater returns. The significance of this research lies in providing insights for other companies in the semiconductor sector, including Intel itself, on how to sustain development in the future semiconductor market. Similarly, this approach to acquisitions can also be extended to other markets, serving as a model for other companies to follow.

**Keywords:** IDM2.0, Intel, Tower Semiconductor, Semiconductor.

## 1. Introduction

In recent years, the semiconductor industry has witnessed strategic movements that have shaped competitive dynamics and technological advancements. SANTA CLARA, Calif., and MIGDAL HAEMEKE, Israel, Feb. 15, 2022 – Intel Corporation (Nasdaq: INTC) and Tower Semiconductor (Nasdaq: TSEM), a leading foundry for analog semiconductor solutions, announced a definitive agreement under which Intel will acquire Tower for \$53 per share in cash, representing a total enterprise value of approximately \$5.4 billion [1]. This notable case of Intel's acquisition of Tower Semiconductor highlights the ever-evolving nature of the semiconductor market.

To comprehend the significance of this acquisition, delving into Intel's history is imperative. Established in 1968, Intel rapidly emerged as a pioneer in the semiconductor sector. As one of the few Integrated Device Manufacturers (IDMs), Intel initially enjoyed a competitive edge by vertically integrating design, manufacturing, and packaging processes. Therefore, in the past, when chips were not as high-end as they are now, IDM companies used to complete the manufacturing process themselves. However, as the semiconductor industry evolved, these three components gradually became independent, especially due to the rapidly increasing costs and technological demands of the manufacturing step. Now IDMs can provide contract fabrication services for other firms, or can outsource consistent part of their production cycles to 'pure-play foundries', or simply foundries, like TSMC, Samsung Foundry, UMC, GlobalFoundries, and SMIC [2]. In fact, many IDM companies have even abandoned independent manufacturing and instead transitioned into chip design companies. Clearly, Intel has no intention of relinquishing its dominant position among IDM companies, which is why the company places a strong emphasis on advancing its manufacturing technologies and scaling capabilities. Especially after being surpassed by its competitor Samsung, Intel, once the former leader among IDM companies, has realized the need for change.

Founded in 1993 and listed on the NASDAQ stock exchange in the United States, Tower Semiconductor is a leader in the high-value domain of analog semiconductor solutions. The company manufactures analog integrated circuits for over 300 global clients. Its manufacturing facilities are located in Israel, the United States, and Japan. Additionally, Tower Semiconductor specializes in the

specialized fabrication of various chips, including analog semiconductors, sensors, mixed-signal semiconductors, and more. Despite not always having the most advanced technology, the company's operations show remarkable stability, with products boasting extended lifecycles. The semiconductors and circuits produced by Tower Semiconductor find widespread application across various sectors, including automotive, consumer goods, medical devices, and industrial equipment.

This study focuses on two key aspects of the recent acquisition case. Firstly, it examines how Intel aims to strengthen its position as a dominant player in the semiconductor industry by adapting to the market's division into distinct segments. This acquisition serves as a strategy to refine Intel's IDM operations and maintain its historical advantages. Secondly, the study investigates how ongoing and future changes in the semiconductor market, along with shifts in sectors like AI and automotive are shaping the industry's landscape. The study aims to understand how Intel's acquisition aligns with these market dynamics and positions the company to respond effectively to these evolving trends.

The following sections of this paper are organized as follows: The first section will delve into Intel's motivations behind the acquisition in this case and its strategic advantages post-acquisition. The second section will explore how various domains are impacting the current landscape of the semiconductor industry.

## **2. Motivations for Acquisition and Strategic Advantages**

### **2.1. Motivations for Acquisition**

The semiconductor industry is a complex industrial ecosystem that encompasses several crucial stages. It comprises the following three main segments: Design, Manufacturing, and Packaging and Testing. The business models in the semiconductor industry are primarily divided into two main categories: IDM (Integrated Device Manufacturing) and vertical specialization. Under the IDM model, companies handle all aspects of chip design, manufacturing, and packaging and testing internally, allowing for an advantage in integrating the entire value chain. On the other hand, the vertical specialization model involves chip design firms (Fabless), wafer foundries (Foundry), and packaging and testing facilities (OSAT) individually handling chip design, manufacturing, and packaging and testing. This leads to a collaborative effect within the industry value chain. The IDM model, represented by companies like Intel and Samsung, embodies an autonomous and fully controllable industry chain. However, it also implies that companies need to extend their efforts extensively. In other words, the multitude of operations implies that IDM companies need to comprehensively enhance themselves. They not only invest significant capital in ongoing chip research and development, but also allocate substantial resources to enhance chip manufacturing processes. Over the past three decades, Intel was one of the largest players in the semiconductor market. From 1988 to 2018, Intel maintained a leading position in the semiconductor sector, fueled by its high-performance central processing units (CPUs) and other innovative products, establishing itself as a dominant force in the industry. However, during this period, the semiconductor market underwent significant transformations and intensifying competition, ushering in new challenges and competitors. As time progressed, Intel's market shares gradually faced erosion from other competing rivals. Particularly in specific domains, such as graphics processing units (GPUs), Intel's dominance was surpassed by NVIDIA. NVIDIA secured its market share by leveraging its robust GPU performance and leading applications. Currently, Samsung's market share has surpassed that of Intel, and Samsung's success is rooted in the changing market dynamics. This shift is a result of the continued impact of Moore's Law and the ongoing process of digital transformation, prompting enterprises to transition from a "generalist" strategy to a more "specialist" approach. From the evolution of the semiconductor industry's production modes, it can be observed that outsourcing is replacing the IDM model as a trend [3]. IDM's ability to grasp the overall picture is commendable, but expanding reproduction costs are exorbitant. The practice of tightly controlling the entire industrial chain along with broad and all-encompassing responsibilities has resulted in reduced research and development efficiency, leading the semiconductor industry towards an inevitable trend

of finely specialized social division of labor [3]. Similarly, the large scale of IDM companies has also brought them various issues, such as chaotic management and distribution of profits. The motivation behind Intel's acquisition of Tower Semiconductor is to enhance, or even break through, the traditional IDM model in order to adapt to these market changes.

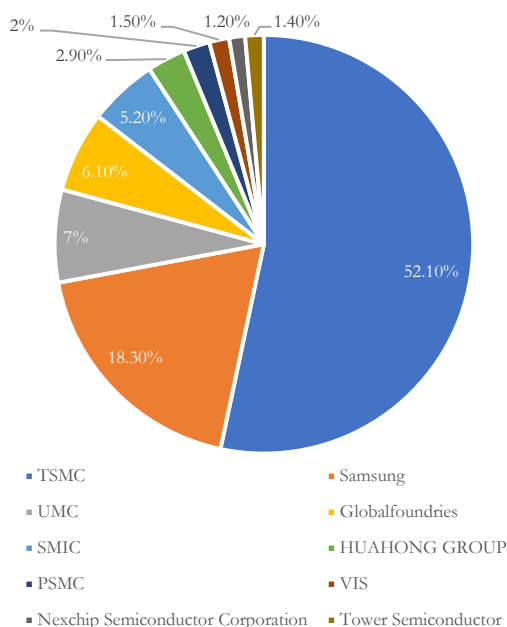
It is precisely due to the growing need for changing the IDM model that Intel's CEO, Pat Gelsinger, introduced the strategic concept of IDM 2.0. IDM 2.0 represents the combination of three components that will enable the company to drive sustained technology and product leadership: 1. Intel's global, internal factory network for at-scale manufacturing is a key competitive advantage that enables product optimization, improved economics, and supply resilience. 2. Expanded use of third-party foundry capacity. 3. Building a world-class foundry business, Intel Foundry Services [4]. Considering Intel's introduction of the IDM 2.0 strategy, it's evident that the acquisition of Tower Semiconductor aligns with the implementation of the first aspect of this strategy. Tower Semiconductor offers worldwide manufacturing capabilities with a focus on quality and flexibility, ensuring consistent global capacity. This allows for multiple fabrication options across three geographical regions, catering to both fabless companies and integrated device manufacturers (IDMs). The company maintains a proactive approach to expanding its wafer capacity in existing or potential geographic locations [5]. By leveraging Tower Semiconductor's mature wafer foundry capabilities, Intel can strategically enhance its share and capabilities in the manufacturing sector. This move not only strengthens Intel's competitive position but also aligns with the IDM 2.0 strategy, enabling the company to navigate the ever-changing semiconductor market landscape more effectively.

## 2.2. Strategic Advantages

The first significant strategic significance of this acquisition case is that it provides geographical flexibility for Intel's internal manufacturing. Tower Semiconductor's acquisition offers intrinsic advantages as it possesses wafer manufacturing facilities across Asia, Africa, and the United States, encompassing a vast geographical scope. Prior to the acquisition, Intel's manufacturing facilities were predominantly concentrated in Asia, indicating a lack of geographic flexibility and agility within the original supply chain. According to Intel's beliefs, "The world desperately needs more geographically resilient supply chains. Our moonshot goal is that by the end of this decade, the US will have gone from 12% to 30%; Europe from 9% to 20%; that we'll collectively go from 80% to 20% to 50% by the end of this decade, creating a geographically balanced and more resilient supply chains for the future. A bet on Intel is a hedge against geopolitical instability in the world [6]." Therefore, the acquisition of Tower Semiconductor not only aligns with Intel's IDM 2.0 strategy, enhancing its capacity to address potential disruptions, but also cultivates a more robust and responsive manufacturing ecosystem. It strategically expands the company's manufacturing horizon. By integrating Tower Semiconductor's diversified geographic manufacturing capabilities into its operations, Intel gains the flexibility and agility required to navigate the increasingly intricate and dynamic landscape of the semiconductor industry.

The second strategic significance is a direct enhancement of Intel's manufacturing capabilities. As stated by Pat Gelsinger, Intel CEO, "This deal will enable Intel to offer a compelling breadth of leading-edge nodes and differentiated specialty technologies on mature nodes." [1] Tower Semiconductor, being one of the world's top ten semiconductor foundries, possesses significant manufacturing experience and holds unique design advantages. This experience and expertise can substantially elevate Intel's internal manufacturing capabilities, ensuring that the chips designed by Intel won't face production bottlenecks. However, this strategic advantage in manufacturing serves primarily for Intel's internal purposes rather than primarily aiming to compete for a larger share in the global semiconductor foundry market. Based on the statistics from Q4 2021 and Q1 2022 (please see Figure 1 & 2), despite Tower Semiconductor being among the top ten semiconductor foundries globally, its market share is significantly smaller compared to TSMC and Samsung. Therefore, considering these data, attempting to acquire a substantial market share through the acquisition of Tower Semiconductor seems unrealistic for Intel. Thus, Intel's acquisition should lean more towards

leveraging Tower Semiconductor's technological strengths to address its own shortcomings. This acquisition is just a part of the IDM 2.0 strategy. Intel's aim to gain a larger share in the foundry sector and potentially surpass Samsung relies more on continuous expansion through subsequent manufacturing facilities. For instant, on June 19, 2023, Israeli Prime Minister Netanyahu announced that Intel will invest \$25 billion in building a semiconductor manufacturing facility in Israel. This marks the largest foreign investment in the country's history [7].

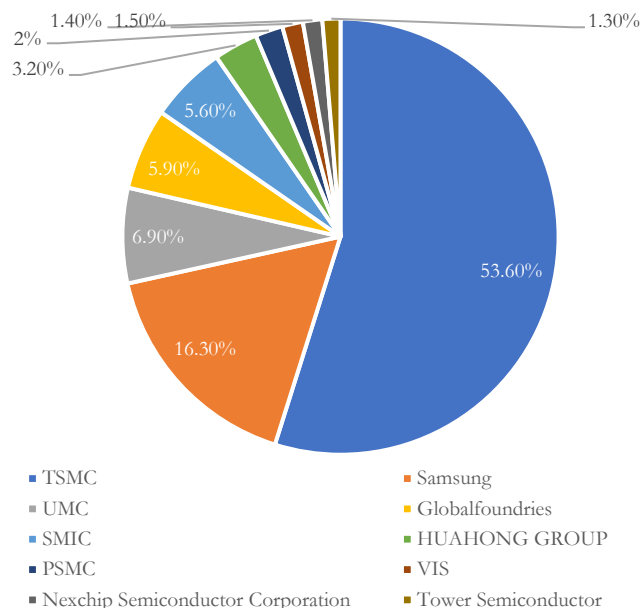


**Figure 1.** The market shares of the top ten global wafer foundries in Q4 2021

Source: TrendForce, China Great Wall Securities

Photo credit: Original

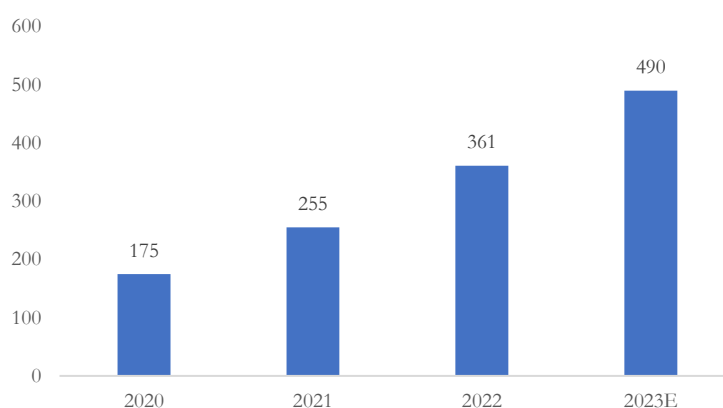
The third strategic advantage, and perhaps the most easily overlooked one, is that Tower Semiconductor can offer greater value to its customers, thereby attracting a broader clientele while also satisfying the existing customer base. For Intel to venture into the foundry sector, it's essential to have a substantial number of clients to generate a significant volume of business. Although Intel secured agreements with 7 out of the top 10 semiconductor design companies in the world in 2022, the actual volume of business remains relatively limited. This is because these businesses are either specialized processes or involve advanced process nodes of 16nm and above, which do not contribute significantly to the volume of advanced process node foundry business [8]. The inclusion of Tower Semiconductor can effectively elevate Intel's manufacturing processes and overall manufacturing capabilities. This approach can also attract potential users and, more directly, bring in customers who have had long-standing collaborations with Tower Semiconductor, integrating them into Intel's service portfolio. Taking the defense sector as an example, Jazz Semiconductor Trusted Foundry (JSTF), a subsidiary of Tower Semiconductor Newport Beach, Inc., was accredited by the United States Department of Defense's Defense Microelectronics Activity (DMEA) as a Category 1A Trusted Supplier. This accreditation allows JSTF to manufacture semiconductors that could be used in trusted applications [9]. Therefore, Tower Semiconductor's distinct advantages in aerospace and defense could directly foster collaboration between the U.S. Department of Defense and Intel.



**Figure 2.** The market shares of the top ten global wafer foundries in Q1 2022  
Source: TrendForce, China Great Wall Securities  
Photo credit: Original

### 3. Impact on Other Fields

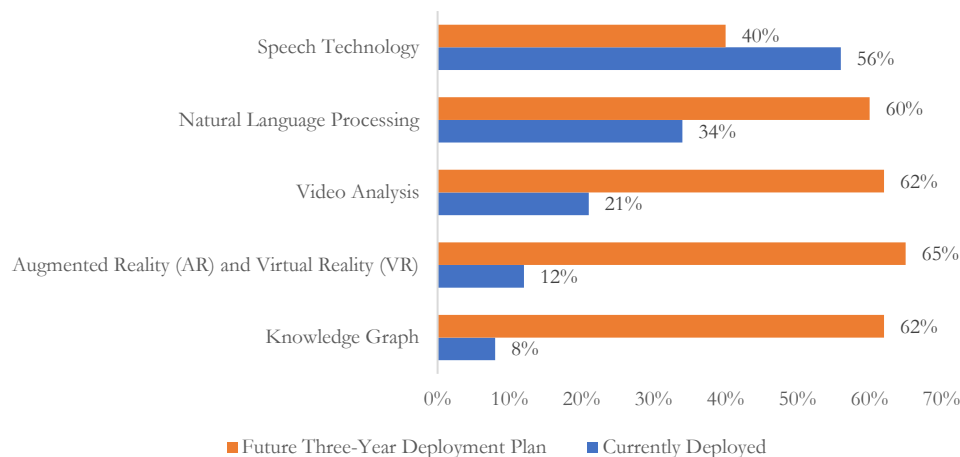
The explosive popularity of ChatGPT has directly driven the rapid growth of the AI market. Moreover, it's not only ChatGPT; an increasing number of AI products are also gradually emerging, such as AI image recognition, AI data analysis, and more. The rise of the AI market has directly led to the rapid development of AI chips.



**Figure 3.** The global AI chip market size from 2020 to 2023 (in billions of dollars)  
Source: ASKCI, Sealand Securities  
Photo credit: Original

According to the data in the graph, the AI chip market has experienced an annual growth rate of over 35% during this period. This significant growth rate indicates that AI chips are rapidly advancing. At the same time, this growth has led to a substantial increase in the demand for chips. Starting from 2012, deep learning demonstrated its powerful capabilities in fields such as speech recognition, image recognition, and natural language processing (NLP), marking the practical phase of AI technology. Concurrently, the computational requirements for AI models experienced exponential growth, doubling approximately every 3.4 months. From 2012 to 2018, computational demand increased by 300,000 times, while according to Moore's Law, chip computing power only increased by 7 times.

This surge in computational demand signifies a significant mismatch between chip supply and demand. Taking the example of TSMC, the leading player in the foundry sector, the proportion of AI chips in its total revenue has also seen a significant increase. According to TSMC's calculations, over the next 5 years, their AI-related products such as CPUs, GPUs, and AI accelerators are expected to grow at a nearly 50% annual compound growth rate. The corresponding revenue share within their total revenue is projected to increase from 6% to a range of 11% to 13% [10].



**Figure 4.** The Application Status of Enterprise Artificial Intelligence Technology in 2022

Source: IDC, China Galaxy Securities

Photo credit: Original

Due to the popularity of ChatGPT, many people now tend to associate AI with ChatGPT and even assume that all AI products are similar to language analysis AI like ChatGPT by default. However, we can observe from the 2022 data on the application of AI technologies that computer vision is currently the most prominent application type. Image recognition, biometric identification, and speech technology are widely adopted techniques. In the next three years, AR and VR, video analysis, knowledge graphs, and natural language processing will become the primary areas of focus. So, even though Intel may not surpass Nvidia in the GPU domain, it can still gain advantages in other areas. Considering this acquisition case, it's evident that Intel can leverage Tower Semiconductor to gain an advantage in image technology. The most significant reason is that Tower Semiconductor holds an absolute leading position in CMOS image sensors. Tower Semiconductor's worldwide recognized leadership in CMOS image sensors and pixel technology is derived from its vast experience and proven ability to supply sensors with best-in-class performance, customized to product and application needs [11]. In the current AI market where demand outpaces supply, coupled with Tower Semiconductor's technological advantage in CMOS image sensors and Intel's enhanced manufacturing capabilities under its IDM 2.0 model, Intel can promptly seize a prominent position in the field of image technology.

There are numerous specific applications of image technology, with a particular focus on its application in the field of autonomous driving. In fact, Intel acquired Mobileye in 2017. Mobileye is a company specialized in developing computer vision, perception, and driver assistance systems. Its technology can be applied to autonomous driving and safety functions in automobiles. This acquisition allowed Intel to further expand its presence in the field of autonomous driving technology. Mobileye's proprietary software algorithms and EyeQ chips can perform detailed analysis of visual information and predict potential collisions with other vehicles, pedestrians, bicycles, or other obstacles. At the same time, Mobileye holds an 80% market share in the automotive onboard vision ADAS market. As an equally important component in autonomous driving, CMOS image sensors can play a significant role, and Tower Semiconductor can contribute in this aspect. Therefore, with the combination of Tower Semiconductor and Mobileye, Intel can continue to venture into the automotive chip industry.

## 4. Conclusion

This paper delves deep into Intel's acquisition of Tower Semiconductor, extensively examining the backdrop and context. It primarily investigates the motivations driving Intel's acquisition, the challenges it encountered, and elaborates on the strategic advantages derived from the acquisition. Additionally, it delves into the alignment between the acquisition and the ongoing developments in the market and external factors.

The principal findings of this paper revolve around three critical dimensions of strategic advantage. Firstly, it sheds light on how Intel's own beliefs helped identify geographical advantages stemming from the acquisition. Secondly, it emphasizes the direct enhancement of manufacturing capabilities. Thirdly, it highlights the potential for attracting new customers through this strategic move. Another significant revelation of this study lies in its analysis of the ever-changing dynamics of the chip market. By amalgamating the resources and expertise of Intel's previous acquisition, Mobileye, with the current acquisition of Tower Semiconductor, the study elucidates how the two acquisitions work in tandem to adapt to these changing dynamics.

The core objective of this paper is to exemplify, through this acquisition case study, that successful acquisition activities necessitate a synergistic amalgamation of ongoing strategies, harnessing the diverse capabilities of subsidiary companies, and staying nimble in response to market shifts. Ultimately, this acquisition case study demonstrates the intricately coordinated interplay of various factors required to adeptly navigate the shifting landscape of a rapidly evolving industry.

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