Supply Chain Resilience in Large Organizations: TSMC Case Study

The global landscape of supply chain management underwent a profound transformation with the onset of the COVID-19 pandemic. As the virus spread rapidly across borders, it unleashed unprecedented disruptions, challenging the resilience and adaptability of supply chains worldwide. Amidst this turmoil, organizations grappled with supply shortages, logistical bottlenecks, and fluctuating demand, underscoring the critical need for robust supply chain strategies capable of withstanding unforeseen shocks.

This report delves into the realm of supply chain resilience through a comprehensive examination of the Taiwan Semiconductor Manufacturing Company Ltd (TSMC) case study. TSMC, a leading semiconductor manufacturer, navigated the tumultuous waters of the pandemic with agility and foresight, offering valuable insights into effective supply chain management practices during times of crisis.

The pandemic-induced surge in demand for technology products, coupled with disruptions in global logistics, posed significant challenges for TSMC and its intricate supply chain network. However, TSMC's proactive responses, strategic investments, and collaborative efforts not only mitigated the impact of disruptions but also positioned the company as a beacon of resilience amidst uncertainty.

By dissecting TSMC's journey through the pandemic, this report aims to distil invaluable lessons and best practices for supply chain professionals, industry stakeholders, and policymakers. As organizations navigate the uncertain terrain of the post-pandemic world, the principles and strategies elucidated in this report serve as a compass for building resilient and agile supply chains capable of thriving in the face of adversity.

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# Part 1 – Introduction

Taiwan Semiconductors Manufacturing Company

Taiwan Semiconductor Manufacturing Company Limited (TSMC) is a multinational semiconductor contract manufacturing and design company. It produces and sells semiconductors integrated device manufacturers and fabless semiconductors companies. They supply fabless chip designers like Apple, Nvidia, Qualcomm and AMD. TSMC produces 92 percent of worlds most advanced integrated circuits, while the rest is produced by Samsung Electronics. The major factor for TSMC in this business is its old business model: produce extraordinary well-made devices for other companies. The company also offers a range of wafer fabrication processes that helps other companies to manufacture mixed-signal, radio frequency and other different types of semiconductors. The semiconductors made by TSMC serve a global customer base which is large and diversified for different types of applications.

TSMC is a major player and it is a part of a highly important supply chain in the world, as it serves and operates in the world’s fourth most traded category of goods. The products produced by TSMC are used in a variety of markets such as mobile phones, high performance computing, electronics used in the automotives and Internet of Things (IoT). This large diversification in its supply chain intern helps TSMC to handle the fluctuations in the demand, so it can easily achieve higher levels of capacity utilization. Thus, generating profits and healthy returns for the investment.

Apart from this, the company also provides mask making, bumping, probing, assembly and testing services. TSMC runs and manages its business operations in US, Canada, Japan, China, the Netherlands, South Korea and European Countries and Africa.

1. Pandemic effect on TSMC

Due to the Corona Virus outbreak, most of the world went into the lockdown. Corporate workers, teachers, students, IT employees and many people working in different sectors are made to work from home. This change in working style led to increase in demand for laptops, personal computers, Smart phones etc. These changes made many families to switch from one device per household to one device per person. Technology sales have soared due to this unexpected and unprecedented pace of change. The laptop industry alone grew 26.7 percent in sales in 2020. The replacement cycles for laptops, which is generally 6 years, was compressed as people started to upgrade their laptops at the beginning of the pandemic. Demand and replacement cycles for TVs and displays have also been boosted.

This sudden demand had put immense pressure on the technology and semiconductor industry. While many businesses welcome rising demand, many semiconductor industries including TSMC were caught off guard. Many industries including TSMC could not handle this sudden rise in demand, this led to chip shortages across the entire sector affecting other industries. This shortages in supply and increase in demand led to higher chip costs to customers. TSMC soon caught up with this increase in demand by increasing its production by supplying much needed products and experienced rapid growth of revenue by 31.4 percent year-over-year, as compared to normal 10 percent yearly growth.

1. Key supplier in TSMC’s supply chain - ASML

Advanced Semiconductor Materials Lithography (ASML) is a leading provider of advanced technology systems for the semiconductor industry. It provides the chipmaker industries with everything they need such as hardware, software and services. It is one of the largest suppliers of Photolithography systems, which are used in the production of computer chips. And it is only industry which supplies Extreme ultraviolet lithography (EUV) machines in the world.

Covid-19 outbreak had a very little impact on ASML’s manufacturing capability. Also, the demand from customers side (TSMC one of the customers) also tend to slightly increase. Apart from manufacturing ASML witnessed problems in its supply chain due to the pandemic. Due to some shipment and travel restrictions, ASML faced some problems in delivering deep ultralight (DUV) scanners to China and some other parts of the world. ASML also faced some issues within its own supply chain, but resolved it immediately.

One of the main issues that is faced by ASML is from customer’s side. Due to increase in demand, ASML needed to deliver some of its products without prior normal Factory Acceptance Tests (FAT). So, the revenue recognition is only done when the product is successfully installed at the customers site.

# PART 2 – Main Section

1. Changes in the “Business Plan” with respect to Supply Chain due to Pandemic.

TSMC success had been mainly built on the concentration of its operations on Taiwan’s West coast. Although TSMC depends on Global network of suppliers, many key inputs which are necessary for running the factory are available within a short distance. Although TSMC had met the needs of its customers during the pandemic. The supply chain downstream of TSMC to its customers faced many issues in delivering the products to the end customers. As a result, many industries in countries like USA have faced tremendous shortage of semiconductors during the pandemic. In response US tried to reboot its semiconductor manufacturing. SO, TSMC have to act immediately to stop its existing and potential customers in US to look at local factories.

As a result, TSMC had adapted its business plan and proposed to build a US $12 billion fab in Phoenix, Arizona. TSMC assured its customers in the states to build six different sizes of chips in that factory. TSMC had discussed about investing in a research facility and a Chip manufacturing factory in Japan. And, promised a factory in Germany.

During the Fiscal year 2020, the company had invested TWD 109,486 million on its Research and Development activities as compared to TWD 91,419 million in Fiscal year 2019. This increase in capital investment is mainly due the sudden surge in demand it experienced during the Covid-19 outbreak. To ensure to maintain its production capabilities and meets the un-anticipated customer demands, TSMC increased its capital investment to upgrade its Manufacturing process technologies. To further enhance its manufacturing and innovation capabilities in order to meet the increasing customer demand. In July 2021. TSMC had announced that it is going to start manufacturing 2 Nanometer chips at a new plant in Hsinchu, Taiwan. This move is to make sure the company meeting the demand in the coming year 2023. Also, the growth in the sales of the smartphones sided for market growth of TSMC. So, TSMC launched N6RF for next generation 5G smartphone and WIFI 6/6e performance.

1. Government/State Assistance for TSMC

TSMC did not receive any special government assistance during the pandemic. As TSMC with the increase in demand for its products due to change in the work culture in the world and with the growing revenue, TSMC is self-sustained in all aspects.

On the other hand, The US mainly the Biden administration is trying to rebuild the US semiconductor market capacity to promote local industry and technology. To rebuild the manufacturing capability for semiconductor in the US, the help of foreign companies such as TSMC and Samsung are absolutely necessary for US. In this sense, US officials have assured a strong commitment to the leaders and officials on the administration’s semiconductor initiatives. The US supply chain review also clearly stated and promised the federal government subsidies to boost investments and attract foreign players into their market.

1. Supply Chain during the Pandemic

The Global semiconductor industry was under a lot of pressure with increase in demand. The short supply of chips made the technology production companies to run slow. Even though with an increase in number of cases of covid infections in its employees, TSMC continued the production of its chips, as the chip manufacturing process is mostly automated and manufacturers have separated employees in groups to limit any spread of the Virus.

King Yuan Electronics, a leading supplier of semiconductor testing and packaging services for TSMC had to halt its operations for 15 days, due to the spread of the virus among its employees. Although, the major problems faced by the supply chain was tightening of national borders of the world due to pandemic.

1. Strategic Choices by TSMC

* In April 2021, TSMC announced a plan to invest $ 100 billion in the R & D and manufacturing technologies of chips over the next three years to address the global chip shortage.
* In 2020, TSMC has spent around $ 17 billion in the production of semiconductors chips, but had originally planned to spend only $25 – 28 billion until 2021. This budget change is adapted to address the shortfall and increased demand of chips in telecommunications.
* In 2019, the company announced its plans to start a new R & D centre in Taiwan. This is to improve the manufacturing technology used in chip production.
* In the year 2020, TSMC agreed to invest US $12 billion to start a chip factory in Arizona, to continuously meet the semiconductor demand in the country.
* TSMC had entered into a collaboration with Synopsys to enable the designs of mobiles, 5G, HPC and AI to aggressively cope up with the increase in trend of mobile phone, IoT etc.
* In the year 2020, TSMC had acquired a plant from Optimax Technology for production purposes of its products, to meet the increased demand for its products.
* In the light of problems faced by TSMC to supply its products to the customers in Japan, the company had decided and announced its plan to build a Chip Manufacturing plant in Japan in October,2021.

**Part 3**

1. Conclusion

TSMC had reported a revenue of $15.7 billion in December 2021, with a profit of $6 billion. The semiconductor manufacturing company as worlds largest chip manufacturer, took the advantage of the global chip shortage and delivered its products by enhancing its production capabilities and advanced supply chain methodologies. With the support of local government, top engineering talent base and cost efficiencies TSMC had risen to the top of semiconductor industry during the pandemic. TSMC had been ruthless with its capital investments in R & D, which is producing fruitful results.

TSMC is one of the companies that had contributed in adding value to the lives of the people in the world during pandemic. With the increase in demand and advancement of technologies and a diversified customer base, the future of TSMC is assured with continuous growth and development.

1. Recommendations

The strategic choices made by TSMC, during the pandemic, are very straight forward and very logical. The choices that TSMC undertook not only addresses with current global crisis in the supply chain of the world, but those moves also ensures the position of TSMC to stay at the top of the supply chain during the situations like these. The strategies adapted by the company ensure its presence in the world and serve various technological needs of different organizations which are emerging on a daily basis with innovative and ground breaking technologies.

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