

# IMPACT ANALYSIS IN AUTOMOBILE INDUSTRY DUE TO SHORTAGE OF SEMICONDUCTOR CHIP IN NAVI MUMBAI, MAHARASHTRA, INDIA

**Bidisha Roy Goswami<sup>1</sup>, Shamik Goswami<sup>2</sup> and Sameen Intekhabalam Shaikh<sup>3</sup>**

<sup>1,3</sup>Assistant Professor, Rajeev Gandhi College of Management Studies, Navi Mumbai

<sup>2</sup>Associate Consultant, TCS

<sup>1</sup>bidisha15.roy@gmail.com / <sup>2</sup>gskol@gmail.com / <sup>3</sup>sameen1995@gmail.com

## ABSTRACT

*In the modern world, automobiles play a significant role in daily life. Every family needs it on a basic level. Imagine having to travel hundreds of miles on foot over the course of several days, but because to the invention of the automobile, transportation is now much faster, simpler, and more dependable. There aren't enough chips left for the car industry. Due to the lengthy lead times for the tiny silicon chips, production of everything from smartphones and home appliances to driver-assistance systems has been hampered, leading to the global semiconductor crisis that started in the first quarter of 2021. The study's findings show how the decline in semiconductor sales affected India's vehicle market.*

**Keywords:** *Automobile Industry, Semiconductor Chips, Semiconductor Crisis, Semiconductor Shortage*

## INTRODUCTION

In the worldwide automotive industry, there is now a severe semiconductor chip shortage. Due to a sharp rise in demand for consumer electronics during the COVID-19 pandemic that outstripped the available supply of semiconductors, this scarcity was brought on. The manufacturing and supply cycles were impacted by numerous countries' complete lockdowns in 2020, which led to the onset of the worldwide chip scarcity problem. After a hurricane stopped production in the U.S. and a factory in Japan was destroyed by fire, which combined accounted for 50% of the semiconductor chips used in cars worldwide, supply took a significant hit earlier this year. Additionally, the introduction of the Delta strain and subsequent COVID-19 outbreaks in Southeast Asia exacerbated the lack of semiconductor chips.

## OBJECTIVE OF STUDY

The objectives of the study are:

To understand impact of semiconductor chip shortage on automobile industries

To understand how this has happen at first place

To study the disruption in vehicle delivery

To study how industry players can overcome the problem in terms of short term and long-term solutions.

## RESEARCH METHODOLOGY

**Research Gap:** Past studies show the impact of semiconductor shortage in global automobile markets. The factors affecting in Indian context needs to be considered.

**Research Type:** This is descriptive research.

**Data Collection & Sample Size:** The sample size was 41 due to diverse situation in data collection. The samples are categorised into two categories a. Dealers or franchise (count 29) and b. Original Equipment Manufacturers OEM (count 12). Dealers or franchises, where information particularly lead time and waiting time are key. The study conducted on various dealers and franchises situated in Nerul, Kharghar and Panvel area of Navi Mumbai. Other than that, there two Original Equipment

Manufacturers are also considered in the study (names confidential). Whereas OEM provide the data for supply chain disruption due to chip shortage. Thereafter, it is also supported by secondary data by various site such as the cartrade.com or cardekho.com. The secondary data was used in this study mainly from the research articles published by various sources.

Limitations: This study considers all chipsets being used in vehicle manufacturing and their shortages during a period from March 2020 and February 2022. Also, there is a supply chain constraint in this entire study that is the entire landscape of chip shortage is divided into two supply chain processes a. processed wafer manufactured and transported to semiconductor chipset organization (such as NXP) and b. then fabricated, programmed, and assembled chipsets are transported to automobile OEMs.

### SIGNIFICANCE OF THE STUDY

This study gives a comprehensive impact analysis in Automobile Industry due to shortage of semiconductor chip in Navi Mumbai, Maharashtra, India.

### LITERATURE REVIEW

In the worldwide automotive industry, there is now a severe semiconductor chip shortage. Due to a sharp rise in demand for consumer electronics during the COVID-19 pandemic that outstripped the available supply of semiconductors, this scarcity was brought on. The manufacturing and supply cycles were impacted by numerous countries' complete lockdowns in 2020, which led to the onset of the worldwide chip scarcity problem. After a hurricane stopped production in the U.S. and a factory in Japan was destroyed by fire, which combined accounted for 50% of the semiconductor chips used in cars worldwide, supply took a significant hit earlier this year. Beyond the car industry, other industrial players are also feeling the effects of the chip shortage as they struggle to obtain chips. That demonstrates the weakness of those supply chains, which heavily depend on Asia as a centre for the production of semiconductors. Numerous automakers are currently in crisis mode, and few people anticipate an immediate resolution. To address the imbalance in demand, chipmakers and automakers will need to cooperate. This article discusses both the causes of the scarcity and potential solutions.

*[Article published in Mckinsey & Company by Ondrej Burkacky, Stephanie Lingemann, and Klaus Pototzky on May 27, 2021]*

### RESULTS AND DISCUSSION

Separate appointments were taken to have personal meeting/interview from each dealer or franchises. The interviews were conducted as potential car buyer with a set of questions to the participants. Key points are taken from the interview are:

- Models available with year of manufacturing
- Different variants in each segment
- Transmission type (Manual or Automatic)
- Emission norms (BS4 or BS6)
- Availability of electric version
- Average waiting time in each car segment
- Change in waiting time base on the additional feature
- Relation additional features with waiting time

Twenty-nine recipients have participated in the interview from different dealer or franchises. Further, data collection done in two major Indian auto giants (OEM). Participants were assured confidentiality and were given an opportunity to decline to participate in the study. Twelve participants participated in the study and six participants have declined to participate in the study. The primary data collected after conducting receiving mail from the questionnaire of the group. The questionnaire was focused on:

- Supply chain process related to electronic items specially semiconductor circuits
- Country of origin
- Covid 19 effect on customer demand
- Demand changes due to unlocking after covid 19 lockdown

**Table 1:** Semiconductor Companies by Market Share

Company	Market share	Country
TSMC	54%	Taiwan
Samsung	17%	South Korea
UMC	7%	Taiwan
GlobalFoundries	7%	U.S.
SMIC	5%	China
HH Grace	1%	China
PSMC	1%	Taiwan
VIS	1%	Taiwan
DB HiTek	1%	China
Tower Semiconductor	1%	Israel
Other firms	5%	N/A

TSMC, short for Taiwan Semiconductor Manufacturing Company, is by far the world's largest chip manufacturer. It's also the sixth most valuable company in the world with a market cap of over \$600 billion, and supplies chips to the likes of Apple, Intel, and Nvidia. Taiwan's role in the world economy largely existed below the radar, until it came to recent prominence as the auto industry suffered shortfalls in chips used for everything from parking sensors to reducing emissions. With carmakers including Germany's Volkswagen AG, Ford Motor Co. of the U.S. and Japan's Toyota Motor Corp. forced to halt production and idle plants, Taiwan's importance has suddenly become too big to ignore. U.S., European and Japanese automakers are lobbying their governments for help, with Taiwan and TSMC being asked to step in.

## FACTORS AFFECTING THE SEMICONDUCTOR CHIP SHORTAGE

### Lack of new capacity

Through consolidation and the attainment of larger scale, the semiconductor industry has developed in recent years. In line with sales, its capacity has grown slowly but gradually by about 4% annually. Parallel to this, semiconductor usage has been consistently high over the past ten years (at or above 80%).

### Geopolitical tensions

Some consumer electronics manufacturers have significantly expanded their chip inventories in order to survive a period of restricted access to semiconductor manufacturing due to geopolitical concerns.

### Contract terms

In contrast to other industries, which are more frequently governed by long-term binding agreements (so-called take-or-pay deals) and give semiconductor suppliers purchase orders that last much longer than six to twelve months, the typical contracts for sourcing parts in the auto industry are very different from other industries' contracts. The chip-sourcing commitment cycle for the auto sector, however, tends to be shorter term—especially with respect to binding purchase commitments on the order of a few weeks to a few months—despite an auto supply chain that is complicated and frequently substantially outsourced.

### Limited stock

The auto supply chain makes extensive use of just-in-time manufacturing techniques, which can reduce waste and boost productivity by keeping on-hand inventory low. The reduction of inventory

typically has a positive financial impact; nevertheless, in the event of a sudden shortage, the practise immediately disrupts the entire supply chain. Since many players were unprepared for the chip scarcity in 2020 and 2021, they probably only have a very little amount of stock to last through the crisis.

### 5G rollout and overlapping chip demand

By node size, semiconductor industry demand varies. Although many automakers don't require them, chips in the smaller size ranges—the most cutting-edge of which are seven and 14 nano meters or smaller—are frequently employed in cutting-edge technology applications. The auto industry must take into account a number of secondary effects of widespread technology adoption, according to our findings.

### Impact on Indian Automobile Industries

Chipmakers now have some flexibility to significantly raise prices due to the increased demand for chips. TSMC disclosed a 20% price increase for chips used in autos earlier this year.

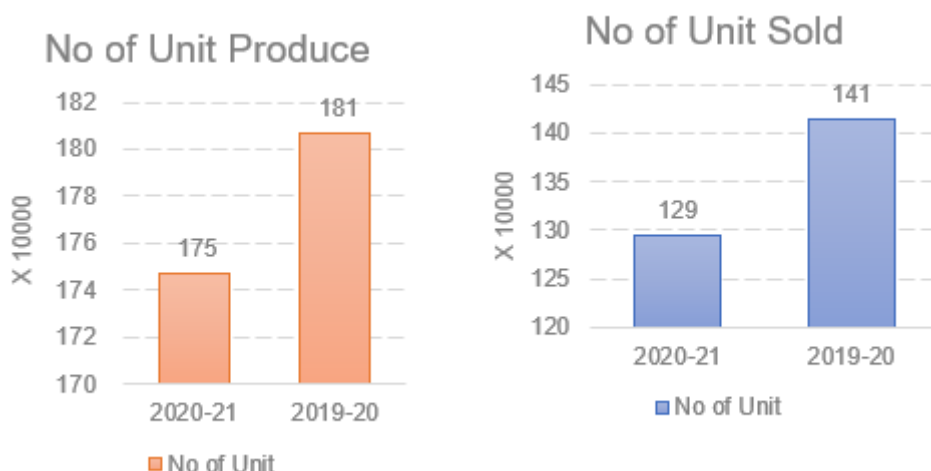
The businesses will either need to raise their pricing or pass along the increased production costs. According to CRISIL Research, the chip scarcity will persist throughout the remainder of the current fiscal year, causing further harm to the industry. The demand for new cars is expected to decline by around 2.5 lakh units in FY22 as a result of a chip scarcity.

Chipmakers now have some flexibility to significantly raise prices due to the increased demand for chips. TSMC disclosed a 20% price increase for chips used in autos earlier this year. The businesses will either need to raise their pricing or pass along the increased production costs. According to CRISIL Research, the chip scarcity will persist throughout the remainder of the current fiscal year, causing further harm to the industry. The demand for new cars is expected to decline by around 2.5 lakh units in FY22 as a result of a chip scarcity. The industry's overall sales are being impacted by the continued shortage of chips as well as other commodities including the cost of steel, rubber, and fuel. Maruti, which has already increased the cost of its vehicles twice this fiscal year, has planned another price increase for various models beginning in January 2022. Due to the strong price elasticity of demand, price increases in high-end cars are generally absorbed; however, this is not the case for entry-level vehicles.

### Company wise data analysis

**Table 2:** Performance Analysis of Maruti Suzuki

Maruti-Suzuki	
Unit sold in 2020-21	12,93,840
Unit sold in 2019-20	14,14,346
Growth (Sales)	-1,20,506
% Of Growth (Sales)	-8.52%
Average waiting time	19 Weeks
PV in 2020-21	17,46,720
PV in 2019-20	18,06,720
Growth (PV)	-60,000
% Of Growth (PV)	-3.32%

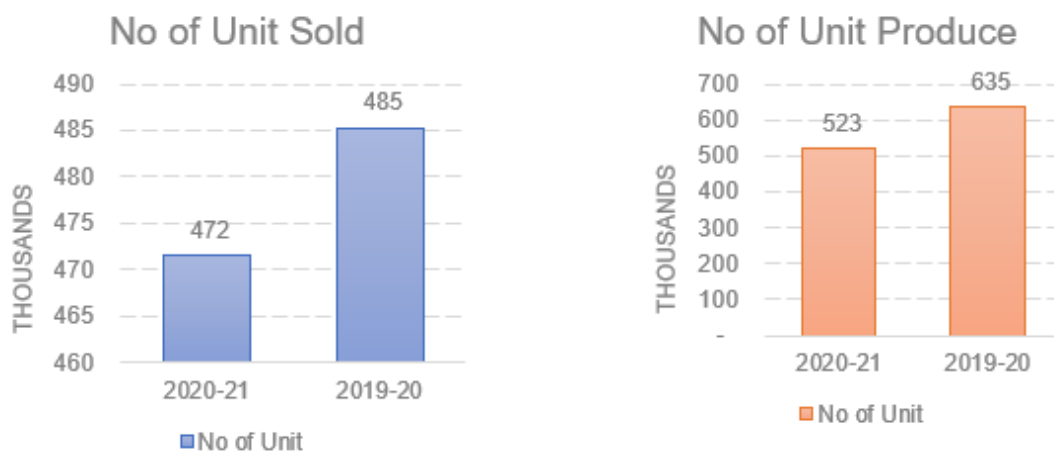


**Analysis**

There is a significant decrease in no of units sold compared to sales in 2020-21 and sales in 2019-20 i.e. 1,20,506 units less which is around 9% drop. Also, the production volume has seen a dip of 3% year-on-year. The automaker recorded a 48% decline in net profit to Rs 1,011.3 crore on as net sales remained flat at Rs 22,187.6 crore in Q3 2019-20 over Q3 2020-21. Maruti Ertiga CNG has the highest waiting period of 36-40 weeks. Models such as Wagon R, Dzire and Swift have at least three months waiting. Maruti Alto 800 has the least waiting period of two to six weeks.

**Table 3: Performance Analysis of Hyundai Motors (India)**

Hyundai	
Sales in 2020-21	4,71,535
Sales in 2019-20	4,85,309
Growth (Sales)	-13,774
% Of Growth (Sales)	-2.84%
Average waiting time	24 Weeks
PV in 2020-21	5,22,542
PV in 2019-20	6,35,413
Growth (PV)	-1,12,871
% Of Growth (PV)	-17.76%

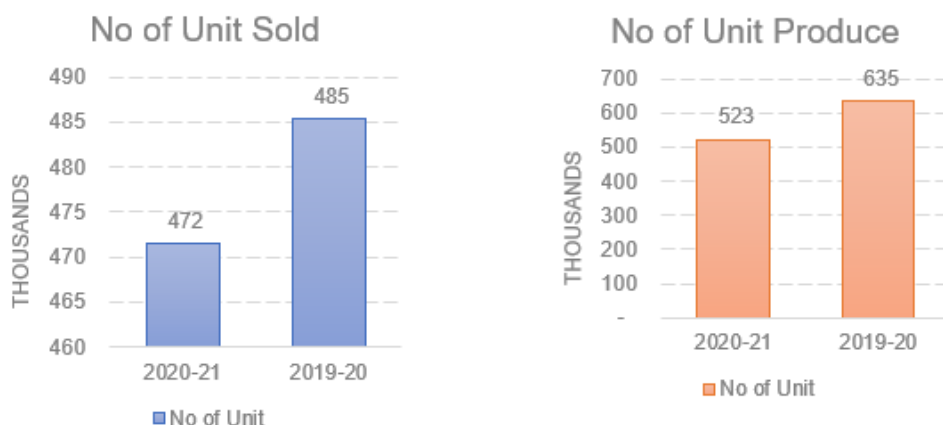


**Analysis**

There is also a significant decrease in the number of units sold compared to sales in 2020-21 which is 4,71,535 and sales in 2019-20 is 4,85,309. It is around 3% drop. Also, the production volume has seen a dip of 17% on a year-on-year comparison. The semiconductor crisis has pushed the Creta waiting period up to 10 months. Alcazar has a lesser waiting period due to lower demand. Hyundai recently announced its plans to launch six new EVs in India by 2028 due semiconductor chip shortage.

**Table 4:** Performance Analysis of Tata Motors

Tata Motor	
Sales in 2020-21	3,31,181
Sales in 2019-20	1,69,880
Growth (Sales)	1,61,301
% Of Growth (Sales)	94.95%
Average waiting time	12 Weeks
PV in 2020-21	1,70,150
PV in 2019-20	1,52,943
Growth (PV)	17,207
% Of Growth (PV)	11.25%



**Analysis**

All manufacturers are not suffering due to semiconductor shortage. The performance has improved in no of units sold compared to sales in 2020-21 which is 3,31,181 and sales in 2019-20 is 4,85,309. It is around 95% increase. It recorded the highest ever EV sales during the quarter and sold 10,000 EVs in the nine months of FY22, crossing new milestones. Also, the production volume has seen an increase of 12% on year-on-year comparison. JLR posted a loss of 9 million pounds in the quarter, while revenue was down 21.1 per cent at 4.7 billion pounds, JLR sales remain constrained by chip shortages with retail sales of 80,126 vehicles, down 37.6 per cent as compared to the third quarter of FY21. The average waiting period is about two months. But No waiting period for buyers in Chennai, however the highest waiting time of up to four months in New Delhi and average wait time of 2-3 months in other metros. Tata Motors-owned Jaguar Land Rover (JLR) is asking customers to wait for up to 12 months to take delivery of the vehicle as the backlog of orders for the two British brands has hit 100,000 units across the globe. [note: JRL figures were taken from secondary data]

**Table 5:** Performance Analysis of Mahindra

Mahindra	
Sales in 2020-21	1,55,539
Sales in 2019-20	1,80,263
Growth (Sales)	-24,724

% Of Growth (Sales)	-13.72%
Average waiting time	44 Weeks
PV in 2020-21	1,70,150
PV in 2019-20	1,83,384
Growth (PV)	-13,234
% Of Growth (PV)	-7.22%

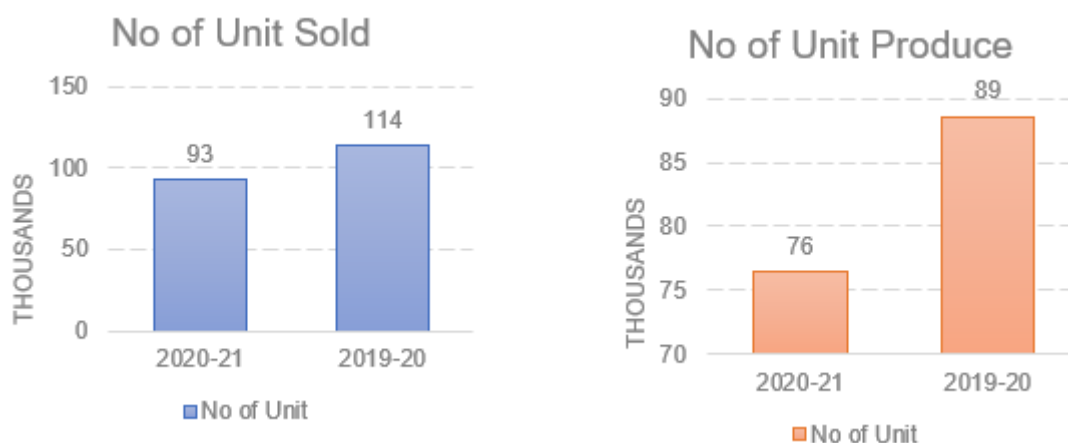


**Analysis**

Mahindra & Mahindra Ltd had a nearly two-fold dip in passenger vehicle sales at 1,55,539 units. The company had sold 1,80,263 units in the last year. Mahindra & Mahindra (M&M) and Mahindra Vehicular Manufacturing (MVL) posted a combined net profit of Rs 163 crore in Q4FY2021 compared to a loss of Rs 3,255 crore in Q4FY2020. Due semiconductor chip shortage the production volume will also decrease in 2020 of 1,70,150 units compared to 2019 of 1,83,384 units. Mahindra XUV700 and Thar have a waiting period of almost a year. The company also recently announced about the Mahindra thar crossing 75,000 bookings in a year, although only about 30,000 units have been delivered to customers and 45,000 orders are still pending.

**Table 6:** Performance Analysis of Toyota Kirloskar

Toyota	
Sales in 2020-21	93,124
Sales in 2019-20	1,14,081
Growth (Sales)	-20,957
% Of Growth (Sales)	-18.37%
Average waiting time	40 Weeks
PV in 2020-21	76,472
PV in 2019-20	1,88,576
Growth (PV)	-1,12,104
% Of Growth (PV)	-59.45%








**Analysis**

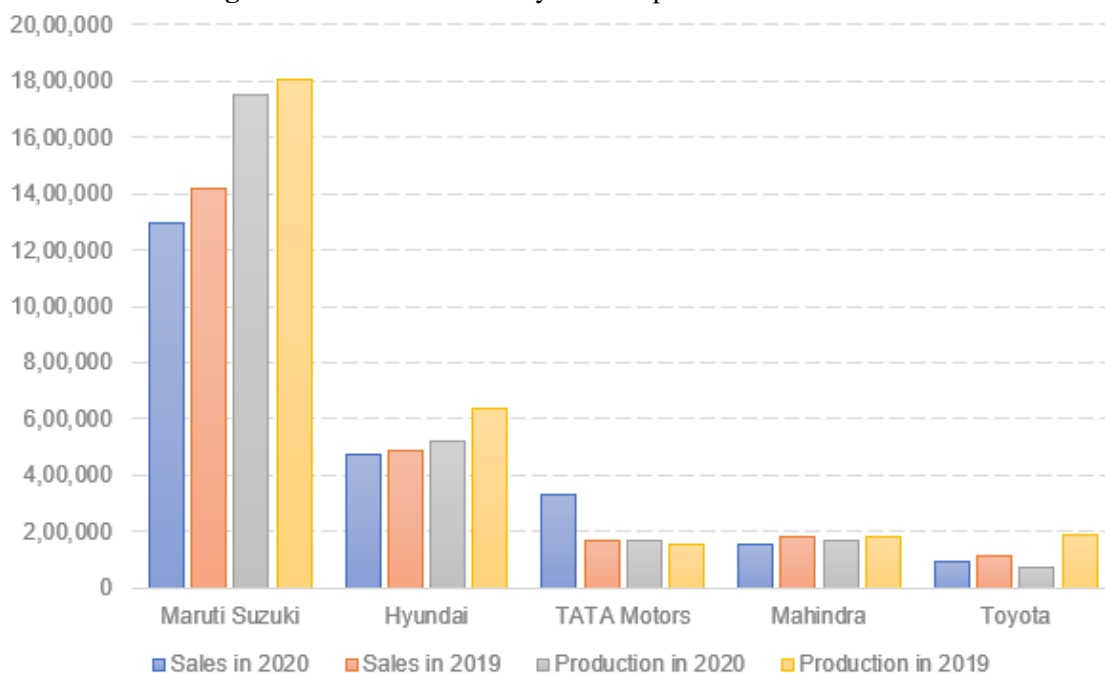
Japanese motor industry giant Toyota saw its profits fall by 21% for the last three months of 2021 as the global chip shortage hit production. In September, Toyota slashed its worldwide vehicle production by 40% because of the chip shortage. Toyota Ltd observed a dip in passenger vehicle sales at 93,124 units. The company had sold 1,14,081 units in the last year. Due semiconductor chip shortage the production volume plunged to 2020 of 76,472 units compared to 2019 of 88,576 units. During 2020, there was a complete shutdown of 6 months and 2021, it was for 3 months. There is a waiting period of almost a year for all the variants. For example, Toyota has dropped model Yaris from the product list for customers.

**Overall Analysis**

**Table 7: Performance Analysis of Top 5 Auto Giants in India**

OEM	Sales in 2020	Sales in 2019	Production in 2020	Production in 2019
 <b>MARUTI SUZUKI</b>	12,93,840	14,14,346	17,46,720	18,06,720
 <b>HYUNDAI</b>	4,71,535	4,85,309	5,22,542	6,35,413
 <b>TATA MOTORS</b>	3,31,181	1,69,880	1,70,150	1,52,943
 <b>Mahindra</b>	1,55,539	1,80,263	1,70,150	1,83,384
 <b>TOYOTA</b>	93,124	1,14,081	76,472	1,88,576



**Figure 1:** Performance Analysis of Top 5 Auto Giants in India

## CONCLUSION

In this cutthroat marketplace, many of businesses vie for market share in the same product category. Promoters and top management are forced to embrace new policies in their businesses due to competition, rivalry, and changes in client demand. This study demonstrates that there is a severe scarcity of semiconductor chips, which is having a negative effect on the global auto industry. Therefore, OEMs must diversify into contemporary design studios and start-ups in order to maintain their options. Automobile makers may also get into instances where there isn't a sample of a chip that fits and replacement is required. In this scenario, a manufacturer should select chips from the same batch that are suitable for the development stage but have smaller or greater output capacities. The device may work if it is properly constructed, albeit with fewer functions. It is always preferable to ship a product with fewer features than none at all. Most chip providers have altered their terms and conditions of sale in light of the current circumstances. Instead of the customary shorter cancellation period terms, they have switched to a huge cancellation lead time. So ordering from various providers can shift the game. Additionally, OEMs can believe that storing far more inventory than necessary at some point is a solution to the issue.

When chip shortages affect the production of automobiles, automakers who are overly dependent on Taiwan—more especially, the Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest semiconductor chip producer with a market share of 54%—pay a heavy price. Automobile behemoths like Volkswagen of Germany, Ford of the United States, and Toyota Motor of Japan were compelled to shut down their factories and remain idle for three to six months. For instance, the Covid 19 lockdown added the finishing touches to the situation and made things worse over the course of six months. The UK manufacturer recorded a loss before tax of 9 million pounds (\$12 million) for the quarter that ended on December 31 as opposed to a profit of 439 million pounds. So, automakers in current situation are planning strategically to overcome this situation

- Increase the average waiting time for new booking or not accepting new booking at all.
- Discontinuing the old model which are driven by lower generation chipset
- Vendor diversification as much as possible
- Short term contract over long-term fixed price contract

- Increase capacity in production facilities
- Provide incentives to influence supplier

## REFERENCES

- (Alsop, 2021) Share of the global semiconductor industry by country from 2018 to 2020
- (Arun, 2021) Why chip shortage may lead to sluggish auto sales this fiscal
- (Association, 2022) Global Semiconductor Sales, Units Shipped Reach All-Time Highs in 2021 as Industry Ramps Up Production Amid Shortage
- (Burkacky, Lingemann, & Pototzky, 2021) Coping with the auto-semiconductor shortage: Strategies for success
- (CarToq Desk, 2021) Semiconductor shortage impact on Indian auto industry: 7 lakh orders pending
- (Casper, et al., 2021) The Impact of the Computer Chip Supply Shortage
- (Crawford, Dillard, Fouquet, & Reynolds, 2021) The World Is Dangerously Dependent on Taiwan for Semiconductors
- (Editors, 2021) What Do Semiconductor Chips Do in Cars?
- (Gupta, 2022) Chip demand pushes automotive and lubricant industry changes
- (HAJDU, 2021) COVID-19 pandemic and managing supply chain risks: NVIDIA's graphics card shortage case analysis
- (India, 2021) Semiconductor shortage pulls down India's PV dispatches in Sept
- (LAPEDUS, 2021) More Silicon Wafer Consolidation
- (Lee, 2021) 2 charts show how much the world depends on Taiwan for semiconductors
- (Maruti, Hyundai Witness Dip In Wholesales In March; Tata Motors, Kia Post Highest-Ever Sales, 2022)
- (Mukherjee, 2021) Toyota to halt operations in Karnataka plants from April 26 to May 14
- (Outlook) : Average Waiting Period For Toyota Yaris Higher Than Honda City, Maruti Ciaz, 2020)
- (Priddle, 2021) What Happened with the Semiconductor Chip Shortage—and How and When the Auto Industry Will Emerge - The chip-shortage crisis is improving but won't be resolved overnight.
- (Ramachandran, 2022) Way ahead for global automotive industry amid semiconductor chip shortage
- (Salman, n.d.) New Cars with Highest Waiting Period in India
- (Sharma, n.d.) Indian car manufacturers just had their worst festive season in a decade
- (Silberg, 2021) 22nd Annual Global Automotive Executive Survey 2021 by KPMG
- (Thakur, 2021) Can Indian Auto Industry Overcome the Challenge of Chip Shortage?
- (Wayland, 2021) Chip shortage expected to cost auto industry \$210 billion in revenue in 2021
- (Wu, Zhang, & Du) An Analysis on the Crisis of "Chips shortage" in Automobile Industry - Based on the Double Influence of COVID-19 and Trade Friction