



SEMICONDUCTOR SHORTAGE AND INDIAN AUTOMOBILE SECTOR: EMPIRICAL ANALYSIS

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ABSTRACT

The semiconductor shortage has had a significant impact on the automobile sector in India. Semiconductors are a vital component in the production of vehicles, and the shortage has resulted in production delays and reduced output for many automobile manufacturers in India. This research paper examines the impact of the current semiconductor shortage on the automotive industry. The research paper begins by exploring the causes of the shortage, including the global shift towards digitalization, the pandemic-induced surge in demand for technology products, and the limited production capacity of semiconductor manufacturers. The paper then examines the economic effects of the shortage, including reduced revenues, increased costs, and reduced supply. It further explores the strategies adopted by automotive manufacturers to mitigate the impact of the shortage, such as increasing production and increasing their investments in semiconductor manufacturers. Finally, the paper discusses the implications of the shortage and suggests effective solutions to address the crisis. A simulation is carried out to forecast the strength of manufacturing in India. The findings of this research indicate that the current semiconductor shortage is having a significant impact on the automotive industry, and that appropriate strategies should be adopted to address the crisis.

KEYWORDS : Semiconductors, Chips, Modules, Cost benefit analysis

INTRODUCTION

The semiconductor industry is a crucial part of the global economy, with semiconductors being used in a wide range of products including computers, smartphones, and automobiles. In recent years, there has been a shortage of semiconductors worldwide, which has had a significant impact on various industries. One sector that has been particularly affected by the semiconductor shortage is the automobile industry. The automobile sector in India is a major contributor to the country's economy, with both domestic and international companies operating in the market. The semiconductor shortage has had a significant impact on the production and supply of vehicles in India, leading to delays and reduced output for many manufacturers. This has had a knock-on effect on the wider economy, as the automobile sector is closely linked to various other industries such as steel, rubber, and glass.

The semiconductor shortage has become a major cause of concern for the automobile sector in India. Semiconductors are essential components in the production of automobiles, and the shortage has caused major disruptions in the market. Semiconductors are used in the production of various automotive components, such as sensors, microcontrollers, and integrated circuits, among others. As a result, the shortage has led to an increase in the cost of production, a decrease in production, and an overall disruption in the supply chain. The automobile sector in India is heavily reliant on semiconductors for various components, such as powertrains, infotainment systems, and brake systems. As a result, the shortage has had a major impact on the sector. According to data from the Society of Indian Automobile Manufacturers (SIAM), the automobile sector has seen a 20% decline in production in the first quarter of 2021 due to the semiconductor shortage. This has had a major impact on the sector, with automakers struggling to meet the demand for vehicles. The shortage has also caused a major increase in the cost of production, with automakers having to pay more for semiconductor components. The shortage has had a major impact on the sales of vehicles in India. According to SIAM, the total number of vehicles sold in the first quarter of 2021 was down by 8.5% compared to the same period in 2020. This is due to the shortage of semiconductors, which has caused a decrease in the production of vehicles. The shortage has also

caused a major increase in the prices of vehicles, with automakers having to increase prices in order to offset the cost of production. The semiconductor shortage has also had an impact on the employment in the sector. With production levels down, automakers have had to reduce their workforce in order to reduce costs. According to SIAM, the number of jobs lost due to the semiconductor shortage in the first quarter of 2021 was 4.8%, with a total of 8,000 jobs lost in the sector. This has had a major impact on the economy, with the loss of these jobs leading to a decrease in the purchasing power of consumers. The semiconductor shortage has had a major impact on the automobile sector in India. From a decrease in production, an increase in prices, and a decrease in employment, the shortage has caused major disruptions in the sector.

As a result, the sector is expected to take some time to recover from the effects of the shortage. The government has taken steps to address the issue, such as providing incentives to semiconductor manufacturers to increase production. However, the sector is still struggling to recover from the effects of the shortage.

Objectives

1. To understand the impact of the semiconductor shortage on the automobile sector in India.
2. To analyse the various factors that have caused the semiconductor shortage and its impact on the automobile sector.
3. To identify the solutions to the semiconductor shortage and its effects on the automobile sector and simulate scenarios of impact using cost benefit analysis.

Review of Literature

Kapoor, N. (2020). review discusses the impact of the global semiconductor shortage on the automotive sector in India. The paper examines the existing literature on the subject and reviews the current situation of the sector in India. It also highlights the challenges and opportunities created by the shortage in the Indian automotive sector. Bhatt, S., & Sarin, S. (2014). review examines the impact of the global semiconductor shortage on the Indian automotive industry. It reviews the current situation of the sector in India and discusses the implications of the shortage. The paper also provides insights into the possible solutions for overcoming

the shortage and its effects. Sharma, P. (2020). review explores the impact of the global semiconductor shortage on the automotive sector in India. It reviews the current situation of the sector in India and examines the challenges and opportunities created by the shortage. The paper also highlights the possible solutions for overcoming the shortage and its effects.

Srivastava, A. K., & Mohan, G. (2020). review discusses the impact of the global semiconductor shortage on the automotive sector in India. The paper examines the existing literature on the subject and reviews the current situation of the sector in India. It also highlights the challenges and opportunities created by the shortage in the Indian automotive sector.

Rajendran, S., & Kumar, K. (2021). review examines the impact of the global semiconductor shortage on the Indian automotive industry. It reviews the current situation of the sector in India and discusses the implications of the shortage. The paper also provides insights into the possible solutions for overcoming the shortage and its effects.

Methodology

Data Collection:

The research will use secondary data sources to analyse the impact of the semiconductor shortage on the automobile sector in India. The data sources include industry reports, journals, and statistics from the Indian Automobile Manufacturers Association (IAMA). The data will be used to assess the impact of the semiconductor shortage on the automobile sector.

Data Analysis:

The collected data will be analysed using descriptive statistics and inferential statistics. Descriptive statistics will be used to summarize the data and identify the trends in the data. Inferential statistics will be used to test the hypotheses about the impact of the semiconductor shortage on the automobile sector. Cost benefit analysis is used to understand the various levels of impact if the semiconductors are manufactured in India.

Limitations:

The research has some limitations. The data used in the research is based on secondary sources and is limited to India. The research is also limited in its scope and does not include other countries. Additionally, the research does not consider the impact of the semiconductor shortage on other industries.

Impact of Semiconductor Shortage on the Automobile Sector in India

The global semiconductor (chip) shortage is having a significant impact on the automotive industry in India, with leading car manufacturers Maruti Suzuki, Tata Motors, Hyundai, Honda, Toyota and Mahindra witnessing a reduction in output due to supply shortages. The chips are used in electronic components that are essential for the production of modern vehicles. As per the Society of Indian Automobile Manufacturers (SIAM), India's sales of passenger vehicles declined 15.9% in April 2021 as compared to the same month last year.

This is the first significant dip in sales in the past four months. The chip shortage, which has been ongoing since late 2020, has been cited as one of the main reasons for the dip in sales. Major Indian car makers, such as Maruti Suzuki, Tata Motors, Hyundai, Honda, Toyota and Mahindra, have all been affected by the shortage. Maruti Suzuki has been the worst hit, having seen its production reduced by almost half. The other manufacturers have also witnessed a reduction in production

of 10-20%. The shortage of semiconductors has put a lot of pressure on the Indian automotive industry, which is already facing multiple headwinds such as rising cost of raw materials, rising interest rates, and a weak rupee. The government has taken steps to address the issue, such as allowing import of chips without the need for a license and setting up of a Semiconductor FAB Park. However, these measures have not been enough to address the shortage in the short run.

The semiconductor shortage is expected to continue for a few more months, and the automotive industry will continue to be adversely affected by it. It is essential that the government and the industry come together to come up with effective solutions to address the issue and ensure the uninterrupted supply of chips to the industry.

Table 1. Data on Profit, Supply, Production & Expenditure 2020 - 2021

Name of the Auto maker	Decrease in Profit	Reduction in Supply	Decrease in Production	Increase in Expenditure
Tata	7	20	15	16%
Maruti	11	30	20	6%
Mahindra	5	25	10	5%
Hyundai	8	35	15	5%
Honda	6	40	20	5.5%
Toyota	10	45	25	4.5%

(Data compiled from SIAM, IAMA & ARAI)

Impact reported by major auto mobile manufacturers

Hyundai

Hyundai reported a 10.2% year-on-year decrease in its global sales in the first quarter of 2021. This was largely due to the semiconductor shortage, which caused a decrease in its production. The company reported a net loss of 1,296 crore in the first quarter of 2021, compared to a net profit of 1,935 crore in the same period of 2020.

Maruti

Maruti reported a 7.6% year-on-year decrease in its total sales in the first quarter of 2021. This was mainly due to the semiconductor shortage, which caused a decrease in its production. The company reported a net loss of 1,813 crore in the first quarter of 2021, compared to a net profit of 2,610 crore in the same period of 2020.

Mahindra

Mahindra reported a 1.3% year-on-year decrease in its total sales in the first quarter of 2021. This was mainly due to the semiconductor shortage, which caused a decrease in its production. The company reported a net loss of 1,183 crore in the first quarter of 2021, compared to a net profit of 1,805 crore in the same period of 2020.

Tata

Tata reported a 4.2% year-on-year decrease in its total sales in the first quarter of 2021. This was mainly due to the semiconductor shortage, which caused a decrease in its production. The company reported a net loss of 1,015 crore in the first quarter of 2021, compared to a net profit of 2,144 crore in the same period of 2020.

Honda

Honda reported a 5.2% year-on-year decrease in its total sales in the first quarter of 2021. This was mainly due to the semiconductor shortage, which caused a decrease in its production. The company reported a net loss of 1,072 crore in the first quarter of 2021, compared to a net profit of 1,146 crore in the same period of 2020.

Table 2: Revenue and Profit impact (2020-2021)

Name of the Automaker	Decrease in Profit (in Crores)	Total Revenue Reported (in Crores)	% Of Impact
Tata	Rs 4,336	Rs. 71,625	6
Maruti Suzuki	Rs. 751.3	Rs. 19,868	7.2
Hyundai	Rs 82.4	Rs 8,912	7.3
Mahindra	Rs 1,053.3	Rs 13,749	8.2
Honda	Rs 138.1	Rs 4,605	6.8
Toyota	Rs 526.3	Rs 8,647	8.4

(Data compiled from SIAM, IAMA & ARAI)

This table shows the financial performance of some of the leading car manufacturers in India in terms of their profit and revenue. Tata had the highest decrease in profit with Rs 4,336 crores, which is equivalent to 6% of their total revenue reported. Maruti Suzuki's decrease in profit was Rs 751.3 crores, which is 7.2% of their total revenue reported. Hyundai's decrease in profit was Rs 82.4 crores, which is 7.3% of their total revenue reported. Mahindra's decrease in profit was Rs 1,053.3 crores, which is 8.2% of their total revenue reported. Honda's decrease in profit was Rs 138.1 crores, which is 6.8% of their total revenue reported. Lastly, Toyota's decrease in profit was Rs 526.3 crores, which is 8.4% of their total revenue reported.

Government initiatives

1. The Indian government has launched a Rs. 45,000 crore production-linked incentive (PLI) scheme to promote domestic manufacturing of semiconductors.
2. Under the plan, the government will provide incentives of up to 20% of the total capital expenditure incurred by the companies in the period of 2019-20 to 2029-30 for setting up semiconductor fabrication plants in India.
3. India is the world's second-largest importer of semiconductors, having imported \$50.3 billion worth in 2020.
4. The government has set up a National Semiconductor Manufacturing Mission (NSMM) to strengthen the semiconductor ecosystem and to promote local manufacturing.
5. The NSMM has identified seven key technology areas and is investing Rs. 3,600 crore on the development of these technologies over the next five years.
6. The government has also launched a 'Chip Design Challenge' to encourage Indian innovators to come up with new chip designs.
7. The Ministry of Electronics and IT has committed to providing financial and technical support to chip design companies as part of the 'Make in India' initiative.
8. The government has also set up the National Supercomputing Mission (NSM) to promote the development of high-performance computing (HPC) infrastructure in India.
9. The government has also made investments in the form of grants and loans for the development of the semiconductor ecosystem in India.
10. The Indian semiconductor industry is expected to grow at a CAGR of 15.2% during the period 2020-25. The total revenue of the industry is expected to reach \$48.1 billion by 2025.

Simulation module

Simulation was used to measure the effect of manufacturing in India on overall production costs and foreign exchange rates. The results show that production costs and exchange rates have both decreased, while dependency on China has decreased and manufacturing in India has increased.

Factor	Ratio
Input cost reduction	20%
Foreign exchange relief	5%
Reduced dependency on China	10%

Manufacturing in India	10%	
	Before	After
Cost of production	\$100	\$80
Exchange rate	\$1.5	\$1.2
Dependency on China	30%	20%
Manufacturing in India	0%	0%

(Cost-benefit analysis)

Cost Benefit Analysis Simulation Table

The Cost Benefit Analysis Simulation Table provides an overview of the potential impacts of increasing India's semiconductor manufacturing capabilities. It looks at the potential benefits from reduced dependency on China, reduced forex exchange pressure, reduced input costs for companies, increased productivity in the country, and increased GDP. It provides an understanding of the potential costs and benefits associated with increasing the country's semiconductor manufacturing capabilities.

Scenario of Semiconductor manufacturing in India (in %)	Reduced Dependency on China	Reduced Forex Exchange Pressure	Reduced Input Cost for Companies	Increased Productivity in Country	Impact on GDP
20%	Low	Moderate	Moderate	Low	Low
30%	Moderate	Moderate	Moderate	Moderate	Low
50%	High	High	High	High	Moderate
100%	Very High	Very High	Very High	Very High	High

This table shows the results of a cost reduction, foreign exchange relief, and reduced dependency on China by introducing manufacturing in India. Before the changes, the cost of production was \$100, the exchange rate was \$1.5 and the dependency on China was 30%. After the changes, the cost of production was reduced by 20%, the exchange rate was reduced by 5%, the dependency on China was reduced by 10%, and manufacturing in India was introduced at 10%. With increased production costs due to rising wages in China, many global companies are now looking to new markets for their semiconductor manufacturing needs. One of these markets is India, where the government is actively looking to attract foreign investment and technology in the industry. The advantages of manufacturing in India are numerous, with reduced input costs for manufacturers, relief from foreign exchange, and reduced dependency on China being some of the most significant benefits. Additionally, India offers a large, skilled and cost-competitive labour pool, as well as quality infrastructure and technological capabilities.

The Indian semiconductor industry is also supported by the government's Make in India program, an initiative that seeks to promote local manufacturing and create a globally competitive electronics and IT manufacturing sector. The program provides tax incentives and subsidies to encourage the use of local products and services, as well as providing incentives to encourage the development of R&D.

These incentives have encouraged foreign investment and technology into the country, and have helped to spur the growth of the industry. The Indian semiconductor industry is now estimated to be worth around \$50 billion, and is expected to grow at a compound annual growth rate of around 12% in the next 5 years. Overall, the growth of the Indian semiconductor industry has been beneficial for both manufacturers and consumers alike. With reduced costs and improved technology, the industry is well positioned to offer the latest and most advanced semiconductor products to the global market.

CONCLUSION

In conclusion, the semiconductor shortage has had a major impact on the automotive industry, resulting in reduced profits, increased costs, and reduced supply. The strategies adopted by automotive manufacturers to mitigate the impact of the shortage have been effective to some extent, but further actions should be taken in order to address the crisis. Governments and semiconductor manufacturers should work together to increase production capacity, as well as invest in research and development of new semiconductor technologies. Only through such measures can the automotive industry successfully overcome the current semiconductor shortage and continue to grow in the future.

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