

Supply Chain Issues & Chip Shortage

TOSHI PANDIT¹, ABHISHEK S JAIN², DEENU CHOGANI³, PALLAV CHAWLA⁴, DR. ANITA WALIA⁵, DR. SUPRITA RAI⁶

^{1, 2, 3, 4, 5, 6} Center for Management Studies - Jain (Deemed-to-be University)

Abstract- Supply chain has caused disruptions in both global and local market, the chip shortage has not only challenged the automobile industry but also the computing and electronic industries. During pandemic retail vehicle sales dip due to which companies had to withdraw the orders of semi-conductor whereas demand for laptops and mobile phones increased which in turn led to delay in car production due to shortage of chip globally. For instance, Ola faced major problems as it was not able to complete the deliveries on time, founder Bhavish Agarwal blames the delay on chip shortage he added that the demand is much more than the supply of semi-conductor chips. Other than Ola there are several other Indian companies which has been affected due to it. To reduce the impacts of shortage in business companies can examine the inventory management system and take orders according to it, improve supplier relations can decrease the risk of getting in unfavorable conditions, improving the R&D manufacturing efficiency by bringing in Artificial Intelligence as it can speed the process by eliminating defects. Where it takes humans around six months whereas AI can develop faster and more efficient processors through algorithms.

Indexed Terms- Chip Shortage, Graphics Card, Database, AI in R&D, OLA Delayed Orders, Dip in Car Sales

I. INTRODUCTION

- Supply Chain

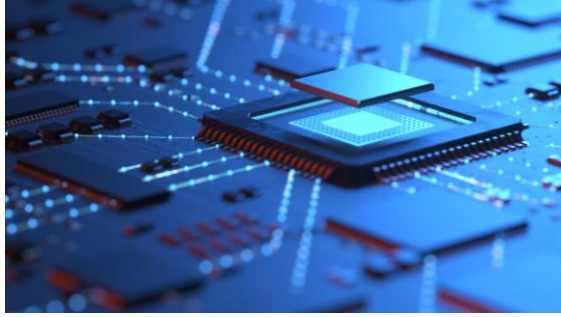
Supply chain disruption has climbed to the top of the threat list across industries. The chip shortage has slowed car production, pushed back consumer

electronics product launches, and hampered company's ability to recruit new employees. Businesses will need to prepare for production ramp-up and the long-term effects of the economic crisis as the shortage subsides. Addressing the chip shortage and getting back to normal means dealing with a new shortage labour.



What Started The Chip Shortage?

Most people would agree that COVID was a significant contributor to the chip shortage, but what happened behind the scenes? Manufacturers anticipated a drop in consumer purchasing due to lockdowns and job losses. According to a recent CNET article by Stephen Shankland, semiconductor chip orders were put on hold to anticipate the economic impact, and supplies were reallocated to other customers. Demand increased faster than expected due to stimulus funds and at-home needs, resulting in losses for several companies. The combination of this and simultaneous shutdowns of semiconductor chip manufacturing facilities had a significant impact on chip availability. Although we are not out of the woods yet, experts predict that the chip shortage will end within the next year or two.



- How Has Manufacturing Been Affected by The Chip Shortage?

The semiconductor business has experienced shortages before, but the one that started because of the pandemic in March 2020 is much deeper, particularly in Europe and the Americas. Amid the pandemic, demand dropped, orders were cancelled. Asian factories went into a slowdown, and many closed as companies tried to figure out how to operate safely and with significantly reduced demand.

Global supply chain disruptions have exacerbated in the last 2-3 years, owing to a 'perfect storm' of multiple developments that converge to question the very model of globalization that the world has followed since the 1970s. Global companies, including automakers, footwear manufacturers, and mobile phone producers, have had to cut down production and the ripple impact is being felt across sectors and geographies. With the advent of the Omicron mutation, further disruptions may be in store.

The range of factors causing global supply chain disruptions is extensive, and these have led to supply gaps in products such as household essentials, computer chips, cars, and so on, and are combining to increase input costs, delivery timelines, and logistics costs, and even disrupt festival plans that typically involve higher consumer purchases.

You've probably already felt the effects of the chip shortage, whether as a consumer or a producer. Lead times are four to eight weeks longer than usual, sometimes more. Manufacturers of automobiles have been forced to halt production or ship unfinished

goods. Because vehicle supply has decreased while consumer demand has increased, we are witnessing price inflation that has impacted millions of consumers.

During the pandemic period over 2020, many manufacturers across the world had cut down their production and reduced orders for intermediate goods and raw materials. Once recovery commenced, the strength of suppressed demand rising again caught them on the back foot. This led to supply bottlenecks in critical inputs – particularly microchips and shipping containers.

Microchips further saw a rise in demand owing to higher purchases of electronic items such as laptops and phones as working professionals and students shifted to virtual interactions during COVID times. The lead time between ordering chips and their delivery was estimated at 21 weeks in August 2021 compared to six weeks in July 2021. As chips require investments of US\$ 10-12 billion and a long period to set up new manufacturing facilities, the shortage could continue despite the fact that governments have earmarked funds for investing in setting up new production centres.

- How Can we Reduce the Impacts Of These Shortages On Your Business?

Ascertain that your company is ready for a return to "normal." Do you have enough materials and employees to meet increased throughput? Work with HR to evaluate employee benefits and launch a hiring campaign.

- Improve R&D and manufacturing efficiency
To keep up with increased production, industrial automation may be required.
- Examine your inventory management systems
Is just-in-time delivery a thing of the past? Rethink your production models. Is it more cost effective to reserve materials for higher production volumes?
- Improve your supplier relationships
Open lines of communication to ensure they're prepared to meet your ramp-up needs and to help set expectations for the future.
- Everything shifts

You've adapted to stay ahead of the competition and maintain your market-leading position. Now, as we near the end of the backlog, it's time to revisit your processes with a little foresight

- Factors Contributing to Chip Shortage:

1. *Increased Demand:*

The growing demand for semiconductors, particularly in consumer electronics and automotive industries, has been a significant factor in the chip shortage. Rapid technological advancements, such as 5G, artificial intelligence, and the Internet of Things (IoT), have driven the need for more powerful and advanced chips, resulting in increased demand from various industries. This surge in demand has strained the capacity of chip manufacturers, leading to shortages.

2. *Supply Chain Disruptions:*

The complex and global nature of the semiconductor supply chain has been susceptible to various disruptions, contributing to the chip shortage. Factors such as natural disasters, geopolitical tensions, trade disputes, and the ongoing COVID-19 pandemic have disrupted the supply chain and impacted chip production. For instance, trade tensions between the United States and China have resulted in tariffs and export restrictions, disrupting the flow of chips and affecting the supply chain.

3. *Concentration of Production:*

The semiconductor industry is dominated by a few key players, resulting in a concentrated production base. The majority of chip manufacturing is concentrated in a few countries, such as Taiwan, South Korea, and China, with a limited number of manufacturers having the capability to produce advanced chips. This concentration of production has made the supply chain vulnerable to disruptions, as any disruptions in these key production hubs can significantly impact the global supply of chips.

4. *Supply-Demand Mismatch:*

The lead times for semiconductor production are typically long, ranging from several weeks to several months. As a result, chip manufacturers rely on demand forecasts to plan production capacity. However, the recent surge in demand for chips has

resulted in a supply-demand mismatch, with demand outstripping supply. This has led to extended lead times and delays in chip deliveries, exacerbating the chip shortage.



- Impact on the Global Supply Chain:

The chip shortage has had enormous ramifications for the worldwide supply chain, causing disruptions and issues in a variety of businesses. The following are some of the major effects of the chip shortage on the global supply chain:

Delays in Production:

The chip scarcity has caused production delays in various industries, including automotive, consumer electronics, and industrial manufacturing. Due to a shortage of enough chip supply, several firms have been compelled to restrict or cease production, resulting in delays in delivering final items to clients.

Cost Increases:

The chip scarcity has also resulted in cost increases for enterprises in the worldwide supply chain. Chip prices have grown as demand has outstripped supply, resulting in greater production costs for firms that rely on chips in their goods. Profit margins and total supply chain expenses have suffered as a result.

Supply Chain Reorganisation:

Some firms have had to rearrange their supply networks in reaction to the chip scarcity. Diversifying suppliers, reshoring or nearshoring production, or redesigning goods to employ different components are all possibilities. Such supply chain reconfigurations can be time-consuming and expensive, necessitating the adaptation of

organisations' supply chain strategy to reduce the impact of the chip shortage.

Customer unhappiness:

As firms struggle to satisfy customer demand for items that rely on chips, the chip scarcity has resulted in customer unhappiness. Delayed

- HISTORY Of SUPPLY CHAIN MAMAGEMENT

Supply chains link the world, and recent disruptions have been felt globally. This timeline examines the evolution of supply chain management, or the skill of keeping things operating smoothly.

Local supply chains existed prior to the 1900s.

Prior to the first industrial revolution, supply chains were mainly regional and local. The distance that commodities could be distributed expanded as the usage of railroads increased.

1900-1950s: Supply chains expand further.

Global supply chains began to take shape between the 1900s and the 1950s, as organisations such as UPS opened their doors. Following World War II, industry leaders began to consider upgrading manual operations, investigating the use of mechanisation, and showing the benefits of analytics in military logistics. Prior to the 1950s, the notion of 'unit load' became prominent, which was later expanded to transportation management.

Physical distribution in the 1960s and 1970s

DHL joined the rising number of logistics companies in the 1960s, followed by FedEx in the 1970s. During this period, time-sensitive freight movement shifted to trucks, prompting companies to coin the term "physical distribution."

Inbound, outward, and reverse flows in the 1980s

With the advent of personal computers, supply chains gained greater access to planning tools such as spreadsheets and map-based interfaces. Supply chains were seen as an expensive, vital, and complicated function by the mid-1980s. In order to represent incoming, outward, and reverse flows, the National Council of Physical Distribution

Management changed its name to the Council of Logistics Management (CLM).

1990s to 2000s: technological revolution and globalisation

The supply chain sector expanded during this time period, with solutions such as enterprise resource planning and advanced planning and scheduling, as well as a surge in worldwide imports and exports.

4.0 Industry (2010-2020)

While AI, data, and the Internet of Things IoT were all around before 2010, their usage has skyrocketed in the last decade, and supply chains are no exception. Organisations all across the globe have used Industry 4.0 technology to power their digital transformation efforts.

2020: COVID-19

The epidemic swept over the world, and supply chains came to a standstill, leaving little doubt about the necessity of these critical business tasks. The outbreak of COVID-19 prompted investment in localization, as well as further investment in digitization, in order to limit the pandemic's impact.

II. REVIEW OF LITERATURE

Supply Chain Management is a network of facilities that manufacture raw materials, process them into intermediate items, and then finished products before delivering them to clients via a distribution system. The main goal of supply chain management is to "optimise chain performance to add as much value as possible for the least cost possible" (Lee & Billington 1995). In other words, it tries to connect all supply chain agents to collaborate inside the organisation in order to maximise supply chain efficiency and give the maximum advantages to all linked parties (Finch 2006). Since the 1980s, industries have progressively extended their use of supply chain management practises. A variety of definitions are provided, and the subject is addressed from many angles. Cousins et al. (2006), Sachan and Datta (2005), and Storey et al. (2006), on the other hand, offered a good survey of supply chain management literature. These articles clarify the idea, principles, nature, and evolution of SCM and suggest that there is much research being undertaken

in this topic throughout the world. They critically reviewed advancements in supply management theory and practise. Gunasekaran and McGaughey (2003) expanded the scope of SCM to include Total Quality Management areas such as management commitment, organisational structure, training, and behavioural difficulties in addition to material management, partnership, and information technology. Because company existence is dependent on integration, a thorough grasp of the integration process is essential in SCM. Mouritsen et al. (2003) demonstrated that the basic hypothesis "the more integration (wider the scope) - the better the management of the chain" is not always true and that it is highly dependent on the "environment" of the supply chain and the power relations between the supply chain participants. To examine effective SCM methods, the authors presented a set of management methodologies and tools. It has also been noticed that research in SCM is not confined to hypothesis testing and data analysis, but that more sophisticated techniques like as simulation, Artificial Neural Network, and Fuzzy logic are also applied for optimisation and decision making. Koh and Tan (2006) used fuzzy logic principles to analyse and monitor supplier performance based on product quality and delivery time criteria, whereas Chiu and Lin (2004) demonstrated how the concepts of collaborative agents and artificial neural networks (ANNs) can work together to enable collaborative supply chain planning (SCP).

According to the literature study, researchers have investigated supply chain management from a system viewpoint, or the systemic natures of interactions between supply chain members are noted. Although multiple studies examine SCM from various angles, this study provides a deeper knowledge of supply chain operations.

III. RESEARCH METHODOLOGY

In our above study, we have conducted our research by collecting data from secondary sources such as online articles, newspapers, business magazines and finance research papers which helped us conclude to the above information.

- Statement of the problem

This research has been undertaken to assess the information on supply chain issues and global chip shortage. Therefore, using general terminology, the statement of the problem could be generalized as role of supply chain issues and global chip shortage.

- Objective of the study

To analyze the supply chain disruption and global chip shortage.

- Scope of the study

This study, based on research work, was conducted to study the levels of supply chain disruption and global chip shortage. This research was undertaken for a specific period of approximately 2 months. The study is an exercise, which is well planned into the curriculum, giving the researcher a valuable opportunity to experiment and exhibit the acquired management and administration skills, as required. The study has given rise to detailed information that helps in judging the levels of supply chain disruption and global chip shortage.

- Methodology

The method adopted for data collection required for this research is the Survey Method. Thus, a questionnaire was prepared consisting of simple questions and was distributed among 100 students of the university. The Survey Method proved to be instrumental in framing the customer profile and also in realizing their opinions on supply chain disruption and global chip shortage.

Research Technique: Descriptive Research

Method Adopted for Data Collection: Survey Method

Sampling technique

Sample Size: 100

Sampling Design: Convenient Sampling, Simple Random Sampling

Sample Unit: Students of universities

Tools of data collection.

The main tool used for collecting the data for this research is the Questionnaire. The questions in the questionnaire were arranged in a logical order with personal information in the beginning followed by questions related to supply chain disruption and global chip shortage. The questionnaires were to be filled by 100 students. This was done by personally asking the students to fill the questionnaire or was filled by interviewing students over the telephone and some of them also chose to reply to questionnaires, which were sent to them through E-mails.

Primary Sources of Data

- Direct access to students
- Meeting the students from various universities
- Telephonic conversations with the students
- E-mails received from students consisting of answered questionnaires.

Secondary Sources of Data

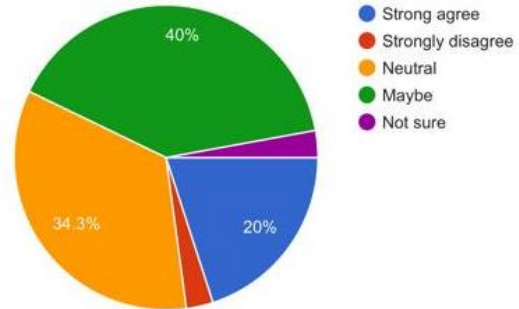
- Internet websites
- Newspapers and magazine articles
- Finance text books

Plan of analysis

The data collected through the questionnaires was processed and reduced to tables. Thus, the data was organized systematically. Statistical tools like percentages were used to analyze the data. The facts and figures, thus derived, were represented through charts and graphs therefore making it easy to interpret the data. The graphs and charts showed the clear picture of the answers to each of the questions in the questionnaire. Based on these, the findings were arrived at and this was helpful in arriving at conclusions. On the basis of these conclusions, the recommendations and suggestions were formulated.

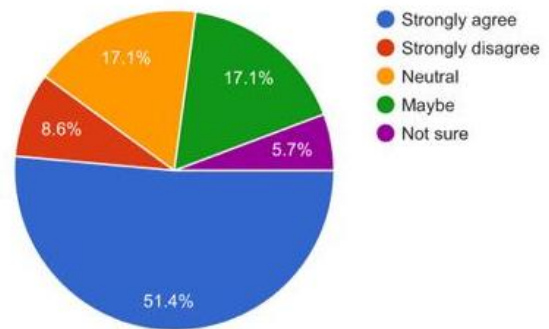
IV. DATA ANALYSIS

4.1 Do you think people have heard about supply chain before?



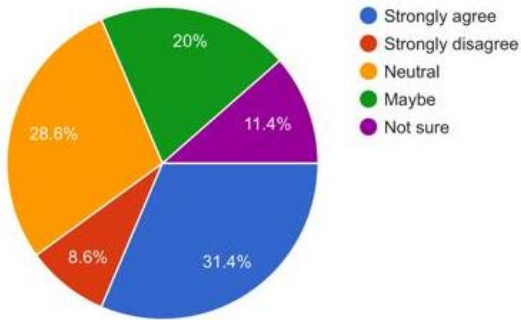
Inference: As per the data collected and visualised we can see that the majority of our audience is not sure about what supply chain is or its functionality. Only 20% are aware or have heard about the supply chain.

4.2 Do you think supply chain issues slow down product building processes?



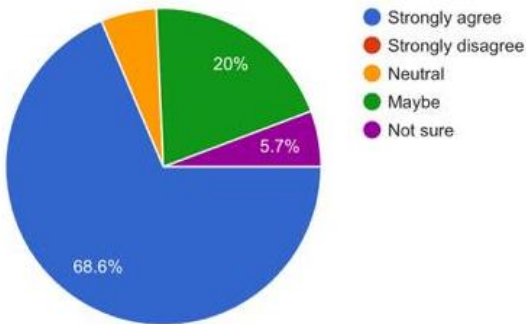
Inference: As per the data we have received we can easily see the difference between whether the supply chain issue slows down the product building process or not.

4.3 Do you think chip shortages affect employee recruitment?



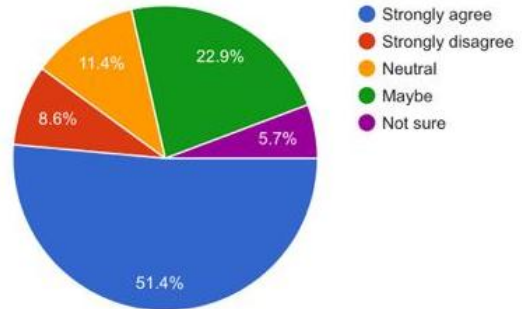
Inference: From the plot above we can see a slight conflict between the two extreme opinions. But when narrowing down the analysis we can conclude the yes, chip shortage does affect employee recruitment in a direct manner as per the strongly agree and maybe opinion.

4.4 Do you think the COVID 19 pandemic affected the supply chain management?



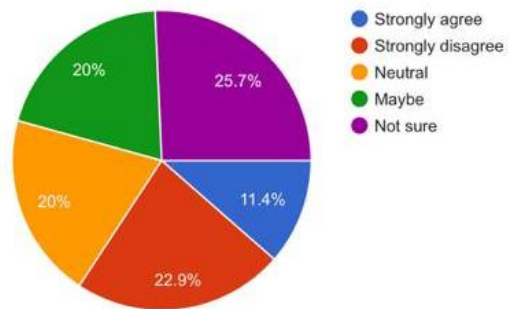
Inference: There is no doubt about the opinion poll stated above, we can easily see the difference between strongly agree and strongly disagree opinions hence we can conclude by saying that yes COVID did have a huge impact in the supply chain management.

4.5 Do you think various pandemics have affected the chip shortage?



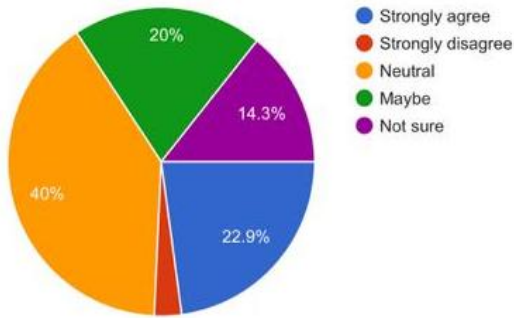
Inferences: As per the poll above, we can see 51.5 percent believe that yes, various pandemics have after the chip shortage and the second least data section i.e. belongs to strongly disagree which more or less proves the vise versa.

4.6 Do you think shortage issues would end?



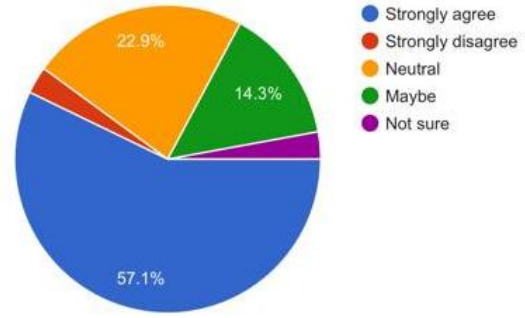
Inferences: The majority angle in the pie graph represents that shortage issues won't come to an end any time soon since the strongly disagree and not sure portion comprises 22.9 and 25.7 percent respectively. In my personal opinion as per the increase in population and cost of living shortage issues would never cease to end.

4.7 Do you think the chip shortage affected migration?



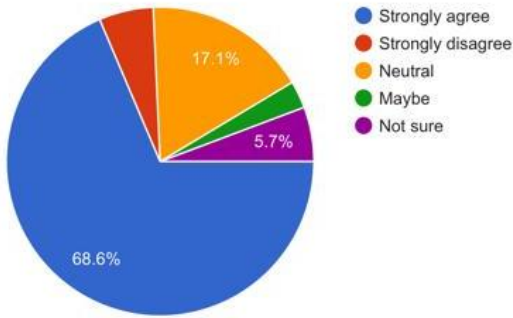
Inferences: It would be tricky to predict anything as per the above poll since a larger sum has opted for neutral but other than that if we focus on strongly agree and strongly disagree poll then we can say that yes chip shortage has affected migration.

4.9 Do you think the chip shortage and supply chain issues could be reduced?



Inferences: As stated before the due to various factors chip shortage issues and supply chain issues won't come to an end anytime soon but they can be reduced under strict circumstance and that can easily be analysed out from the above data.

4.8 Do you think nig companies were affected?



Inferences: We are all aware that in the pandemic demands of products belonging to bigger and reputed companies did enhance and for the same reason it has affected them a lot, when you think about it let's take an example of Tata vehicles, post COVID it's waiting time increased to 7 months hence standing with the poll.

FINDINGS

- We got 50 responses for all the 9 questions which say that the issue of supply chain management is not heard by a lot of people as you can see in the first chat only 20% of the people know about the issue.
- Supply chain issue slow down production building process as we can see 51.4% people who strongly agree and rest people are neutral 17.1% and maybe 17.1%
- Employee recruitment is affected by chip shortage or not is a conflicting topic as from the response we cant analysis
- COVID 19 pandemic affected the supply chain management as we can see 68.6% people strongly agrees
- So from the overall situation we can say that supply chain issue have a effected a lot of people and in a lot of domain

ANALYSIS AND CONCLUSION

According to their responses to a poll regarding its usage in the manufacturing business, the participants' awareness of supply chain and its difficulties vary. The majority of participants agree that COVID 19 has caused supply chain management issues, with chip shortages wreaking havoc on the automotive and other electronics industries. It is not only essential in

these businesses, but it also plays an important part in AI. The chip scarcity has hampered vehicle delivery, causing delays across the supply chain. In addition to the delays in vehicle delivery, global automakers have begun temporarily abandoning various features and high-end electronic components to deal with the chip scarcity.

While the present supply chain is undeniably affected, it is apparent that supply chain management is neither dead or dying. It is developing, as it has done from its birth. However, because we are in the midst of the Fourth Industrial Revolution, we are witnessing this disruption on a wider scale and at a quicker rate. As a result, there are obvious concerns associated with this disturbance. People are concerned that these developments may cause them to be relocated and out of job.

To alleviate this worry, I advise people to recall Henry Ford's invention of the assembly line. People who manufactured these cars by hand were threatened by the prospect of being supplanted by vast assembly lines. However, employees were able to execute duties on the assembly line that were previously unavailable. Employees were able to undertake higher-quality testing since the automation moved pieces more quickly. Employees were given the chance to learn new skills.

Similarly, when the Fourth Industrial Revolution automates dull, repetitive, or risky work, both employers and employee's benefit. Automation will result in tighter delivery schedule commitments, faster fulfilment, more efficiency, and increased revenues for businesses. Employees will benefit from the opportunity to acquire and develop new, vital skills.