



# IMPACT OF COVID-19 ON SUPPLY CHAIN MANAGEMENT – CHANGING PARADIGMS WITH SPECIAL REFERENCE TO MANUFACTURING INDUSTRY

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**Abstract:** The age old adage of delivering the right product in the right quantity with right cost to the right place at the right time of supply chain management perspectives is being increasingly challenged in today's world with the variability, complexity, market turbulence & the dynamic turmoil and chaos induced by un-predictable events like Covid -19 pandemic. There is no doubt that the traditional supply chain is changing from a rigid, linear flow to a rather flexible, agile value network designed to deliver instant choice, along with hyper-personalization across a variety of fulfillment channels and an expanding range of digital enablers. The strategic choices made of fast, scalable, intelligent and cross knitted strategic threads enabling sustainable growth and value perspectives are required to solve current challenges and prepare for rapid and responsive consumer-driven supply chains in future. Shifting from a traditional supply chain to a new supply network matrix creates room for growth, optimizes operations and improves service while reducing costs and working capital for businesses. This new paradigm shift in the supply chain introduces greater levels of complexity as organizations has to manage the flow of materials, products, and data between and amongst a growing number of ecosystem partners, all of which must be coordinated to maintain stability in the network.

Supply chain capabilities are demanded by business needs arising from unprecedented situations, and they should be able to meet shorter planning cycles and have an inbuilt ability to respond more quickly to changing demand and supply dynamics. For this to happen, a successful supply network has to leverage data-driven intelligent automation sciences & applications like Artificial Intelligence (AI) and Machine Learning (ML) to enable ongoing planning capabilities and automated responses to meet unchartered undetermined scenarios. This requires system training to be embedded in supply chains networks to distinguish between inconsequential shifts and situations that require pre-planning. The challenges and perspectives in the chaos induced by unpredictable business changes by the pandemic and plausible supply chain management solutions constitute the preamble of this paper and a P5R5 Risk Management Model is postulated.

**Key Words:** Covid, digital, impact, management, pandemic, supply chain

## INTRODUCTION

Throughout history epidemics, plagues have ravaged humanity and the saga and history of mankind took unprecedented courses due to their aftermaths. We are living in a time of such significant upheaval where an epidemic is devastating mankind and economy like never before. In just a few months, the Covid-19 pandemic has utterly changed the way we live our lives, and has had a huge impact on the way we do business.

The ongoing global corona virus pandemic or more popularly termed Covid-19 pandemic, is caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). In December 2019 the outbreak was first traced and identified in Wuhan, China and the World Health Organization declared the outbreak a Public Health Emergency of International Concern on 30 January 2020 and a pandemic on 11 March. By 25 August 2020 itself, more than 23.6 million cases of Covid -19 have been reported in more than 188 countries and territories, resulting in more than 8 lakh deaths.

The economy has suffered, the way of working worldwide has changed, the protocols of social and personal interaction has changed, the very way we work has been transformed, stay at home, remote working, quarantine, become more prevalent, and face-to face meeting sharply reduced, a new business order is being set in with the pandemic transforming business spaces.

A crisis as life-altering as the corona virus pandemic naturally inspires speculation and forecasts about how it will change everything. But it is worth recalling that a far deadlier predecessor, the Spanish Flu, killed 50 million to 100 million people between 1918 and 1920, and was followed by the Roaring 20s. So did it change everything? Possibly, it simply expedited trends that were already underway. And the same may be true today. The corona virus hit at a time when the world was already turning inwards, largely in reaction to the global financial crisis of 2008. Nations have been erecting barriers to the free flow of people, money and goods, even as the flow of internet data have continued to rise rapidly.

COVID-19 pandemic has paralyzed economic activity across the globe. Production activities fell sharply across Asia in March 2020, with a sharp fall in export powerhouses such as Japan, South Korea, China, and India. For instance, China's Caixin Market Manufacturing Purchasing Managers' Index fell to a record low of 40.3 in February 2020. On a similar note, South Korea's IHS Market PMI lowered to 44.2, its lowest since January 2009 when the economy was affected by the global recession. Japan's PMI fell to a record low of 44.8, its lowest since April 2009. Due to the pandemic, the Indian manufacturing industry is expected to lose \$31 billion during more than one month of lockdown. World Economic Forum, 2020 has made a prediction that global gross domestic product is likely to fall by more than 3 percent in the year 2020. All these figures of loss due to Covid - 19 are based on prediction and nobody knows exactly what will be the actual after effect impact of this disruption in the economic front. Also, this pandemic is bound to make changes in the socio-political front across the globe.

Increasing pressure on companies over time to reduce supply chain cost has forced companies to look for low-cost supplier and production facilities located at different locations of the globe. In the process, companies have become global and developed a diversified complex supply chain network structure. Covid -19 comes out as a major disruptive event of massive consequences in the global supply chain. This disruptive event has raised questions on the last three decades popular manufacturing strategies of outsourcing, offshoring, etc. It has shaken the operation of the global supply chain and has compelled firms and industries as a whole to reconsider and transform its global supply chain network model. This disruption has put an important question mark on a collection of raw materials from one place, produce in another country and sell it in a different market place to keep the sourcing, production and distribution cost at a minimum. By acquiring global suppliers, companies take advantage of quality, flexibility, environmental sustainability, cheap labour, specialized skills and capabilities. However, a globalized supply base also results in many challenges that may include uneven information, increased lead time and so on which lead to various risk events. The COVID 19 pandemic has imposed a severe stress test on the global supply chain in terms of its resilience, robustness and fragility to continue its operation.

The traditional supply chain is now outdated due to impact of digital world and past rigid, linear flow, the today's supply chain is not a chain at all but now it is flexible, agile value network designed to deliver instant choice and hyper –personalization across a variety of fulfillment channels and an expanding range of digital enablers. Shifting from a traditional supply chain to a new supply network creates room for growth, optimizes operations and improves service while reducing costs and working capital. At the same time, this new model introduces greater levels of complexity as organizations must now manage the flow of materials, products, and data between and amongst a growing number of ecosystem partners, all of which must be coordinated to maintain stability in the network. It is a well-known fact that if we compare with Spanish flu pandemic of 1918 with the present Covid – 19 Pandemic, it is found that there is key difference of supply chain perspective between these two situations. The present situation is generally different from past pandemics from the recent history, due to the astronomically different economic equations. For example, the contribution of China for world GDP was only 4% whereas the present is 17 % which shows more painful and damaging from an industry perspective.

Hence this article is a study is on the larger macroeconomic problems and gravity of impact of Covid – 19 on the global supply chain management systems. It is imperative to examine new opportunities that may arise in the post Covid – 19 World so that constant and strong remedies may evolve to solve the pressure on the supply chain networks to work efficiently.

## II. Supply Chain Management and COVID 19 Impact

The management of relationships amidst suppliers and customers both upstream and downstream for delivering superior value to customer and at less cost to the supply chain as a whole is what Supply chain Management is all about. (Christopher, Martin, 2016) Supply chain management process involves a balance and synchronized motion between the demand management, integrated partnerships, procurement, control of inventory, manufacturing, logistics, product lifecycles, pricing issues, lead time issues, planning and forecasting, synchronized supply and demand, supply chain feedback and improvement. Supply chain management is an intriguing and challenging area with various risks and challenges in face of the recent pandemic issues.

Any organizational performance is significantly challenged and affected by the stress and disruptions in the supply chain (Hendricks and Singhal (2003). Several studies attempting to explain precursors of supply chain networks levels disruptions based on network (Kim, Chen et al. 2015) and organization levels (Bode, Wagner et al. 2011) have been investigated. Studies (Bode et.al. 2011) have looked into the organizational responses to supply chain disruptions, using the dual viewpoints of resource dependency theory (Carroll, 1993) and information processing theory (Tushman and Nadler, 1978). Pandemic puts such a heavy strain in the supply chain and frantic disordered supply demands get generated in distorted order placements, disturbed buying patterns induced price fluctuations, distorted demand estimates and forecasts, communication lapses in supply chain links time, disorganization in time and supply of order decisions all the well-known implications set back drop to the Bullwhip effect (Wang & Disney, 2016; Chen et al., 2000; Lee et al., 1997). In the issues faced during pandemic the supply chains safety, reliability, visibility, traceability, transparency, coordination, cooperation is effected due to the various stages of pandemic issues across the supply chain environment.

The pandemic Covid-19 has been already projected as a crisis for the economies of India and worldwide and IMF projections for India GDP is projected to grow only at 1.9%, as per the Economic Times but again the figure is debated and downgraded by several rating institutions to 0.2-0.5 per cent. Even the strains on Indian food security chain are being projected with the lock down situation in the country. Worldwide lock down of community is affecting labour supply and raw material supply availability for manufacturing, agricultural operations, the crisis is precipitated further by breakdown of logistics and transportation networks and facilities.

A supply chain is a network between a company and its suppliers to manufacture and distribute a specialized and required product to the final buyer or customer. The supply chain again represents the steps it takes to get the product or service from its initial state to the customer. Supply Chain Management (SCM) is the process of overseeing and controlling the logistics of goods and services from producer to the customer. A supply chain manager's goal is to amend the efficiency of the supply chain, minimize time and costs. Supply chain planning and execution systems are the two main classified categories based on the performance of supply chain management system. The five activities of management of supply chain are alignment of flows, integration, process coordination, complex system design and finally resource management. The main key goals for SCM is demand fulfillment, better customer value, improve organization responsibilities, network building and increase of financial efficiency. Responsible SCM can build company's image and suppliers and finally better CSR performance thereby increasing quality and productivity with an aim of costs reduction.

The Indian Institute for Supply Chain Management conducted one survey during recent Covid -19 periods and concludes that the 75 % of companies faced supply chain disruptions in one way or other. This leads to logistics imbalance resulting delays in receiving orders and supplies including service sector. Also supply chains are suffering shortage of supplies and many issues are not fulfilled considering various sectors which handle, like from electronic to construction materials. The main primary reason behind these is the disruptions in web-like links between manufacturing organization that facilitate the flow of goods and materials.

The global manufacturing industry has taken a beating in the new pandemic aftermath be it the process manufacturing sector like chemicals, pharmaceuticals, food industry, paints, coatings, cosmetics, health care or be it the discrete manufacturing sector of electrical, automobiles, machinery and its parts, electronics, aviation, metal etc. Covid -19 pandemic has already affected taken lives of 809000 worldwide still affecting 23 million as this article goes on record but is still going strong, with no vaccine as a savior for the world. Unlike other major global worries of 2020 in form of earthquakes, cyclones rumors of World War, Worldwide economic downturn the Corona virus pandemic have thrown out of gear many industry and sectors worldwide, declines in foreign direct investments globally, economic downturn worldwide, other than causing its sharp impact on human misery. Even United Nations Conference on Trade and Development (UNCTAD) estimates shrinkage in global FDI from 15 to 5 percent in wake of COVID-19 outbreak based on the factory shutdowns worldwide resulting due to downfall in the manufacturing sector. Country after country has applied curbs in the manufacturing sector viz. like India, one of the major API (active pharmaceutical ingredients) manufacturer, curbed export of 26 ingredients used in pharmaceuticals commonly to ensure that critical availability & supply of API's in Covid resistance measures are not affected. Production of masks, sanitizers, ventilators, covid care related products were manufactured by many Parma and other industries altering their line of production chains.

Estimates put the decline of 2.4 percent in global chemical production in Feb 2020 & 1.3 percent in April 2020 in the covid 19 pandemic. In the data compilation for more worldwide 40 economies IHS Market have indexed the JP Morgan Global Manufacturing PMI Purchasing Managers' Index™ (PMI™) data to have dropped from 47.3 in March 2020 to 39.7 in April 2020, the lowest since the March 2009 global financial crisis with continuous signaling of downscale in worldwide manufacturing, a marked intensification of the PMI decline in April in face of the COVID-19 pandemic escalating statistics. The JP Morgan Global Manufacturing PMI, compiled by IHS Market from its business surveys in over 30 countries, slumped from 47.3 in March to 39.7 in April, its lowest since the height of the global financial crisis in March 2009. The PMI has seen three successive months of deteriorating health of worldwide manufacturing, with April seeing a marked intensification of the decline amid the escalating COVID-19 pandemic This PMI index fall is also bundled with steep falls in output and new orders, reported record supply shortages., Jobs being cut, weak demand, high rates of decline in manufacturing in most countries

COVID 19 has had immediate impact - Manpower availability in both skilled and unskilled categories, production short fall on account of capacity reduction, panic in consumer market on account of stock-out / over stocking of goods and materials which all leads to downfall in productivity and thereby affecting profit/economy of the manufacturing industry. Hence manufacturing industries should take immediate steps to protect themselves from the fallout on case to case basis.

As early last month, 35% of manufacturers were already facing supply chain disruptions. This has likely only increased with time as the disease has spread across the world. The widespread closure of business means a reduced workforce to facilitate supply chain, not to mention the disruption to Global production and shipping already caused by the pandemic.

## Covid Impact Index by Industry

Source: Wikipedia

| Serial No. | Categories | Sectors |            |        |              |            |               |                        |           |             |           |
|------------|------------|---------|------------|--------|--------------|------------|---------------|------------------------|-----------|-------------|-----------|
|            |            | Finance | Energy     | Health | Transmission | Media      | Retail Market | Manufacturing Industry | Education | Non Profile | Logistics |
| 1          | Human      | 2       | 3          | 1      | 2            | 2          | 3             | 4                      | 4         | 4           | 4         |
| 2          | Functions  | 2       | 3          | 4      | 3            | 4          | 1             | 4                      | 1         | 3           | 4         |
| 3          | SCM        | 0       | 4          | 3      | 4            | 1          | 0             | 4                      | 0         | 0           | 4         |
| 4          | Money      | 4       | 3          | 3      | 4            | 2          | 2             | 4                      | 4         | 4           | 4         |
| 5          | General    | 2       | 3          | 3      | 3            | 3          | 2             | 4                      | 3         | 3           | 4         |
|            | 0 - Slight |         | 1 - Modest |        | 2 - Serious  | 3 - Utmost |               | 4 - Extreme            |           |             |           |

At micro manufacturing levels due to government directives, lock down etc more and more employees are reducing from work front and stop coming in to work, causing reduction in the scale of operations, cascading effect on with consequent effect on quality, cost and production volumes and this in turn affects the turnover, which slows down gradually to a trickle. In the logistics front this leads to uncertainties with transporters struggle to not only place vehicles for operations but staggered supply and running along with crisis time they quotes for carrying goods, plus lower attendance in operational front, the risks are increasing steeply. The shorter working hours, slower rate of banking operations, jammed, heavily overloaded communications lines lead to delayed financial transactions, which also thereby create financial & monetary risks. Many large suppliers to producers are disengaging playing safe as risk bearing is critical along with end users trimming needs and disengaging from consumption by postponing needs all creating a vicious circle of manufacturing and economic downtrend.

Safeguarding Staff and Core manufacturing operations –

Management have to find methods to see that employees has to be least impacted by the Covid pandemic and has to provide a safe working conditions and safety of all personnel especially for those allotted to work in manufacturing sectors. Factors such as frequent work place disinfection and the implementation of sanitization, social distancing and remote access infrastructure should also be considered, similarly, they must identify/study the people that are critical to operations and provide them with the necessary infrastructure facilities including their individual safety. Alternatively, for emergency and essential staff should be identified and trained to ensure they are ready to take on additional responsibilities. Due to the labor shortages, reduced demand, fluctuations and shortage in the raw material supplies chains the manufacturing sector management is facing new challenges. Management has to ensure that worker safety measures, best hygiene & sanitization practices have to be revisited and implemented. Lining up of alternative suppliers and revisiting materials sourcing strategies, rationalization of product ranges, evaluating agility and resilience of supply chain, crisis and emergency response plans is immediately required for manufacturing sector to manage in this crisis times. e-commerce & distribution networks have to be optimized and streamlined, change in pricing, and promotion strategies are all required to stay afloat.

### III. Supply Chain Risk Management Strategies

During this black swan event, the manufacturing industry is trying to come up with a solid risk response strategy. Financials and budgeting aside, some of the key trans-formative steps that business would want to take while coming up with their risk response strategies are – risk/gaps identification in the supply chain which causes disruptions and mitigate these risks, disruptions/events monitoring from raw material supplier: intermediate distributor: and handlers to inventory and factories and plants, communication that informed by accurate data and insights with key suppliers coordination, digitization of all supply chain networks which starts from placement of purchase orders to final product in the hands of customer and running of inventory run out/ predictive and intelligent analytics which forecast outcomes ahead of time.

It is a digital connected globalized networked world of business today which makes risk mitigation in supply chain a difficult task along with the looming threat of cyber interference of various hues. Any resilience model has to strategize for reduction of risks to a new P5R5(PPPPRRRRR) risk management model furthering the PPRR risk management model



Fig.1 PPRR risk management model

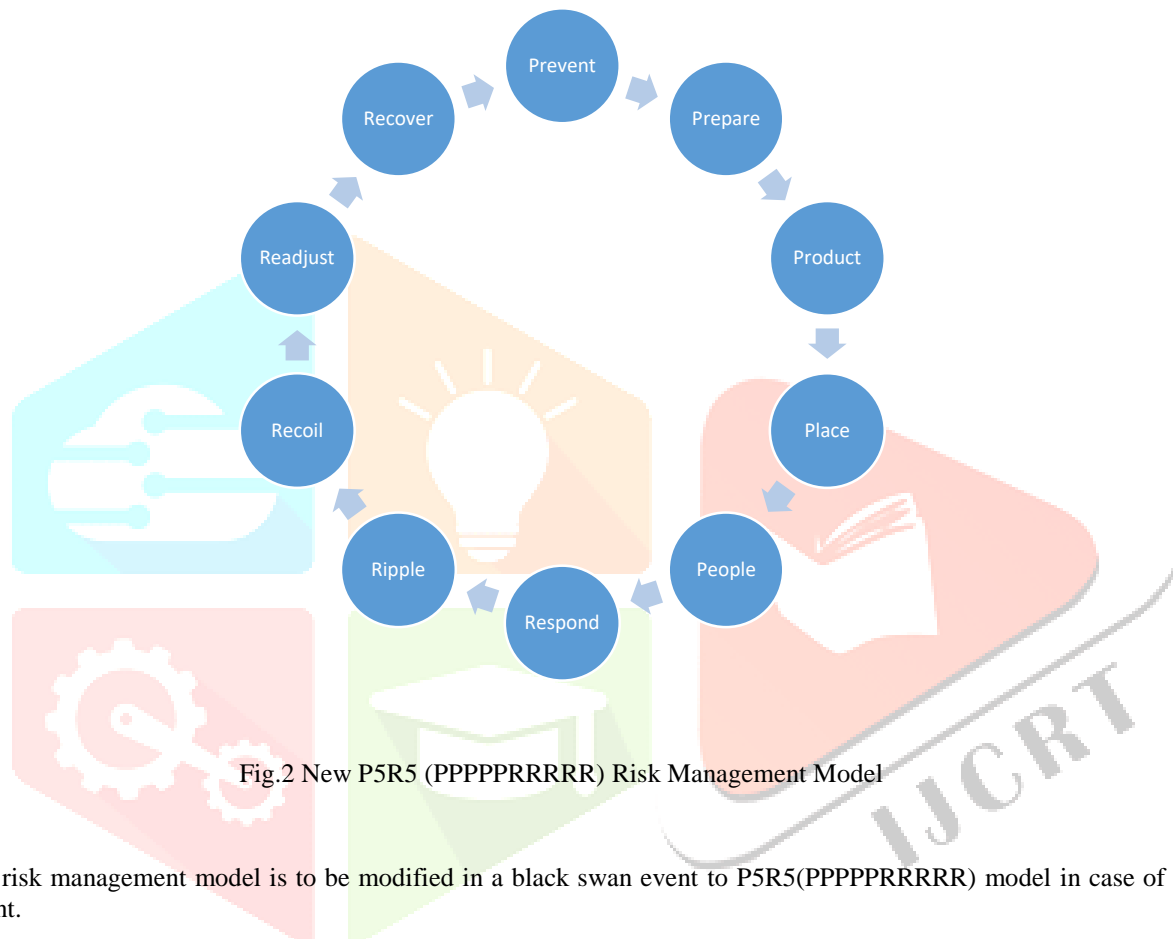


Fig.2 New P5R5 (PPPPRRRRR) Risk Management Model

The PPRR risk management model is to be modified in a black swan event to P5R5(PPPPRRRRR) model in case of a supply chain risk management.

- a) Prevent: Precautions to see that non-negotiable core links are not swapped in the unpredictable chaos
- b) Prepare: Strategic Themes & Enablers are incorporated in the supply chain by a contingency plan in case of an emergency like Covid 19.
- c) Product: The positioning of product and its need is to be clearly mapped.
- d) Place: The geographical locations, political contexts, environmental risks and climates are to be mapped clearly
- e) People: The availability of skillful personnel and people in chain has to be ensured with succession plans
- f) Respond: As soon as the chaos comes the response has to be executed to reduce impact of disruption
- g) Ripple: As multiple forces may act in such crisis ripple effects of contingency plan is to be figured.
- h) Recoil: Change of plans as per the changing effects from the ripple of the ground situation
- i) Readjust: Strategy change or mellowing or strengthening based on response of situation plan is to be readjusted
- j) Recover: With this phase normalcy resuming has to be made as quickly as possible

In such Pandemic environmental risks are to be figured because it is seen that Covid-19/corona virus pandemic exposed gaps in global supply chains depending on fatality rate of virus which had variance across regions. China being hub of world trade, many vendors were forced to re-evaluate their options because many of their suppliers were based in China, which at a time was the pandemic epicenter. Environmental risk is difficult to prevent but a proactive model of action plan is to be in strategy for facing such calamity. In respond to corona epidemic many companies switched over to making of sanitizers, ventilators etc. using their product line. Multi retail and supplier models were enabled for networks by many businesses. In the cyber world of business digital technologies play a major role along with it threats of hacking, malware, ransomware, phishing, also are equally present and with epidemic differ loads on networks, slow networks ripple has to be taken care for with planning and new strategies. The ripple effect of business will also effect financial stability which has to be taken care for as many businesses hadn't strength in the supply chain as it was thought of, which is a risk and that needs careful evaluation of chain elements.

In the recoil part of strategy evaluation of freight carrier metrics, transit time revaluation, loading unloading data, route optimization, preventive maintenance schedule, logistics efficiency & audit, documentation is all to be re-planned for supply chain risk mitigation. Monitoring risks continuously is the only method to readjust and adjust the supply chain to the new dynamics in a pandemic framework but the task doesn't stop there. All levels of supply chain is to be observed for potential threats and risks carefully. For this a scalable metrics of software enabled digital system has to be enabled to monitor the various aspects of risk and also for intel to find alternatives in disruptive times. Data modeling to risk event scenarios with unpredictable breakages has to be done with technology developments in data science, big data, predictive analytics, and data modeling. Data has to be collected collated and stored in well designed and organized repository for such predictive analysis

These initiatives, executed with the right technologies, collectively help in the recovery process, while also creating the ability to withstand future disruptions in the supply chain. Without the right technology though, much of your scenario planning will just be guesswork. The pandemic has taught the requirement for at least some amount of safety stock, which was slashed to the barest minimum by those who consider inventory at rest to be nothing more than a drag on the balance sheet. Suggestions of an additional product plan should be in pipe line for a more effective long-term strategy, keeping in the visibility over the entire supply chain dynamics. Industries' emphasis even though in this mechanized world is on machines but the human factor which has been highlighted in the pandemic that actually people are at the center of all these systems. Even though the idea of Artificial Intelligence completely taking over the task of arriving key decisions about sourcing, stocking, routing and delivery activities the human need requirement in the system haven't yet written off.

#### IV. Challenges and Trends in Supply Chain Management

Enabling a supply network requires organizations to create and standardize robust data collection and analysis capabilities that can inform planning systems. Many of today's supply chains are largely analogue, so even applying real-time insights often require manual human intervention; in a data driven world, this is unacceptable. Every aspect of the supply network must be integrated and a great deal of insights-based decision making must be automated, ultimately improving overall speed and humility of the organization to bring the data to the Centre of each business function, so companies must be more deliberate in organizing themselves in a way that embrace data-enabled technology. Fostering post-pandemic success Simchi-Levi suggests five steps to follow during this pandemic period and they are – Identification of suppliers in affected regions and estimation of TTR by scenario, estimation of demand and assessment of products and spares affected on supplier's side and how much time to taken for overcome these shortfalls and finally assess the logistics capacity. Supply chain has evolved to an incipient caliber as there's an abundance of potential from incipient age supply chain management solutions. The management solutions have been able to find discrepancies in areas of financial crisis, position supply chains as enablers of revenue margin magnification, purchase procedure that support the designation as well as management of a sustainable technological support for supply chain has been a great facilitator of supply chain companies, Gartner recently report that the Ecumenical supply chain management software market contracted 0.7 percent from 2008, with revenue totaling \$602 billion in 2009.

In recent past Gartner published that the Global Supply chain management software market shown 7 % reduction from 2008, with revenue totaling \$ 602 billion in 2009 based on the fact that new age management solutions have been able to find discrepancies in areas of financial crisis, position supply chains as enablers of revenue margin magnification, purchase procedure that support the designation as well as management of a sustainable technological support for supply chain has been a great facilitator of supply chain companies. Supply chain has evolved to a new level as there's a lot of potential from new age supply chain management solutions. These solutions have been able to curb discrepancies in areas of financial crisis, position supply chains as enablers of revenue margin growth, procurement processes that support the sign as well as management of a sustainable supply chain technology has been a great facilitator of supply chain companies, Gartner recently report that the Global supply chain management software market contracted 0.7 percent from 2008, with revenue totaling \$602 billion in 2009.

A series of discussions with business stalwarts conducted by the Supply and demand authorize chain executive Magazine, unrevealed following trends in supply chain management. There is a possible emergence of a closed loop supply chain. Infrequently referred to as cradle-to-cradle supply chain, this term describes a zero-waste supply chain that re-utilizes all materials. Recycling is one astronomically immense innovative aspect of technology, 20 years ago a plethora of accentuation wasn't genuinely placed on recycling. However, the 21st Century has shown faith in the aspect of re-utilizing materials so as to eschew wastage of materials that would be used to achieve other things. Certifying the suppliers as a sustainable source is very consequential. Comprehensive back-end research is required to manage the process, and cyclopean effort is being allegiant to ascertain the cull of the right certification system. While most participants are looking to international customers for future market magnification, few are yare for the intricacy that results from accommodating global customers with regionally customized products.

End-to-end supply chain cost optimization will be critical in the future. Risk and opportunity management should span the entire supply chain, including the supply chains of key partners. Subsisting supply chain organization are not authentically integrated or potentiated – lack of integration between product development and manufacturing functions are standing in the way of capturing the benefits of economic instauration. Albeit supply chain management practices are growing expeditiously, challenges are in evitable and there is a desideratum to understand that the industry (SCM Industry) finds methods of surmounting these challenges prosperously, companies will still not achieve efficiency and profitability in their globalization efforts.

In future optimization of cost in the end-to end supply chain will be a critical one. Hence risk and opportunity management concept should span the whole supply chain including key partners of supply chain. Current supply chain network is not fully integrated – the idea of forming IMG (Integrated Material Group) among similar industries which are common in manufacturing functions and product development may be explored. Hence in order to achieve productivity and profitability and to overcome, the manufacturing industries should face these challenges since supply chain management practices are growing globally and rapidly.

Having the idea/technology that legacy planning systems such as APO's i2's, JDA and Oracle applications designed in the 1980's and 1990's won't be able to keep up with the present challenges. These applications were not designed to handle the manufacturing, as today's rapid and unexpected changes from remote supply chain partners and customers are beyond their capacity. These applications were created

to handle complex computations of large sums of data. With today's global outsourced, multi-tier supply chain approach, the legacy planning systems became an outdated one.

Epidemic effects and disruptions create not only a sudden bang on the supply chains but with the severity and spread of epidemic propagation ripple effect in the networks is created of which control is a challenging task. For the resilient strength of Supply chain networks during crises in epidemic type disruptions where multi-dimensional forces of various magnitude come to play on the networks predictability of course to be chartered can be sought out with help of new digital technology and engineering platforms of Artificial Intelligence, data analytics, machine learning, block chain technology. Along with it Internet-of-things, social media data, wireless sensors, and storage & fast retrieval of data systems all have led to huge unprecedented data compilations in different varieties and the use of this new mentioned data, knowledge and analytical platforms for decision headways are areas of new research focus too. (Choi et al., 2017; Choi and Lambert, 2017b, 2018, Ivanov and Dolgui, 2020, Queiroz and Wamba, 2019). Dynamic capability of systems for big data analytics can be used for bettering supply chain performance in cost and operations, adaptability, agility. (Dubey et al., 2019, 2020,) But challenges are also high in decisional process when disruptions happen as data quality is poor and unreliable at times (Choi et al., 2019)

Many new studies focus risk analysis and reduction of ripple effects of supply chain disruptions, with the help of the technology advance in Industry 4.0, using relations and cross interactions between big data analytics and advanced mode of systems of disruption tracing and tracking data in supply chains. (Ivanov et al., 2019)

## V. CONCLUSION

In the supply chain management for the manufacturing industry, two assets are crucial to the success of the operation – time and cost. Having an efficient supply chain is a key factor of any well-functioning business, but supply chain management in the manufacturing industry is even more critical. In general, nature of product, customer satisfaction and technology are three reasons behind the successful operation of supply chain management in the manufacturing industry. Owing to the ongoing COVID19 induced supply chain disruptions, the global supply chains will require restructuring to ensure business goals and objectives are met. A complete rethink of processes and a real adoption of digitization are just one step towards creating future resiliency.

The one thing that humans are better at than any other sentient life-form is our ability to learn from our cumulative experiences and implement that learning's to come back stronger. From a purely business perspective, Covid-19 presents a slew of serious and sometimes unprecedented challenges for organizations cutting across the business environment, including a possible liquidity crunch, global supply chain disruptions, increase in trade barriers, and a shifting consumer mindset. However, the post-Covid world will see digital technologies playing a critical enabling-role in delivering improvements throughout the breadth of businesses, including more resilient supply chains, significantly enhanced user-experiences, and intelligent optimized processes to deliver business outcomes.

It is emphasized that today's supply chain concept is far more dynamic and crucial to meet immediate and sudden demand on these pandemic period and an efficient/effective network supply has to leverage data-driven intelligent automation sciences & applications like Artificial Intelligence (AI) and Machine Learning (ML) techniques. Hence most manufacturing industries should rely upon new prudent technologies like AI and cloud technology so that concept of driverless trucks, drone delivery systems and so on, which results in future the Supply Chain Management solutions will become even more automated and hence cloud migration is inevitable and useful. According to Forecasts, more than 67% of the enterprises will largely depend on cloud-based platform by the year end 2020 to implement digital transformation and drive customer expectations i.e., advanced digital technologies are not only part of the solution to the disruption during Covid, but they will also be the solution in the post-Covid World. New Risk Mitigation Models has to be developed in the coming years synchronizing the cyber developments, software and hardware developments and new scientific platforms with the evolving new business and risk mitigation models.

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