Artificial Intelligence in Supply Chain

Assembling Your Supply Chain Technology Stack

01 Map Your Supply Chain

02 Identify Your Risks

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04 Seek Out Suitable Technologies

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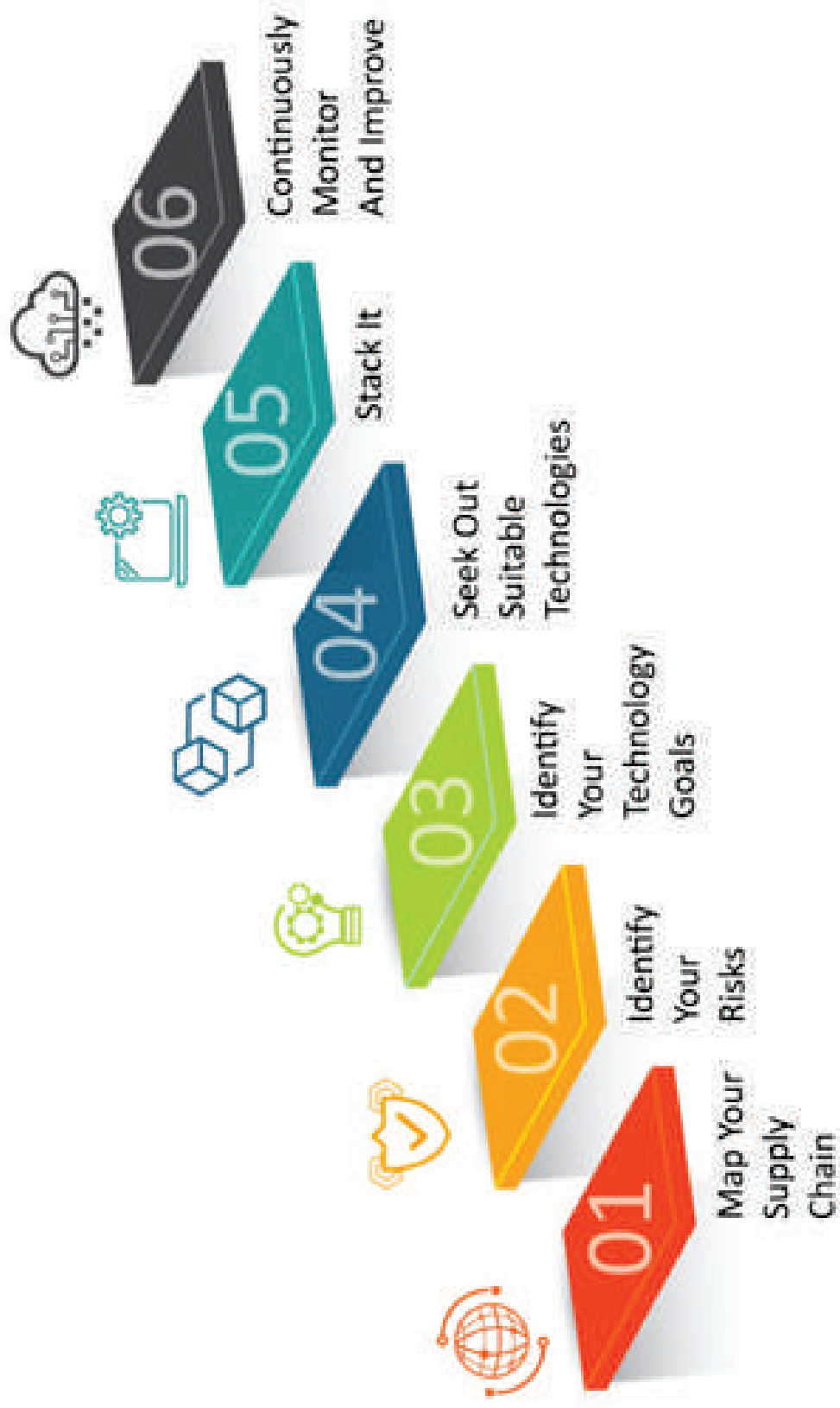
From the Desk of The National President

Dear Members,

Greetings from National President!!

As I write my last message in MMR as National President, the memories of last 2 years is coming live before me. The tenure of the current NEC started with a very promising note and we all wanted to do a lot of good things in a very short span. However as fate will have it, COVID 19 cast its evil shadow and all the routine activities came to a standstill. The only thought we all had was to keep ourselves and our loved ones protected from the Pandemic. Even before we could realize the enormity of the Pandemic, we had lost many of our loved ones. While life was coming back to normal, new COVID variant Ómicron' has occupied the center stage once again bringing back fears of perhaps the third wave.

There is always a bright side of any situation. Pandemic situation necessitated using oftechnology to restore normal working. Online education became the order of the day so was online examination and assessment. Work From Home (WFH) became a new normal. IIMM also used the opportunity to have online lectures for our two AICTE approved courses which was appreciated by all our stake holders including students, course coordinators and branches. Next big change to follow was conducting online examinations and assessment. By the time the tenure of the current NEC is getting over, we have streamlined the online examination system and assessment. This has taken the burden off from the branches to conduct examination. Students can appear in these examinations from anywhere provided they have the proper network connectivity. Various branches conducted online webinars at regular intervals for the benefit of their members. These being online events, it was also convenient for members from other branches to participate in these webinars. Even major events like branch signature events were conducted online giving an opportunities to members to participate and meet each other on online platform. Eventssuch as giving away major awards like life time achievement award or award of fellowship to CRIMM scholars were successfully carried out on online platform. The most interesting thing to watch was handing of the NATCOM flag by Chennai Branch to Vadodara Branch digitally during Spectrum 2020 & NATCOM 2020-21

The election for new NEC through Postal Ballot is in progress which will conclude on 13th Dec. 21.I thank Sh. Asok Dasgupta our Past National President to successfully initiate the election process as Election Officer and bringing about a marked change in the electioneering. The CVs of all the contenders for the election was circulated among the members thus giving the members the opportunity to know their future leaders. Preparation for Disha the signature event of MumbaiBranch from 9th to 11th Dec.21 is underway and so is the preparation for NATCOM 21 by Vadodara Branch which is scheduled on 17th and 18th of December 21. I wish both these events a great success.

I take this opportunity to thank my NEC colleagues, NC members, Branch Chairmen, Past Presidents, NHQ staff members of Mumbai and Delhi for the support they have extended during my tenure. I wish all members of my extended IIMM family a good health, peace and prosperity.

With Warm Personal Regards

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From the Desk of Chief Editor

Dear Members,

Supply chain evolution over the decades have seen different phases from being simply a Physical Distribution Channel in 1960s to a more complex integrated sequence of activities nowinvolving continuous technological upgradation and digitization, aiming at value optimization and competitiveness.In this modern era of Machine Learning, Automation and Internet of Things (IOT), the supply chain function can be redefined as web linking of multiple functions, including logistics, production, procurement and marketing & sales.

As global supply chains are becoming increasingly complex and important for business entities, the margin for error is rapidly shrinking.Further to it, market volatility, which has been aggravated by the COVID-19 pandemic, have realized us to have smarter, agile and reliable supply chain. Ever increasing expectations of ultra fast delivery of supplies between suppliers, manufacturers and consumers urge the need of industries to leverage the prowess of the Artificial Intelligence (AI) and in Supply Chain and Logistics.

AI driven tools and techniques in modern supply chain will prove to be a game changer as these intelligent systems can analyze and interpret huge database quickly, resulting in faster decision making process and accurate forecasting of the supply & demand equation.These supply chain decisions will also be much smarter as it will help decision makers evaluate alternatives against an incredibly complex and dynamic set of risks and constraints.

Besides this, it will also help supply chain managers to foresee the upcoming bottlenecks& abnormalities, so that preventive action can be taken at right time. Shipping companies are using Internet of Things (IoT) devices to gather and analyze data about goods in shipment and track the status and continuous location.

According to PwC**,** AI applications have the power to transform the way business is done and contribute up to $15.7 trillion to the global economy by 2030. Today, AI can seed in the much needed exceptional agility and precision in supply chain optimization. It can also trigger a transformational increase in operational and supply chain efficiencies and a decrease in costs where repetitive manual tasks can be automated.

AI is the next big tool, essential for innovative supply chain transformations and is paving the way for a paradigm shift in supply chain from simple reactive intelligence to predictive, adaptive and continuous learning supply chain systems which will drive better & faster results on existing data thereby improving the cost and efficiency of an increasingly complicated supply chain. It is therefore,imperative that SCM professionals start implementing AI based solutions in their areas of work

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MATERIALS MANAGEMENT REVIEW

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ROLE OF SUPPLY CHAIN FOR INDIA VISION 2025

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1.0 Introduction : In today's world, the long term survival of any business entity is dictated by the efficient supply & delivery process that entity has implemented. To succeed in a dynamic demand & supply environment, Indian Companies need to ensure that proper coordination is in place between their suppliers & their customers until the last of the supply chain demands are satisfied without delay. This necessitates the need for tracking the inventory on hand augmented by a solid order & supply chain management. This is very crucial to cost control, availability to supply on demand, maintain market control & eventual profitability.

To meet this critical need to handle the demand & supply effectively, supply chain management is an important component. Companies are investing crores of rupees in SCM product & applications with SCM, a business can estimate future demand for its products, enabling planners to accurately estimate future needs for supply & extends to execution with the planning of their plants, transportation & logistics.

With much of competition from global players in the market, companies in supply chain business face multiple challenges. Materials & Production cost must be minimized without sacrificing quality or timeliness. Inventory levels must be optimized to keep the balance sheet healthy, order gets shift with in hour, & when that is not feasible, customers must be notified promptly of delays.

In any supply chain, there is one last entity on which the entire process depends on "the customer" all manufacturers, suppliers, distributors & retailers will only be successful if they collaborate with each other in satisfying the customer demand. If one supply chain fails to meet the demand, there will be a chain reaction that will eventually affect the end customer supply resulting in customer dropping their business as well.

2.0 Global Economic Scenario: - The Economies of the Asian region are growing at fast pace in the global economies. Asia is a host to three economies viz. China, Japan & India and accounting for more than 35% of world GDP. Today Asia's share in the world GDP exceeds that of European Union & the US. Being the fastest growing economies of the world, over past 2 years, china & India contributed 73% to the Asian growth and 38% to the World GDP growth. Asian region has increasingly become a major centre of World Trade, Global capital flows and other Macro-Economic parameters. One of the major strength of Indian Economy is that India will remain one of the youngest Countries in the world in the next few decades. This demographic dividend is seen as inevitable advantage provided prerequisites such as skill upgradation & sound governance to realize it are put in place. In terms of business environment, the impressive growth coupled with market orientation of the economy has being a bottom – up – exercised with a very broad based growing entrepreneurial class. These tendencies are perhaps reflection of a penchant for innovation among growing entrepreneurial class in India, imbued with professionalism & seeking to be globally competitive.

3.0 India Vision 2025:- Our vision of India 2025 is of a country with a well-developed network of roads and railways and adequate capacity to handle the growth in demand for transport. It is expected that the volume of road traffic will multiply about five-fold, carried over a 70,000 km network of National Highways, including 5,000 to 10,000 km of expressways, linking the golden quadrangle of Delhi-Mumbai-Chennai-Kolkata-Delhi as well as northern, southern, eastern and western portions of the country, mostly with four or more lanes. State Highways with at least two way lanes will link most districts. Rural roads will provide access to the furthest outlying villages. Technological progress will generate vehicles that are pollution free and fuel-efficient. An efficient public transport system will lead to a reduction in the population of two-wheelers in major urban areas.

Based on projected GDP growth of 8 per cent per annum, the total freight traffic is likely to reach about 5,500 billion tonne km by the year 2025, five times the level in year 2000. The proportion of manufactured products to bulk cargo will also rise, with a larger proportion of liquids being carried through the pipelines. General merchandise will travel longer distances and in much smaller consignments, favouring smaller carrying units. The rising value of consignments will place a higher premium on the speed of transit in order to minimise inventories. The total logistical

management of transportation, marketing and distribution will become commonplace for most general merchandise. These changes, together with the impact of other factors such as energy efficiency, environmental pollution, and technological changes in each mode, will result in changing preferences for alternative modes of transport.

Passenger traffic is expected to increase more than four-fold over the next 20 years. For long distance travel, the demand for air services will grow rapidly, as speed becomes an increasingly important consideration. Already more people travel between Delhi and Mumbai by air than by rail. Overnight sleeper class travel will continue to be the railways' strength, as long as booking, reservations, comfort and other customer services are continuously enhanced to keep pace with rising customer expectations.

For medium distances up to 500 kms—with four-lane highways connecting the country, expressways coming up close to the main metro cities, and car ownership increasing rapidly—the bulk of the passenger travel may start moving towards 'own vehicle travel', a phenomenon already observed in most countries. Fast inter-city rail services will have an edge over air travel for this segment of traffic.

Road transport is best suited for short distance traffic, except where volumes increase to very high levels and rail-based mass rapid transport offers a cost-effective alternative.

The railways will have to be expanded to handle a three-fold increase in traffic. Improved customer service, comfort and safety, a reduction in freight costs and tariffs, elimination (or at least reduction) of the uneconomic services, non-paying projects and subsidies will be necessary for this. India will need airports of international standards for passenger and cargo handling and modern handling systems at major ports to reduce delays in berthing. Institutional arrangements will need to be in place with adequate funds for proper maintenance, especially of roads. Urban transport systems will be needed in all cities with a population of a million plus.

4.0   Supply Chain Management:- The central idea of supply chain mgmt. is to apply a total system approach to managing the flows of information, materials & services from raw material suppliers through factories & warehouses to the end customer. Recent trends such as outsourcing & mass customization are forcing companies to find flexible ways to meet customer demand. The focus is on optimizing core activities to maximise the speed of response to changes in customer expectations.

Virtually every industry is broadening its product lines to provide the variety of choices that customers want. The challenge is not only to produce so many different products but also to distribute the products to a global customer base.

Supply chain mgmt. is important in business today. The term supply chain comes from a picture of how organizations are linked together as viewed from a particular company. Many companies have enjoyed significant success due to unique ways in which they have organize their supply chain. For example, Dell Computers, skips the distribution & retail steps tipical of a manufacturing supply chain. However, a good supply chain design for one company may not work for another. The supply chain should be structured to meet the needs of different products & customer groups.

Measures of supply chain efficiency are inventory turnover & weeks of supply. Efficient process should be used for functional products & responsive processes for innovative products. This alignment of supply chain strategy & products characteristics are extremely important to the operation success of a company.

Companies that face diverse sourcing, production & distribution, decisions needs to weigh the cost associated with materials, transportation, productions, warehousing & distribution to developed a comprehensive network design to minimize cost.

5.0 The role of key component of supply chain :- The role of key components of supply chain for fulfilment of India Vision 2025 are discussed as under:-

5.1 Warehousing : In India, the role of warehouses in the overall supply chain was always underplayed. But the present concept of integrated supply chain management has to focus on all components viz. transportation, warehousing, inventories, information etc. so as to improve the efficiency of supply chain which is vital to the economy of the nation. The four major types of warehousing in India are for the storage of Industrial goods, white goods, Agricultural goods and Perishable goods.

Warehouse is an integral part of logistics, a tool for competitive advantage. Warehouses are required to hold inventories to balance the demand and supply. It acts as a buffer between uncertain supplies and manufacturing plans and cyclic market requirements in the outbound logistics. Warehouses are also required for preservation, storage of goods, as consolidation hubs and as distribution centres.

Today manufacturing companies are concentrating more on the core activity and have gone ahead outsourcing the warehousing and transportation to 3PL service providers and to save on inventory, they prefer to maintain a stock & replenish on need basis.

There is a trend to develop efficient warehousing to support the integrated logistics needs. Older warehouses were mere godowns without proper material handling facilities leading to wastages, damages, obsolescence and higher cost of operation, are steadily being replaced by newer automated warehouses with advanced, computer controlled material handling system requiring few employees. This will bring about transformation in the logistic and warehousing industry. The entry of multi national companies in India have brought the international logistics concept and the trends are to outsource the supply chain management function to the third party logistics (3PL) service provider to provide world-class services.

Indian companies have evolved from conventional transport to a single window logistics service provider with a value addition of warehousing, inventory management, distribution and other customized services. The warehousing has evolved lot of value added services. With the vibrant economy, warehousing would be more adaptive, flexible; customers focused and continue to be a key driver to provide a single window logistics solutions.

5.2   Inventory Management :- Inventory management will play key role as it affects customer satisfaction. Firms need to maintain the delicate balance between carrying too little inventory & carrying too much. Thus in managing inventory, firms need to balance the cost of carrying larger inventories against resulting sales & profits. Many companies would greatly able to reduce their inventories & related cost through just in time logistics systems. For example, Dell a master in just in time producer have realized substantial savings in inventory carrying & handling costs. By RFID in place, companies would know at any time exactly where a product is located physically within the supply chain.

5.3   Transportation:- The choice of transportation carriers affects the pricing of products, delivery performance & conditions of the goods when they arrive. In shipping goods to its warehouses, dealers & customers, the firm would be choosing among 5 main transportation modes; Truck, Rail, Water, Pipeline & Air alongwith an alternative mode for digital products ; the internet. In choosing a transportation mode for a product, shippers would be balancing many considerations, speed, dependability & availability cost & others. Thus, if a shipper needs speed, Air & Truck are the prime choices for transportation.

5.4   Radio Frequency Identification (RFID):- Radio Frequency Identification is an automatic data collection technology that was tiny computer chips attached to objects that track products as RFID tagged items move through a supply chain. It is an electronic labelling & data collection system using radio frequency signals to identified & count closely spaced items.

India emerges as natural choice for firms engaged in RFID product development because of its highly skilled work forced & strong IT based. India is also being used as a centre for executing RFID implementation for entire Asia pacific region.

RFID has best application in the area of SCM. If a store shelf is empty of a popular product, with RFID technology, a computer could send a e-mail to alert about the shortage. The store could than automatically notified the distributor & manufacturer about the product for more products to be shipped. All the members in the supply chain stand to benefit-the customer, the retailer & manufacturer.

RFID, a tab on goods as they move throughout supply chain process, proactively communicate information about their identities & locations without any human interventions.

SCM in India is in a nascent stage. It is difficult to find many companies who are moving 10 – 100 millions cartons a year. Further, retail sector is just getting organized & thus only a small percentage of retailers will consider using RFID for managing their supply chain. Sectors like retail apparel, aviation & energy are experimenting with RFID technology in a big way. M/s Bartronics, Hyderabad based company manufactures the smart RFID tags. Wipro, Satyam & Infosys are providing the Hardware Solution, Software services & consultancy. Dr. Reddy's Laboratories, M/s ITC, M/s L&T, M/s Maruti Udyog, M/s Ashok Lenant & M/s Pantaloon are the companies who have begun use of RFID in their supply chain.

6.0   Conclusion :- In this Era of competition, the large Indian manufacturer are exercising not only to exercise control on cost but also to use all the components of supply chain management including logistics, warehousing as a means of differentiation in both domestic & international market. Due to the advantage of forthcoming road infrastructure, software capabilities, forthcoming private telecom network, cheep labour work force & most importantly the availability of end market, the supply chain management is going to contribute in a big way for achieving India Vision 2025.

Government of India needs to take challenge in shorting out the issues of custom clearance, flexibility in labour laws & other related issues so that multinational are encouraged to go in for massive investment to give boost to economic development of India for fulfilment of India Vision 2025.

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SUPPLY CHAIN DISRUPTIONS & RESILIENCE

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COVID -19, lead to Supply-Chain Disruptions &Blockages that has a Significant Economic Effect, Health,Safety and SocialImpacts Globally - like Delivery Delays, Increased Costs, Shortage of Labor, Shortage of Inputs, Shut down of Operations, Health Issues of People, Job Loss, Income for Survival, Increased Inflation etc… etc…. and created a lot manyuncertainties.

Supply Chain Management (SCM) : Supply Chain Management (SCM) can be defined as **Management of the Supply Chains** as an **Integrated Process of Acquisition** and **Management of Flow of Supply** of from point of origin to point of consumption and **Delivering Further Value Added Output to the Next Level Point of Consumption** (like from supplier to manufacturer to wholesaler to retailer and to final consumer) by **Balancing Supply and Demand** with **Optimal Management of Resources** with the objective of establishing relationships for **Maximizing Value for Mutual Benefits** on Economically, Socially and Environmentally **Sustainable basis**. (As defined by the Author **SN Panigrahi** in his Article "**Value Insights into Supply Chain**" Published in Aug'2010 issue of MMR – IIMM)

Supply Chain Management (SCM) involves the **Flow of Goods or Services** in an efficient manner. It encompasses all the steps involved in procuring raw materials through to the finished goods, in a way that is streamlined and provides **value to the customer**. Supply Chain Management is an integral part of most businesses and is essential to Organizational success and Customer Satisfaction - **Improves the overall Planning and Efficiency of BusinessOperations, Boosting Customer Service; Reducing Operating Costs; Improve Financial Position; Increases Profit Leverage etc.** However, when **Disruption** happens it Disturbs entire Chain of Activities.

SN Panigrahi,
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Supply Chain Disruption

A Supply Chain Disruption is any Sudden Change or Crisis – be it Local or Global – that Severely Impact the Supply Chain Activities, Processes and operations. Supply chain disruption is defined as a Major Breakdowns in the Production or Distribution / Supply in a Supply Chain that Challenges your business's ability to Plan, Source, Make, Deliver and/or Sell Products and other Transactions when an External Force Acts upon beyond the Control of the Business.

Causes of Supply Chain Disruption includingevents such asPandemics, Natural Disasters, Product / Process Problems (Quality Issues, M/C Breakdown, Sudden Halting / Fall in Production due to Accidents; Unexpected Surge in Capacity etc.), Drastic Price Fluctuations, Cyber Attacks, Logistic Failures & Delays, Supplier Bottlenecks, Regulatory Issues, Geopolitical Instability (War, Civil Disturbances, Terror Attacks, Strikes etc).

Ø Examples:

Ø On March 11, 2011 an earthquake struck off the Pacific coast of Japan causing a tsunami which in turn led to a nuclear disaster at the Fukushima Daiichi Nuclear Power Plant. The catastrophe affected many businesses and the global economy, temporarily shuttering those that reportedly produced 22% of the world's supply of 300-millimeter silicon wafers (a necessary component in semiconductors) along with 60% of certain necessary auto parts.

Ø A **powerful undersea earthquake that struck off the coast of Sumatra island, Indonesia in 2004, followed by tsunami**severely affected the infrastructure in the region, disrupting connectivity and supply chains as well as local production chains.

Ø **In 2015, November, Operations at the Chennai port**, especially in the container segment, have been thrown awry by the **catastrophic floods** that have hit the city, leading to massive disruption of life and property, impacting Business Heavily.

Ø **NaturalDisasters in Asia from 1970 to 2019** recorded 3,454 disasters with 975,622 lives lost and **$2 trillion reported in economic damages.**

Ø The **Ever Given**, the massive container ship that was horizontally wedged in the **Suez Canal** blocking off all traffic for nearly a week in the Month of Mar'2021.In 2020, more than **50 ships per day on average passed through** the 120-mile long waterway, accounting for **around 12% of global trade**.

Ø Businesses lost an estimated $28 trillion in 2020 due COVID- 19

Supply Chain Disruptionmay lead to Risks in terms of

Ø **Delivery**
Ø **Quality**
Ø **Costs**
Ø **Supplier & Customer Relationships**

These Factors Reflect as Decreased Productivity, Increased Costs, Non-Availability of Inputs & Raw Materials, Delayed Deliveries or Non-Deliveries, Stockouts and Loss of Revenue, as well as Loss of Customer Trust- Rising Customer Dissatisfaction; Cash Flow & Financial Problems, Closure of Businesses or Insolvency, and more and many Economic Fall outs.

Supply Chain Disruption - Types

Supply Chain Disruptions may be Classified in to Following 4 Types :

Disruption Type 1: Demand Drop (Decreased Demand) : Examples – Airline Industry, Hotel, Tourism industry Completely come to stand still during COVID Lock Down period.

Disruption Type 2: Demand Surges (Increased demand): Examples – Hospital, Medical & Pharma Industry, Online Food & Grocery Business, Sanitation, Shipping Industry.

As economies restart, the supply chain will be critical to supplying goods and services quickly, safely and securely. This also creates a disruption or distortion like we are facing at present in shipping & logistic crisis. This phenomenon we have seen even in advanced nations. For Example, as on 5th Nov'2021, approximately 70 ships filled with cargo were anchored outside the ports of Los Angeles and Long Beach, which are the points of entry for more than **40 percent of US imports**. This backlog is a clear reminder that there aren't enough workers or facilities to take in all the products that are being shipped to the United States right now. This type of incidences is seen all over world.

Disruption Type 3: Reduced Productivity : asresult of a Labor Shortage, Equipment Shortage, Raw Materials / Input Shortage

Example : **Semiconductor Chip Shortage -** The **semiconductor chip shortage** is now expected to cost the global automotive industry **$210 billion in revenue** in 2021, according to consulting firm AlixPartners. It forecasted that **7.7 million units of production will be lost in 2021.**

Disruption Type 4: Storage and Access Restrictions : Examples -social distancing requirements for employee safety, warehouse shutdowns

We have seen Many Types of Supply Chain Disasters and Disruptions in the Past. They are either confined to a Particular Region, Country or effected for a Shorter Period. However, **the COVID-19 pandemic is a peculiar and unusual happening in terms of its geo-graphical scope – Spread Across the Globe; Economic Impact - effected all most all Economic Activities; Duration - become a Long-Term Crisis - No Definite end and Assessable Impact. It has long-lasting &far-reaching implications for how people work and how supply chain's function.**Even natural disasters as devastating as the earthquakes and tsunamis that struck in Indonesia in 2004 and Fukushima, Japan, in 2011 take most nations only a few months to recover from. On the other hand,**COVID-19's impact on global supply chains and economies is expected to be felt for a much longer period**.

During the COVID Period All are Not Well–In the past two years, Impact of COVID and it's associate many events worldwide have triggered disruption of the global supply chain - hampered factory operations and sown chaos in Global Shipping - demand for shipping has outstripped the availability of containers – Damaged many economies around the world. we have seen Shortage &Stockout Situations for many items including very Essentials like Food, Groceries, Household **supplies,** Medical, Personal Protective Equipment's (PPP), Clothsand so on. With Lead Time Issues, Uncertain Demand & Deliveries – **All the Supply Chain Targets &**

Measures goneawry. Govt. Regulations / Restrictions for Mobility, Lockdowns, Increased border controls and customs regulations result in longer wait times, and lack of capacity for long-haul and last-mile fulfillment etc apart from overall Economic slowdown, Short Supplies, Labor Non-availability, Health Issues and Severe Financial Crisis created extreme challenges - **challenges of keeping the businesses running & keep them stable.**

Pandemic's impact on global trade is so devastating that it has **exposed the Fragility of the Supply Chain**andproved to be a real test of corporate **Ingenuity, Resilience and Flexibility to face the Crisis**.Covid-19 in India, Impacted on jobs, incomes, inequality, poverty and Loss of Human Capital. **Therefore, there is a pressing need for businesses to build Time Relevant Shot / Long-term Resilience in their value chains for managing future challenges.**

Supply Chain Resiliency: Resilience is a Crucial Characteristic of any Business to sharpen the focus and create an environment to combat uncertaintiesin the event of adversitiesand difficult situations.**Supply chain resilience** is about managing and adapting to the unknown across the whole spectrum of risk - Dynamics, Complexity, and Uncertainty in Supply Chains. It is "**the ability of a supply chain to both resist disruptions and recover operational capability after disruptions occur**."

Supply chain resilience refers to an organization's **ability to use its resources to handle unanticipated supply network disruptions. In other words, it is the ability to respond to and recover from challenges without disrupting operations or deadlines.People, Processes and Technology** are the three key enablers of a robust supply chain resilience strategy.

Supply Chain Resiliency has **Three Elements** :

Ø **Agility –** Responsiveness in Uncertainty
Ø **Adaptability -** Fitting to Changing Needs
Ø **Alignment –**Synergies Between Strategies & Actions
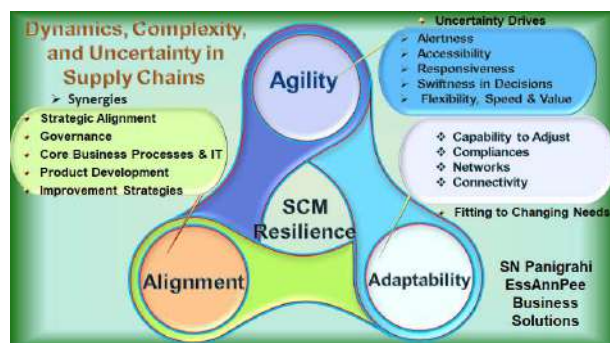
Strategies for Improving Supply Chain Resiliency:
Ø **Mapping your Supply Chain Network with Risk Factors. Conduct Global Scenario Planning.**
   Map Out Your Supply Chain to get a clear understanding of which entities are most vulnerable to risk. **Identify Sources of Risk** – both External & Internal and Document.
Ø **External Supply Chain Risks**
v Demand Risks
v Supply Risks
v Environmental Risks
v Business Risks
Ø **Internal Supply Chain Risks**
v Manufacturing Risks
v Business Risks
v Planning and Control Risks

v Mitigation and Contingency Risks

Identify Critical Suppliers in Affected Areas & Assess the Risk Involved in the Entire Chain - Tier 2,3 etcExtended Supply Base- A lack of Transparency, Traceability & Accessibility relating to Second - and Third-tier Suppliers has left many firms vulnerable to shortages of critical components**.**

Ø **Assess Risk & It's Impact -** Adopt Risk Evaluation Tools to understand the areas & levels of impact.

Ø Perform a Full Assessment of Suppliers based on factors such as **PESTLE**(Political, Economic, Social, Technological, Legal, & Environmental)

Ø **Prioritize by Probability and Impact.** Evaluate every impossible scenario, so that you can prioritize potential risks by taking into consideration likelihood they could actually take place and its impact. Then estimate the financial and brand impact of each event. Develop mitigation contingency plans, starting with the most likely and highest-impact risk scenarios.

Ø **Be Aware of Suppliers' Risks.** Be aware of risks your suppliers may face, including supply risks due to Pandemics, regulations compliance, country risk, economic and political conditions or anything that may impact their ability to serve you.

Ø **Build a Supply-chain Risk-Management Framework – Your Strategy**

Ø **Develop Risk Response Plan (Strategy)**

Ø **Create a Supply Chain Emergency / Contingency Plan - Carefully document all processes and create a single source of truth that employees can refer to when executing on your contingency plan.**

Ø **Avoid Single Sourcing and Shift to Alternative Sourcing or Multi-Sourcing :** Multiple Suppliers - **Monitor Potential Disruptive Risks and Develop Alternate -Sourcing Strategies** for Crucial Items. - businesses should take the consideration and responsibility of creating strategic cost-benefit analysis on the additional cost of sourcing from other supply areas or nations.

Identify Backup Suppliers - Create a Plan B, Plan C, Plan D, and so on. Diversify Supply Base and Supplier Network so that you aren't reliant on a Single Supplier and from Single Location.

Ø **Avoid Single Country Focus (**like China Centric**) and Plan for Suppliers from Different Geographical Locations.**

Ø **Shift from Offshore (Global Sourcing) to Nearshore (Local & Nearby Countries) to Sureshore.**

   Sureshoring – the ability to source goods or services from multiple locations so as to avoid h a v i n g a **Single Point of Failure.**

Ø **Diversify Customer Base** : Domestic Market, Exports, Customers from Different Regions or Groups

Ø **Develop Stronger Association with Supply Chain Partners.** Good Supplier Relationships Create Opportunities. Especially Strengthen Logistic Service Capabilities with stronger tie-ups with Logistic Partners. Also Evaluate Alternative Logistics Options and Prepare for Potential Channel Shifts.

Ø **Create Backup Plans** and Test for Supplier's Outage - Create Backup Plans like inhouse manufacturing or alternative manufacturing methods

Ø **Build up Inventory.**

   Build Buffers for Inventory and Capacity

Ø **Pause Just in Time (JIT)**approach for Time being and **Shift to Just in Case (JIC)**

Ø **JIT** operations receive inventory only as it's needed for production **(Pull)**, whereas **JIC** stocks up inventories ahead of time (Based on Certain Forecasts **– (Push))**.

Ø This move expands companies' focus from**Optimizing Efficiency to Managing Risk.**

Ø **Empower Employees to Make Decisions**

Ø **Establish a Crisis Response Team to make Critical Decisions in the Event of an Emergency.**

Ø **Digitalize Supply Chain : Integrate a digital system into your supply chain**, which will enable it to be demand-driven. With the use of a digital system, you can respond to sales, and adjust your value chain based on these sales.

Ø **Improve Supply Chain Visibility -** Increase use of advanced data analytics to improve the efficiency of supply chain management

   Have End-to-End Visibility is Important to Dig Down the Details. Align IT Systems & Support to Evolve Work Requirements. Supply chain visibility is **the ability to Track different goods and / or Products in Transit**, in the Inventory or in the Process - giving a **clear view of the Inventory, Production Scheduling, Material Movement, Customer Services**, and**Proactive Status Updates.**

Ø **Stay up to date on Current Events and Adapt your contingency plan accordingly.**

Ø **Establish Timely Communication** with key Customers, Suppliers and other Stakeholders.

Ø **Conduct a Supply Chain Vulnerability Audit - Audit Suppliers & Service Providers based on their disaster plans.**

Ø **Institutionalize Good Practices - Governance and Regular Reviews.**

Ø **Built a Risk-Aware &ResilienceCulture -**Culture Binds an organization, blending its DNA, Legacy, Mission, Processes & Leadership- acts as a key lever during crisis enabling Collaboration and taking Informed Decisions Timely& Proactively**. Resilience Culture opens up people's mind to different Tactics and Strategies to tackle difficult and uncertain situations.**

Ø **BuildSupply Chain Talent** - Risk-AwarenessCulture and Ability to Face Risks &Quickly Respond to Risks,isn't built overnight. Businesses must Nurture it throughEducating Employees and Critical Suppliers, Training on ability to face disruption and how to react and find contingencies.

Ø **Prepare Succession Plans** for Key Executive Positions and Develop & Encourage **Multiskilling** to **Avoid Single Point of Failure**

New and unexpected crises in supply Chain are inevitable. The best way to create a more flexible and resilient supply chain is by developing contingency plans and managing data through automated processes. By establishing a plan of attack and relying on reliable data, companies can thrive even when their supply chain is disrupted.Organizations are working to Transform the Supply Chain Business Model to make it more Agile and Resilient by Adapting Advanced Technology and other Strategic measures to mitigate risks by **taking action to reduce an organization's exposure to potential risks and reduce the likelihood that those risks will happen again**.

Disclaimer : The views and opinions; thoughts and assumptions; analysis and conclusions expressed in this article are those of the authors and do not necessarily reflect any legal standing.

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WHEN TWO CHAINS COMBINE SUPPLY CHAIN MEETS BLOCKCHAIN

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Supply chains acrossindustries and countrieswill be reimagined, improved and disrupted by blockchain technologies. We now have safer andmore efficient ways toconnect with business partners as well as to track and exchange any type of asset. The ability to deploy blockchain technologies to create the next generation of digital supply chain networks and platforms will be a key element in business success.

Supply chains encompass the end-to-end flow of information, products and services, and money. The way these components are managed affects an organisation's competitive positioning in areas such as product cost, working capital requirements, speed-to-market, and service perception. Organisations are exploring innovative methods to streamline their supply chains to meet evolving consumer demands and optimise efficiencies. Technological advances are collapsing linear supply chains into dynamically connected and always-on digital supply networks (DSN), transforming how businesses exchange and share information and assets. Currently 90 percent of organisations feel they are not adequately prepared for the industry disruptions from these digital trends. Furthermore, many believe that 40 percent of Fortune 500 companies will not exist in a decade as a result of these disruptions. These findings suggest that business leaders are under growing pressure to innovate and reconfigur e their supply networks, maximising value and efficiencies while reducing costs in an increasingly competitive world.

four key supply chain pain points that client are experiencing across the globe:

Blockchain has been described as an information game change rduetoits unique capabilities and benefits to provide greater information transparency. Atitscore, blockchain is a distributed digital ledger that lives on the internet and records transactions and events. The technology relies on well-established crypto graphic principles and operates as are pository for information, which is recorded and shared through a peer-to-peer community. W ith in the decentralised network, all participants maintain their own copy of the ledger, referred to as a node, where they validate new entries to the chain through the use of a consensus protocol. While one of the primary uses of blockchainis record keeping, organisations should know that blockchain is much more than simply an enterprise database. While databases are suitable for recalling ad hoc queries of large volumes of structured and relational data that require complete privacy within a single organisation's parameter, blockchain is designed to record specific transactions and events that are shared across a network of parties where transparency and collaboration is required. In a supply chain, a private or permissioned blockchain may be implemented, dictating users' ability to read and write to the blockchain. The implementation of blockchain technology can remediate the afore mentioned supply chain pain points including traceability, compliance, flexibility, and stake holder management.
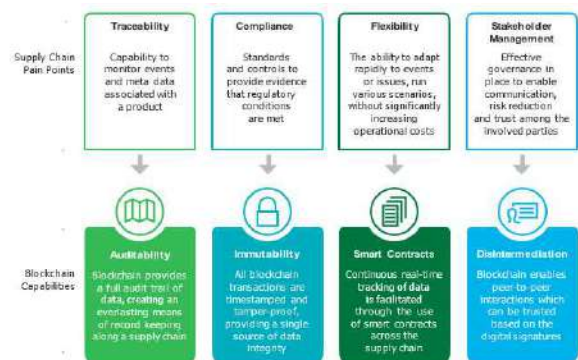
Globally, identifies blockchain as a key technology with inherent capabilities to remediate supply chain inefficiencies. A business assurance provider that certifies companies' processes, products, facilities and supply chains to national and international standards, proving the capability of this technology in a production environment. Blockchain can provide a complete chainof custody for items that are stored on the blockchain, from their origin to point of sale. Furthermore, users can trust the data on the chain due to its immutability and the use of digital signatures, which enable non-repudiation capabilities. Blockchain's tracking capabilities (including time stamping) provide a full audit trail which gives businesses increased confidence in the authenticity and quality of goods, impacting sourcing decisions. The distributed nature of the platform allows for greater oversight and control of products while real-time tracking via smart contracts

gives supply chain stakeholders the flexibility to make rapid decisions and update inventory levels on a continuous basis, there by reducing working capital inactivity. Many Organisation are working with clients in the retail and consumer products industry to develop pilot blockchain solutions for supply chain painpoints and they also developed a track and trace proof-of-concept 'Trace Chain' to enhance the transparency and visibility of the chain of custody in global supply chains.

According to the World Health Organization, it is estimated that up to $200 billion worth of counterfeit pharmaceutical products are sold globally every year and 50% of these drugs are purchased online. Counter feiting usually occurs at the manufacturing source where a contracted manufacturer or distributor either siphons legitimate drugs and resells them or enters counterfeit drugs into the supply chain as 'authentic' units. Although electronic drug pedigree solutions are being implemented to resolve traceability issues, these systems still rely on siloed data sources and exchanges of information via two-way interactions, suggesting that the market place lacks a technology solution for the problem.

In 2013, US Congress enacted the Drug Quality and Security Act (DQSA) toimprove patient safety. This Act requires pharmaceutical companies to ensure the traceability of prescription drugs throughout the entire chain by 2024. Stakeholders are under mandate to identify and report any illegitimate drugs in the network within 24 hours. Consequently, pharmaceutical companies are under increased regulatory pressure to develop innovative and effective ways to track, report, and share information with the US Food and Drug Administration (FDA) across all stages of the supply chain. Although technologies have been available for years, traceability still has nowhere near the level of granularity needed to satisfy the new regulations. To improve efficiency, a game-changer is required and blockchain could be just that.

Pharmaceutical supply chain

Today

Tomorrow
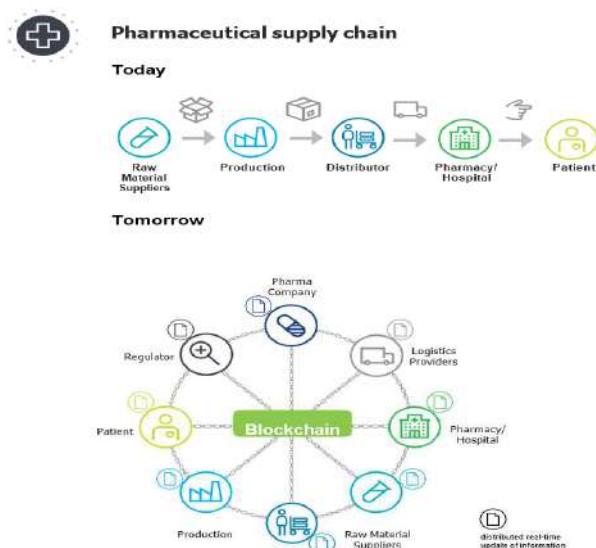
Some organization indicates that blockchain is a potential solution that "can help track how drugs move from the manufacturer to end consumer, providing stake holders with visibility and improving demand management, revenue forecasting and overall performancemanagement." Blockchain's smart contract functionality, along with the use of IoT devices, could deliver an effective, continuous drug tracking capability for pharmaceutical stake holders where the full provenance of a unit, its conditions, authority rights, and check point approvals could be accessed at any point in time, there by enhancing the complete audit trail of each item in the chain. Any deviation, such as the drug temperature, could be captured through an IoT device, whose data would be input and tracked via smart contracts on the blockchain. The smart contract rules would then execute notifications and actions to be taken by the affected stakeholders incharge of that phase of the supply chain. Smart contracts could be coded to perform specific tasks and trigger diverse responses depending on the conditions being monitored. This would provide organisations with the ability to automatically respond toevents. For example, if certain pre-defined conditions are not met, drugs could be recalled before they are released to the market. Using detection capabilities for negative conditions and recalling a drug ontime could not only reduce stakeholders' compliance risk but could also prevent the sale of dangerous products and potentially protect patients from adverse events. Enhancing the contracts with a digital signature could also provide stake holders with accurate and accountable tracking throughout a drug's lifecycle, leading to disintermediation of the chain by eliminating the need force rtification processes by a sole authoritative source. Blockchain platforms could be used to store information and enforce regulatory rules across the entire supply chain. Smart contracts used for data storage could follow a simplified structure, suchas:

AddItem—e.g.,ID, location, timestamp, current stakeholder

UpdateItem—e.g., ID,new location, new times tamp, news takeholder

LookUpItem—e.g., ID, retrieve locations, and retrieve stakeholders

IoT devices could help capture the detailed information and its flow and provide easy access to any stakeholder with credential store trieve the information. From a regulatory perspective, depending on legislative requirements, blockchain solutions couldact as a reliable source for entities such as the FDA who could retrieve a full history of product flows via the blockchain. Using the same platform, pharmaceutical companies could prove their compliance with standards. In addition, the eco system could develop its own in-chain smart contracts to trigger and notify stakeholders whenever pre-defined conditions or out of the ordinary events occurred. Product tracking is one of multiple use cases

that clearly show how blockchain can beleveraged to resolve issues of traceability, compliance and flexibility where multiple stake holders depend on one another for information sharing. Pharmaceutical companies are already investigating this game-changing technology, which promises not only regulatory compliance benefits but also end-to-end traceability.

Automotive industry

The automotive industry is in the mids to fa historic change with the rise of disruptive technologies beginning to have a profound impact on infrastructure, supply chain and business models. The influx of these new technologies is driving industry players to streamline their processes, leading to shorter productlife cycles, new business models to meet on-demand preferences, and the development of different types of vehicle and in-house vehicle services.With the emergence of more tech-oriented products and services, analysis and management of supply chains has become more difficult.

Original Equipm ent Manufacturers (OEMs) now operate in more countries than ever before and visibility has worsened across disparate systems. To proactively address consumer complaints associated with these issues, Asim Kailash Agrawal, Manager at Deloitte Malaysia KL, reports that clients inemerging markets, like South east Asia, intend to leverage market intelligence in order to" detect product quality issues at an earlier stage, recall products quickly, and track the issue back to the source." Many Organization, have noticed that several OEMs are already exploring the potential of blockchain technology.

As it pertains to the supplychain of automobiles, he states that the blockchain provides "great potential in thetracking, tracing and provenance of parts in the upstream supply chain and in truly understanding each individual 'as-built' vehicle.

"Further more, inherent capabilities of blockchain, such as immutability and transparency of vehicle records,have the potential to create an after market opportunity and a shared purchasing platform.

Purchasing platform:

Purchasing Platform refers to the transfer of value and interaction amongst alltier level suppliers and OEMs along the automotive value chain, facilitating the buying, selling, and reselling of all types of raw material and car parts.

Stakeholders using theplatform can (1) access information on raw materials, (2) buy and sell raw materials attheir disposal, and (3) be held accountable for activities and checks. This is enabled by the real-time capability, smart contracts functionality, and distributed features associated with the platform.

Automotive supply chain
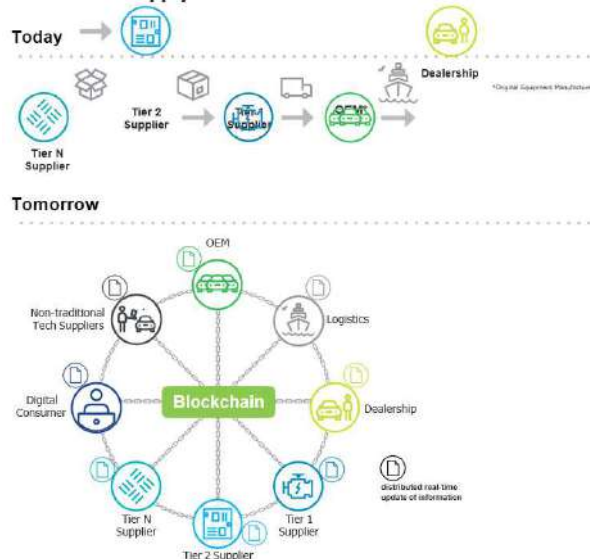
Food supply chain
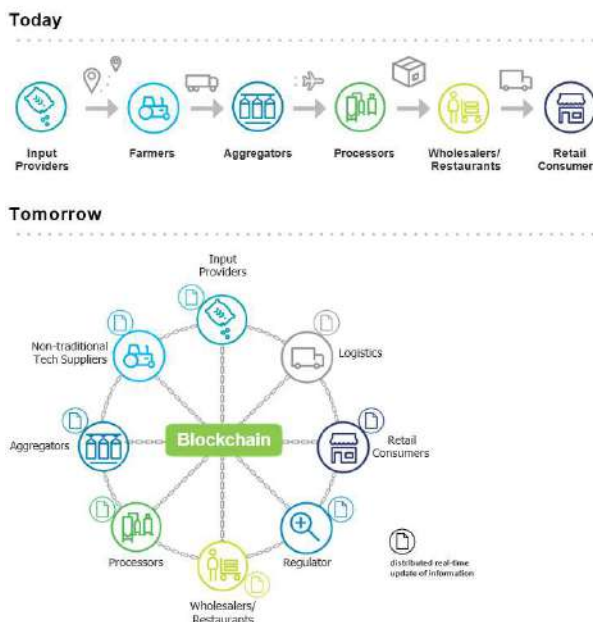
It is critical that organizations conduct acomprehensive review and assessment to ensure they can introduce controls to mitigate and manage the issues associated with blockchain implementation. Careful evaluation of risks using Blockchain Readiness Framework can set the foundations of a prosperous blockchain journey. An organization's appetite for the risks associated with blockchain may bemeasured across three primary domains: Standard Risk, Value Transfer Risk, and Smart Contract Risk. Additionally, matters such as levels of market adoption and regulatory involvement raise concerns across most nascent technologies.

Increased transparency, an in herent capability and the most notable advantage of blockchain, may cause some businesses to think twice before progressing towards implementation due to concerns about competitive advantage and security.

However, the most common concerns, detailed below, may be mitigated by effective planning.

Source visibility

- **Concern:** Competitors might be able to view supply chain sourcing details.

- **Mitigation:** The identities of parties involved in a transaction or movement of goods are hidden. Only their public keys are visible to the rest of the network. New public keys can be used for each transaction for added security.

Supply chain security

- **Concern:** Using distributed ledger technology might put supply chains at risk of a cyber-attack.

- **Mitigation:**Blockchain's underlying capabilities provided at a confidentiality, integrity and availability, but as with any other technology, organisations need to have in place robust cyber defence strategies.

Dataownership

- **Concern:** A third party might own the supply chain data.

- **Mitigation:** Suppliers would need tobe in centivised to share data and use the blockchain in conjunction with their internal local data system.

Transaction volume

- **Concern:** Competitors might be able to determine how much merchandise is moving.

- **Mitigation:** The contents of at racking record on the blockchain can been crypted.

- Implementing an emerging technology in variably causes businesses to hesitate. However, thorough evaluation of the aforementioned considerations will likely all eviate the risks associated with a blockchain implementation. Above all

- other considerations, creating a blockchain strategy today will support entities in managing and developing solutions, which can then be shared across the business, remediating existing challenges and creating operational efficiency gains.

- **How to take action**

- Launching a blockchain journey may be simplified by planning the approach in the incremental steps shown below.

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IMMUNISE INDIA: LEARNINGS FROM COVID -19: TO PREVENT ANOTHER PANDEMIC AND CURB OTHER VACCINE PREVENTABLE DISEASES

Vaccination saves lives. This is something we have come to learn all over again over the past two years. They are critical to securing life-long protection against a number of diseases and enable you and your loved ones, particularly children, to live a healthy life.The pandemic has in many ways revealed learnings and laid bare the gaps in vaccination programmes undertaken by public health institutions across the world. However, it has also shown us many ways in which we can overcome and harness the learnings and innovations developed during the pandemic that have the potential to have a massive impact on immunisation policies and implementation against vaccine preventable diseases other than COVID-19.

These revelations have been captured incisively in The Economist Intelligence Unit's white paper 'Health Systems Swimming Naked'. The title has been inspired by a quote from Warren Buffett's famous line – "Only when the tide goes out do you discover who is swimming naked." Upon reading this report, you will come to see how the pandemic and the response by countries in the coming years will show us which of them will be vulnerable to an upsurge in vaccine preventable diseases or which 'Health systems are swimming naked'.In order to discuss in greater depth the impact of the COVID-19 pandemic and understand the importance of vaccinations in curbing other non-COVID vaccine preventable diseases such as measles, meningitis, tetanus, diphtheria, pertussis (whooping cough), rotavirus and haemophilusinfluenzae type-B, GSK and Economic Times Healthworld have convened a distinguished panel of experts who are pioneers in their respective fields - Dr. Nirmal Kumar Ganguly, Dr ShahidJameel, Prof. K Srinath Reddy, Dr. Kishore Kumar and Dr. Raj Shankar Ghosh - who will offer us their insight on preventing the outbreak of vaccine preventable diseases, the immunisation programmes that keep them in check and how the public health institutions and other stakeholders such as doctors, pharmaceutical companies, private healthcare players and the general public can all play their role to Immunise India.

Key Discussion Points

- The importance of immunisation/vaccination in preventing the outbreak of vaccine preventable diseases and securing a long and healthy life, particularly for children

- The prevalence and prevention of other vaccine preventable diseases, particularly measles, meningitis, rotavirus,tetanus, diphtheria, pertussis (whooping cough) and haemophilusinfluenzae type-B

- Learnings from and the impact of COVID-19 on immunisation programmes going forward

- Pandemic-era improvements made in digital and health infrastructure and how they can be harnessed to curb other vaccine preventable diseases

- India's immunisation programmes and how they can be improved or their scope broadened to cover more vaccine preventable diseases

Source: ET Healthworld

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SAVE ON YOUR WORKING CAPITALTHRU' VENDOR MANAGED INVENTORY & CONSIGNMENT INVENTORY

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The other day, one of my students heading a successful oleo resin factory warehouse during discussions confided to me that the major task assigned to him is on finding out methods to reduce the existing inventory level by at least 25%. This prompted me to think on VMI & CI.

As we all know, the major components of precious working capital for any manufacturing unit are Trade Receivables, Inventory, Cash/ Bank Balances and Trade Payables. Inventory happens to be the major component.

Managing Inventory at optimum levels for any organization is a continuous skirmish. Demand projections and fluctuating costs, especially after the pandemic period (or can we confidently say 'after' at this juncture!) makes the task incredibly complex. However, we have experienced that strategic integrations between vendors and customers can reduce this friction to a very large extent.

Vendor Managed Inventory

Vendor Managed Inventory or VMI is a reasonably advanced form of stock management that has several potential benefits for all involved. In a VMI set up, the supplier (the organization who provides the inventory) and the customer (the organization who needs their inventory replenished) have an almost symbiotic relationship.

VMI is a process where the vendor generates orders for their customers based on demand information that they receive from the customer. The vendor and customer are bound by an agreement which determine inventory levels, fill rates and costs.

The customer benefits from this situation almost immediately when the first replenishment comes into their warehouse. They get an uninterrupted flow of stock that is constantly replaced without having to do the calculations themselves.

I have explained to my student that there are so many benefits if he is able to strike a deal with his trusted suppliers especially for his MRO items etc. Basically, it is all the indirect material and purchases used to support manufacturing i.e., tools, gloves, hammers, oil, grease, brooms, cutters, drills, etc. One of the benefits is that the vendor will be responsible for supplying the items when the items are needed by the customer. This takes away botheration of the customer to keep significant safety stock. Lower inventories will obviously lead to considerable cost savings for customer. Demand uncertainty is removed by the vendor constantly monitoring customers' inventory and demand stream which removes the possibility of customer raising number of large and unexpected orders to meet requirements.

The customer also can benefit from reduced purchasing costs. The routine of his purchasing department spending much time on calculating and generating Purchase Orders is also circumvented as the vendor is not supplying items based on POs, but merely on data collected from the customer's requirement pattern. Hence there is no need for PO corrections and reconciliations which further reduces purchasing costs and time. Cost savings also come from reduced warehouse costs as lower inventories naturally reduce the need for warehouse space and warehouse resources.

The manufacturer can gain some benefits from VMI as they can gain access to a customer's point of sale (POS) data which makes their forecasting somewhat easier. Manufacturers can also work their customer's promotional plans into forecasting models, which means enough stock will be available when their promotions or special sales are running.

VMI will help to improve inventory turnover for both supplier and customer. In the case of customer, he receives inventory Just In Time (JIT) with "ZERO" working capital. The foremost benefit for a supplier, however, is that they gain a reliable, long-term customer

who is unlikely to switch to another supplier, provided they endow with a decent service. Switching suppliers when using a VMI system is not a trivial task, and if the current arrangement is satisfying a customer's requirements, it is rare that they switch to another supplier without good reason. Vendor has the leverage to hold the right amount of inventory needed by the customer. The vendor ensures that he has predictable sales and need not clutter his inventory in customer's warehouse. Thus a mutually beneficial and supportive relationship is built up between vendor and customer. Both Supplier and customer ensures saving costs from simpler procurement/order processing.

The bottom line is that an optimized supply chain means that you are delivering to your customers what they want when they want it, and accomplishing that by spending as little money as possible. The supplier gains very little from the arrangement in the short term. They are essentially taking on a huge amount of additional work without any of the data required to make the process profitable for them. However, over time this changes, and within a few months, the supplier can start to accurately manage their own stock levels to increase their own efficiency and profit margins. Vendor's actions are based on modeling of previous sales, forecasting, and other mathematical methods that will turn out accurate after a few months.

Since the supplier is controlling the ordering process, customers need a way to minimize the risk of the supplier ordering and piling up stock that the customer doesn't require. This risk is usually alleviated through one of the two methods.

The first method is making the supplier agree to buy back any unsold stock remaining with the customer. This removes any potential overstocking risk for the customer by the supplier.

The second way of mitigating the risk of overstocking is called Consignment.

I have explained to my student regarding pros and cons of Consignment also.

Consignment Inventory

The word 'Consignment' comes from the French word 'consigner', meaning "to hand over or transmit", originally from the Latin consignare "to affix a seal", as was done with official documents just before being sent. Consignment is the act of consigning, which is placing any material in the hand of another, but retaining ownership until the goods are sold or transferred. When a trader sell goods directly to consumer, whether they are in his home country or overseas, these are ordinary sales. However, a trader may send goods to an agent to sell them for him, these goods are said to be on consignment. Consignment may be done for shipping, transfer of goods to auction, or for sale in a store (i.e., a consignment shop). In case of consignment goods are sent to the agent for the purpose of sale, the agent sells the goods on behalf of the sender, according to his instructions. The sender of goods is known as consignor and the agent is known as the consignee.

We can take an example to understand it better. Suppose Mr. Sam, a dealer of SKF consigns a set of bearings to Mr. Ram who offers to sell it for him at his store. Mr. Sam (the consignor) and Mr. Ram (the consignee) have not exchanged any money and no purchase was transacted, and hence Mr. Sam still owns the bearings. One day a customer purchases the bearings at Mr. Ram's store. Mr. Ram gives the proceeds to Mr. Sam, after deducting his commission or margin for Mr. Ram's service as the seller.

Here the most important thing to be remembered is that the relation between the two parties is that of consignor and consignee and not that of a buyer and seller. Thus a consignor who consigns goods to a consignee transfers possession but not ownership of the goods to the consignee. The consignor is entitled to receive all the expenses in connection with the consignment. The consignee is not responsible for damage of goods during transport or any other procedure. Goods are sold at the risk of the consignor. The profit or loss belongs to the consignor only. The consignor retains title to the goods. The consignee takes possession of the goods subject to a trust. If the consignee converts the goods to a use not contemplated in the consignment agreement, for example selling them and keeping the proceeds of the sale for himself, then the consignee commits the crime of misappropriation.

Thus, the concept behind consignment is reasonably simple. In a nutshell, it basically means that you don't actually own the stock in your warehouse; it still belongs to the supplier. When you use or resell the stock you purchase it from the supplier, the customer only ever pays for what they use and investment in stock is massively reduced.

Essentially what this means is that the customer is selling or using stock that doesn't technically belong to them yet, but as soon as the sale or usage takes place, it belongs to the customer.

I have given another example to my student who has now become keener to understand this concept.

Oman Oil, a lubricant supplier has provided the customer with several drums of lubricants in their warehouse on a consignment basis. Every single drum belongs to Oman Oil, the supplier, even though it is lying in the customer warehouse.

One of the customer's workers needs to use some of the lubricant for working on the gantry crane. He came to the warehouse and took the lubricant drum after completing the necessary formalities on documentation. The moment he takes the lubricant out

of the store and uses it, the material belongs to customer. Payment needs to be made on whatever payment schedule the customer and the supplier have worked out.

From the customer's point of view, consignment can be used to create a significant advantage in some situations. Imagine you know of a highly specialist and expensive resin that it would be beneficial to have in stock. But this resin is rarely required due to its specialization. With consignment inventory arrangement, you can have this resin in stock without having to pay for it unless it is needed.

Moreover, Consignment Inventory allows customers to experiment on new products or sales channels. Let's assume there is a new variety of highly effective paint primer in the market that customers may want to buy but is very expensive. Traditionally it would be risky to invest in the paint primer to have it in stock before a firm demand is established. But with consignment, customer can ask the supplier for the material and have it in the stockroom at literally zero cost or risk to customer.

These are only simple examples and only tip of the iceberg with regard to the tremendous opportunities in front of the customer. A prudent Warehouse Manager can visualize a lot more creative ways which can help them increase sales and get the edge over their competition.

The Differences between VMI and Consignment

There is a chance that some of us will get confused with the difference in VMI & CI and wonder how this can be sorted out.

In fact, VMI and CI are two entirely different principles.

VMI is a method of controlling 'how much stock' is in the stockroom of the customer. It has almost nothing to do with 'who owns the stock'.

Consignment is a method of determining 'who owns the stock' in a stockroom at any given point. It has almost nothing to do with how it is replenished.

For example, most consignment based inventories in the world are totally unrelated to VMI.

Consignment is not a new idea, especially when compared to the reasonably modern idea of VMI. A customer can stock their warehouse on a consignment basis without ever even knowing VMI exists, let alone implementing it.

Similarly, VMI systems do not have to use consignment to decide who owns what in the customer's stockroom. Many VMI systems use the "supplier buy back" method I mentioned in the VMI section instead of using consignment.

However, just because they are unrelated concepts does not mean that they cannot be used together. It is possible and often beneficial for a VMI system to use a consignment based system. But this does not mean they are the same thing.

To make it more clear, we can say that;

Vendor Managed Inventory doesn't have to use Consignment.

Consignment can be used without VMI.

But Consignment and VMI can be used together for better results.

Now the question often asked is why Consignment is said to be a good complement to VMI

One of the reasons for consignment often getting confused with VMI is because the concepts work so well together. As we have seen earlier, since customers have little control over their stock levels in a VMI system, they need some kind of guarantee that they are only going to be paying for what they need.

The method we mentioned earlier about buying back stock from customers is a reasonably fine way of dealing with things. But it has got nothing on consignment based methods and suppliers buying back stock from a customer is a hugely wasteful way of doing things in comparison.

With the buyback system, the customer needs to keep an eye on stock themselves to decide what they want the supplier to buy back from them. The customer and the supplier have to create invoices for both the initial sale and the buyback, and then money transfers need to be made. This takes the whole concept of VMI into jeopardy.

With a consignment based system, we can avoid all that wasted time and energy. The customer only ever buys what they need, and the supplier only sells what the customer wants.

Now the daunting question is whether we will recommend Vendor Managed Inventory (VMI) or Consignment Inventory (CI) for our company. Do more with less resources is the order of the day. In the case of VMI, it seems that we have to regulate the suppliers more than in the case of CI would require. CI allows having the inventory costs in the hands of the supplier so the inventory cost is lower for the customer. However, with CI, the customer still has to manage the inventory even though the customer will not pay the supplier until the item is used. VMI means the customer paying someone to come in and manage their inventory for them. Many supply chain management professionals today find themselves frequently comparing the complex pros and cons of VMI vs CI.

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INDUSTRY 4.0- THE DIGITAL TRANSFORMATION OF THE MANUFACTURING AND MARKETING TECHNIQUES

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ABSTRACT:

The fourth Industrial Revolution which is commonly referred as Industry 4.0 or even Business 4.0 is the ongoing transformation of manufacturing practices by making use of technologies that make it possible to gather and analyse data, speed up the process or production in a manufacturing unit (by automating the equipment/tools that can reduce human intervention thereby significantly reducing the chance of human error) and providing a means produce high quality goods at a significantly reduced price.

This is all done to increase the industrial value chain by making the entire process more efficient and effective. In simple Industry 4.0 is the mass scale adoption of new technologies and industrial practices across various domains. IoT, Block Chain, Artificial Intelligence (AI), Augmented Reality, Big Data are some of the niche technologies that are adopted by contemporary industries and businesses to foster growth. In this article the focus will be on providing insights to some of the industry disrupting technologies.

KEYWORDS: Block-Chain, Neural Network, Natural language Processing (NLP), Artificial Intelligence, Augmented Reality, Virtual Reality, Big Data, Hadoop, Hadoop Distributed File System, Map Reduce

INTRODUCTION:

Industry 4.0 - Technological pillars
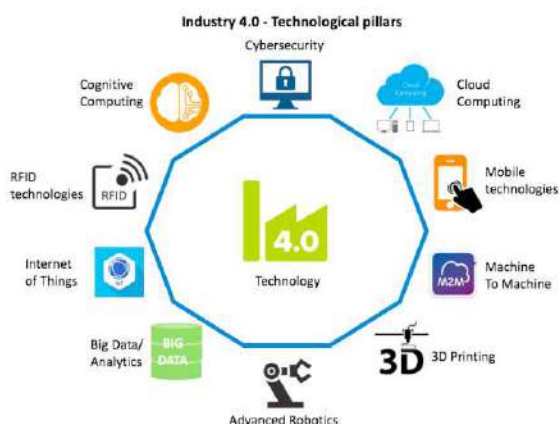
The secret to growth in this contemporary world of disruptive technologies is the willing to learn and relearn, and the fourth industrial revolution proved this. Technologies in trend today might become obsolete in the next decade. In the last decade there has been a tremendous acceleration in development of state of art sophisticated technologies like IoT, Block-Chain and so on. All these brings us in the midst of technological transformation (referred to as Industry 4.0) that is rapidly adopted by companies across the globe. Even though some dismiss Industry 4.0 as merely a marketing buzzword, tremendous shifts are happening in manufacturing and in the field of research that deserves our attention.

Figure 1: Industry 4.0 technologies

SOME NICHE TECHNOLOGIES DISRUPTING THE BUSINESS ARENA: In this section the focus will be on some listing out some of the technologies that have taken the entire world by storm.

Artificial Intelligence : Artificial Intelligence (AI) is simply the simulation of the human brain which is achieved by implementing various Neural-Network algorithms. With the help of AI smart machines are created that are capable enough of performing tasks that were once done by humans.

"**AI is a computer system able to perform tasks that ordinarily require human intelligence... Many of these artificial intelligence systems are powered by machine learning, some of them are powered by deep learning** and some of them are powered by very boring things like rules." -These were the quotes of Jeremy Achin, the CEO of Data Robot. Today the chatbots used in many of websites are powered by the NLP (Natural Language Processing) and Neural Engines which comes under AI, autonomous vehicles like the ones made by Google and Tesla are also the product of AI and surprisingly enough the digital assistants in our mobile phones like Siri or Google Assistant are also powered by AI. Now AI is in the palm of our hands and even around us when we take into consideration the smart home devices integrated with Alexa or Google Home.

Today AI is extensively used in the IT operations and this is called AIOps. AIOps is used in IT automations and for identifying errors in IT log files. AI is also utilized in R&D activities and today various AI enabled systems are deployed by militaries around the globe. In sales domain, Artificial Intelligence helps to improve sales forecasting, predict customer demands (often termed as demand forecast) and optimize the supply chain processes. This shows that AI technology has now

become an integral part of our lives and unlike old days, now it has become very affordable for both the consumers and businesses to adopt it.
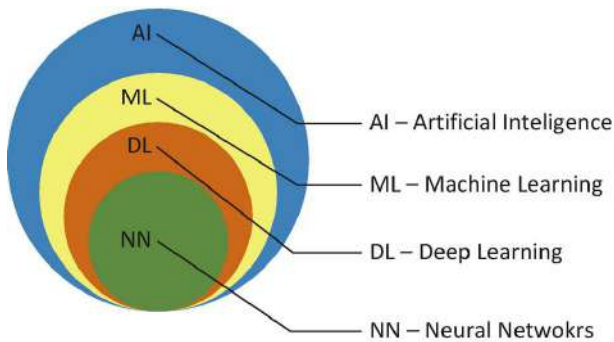

Figure 2: Graphical Visualization of AI,ML,DL and NL

Augmented Reality and Virtual Reality : Augmented Reality (AR) is a technology that overlays digital information onto the actual physical world. So to put it in simple ways it is a combination of real and digital world. This integration is achieved with the help of various external sensors, camera, sometimes GPS and 3-D scan algorithms. AR provides a means for developers and designers to enhance their view of their physical world around them. There is an obvious distinction between Virtual Reality and Augmented Reality which is often overlooked or is mistaken by the user. In Virtual Reality (VR) as its name might suggest, is a technology where user's perception of reality is completely based on the virtual or digital information that in most cases has no relation with the external world. In simple VR technology could create a fictional world and hence these days VR techs are used in gaming consoles like PlayStation VR gear. Some of the commonly used methods used to deploy Virtual Reality are: 3-D VR caves, VR holographic projectors and VR Helmets.

VR Helmets are wearable headsets that include gyroscope, accelerometer and other sophisticated sensors. This is an old idea with a new breath of life wherein the end user wears a VR helmet to get immersed in the virtual world.

3-D VR Caves are a special room sized cubes whose walls are made of non-thermal refractive materials, with more than one VR projector inserted on the rooms wall, to create a fully immersive Virtual Reality(VR) experience. This method creates an experience that is more enchanting than the one created by a single holographic projector hence this method is fast replacing the old school VR holographic projectors.

In contrast to Virtual Reality (VR), in Augmented Reality, an additional computer-generated information is given to the user that enhances the end-users experience of the real world. So, AR is not creating any fictional world as was the case with VR instead it is just overlapping some extra digital substance to the real world to enhance it.

Figure 3: VR helmet

Today Augmented reality is extensively used in businesses across the world. It offers a way to the customer to try the product before buying by creating a shopping environment for the potential customers. Even retail outlets like Walmart are using AR to train its service staff on how to work and attend its customers, something that was unheard of a few years back. Designers and architects use AR apps on their smartphones and tablets to visualize the design and scale it instead of creating costly prototypes, which greatly eases their work.

What is quite surprising is that today even an inexperienced person can troubleshoot problems in smartphones, laptops and automobiles by following step by step overlays in AR apps provided by the OEMs and manufacturers. As an example, in 2015 Hyundai became the first automobile company to launch AR guide to its customers that enables them to fix problems on their own. Such kind of AR overlays can replace the user manuals and paperwork, thereby providing the customers a better experience. The success of AR driven apps like Pokémon Go launched in 2016, just showed the world how excited the end users and consumers could get over this technology which has a tremendous potential.

Figure 4: Augmented Reality(AR) in action

Big Data : Big Data refers to huge volume of data (data that is both structured and unstructured) that cannot be stored or processed by conventional means, this is

because the computing resources(be it the memory or raw processing power)of the traditional systems will not be sufficient to perform tasks on data of this scale. In order for the data to be classified as Big Data, the data needs to be of the order of Terabytes(TB) or Petabytes. One Terabyte is numerically equal to 1024 Gigabyte(GB) and one Petabyte is equivalent to 1024 Terabyte. These numbers are absolutely jaw dropping and according to a recent survey 1.7MB of data is generated every second by every person and by the end of 2020, 44 Zettabytes will make up the entire digital space.

Figure 5: Social Media- fuelling the Big Data revolution

Now the obvious question arises what generates this huge amount of data. The answer to this is quite simple, all the social media applications (like Facebook, Twitter, LinkedIn etc.), streaming services like Netflix, Amazon Prime, IoT devices and data from other digital platforms/devices add up to create this huge amount of data in the digital space that eventually leads to creation of Big Data. The advent of faster internet, along with the rise in sheer number of users using smartphones has made storing and processing data generated by various applications, an even challenging task to accomplish. But even though this is a challenging task, companies need to process this data in a short span of time because that data/service provided is a source of revenue for these companies. This is when Big Data technologies/frameworks like Hadoop comes into picture.

Hadoop is an open source framework that allows distributed processing of huge volumes of data. Hadoop was developed by the Apache Software Foundation and was written in Java. It is designed to store and process huge volume of data efficiently. The Hadoop framework has three main components namely the HDFS(Hadoop Distributed File System), YARN and Map Reduce. HDFS stores data from the Hadoop clusters and Map Reduce computes the data present in HDFS. The YARN is used for cluster resource management. The Hadoop cluster has a master and slave node. Node is basically a technical term to describe a system or a machine. Hadoop is not the only framework for Big Data , there are other frameworks like Spark, Storm etc but Hadoop is the most widely used framework.
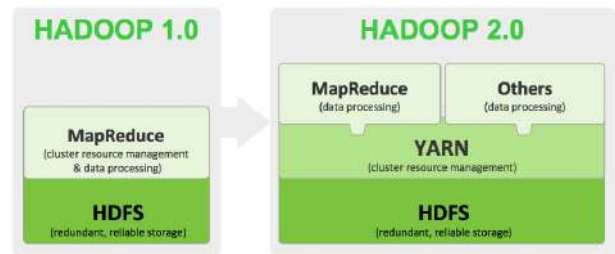
Figure 6: Hadoop Layers

The advantages of Bid Data Analytics and frameworks in business context are as follows:

1. Data regarding demand for a particular product or service can be accumulated from various market points like the official company store/website, online e-shopping sites(like Amazon,Flipkart), retailers and distributors. Once the demand and user perception regarding a product/service is known, the entire supply chain could be optimised to speed up the delivery of that particular product/ service.

2. Big Data analytics helps in real time forecasting which is very critical for the company or the enterprise to stay ahead of the competition. This helps in faster competitive pricing(like the one that happens commonly during the holiday season) which in tern helps to boost sales and sometimes helps maintaining customer loyalty.

3. Big Data analytics helps in reducing the risks by optimising dynamic decision making for an unforeseen and an unexpected future threat.

4. Big Data helps in processing business transactions in an efficient and transparent way which is of great benefit for the company.

Big Data is becoming more relevant today than ever before as the market is getting more and more competitive every passing day. Hence startups and big companies alike have leveraging the advantage of Big Data techniques to compete, evolve and capture the market space.

Conclusion :

Industry 4.0 is the result of technological growth, innovations and R&D in various fields of the industry over a few decades and today IoT, Big Data, Cloud Computing, AI and other niche technologies are pushing it forward. Today the platform is set for industries to leverage the advantages offered by bleeding edge technologies which come under Industry 4.0 to stay alive and relevant in this competitive marketspace. Implementation of Industry 4.0 by corporate houses is a win-win situation for both them and the end consumers.

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GREEN SUPPLY CHAIN MANAGEMENT – GSCM

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As the year 2020, started we knew nothing or expected anything like what we have seen in the past several decades. COVID 19, which has created a huge storm in the everyone's life and in every sphere of business, where people lost their lives, medical facilities were and are still being tested (while I write this) financial markets, consumerism & mental health are all being put under severe pressure by internal & external acts.

Isn't it time for the organizations to have to realize that to most effectively manage the environmental burdens caused by industry and commerce, they need to look beyond just their most immediate operations and processes. Organizations need to consider their supply chain both upstream and downstream.

What are the external forces evolving for a greener environment?

Commerce and industry have gone through substantial changes over the past few decades. In the hearts of these evolutionary and revolutionary changes are political, social, technological, market, and economic forces that have caused organizations to seriously consider their impact on the natural environment.

Several forces have culminated in a much larger audience and stronger interest in greening and, broadly, sustainability.

If I need to rank the drivers then, here is the below –

1.   Science on environmental damages caused by industry has improved. In this situation, ignoring factual ûndings and consensus within science is hard to ignore. Climate change science, pesticides and endocrine disruptors, ozone-depleting gases, and a number of other environmental problems can be traced to practices, processes, and products from the industry.

2.   Communication is far swift & widespread than ever before. Companies can communicate with their shareholders, employees, and competitors. Consumers and communities and other stakeholders who are inûuenced by industrial and corporate activities can get their information faster. The advent of the Internet and minute-to-minute news and reporting have all contributed to this pervasive and incessant communication. Sharing this information has become easier than ever. Organizations seeking to limit their image and reputation risks pay close attention to this ubiquitous communication related to environmental concerns.

3.   Change which is a constant has become faster. New technologies and cultural changes have always occurred. But now, concerns that were once viewed, from an environmental perspective, as due to occur decades from now are starting to appear.

Record volatility in weather conditions, warming at historically increased and higher than ever levels, and the melting of the polar cap are all concerns that were expected to occur in the long-term future.

Industrially, globalization has become very common in commerce and industry; thus changes in one area can easily permeate the world. This includes environmental regulatory practices.

4.   Costs are higher and the impact is greater than in times past. As world population and affluence increase, further, development means the additional anthropocentric value is at stake. Environmentally related crises and catastrophes can mean a heightened impact due to the greater number of people affected and the greater developed property values lost.

The sea- coast regions of the world have the most valuable properties. These regions are very susceptible to weather changes, sea-level change, and contamination due to vulnerable watersheds. If environmental damage is caused by an industrial environmental accident, the integrated and concentrated populations of a region can be greatly affected. Sources of livelihood could be disrupted.

In developing countries, where the growth has been at historic levels—never before has this type of economic growth occurred globally— and where regulations and industrial hygienic and environmental practices have been lax, polluted lands and rivers can cause large parts of cities to shut down.

Finally, stakeholders have a louder voice. Communities, non-governmental organizations (NGOs), and other non-ûduciary stakeholders can instantaneously broadcast their messages to the world. Given that communication and knowledge transfer has become easier and more accessible than ever before in the history of man, the same systems can prove valuable for those previously with limited voice. The major conduit of this information and messaging consists of various social media outlets. In many places in the world, news of corporate and supply chain environmental issues, accidents, disasters, and various incidents can be broadcast broadly through YouTube, Twitter, Facebook, and even LinkedIn. Blogs have also become part of the social media landscape where various stories can be written and delivered by individuals. Stakeholder websites have also become avenues for sharing reports and stories broadly.

These and a number of other forces are causing organizations to pay greater attention to greening and environmental issues, more so now than in the past when regulatory issues were the major drivers.

Environmental Concerns

The major reason for the greening of corporate supply chains is to address environmental burdens caused by industry and its operations. The environmental burdens can occur in different media such as air, water, or land and at various levels, such as global, regional, and local levels.

Global issues affect regions throughout the world. The most pervasive environmental concern centers around global warming and climate change. Increasing global temperatures have been tied to anthropogenic activities. Likewise, species decimation is considered a global problem since various species can affect local or global ecosystems. Also, the global impact on plant biodiversity can also affect the potential to ûnd medicines and cures.

Regional problems impact regional areas. For example, acid rain is a major issue in many developing countries due to increased manufacturing. Regional issues relate to the acidiûcation of lakes and waterways, which may impact many water species and communities that depend on those water supplies.

Local problems are those that may impact municipal areas instead of whole regions. For example, pesticides and herbicides may affect local waterways and agricultural regions. Herbicides may cause less diversity and more sensitivity among the plants in a region due to a decrease in biodiversity. Pesticides with endocrine disruptors can impact human health and fertility in local areas.

Industry and its supply chains have been major contributors to these sources of anthropogenic environmental burdens. But industry and supply chains are needed to supply the demands of our increasing populations. The balance of economics with the environmental and social inûuences of organizations and their supply chains is a challenge for both organizations and governments.

Green Supply Chain Management from linear Supply Chains to Closing the Loop via Circular Economies.

The traditional supply chain management description by several academics and professors implies a linear relationship with ûows up and down the supply chain.

As environmental issues and sustainability become more integrated, the supply chain will need to become more circular and nonlinear, where loops may not necessarily return to the beginning of a supply chain but can occur anywhere within the supply chain.

The return aspect has been recognized as an important dimension within the SCOR model, although extending the life of the product and greening aspects were not the major goals in the introduction of the return activities. These major activities were initially concerned with warranty and service returns.

To "close the loop" of the supply chain, major elements of reverse supply chains and reverse logistics need to be integrated into the standard linear deûnition of the supply chain. The activities may also relate to various greening concepts, such as recycling, remanufacturing, reclamation, reuse, and reduction, which are listed in the ûgure in the order of least to greatest environmental burden.

The forward supply chain begins with product and process design. Procurement focuses on the upstream supply chain.

Both raw material (non-recycled material) and virgin material (material that appears in its most fundamental form) are acquired for production purposes.

Production may contain fabrication and/or assembly operations and activities. Finally, come distribution activities to the customers for consumption. These are the traditional linear activities of the supply chain.

The return activities, managed by reverse logistics functions, then ûow back into various stages of the forward supply chain. Reuse, remanufacture, and recycle activities may occur at different stages.

Typically, the later the stage at which the ûow of returned products and materials occurs back to the forward supply chain, the less energy that is expended, the fewer operations that occur, and the less environmental burden that results.

Other elements of this model include energy usage, waste generation, and reduction of materials and waste throughout the supply chain activities. This ûow may be for one or multiple organizations.

Corporate Environmental Management

Understanding some of the major greening activities of green supply chains requires understanding some of the major internal corporate environmental practices that have evolved over the past couple of decades.

Traditional corporate environmental management activities would include ûling environmental reports, acquiring environmental information that is required by law, and complying with environmental regulations. These activities are typically reactive activities inasmuch as they are required by law.

But, in order to not only meet regulatory policy but possibly to gain competitive advantage, a number of practices, tools, and technologies have been utilized by organizations. Four major corporate environmental elements include environmental management systems (such as ISO 14000 systems), life cycle analysis (LCA), and eco-design (also known as design for the environment).

1. Environmental Management Systems (ISO 14001)

Environmental management systems (EMS) can be deûned in many ways. EMSs can range from relatively informal systems managed operationally by a standalone single computer to more involved programs, such as the best known EMS standards, the ISO 14001 certiûed EMS. The ISO 14000 series of standards

includes elements of organization evaluation and product/process evaluation. These standards include descriptions of EMS, environmental performance evaluation, and environmental auditing. Product and process standards help to deûne LCA, environmental labeling, and environmental factors in product standards. The only standard that may be registered or certiûed is the ISO 14001 (environmental management system) standard. The remaining elements are only guidelines available to organizations.

The substantive requirements of ISO 14001 document and include Environmental Policy, Planning, Implementation and Operation, Checking and Corrective Action, and Management Review. The ISO 14001 EMS requirements embody the PDCA (plan-do-check-act) cycle of continuous improvement. In the PDCA cycle, an organization plans a change aimed at improvement (plan), implements the change (do), evaluates the results (check), and ûnally institutionalizes the change (act). The comprehensiveness of these systems incorporates many traditional corporate environmental activities and more proactive, competitively Oriented activities, including LCA and eco-design, which we brieûy introduce.

2. Life Cycle Analysis

Life cycle analysis (LCA) is a systemic process used to evaluate the environmental burdens associated with a product or process. It identiûes energy and materials used and the wastes or emissions released to the environment LCA is also meant to evaluate and implement opportunities to effect environmental improvements. A life cycle of a product, service, or utility may include evaluation and analysis from the inception or the design of a product until its end-of-life disposal or disassembly and beyond, such as its reassembly. LCA involves calculating and analyzing the burdens associated with the production, use, and reuse of utilities, goods, and services over their life cycle. This includes processes such as cultivation, extraction, manufacture, delivery, use, recycling, and maintenance. The closed-loop nature of materials and products has made such an analysis more complex and may incorporate product stewardship activities.

An LCA could include three separate but interrelated components: an inventory analysis, and impact analysis, and improvement analysis. Life cycle inventory analysis quantiûes energy and raw materials requirements, air emissions, waterborne efûuents, solid waste, and other environmental releases incurred throughout the life cycle of a product, process, or activity. The goal is to examine all the inputs and outputs in a product's life cycle, beginning with a product's composition, where those materials came from, where they go, and the inputs and outputs related to those component materials during their lifetime. It is also necessary to include the inputs and outputs during the product's use. In practice, much of LCA focuses on this level of analysis.

Life cycle impact assessment is an evaluative process of assessing the effects of the environmental ûndings identiûed in the inventory component for all inputs and outputs throughout the activities of an organization or supply chain. The impact assessment normally addresses ecological and human health impacts but has expanded to include social, cultural, and economic impacts. The impacts from a process from the production and use of a product in order to benchmark impacts from competing products or processes could be compared to help manufacturers or consumers choose among options.

Life cycle improvement analysis (LCIA) is a continuous improvement process. LCIA conducts an improvement analysis to determine how the product, service, or utility inûuences the environment. For example, the conservation of energy or water in the manufacturing process will reduce the environmental impacts of that process. Substituting a less hazardous chemical for a more toxic one would also reduce the impact. The change is then made in the inventory analysis to recalculate its total environmental impact.

3. Design for the Environment and Eco-Design

The term 'design for the environment (DFE)' or 'eco-design' refers to the environmental design of a product and/or a process. It focuses on reducing (preventing) the environmental effects of a product before it is produced, distributed, and used. Eco-design examines the disassembly of products at the end of life and reveals the associated cost beneûts and environmental impact of revision, reuse, and recycling. Eco-design and LCA typically go together with the required appropriate information and database systems. Along with the usual design factors, DFE recognizes that environmental impacts must be considered during the new product and process design and redesign. It is deûned as the systemic consideration of design performance with respect to environmental, health, and other objectives over the full product life cycle. DFE is a design process in which a product's environmentally preferable attributes—recyclability, disassembly,

Maintainability, refurbish ability, and reusability—are treated as design objectives rather than design constraints.

DFE is the ultimate pollution prevention tool. It is at the design phase of any product where a majority of the product's characteristics are ûxed, and 80 percent of the environmental impacts may be determined at this stage. The DFE process usually entails ûve major steps: assess environmental impacts; research the market; run an ideas workshop (brainstorm), or ideas generation; select design strategies; design the product. The tools for DFE are quite varied and range from simple scoring approaches to techniques that include detailed databases and a broader continuous evaluation of the product and process as data is generated and gathered.

Other corporate environmental management activities that may inûuence organizational and inter-organizational planning include product stewardship, ecological and carbon footprinting, eco-labels, total quality environmental management, lean principles, and the so-called RE's—Recycling, Remanufacturing, Reuse, Reclamation & Reduction.

To be continued….

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TRANSFORMATION OF SUPPLY CHAINS THROUGH DIGITIZATION

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Abstract : This paper analyses the various facets of digital supply chain transformations and its benefits as reported in the McKinsey's report on digital supply chains and also PwC reportson Industry 4.0 - how digitization makes the supply chain efficient, agile and customer-focused.

Digital transformation ways and its impact on supply chain and creating or defining market place were discussed. The McKinsey digital supply chain compass maps supply chain 4.0 improvement levers and main value drivers were highlighted. Future digital supply chain transformations and its benefits were also discussed.

Keywords: digital disruptions, electronic innovations, digital transformations, supply chain 4.0,

Introduction : The companies that are truly aiming in recent times have something significantly in common: a digitized supply chain. 89% of companies with digital supply chains receive perfect orders from international customers, and entering on time delivery / error free delivery.

Companies have saved labour time for its logistics team after digitizing its vendor booking process. Digitization brings about future supply chains (supply chain 4.0), which will be faster, more flexible, more granular, more accurate, more efficient and agile in nature (McKinsey, 2019).

Supply chain professionals expect digitization to bring significant economic benefits to both top and bottom lines. Companies with highly digitized supply chains and operations can expect efficiency gains of 4.2% annually, while increasing revenue by 2.9% a year. Companies across industries are already investing heavily to develop their own versions of the digital supply chains. According to a recent PwC study on the rise of Industry 4.0, a third of the more than 2000 respondents say their companies have started to digitize their supply chains and fully 72% expect to have done so five years from now. Lot of supply disruptions are going to take place in the coming years.

Redefining the supply chain : There are five main ways in which electronic innovation / digital transformations impacting the supply chain and creating or redefining market place.

Main ways	Details
Dematerialization	Reduction, removal, and redeployment of substantial assets invested in traditional sales and marketing.
Disintermediation	Compression in the length of the supply chain through the elimination of middle men in the sales process.
Deverticalization	Creation of extended enterprises, linked manufacturers and inter-linked groups operating within new electronic markets.
Data integration	Real time access, capture and transfer of data between trading partners.
Development of products	Which support, sustain and new extend electronic commerce

Source: Jon Hughes, Mark Ralf & Bill Michels, 2002.

Digital supply chains : Digital supply chain means that it is an integrated planning and execution, logistics visibility, procurement 4.0, smart warehousing, efficient spare parts management, autonomous and B2C logistics and prescriptive supply chain analytics.

The McKinsey Digital Supply Chain Compass maps Supply Chain 4.0 improvement levers to 6 main value drivers

SOURCE: McKinsey

Figure 1 The McKinsey digital supply chain compass

supply chain 4.0 improvement levers to 6 main value drivers.

Digital transformation includes digital development and digital disruptions. Digital supply chains are working on 'pull based inventory' principle. Digital transformation improves speed, flexibility, operational efficiency and customer experience (Sengottuvelu, 2019).

Digitization brings about future supply chains (supply chain 4.0), which will be faster, more flexible, more granular, more accurate, more efficient and agile in nature (McKinsey, 2019).

According to McKinsey study, planning, physical flow, performance management, order management, collaboration and supply chain strategy are 6 main value drivers in the supply chains.

Today's supply chains are a series of discrete steps involved, product development, sourcing & procurement, manufacturing, marketing, distribution, logistics and customer care. Digitization will change that, bringing down walls and creating a completely integrated ecosystem that is fully transparent to all the entities involved. The ecosystem will depend on several key digital technologies including 3D printing, robots, analytics & other logistical platforms (Stefan Schruf, 2017).

Future digital supply chain transformations

According to Jag Srai (2017), the future digital supply chain transformations (DSCTs) are going to take place in the following areas:

Digital supply chain transformations	Salient features and benefits
i. Automated e-Sourcing	Digitization can give enhanced visibility through seamlessly connected, automated replenishment in line with real-time KPI monitoring and predictive disruptive analytics.
ii. Digital factory design	3D, FMS, & EDI will deliver a new paradigm for factory layout design, process and material flow. Organization will need to analyse if, it is cost effective and whether it will create and capture the most value.
iii. Real-time factory scheduling	Sensor- enabled smart devices, real-time data KPI monitoring & predictive maintenance could lead to increased productivity and improved delivery service.
iv. Flexible factory automation	While automation can deliver cost for variety, increased customization, labour saving, quality assurance, closer to market and improved health and safety it also needs to support necessary economics and enable flexible configuration.
v. Digital production process	Additive manufacturing, & continuous processing with advanced process analytics will enable new product designs and enhanced customization, it can also disrupt entire supply chains.
vi. E-Commerce fulfilment	Web-based order management and inventory management to multiple POS, covering last-mile delivery and direct delivery, constant monitoring of usage and experience and tailoring to suit to the requirements.
vii. Extended supply chain (near) real-time monitoring	This could help companies to optimize integration, predict disruptions and support dynamic decision-making.
viii. Digital product quality	Companies can create powerful digital product quality management systems by connecting back from customers to suppliers. This could result in problem prevention and faster resolution, better performance, compliance verification and avoided warranties.
ix. Digital supply chain design	Digital network design modelling and visualization tools can be used to redesign the total supply network configuration.
x. Product life cycle management (PLM)	Next-gen PLM systems will provide accurate, up to-date product information accessible throughout the value chain and product life cycle.
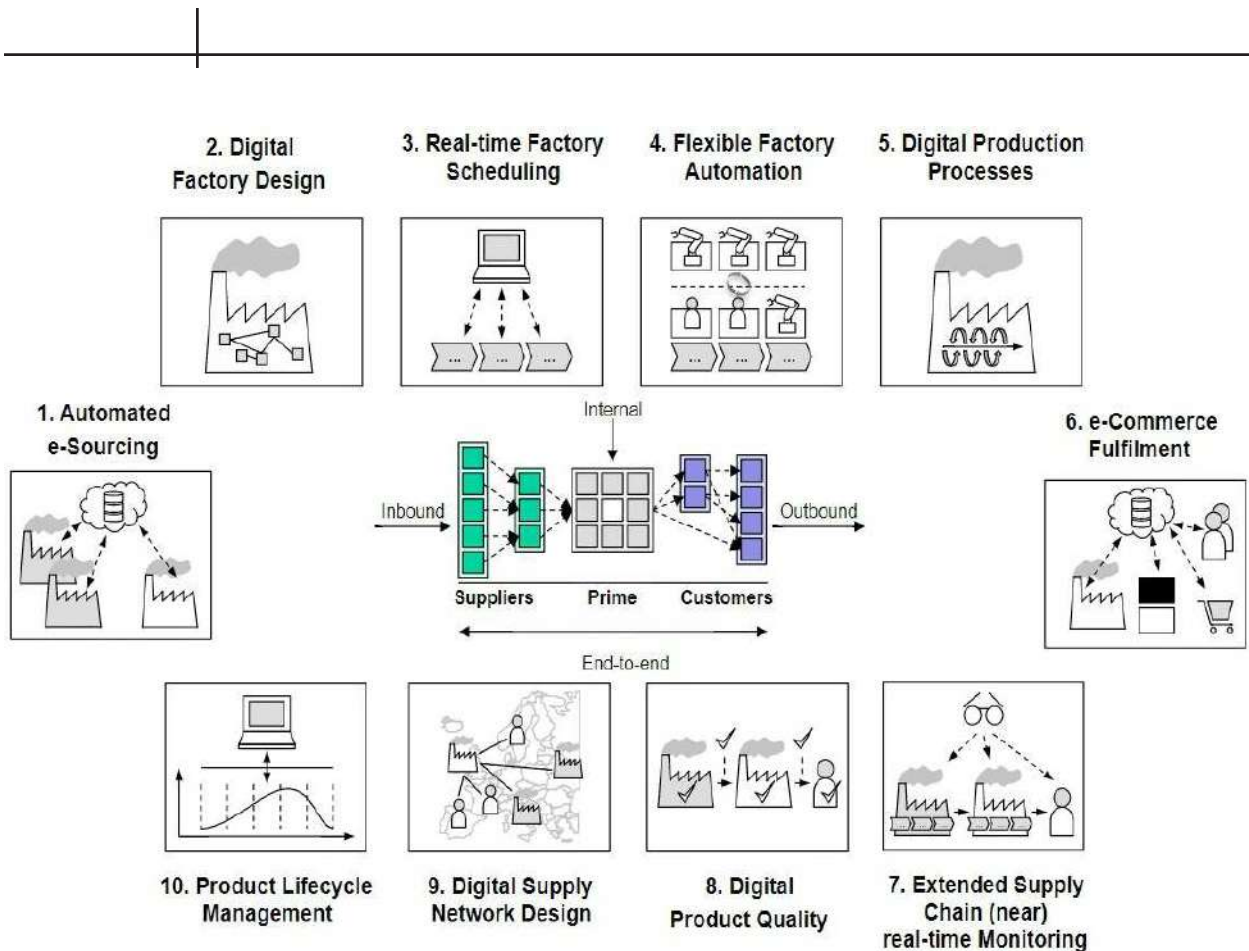
Figure 2 Future digital supply chain transformations

Figure 2 shows the future digital supply chain transformations and its salient features with benefits. For examples, when companies are having issues related to scheduling, then DSCT- 3, will take care of such issues. Similarly, quality related issues are addressed through DSCT-8, product life cycle management through DSCT-10, so on and so forth.

Conclusion : In recent years companies are more focusing on their supply chain digitization. This is going to continue for next 5-10 years. According to the reports of McKinsey and PwC, Industry 4.0 technologies are going disrupt the supply chains further. IoT, AI, ML 3D, Sensor based –smart devices and automation are going to bring new challenges and opportunities to the corporates. Linear supply models operating in silos are going to adopt integrated supply chains. Supply chain strategies are going to focus on lean and agile philosophies in business. Supply chain professions in general are going to focus more value added links in their supply and eliminate non-value added activities / functions. In other words, how value is added in their supply chains to offer to their customers.

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PHARMACEUTICAL SUPPLY CHAIN VULNERABILITIES: ROLE OF INFORMATION TECHNOLOGY

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Introduction : A supply chain is a set of processes, people, infrastructure, operating policies and agreements among different entities, whose objective is to transform the raw materials into finished goods and deliver to end customers, profitably. Modern supply chains are typically global and dynamic network arrangement of business entities that process the demand information upstream and coordinate product delivery downstream. Increased specialization and the drive towards efficiencies have resulted in burgeoning number of independent players across all supply chains necessitating the increasing need for integration across both strategic and operating levels. Additionally, pharmaceutical supply chains are vulnerable to a set of specific external forces acting on them. Goal of supply chain integration is to ensure smooth flow of product and information on one hand and plug the vulnerabilities on the other hand. Information Technology is the oil with which this integration machinery works. This paper examines the pharmaceutical supply chain vulnerabilities and role of Information Technology in enabling a better integration in light of these vulnerabilities.

Pharmaceutical Supply Chains : Pharmaceutical supply chains consist of the following entities:

1. **Product Development Organizations :** These are either specialized independent research organizations or in-house R&D departments of large pharmaceutical companies, whose focus is to develop new drugs for different therapeutic applications. New drug development process is long, arduous, costly, highly regulated and is ridden with uncertainties. A new drug development begins with evaluation of thousands of potential molecules to zero-in on one. It is not uncommon for this process to take 8 to 10 years before a successful launch and burn a couple of billions of dollars in the course.

2. **Active Pharmaceutical Ingredient (API) Manufacturers :** API (also known as bulk drug) is the main raw material used for making final drugs (also called formulations). API is essentially molecule that is produced using a series of chemical and physical processes. API manufacturing is a capital intensive, batch processing and quality sensitive task. Good Manufacturing Practices (GMP) and regulations govern the quality standards to be followed in API manufacturing. A typical batch processing cycle-time can run into days and a WIP of 30 to 60 days is common. Most of API manufacturers are situated in India and China. Often, API manufacturers also outsource part of the production processes to Intermediates and may also have downstream formulation plants.

3. **Secondary / Finished Dosage / Formulation Manufacturers :** Formulation manufacturers (also known as secondary or finished dosage manufacturers) are involved in producing the ready-to-consume form drugs in tablets, capsules, injection vials etc. from APIs and other pharmaceutically inert binding material. These are the global majors of the pharmaceutical industry. Formulation plants are typically smaller in size, closer to markets and produce smaller batch sizes in comparison to API manufacturers. Formulations consist of drugs within (branded) and outside (generic) patent expiry date. While Formulations manufacturers typically focus on branded drugs, API manufacturers contend to move up the value chain by developing the generic formulations for drugs approaching patent expiry. Formulation manufacturing may be outsourced or handled in-house. Similar quality norms prevail in Formulations manufacturing processes as in API manufacturing.

4. **Transportation, Warehousing and Distribution :** The distribution of Finished Dosages to the patients happens through a multitude of channels such as company's own warehouses, wholesalers, 3rd party distributors, large pharmacy retailers, Group Purchase Organizations, direct-to-customers (typically large healthcare providers or NGO organizations), government operated public healthcare organizations etc., to name a few.Global transportation of bulk drugs is typically through a combination of ocean and over the road networks. Formulationsare transported using air and over the road carriers. Transportation and warehousing of different drugs requires controlled temperature (ambient: 20~250C, refrigerated: 2~80C, frozen: sub-zero) conditions and specialized end-to-end cold chain infrastructure. Dispensation of drugs to patients happens through the end-points of the above mentioned distribution nodes either on prescription or over the counter depending on the type of drug.

Pharmaceutical Supply Chain Vulnerabilities : In comparison to the traditional consumer durables or FMCG supply chains, pharmaceutical supply chains are quite complex. Following vulnerabilitiescontribute to this complexity:

1. **Temperature excursions : Any temperature excursions of the drug in the** lengthy supply chain may render the entire batch useless at best and

out-right dangerous at worst. There are pockets of supply chains such as transportation, transshipment and loading & unloading which are highly vulnerable for excursions.Management of interfaces between different supply chain partners with a focus on such excursions is crucial for the overall supply chain success.

2. **Rigid Production Processes :** Usage of conventional batch processing is no longer suitable for the current dynamic environment. Make-to-order and continuous production are the order of the day as (a) there is a proliferation of specific drugs for specific conditions and (b) nobody in the supply chain wants to keep excess inventory of potentially non-moving drugs. Advanced Manufacturing Technologies that support continuous production are now already available. It is a moot question as to how many of the pharmaceutical supply chains are ready to radically overhaul their production processes.

3. **Multitude of stakeholders :** Pharmaceutical supply chains are constantly subject to nudges and forces from a variety of stakeholders such as public-at-large, regulatory bodies, insurance companies, Group Purchase Organizations, NGOs, medical device manufacturers, healthcare providers, camps promoting alternate medicines / treatment methods etc., to name a few. Given the sensitivity of outcomes in terms of the physical well-being of patients, it is imperative that the pharmaceutical supply chains cannot afford to ignore the voice of any of these stakeholders.

4. **Expansion of the coverage :** Measures by national governments to increase the insurance coverage for poorer sections, increased life expectancy, decreased infant mortality, emergence of life-style related diseases in affluent countries, out-break of epidemics in developing countries etc., are putting immense pressure on pharmaceutical supply chains to come up with custom supply chain designs that are suitable for individual market segments.

5. **Increasing accountability :** The complete traceability of a drug's batch is a key requirement for pharmaceutical supply chains, in order to assign accountability to the correct entity. Even the unknown or unforeseeable side-effectsmissed during drug development and approval can result in huge implications for a pharmaceutical supply chain.

6. **Sustainability :** Reverse logistics to collect and safely dispose the expired drugs, adhering to mandatory affluent treatment, hazardous material disposal by the API and formulations manufacturers are the key sustainability requirements of pharmaceutical supply chains.

7. **Radical Innovations :** New developments in Biologics, Nucleic acids, cell therapy, regenerative medicine, implantables and bioelectronics have the potential to totally alter the way new drugs are developed and administered to patients.This may mean a complete overhaul of current pharmaceutical supply chains to remain relevant in the new reality.

8. **Counterfeits :** The menace of Counterfeit drugs is rampant across the globe. It is important for the pharmaceutical supply chains to sensitize pharma retailers and customers on the perils of these counterfeit drugs and also put sufficient security measures in their supply chains to detect and prevent infiltration of the counterfeits.

Information Technology &Supply Chain Integration : Integration of supply chains involves shared strategic objectives, transparency and timeliness of information sharing, creation of joint planning, feedback & performance review mechanisms, institutionalizing flexibility of operations and undertaking continuous improvements projects together by different supply chain partners. Integration can be achieved in different degrees depending on the length and trust in the relationship. Lowest level of integration is at the operational planning and execution and the highest level is when the supply chain partners share the strategic objectives and align their commercial relationship to suit these objectives. Information Technology is a foundation on which supply chain integration can be realized among the supply chain partners. The following section briefly describes about a few existing and emergent technologies and how pharmaceutical supply chains can leverage these technologies to achieve integration.

Supply Chain Management Electronic Data Interchange (EDI) : Real-time information on plans, reports, transactions and alerts can be exchanged between the enterprise systems of partners via supply chain electronic data interchange (EDI). Information documents such as purchase orders, shipment notices, invoices etc., are pre-coded and standardized in EDI framework. Implementation of EDI is known to reduce the business cycle times and improve data quality.

To1 illustrate the point, a specialty pharmaceutical company offering consumer healthcare & prescription products has been able to achieve same day dispatches to its trading partners such as McKesson, Cardinal Health, Walmart, Target and CVS. ProcessOne has helped this company automate the order fulfillment process data transmission through P1 EDI implementation. Purchase orders (at customers) trigger Sales Order generation (at the company HO), which in turn raise Advance Shipment Notice (at the Company Warehouse) followed by Invoice generation (at the company HO). These documents are electronically transmitted to the relevant trading partner with no manual intervention. This was a huge improvement compared to 2 or 3 day delay in dispatches, manual errors and high cost of fulfillment process.

Cloud Computing: Cloud based SCM solutions promise rapid scalability, immediate deployment and access from anywhere. Pharmaceutical supply chain partners, especially the ones without existing in-house enterprise systems could consider this solution to be digitally visible and integrate with the rest of the supply chain.

A few use cases for cloud in pharma industry identified by IDC2 and Ponemon Institute are: locating and managing subject patients in a certain area for clinical trials, access to product identifier database for pharma shipments by various heterogeneous stakeholders simultaneously and search virtual chemical libraries to identify potential molecules for future developments.

Industry 4.0 : Industry 4.0 collectively refers to a cyber-physical setup in which all the connected systems communicate with each other and manage decentralized and localized planning and execution. Key building blocks of Industry 4.0 are Advanced Robotics, Additive Manufacturing, Augmented Reality, Simulation, Horizontal & Vertical Integration, Industrial Internet and Cybersecurity. Pharmaceutical supply chains can use Industry 4.0 in production and logistics planning and controlling. Automated batch level tracking and control within the plant and pallet level tracking and control during transit is possible by using suitable sensors. Simulations can be used to optimize the production across the supply chain without having to incur costly set-ups.

According to a report by Frost and Sullivan, ApotexPharmachem3, a Canadian pharmaceutical manufacturer has implemented IIoT concepts such as autonomous vehicles, RFID tracking and smart sterilization that helped the company achieve real-time view of the plant operations, improve efficiency and productivity and thereby increase its capacity.

Block Chain : A block chain is defined as an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. Thus the transactions recorded in block chains are immutable and the updates are traceable. By having the sensors record details such as chemical composition, temperature, package open status etc., into a block chain directly, everybody in the supply chain is aware of the prior transactions that have occurred on their shipments.

Merck4 has developed a PoC (Proof of Concept) Blockchain application in partnership with SAP to ensure authenticity of the returned drugs. This mobile application keeps track of the item number, a serial number, a batch number, and an expiration date every time the shipment changes hands in addition to geographically tracing the shipment, making it virtually impossible for the counterfeit drug to enter the supply chain.

Big Data& Analytics : Big Data refers to those IT applications that can collect, preprocess and generate learning / insights from this data. Typically sources of big data are social media platforms, company & other related websites and a hoard of sensors deployed across the supply chain. Analytics is of three kinds, namely descriptive, predictive and prescriptive. Pharmaceutical supply chains can find immense value in developing Big Data & Analytics capabilities in areas such as drug development (shortlisting molecules), impact of different local events on drug demand, quickly respond to reported drug side-effects etc.,

Merck5 had analyzed its production data of 255 batches over last 10 years that was spread over 16 databases pertaining to one vaccine, performed over 15 billion calculations using Big Data concepts with a help of an analytics firm, Hortonworks to identify variable levels (from among hundreds of variables) of batches with highest yields. Using the insights, the company had significantly improved the yields and reduced the cost of production of this vaccine and later by applying same principles, other vaccines as well.

Conclusion : In conclusion, we summarize the efficacy of various Information Technology options in achieving integration and in addressing vulnerabilities of pharmaceutical supply chains as follows, with a caveat that IT is just a tool and it is the managers that must make it work:

Vulnerability / IT Solutions	EDI	Cloud	Industry 4.0	Block Chain	Big Data & Analytics
Temperature excursions			Y	Y	
Rigid Production Processes			Y6		
Multitude of stakeholders	Y	Y		Y	Y
Expansion of the coverage	Y	Y	Y		Y
Increasing accountability	Y	Y	Y	Y	
Sustainability			Y7		Y
Radical Innovations				Y8	Y
Counterfeits				Y9	

The above analysis indicates that whilst for some vulnerabilities (viz., Multitude of stakeholders, Expansion of coverage etc.,) a combination of IT solutions are relevant for best results whereas for the vulnerability, Radical Innovations the existing IT solutions are inadequate in their current state.

(Footnotes)
1http://www.processonesolutions.com/news/2017/6/15/lup16dk9ly735bse7z1irwvgffvt1w
2https://www.healthcareitnews.com/news/top-pharma-use-cases-cloud
3https://ww2.frost.com/frost-perspectives/towards-pharma-40digitization-pharma-manufacturing/
4https://hackernoon.com/top-5-use-cases-of-blockchain-in-pharma-and-healthcare-that-you-should-know-about-77ccdd76369b
5https://hortonworks.com/solutions/pharmaceuticals/
6Advanced Manufacturing Methods are considered part of Industry 4.0 portfolio
7 Effluents emission can be simulated using Industry 4.0 and Analytics suite and appropriate managerial decisions be taken
8Once the company has built Radical Innovation capability, Block Chain, Big Data & Analytics can be useful in integration
9Counterfeits infiltrating into the legitimate pharmaceutical supply chains can be detected and blocked using block chains

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HOW MOBILE TECHNOLOGY IS HELPING LOGISTICS AND SUPPLY CHAIN SECTOR TO EVOLVE?

Over the past few years, the transport and logistics industry has adopted mobile technology to improve their processes and operations. This sector is no different from others because now, it is greatly under the influence of digital technologies. From the time digital technology is introduced in the logistics and supply chain industry, the sector has evolved dramatically. By keeping the growing competition, complexities, and ever-changing consumer demands in mind, several user-friendly mobile applications are developed by IT experts and are used by many top companies that are offering transportation services in India.

Logistics companies have already realized that by using mobile technology, their business can achieve greater visibility in their supply chain performance. They are trying to identify different opportunities to gain efficiencies and cut down costs. Logistics and transport agencies work in an environment that calls for improved and more efficient management of the supply chain. Workers in these firms are required to work from onsite as well as off-site locations. So, these companies prefer to use smartphones with some important features such as barcode and label printers, built-in cameras, scanners, GPS, Near Field Communications (NFC), Voice Recognition Software, shared logistics networks RFID tags, etc.

Why transportation service companies should invest in mobile app development for the supply chain?

Mobile app development for the supply chain ensures an integrated mobile fleet solution to have live tracking of goods. It will enable the mobile team to get adequate assistance from IoT to get the right information in multiple transitory touch points.

One of the major benefits of using mobile technology in the supply chain is that it helps in optimizing inventory management system that enables the faster movement of goods and reaches customers'

doors timely. Doorstep delivery mobile applications suggest the best routes for faster movement of goods and also help in locating customers using GPS coordinates. In overall, making it easier for the mobile fleet operator in finding the precise location and deliver the goods on time.

Many logistics companies are realizing the benefits of implementing mobile apps in their supply chain, but still, there are some agencies providing transportation services in India, have a dilemma whether to invest in mobile app development or not. Such companies can compensate for the cost of mobile app development for supply chain management by getting advantage from improved supply chain visibility, mitigating errors, shrinking down the lead time, and optimizing transportation networks resulting in improved inventory management.

The real-time data is fed or updated continuously to the dynamic optimization engines that have the core of supply chain management. Therefore, mobile apps not only suggest optimal routes but also it provides some real-time insights to vehicles and driver performance to the shipper. Furthermore, it aids in measuring the productivity and efficiency of each network involved in the complete supply chain. With mobile technology, logistics companies can create an entirely new standard for vehicle communications, by adding new levels of ease and sophistication. This offers an environment for companies to offer transportation services in India that is going beyond the four walls of the warehouse to deliver.

Mobile technology has changed the dynamics of the logistics and transport sector. Read below to understand how friendly and intuitive mobile apps have helped this sector to evolve. You can also check **top trends rule supply chain management in 2020** if you want to deeply understand the role of mobile technology in the supply chain industry –

Helping in managing valuable human resources!

Workforce plays a crucial role in a company with little to no room for negligence and mismanagement, especially at some crucial touch points. For this, organizations emphasize on right training, communication, and modifying organizational structure as and when needed. Mobile technology allows companies to effectively integrate different human resources in numerous departments to deliver secured information that runs throughout the organization. However, the cost goes a little high to take care of these resources, but it also reduces worker fatigue and hence improving their overall productivity in working hours.

Shipment tracking systems!

Earlier, customers used to get an estimated delivery date on booking their shipment and then were left in the dark with no updated information, unless they decided to make a phone call for further inquiry. Today, mobile technology allows the shipper to provide real-time location regarding the shipment to customers and keep them updated about the progress. Customers can also access shipping and tracking features 24/7. Not only this improves the user experience, but also saves time and money for the company as well.

Eliminating data redundancy!

When there were no mobile apps for **logistics and supply chain,** the data redundancy rate was higher as manual entries created a hard time for heads of the respective departments. The data discrepancies due to human error made the whole supply chain system devoid of reliability to an extent that only back-office systems were to be relied on. With mobile app development and its implementation in the logistics sector, the data entered reflects immediately. This reduces the chances of human errors and boosts the entire process with utmost data reliability.

Quick and flexible delivery process!

Using mobile solutions, companies involved in supply chain management and **transportation service** can change delivery schedules as well as routes on the go which means amazing flexibility to the organization. Improving the control of their supply chain operations increases customer retention and provides opportunities for new levels of an alliance between logistics providers and customers. With mobile app solutions, logistics companies can improve their supply chains with real-time data which enables drivers to inform any delay. Companies can improve their dispatch operations, record keeping, inventory management, tracking goods, inspections and more with real-time data. As a result, they can enhance their supply chain operations.

Time-saving and reduce costs!

Logistics mobile apps allow you to optimize routes for each driver reducing fuel expenses. These apps can simplify major functions to improve driver efficiency. Weather update and traffic congestion alerts on the driver's phone can help him to take the best route to reach the destination on-time. This way it helps the organization to operate more efficiently at the same time reducing operational costs.

Easy and timely dispatch of work orders!

Companies implementing mobile technology in their business can speed up processes and work orders. Using inventory software, they can optimize dispatches and routes. They can also manage rides, minimize miles driven and increase revenue. Logistics is not only about moving and delivery of the goods, but it is also about effective warehouses management. The software allows you to store all the inventories received at the warehouse and dispatched to the final destination. These apps will make it easier to store goods and locate the inventory easily because all the information will be in a database.

The transportation and logistics industry spend money hugely on auto parts, vehicle insurance, fuel, maintenance, and more. Investing in advanced mobile technology is the key to improve the operation, workflow and productivity of the transportation company and garner other amazing benefits. To empower your business in the transportation industry and take it to next level, implementing mobile technology will be the suitable choice.

Source: TruckGuru

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ARTIFICIAL INTELLIGENCE (AI)
IN SUPPLY CHAIN

SARAH HUNT

Applying **artificial intelligence (AI)** is one way supply chain professionals are solving key issues and improving global operations.

AI-enhanced tools are being used throughout supply chains to increase efficiency, reduce the impact of a worldwide worker shortage, and discover better, safer ways to move goods from one point to another.

AI applications can be found throughout supply chains, from the manufacturing floor to front-door delivery. Shipping companies are using **Internet of Things (IoT)** devices to gather and analyze data about goods in shipment and track the mechanical health and constant location of expensive vehicles and related transportation tools.

Customer-facing retailers are using AI to gain a better understanding of their key demographics to make better predictions about future behavior. The list goes on — anywhere there are goods that need to make it from point A to point B, there's a good chance AI is being used to enhance, refine, and analyze supply chain operations.

Some of the benefits derived from AI in supply chains are less tangible than others. For example, determining the impact of predictive analytics based on supply chain data can eventually yield benefits, but some companies are reporting a direct link between revenue shifts and the addition of AI in supply chains. Recent research conducted by **McKinsey & Company** found that 61% of executives who have introduced AI into their supply chains report decreased costs, and more than 50% report increased revenues. More than a third of study respondents reported revenue increases of more than five percent.

An IBM article, "AI is reshaping the supply chain," featuring **Aera Technology** senior engagement director Arnaud Morvan, identifies four advantages to applying AI to modern supply chain challenges:

- End-to-end visibility enhanced with near real-time data

- Actionable analytic insights based on pattern identification, at scale, far exceeding the abilities of conventional supply chain systems

- Reduced manual human work

- Informed decision making augmented by **machine learning (ML)**, AI-driven predictions and recommendations based on analyzing multiple potential scenarios

Here, we examine some of the ways AI is used in supply chains:

See more: Artificial Intelligence Market

5 Examples Of AI In Supply Chains

1. Demand Forecasting Is Improving Warehouse Supply And Demand Management

Machine learning is being used to identify patterns and influential factors in supply chain data with algorithms and "constraint-based modeling," a mathematical approach where the outcome of each decision is constrained by a minimum and maximum range of limits. This data-rich modeling empowers warehouse managers to make much more educated decisions about inventory stocking.

This type of big data predictive analysis is transforming the way warehouse managers handle inventory by providing deep levels of insight impossible to unravel with manual, human-driven processes and endless, self-improving forecasting loops.

C3 AI uses AI to power its Inventory Optimization platform, which gives warehouse managers data on inventory levels in real-time, including information about parts, components, and finished goods. As the machine learning ages, the platform produces stocking recommendations based on data from production orders, purchase orders, and supplier deliveries.

2. AI Is Optimizing Routing Efficiency And Delivery Logistics

In a world where just about anything can be ordered online and delivered within data, companies that don't have a firm handle on delivery logistics are at risk of falling behind. Customers today expect quick, accurate shipping, and they're all too happy to turn somewhere else when a company is unable to deliver on that expectation. McKinsey & Company **reports** that around 40% of customers who tried grocery delivery for the first time during the COVID-19 pandemic intend to keep using these services indefinitely. Customers in major markets like New York and Chicago have dozens of choices.

Delivery logistics is a detail-oriented, challenging field.

This Economist **article** unpacks some of this complexity, pointing to the "devilishly complex" task of delivering 25 packages by van — the number of possible routes for a single van adds up to around 15 septillion.

AI-driven route optimization platforms and GPS tools powered by AI like **ORION**, a company used by logistics leader UPS, create the most efficient routes from all the possibilities, a task untenable with conventional approaches, which have been inadequate for fully analyzing the myriad route possibilities.

See more: Artificial Intelligence: Current and Future Trends

3. Machine Learning AI Is Improving The Health And Longevity Of Transportation Vehicles

IoT device data and other information taken from in-transit supply chain vehicles can provide invaluable insights about the health and longevity of the expensive equipment required to keep goods moving through supply chains. Machine learning makes maintenance recommendations and failure predictions based on past and real-time data. This allows companies to take vehicles out of the chain before performance issues create a cascading backlog of delays.

Chicago-based **Uptake** uses AI and machine learning to analyze data to predict mechanical failures for a wide range of transportation vehicles and cargo containers, including trucks, cars, railcars, combines, and planes. The company uses data from IoT devices, GPS information, and data pulled directly from vehicle performance records to arrive at its predictions, which can greatly reduce downtime.

4. AI Insights Are Adding Efficiency And Profitability To Loading Processes

Supply chain management includes a great deal of detail-oriented analysis, including how goods are loaded and unloaded from shipping containers. Both art and science are needed to determine the fastest, most efficient ways to get goods on and off trucks, ships, and planes.

Companies like **Zebra Technologies** use a combination of hardware, software, and data analytics to deliver real-time visibility into loading processes. These insights can be used to optimize space inside trailers, reducing the amount of "air" being shipped. Zebra can also help companies design quicker, less risky, more efficient processing protocols to manage parcels.

5. Supply Chain Managers Are Uncovering Cost-Saving And Revenue-Increasing Methods With AI

Moving goods around the world is expensive, and only becoming more expensive. Bloomberg **reports** that the cost of moving goods by ship, for example, increased by 12% in 2020, the highest level in five years, according to the **Drewry World Container Index**.

Companies like **Echo Global Logistics** use AI to negotiate better shipping and procurement rates, manage carrier contracts, and pinpoint where changes in supply chains could deliver better profits. Users access a centralized database that takes virtually every aspect of supply chains into account to deliver financial decision-making advice.

AI in supply chain innovations are paving the way for a future where we can eventually expect to see AI-powered, autonomous vehicles used throughout supply chains. The data these platforms are mining and analyzing today will continue improving the cost and efficiency of an increasingly complicated global supply chain

Source: datamation.com

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COMMODITY INDEX

Commodities	Days's Index	Prev. Index	Week Ago	Month Ago
Index	3448.5	3436.3	3452.8	3506.4
Bullion	7426.8	7344.3	7665.8	7500.8
Cement	2497.5	2497.5	2497.5	2497.5
Chemicals	3242.8	3242.8	2837.5	2407.3
Edible Oil	3103.8	3108.4	3111.8	3128.5
Foodgrains	2628.9	2628.9	2537.7	2545.8
Fuel	3582.9	3582.9	3582.9	3893.6
Indl Metals	1920.0	1920.0	1919.9	1920.0
Other Agricom	2336.9	2355.7	2391.0	2457.4
Plastics	3105.4	3105.4	3170.1	3324.8

Source: ETIG Database dated 26th November 2021

PHARMA INDUSTRY EXPLORES HOW BLOCKHAIN AND STANDARDS CAN IMPROVE SUPPLY CHAIN SAFETY

KRAIG ADAMS, GS1 US

Blockchain may well be a highly effective technology for the pharmaceutical supply chain, promising potential for faster delivery of safe medications and meeting government requirements at the same time.

There is plenty of buzz around the potential for blockchain technology to transform and secure supply chains for increased, immutable chain of custody and tracking of products as they move through distribution channels. While the exploration of blockchain has so far been largely focused on the food industry, the pharmaceutical industry also sees tremendous value in blockchain's ability to securely exchange serialized data from manufacturers all the way to pharmacies.

This vision has been investigated recently in a number of pilot programs conducted by leading pharmaceutical manufacturers, wholesale distributors and dispensers in collaboration with the U.S. Food and Drug Administration (FDA). FDA's Drug Supply Chain Security Act (DSCSA) Pilot Project Program is intended to assist drug supply chain stakeholders, including the FDA, in developing an electronic, interoperable system that will identify and trace certain prescription drugs as they are distributed within the United States. It also supports an even larger vision set forth in the 2013 act, which focuses on improving supply chain visibility and transparency in the pharmaceutical supply chain. Meeting the requirements of the DSCSA and product authentication/anticounterfeit measures are the most prevalent use cases in the pharmaceutical industry using distributed ledger technology.

How blockchain helps industry meet regulatory requirements

Six of the 20 FDA-sponsored DSCSA pilots completed early this year were focused on determining the usefulness of blockchain for boosting supply chain visibility and product ownership traceability, as well as identifying a path forward for this potential game-changing technology. All six pilots incorporated GS1 Standards as an essential foundation for improved data sharing, since the standards provide a common language that can be understood by all supply-chain partners.

The DSCSA expressly requires pharmaceutical products to be serialized and labeled with specific standardized data to support an interoperable, electronic system for identifying and tracing them throughout U.S. distribution. Packages must be marked with a two-dimensional barcode containing unique product identifiers and other regulated data elements applied in a standardized way to facilitate accurate product tracking across the healthcare supply chain. This will also associate the physical product markings with the serialized electronic data exchange that will be required, per DSCSA, on or before Nov. 27, 2023.

The DSCSA blockchain pilots also centered on verifying saleable returns — meaning if a product is returned, the manufacturer and wholesale distributor work together using standards-based systems to verify the product identifiers and the transactional data before it goes back into the supply chain./

Blockchain records are permanent

This is where blockchain's immutability comes in. In general, a distributed ledger's value centers on its capability for validating product authenticity by enabling permanent and unalterable documentation of a product's legitimacy and chain of custody. Counterfeit products are a problem for any industry, but in pharmaceuticals, they can lead to unthinkable consequences — literally risking lives. Confirming the absolute authenticity of a pharmaceutical product is a top priority for the industry, the FDA and healthcare in general.

Combined with the same GS1 Standards already being implemented to support DSCSA requirements, blockchain technology may unlock the key to critical, effective traceability through better data sharing — integrating the internal data and processes a company/uses/to track products into a larger ecosystem of external data exchange that takes place between trading partners./

Data standards fortify blockchain benefits

A GS1 data-sharing standard called Electronic Product Code Information Services (EPCIS) makes blockchain more effective, as it can help partners transmit key information on a transactional level — the what, where, when and why behind product movement through a supply chain. This standard is being used by the pharmaceutical industry in preparing for DSCSA interoperability required by 2023.The ability to accurately track pharmaceutical products as they travel throughout the supply chain assures authenticity and prevents acceptance of altered or counterfeit products, helping safeguard patients from dire consequences.GS1 US

EPCIS documents "what" is being distributed (the product) with the Global Trade Item Number (GTIN) encoded in the barcode as the required, unique product identifier. Dates of transaction events (when) are recorded to EPCIS using a standardized format dictated by the DSCSA as "MM-DD-YYYY," helping eliminate errors in interpreting expiration dates. EPCIS further records "where" the product has been by leveraging Global Location Numbers (GLNs) of manufacturing facilities, distribution centers and dispensaries, so that the location history can be recorded on a blockchain with specificity. These transaction records are particularly useful during a product recall or withdrawal, as end-to-end traceability requires full knowledge of all the locations where affected or unsafe products have passed through.

Finally, EPCIS provides information on business process steps that occur, such as commissioning, packing and shipping. It documents the state of the item (e.g., saleable, expired, in transit, etc.) and may even be used to capture sensor data such as temperature, which is key for cold chain applications in certain industries, including healthcare.

Immutable data records protect patients

The ability to accurately track pharmaceutical products as they travel throughout the supply chain assures authenticity and prevents acceptance of altered or counterfeit products, helping safeguard patients from dire consequences.

One FDA DSCSA pilot led by MediLedger demonstrated that a neutral platform using blockchain technology can help the industry mitigate those risks and be used to support an interoperable system for the pharmaceutical supply chain, as mandated by DSCSA. The MediLedger Project represented a broad group of industry stakeholders, including manufacturers, national and regional wholesale distributors, pharmacies, logistics providers and GS1 US.

The MediLedger Project further reported that data privacy can be assured by implementing "zero-knowledge proof" technology, where all transactions posted to the blockchainsolution are fully concealed, so that no confidential information is shared. The need for patient privacy is paramount, making such capability essential in any data-sharing protocol for pharmaceutical products.

Blockchain's main benefits are its neutrality and the permanence of its data recording. That's why its success depends upon trading partners' diligent approach to data generation and stewardship. Incorrect data cannot be erased from a blockchain. Healthcare industry engagement will be needed for broad adoption of data standards, implementation and exchange. Since DSCSA mandates the establishment of these practices, these requirements will be met anyway, setting the stage for successful integration with blockchain.

Conclusion

Blockchain may well be a highly effective technology for the pharmaceutical supply chain, promising potential for faster delivery of safe medications and meeting government requirements at the same time. As with all interoperability improvements, it will depend upon the establishment of highly reliable, accurate data systems that incorporate industry standards. It all begins with data quality.

Source: sdcexec.com

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THE CRUCIAL ROLE OF TECHNOLOGY IN INCREASING LOGISTICS EFFICIENCY

VIVEK JUNEJA, FOUNDER AND MANAGING DIRECTOR, VARUNA GROUP

Prior to March 2020, like most other industries, the logistics industry, too, was undergoing a gradual yet permanent transformation in terms of technological adoption. However, since the onset of the Covid-19 pandemic, the logistics industry found itself at the forefront of disruption with heavy restrictions on the movement of goods and people. The pandemic not only tested supply chain resilience and efficiency to the hilt but also paved the way for accelerated technological adoption across the sector.

With numerous networks and players in the logistics industry, digitization and incorporation of technologies make the sector more advanced, connected, and lucrative. Between risk mitigation, cost optimization, and increased customer satisfaction, automation has become the cornerstone for heightened efficiency in the logistics sector. Here is how technology plays a pivotal role in enhancing the logistics sector's operational efficiency.

Complete visibility of the consignment : Visibility in the logistics domain relates to being aware of what is happening to your consignment from the beginning to the end. While this seems deceivingly simple, achieving complete visibility of the consignment while following a traditional, manual business approach is an arduous, time-consuming process. Companies are often caught off-guard due to poor visibility. Now, although it can be a complex process, visibility is vital to business success, and to reap the full benefits of consignment, automation is key.

In the transportation and distribution division, new-age technologies not only help with total visibility but also identify the productivity of the vehicles in transit through GPS installation. Complete visibility of consignment automatically allows both the logistics service provider and companies to keep a track of their consignments and make alternate arrangements or rectify the problem when issues arise in-transit.

Milestone-based tracking : Real-time tracking of shipments has indisputably been a game-changer in the logistics industry. Today, by deploying technologies such as AI, ML, IoT, and Data Analytics; Logistics Service Providers through dedicated customer portals, help companies get access to milestone-based tracking, thereby enabling them to view the details of the shipment from one hub to another along with the exact date of delivery. Milestone-based tracking enables firm control and a more in-depth collaboration throughout the supply chain.

Route optimization : In a nutshell, route optimization is the process of discerning the most cost-effective route for a vehicle carrying a shipment. However, it is slightly more complex than finding the shortest point between the pickup and delivery points. Leading-edge technologies have significantly reduced the transit time of the shipments through route management systems. The advanced algorithm efficiently calculates the shortest and most cost-effective route depending on the two locations. Route optimization not only saves cost but also time and manpower in the long run.

Paper-less offices and virtual payments : A no-brainer, the advent of technology and widespread digitization have given way to paperless offices, especially in creating applications for key documents such as lorry receipts (LR) and proof of delivery (POD).

Automating these processes has not only resulted in increased efficiency but it will also bring the logistics industry a step closer to facilitating contactless logistics.

Apart from this, the mass adoption of digital payment solutions such as debit/credit cards, UPI-based payments, net banking, etc., have been game-changers. Particularly in the logistics industry, the introduction of virtual fuel cards has been a big step in providing the much needed visibility and transparency in financial transactions that were predominantly done by way of cash earlier. The elimination of cash-based transactions has enabled an efficient process as the e-toll system automatically calculates the charges according to the vehicle's assigned route.

Geofencing and System integration : A location-based service, Geofencing entails marking a certain area or creating a virtual boundary – a geofence. With this, the logistics company gets milestone-based notifications when there is a movement within the geofence. Numerous touchpoints including the company's office, driver homes, client warehouses, etc. are part of this marked area. They typically receive notifications when a vehicle moves from their facilities towards the client, when it reaches within 5 km of the destination, and when the vehicle finally leaves the warehouse. Simply put, Geofencing helps a company track the exact movement of the vehicle.

Furthermore, with system integration, various software's, like the one at the warehouse, the client's office, or within the vehicles can remain connected to the same database and exchange real-time information. Thus, relevant data becomes available across platforms without the need for employees to re-key information in different databases. This ultimately allows information to be shared among all stakeholders involved while boosting efficiency by reducing the chances of human error.

Minimum-Maximum quantity with Threshold limit : Technology has bridged several glaring gaps that previously existed in the logistics industry, one of the major ones being supply and demand mismatch. IoT-based systems share notifications for out-of-stock items to both the downstream and upstream sides of the supply chain process. This leads to an optimization in product availability making sure it's present 24×7, throughout the year to the end customer, making it a seamless and convenient process.

Evidently, technology now plays a key role at every stage of the supply chain process. Advanced methods like connected warehouses, geofencing, route optimization, and digital payments are cohesively leading to improved performance. On the back of such strides in technology, supply chains are becoming more efficient with high levels of accuracy due to reduced human intervention. While human effort is decreasing rapidly, critical activities are being mapped in real-time with glitches being identified almost instantaneously. From transportation to shipment to tracking and delivery, supply chains will continue to transform with the evolution of technology. Needless to say, the future of logistics is now. How well companies embrace these advancements will be the key touchstone for customers while choosing their service providers going forward.

Source: Times of India

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IIMM Materials Management Review

THE FOUR TECHNOLOGIES SHAPING NEXT-GEN SUPPLY CHAINS

Danny Shields, Vice President of industry relations at Avetta, a provider of cloud-based supply chain risk management technology and SCB Contributor

"Uncertainty is the only certainty there is," mathematician John Allen Paulos once wrote. The procurement and supply chain management industries are no exception, but next-generation technology provides trends worth watching.

With time, the supply chain has shifted from the back-office function it once was to a strategic driver of business growth. Contemporary business models, technological advancements and innovative processes have made supply chains efficient and agile.

Supply chains will become more complex and internationally dispersed. Procurement leaders need to build on newer capabilities to help them navigate the changing business landscape and adapt quickly.

At this rate, what will supply chains look like in the year 2030? Big data, cloud computing, artificial intelligence (AI), robotic process automation (RPA) and the internet of things (IoT) will help procurement leaders, contractors and supply chain managers meet future demand.

While big data in logistics is still in its infancy, it's the foundation on which AI, cloud computing and RPA become more accurate and effective in simplifying tasks and relegating them to automated systems. Big data expands the dataset for analysis beyond the traditional internal data in supply chain management systems and software. It also applies statistical processes to new and existing data sources. Now, most companies lack the tools and knowledge to explore and utilize big data in their supply chains. In the future, these tools will be more accessible.

Cloud Computing and AI

Supply chains generate big data, and cloud-based AI turns that data into insights. Cloud computing coupled with AI has transformed how supply chains operate, and its abilities will only increase in complexity over the next 10 years. Through predictive analytics, cloud and AI systems can use past trends and market indicators to facilitate the following processes:

· powering process automation

· informing supplier selection

· improving customer support

· streamlining supplier onboarding and automating supplier management

· providing real-time information on shipments

· analyzing carrier performance

· anticipating trends in operational issues

Progressive companies already utilize supply chain knowledge management systems to respond to supply chain difficulties in real-time. With a cloud-based, mobile-enabled solution, supervisors input information from the worksite, immediately notifying operators.

Companies can build transparent supplier relationships by automating the information exchange between an organization and its suppliers and contractors. Organizations can easily manage their vendors down to each individual worker across geographically dispersed worksites. Workers can complete site-specific orientation and training online before they set foot on site. Operators can track the completion status of the training curriculum and assess knowledge retention through online evaluations.

Analytics can help companies monitor supplier/vendor capabilities and track data on a supplier's compliance or performance. Traditionally, different departments compiled this information through paper records. Decision-makers had to sift through piles of papers or electronic files to find this information. Today, advanced analytics allows operators to define supplier attributes to categorize them into logical profile sections. Detailed supplier profiles make it easier for operators to quickly retrieve, process and validate supplier information in a matter of seconds.

Once a new supplier is onboarded, collecting, verifying and storing supplier data will ensure responsible supplier risk management. A high-end analytics engine can analyze this data to generate supplier performance insights in real-time. Such insights empower sourcing professionals to easily monitor the supplier and vendor pool, their credentials such as certificates of insurance (COIs) and their compliance status.

Delivering tangible cost savings has always been a critical task for procurement and will continue to be a high priority in the next decade. Considering this, procurement leaders will have to look for newer ways

to achieve cost efficiency. One way is through supplier analysis. Critical supplier information is often trapped in varying data management systems. Consolidating that data into one common repository helps operators get better visibility into spending across the entire value chain. A centralized data framework, complemented by an analytics engine, for example, can help decision-makers identify expensive or low-performing suppliers. A new central data management system can be seamlessly integrated with the legacy system through application programming interfaces (APIs).

Robotic Process Automation

Robots are expected to see "strong growth over the next five years, particularly within supply chain operations that include lower-value, potentially dangerous or high-risk tasks," according to Deloitte. With the massive growth in e-commerce, this should not surprise anyone in the logistics world. Robotic technology applications include automated vehicles like drones, trucks and trains, last-mile deliveries and storage and retrieval systems (ASRS).

The increased usage of autonomous robots can achieve the following objectives:

· increase efficiency and productivity

· reduce re-work and risk rates

· improve employee safety

· perform mundane tasks so humans can work more strategic efforts

· increase revenue by improving order fulfillment and delivery speed, leaving customers satisfied

New pricing structures will enable companies to invest in automation, making the leap into robotics much more feasible. Using a RaaS-type model (Robotics as a Service), providers lease units through a monthly service contract instead of customers paying an up-front capital expenditure.

Internet of Things

An emerging trend for supply chain managers is asset tracking through IoT to save time and money and enable data-driven decision-making.

The IoT is made up of interconnected physical devices that can monitor, collect and send data to cloud-based software for analysis via Wi-Fi. IoT devices have improved quality management in supply chains through GPS tracking of shipments and monitoring parcel conditions. RFID chips, smart devices and mobile sensors can track and authenticate products, measure temperature, humidity, light levels, movement, handling, speed and other environmental factors of shipments.

The growing pace of technological innovation propels digital supply chain management solutions. Thankfully, embarking on the technical journey will become more accessible and cost-effective as more technologies emerge. Organizations that rapidly adopt these emerging solutions while incrementally replacing legacy systems will better navigate this decade with greater insight and efficiency.

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Source: supplychainbrain,com

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INDIA'S FUTURE AND ROLE IN
THE POST-COVID-19 WORLD

BORGE BRENDE
PRESIDENT, WORLD ECONOMIC FORUM

- We are gradually moving into a post-COVID dispensation.

- There is a trend towards a more multipolar world and the power centre of the global economy is shifting to Asia.

- In this new era, India will prioritize economic expansion and sustainability for sustained growth and influence on the world stage.

Almost two years after the World Health Organization declared COVID-19 a pandemic, the world is coming to terms with the disruptions caused by the virus. The most profound and consequential impact has been the pandemic's toll on healthcare systems. And then there has been the more persistent and reverberating economic toll.

Government action to counter infections and contain the spread of the virus led to global supply shocks, especially in manufacturing, and lockdowns and other containment measures caused widespread business disruption. It is now clear that the pandemic has brought the world to the second great economic and financial crisis of the 21st century and is likely to have long-term structural repercussions. What's more, it has laid bare the fragilities of the global economic and geopolitical order.

The churn in the international order, however, had begun even before the pandemic; power equations had already started to change because of geopolitical shifts. There was an indisputable trend towards a more multipolar world and the power centre of the global economy began to shift to Asia.

The current world order has been substantially altered and this is bound to give rise to a new post-COVID dispensation. In this state of flux, space has been created for aspiring and emerging powers to take centre stage and help shape a new world with a better future for all.

Indeed, rays of recovery are beginning to emerge in our economies. The International Monetary Fund (IMF) projects that the global economy will grow by 6% in 2021, and forecasts 9.5% growth in the Indian economy. At the same time, the world is seeing exponential growth in digital services and infrastructure, from the adoption of large-scale work-from-home arrangements to the use of cloud services and videoconferencing.

Many tech leaders have noted that the advancements in digital transformation that were achieved within a couple of months would have normally taken two to three years. These are hopeful signs, but there is still much work to be done.

India's future on the world stage

Despite the economic devastation caused by the virus, India's agile response has been commendable, especially as the country rallied to manage a deadly second wave of the virus early in 2021. India was the first country to feel the impact of the virulent Delta variant but quickly swung into action to ensure that as many people as possible were vaccinated. One billion doses of the vaccine have already been administered.

In addition to protecting its own population, India has also acted in the world's best interest by providing medical supplies and equipment to more than 150 countries across the globe and placing a critical supply of the COVID-19 vaccine on the world market. Indeed, the pandemic is an inflection point for India to introspect on its potential as a global leader, especially coming at a time when the country is celebrating 75 years of independence.

For years, India has supplied crucial drugs and medications to the global market, more recently investing in the supply of the COVID-19 vaccine to ensure equitable access around the world.

At the start of the COVID crisis, India's South Asian Association of Regional Cooperation (SAARC) initiative held the first multilateral summit, inspiring the G20 and others to follow suit. With the country taking over the G20 presidency in December 2022, it will certainly play a leading role in the post-COVID global recovery process.

Away from the pandemic, India is meeting other global commitments including living up to its climate mitigation promises. It is also well ahead of target to achieve other ambitious commitments such as making renewables 40% of its energy mix by 2030 and managing the sequestration of 2.5 billion tonnes of carbon.

At the ongoing United Nations Climate Change Conference of the Parties (COP26) taking place in Glasgow, Scotland, Prime Minister Narendra Modi committed India to an ambitious Panchamrit

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pledge that will see the country address five key sectors of its economy to reduce its greenhouse gas emissions. The five sectors - energy, mobility, industry, infrastructure and cities, and agriculture - are critical to achieving the global 1.5-degree Celsius warming target.

A recent report from the World Economic Forum - Mission 2070: A Green New Deal for a Net-Zero India - outlines how India's path to net zero will have an estimated economic impact of over $1 trillion by 2030 and around $15 trillion by 2070. In addition, India has prioritized cooperation, technology, and digitalization as part of its efforts to support the achievement of the United Nation's Sustainable Development Goals (SDGs).

Challenges and opportunities

India is marking 30 years since the deregulation of its economy, which is another significant turning point in its history and a testament to its ability to reinvent itself. Successive governments have been focused on achieving inclusive growth and self-sufficiency not just for the current generation but for generations to come. But the current administration's efforts to promote digital empowerment and last-mile financial inclusion are especially noteworthy. Under the auspices of a government-backed digital payment system, millions of poor, unbanked families have entered the formal economy and can now access basic financial services.

On the global stage, India's diplomatic efforts are driven by the philosophy of vasudhaivakutumbakam - the world is one family. This is the kind of narrative the world needs for such a time as this. Indeed, India's call for renewed and reformed multilateralism is resonating with global leaders and policy-makers.

In the past few years, major structural reforms have been launched by the Indian government to boost the long-term outlook of the economy. The government's vision to catalyze India's transformation is evident in the launch of several initiatives including the Gati Shakti National Master Plan and the Atmanirbhar Bharat mission.

The government has also announced the National Infrastructure Pipeline and National Monetization Plan to boost infrastructure development. This wide-ranging development agenda supports initiatives across multiple sectors including reforms to consolidate multiple and disparate labour laws, drafting of the Insolvency and Bankruptcy Code, and banking reforms. India must maintain the momentum of these laudable initiatives and continue to enhance the robustness and vitality of its economy. At the same time, these and other structural reforms should be aimed at ensuring equitable and inclusive growth.

This is critical because the pandemic has exposed and exacerbated existing inequalities and their impact on vulnerable groups who are mainly employed in the informal sector. These are inequalities that the Indian government was addressing even before the pandemic struck through inclusive and equitable development that includes the provision of income support for farmers, safe and affordable housing, safe drinking water and electricity for all.

Going forward, India will have to prioritize economic expansion and sustainability to maintain its trajectory of growth and influence. The country must continue to embrace transformational, rather than incremental change to shape an economic policy that supports rapid growth. This will require a continued commitment to wide-ranging and systemic sectoral reforms, with strong measures to restore fiscal balance and strengthen the banking system.

India will also need to continue making strides to increase competitiveness and the ease of doing business. The country will also have to ramp up its infrastructure efforts, not just for roads and bridges, but for health and education too. Equally critical is the need to ensure that India's demographic advantage becomes a dividend and that millions of young people entering the workforce every year gain meaningful employment.

One must also mention India's renewed focus on the space sector via the recently launched Indian Space Association. Back here on planet earth, however, the Indian government is also placing due emphasis on manufacturing. With the reshoring of global supply chains and quest for geographical diversification in their redistribution, India offers a safe and stable destination and could emerge as an important hub for global manufacturing. India has a demographic advantage, skilled workforce, technical know-how, and the research and development capacity needed to create a strong niche for itself in the global market.

Last but not least, India is also expeditiously moving forward on its energy transition journey: the government's plan to establish a National Hydrogen Mission is a step in the right direction. India also has a unique opportunity, and an important role, in fostering regional co-operation in South Asia, thus creating new opportunities for growth and prosperity.

Amid the ongoing volatility and change, India has a rare opportunity to undertake several policy changes to not only address the short-term public health challenges but also to become an important axis of power and influence in the post-COVID world. The World Economic Forum stands with India in its efforts to assume new leadership roles and to help propel the world into a better, brighter, and more sustainable future for all.

The views expressed in this article are those of the author alone and not the World Economic Forum.

Source : World Economic Forum

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TOWARDS A CLEAN ENERGY ECONOMY SHIFTING TO CLEAN PASSENGER AND FREIGHT MOVEMENT

Background and size of the prize Transport accounted for 4.9 percent of India's gross value addition in 2016–2017 and 14 percent of the country's greenhouse gas emissions in 2019.13 In passenger mobility, considering India's low rate of car ownership (22 cars per 1,000 people),14 high share of non-motorized transport and shared mobility, and rapidly growing domestic innovation ecosystem, the country has an opportunity to leapfrog over a car-centric paradigm to a shared, electric, and connected passenger mobility future.

In freight transport, considering India's skewed modal share (71 percent of India's freight transport is road-based, whereas only 17 percent is rail-based), less fuel-efficient vehicles, and low operational efficiency, India has an opportunity to shift to a cost-effective, clean, and optimized freight transport system.

India's policy leaders have shown a strong commitment to electric passenger mobility through the FAME II scheme, the National Mission on Transformative Mobility and Battery Storage, guidelines on EV charging and charging infrastructure from various ministries, and the announcement of state EV policies in eight states. A supportive policy environment has also been created in the freight segment through Make in India, an initiative to encourage domestic manufacturing; Digital India, a program to transform India into a digitally empowered society; and the Logistics Efficiency Enhancement Program, which aims to improve infrastructure, procedures, and information technology.

Business leaders are capitalizing on these emerging markets by creating new products and business models. New models in the electric two- and three-wheeler segment, indigenous mobility as a service and food delivery service platforms have been instrumental in India's move towards clean mobility. The Auto Expo held in February unveiled new models of electric four-wheelers and two-wheelers that will hit the Indian market in 2020, and experts believe that despite the COVID-19 impact, EV market growth will continue in light-mobility segments, such as two-wheelers, rickshaws, and autos. IIIIIIIIII 2 13 | RMI.ORG Towards a Clean Energy Economy Shifting to Clean Passenger and Freight Movement 14 | RMI.ORG IIIIIIIIII To maintain its momentum in clean transport, India must continue to prioritize shared, electric, and connected passenger mobility and cost-effective, clean, and optimized freight transport. Together, India's passenger and freight

transport sectors can avoid about 600 Mtoe of oil equivalent (Rs 20 lakh crore of oil import savings) and 1.7 gigatonnes of tailpipe carbon dioxide emissions by 2030 (Exhibit 5).

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mobility and cost-effective, clean, and optimized freight transport. Together, India's passenger and freight transport sectors can avoid about 600 Mtoe of oil equivalent (Rs 20 lakh crore of oil import savings) and 1.7 gigatonnes of tailpipe carbon dioxide emissions by 2030 (Exhibit 5). Reductions in passenger mobility, fuel demand, and emissions can come from reducing demand for motorized mobility through non-motorized transport, working from home for those populations who can do so, and shifting to more efficient modes of transport such as public transport and shared mobility. Additionally, switching to EVs while improving the efficiency of internal combustion engine vehicles that remain on the road will be important. Reductions in freight transport fuel demand and emissions can come from shifting long-haul freight from road to more energy-efficient and less carbon-intensive rail, making vehicles more efficient and electrifying them where it makes economic sense, and optimizing logistics and operations. Towards a Clean Energy Economy EXHIBIT 5: Oil Demand and Tailpipe Carbon Dioxide Emissions in India's Passenger and Freight Transport Sectors for Business-as-Usual and Efficient Scenarios (NitiAayog and RMI analysis). Note: Numbers in the graph and text may not match due to rounding. Efficiency to Reduce Oil Demand and CO2 Emissions 15 | RMI.ORG Towards a Clean Energy Economy Emerging situation and challenges in the context of COVID-19 COVID-19 has and will continue to disrupt business as usual in the mobility sector. COVID-19's impacts on passenger and freight segments, as well as the auto industry, raise questions like: • Will the overall demand for mobility fall in the short to medium term? • Will public and shared transport modes see declining ridership? • Will private modes be preferred? • Will a lack of auto sales cause a severe hit to the supply chain? • Will a growing call for self-sufficiency lead to a push to create local supply chains? • Will it push back the electric mobility transition? • Will the Prime Minister's call for domestic manufacturing and localisation attract investments at a time when a recession is looming? • Would the new mobility ecosystem propelled by startups be able to survive the crisis? Impact on passenger mobility Complete lockdown and several extensions have severely impacted passenger mobility across segments. Google's COVID-19 Community Mobility report for India shows a 57 percent decline in mobility trends in public transport between March 28 and May 9 compared with normal activity levels.15 State and city-level data also show significant declines in public transport ridership. This could add pressure on cash-strapped state transport undertakings (STUs). According to Central Institute of Road Transport (CIRT)'s data STUs faced losses as high as Rs 16,409 crore (US$2.18 billion) in 2016–17.16 In fact, airlines and airports could be looking at losses of about Rs 25,000 crore (US$3.3 billion) due to the lockdown, with significant effects in railways as well. Walking and driving activity have also decreased significantly, down by about 60 percent (Exhibit 6). IIIIIIIIII EXHIBIT 6: Apple's COVID-19 Mobility Trends Report, India, January to May 202017 Covid-19

Impact on Mobility in India 16 | RMI.ORG The shared transport sector has also been impacted. On one hand, autorickshaws, ride-hailing platforms, employee transport services, and some first- and last-mile modes are experiencing significant demand reductions. For example, many cities and states are requiring autorickshaws to ferry single passengers, affecting travellers and driver incomes, and ride-hailing companies like Ola are focusing their resources on cutting costs and providing minimal services, such as ferrying essential workers and government officials. On the other hand, micromobility companies like Yulu and car-sharing companies like Zoomcar are preparing for demand growth as preferences shift to more private modes of transport. Impact on freight supply chain and urban deliveries Since the start of the lockdown, freight demand has been shifting, with online food orders dropping by 20 percent and demand for grocery deliveries on the rise.18 The overall effect of the lockdown has been lower consumption, leading to reduced freight demand. BNEF predicts that India's freight demand will fall by 20 percent in 2020.19 As a result, many operators are adding surcharges for deliveries and other increases to cover rising costs. Logistics costs are rising due to lower utilization, with the average daily distance travelled by trucks down by 15–20 percent, as well as supply and manpower shortages.20 As transporters try to conserve cash, they have been seeking a variety of cost-saving measures, including lower fuel prices in the medium to long term. With EV companies revising their strategies to include more affordable electric two-wheeler products in their portfolios, final-mile logistics firms and e-commerce companies could continue their path to final-mile electrification. Impact on the auto industry and electric vehicles Auto sales could decrease by as much as 45 percent in the financial year 2020–21. EV production could be affected in the short term due to lower demand and supply-chain disruptions with BNEF estimating an 18 percent decrease in global EV sales in 2020. However, their forecast also mentions that countries like India, where EV adoption has been slower, could see better than average EV sales in the medium term if governments and early adopters continue to lead on procurement. The EV market may experience other shifts. For example, there is an expectation of demand for more affordable EV products. This potential shift in consumer preferences may affect manufacturers' investment and production decisions. Ultimately, resuming production levels for conventional vehicles and EVs will depend on demand revival, supply-chain reactivation, and access to the labour force. IIIIIIIIII Towards a Clean Energy Economy IIIIIIIIII Towards a Clean Energy Economy CHALLENGES SITUATION ON THE GROUND Less interest in shared transport, more interest in private vehicles and modes Less demand for EV products in the short term Impacts on freight demand and the sector • While ridership of public transport is expected to decline in the short term, this price-sensitive market may not be able to switch modes easily, making it important to strengthen and improve

public transport options, especially bus systems and metros. • Indian consumers may seek to move away from shared mobility options and invest in two- and four-wheelers, as well as second-hand products, which are available at affordable price points.21 • Ridership of shared and ride-hailing services like Ola and Uber has dropped by as much as 60 percent during the work-fromhome shift.22 • Car-sharing platforms, such as Zoom, expect a three-fold increase in demand as people will have higher safety perception.23 • Last-mile modes will be affected due to lower passenger mobility demand and use of public transport, with shared modes like electric rickshaws and autos being the most affected. • Lower disposable incomes and a tendency towards cash saving will lead to reduced demand for EV products. • Under the gross cost contract model, e-bus operators may not have the capital to run buses; OEMs may not want to own and operate their own buses. • Some OEMs' customers are pushing back their EV business plans by two or more years. • That said, there is potential for several customer segments to pick up in the medium term, including corporate customers and last-mile logistics firms. • Freight demand may have a medium-term impact, with The Energy and Resources Institute (TERI) estimating that heavy truck activity could decrease, while the urban freight segment has the potential to flourish. New challenges There will be many new challenges and opportunities in a post-COVID era. The table below highlights some prominent barriers and the current situation on the ground. 17 | RMI.ORG 18 | RMI.ORG IIIIIIIIII Towards a Clean Energy Economy CHALLENGES SITUATION ON THE GROUND Impacts on EV supply chains Impacts of financing Impacts on policy change Unemployment • There may be delays in EV production as manufacturers focus on reviving demand and producing BSVI vehicles. • Curbs on imports of Chinese components may lead to disruptions in EV manufacturing. • Without cash flowing through the system, a cash crunch is growing in auto components markets and auto companies. • Industry fears that banks may be wary of providing loans to EV owners. • There may also be declining venture capital funding in the EV and mobility startup space. • Many state EV policies and e-bus projects may be delayed due to other priorities and social-distancing challenges. • Ola and Uber recently laid off 1,900 employees. • Swiggy and Zomato recently laid off 2,600 employees. • According to ACMA, the auto components industry could cut nearly 5 lakh jobs in the next quarter. • Several auto dealerships will be shutting shop. • About 13 lakh truck drivers have been affected by reduced freight demand and supply-chain disruptions. Strategic opportunities for economic recovery Short-term suggestions (6–8 months) • Liquidity: Provide liquidity to the auto industry, STUs, and logistics providers, fleet aggregators, operators, and auto dealers. Make working capital available for salaries and other ongoing costs.24 • Safe public transport and freight operations: Issue guidelines or standard operating procedures (SOPs) for safe operation of public transport services (i.e., metros and city bus services), including social-distancing measures

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corridors to promote the electrification of the medium- and heavy-duty truck segment.

Reductions in passenger mobility, fuel demand, and emissions can come from reducing demand for motorized mobility through non-motorized transport, working from home for those populations who can do so, and shifting to more efficient modes of transport such as public transport and shared mobility. Additionally, switching to EVs while improving the efficiency of internal combustion engine vehicles that remain on the road will be important. Reductions in freight transport fuel demand and emissions can come from shifting long-haul freight from road to more energy-efficient and less carbon-intensive rail, making vehicles more efficient and electrifying them where it makes economic sense, and optimizing logistics and operations. Towards a Clean Energy Economy EXHIBIT 5: Oil Demand and Tailpipe Carbon Dioxide Emissions in India's Passenger and Freight Transport Sectors for Business-as-Usual and Efficient Scenarios (NitiAayog and RMI analysis). Note: Numbers in the graph and text may not match due to rounding. Efficiency to Reduce Oil Demand and CO_2 Emissions 15 | RMI.ORG Towards a Clean Energy Economy Emerging situation and challenges in the context of COVID-19 COVID-19 has and will continue to disrupt business as usual in the mobility sector. COVID-19's impacts on passenger and freight segments, as well as the auto industry, raise questions like: • Will the overall demand for mobility fall in the short to medium term? • Will public and shared transport modes see declining ridership? • Will private modes be preferred? • Will a lack of auto sales cause a severe hit to the supply chain? • Will a growing call for self-sufficiency lead to a push to create local supply chains? • Will it push back the electric mobility transition? • Will the Prime Minister's call for domestic manufacturing and localisation attract investments at a time when a recession is looming? • Would the new mobility ecosystem propelled by startups be able to survive the crisis? Impact on passenger mobility Complete lockdown and several extensions have severely impacted passenger mobility across segments. Google's COVID-19 Community Mobility report for India shows a 57 percent decline in mobility trends in public transport between March 28 and May 9 compared with normal activity levels.15 State and city-level data also show significant declines in public transport ridership. This could add pressure on cash-strapped state transport undertakings (STUs). According to Central Institute of Road Transport (CIRT)'s data STUs faced losses as high as Rs 16,409 crore (US$2.18 billion) in 2016–17.16 In fact, airlines and airports could be looking at losses of about Rs 25,000 crore (US$3.3 billion) due to the lockdown, with significant effects in railways as well. Walking and driving activity have also decreased significantly, down by about 60 percent (Exhibit 6). IIIIIIIIII EXHIBIT 6: Apple's COVID-19 Mobility Trends Report, India, January to May 202017 Covid-19 Impact on Mobility in India 16 | RMI.ORG The shared transport sector has also been impacted. On one hand, autorickshaws, ride-hailing platforms, employee

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Source : Niti Aayog

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IMPACT OF AI IN
SUPPLY CHAIN MANAGEMENT

TERRY BROWN

Artificial intelligence (AI) in supply chain management is no longer about a future promise. There may be some variations in adoption across industries, but the technology is having a significant impact on how companies operate today. That's the broad conclusion from KPMG's 2020 Living in an AI World study. But is it possible to quantify that impact across specific use cases or business functions, like the value of AI in supply chain management (SCM), for instance?

A McKinsey global survey sets out to answer that question by studying the cost and revenue impact of AI adoption across 33 use cases and eight business functions – including the impact of AI in supply chain management. Overall, a majority (63%) of these early AI adopters have seen revenue increases, and around 44% report cost savings. High performers are also three to four times more likely to report shifts of more than ten percent in terms of the same metrics. Turning specifically to the focus of this article, the study ranked the impact of AI in supply chain management second and third across all eight business functions studied in terms of share of respondents indicating the potential for cost decrease and revenue increase. Overall, 63% and 61% of respondents indicated that they were able to achieve revenue bumps and cost reductions, respectively. Within SCM, sales and demand forecasting, spend analytics, and network optimization were the most likely use cases for driving these shifts.

The McKinsey study provides a broad overview of the potential impact of AI in supply chain management. However, it does look like it will take some time before real-world adoption scales up to reflect that potential.

Adoption of AI in Supply Chain Management : Currently, a mere 12% of businesses are deploying AI in supply chain management, as per a recent report from MHI and Deloitte. Compared to the previous year's edition of the same study, AI has even dropped a rank in terms of disruptive potential, relegated to the fourth position by an increasing emphasis on sensors and automatic identification.

Even in terms of adoption priorities, AI is currently in the eighth position behind even complementary technologies such as IoT, robotics, and prescriptive analytics. The good news is that nearly one-quarter of respondents to the study expect to have deployed AI over the next two years.

But, as the authors noted in their 2019 report, AI "depends on many of the survey technologies as a foundation." As such, there could be a lot of overlap in capabilities between some of these discrete clusters – and therefore, a huge leap in the potential impact of AI in supply chain management. The other point to consider is that companies need to build the digital infrastructure required to deploy technologies like AI and machine learning (ML). This point has been analyzed further in a European survey on the digital readiness of corporate supply chains.

Defining Digital Readiness of Supply Chains : Last year, supply chain specialist JDA (now Blue Yonder), in association with the Warwick Manufacturing Group (WMG), published a Supply Chain Digital Readiness study that defined digital readiness across four key levels. The researchers worked with 180 major European manufacturing companies to understand how close they were to achieving a fully digital supply chain.

The findings revealed that over a third (35%) of the companies that participated in the study were still at level one. i.e., end-to-end data visibility still remained the primary objective, supply chain processes continued to be backed by basic ERP systems, and they relied on simple analytics tools like spreadsheets, predominantly for reporting.

Just over half (52%) qualified for level two readiness – i.e., there was limited deployment of specialist SCM tools, a degree of process automation, and the use of analytics tools to drive cost optimization efforts.

JDA/WMGLevel three remains an exclusive club with just 13% qualifying for access based on their capabilities for dynamic end-to-end supply chain optimization, use of advanced analytics including ML/AI, and real-time visibility across the IoT and supply chain ecosystem. Level three readiness, however, is projected to more than double (31%) by 2023. Over the next five years, just under 10% of companies are expected to acquire level four self-learning autonomous capabilities.

AI in supply chain management is a market that is estimated to grow at a CAGR of 45.3% to reach $21.8 billion by 2027. However, much of that growth will be contingent on organizations' ability to ensure that their supply chains are digitally ready. For instance, Gartner has warned that 80% of supply chain blockchain initiatives will remain stuck in proof-of-concept (POC) or pilot stages unless companies focus on digitizing their supply chains. It is a similar situation for AI in supply chain management, as the progress of deployment will depend entirely on the success of digital transformation initiatives focused on supply

chains.

Digital supply chains, with end-to-end visibility, AI/ML-driven intelligence, real-time decisioning capabilities, and a significant degree of autonomy, are more an inevitability than an option. Most SCM leaders acknowledge this new reality, with a huge majority (80%) expecting digital supply chains to become the predominant model over the next five years.

For companies that are willing to invest the resources to drive the necessary digitization, technologies like ML and AI have the potential to transform almost every aspect of supply chain management to enhance growth, profitability, customer experience, and competitive advantage.

AI/ML Applications in Supply Chain Management : AI and ML have a range of applications across the SCM value chain, including in supply chain planning, warehouse management, fleet management, risk management, inventory management, planning and logistics, and communications. Here's a brief look at how these technologies can enhance the efficiency, productivity, and value of each of these applications.

AI/ML in Transportation and Fleet Management : The global TMS (Transportation Management Systems) market is expected to grow at a CAGR of 14.5% and almost double over the next five years, from USD 2.5 billion in 2019 to USD 4.3 billion by 2025. The development arc of these systems mirrors the exponential growth in data sources, such as IoT sensors, actuators, RFID, GPS, and barcodes. As a result, modern transportation management systems need to do more than record time and place of shipments. Today, a digital TMS needs to facilitate smart functionalities like dynamic routing and automation across the transportation lifecycle to enable businesses to optimize transportation performance in real-time. Dealing with the volume and the diversity of this new data will be next to impossible without embedded ML and AI.An ML/AI-enabled intelligent TMS can automate almost every process across the transportation value chain, starting with load tendering. In fact, smart systems that combine advanced analytics and embedded intelligence are able to autonomously handle 25% or more of load tendering and automate related activities, including booking, approval, routing, and alerts. These solutions allow operators to dynamically switch not just between optimal routes, based on weather, traffic, etc., but also between cost-effective greener alternatives to manage transportation risks and costs while enhancing productivity, efficiency, and performance.

Technologies like AI and ML are facilitating a new generation of transportation management solutions that continuously learn by comparing inputs with outcomes. They also introduce innovative capabilities such as real-time fleet tracking, improved vehicle utilization, and more cost-effective and proactive approaches to fleet maintenance. Most important of all, intelligent TMS allows companies to come up with the best transportation and logistics strategies that perfectly balance the competing priorities of shippers, drivers and fleets without compromising service levels.

AI/ML in Warehouse Management : A conventional warehouse management system (WMS) did not traditionally incorporate any form of advanced intelligence beyond basic descriptive analytics. However, WMS capabilities are slowly but surely evolving to support the intelligent warehouse of the future. In fact, Gartner estimates that by 2024, at least half of all WMS offerings will include embedded machine learning capabilities. In fact, the analyst's Magic Quadrant research methodology for the WMS market now takes into consideration advanced capabilities such as predictive or prescriptive analytics, ML and AI, and integration with emerging material handling automation techniques such as robotics.

AI and ML technologies are ideally suited for the increasingly complex and dynamic nature of the modern warehouse. The functionalities of an intelligent WMS extend far beyond basic inventory management to optimize all core warehouse management processes. For instance, once products are scanned at the warehouse entrance, algorithms can autonomously determine optimal stocking positions and identify the most efficient routes for workers. AI/ML can also help warehouse managers understand the impact that different attributes have on task completion and order processing times in order to make workflows more productive and efficient. Intelligent real-time tracking of all warehouse processes and workflows provides warehouse leaders with the information required to transform warehouse management.

AI techniques like neural networks and reinforcement learning are also helping warehouse robots learn how to deal with the complexity and diversity of these dynamic environments. In short, intelligent warehouse management systems are becoming the smart hub of digital warehouse operations, with data and decisioning flowing seamlessly across processes and workflows.

AI/ML in Supply Chain Planning : Digital supply chain planning (SCP) is critical to the success of digital supply chains. In a 2019 research note on supply chain planning, Gartner described a progressive model that enables companies to enhance the quality and timeliness of their planning initiatives while ensuring that their technology initiatives were aligned with the digital maturity of their supply chain processes.

As per the Gartner model, SCP in stage 1 maturity companies still involved a high degree of manual planning with basic tools like spreadsheets and models powered by low-quality data.

In stage 2, companies still have to deal with poor quality data and a discrete planning process involving multiple models aligned with different functions of the supply chain. However, there is already a big opportunity for companies to leverage the power of algorithmic tools and techniques to achieve significant improvements,

even in a function-level planning process. For instance, ML can be used to self-correct master data. It can also be combined with functional planning automation to improve the quality of planning models and automate predictions in the planning process.

By the time we get to stage 5 maturity, the opportunity for companies to transition to a fully algorithmic SCP paradigm that completely transforms their approach to supply chain planning emerges. Here, the SCP process makes extensive use of multiple data types and sources with the flexibility to add new datasets at will. The business can also successfully create a fully evolved digital supply chain twin – a near-real-time digital representation of the physical supply chain that can be used to simulate interactions and relationships. There is also a high degree of prediction and prescription automation, function-level planning has evolved into an end-to-end process, with up to 95% of planning decisions being done autonomously, and supply chain planners are now more involved with managing algorithms and datasets.

AI/ML in Procurement : According to IDC's latest supply chain predictions, at least half of all large manufacturers will automate supplier and spend data analysis by the end of the year to achieve a 15% gain in procurement productivity. In recent years, procurement has gradually shifted from being considered a tactical and transactional activity to a more strategic position within SCM as well as the business. One indicator of this increasing importance is the growing range of AI/ML-based solutions available today to address almost every aspect of the procurement function.

Today, sourcing bots can apply ML to understand and automate a company's sourcing process, and even integrate with external systems to trigger events based on a range of variables. Contract analytics platforms automate discovery and onboarding, use Natural Language Processing to identify policies, and locate specific data points using a latent semantic indexing (LSI) engine. Intelligent supplier information management systems offer innovative ways to unify supplier data and extract valuable insights. Supplier risk management solutions use AI to analyze and identify gaps in a company's supply and recommend specific actions to reduce risk exposure. Machine learning is accelerating accounts payable workflows, automating fraud detection, and ensuring compliance. AI-powered spend analysis solutions automate data extraction, spend classification and vendor matching and offer advanced spend analytics to improve performance, supplier relationships, and profitability. And AI-powered chatbots are streamlining procurement communications with conversational interfaces that enable frictionless interactions between procurement and supplier systems.

These are just a few examples of the impact of AI in supply chain management. As these technologies continue to evolve, we are getting closer to the next generation of data-driven, self-learning, and truly autonomous cognitive supply chains.

Final Thoughts : The current COVID-19 pandemic has exposed vulnerabilities in almost every company's supply chain, with 94% of Fortune 1000 companies experiencing supply chain disruption and a consequent downgrade in their growth outlook. This has been a risk event that practically no supply chain risk management contingency plan has accounted for. According to some, this may well be the black swan event that triggers a large-scale comprehensive transformation of conventional supply chain models. The capabilities and technologies required to drive effective supply chain transformation are readily available. Technologies like ML and AI in supply chain management have the potential to deliver data-driven, intelligent supply chains that, apart from enabling real-time end-to-end visibility, cognitive capabilities, and autonomous decisioning, can also help companies manage atypical, world-altering risks.

Summary: Impact of AI in Supply Chain Management

A McKinsey study ranked the impact of AI in supply chain management second and third across all eight business functions studied in terms of share of respondents indicating the potential for cost decrease and revenue increase. Overall, 63% and 61% of respondents indicated that they were able to achieve revenue bumps and cost reductions, respectively. Within SCM, sales and demand forecasting, spend analytics, and network optimization were the most likely use cases for driving these shifts. Currently, a mere 12% of businesses are deploying AI in supply chain management, as per a recent report from MHI and Deloitte. Even in terms of adoption priorities, AI is currently in the eighth position behind even complementary technologies such as IoT, robotics, and prescriptive analytics. AI and ML have a range of applications across the SCM value chain, including in supply chain planning, warehouse management, fleet management, risk management, inventory management, planning and logistics, and communications. Here's a brief look at how these technologies can enhance the efficiency, productivity, and value of each of these applications. Technologies like AI and ML are facilitating a new generation of transportation management solutions that continuously learn by comparing inputs with outcomes. They also introduce innovative capabilities such as real-time fleet tracking, improved vehicle utilization, and more cost-effective and proactive approaches to fleet maintenance. Digital supply chain planning (SCP) is critical to the success of digital supply chains. In a 2019 research note on supply chain planning, Gartner described a progressive model that enables companies to enhance the quality and timeliness of their planning initiatives while ensuring that their technology initiatives were aligned with the digital maturity of their supply chain processes.

Source :IT Chronicles

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PREPARE YOUR SUPPLY CHAIN FOR
CRISIS AND BEYOND

SUMIT WADHAWAN

Developing a cogent supply chain response to the coronavirus outbreak is extremely challenging, given the scale of the crisis and the rate at which it is evolving.

The best response, of course, is to be ready before such a crisis hits, since options become more limited when disruption is in full swing. However, there are measures that can be taken now even if you're not fully prepared. And although its long-term consequences have yet to fully play out, the coronavirus outbreak already provides some lessons about how you can better prepare your company to deal with future large-scale crises.

What You Can Do Now

Let's first look at some actions that can be taken to mitigate the impacts of the crisis on supply chains.

1. Start with your people.

The welfare of employees is paramount, and obviously, people are a critical resource. The companies that recovered the fastest after Hurricane Katrina in 2005 were those that tracked down all their employees who dispersed across the south-eastern United States. Procter & Gamble even went so far as to create a local employee village on high ground with housing, foodstuffs, and cash advances for employees and their families. It may be necessary to rethink work practices. When an ice storm shut down Louisville, Kentucky, in 2009, local workers could not get to UPS's sorting hub. But workers could still travel by air, so the company flew in personnel from other cities to keep the hub running. This interchangeability depended on job and equipment standardization.

2. Maintain a healthy skepticism.

Accurate information is a rare commodity in the early stages of emerging disasters, especially when governments are incentivized to keep the population and business community calm to avoid panic. Impact reports tend to be somewhat rose-tinted. However, local people can be a valuable and more reliable source of information, so try to maintain local contacts.

3. Run outage scenarios to assess the possibility of unforeseen impacts.

Expect the unexpected, especially when core suppliers are in the front line of disruptions. In the case of the coronavirus crisis, China's influence is so wide-ranging that there will almost inevitably be unexpected consequences.

Inventory levels are not high enough to cover short-term material outages, so expect cause widespread runs on common core components and materials. In 2005, Hurricane Rita struck Houston and western Louisiana, causing widespread shutdowns of oil refining assets located in the region. What came as a surprise to consumer-packaged-goods firms some six months later was that petroleum-based packaging was in short supply because of Rita's impact on supplies of the raw materials needed to make these materials. Many firms scrambled to redesign packaging using old-style paper and cardboard.

4. Create a comprehensive, emergency operations center

Most organizations today have some semblance of an emergency operations centre (EOC), but in studies, it's observed that these EOCs tend to exist only at the corporate or business unit level. That's not good enough — a deeper, more detailed EOC structure and process are necessary. EOCs should exist at the plant level, with predetermined action plans for communication and coordination, designated roles for functional representatives, protocols for communications and decision making, and emergency action plans that involve customers and suppliers.

Designing for a response:

The coronavirus story will undoubtedly add to our knowledge about dealing with large-scale supply chain disruptions. Even at this relatively early stage,

important lessons can be drawn about managing crises of this nature that should be applied down the road.

a. Know all your suppliers

Map your upstream suppliers' several tiers back. Companies that fail to do this are less able to respond or estimate likely impacts when a crisis erupts. After the 2011 Sendai earthquake in Japan, it took weeks for many companies to understand their exposure to the disaster because they were unfamiliar with upstream suppliers. At that point, any available capacity was gone. Similarly, develop relationships in advance with key resources — it's too late after the disruption has erupted.

b. Understand your critical vulnerabilities and take action to spread the risk

Many supply chains have dependencies that put firms at risk. An example is when an enterprise is dependent on a supplier that has a single facility with a large share of the global market. The Sendai disaster highlighted this type of exposure. For example, Hitachi manufactured approximately 60% of the global supply of airflow sensors, a critical component for auto manufacturers. The anticipated shortage of these items forced some automotive original-equipment manufacturers (OEMs) to ration the remaining airflow sensors to their highest margin product lines. The coronavirus outbreak has exposed Apple's and many auto OEMs' dependency on sourcing from China.

c. Create business continuity plans

These plans should pinpoint contingencies in critical areas and include backup plans for transportation, communications, supply, and cash flow. Involve your suppliers and customers in developing these plans.

d. Don't forget your people

A backup plan is needed for people too. The plan may include contingencies for more automation, remote-working arrangements, or other flexible human resourcing in response to personnel constraints.

Revisit Your Supply Chain's Design Until very recently, most global companies could base their supply chain designs on the assumption that materials flow freely globally, enabling them to the source, produce, and distribute products at the lowest-cost locations around the world. U.S.-China trade policy whiplash, Brexit, and now the coronavirus crisis has challenged the validity of this fundamental assumption. Specifically, the coronavirus illustrates the vulnerability of having so many sources located in one spot — and a spot that is far away from critical markets in North America, Europe, and Latin America.

There are many options, and each one involves trade-offs between the level of risk that the enterprises can tolerate and the amount of operational flexibility it wants to achieve. The question is: How should companies design their supply chains to operate effectively in a highly volatile world where consumers are intolerant of tardy responses? Here are two examples:

1. Redesign with second sources:

This supply-chain design provides backup capacity for supply, production, and distribution outages. The backup capacity spreads the risk of disruption across two sources (as long as the disruption does not also affect the second source location). Consequently, it is better to have a second source outside the primary source region. Although this supply chain design lowers risk levels, it incurs higher administrative, quality monitoring, and unit costs. Also, economies of scale vary according to the amount of supply allocated to each supply source.

2. Redesign to source locally:

This design calls for a company to have production facilities with local sources of supply in each of its major markets. Like the above option, it spreads the risk. Since these sources are dispersed, the economies of scale are lower and the capital costs are higher, but the transportation costs are lower.

Firms should regularly revisit and challenge their design choices and the strategies that underpin them.

It's impossible to anticipate the arrival of global crises such as the coronavirus outbreak, but firms can mitigate their impacts by taking supply chain preparedness to a higher level. They should act before a disruption occurs and adjust and execute new plans afterwards rather than starting from scratch every time they are plunged into a new crisis.

Source: sourcingandsupplychain.com

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BRANCH NEWS

HYDERABAD BRANCH

Hyderabad branch of IIMM organized Two Webinars in the month of October' 2021 :

1. **Session on Project Guidance &Dissertation on 24th Oct'2021.** Shree Kuldeep Rai, an Eminent Faculty with Rich Industry & Academic background took the Session. Guided the Students by explaining lucidly how to select a project, research methodologies, data collection, analysis, project report writing and presentation.

2. **Agripreneurship2.0 :Case Study based Immersive Workshop was Jointly Organized by IIMM Hyderabad &LifeDekho - Pluto Corporate ServicesPvt. Ltd on 31st Oct'2021.** There were over 65 Participants. CA Rishabh Sawansukha, addressed the participants.

This One-hour Program was focused on Three Case Studies explaining how Unique Opportunities can be Explored through Agripreneurship& Prosper.

Based on very good response now a detailed 15 hrs program: **Certified Agripreneur Professional (CAP©)** Training is planned to Organize Jointly by IIMM – Hyderabad & Life Dekho (Pluto Corporate Services Private Ltd).The **CAP Certification Program is Scheduled for 6 Days – 6 Sessions -2 $\frac{1}{2}$ Hrs Each- starting from 15th Dec'2021.**

Highlights of the Program :

Ø Practical Approach - Step by Step Guiding & Handholding Support

Ø To Start Agripreneur Business – How to Establish FPO – How to Generate Profits from Agripreneur-Business with Innovation & Collective Efforts of Farmers.

Ø To Understand Govt. Encouragement – Schemes - Incentives & Subsidies.

Ø To Know How Raise Funds - Legal & Regulatory Requirements.

Ø How to Explore Market for Agri-Products in India & Abroad – Branding & Pricing.

Ø How to Export Agri-Products & it's Related Formalities, Logistics & Documentation.

Ø Case Study based immersive capacity building

Ø Online mode with Alumni Network building

Ø And Many more to Learn – Practice & Prosper.

Flexible Certification:

v Certified Agripreneur Professional (CAP) will be awarded to those who Participated all the 6 Sessions.

v Flexibility to Attend any Session of your Interest – Participation Certificate shall be issued for that Session.

v All the Certificates are issued Jointly in the Name of IIMM &LifeDekho (Pluto Corporate Services Pvt. Ltd)

For more details IIMM Hyderabad Branch may be contacted at iimmhyd.course.director@gmail.com

The Branch Conducted a Program on **GST for Supply Chain Professionals on 21st Nov'2021.** The Session was taken by **SN Panigrahi,** International Business Consultant & Trainer, National Council & Life Member, IIMM – Hyderabad. Subject Material Link can be found @ below:

https://www.slideshare.net/SNPanigrahiPMP/gst-for-supply-chain-professionals-webinar-of-iimm-hyderabad

A webinar **"A Practical Approach To Supply Chain Risk & Resilience Management"** is planned **on27th Nov'2021.** SpeakerAshish MendirattaFounder at SIMSA.

The Hyderabad Branch alsoConductedContact Classes for 1st Semester Students on 18th, 21st, 24th, 25th& 26th Nov'2021.

IIMM – Hyderabad Forthcoming Programs are as follows:

JAMSHEDPUR BRANCH

1. GDMM Batch 2019-2021 completed Final year Project

Training Program which was conducted at various organisation.

Training Details

Mrs. Babita Pradhan Hi-Tech Chemical Pvt Ltd.	Mr. Supriyo Chatterjee Tata Motors Limited
Mr. R. Satish Kumar Tata Steel Utilities and Infrastructure Services Limited	Mr. Sanjay Singh Brahmananda Narayana Multispecialty Hospital, Jamshedpur
Mr. Nikhil Kr. Singh Long Product Mill, Jamshedpur	Miss. Shweta Panday Tata Steel, Jamshedpur

All students completed his project on allocated time and company also provided the Project Training Certificate. The project training duration was 2 to 3 month. Out of these projects two projects have selected as a best project by the company also.

Mr Siddharth Kashyap (Vice Chairman IIMM Jamshedpur Branch) wrote a story book "**Biryani House & Other Stories**". Biryani House & Other Stories is an anthology of short stories that would transport you to lush green surroundings of a mountain to a desolate 'guest house'. You would softly leave your present and meet the mystic 'Baba' on the way. 'Boundless love' happens at Biryani House. 'Old Monk and Wills' would end but 'love story never ends! You would meet Doctors of many kinds in 'Skin Doctor' and 'Doctor and the ladies'. The common man in 'Being Human'. Finally, a 'fire wall' with a business case.

PUNE BRANCH

Considering the relaxation on the restrictions imposed by the authorities due to the Pandemic, IIMM Pune Branch has initiated a program - "Rise Again!" The said program will be a series of Bilateral Knowledge Sharing session. One such session was organized by the branch on the eve of 21st October'21 at its office. The guest speaker, Mr. Pradeep Paranjape a Senior Consultant in Kaizen Institute, India, Africa & Middle East shared his knowledge on "Lean Transformation" with all the participants.

Vice Chairman, Mr. Shrivardhan Gadgil welcomed all the members for the session & gave brief introduction of the speaker. Mr. Pradeep Paranjape gave insights about Lean Transformation. He emphasized that Lean means Fit – Fit it is neither weak nor fat but it is fit for survival, growth, competency and competition. He further mentioned that in any organization, we wish to be faster, better and economical and so we always focus on 3 important objectives –

1) Reduce Lead Time or Delivery Time,
2) Improve quality,
3) Reduce cost and we also focus on safety and housekeeping.

This approach is deployed with 5 critical steps which are:

1. Specify value - from customer's view point
2. Identify the value stream – identify VA and NVA in value delivery process
3. Flow – Remove obstacles in the process flow, remove MUDA/NVA
4. Pull- Let customers pull value
5. Perfection.

He further informed that as per the Japanese expert Mr. Taiichi Ohno, MUDA /NVA / WASTE can be defined as "Any activity for which the customer is not prepared to pay for".

The 8 types of waste are already known, which can be listed as below & remembered as **"D.O.W.N.T.I.M.E."** i.e. Defects, Overproduction,Waiting,Non utilization of talent, Transportation, Inventory, Motion and Extra processing. He gave the following suggestion to introspect and then start the journey of Lean Transformation:

What is my Job/ Responsibility/ Process? ?
How can I prove - Is it fulfilled / completed? ?
How can I do it better in future?

The lecture was followed by a questions & answers session. The Chairman, Mr. Shripad Kadam felicitated the speaker, Mr. Pradeep Paranjape as a token of appreciation. Hon.Secretary, Arjunsingh Rajput concluded the session with a vote of thanks. The program was attended by more than 30 members.

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BRANCH CHAIRMAN

Prepared by Sanjay-IIMM, Delhi Branch

EXECUTIVE HEALTH

EVERYTHING YOU NEED TO KNOW ABOUT HIGH CHOLESTEROL

High cholesterol is a pretty common issue in the U.S. In fact, according to the Centers for Disease Control and Prevention (CDC)Trusted Source, nearly 94 million U.S. adults ages 20 or older have what could be considered borderline high cholesterol.

However, because this condition can often present without any real symptoms, you may not even know you have it until you visit your doctor.

If you're wondering what causes high cholesterol, what to do if you've been diagnosed with it, and if there are ways to reverse it (hint: there are), read on for all the answers.

What is cholesterol?

Cholesterol is a type of lipid. It's a waxy, fat-like substance that your liver produces naturally. It's vital for the formation of cell membranes, certain hormones, and vitamin D.

Cholesterol doesn't dissolve in water, so it can't travel through your blood on its own. To help transport cholesterol, your liver produces lipoproteins.

Lipoproteins are particles made from fat and protein. They carry cholesterol and triglycerides, another type of lipid, through your bloodstream. The two major forms of lipoprotein are low-density lipoprotein (LDL) and high-density lipoprotein (HDL).

LDL cholesterol is any cholesterol carried by low-density lipoproteins. If your blood contains too much LDL cholesterol, you may be diagnosed with high cholesterol. Without treatment, high cholesterol may lead to many health issues, including heart attack and stroke.

High cholesterol rarely causes symptoms in the beginning. That's why it's important to get your cholesterol levels checked on a regular basis.

High cholesterol symptoms

In most cases, high cholesterol is a "silent" condition. It typically doesn't cause any symptoms. Many people don't even realize they have high cholesterol until they develop serious complications, such as a heart attack or stroke.

That's why routine cholesterol screening is important. If you're 20 years or older, ask your doctor if you should have routine cholesterol screening. Learn how this screening could potentially save your life.

Causes of high cholesterol

Eating too many foods that are high in cholesterol, saturated fats, and trans fats may increase your risk of developing high cholesterol. Living with obesity can also increase your risk. Other lifestyle factors that can contribute to high cholesterol include inactivity and smoking.

Your genetics can also affect your chances of developing high cholesterol. Genes are passed down from parents to children. Certain genes instruct your body on how to process cholesterol and fats. If your parents have high cholesterol, you may be at a greater risk of having it too.

In rare cases, high cholesterol is caused by familial hypercholesterolemia. This genetic disorder prevents your body from removing LDL. According to the National Human Genome Research InstituteTrusted Source, most adults with this condition have total cholesterol levels above 300 milligrams per deciliter and LDL levels above 200 milligrams per deciliter.

Other health conditions, such as diabetes and hypothyroidism, may also increase your risk of developing high cholesterol and related complications.

LDL cholesterol, or "bad cholesterol"

LDL cholesterol is often called "bad cholesterol." It carries cholesterol to your arteries. If your levels of LDL cholesterol are too high, it can build up on the walls of your arteries.

This buildup is also known as cholesterol plaque. This plaque can narrow your arteries, limit your blood flow, and raise your risk of blood clots. If a blood clot blocks an artery in your heart or brain, it can cause a heart attack or stroke.

HDL cholesterol, or "good cholesterol"

HDL cholesterol is sometimes called "good cholesterol." It helps return LDL cholesterol to your liver to be removed from your body. This helps prevent cholesterol plaque from building up in your arteries.

When you have healthy levels of HDL cholesterol, it can help lower your risk of blood clots, heart disease, and stroke.

Triglycerides, a different type of lipid

Triglycerides are another type of lipid. They're different from cholesterol. While your body uses cholesterol to build cells and certain hormones, it uses triglycerides as a source of energy.

When you eat more calories than your body can use right away, it converts those calories into triglycerides. It stores triglycerides in your fat cells. It also uses lipoproteins to circulate triglycerides through your bloodstream.

If you regularly eat more calories than your body can use, your triglyceride levels may become too high. This can raise your risk of several health problems, including heart disease and stroke.

Your doctor can use a simple blood test to measure your triglyceride level, as well as your cholesterol levels.

Getting your cholesterol levels checked

If you're 20 years or older, the American Heart AssociationTrusted Source recommends getting your cholesterol levels checked at least once every 4 to 6 years. If you have a history of high cholesterol or other risk factors for cardiovascular disease, your doctor may encourage you to get your cholesterol levels tested more often.

Your doctor can use a lipid panel to measure your total cholesterol level, as well your LDL cholesterol, HDL cholesterol, and triglyceride levels. Your total cholesterol

level is the overall amount of cholesterol in your blood. It includes LDL and HDL cholesterol.

If your levels of total cholesterol or LDL cholesterol are too high, your doctor may diagnose you with high cholesterol. High cholesterol can be dangerous when your LDL levels are too high and your HDL levels are too low.

Cholesterol levels chart : Being diagnosed with high cholesterol doesn't automatically mean you will be put on medication. If your doctor does prescribe you medication, different factors may influence the type of medication they recommend.

With this in mind, most physicians use generalized measurements to decide on treatment plans. They may categorize these measurements as desirable, borderline high, or high cholesterol.

According to the National Library of Medicine, the total cholesterol of most adults can be categorized as:

Total cholesterol	Category
less than 200 mg/dL	desirable
200-239 mg/dL	borderline high
240 mg/dL and above	high

The National Library of Medicine also provides optimal to high categories of LDL ("bad") cholesterol levels:

LDL ("bad") cholesterol levels	Category
less than 100 mg/dL	optimal
100-129 mg/dL	near optimal
130-159 mg/dL	borderline high
160-189 mg/dL	high
190 mg/dL and above	very high

Again, these measurements are general. You and your doctor will consider other personal factors before deciding on a treatment plan.

Lowering cholesterol through diet : To help you achieve and maintain healthy cholesterol levels, your doctor may recommend changes to your diet.

For example, they may advise you to:

- limit your intake of foods that are high in cholesterol, saturated fats, and trans fats
- choose lean sources of protein, such as chicken, fish, and legumes
- eat a wide variety of high fiber foods, such as fruits, vegetables, and whole grains
- opt for baked, broiled, steamed, grilled, and roasted foods instead of fried foods
- avoid fast food and sugary, pre-packaged options when possible

Foods that are high in cholesterol, saturated fats, or trans fats include:

- red meat, organ meats, egg yolks, and high fat dairy products
- processed foods made with cocoa butter or palm oil
- deep-fried foods, such as potato chips, onion rings, and fried chicken
- certain baked goods, such as some cookies and muffins

Eating fish and other foods that contain omega-3 fatty acids may also help lower your LDL levels. For example, salmon, mackerel, and herring are rich sources of omega-3s. Walnuts, almonds, ground flaxseeds, and avocados also contain omega-3s.

Home remedies to lower cholesterol naturally

In some cases, you may be able to lower your cholesterol levels without taking medications. For example, it may be enough to eat a nutritious diet, exercise regularly, and avoid smoking tobacco products.

Some people also claim that certain herbal and nutritional supplements may help lower cholesterol levels. For instance, claims have been made about:

- garlic
- hawthorn
- astragalus
- red yeast rice
- plant sterol and stanol supplements
- blond psyllium, found in psyllium seed husk
- ground flaxseed

However, the level of evidence supporting these claims varies. Also, the Food and Drug Administration (FDA) hasn't approved any of these products for treating high cholesterol. More research is needed to learn if they can help treat this condition.

Always talk with your doctor before taking any herbal or nutritional supplements. In some cases, they might interact with other medications you're taking.

How to prevent high cholesterol

You can't control the genetic risk factors for high cholesterol. However, lifestyle factors can be managed.

To lower your risk of developing high cholesterol:

- Eat a nutritious diet that's low in cholesterol and animal fats, and high in fiber.
- Avoid excessive alcohol consumption.
- Maintain a moderate weight.
- E.xercise regularly.
- Avoid smoking.

Follow your doctor's recommendations for routine cholesterol screening. If you're at risk of high cholesterol or coronary heart disease, they will likely encourage you to get your cholesterol levels tested on a regular basis.

Takeaway

In most cases, high cholesterol has no symptoms. But without treatment, high cholesterol can cause serious health issues. The good news is that your doctor can help you manage this condition, and in many cases, can help you avoid complications.

To learn if you have high cholesterol, ask your doctor to test your cholesterol levels, especially if you're 20 years or older. If they diagnose you with high cholesterol, ask them about your treatment options.

To lower your risk of complications from high cholesterol, practice healthy lifestyle habits and follow your doctor's recommended treatment plan.

Eating a balanced diet, exercising regularly, and avoiding tobacco products may help you achieve and maintain healthy cholesterol levels. It could also help lower your risk of complications from high cholesterol.

Source: Healthline

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