

CS6025 – Supply Chain Management

Smarter Supply Chains with AI

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SLNo	Question	Course Outcome	Blooms Taxonomy
A	Startup demography and landscape	CO1	L2
B	Disruptive milestones and unicorns in the recent past - reasons for success	CO1	L3
C	Govt. Policies and it's impact on startup expansion	CO2	L1
D	Smart supply chains -existing & remedial measures to convert smarter	CO1	L3
E	Impact on Industry	CO1	L1

State chose: Gujarat

1. STARTUP DEMOGRAPHY AND LANDSCAPE

Gujarat, also known as the land of celebrations and festivals, is the fifth-largest Indian state by area and the ninth-largest state by population. It is located on the country's western coast, on the Arabian Sea. It encompasses the entire Kathiawar Peninsula as well as the surrounding area on the mainland. Gujarat is a land of great contrasts, stretching from the seasonal salt deserts of the Kachchh (Kutch) district in the northwest, across the generally arid and semiarid scrublands of the Kathiawar Peninsula, to the wet, fertile, coastal plains of the southeastern part of the state, north of Mumbai. Nearly three-fifths of the residents of Gujarat are rural, although the rural proportion of the population has declined as urban areas have grown.

Gujarat is a leading industrialised state of India and a petroleum producer. It is also famous for its arts and crafts. Gujarat occupies a leading place in India's manufacturing sector, especially in the production of chemicals, pharmaceuticals, and polyester textiles. The state's major industrial belt exists in its southern sector. Gujarat, also the hometown of several Indian millionaires, is gaining prominence as an entrepreneurial hub. Ahmedabad is the epicenter for startups in Gujarat. Ahmedabad is one of the most prominent cities in western India and is famous for its textile industry.

Gujarat is the "Best Performer" in National Startup Ranking consecutively in 2018 and 2019. The state of Gujarat has a well-structured startup ecosystem with specific focus on incubation, regulatory support and awareness as well as outreach initiatives.

The government launched the state's startup policy in 2015 under the Industries and Mines Department. The policy offers benefits and incentives across various areas of intervention to startups. Gujarat is one of the few states in the country to outline sector specific startup policies such as Electronics & Information Technology (IT) Policy and Student Startup and Innovation Policy (SSIP). The state has many prominent startup incubators and accelerators which have contributed to the strong growth of the startup

ecosystem. UCIED (United Center for Innovation & Entrepreneurship Development Foundation) hosted the first edition of Gujarat Startups & Investor's Summit 2016 which enabled startups to connect with investors by bringing them together under one roof on 23rd December 2016.

Startups supporting Sustainable Development Goal – 13 – “Climate Change”:

The Gujarat government has decided to extend help to climate action startups in a bid to improve the green cover and decrease the carbon footprint in the state. The climate change department has kept a provision of Rs.500 crore for the startups for next five years.

Some of the few examples of such startups includes:

- Biodegradable packaging material from agriculture waste and mushroom mycelium.
- Innovating compostable nursery bags that includes unique technical capabilities of natural sapling bags include air and moisture permeability that can retain moisture for longer time, less requirement of water, high plant germination and better plant growth.
- Eco-friendly concrete products like paver blocks, concrete covers, bricks and home decor pots from industrial waste materials which are non-recyclable and thrown in landfills.

2. DISRUPTIVE MILESTONES AND UNICORNS IN RECENT PASTS – REASONS FOR SUCCESS

According to **DPIIT**, a proactive mechanism to identify regulatory issues from disruptive sectors; iCreate, one of the largest incubators in the country and its Student Startup and Innovation Policy (SSIP) helped Gujarat to top the list. Gujarat is blessed with an ecosystem of private enablers such as incubators, accelerators and co-working spaces. The efforts of the enablers coupled with the government's push for entrepreneurship and innovation has resulted in many startups hitting the big time in Gujarat. Home to universities such as Ahmedabad University, IIM-A, MICA, NID, NIFT and more gives the state advantages of having promising talent as well as a culture of innovation. Some of the most prominent names in Gujarat in this category:

- **iCreate:** iCreate is India's only non-academic institution dedicated to fostering startups based on tech innovation into successful businesses. Launched by the government of India, International Centre for Entrepreneurship and Technology (iCreate) is a joint venture between Gujarat Mineral Development Corporation Limited (GMDC) and Gujarat Entrepreneurship and Venture Promotion Foundation (GEVPF). It aims to promote and help startups by providing them with finance, mentors and tech

assistance. What makes iCreate unique is that it is not just an incubator, but a vibrant entrepreneurial ecosystem. A good example of collaboration work of iCreate is iCreate's partnership with Israel's Start-Up Nation Central (SNC), which resulted in the India Israel Innovation Accelerator (i3A). Going forward, international collaboration could also be with the intent of jointly exploring global markets.

- **Venture Studio:** VentureStudio is a startup incubator established by Ahmedabad University in 2011 in active collaboration with Stanford University - Center for Design Research. With innovation as its core philosophy, it has close to 50 active ventures, with close to 40% of them in early revenue stage, spanning diverse domains such as healthcare, medical devices and diagnostics, defense, education, energy, environment, agro, consumer products, logistics, smart technologies etc. It offers multiple fellowship programmes for people with the insights and entrepreneurial drive to start new venture in the life sciences and healthcare, defense, smart city technologies and other areas of focus with critical unmet needs. The Center provides 360° support ranging from pre-seed funding through multiple grants and schemes, personalized mentoring through a network of domain experts, access to cutting edge facilities for product development, market access, team building assistance and support for follow on Angel and Venture Capital financing.
- **CIIE.CO:** Founded at IIM Ahmedabad in 2002, as an academic center, CIIE.CO (Center for Innovation Incubation and Entrepreneurship) has grown to include acceleration, incubation, investment, research and more. Among its various initiatives, it has conceptualized and hosted India's first accelerator, created a cleantech-focussed fund, accelerated over 600 entrepreneurs, funded over 120 startups and more. Through the continuum of incubation, acceleration, capital, insights - it gives everything it takes for these driven entrepreneurs to make a superlative impact. Nestled within the lush IIM campus is CIIE.CO's flagship 20,000 sq ft and additional 31000 sq ft under construction well-equipped innovation space suited to the needs of startups across various stages. Our space has distinct sections for solo founder/co-founders to teams as big as about 20 people.
- **DevX:** One of the most prominent names in the co-working community in the state, DevX has an accelerator programme in place to boost independent innovation in the state. Under this programme, it offers technical mentorship, legal advice, funding support and more. DevX which is prima facie a working cum accelerator is operational into Six business verticals. Extending its presence in Startup Investment domain, DevX has its own fund with the name DevX Venture Fund (DVF) for investing in early-stage tech-enabled startups.
- **The Address:** Like DevX, The Address is one of the most prominent names in the co-working space community in Gujarat. Not only does it provide spacious workspaces for startups but it also helps them by providing services such as legal consultancy, asset management, strategic planning and more. It is a coworking venture from the renowned real estate developer True Value. By designing

coworking spaces and shared office solutions aimed at boosting efficiency, creativity, focus, and workplace happiness for teams of all sizes — it aims to be the coworking brand known for helping businesses scale new heights. It strives to offer the best coworking experience at the most affordable pricing plans. The core focus is to ensure your teams are equipped with everything they need to work at maximum efficiency.

Startup unicorns in Gujarat and Reasons for success:

Many startups like Lending kart and Infibeam originating from Gujarat have been identified as unicorns or startups that are on track to hit a \$1 Billion valuation in the next couple of years.

- **Infibeam:** Infibeam Avenues Limited is an Indian multinational financial technology company which provides payment services globally under the brand name CCAvenue. This ecommerce company which runs payments processing has become one of the most prominent names from the state. Not only did it record net profit growth to \$3.6 Million in December 2018 from \$266K in December 2017, but it also signed a MoU with Middle East's investment firm UniPropitia FZCO to expand its services to the Arab League countries.

Reasons for success

Infibeam was launched at a time when online retailing was in its infancy in India. It initially focused on the automobile segment. In November 2008, Infibeam acquired the photo printing portal Picsquare to enter the gifting space. The product basket was gradually expanded to include everything from mobiles to footwear. Infibeam made an impact to begin with, and there were rumors initially that Amazon was planning to acquire it to enter India. Infibeam was very focused on capital efficiency, and so it did not raise large sums of money. Infibeam's large number of merchants portfolio, nearly 3 million, and growing, are the potential customers for offering lending services. In the lending space, the company has already started Express Settlement of merchant funds. The lending through express settlement is at a run-rate of about 750 crore (US\$ 100 million) a year based on the run-rate of March 2021. Later, the company will also offer virtual and physical cards, and business loans to the SMEs and corporates.

- **Menstrupedia:** Founded in 2014, Menstrupedia comic is a guide to educate people around the world, particularly in India, on menstruation. It was started by Aditi

Gupta and her now husband, Tuhin Paul. This content startup has not only penetrated the domestic markets but has also crossed the borders to reach users in 20 different countries. Using a comic book format to educate people about menstruation it is present in over 6K schools, 120 NGOs. It is in use in more than 250 schools in India. They also gained popularity when they appeared on Shark Tank India Indian version of American series Shark Tank.

Reasons for success

Aditi Gupta and Tuhin Paul have taken nearly two years to convert their digital initiative on educating girls on the 'forbidden' topic to come up with a comic book on the same. She had introduced these comics on a website which ultimately urbanized into a ready to lend a hand platform that provided information on teenage years and sexual characteristics for young adulthood and pre-teens. Menstrupedia is a website that puts out an easy to make use of guide to menstruation, youth and wellbeing. It also ruins several mythologies that are commonly believed about menstruation. The one and only principle of this website was to be an ethnically insightful and easy to recognize method of considerations a taboo subject. The website contains a lot of sections such as comic books, blogs, Questions and Answers part and study pieces. This comic has been incorporated into the program of study of over 70 schools across India, used by 6000 schools, 12 NGOs such as Protsahan, Munshi Jagannath Bhagwan Smriti Sansthan, Instincts, Kanha all along among two Buddhists monasteries in Ladakh and 2,50,000 young women. It is capable of distributing information in 18 diverse countries and has been interpreted and hooked on over 11 languages. Menstrupedia has started quite a lot of campaigns in association with Whisper India such as Touch the Pickle group in cooperation with numerous actresses like Shraddha Kapoor, Parineeti Chopra, Kalki Koechlin, Neha Dhupia, Mandira Bedi amongst others

- Lending kart:** Lendingkart was founded in 2014 as a digital lending platform for SMEs by ex-banker Harshvardhan Lunia and ex-ISRO scientist Mukul Sachan. The Lendingkart Group has two arms - Lendingkart Finance Limited (non-deposit taking NBFC) and Lendingkart Technologies Pvt. Ltd. (develops the underlying technology). Lendingkart Finance is a non-deposit-taking Non-banking Financial Company (NBFC) registered with RBI that offers business loans, MSME loans, working capital loans to individuals, self-employed customers, and Small and Medium-Sized Enterprises (SMEs) and MSMEs. Among the most prominent names is Lending kart from Gujarat. The startup today has a presence in three cities (Ahmedabad, Bengaluru, and Mumbai) and has helped MSMEs all over the country. Soon to become a unicorn, this startup has raised over \$200 Million funding and claims to have reached more than 1300 cities across all 29 states and union territories of the country. The company uses its in-house big data analytics tools and machine learning algorithms to evaluate the creditworthiness of customers, risk identification, fraud detection

and disburse loans within 72 hours. The primary underwriting process is done via data models built by the in-house data science and data engineering team at Lendingkart.

Reasons for success

The data sources at Lendingkart were mostly fixed but their data pipelines weren't finalized. Pradeep and his team used to try out multiple pipeline combinations with a range of transformations. This entire process was time consuming and used to eat up most of their team's bandwidth due to which they couldn't focus on other important projects.

Considering the impact of this delay and unreliable data output, Pradeep decided to look for an automated data pipeline solution that can be reliable, provide pre-built integration with multiple data sources, support advanced transformations and can build pipelines quickly. The data engineering team at Lendingkart built multiple pipelines using Hevo and found some of its features like Auto-mapping, CDC, JSON based API parsing, and Python interface extremely helpful as it saved their time and efforts in extracting, transforming and storing their data to the data warehouse. Hevo became one of the key tools in Lendingkart's data stack as it helped them connect and pull data from multiple data sources like MongoDB, MySQL, Salesforce, Google Analytics, Facebook Ads, Intercom, Mixpanel and store it into Amazon S3 and Redshift. The data science and analytics team at Lendingkart used this data from S3 and Redshift for training ML algorithms and creating MIS reports on the custom-built dashboard.

Hevo not just helped Lendingkart build pipelines quickly but also allowed them to aggregate 4X more data at the same cost compared to their old setup. Since its inception, Lendingkart Finance Ltd. has disbursed over 1,00,000 loans to more than 89,000 SMEs from over 1300 cities across India. The company has grown exponentially and recently raised ₹319 crores in Series D funding to further expand its lending base and reach out to under-served small enterprises.

- **Beardo:** This men's grooming brand from Ahmedabad has earned fame not only in the state but is also one of the prominent names in the country for its sector. It is a shop for the complete range of Men grooming products for your hair, beard, mustache, skin & face. Shampoo, beard wash, beard oil, facial serum, face lotion etc. In search of a space to create their own brand, the duo decided to start this. It has seen interest from various giants in the country such as the FMCG Company, Marico which acquired a 45% stake in the startup in 2017 and plans to acquire it by March 2020.

Reasons for success

Free shipping and marketing are key factors for this brand's success. By March 2016, the company had expanded into the hair, body and styling categories through the introduction

of 6 new products. Following this, they brought Bollywood actors on board as the faces of Beardo. Later they started selling on e-commerce platforms after big companies like Amazon and flipkart. With various bearded looks back in rage, Beardo observed the lack of grooming products for men and therefore decided to change the grooming game for men with exclusive products made using choicest ingredients and a quality controlled manufacturing process. Beardo is not just a beard care expert that only focuses on beard grooming products, we've also forayed into men's skincare range that includes scrub, moisturizer, masks, bodywash, serums et al and a carefully curated hair care range that focuses on hair types and various hair problems that men are prone to. They always come up with breakthrough products which are hassle-free to use and are effective on men.

- **Torchit:** Torchit is a Govt. of India-aided social-tech startup that empowers people with Disabilities to lead a dignified, independent, and meaningful life through the design & development of state-of-the-art technological solutions using Artificial Intelligence and Machine Learning. An early-stage startup discovered by Inc42 during its visit to the state with BIGShift, Torchit is helping the visually challenged with their assistive mobility device. TorchIt works towards designing & developing modern & innovative products using the power of Artificial Intelligence & Machine Learning to bring equity & independence to the lives of the Differently impaired communities. TorchIt, being a National Awardee, is working towards enabling the Persons with Disability (PwD) with Power of Independence by providing the most innovative and affordable assistive solutions. Its flagship product, Saarthi, uses the ultrasonic sensor to help those with impaired vision understand how close or far objects are in closed spaces.

Reasons for success

Enabling IoT, AI & ML-based solutions for improving the quality of life of Persons with Disabilities. TorchIt is brewing a microsystem within the organization where the Differently differently impaired community is not only empowered through using modern & effective products, but it tries to integrate as many differently impaired people in its workforce, thereby giving more freedom & power to the community. Torchit's flagship product, called Saarthi, uses the ultrasonic sensor to help those with impaired vision understand how close or far objects are in a closed room, lobby or slightly more open areas. The haptic feedback built into Torchit lets its users know how far or close objects are and allows them to course-correct. Safety and ease of user were the two biggest factors that determined Torchit's development and feature-set. To make it convenient for anyone with visual impairments or blindness, Saarthi fits into a conventional white cane that most such users are already familiar with and trained for. Torchit's internal quality control team checks each and every unit before dispatch and provides a year-long device warranty to cover for any faults in the device. Due to its international appeal, Torchit has gained grants from

Millennium Alliance, which is a collaboration between the Federation of Indian Chambers of Commerce and Industry (FICCI), United States Agency for International Development (USAID), UK Aid Direct and Facebook. It has also received seed funding from angel investors.

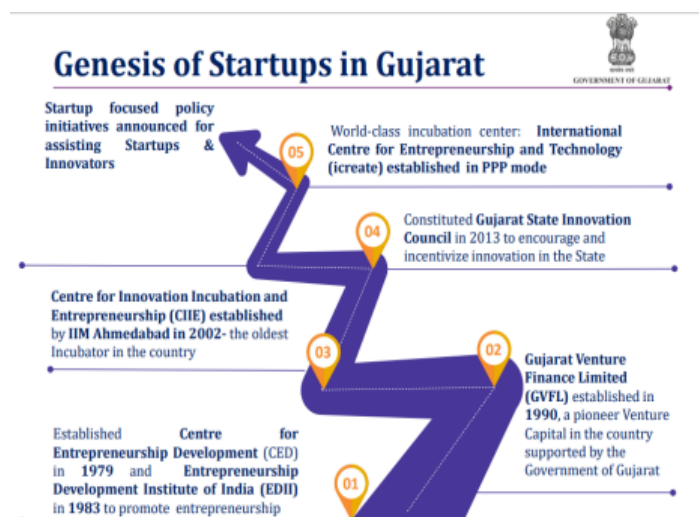
- **Reelo:** Another early-stage startup from Inc42 BIGShift that Parin and Prit jointly built and launched in Nov 2017 at Ahmedabad. Reelo is a loyalty programme platform built to empower small businesses to create their own customer rewards program, helping local stores and shop owners grow their businesses by acquiring new customers and retaining old ones. It is a customer marketing platform for modern retailers to get customers to come back again and again, build a strong brand and increase revenue - all in one place. Starting its operations in 2017, the startup claims to have a presence in 24 cities and more than 1,500 clients.

Reasons for success

In the aftermath of Covid-19, restaurants, salons and other offline retailers are struggling hard to sustain. As the competition for customer's attention increases, it has never been more crucial for retailers to have a 360-degree view of the people who keep them in the business. Most retailers have no knowledge about customers who don't return after their first visit. They wanted to give retail businesses a leg-up against competition that's growing by the day. Reelo helps to make intelligent customer engagement simple, accessible and affordable through a technology-driven and customer-centric approach using simple and effective customer marketing tools.

With customer insights and an easy-to-use system, Reelo solves the problems of complex, and bulky customer management practices by deploying a loyalty marketing system that is both quick, easy-to-use, and affordable. It provides businesses with access to large customer behavioral data, tools, and facilities which were earlier available to bigger competitors only. Reelo is a Canva for intelligent customer engagement that empowers retailers with no marketing or technical skills to increase their sales with smart marketing. To bring customers back more often and spend more on each visit, Reelo pools personalised digital rewards, messaging tools, and automated promotions in an easy-to-use marketing program. Offline businesses in F&B, Beauty & Wellness, Grocery, and Retail are the key sectors where they operate currently.

3. GOVERNMENT POLICIES AND ITS IMPACT ON STARTUP EXPANSION



- The government of Gujarat has been very proactive in its initiatives and measures to help startups grow and scale-up.
 - **The IT and Electronics Policy brought in 2016 has the following objectives:**
 - Facilitate at least 2000 startups through the policy
 - Establish at least 50 incubators in Gujarat
 - Develop 1 Million square feet of incubation space
 - Facilitate investment of \$1 Billion to startups in the state through various private and government funds
- In line with this policy, the Gujarat government claimed to have provided financial assistance of over \$3.2 Million to more than 175 startups in the span of 2016-2018. Still, the goal is a long way away.
- In addition to that, the state implemented the first-ever Student Startup and Innovation Policy in 2017 to promote the young innovators from the state, which seeks to:
 - Convert at least 1% of graduates into job creators
 - Harness 500 student startups in the next five years
 - File at least 1000 patents from universities in the state every year · Support at least 1000 student-led innovations every year
 - Build capacity for at least 200 premier educational institutes in the state
- The **Student Startup and Innovation Policy (SSIP)** devised in 2017 has the following objectives:
 - Build capacity for at least 200 premier educational institutes in Gujarat · Convert at least 1% of graduates into job creators
 - Support at least 1000 student led innovations every year
 - Harness 500 student startups in the next five years

- File at least 1000 patents from universities in Gujarat every year
- Gujarat has an active investor community which consists of various investing organisations, such as the Gujarat Venture Finance Limited (GVFL), the Gujarat Angel Investors Network (GAIN) and individual angel investors.
 - **The GVFL Startup fund** has been extremely beneficial in driving investments in startups in Gujarat. The fund has a target corpus of INR 250 crore (including INR 50 crore green-shoe option). The Government of Gujarat has intended to invest a total of INR 75 crore in the Fund. The investments are made in early growth stage startups with a potential for major growth within an investment horizon of 4-5 years.
 - **Gujarat Biotechnology Venture Fund** was launched in 2005 under the initiative of Gujarat State Biotechnology Mission. The fund identifies startups, early stage and existing companies in areas of Biopharma, Agri-Biotech, Contract Research, Industrial Biotechnology and other potential areas in biotechnology. The fund has invested in four companies and exited from one.
 - **Gujarat IT Fund** was formed in 2000 to promote IT companies present in the state. Profiles of the investee companies range from Pure play Mobile VAS to radio frequency identification products to solar based lighting. The fund has invested into 10 companies and exited from four out of the same.
 - **Gujarat Venture Capital Fund (GVCF 1997)** was launched for the small sector with emphasis on the IT industry. The duration of the fund was 12 years. The fund supported innovative software product-based companies across India. Investments were made in companies ranging from chip designing to telecom-based products. It was liquidated with profits in 2008.
- **Gujarat Science, Technology and Innovation (STI) Policy:**
 - The policy aims to incentivize startups with an aim to evolve solutions to complex issues of the public sector, which otherwise are difficult to implement in the public sector due to lack of adoption opportunities or presence of procedural challenges.
 - A dedicated Innovation Fund has been created under the policy which will cater to the requirements of two schemes – one for supporting research and development and the other for pilot deployment and testing of technologies
- **Gujarat Biotech Policy:** The state has formulated a Bio-technology Policy in order to promote the biotechnology sector in the state and create entrepreneurial opportunities in the same.
 - The policy also aims to encourage research and development of technologies in the field of biotechnology and thereby create a strong intellectual property driven technology base in the state.
 - The incentives under the policy include incentives for Bio-technology Park, biotechnology units and biotechnology incubators

- As part of the 2015 Industrial Policy, the state government has developed a scheme for aiding startups and encouraging innovation.
- With fund allocation of INR 250 crore, it aims to support 2500 startups over a period of 5 years. Under such a scheme, an individual/ group of individuals having an innovative idea or concept and institutions (universities/ education institutions, Incubation centre/ PSUs/ R&D institutions/ private and other establishments) will be eligible for financial support and mentorship.
- Major objectives of this scheme include:
 - Develop entrepreneurial skills in youth by providing mentoring services & incubation facilities
 - Create a favourable ecosystem for startups, innovation and technology transfer
- **Fostering Entrepreneurship through Bootcamps:**
 - The state implemented the first-ever Student Startup and Innovation Policy in 2017 to assist young innovators from the state
 - Through funds received under this policy, the education department of Gujarat conducted 60+ boot camps spread across 33 districts
 - Such entrepreneurship focused programmes enable students to learn crucial life skills such as problem-solving, teamwork, and empathy
 - The boot camps primarily focused on ideation sessions, mentor workshops, pitching sessions and benefits under startup India
 - Special women-focused boot camps were also conducted to inculcate entrepreneurial skills with an aim of strengthening women entrepreneurs in urban and rural areas

Make in India Initiative:

- Aiming at transforming India into a global manufacturing hub, the central government of India launched the Make in India Initiative (MII) in September 2014
- While Modi's Central government has attempted to increase FDI with a host of reform policies, including the Make in India Initiative (MII), state governments have also adopted many reform measures to enhance their business and investment environments.
- Gujarat is an industrial powerhouse in West India, also known as the 'Petrol Capital of India' and an automobile manufacturing hub. The state government envisions turning Gujarat into a globally competitive and innovative industrial destination, which promotes inclusive growth, sustainable development and skilled employment.
- Some of these industries comprise many labour-intensive business units operated by Micro, Small and Medium Enterprises (MSMEs), which are eligible for state government support schemes and incentives. In fact, assistance to MSMEs in

Gujarat is manifold, including Interest Subsidy, Technology Acquisition Fund, Market Development Support, Cluster Development, and Support for Ancillary and Vendor Development, with the purpose of encouraging MSEs to expand and diversify.

4. SMART SUPPLY CHAINS – EXISTING & REMEDIAL MEASURES TO CONVERT SMARTER

- A policy framework for SEZs (Special Economic Zones) with duty-free imports can give India the benefit of creating a parallel ecosystem for success in manufacturing and becoming a part of global supply chains.
- The SEZs have delivered good results in IT-related services but results in manufacturing have been modest. A major reason for this has been that the development of SEZs was the responsibility of the private sector.
- Making a smarter supply chain through technology.
- Enhancing real-time Supply Chain Visibility
- Logistics and supply chain companies cannot dismiss the idea of integrating forward-looking supply chain visibility (SCV) solutions into their proceedings. The introduction of new-age technologies like Radio Frequency Identification (RFID) that complement barcode technology makes it easier to follow products in real-time.
- Simultaneously, it also provides accurate and detailed information at any given point during the movement of goods in the supply chain. Additionally, several modernistic SCV startups are using fast-track response to change by enabling companies to use real-time data like traffic congestion, weather conditions, state of the roads, and ports. Through this data, the companies can then take necessary actions such as optimising routes and redirecting supply.
- IoT devices on goods and products allow logistics companies to effectively track vehicles, inventory, and equipment. Furthermore, IoT sensors also play an essential role in monitoring shipments, thereby enhancing supply chain efficiency and visibility. In this context, many Small Medium Enterprises (SMEs) and even industry giants in the logistics sector have started collaborating with dedicated IoT startups that offer hassle-free and seamless supply chain visibility.

Leveraging Artificial and Augmented Intelligence

- From smart transportation to intelligent route planning and demand management, AI has emerged as an instrumental part of the supply chain and logistics industry. Industry experts have forecasted that these advancements will reach unprecedented heights over the next few years and benefit supply chain stakeholders such as shippers, suppliers, carriers, and end-consumers.

- The technology is already bringing pioneering changes like predictive optimization, automated warehouse picking systems, and long-term sustainable solutions. Combined with AI, Augmented Intelligence is also expected to lead to human intelligence like the comprehensive experience of supply chain planners, responsibility, flexibility, and devotion to customers in the mix to fortify the entire process further. This integration will automatically reduce labour intensity, save time and cost and get the job done faster. Going beyond a handful of industries with Supply Chain 4.0
- Assisting more than a handful of niche industries, the fourth industrial revolution is rapidly growing in the supply chain and logistics sector. Not just the Fast Moving Consumer Goods (FMCG) industry but almost every minor or major sector such as pharmaceuticals, groceries, and automotive apparel are using supply chains today and paving the path towards Supply Chain 4.0.
- As per a report, with technological advancements, the supply chain model has transformed from a linear to a more integrated one where information flows in an omnidirectional manner. This improves the efficiency of the e-commerce sector and assists brick and mortar stores more seamlessly than ever. The idea is to depend on a reliable, accurate, and trustworthy process that caters to the needs of modern-day companies, right from manufacturing to transportation and distribution.

Skill Development:

- A recurring obstacle in the refurbishment of the manufacturing and logistics sector appears to be the insufficiency of skilled workers. To this end, the Centre for Product Design and Manufacturing (CPDM) at the Indian Institute of Science, along with Talent Sprint, has furthermore introduced a PG-level advanced certification program in digital manufacturing and smart factories.
- The program will aid management and small factory strategy professionals, along with IoT, FMCG, and automotive aerospace pharma and energy industry aspirants.

Digital Transformation:

- FedEx said there is a need to make the global supply chain smarter and more resilient through digital transformation.
- FedEx President and Chief Operating Officer Raj Subramaniam said, "Implementing the latest in AI and cloud computing, we are starting to realising our potential. With the ability to predict where the goods need to be, the new insights or how to get them there, we may be able to move away from this just in time to the right time, right place with right solution".
- The Indian government has made clear its ambitious goals to be a manufacturing centre not just for the domestic market but for the global market as well,

Subramaniam said and emphasised that manufacturing and logistics go hand-in-hand.

5. IMPACT OF INDUSTRY 5.0

Opportunities of Industry 5.0

- Increased automation will impact employment positively in many sectors through the deployment of next-generation technology.
- Highly automated manufacturing systems provide greater opportunity for customization to customers.
- Industry 5.0 provides greater opportunities for creative people to come and work which enables the optimization of human efficiency.
- Machines are versatile according to employee needs to create a high-level choice and industry 5.0 will help the client digitally in managing repeated follow-up assignments.
- Industry 5.0 creates higher-value employment than before because this gives back the liberty to people to be responsible for construction.
- In industry 5.0, the operator within the production cell gets more engaged in the planning method than in the more or less automated manufacturing method.
- It allows liberty of design to function and allows more tailor-made and personal products.
- It enables the automation of manufacturing methods better with Industry 5.0 by feeding the real-time information from the sector.
- More personalised products and services increase customer satisfaction, loyalty and attract new customers which results in increased profit and market share for the companies.
- It provides great opportunities to start-ups and entrepreneurs in creative and innovative spheres to come up with new products and services allied to industry 5.0 provided adequate funding and infrastructure is available.
- Industry 5.0 provides increased importance to the human-machine interaction subject field and offers a larger platform for research and development in this domain.
- Quality services can be provided at remote locations with the help of industry 5.0 especially in the healthcare industry such as medical surgeries in rural areas by robots.

Bringing 'human' to technology

- Essentially, the idea of Industry 5.0 builds upon what we already know and believe to be the future of business and the world at large, driven largely by advanced

technology tools. Embracing this transformation as we encourage the Make in India initiative in the healthcare sector, can be a key stepping-stone to India being a healthcare innovation hub.

- While we are reaping the benefits of current and emerging technology such as AI and machine learning to make our processes more efficient, our urban and rural infrastructure more user-centric, or make our energy use more sustainable, this needs to be balanced by the human touch.
- It would also simultaneously generate employment of a skilled workforce as more health workers would be able to focus on diagnosis and treatment, with technology to rely on for detection. This gives the industry the best of both worlds, where the precision and efficiency benefits of technology will combine with the cognitive abilities that humans are endowed with, such as creative skills and critical thinking.

Make in India: The Gujarat Production Base Opportunity

- Gujarat is among the top five Indian states in terms of gross state domestic product (GSDP) at constant prices, accounting for about 8% of India's GDP. As a relatively well-developed Indian state, Gujarat's per capita income is some 40% higher than the national average.
- According to India's latest Annual Survey of Industries, Gujarat contributes about 18% of the country's value of industrial output. Major manufacturing sectors in Gujarat include petroleum products, chemicals, engineering, automobile and auto parts, textiles and garments, gems and jewellery, and pharmaceuticals.
- If Gujarat were to be treated as a country, it would have a population similar to Thailand's, trailing behind alternative production base competitors including Indonesia, the Philippines and Vietnam in ASEAN, but ahead of countries like Myanmar, Malaysia and Cambodia. With about half of its population aged 15-40, Gujarat has a good supply of young manufacturing workers.
- Gujarat has been a frontrunner in implementing economic reforms in India, with Prime Minister Modi trying to emulate the Gujarat governance model at the national level.
- Gujarat offers a favourable environment for Hong Kong manufacturers to relocate labour-intensive factories. Aside from ranking top among Indian states in the World Bank's EODB (Ease of Doing Business) survey, the Gujarat government's promotion of textiles and electronics manufacturing should be welcomed by Hong Kong manufacturers.
- The State's improving infrastructure is another advantage for those seeking an alternative production base in India. Since India is a large country with huge diversity across states, the forthcoming articles will introduce other states and assess their potential as alternative production bases.

Putting Industry 5.0 to use


- Applications of Industry 5.0 could grow as the understanding of its scope and capabilities increases. For instance, we could see 3D imaging systems mounted on an automated guided vehicle to take patient images during minimally invasive surgical interventions, where time is crucial.
- Such a technology is a perfect balance between human and machine labour that is helping save lives with intelligent imaging technology made in India.

Challenges of Industry 5.0

- This trend increases work polarisation where middle-skill employment is decreasing and the workforce is split into two communities: extremely trained and qualified; low-paid and unqualified employees. This may alleviate the skilled and unskilled divide in the society.
- Due to highly automated manufacturing systems, skill development is a humongous task such as training workforce for adoption of advanced and cutting edge technologies, and inducing behavioural change for interacting with.
- Collaborative robotics is the method of automation, which together with human co-workers also stays an important danger on the shop floor.
- Smart manufacturing systems demand higher autonomy and sociality capabilities as key factors of self-organised systems. The shift from present context to industry 5.0 is difficult due to lack of autonomy in the present systems such as integrated decision making.
- From manufacturing systems, it is difficult to acquire high quality and integrity of the data and it is difficult to accommodate diverse data repositories.
- There is an increased cyber security threat in critical industrial systems and manufacturing lines at industry 5.0 due to its increased connectivity and use of standard communications protocols.

The Big picture

- This industrial revolution relates to human-machine interaction to make jobs easier and quicker. Industry 5.0 brings the personalization idea to the next stage. Industry 5.0 is the realisation of optimal integration of big data, Artificial Intelligence, internet of things (IoT), cloud computing, COBOTs, innovation and creativity.
- Industry 5.0 is expected to create higher-value employment with larger freedom for design thinking and creativity. It helps to improve the productivity of labour and greater opportunity for customization to customers.
- On the flip side, due to highly automated manufacturing systems, skill development for the workforce is a humongous task.

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- There is an increased cyber security threat in critical industrial systems and manufacturing lines at industry 5.0 due to its increased connectivity and use of standard communications protocols. Even though industry 5.0 provides greater autonomy to robots, important and moral based decision making is vested with humans.
 - Overall, industry 5.0 is expected to revolutionise the production systems and process by allowing larger collaboration between humans and robots in providing tailored products to customers.
 - India is aspiring to become a manufacturing hub through initiatives such as Make in India, Skill India and Start-up India. Industry 5.0 has great potential to integrate with these programmes and initiatives in making India the forerunner in smart and collaborative manufacturing systems.