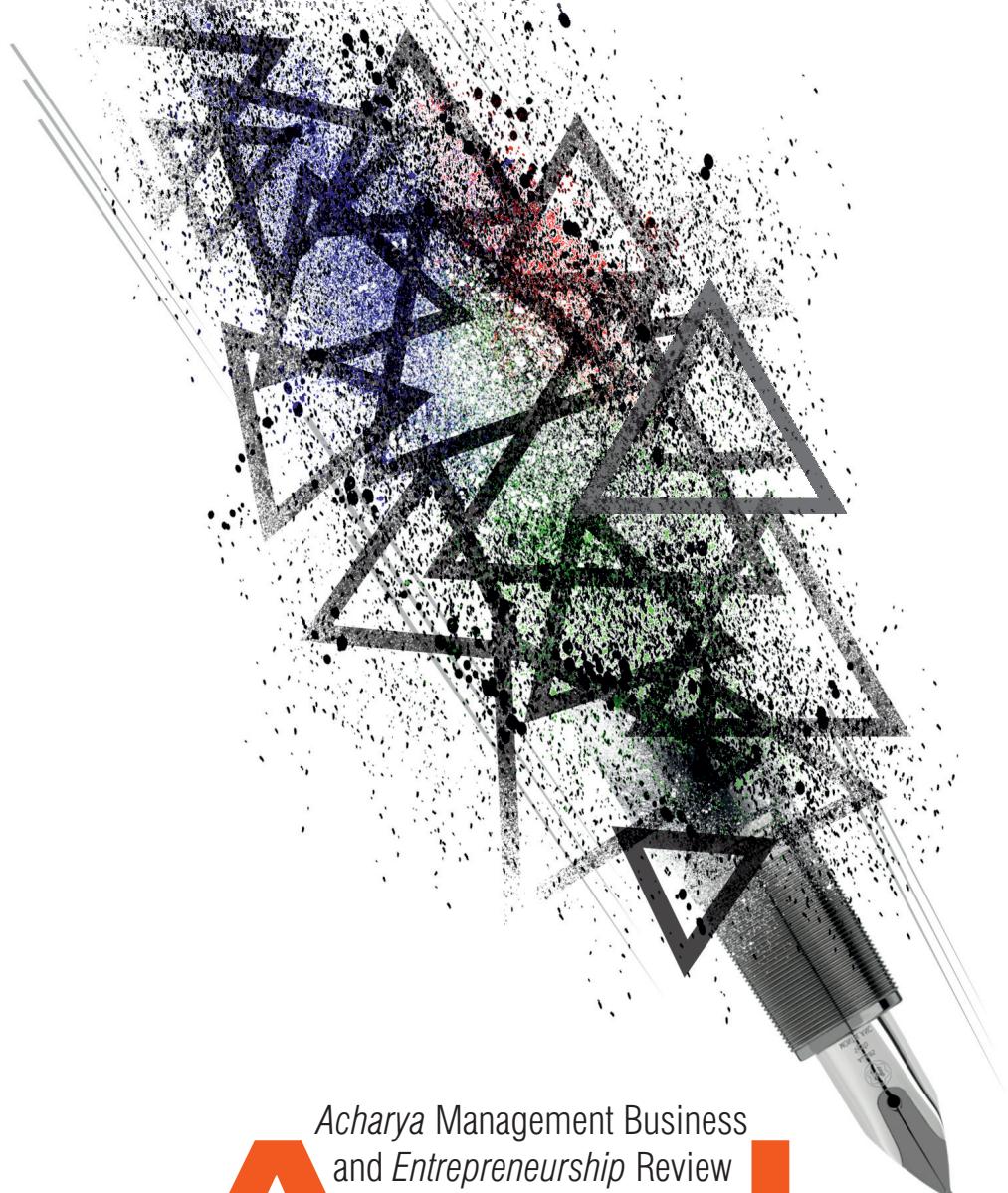




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# AMBER

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# Editorial

**Dear Readers,**

AMBER, an ABBS platform to create and disseminate knowledge has taken 'Digital Supply Chain' as theme of this issue. Supply chain is crucial for every organization and to country as a whole. In addition to improved infrastructure, digitization is another means to make the supply chain and logistics segment more efficient and effective. I thank Prof. C. Sengottuvelu, who is Editor of this issue for his commitment and devotion in bringing out this issue during these hard times. I also thank all the contributors of this issue.

The theme of the next issue of AMBER (Volume 12, Issue 2) is '**India-Africa Business Opportunities**'. Historically, India and Africa have long standing relationship. Indian interest and investment in Africa have become very visible and are on the rise. In the same way, many African countries are aggressive on having trade relationship with India. There is 'level playing field' in our relationships in many ways. If India and Africa works together, there is win-win situation for both these great civilizations, and to the world. In the past five years, more than 85 Acquisitions and Equity Investments were made by Indian companies in Africa for an investment of over USD16 billion plus in highly varied sectors ranging from telecom, agriculture, energy, consumer goods, cement, textiles, etc. Africa is known as the land of untapped potential. It has incredible natural resources like oil, gas, gold, iron ore, manganese, uranium, diamonds, wildlife etc. apart from great human resource. It also has countless opportunities for infrastructural development. India, a democratic country has proven talent in IT, medicine and other service sectors. India's vast market of 1300 million population is another great attraction. Hence large, medium and small enterprises which need a presence are strategizing aggressive business plans, at both sides.

I invite the articles on this broad theme for the next issue of AMBER.

Wish you useful reading.

**Dr.H.R.Venkatesha**  
Director & AMBER- Chief Editor  
Acharya Bangalore B School

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# Internet of Things and Technology Improvement

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## Abstract

The Internet of Things (IoT) could be a modern model that has turned the usual way of breathing into a high-tech type of breathing. Thanks to IoT, those alterations are smart cities, smart houses, effluence power, energy saving, smart transport and smart factories. Loads of critical experiments and investigations are washed out in order to improve the IoT technology. Nevertheless, there are still plenty of obstacles and questions that need to be tackled to grasp the wide-ranging latent IoT. These studies and questions must be examined from different facets of IoT, such as demands, concerns, licensing information, social and conservation effects, etc. The key purpose of this assessment is to include an in-depth discussion from a collected scientific and social point of view. The paper explores modified trials and core IoT, construction and important request domains issues. This paper also brings the prevalent literature to light and illustrates their contribution to many facets of IoT. In addition, the relevance of large data and its interpretation in relation to IoT has been presented. This text will enable students and scholars to understand the IoT and its applicability to the world of interest.

**Keywords:** Internet, Technologies, Applications, Smart cities, Industrial sectors, Health sector, Security.

## 1. Introduction

The Internet of Things (IoT) is an evolving concept that uses the internet to interact with electronic networks and devices in order to make our lives better. In order to provide ground-breaking clarifications on various competitions and issues relevant to a wide range of industries, governmental and public/private organizations around the world, IoT uses smart plans and the Internet. IoT is gradually becoming a significant feature of our lives and can be uniformly observed throughout our lives. Moreover, quantum and nanotechnology benefit from quantum and nanotechnology as regards its stocking, detecting and dispensing speeds, unprecedented before thorough studies of technological know-how, online press stories and the Wi-fi system had been carried out and made available. This is understandable because this will be the first piece of writing coming out anytime someone feels like making new business plans. In our everyday tasks, improvements are continually taking place amid the increasing presence of internet linked artifacts such as IoT devices and technologies. Smart Home Systems (SHS) and technologies including internet-based devices, household mechanization and powerful energy running systems are also a major IoT achievement. Smart wellness system regulates one's body and health. Thus these systems are also used to diagnose and monitor different health conditions in the fitness centre, etc. Through involving robotics and

smart devices, healthcare system is modified completely. With the assistance of IoT innovators and experts, consumers with disabilities and elderly can survive. The great popularity of IoT has an influence on outdated life of poor people. With low expansion costs and easy use, the product is extremely affordable to most. They are getting old because of the Internet of Things. The transport system is another vital aspect of our lives. IoT has become a lot more effective, helpful and continuous in usage. Intelligent sensors, hum techniques are now tracking the circulation of electrical signals through large metropolitan communities. Buses are becoming a common mode of transportation for residents in big cities. In this way they can avoid becoming dangerously trapped in traffic jams. The Internet of Things can impact various facets of life and knowledge. We should have a great deal of diversity in technology by working with various leaders, and also by creating an easy to use interface for the consumers.

### 1.1. IoT Architecture and Technologies

The IoT architecture uses five layers from top to bottom that describe all components of IoT systems. The layers are the relevant layer, the network layer, the middleware layer, the device layer and the market layer. At the bottom of the IoT building there is a layer of awareness composed of physical equipment such as sensors, RFID chips, bar code, and other physical substances linked to the IoT network. Those methods are used to capture information to transport it to the layer of the network. The network layer acts as a tool to move data to the information processing structure from the knowledge layer. About any wired/wireless intermediate interval can be made available in this database, aside from 3G/4G, Wi-Fi, Bluetooth etc. The next step is known as the layer of middleware. The ultimate function of this layer is to process network-level information and make decisions endorsing the results of omnipresent computation. First of all, this stored data is used via the request layer for international device control. There is a business layer at the top of the architecture, which

controls the general IoT framework, its requirements and services. In order to further elaborate future instructions and plans, the business layer visualizes the information and data gathered from the application layer. In addition, the application and implementation domains of the IoT architectures are also modified. The IoT framework consists of a number of functional components, in addition to the layered architecture, that support various IoT operations, such as sensing, authentication and recognition, control and management.

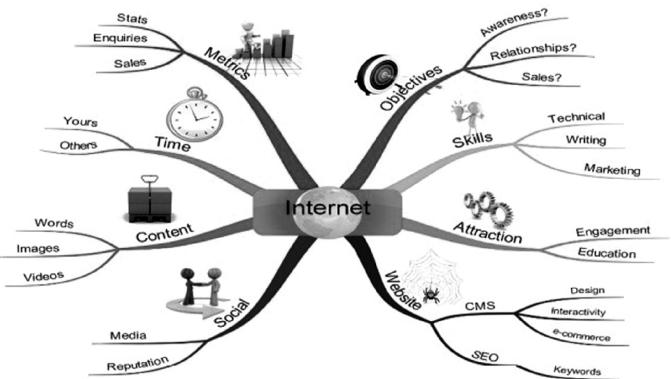


Figure 1: Internet of Things.

### 1.2. Potential Application domains of IoT

Potential Internet of Things technologies are not only popular, but also rather miscellaneous, since they infuse individuals, organizations, and culture into nearly all facets of everyday life. IoT demands span a wide variety of sectors, including manufacturing, fitness, smart cities, defense and many others.

### 1.3. Industrial Sector in India

The patterns of presentations by industrial sectors are mainly traced by the Industrial Productions Index (IIP) and the Annual Industries Survey (ASI), which provide insights on the complexity of the non-organized sector while market surveys of economic censuses provide an overview. The Ministry of Statistics and PI supports the Industrial Statistics in India through the active involvement of the Central Statistics Office, and the National Sample Survey Office.(Department of Industrial Policy & Promotion, Ministry of Commerce & Industry, Ministry of Micro Small & Medium

Enterprises, Ministry of Corporate Affairs, Indian Bureau of Mines, Office of Mines, Office of Textile Officer, Coffee/Tea Boards etc., maintain their own statistics).

#### 1.4. Recent performance of Industrial Sector

The manufacturing, mining, energy and construction industries showed remarkable recovery and steady expansion for three years, but subsequently lost traction due to combination of supply-side and demand-side constraints. The latest measures deriving from the recent update of the Central Statistical Bureau's estimates of the value indicated, however, that the growth resumption started in 2013-14 and continued in 2014-15. It is a decisive factor of India's improved prospects in 2011-2012 and 2012-2013 that the budget is largely removed from vulnerabilities linked to the economic downturn, sustained inflation, high fiscal deficit, drop in domestic demand, external account disparities and the oscillated rupee value. The steep decline in oil prices has also contributed to influences. But sluggish global demand in particular in Europe and updated China has partially contributed to the poor performance of foreign jobs; however, this declining pressure was rewarded by strong domestic demand, which held up the growth momentum.

#### 2. Smart Cities

According to the IoT, the smartness of cities and appealing general organization play a major role in developing them. In the development of smart cities, a range of IoT implementation fields include: intelligent mobility networks, smart construction, waste management of traffic congestion, smart lighting, smart space, and current maps. This may include related features such as: nursing accessible spaces within the city, nursing sounds as well as material conditions in bridges and houses, repairing home sound treatment systems in vulnerable areas of communities, as well as nursing the number of walkers and cars. The IoT allowed by Artificial Intelligence (AI) is also used to track, manage and reduce traffic congestion in Smart Cities. In comparison, IoT enables brainy and climate-adaptive street lighting to be

entered and compost and waste vessels to be discovered by holding track on refuse disposal timetables, material, such as entry to climate-related diversions or unwanted events such as road delays and collisions.



Figure 2: Smart City

#### 3. Healthcare

In the healthcare industry, many of the advantages provided by the IoT programme are most classified into monitoring, classifying, as well as verifying, persons, and automated data collection and recognition of patients, workers, and drugs. Once patient flow is monitored, hospital workflow will knowingly increase efficiency. In comparison, confirmation and recording eliminate events that can be detrimental to patients, preservation of records, and fewer incidents of mismatched babies. In addition, involuntary gathering and transfer of data is essential in workflow mechanization, elimination of deadlines for form processing, automatic procedure auditing,

as well as management of medical inventory. Sensor plans permit senses is centered on patients, primarily in assessing symptoms and using real-time data on health sticks of patients

The Internet of Things (IoT) and Internet of Everything (IoE) proposals are further developed with the creation of the Internet of Nano-things (IoNT). As the name suggests, the principle of IoNT is plotted by incorporating Nano-sensors using Nano networks into different objects (things). One of the primary focus areas of IoNT activities is medical applications. For treatment drives, the application of IoNT in the human body shortens access to data because in situ areas of the body that were historically accessible from or through diagnostic instruments unified with a cumbersome sensor scale are possible. IoNT would therefore encourage the compilation of new medicinal data, leading to new discoveries and improved diagnostics.

#### 4. Status of Big Data Analytics in IoT

An IoT framework encompasses of an immense number of computers and sensors that interacts with one another. The number of such instruments and equipment is growing increasingly with the general development and extension of the IoT network. Such techniques are linked to each other and move a large amount of internet information. This information is incredibly massive and runs through each other and is thus capable of being named as big data. Incessant development of IoT-based networks produces compound problems such as information management and gathering, storage and analysis and analytics. This outline is capable of folding the details from the plans installed inside the systems and doing choice-making data analytics. In addition, industrial efficiency is also enhanced by an IoT-based cyber-physical infrastructure fitted with information processing and techniques for acquiring expertise. With clever towns, traffic jam is a critical problem. IoT detectors and sensors mounted in traffic signals can capture real-time traffic data and this data is repeatedly processed in an IoT-based traffic running system. The IoT sensors

used by patients produce lots of data similar to each other's health status in healthcare research. This vast volume of data must be combined in one database and must be analyzed in real time in order to require quick, highly precise decisions and broad data expertise is the best approach for this mission. IoT will also help to rework the usual methods found in industrial sectors into the new one, along with big data analytics. The sensing devices produce data that can be processed using big data techniques which should assist in different tasks of decision-making. Using cloud storage and analytics will also benefit energy development and management with lower costs and consumer usage IoT devices produce a massive volume of gushing data that needs to be successfully processed and needs further processing in real time for decision making. Deep learning is highly successful in influencing such enormous data and can have highly precise interpretations, so it is incredibly important to build IoT, Big Data Analytics and Deep Learning together.

#### 5. Research Challenges

For all of the above future IoT demands, there must be a reasonable probability in the different fields to assess the achievement and functionality of such statements. IoT has its problems and consequences, as like any other type of technology or invention, the responsibility is worked out to allow mass adoption. While the latest IoT permitting capabilities have advanced dramatically in recent years, there are still several problems that demand consideration, opening the way for new aspects of study to be undertaken. Because the idea of IoT derives from heterogeneous technology used in data sensing, aggregation, action, distribution, inference, dissemination, notification, management, and storage, there are several research problems that are bound to occur. As a result, these research issues that demand attention have spanned multiple research areas

#### 6. Conclusion

Latest progress in IoT is attracted worldwide by researchers and developers. IoT designers and researchers are serenely employed to expand science

to a broad scale and to promote humanity at the greatest possible level. Meeting the numerous challenges and limits of the latest technological processes, though, will only allow for improvements. In this survey paper, the researcher addressed numerous issues and obstacles that IoT developers should take into account to create a better model. Often relevant IoT technology fields are also dealt with where IoT developers and experts are interested. IoT offers a massive amount of information as well as providing resources. The value of big data analytics, which can make reliable choices to build an optimized IoT framework, is therefore very often taken into account. In order to further improve and run the IoT, it can better be defined as a CAS (Complex Adaptive System) that will evolve with the inclusion of new and creative types of software engineering, system engineering, project managing and many other disciplines. IoT's areas of application are very diverse to support several customers with different requirements. The app is represented by three consumers, human, cultural, social and organizational groups. As discussed in the implementation section of this research document, IoT has undeniably an enormous potential to be a massive disruptive force and to some extent already would be positively affecting millions of lives worldwide. More and more research tests will lead to new aspects for IoT processes, the technological features and the interconnected artifacts which will pave the way for more IoT device features.

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# Transforming Futuristic Technology Enabled Supply Chain 4.0 – The Next Industrial Revolution

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## Abstract

Around the world, traditional manufacturing industry is in the throes of a digital transformation that is accelerated by exponentially growing technologies (e.g. **intelligent robots, autonomous drones, sensors, 3D printing**). Disruptive **innovations** are currently changing the landscape of many industries and their business models. Because of increasingly **digitalized processes** and an exponential growth of sensible data, supply chains are also impacted by the **fourth industrial revolution**. Behind the scenes of the world's leading industrial companies, a profound **digital transformation** is now underway. Industrial leaders are digitizing essential functions and processes. They are enhancing their product portfolio with digital functionalities and are investing in data analytics as a foundational capability to drive innovation and significant improvements in efficiency. In India as well, we see industrial companies planning to dramatically increase their overall level of digitization. Choosing a path through the **Futuristic Technology Enabled Supply Chain 4.0** – The Next Industrial Revolution

**Supply Chain 4.0** technologies that Industry 4.0 offers is hard enough, but with uncertainties generated by the **pandemic COVID-19**, perhaps the universe of viable options has become smaller and more manageable, and the business cases clearer. The term '**Industry 4.0**' stands for the **fourth industrial**

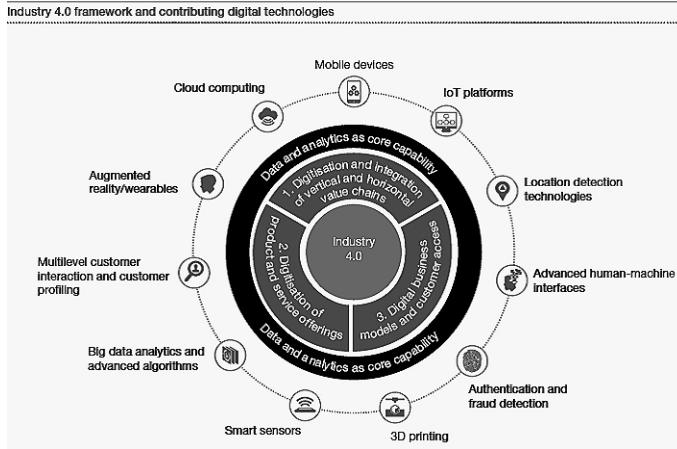


**3D printing**). Disruptive **innovations** are currently changing the landscape of many industries and their business models. Because of increasingly **digitalized processes** and an exponential growth of sensible data, supply chains are also impacted by the **fourth industrial revolution**. Behind the scenes of the world's leading industrial companies, a profound **digital transformation** is now underway. Industrial leaders are digitizing essential functions and processes. They are enhancing their product portfolio with digital functionalities and are investing in data analytics as a foundational capability to drive innovation and significant improvements in efficiency. In India as well, we see industrial companies planning to dramatically increase their overall level of digitization. Choosing a path through the **Futuristic Technology Enabled Supply Chain 4.0** – The Next Industrial Revolution

**revolution**. Other related terms include '**Industrial Internet**' or '**digital factory**', although neither takes as complete a view. While **Industry 3.0** focused on the automation of single machines and processes, Industry 4.0 concentrates on the end-to-end **digitization** of all physical assets and their integration into digital ecosystems with value chain partners. Generating, analyzing and communicating data seamlessly underpin the gains promised by Industry 4.0, which networks a wide range of new technologies to create value. The present paper provides a brief overview of exploring **opportunities and challenges** encountered by the **Futuristic Technology Enabled Supply Chain 4.0**.

**Keywords:** Industry 4.0, Supply Chain, Organizational Change, Innovation

Figure 1: Industry 4.0 Framework



## Introduction

**Technology in Supply Chain :** Around the world, traditional manufacturing industry is in the throes of a digital transformation that is accelerated by exponentially growing technologies (e.g. **Artificial intelligent (AI)**, **Augmented Reality(AR)**, **autonomous drones**, **Block chain**, **sensors**, **3D printing**, **Internet of Things (IoT)** **Internet of Everything (IoE)** **Vertical Reality (VR)**, **Robots**,



Figure 2: Industry 4.0 framework and contributing digital technologies

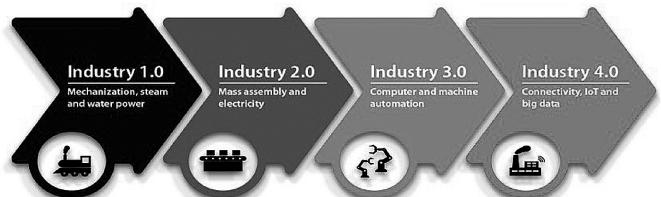
Behind the scenes of the world's leading industrial companies, a profound **digital transformation** is now underway. Industrial leaders are digitizing essential functions and processes. They are enhancing their product portfolio with digital functionalities and are investing in data analytics as a foundational capability to drive innovation and significant improvements in efficiency. *In India as well, we see industrial companies planning to dramatically increase their overall level of digitization.*

The term '**Industry 4.0**' stands for the **fourth industrial revolution**. Other related terms include '**industrial Internet**' or '**digital factory**', although neither takes as complete a view. While **Industry 3.0** focused on the automation of single machines and processes, Industry 4.0 concentrates on the end-to-end **digitization** all physical assets and their integration into digital ecosystems with value chain partners. Generating, analyzing and communicating data seamlessly underpin the gains omitted by Industry 4.0, which networks a wide range of new technologies to create value.

### 1. What is Industry 4.0?

"The question arises with industry 4.0 of whether it is an evolution or a revolution."

The concept of industry 4.0 is widely used across Europe, particularly in Germany's manufacturing sector. In the United States and the English-speaking world more generally, some commentators also use the terms the 'internet of things', the 'internet of everything' or the '**industrial internet**'.

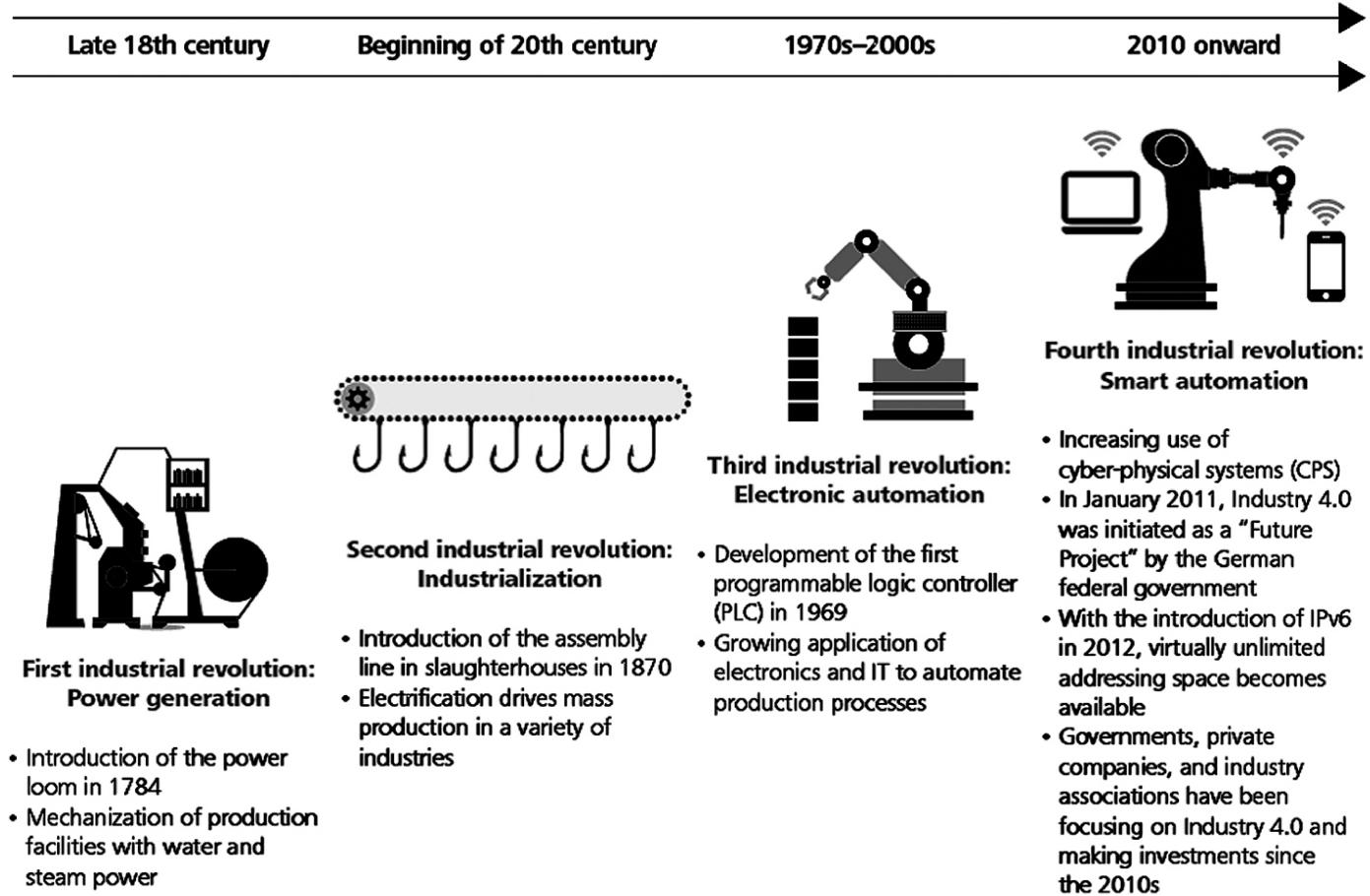


What all these terms and concepts have in common is the recognition that traditional manufacturing and production methods are in the throes of a digital transformation. For some time now, industrial processes have increasingly embraced modern information technology (IT), but the most recent trends go beyond simply the automation of production that has, since the early 1970s, been driven by developments in electronics and IT ( Chart 1).

## 2. Industry 4.0

Industry 4.0 is the current trend of **automation** and data exchange in manufacturing technologies. It includes **cyber-physical systems**, the **Internet of things** and **cloud computing**. Industry 4.0 creates what has been called a "smart factory". Within the modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real time, and via the Internet of Services, both internal and cross-organizational services are offered and used by participants of the **value chain**

**Figure 3. A history of industrial revolutions: Industry evolution with key developments.**



Sources: Germany Trade & Invest, "INDUSTRIE 4.0—Smart manufacturing for the future," July 1, 2014; National Academy of Science and Engineering, "Securing the future of German manufacturing industry: Recommendations for implementing the strategic initiative Industry 4.0," April 2013; Deloitte analysis.

Graphic: Deloitte University Press | DUPress.com

While terms like industrial ***Internet and digital factory*** are also used to describe these changes, here, we use ***Industry 4.0*** to describe the *journey industrial companies taking towards a complete value chain transformation*. At the end of this transformation process, successful industrial companies will become true digital enterprises, with physical products at the core, *augmented by digital interfaces and data-based, innovative services*. These digital enterprises will work together with customers and suppliers in industrial digital ecosystems. These developments will fundamentally change individual companies as well as transform market dynamics across a whole range of industries. And that is true in countries all around the world—in both developed and emerging markets.

Connected manufacturing as Industry 4.0, several other commonly known terms may point to the same phenomenon. These include:

- *Industrial Internet*
- *Connected Enterprise*
- *SMART Manufacturing*
- *Smart Factory*
- *Manufacturing 4.0*
- *Internet of Everything*
- *Internet of Things for Manufacturing*

The term “Industry 4.0” originates from a project in the high-tech strategy of the ***German government***, which promotes the ***computerization*** of manufacturing.

### Design principles

There are 4 design principles in Industry 4.0. These principles support companies in identifying and implementing Industry 4.0 scenarios.

- i. **Interoperability:** *The ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things (IoT) or the Internet of People (IoP).*
- ii. **Information transparency:** *The ability of information systems to create a virtual copy of the physical world by enriching digital plant models with sensor data. This requires the aggregation of raw sensor data to higher-value context information.*
- iii. **Technical Assistance:** First, the ability of assistance systems to support humans by aggregating and visualizing information comprehensibly for making informed decisions and solving urgent problems on short notice. Second, the ability of cyber physical systems to physically support humans by conducting a range of tasks those are unpleasant, too exhausting, or unsafe for their human co-workers.

**Decentralized decisions:** The ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomously as possible. Only in the case of exceptions, interferences, or conflicting goals, are tasks delegated to a higher level.



### 3. Challenges

**Table 1 : Industry 4.0 Key business objectives, organizes**

 <b>BUSINESS OPERATIONS</b>	Productivity improvements	<ul style="list-style-type: none"> <li>Maximizing asset utilization and minimizing downtime</li> <li>Driving direct and indirect labor efficiency</li> <li>Managing supply network costs and synchronization</li> <li>Ensuring schedule and plan stability and accuracy</li> </ul>
	Risk reduction	<ul style="list-style-type: none"> <li>Ensuring raw material price and availability</li> <li>Managing warranty and recalls effectively</li> <li>Mitigating geographic risks</li> </ul>
 <b>BUSINESS GROWTH</b>	Incremental revenue	<ul style="list-style-type: none"> <li>Finding sources of growth for the core business</li> <li>Growing aftermarket revenue streams</li> <li>Deepening customer understanding and insights</li> <li>Strengthening customer integration and channels</li> </ul>
	New revenue	<ul style="list-style-type: none"> <li>Creating new products and service offerings</li> <li>Expanding internationally and in emerging markets</li> <li>Identifying attractive M&amp;A opportunities</li> </ul>

Challenges which have been identified include

- i. IT security issues, which are greatly aggravated by the inherent need to open up those previously closed production shops
- ii. Reliability and stability needed for critical machine-to-machine communication (M2M), including very short and stable latency times
- iii. Need to maintain the integrity of production processes
- iv. Need to avoid any IT snags, as those would cause expensive production outages
- v. Need to protect industrial knowhow (contained also in the control files for the industrial automation gear)
- vi. Lack of adequate skill-sets to expedite the march towards fourth industrial revolution
- vii. Threat of redundancy of the corporate IT department
- viii. General reluctance to change by stakeholders

- ix. loss of many jobs to automatic processes and IT-controlled processes, especially for lower educated parts of society

### 4. Impact of Industry 4.0

Digital Supply Chain  
Where Virtual and Physical Converge



Digital Supply Chain

Proponents of the term claim Industry 4.0 will affect many areas, most notably:

- i. Services and business models
- ii. Reliability and continuous productivity
- iii. IT security
- iv. Machine safety
- v. Product lifecycles
- vi. Industry value chain
- vii. Workers' education and skills
- viii. Socio-economic factors

1. Industry Demonstration: To help industry understand the impact of Industry 4.0, Cincinnati Mayor John Cranley, signed a proclamation to state "Cincinnati to be Industry 4.0 Demonstration City".
2. An article published in February 2016 suggests that Industry 4.0 may have beneficial effects for emerging economies such as India.

## 5. Addressing today's challenges

- i. **Go beyond just data, generate insights** – Use data analytics to understand customers, market trends, track usage patterns, predict failures etc.
- ii. **Improve, standardize, and automate:** processes to reduce internal cost to serve
- iii. **Contract effectively** to get best value and manage risk in the changing digital landscape
- iv. **Embrace technology to support business** e.g. application of sensors, drones, machine learning, 3D printing etc.
- v. **Develop right skills internally and explore partnerships** to meet new digital needs

## 6. What can you do to prepare for the future?

Behind the great potential of the ***digital supply chain (DSC) lays Industry 4.0***, the fourth industrial revolution. A transformation in production and automation was brought on first by steam and water power (Industry 1.0), then by electrification (2.0), and more recently by the digital computer (3.0). Industry 4.0, digitization, is about companies orienting themselves to the customer through e-commerce, digital marketing, social media, and the customer experience.



Digital ubiquity is also causing companies to completely rethink how they go about operations. Operations are often mistakenly viewed as "manufacturing," but operations are what gives a company its ability to act. As with every other aspect of a company, digital technology is enabling completely new operating models.

## 7. Conclusion

In this work on Industry 4.0 two methodological approaches have been used to explore the impact on the procurement function. A scope of study was used to better understand Industry 4.0 while in-depth explorative interviews with seven procurement managers should reveal insights from practice. Of course this study is limited with regards to the number of participants in the explorative survey. However, the conceptual findings and empirical insights support the conceptual differentiation of "Procurement 4.0" from previous maturity levels of technology use in procurement. The observations have been collected in form of six fundamental observations. *Obviously, Procurement 4.0 must support superior Industry 4.0 strategies of the company.* In this role it shall assure the dynamic cooperation across organizations borders

and the achievement of a collaboration productivity rent, while safeguarding the companies risk exposure within the Industry 4.0 supply chain. However, research on the topic is still in its infancy, while practice signaled a high demand for explanatory knowledge. More conceptual and empirical work is needed to better understand the effects of Industry 4.0 on procurement in detail. With these considerations in mind, this work is an initial exploration of the phenomenon and further observations need to be taken.

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# Perceptiveness on the Enhanced Cold Storage Facilities

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## Abstract

*There are tremendous changes in the demand of varieties of food, eating habits and the lifestyle. This change had an impact on the availability of cold chain. The cold chain facilitates the transportation and warehousing of the produce in refrigerated condition. Various produce that are perishable and seasonal to be made available for the consumers throughout the year is one of the aims of cold chain industry. There is a huge loss of agricultural products due to the lack of cold storage facilities. This study focuses to understand the means by which quality products without losing the freshness, genuine taste and appearance can be made available to consumers.*

**Keywords:** Cold storage, chain, agricultural produce, warehousing, transportation

## 1. Introduction

Cold storage is useful for storing different products and can be stored for an extended period. Cold storages store the products like dairy products, meat and poultry products, dry fruits, pulses and pharmaceutical products. All the fruits and vegetables cannot be sold immediately after harvesting, so storing them for future purpose is essential. Some can be processed and stored. Storing them in a cold condition helps the product to stay fresh and new. This helps prolong the shelf-life of the produce, avoid wastages, and preserve the quality. The cold storages are of great help to store the products that are not available throughout the season. The demand for the offseasonal products can be met through cold storages. It is clear that cold storages are of significant use to preserve the products and generate revenue for the hard work that is put forth for producing it. It is estimated that about 133 billion rupees (a capacity of 450MMT every year) worth produce go waste due to the incompetent storage facility, in that 11.36% are fruits and 14.04% are vegetables. Our country has to improve the cold storage facilities at the level of 61 million tons. The present storage capacity is about 26.85 million tons. This can be explained in terms with a capacity of 28.68MMT. Developing cold storages to reduce wastages help the farmers and the economy of the country to develop. This can also help to deliver fruits and vegetables at a competitive rate to the consumers. It is expected that the cold storage market would grow at a compound annual growth rate of 15% in the next five years. Temperature controlled transportation is expected to grow by 17%.

## 2. Literature Review

There has been a substantial focus to increase food production and become self-sufficient. For the past many years, the emphasis is to increase food production productivity by investing in research (Kader 2005). For attaining the goal, the attention is on the post-preservation to increase the returns and provide food security. According to the U.N., tons of foods are wasted every year (Gustavasson, et al. 2011). While discussing the post-production infrastructure related to agriculture, storehouses and cold storages are primary concerns. These facilities help to hold the agriculture inventory for longer duration without damage or decay. The shortfall of food production is mainly due to the lack of quality preservation during post-harvest.

The loss of production of perishable goods happens due to the lack of availability of resources. Another significant wastage is the lack of cold-storage during the post-harvest of the produce. Cold storage helps to reduce the wastages related to perishable foods. The storage mechanism assists in increasing the preservability and avoids contamination by the microorganism. The production of food grain in India is increasing every year. In 2018-19, about 286 million tones compared to 2019-20 were around 296 million tones. The production of vegetables and fruits annually is around 300million tones, and even horticulture is also increasing. Even though production is increasing, the amount of waste is very high to about 67 million tones about to Rs.92,000 crores. In India, every year around the concentration on cold chain industry could improve the storage of food produce, increasing productivity. At present, the number of cold storages in our country is around 7700. The absence of cold chain facility creates a block to appreciate the efforts put by the farmers. Some reports reveal its contributions to economic development (Winrock 2009). The food waste affects the shortage of consumption and affects greenhouse gas emissions (Gustavasson, et al.2011). The methane production causes this in landfills where the food waste is decomposed (Buzby and Hyman, 2012) and creates

climate change (DFI Committee report, 2017). From these facts, the significance of the reduction of food waste is obvious.

In India, the surplus of food is procured through different associations like Food Corporation of India, National Agricultural Cooperative Marketing Federation, and other agencies run by the state government. The wastages that occur are immense compared to the quantity it is produced.

**Table 1: The percentage of wastage of the produce**

Perishable produce that goes waste	Percentage
Fruits and vegetables	4.6 to 15.9
Inland fish	5.2
Marine fish	10.5
Meat	2.7
Poultry meat	6.7

Source: World Food India, 2017

There is an increase in the number of cold storages in India, but the number of cold storage capacity is not adequate compared to the production of vegetables and fruits. The shortfall of cold storage is reported to about 126 lakh tons compared to the production of fruits and vegetables of about 300 million tones. (National Centre for Cold Chain Development, 2015). In 2018, India was ranked as a leading producer of food and meat stands in first and second place in fruits and vegetable production globally but bagged only 103 positions in the Global Hunger Index out of the 119 countries participated. This reveals the poor management of the produce that is produced annually (Aravindaraj et al., 2019).

The considerable availability of cold storage facility has been skewed to specific product and few states. This results in reduced utilization of the capacity. It is recorded that only 68% of capacity has been utilized only for potato, while 38% is for storing other commodities. The potatoes are harvested during January - March and for the rest of the months, it has to be preserved using refrigeration. This assists in the availability of fresh potatoes throughout the year

and helps earn from the hard work. Thus cold storage facility is a boon to the consumers and farmers.

However, despite the growth, the number of cold storages in India is still inadequate compared to the requirement. As per the National Centre for Cold Chain Development (NCCD), there is a shortfall of 126 lakh tons of cold storage capacity. The statistics reveal that from 2014 there are about 1312 cold storage facilities with a capacity of 53.64 lakh MT funded by agricultural ministry and ministry of food processing industries until 2019. The reports revealed that more than 90% of the cold storages are for small scale usage and are run by private sectors, and the rest are managed by public and co-operative sectors.

**Table 2: Percentage of cold storage facility in different states**

Sl.No.	States	Percentage
1	Andhra Pradesh & Telangana	6
2	Bihar	3
3	Chhattisgarh	1
4	Gujarat	15
5	Haryana	3
6	Karnataka	3
7	Kerala	3
8	Madhya Pradesh	3
9	Maharashtra	7
10	Odisha	2
11	Punjab	8
12	Rajasthan	3
13	Tamil Nadu	2
14	Uttar Pradesh	33
15	West Bengal	3

An essential aspect of a cold chain is maintaining temperature for storing and distributing so that products can be stored in a controlled temperature, this help to keep the products freshly for an extended period. For preserving the produce in an edible

condition for a long time, an ambient state has to be created. While discussing the temperature control, two segments have to be noted: the warehousing and transportation.

Nowadays, the cold storages are built with equipment that can regulate the air within the cold chambers. The air within is sucked out and substituted with inert gas. This reduces the oxygen level inside, resulting in less physiological actions of the produce stored inside the chamber. The advanced technology used helps in adding the shelf life of vegetables and fruits that are stored in the chambers.

**Table 3: Key products and end user segments**

Key Products	
Temperature Controlled Warehouse	Temperature Controlled Vehicles
Potatoes, Fruits and Vegetables, Meat, Sea Food, Milk & Milk Products	Meat, Ice Cream, Milk & its products Pharma products, Confectionery

↓ Technology

End Users	
Wholesalers (70-75%)	Organized Retailers (10-15%)
Food Service (15-20%)	Others (3-5%)

Source: Cold Chain opportunities in India - Yes Bank Dutch Embassy Collaborative Study

After the initial processing like sorting, grading and packaging the fruits and vegetables or any other produce is first taken to the pre-cooling centre before it is transported to the cold storages. Depending on the requirement, different storage methods are utilized. Some of the requirements like the duration of storage and the stage (raw or ripe) should reach the destination and increase shelf life. From the cold storages, it is transported to the distribution centre and from there to the retailers. There are situations where the produce is transported to the food processing units for converting it into processed items.

### 3. The Problem Statement

The study by NCCD11 reveals that cold-chain that is developed in our country requires a large investment. There is a requirement of 35.1 million tons of capacity against the existing capacity of 32.86 million tons. A study by NCCD explained the refrigerated transport requirement of around 62000 refrigerated transport units. There is a shortage of cold chain of fruits and vegetables compared to pharmaceutical products, imported foods and processed food. Another study shows a shortage in the creation of ripening chambers, reefer vehicles and pack houses.

**Table 4: Projected growth rate of cold storage market**

Refrigerated storage market	CAGR rate of 15%
Refrigerated transportation market	CAGR rate of 17%
Meat and fish cold storage market	CAGR rate of 9%
Pharma cold storage market	CAGR rate of 16%
Diary cold storage market	CAGR rate of ~ 17.5%
Refrigerated/Reefer trucks market	CAGR rate of 85.3%

The growth at this projected rate will help to manage the situation well. There is a requirement for interventions to improve the present situation.

### 4. Discussion

The temperature-controlled warehousing and transportation are the main segments that have to be focused on understanding the challenges they face. Refrigerated trucks, cold boxes and stores, refrigerators and freezers have to be well managed so that the fresh produce can be preserved well. The produce has to be preserved at a proper temperature to remain fresh when transported, stored and distributed from production to the end-user. In developing countries, it is estimated that (International Institute of Refrigeration) about 23% of foods that get perished quickly are lost are due to improper storing

capability. There is a requirement of an integrated cold chain which is environmentally and socially friendly.

The use of technology has improved the storage process more effectively. The primary concern is related to food safety. Bar-coding is one way by which accurate information regarding the origin of the product and its harvesting process but lacks in providing the details about the transportation. However, this data is helpful when it is taken for refrigeration.

Various data is captured like temperature, time, location, and other relevant information for the products to reach the destination safely. Association of new technology like the internet of things and cloud technology, are emerging areas that support supply chain, especially cold chain. Blockchain is another technology that ensures food safety.

Major logistics providers have relied on analytics and research teams to make sense of the data they generate from their operations. With immense data in hand, companies are utilizing the use of artificial intelligence techniques to automate numerous processes. Many issues related to cold chain logistics and warehousing can be avoided or reduced with the application of these techniques. Reducing transportation cost, expressing shipping without fluctuations in temperature and reducing lead time are beneficial aspects.

With the adoption of 'Internet of Things' linked to cold chain, it can collect data volumes to forecast and improve the cold chain's performance. It helps identify the risk areas like usage of a particular route that is prone to spoilage during a particular period due to weather conditions. The data collected during a period helped the machine learn and predict the feasible route, warehouse condition, status of the products, and transport means. With the collected, large data machine can predict the solution to the issues.

Processing Industries provides integrated cold chain, preservation and value addition infrastructure facilities without any break, from the farm gate to the consumer to reduce post-harvest losses. This will enable to link

groups of producers to processors and market through a well-equipped supply chain and cold chain, thereby ensuring remunerative prices to farmers and year-round availability of food products to consumers.

Integrated Cold Chain Availability Platform is envisaged as a national database that enables active linkage between multiple cold-chain assets across owners, promoting the integration of use though collaboration.

## 5. Conclusion

Some of the measures that can be adopted include linking the pre-cooling stage at the production level itself and justify the investment required in the initial stage itself—strengthening the supply chain links by connecting agriculture industry, transportation firms, and engineering companies related to the cold chain. The association of these organizations will facilitate to provide the necessary cold chain requirement. Investment in research and development to develop reasonable technologies to cater to the need of small- and large-scale manufacturers based on their requirement is another crucial area that needs attention. Viability of the investment has to be considered before investing in any cold chain area for better results.

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# Role of 3D Printing in Digital Supply Chain

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## Abstract

The advent of 3D printing technology has truly transformed the whole world. Owing to the advantages which the technology offers, today it is widely adopted and is used in various sectors such as manufacturing, aerospace, robotics, medical industry and the list just keeps going on. The entire world was taken by storm when scientists unveiled an artificial 3D printed heart which could be implanted in human beings, though at present it is not fully functional however such a discovery creates optimism amongst the people regarding the future of the technology. Medical industry is not the sole area where this technology is surprising people, today small sized yachts are created using 3D printing, and even SpaceX is manufacturing parts of its starship using 3D printing. To some things up 3D printing is a disruptive technology. The use of 3D printing in Logistics and Supply Chain Management is a true game changer that has the potential to change the face of the entire supply chain. There are many 3D printing solutions in the market many of which are being used in Logistics and Supply Chain; however each one of the methods is having its own benefits and limitations. In this paper some of the commonly used 3D printing methods will be explored along with its use case in Logistics and Supply Chain industry.

**Keywords:** Fused Deposition Modeling, Thermoplastic Polymers, Stereolithography, Resins, Selective LASER Sintering, Subtractive Manufacturing, Digital Supply Chain

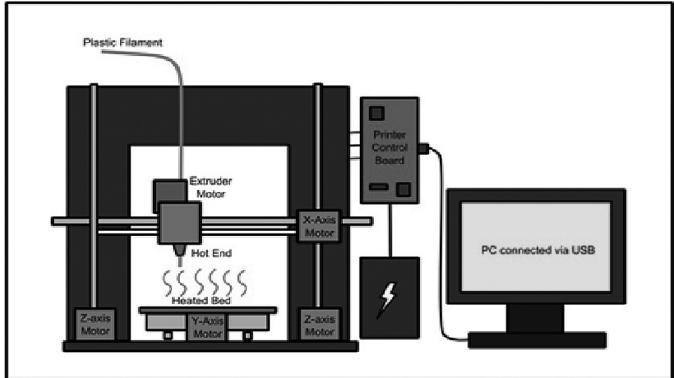
## 1. 3 D Printing Techniques

Some of the most commonly used 3D printing methods that are currently deployed in industries are as follows:

### 1.1. FDM (Fused Deposition Modeling)

Fused Deposition Modeling commonly referred to as FDM is a 3D printing method that is used to make durable objects. FDM printers are the most widely used printer because they are easy to work with and are inexpensive. FDM 3D printing is bottom-up additive manufacturing process where an item is created by depositing the melted thermoplastic layer by layer. To make the objects industry grade plastic and thermoplastic polymers are used. To create the object the design model of the object is created using AutoCAD or similar design software and then the file is converted into a format compatible with the FDM 3D printer like. stl or .obj. The FDM printer takes a spool of thermoplastic polymer material from which the object is made, melts the polymer at its melting points and extrudes it on a bed platform layer by layer to build the object bottom up as depicted in Figure 1 (<https://gronkwena.wordpress.com>).

The obvious advantage offered by FDM is that the articles made with the help of this technique are very affordable. However, this method comes with its own flaws, 3D printed objects developed using this method have rigid edges because of layering process involved, so objects require finishing touches which is time consuming and adds on to the cost.

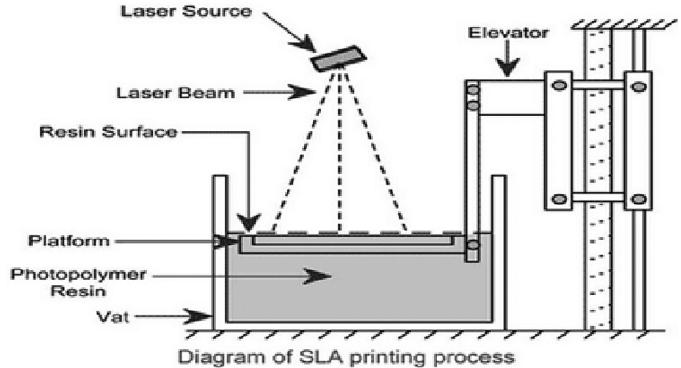


**Figure 1: Fused Deposition Modeling**

### 1.2. SLA (Stereo lithography)

Stereo lithography is a form of 3-D printing technology used for creating models, prototypes, patterns in a layer-by-layer fashion using photo polymerization, a process by which light causes chains of molecules to link together, forming polymers (**Dongkeon Lee et.al, 2006**). This method was first explained theoretically in 1970s however it was in 1980s when it was deployed practically to manufacture 3D printed objects. It uses UV light or high-powered LASER to cure liquid resin. The resins used in this method are photosensitive that means these liquid resins have the tendency to harden when exposed to light of certain wavelength. Just like FDM method, the computer modeled design is fed into the SLA machine. In the SLA machine, the resin is dispensed into resin tank from the cartridge and a build platform is lowered into the resin. At the beginning of the process, a beam of LASER is passed into the tank thereby drawing the first layer of print. Each layer is only a few microns thick. Because of the photosensitive nature of the resin, it solidifies when it comes in contact with the LASER. Computer controlled mirrors are used to direct the LASER in accordance to the design coordinates. Once the first layer is made, the build platform is raised, thereby allowing resin liquid to flow in to make further layers. In this way the whole object is made layer by layer from bottom up. A schematic diagram of SLA machine is shown in Figure 2. The object produced using this technique is very precise however it takes more time to produce the article when compared with the time taken to produce the same object using FDM. The other disadvantage of this

method is the fact that resins used in this technique are brittle in nature hence the final products are not very durable.



**Figure 2: SLA Machine Layouts**

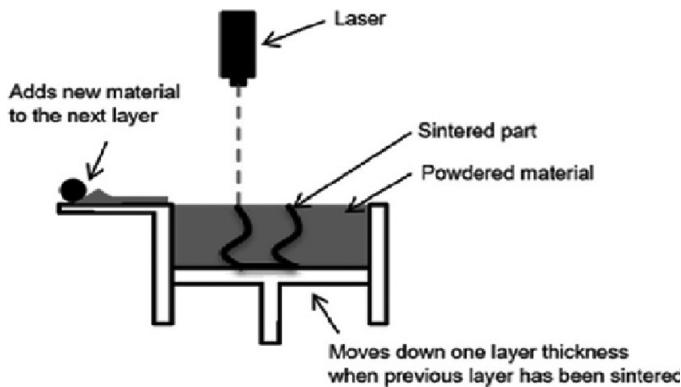


**Figure 3: SLA Machine**

### 1.3. Selective LASER Sintering (SLS)

Selective LASER Sintering (SLS) is another most commonly used 3D manufacturing technique that turns the object modeled from CAD data into real 3D objects in matter of hours. In this process tiny particles of plastic, ceramic or glass are joined by heat from a high-powered LASER beam to form a solid (**Shiwpursad Jasveer, & XueJianbin, 2018**). These days even Nylon 11 or Nylon 12 are being used as base material. These materials are in their powdered form and are placed in a power bed. The CAD data fed into the machine is used to determine the dimensions and coordinates of the object and the LASER beam hits the power bed in accordance to the CAD input file. When this high-powered LASER hits the powdered object, the power heats up and solidifies thereby forming the first layer of the object. Once this first layer is made, the power

bed is lowered to make room for the next layer and the same process of firing LASER at the power bed is repeated to make further layers. A schematic diagram of SLS process is depicted in Figure 4. SLS 3D printing doesn't require any support material during its manufacturing; hence this method can be deployed to produce complex designs.



**Figure 4: Selective Laser Sintering**

### 3. 3D printing in Logistics and Supply Chain Management

The traditional way of manufacturing articles is a subtractive manufacturing technique, wherein the finished object is made by successively cutting the raw material. The logistics involved in carrying materials carved out using subtractive manufacturing is quite complex and significant cost is incurred by the company to ensure that there is smooth delivery of products in the market or the docking hub or warehouse. Again, to store these materials the industries have to rely on warehouses with large capacities, and these large capacity warehouses cost industries significantly. Apart from the complex logistics, subtractive manufacturing is quite complex process in itself generating huge amount of scrap and waste. The advent of 3D manufacturing which is an additive manufacturing technique has disrupted the way materials are transported and are stored in warehouses. Following are the advantages of 3D printing in Logistics and Supply Chain:

#### 3.1. Decentralized production

3D printing technology is portable in nature. The portable nature of the machinery used in production fosters and promotes decentralization when it comes to manufacturing the commodity. As a result of this there could be an increase in local production hubs, which will not only help in decentralization but will also serve as a catalyst to widen the reach of the commodity far and wide. This local production model is very sustainable and will create tons of job opportunities locally in the area where the component production facility is setup.

#### 3.2. Low carbon footprint during manufacturing

It is no brainer that a huge amount of waste is generated during the production of a commodity. The industrial production waste ranges from e-wastes, scrap, metal, oil, screws, sawdust and the list is a never ending one. Industries and factories in partnership with local government authorities try their level best to recycle the wastes generated, but the problem is the fact that not all the waste generated is recyclable and some wastes generated are toxic in nature which pollutes air, water and soil. The waste generated in 3D printing is negligible and the 3D printing machinery consumes less power than the traditional production machines. This makes 3D printing ecologically safe and sustainable.

#### 3.3. Improves productivity in manufacturing facility

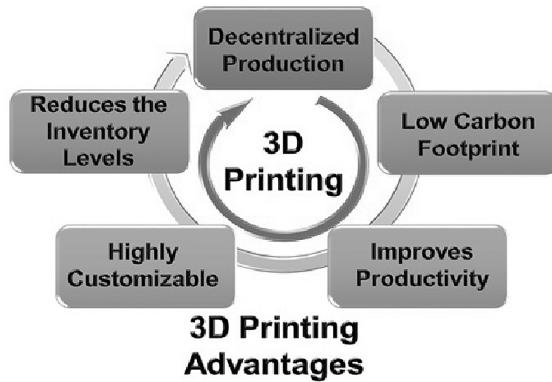
3D printing is faster when compared to traditional manufacturing options. The entire 3D printing process is automated with minimal manual intervention, the worker/product designer just needs to feed the CAD data designed by him/her and feed the raw material and that's it. Because of this automated nature of 3D print manufacturing, the chance of human error is minimal. Workspaces deploying 3D printing are very organized with optimal inventory. All these factors combined together improve the productivity in the manufacturing facility.

### 3.4. Products manufactured are highly customizable

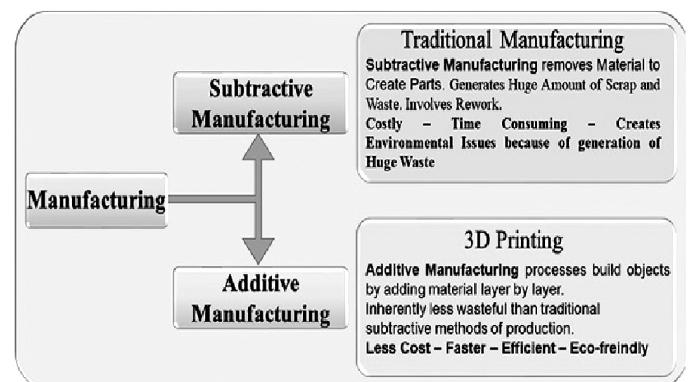
All companies aim to give their customers a wide variety of products. However, if the industry is manufacturing the product in mass, the degree of customization it is able to offer is little. In contrast to this if the company focuses on customization, it will have some difficulty in mass producing the commodity. Additive manufacturing used in 3D printing unlocks new customizable possibilities because it does not require expensive tooling changes based on individual specifications. This simply means using digital manufacturing methods like 3D printing opens the door for mass customization. This also helps the consumers because they will be able to buy tailor made products without shelling out extra cash, this is because the entire manufacturing and logistics cost will go down with 3D printing.

### 3.5. 3D printing significantly reduces the inventory levels

With 3D printing, "built-to-order" model can be implemented with greater ease and flexibility and that could change the dynamics of the entire logistics and supply chain process involved. Today, majority of the industries rely on physical inventories to store the products or parts needed to manufacture the final product like in case of automobile industry. This greatly increases the physical footprint as large facilities are required to store the material. On top of it, industries always have to maintain their inventories in accordance with the demand and market conditions. Any fluctuation in demand of the commodity due to unpredictable nature of human behavior or market fluctuations can put the industry in trouble. This calls for the need to implement digital warehousing wherein new technologies like RFID tags and 3D printing can play a significant role. Industries deploying 3D printing have recorded significantly reduced inventory levels to meet the demands this is because 3D printing is based on "built-to-order" model.



**Figure 5: Advantages of 3D Printing**



**Figure 6: Additive and Subtractive Manufacturing**

Though the technology appears to be a game changer it has its share of limitations as well.

#### Following are some of the limitations of 3D printing:

- i. 3D printed objects are made of thermoplastics, resins, metals and few other materials. So, we do not have an extensive list of materials that can be 3D printed to make finished goods. This is one of the serious limitations of 3D printing.
- ii. With 3D printing becoming more and more affordable anyone can take a scan of article/object created by someone else or by some other company and can take a 3D print of it. And above all this may happen without the consent of the person/company that had manufactured the original product. This is a serious violation of copyright and infringement of Intellectual Property (IP).
- iii. As of today, the technology is not fully evolved to create complex materials at a reasonable price.

iv. 3D printed materials have a serious size constraint.

As an example, FDM which is the cheapest of all 3D printing technologies can only create medium sized objects and it struggles to create small objects with precision. The same goes with SLS which can produce small sized objects with greater accuracy but is time consuming when creating large sized commercial objects thereby making it infeasible in certain manufacturing techniques.

3D printing is gaining significant ground and the limitations posed by the technology should not refrain industries from adopting it as scientists and tech companies are trying out their level best to iron out the flaws of 3D printing.

#### 4. Conclusion

Encouraged by the possibilities of greater personalization, distributed manufacturing and delivery model and less waste generation, more and more businesses across the globe are showing interest towards 3D printing model of manufacturing. This new age digital model has reduced the time and cost of production significantly. This technology also helps in decentralizing the production hubs wherein parts of the same object/material can be manufactured in different places and later on can be assembled. This also helps to drive product customization which is a key for the manufacturers to attract consumers. In terms of inventory and logistics, the objects can be printed on demand that means there is no need to have finished products stacked on shelves or stacked in warehouses (Kubáè, Lukáš & Kodym, Oldøich, 2017). To wrap things in a nutshell, it could be easily said that the 3D printing technology is improving by leaps and bounds and what we are seeing today is just the tip of the iceberg. The technology is also increasingly gaining recognition. It's only a matter of time when majority of the stakeholders in Logistics and Supply Chain Management will adopt the technology and that could benefit both the production houses and the consumers alike.

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# The Supply Chain Management of Shrines in India: Value addition to the Economic Prosperity

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## Abstract

India known as the 'Abode of Gods'; is a land having religious places of worship or shrines in almost every other lane. The country is privileged of being a divine destination, a host to numerous shrines. These Religious places of worship have not only strengthened human beings in their spiritual pursuits but have also been a major source of economic value addition to society and the country. It is evident to learn that the places of worship have been a large stakeholder of the supply chain industry. From years a practice of offerings in the shrines has been prevailing which is closely related to the spiritual devotion of the devotees. This practice of offerings has enabled the system of supply chain in the regions where the shrines are situated. The complete chain of supply management has strengthened over decades. There are various religious products that are related to the religious sentiments of devotees which are manufactured at places distantly located from these shrines. The distribution of these products takes place across the country. The establishment of a shrine does not only invoke divine blessings but also provides employment thereby empowering every individual involved in the chain of supplying the products. It is important to learn how the lesser known supply chain management of shrines functions and adds value to the economic prosperity of the country. This research paper aims to throw light on the supply chain management that is enabled by Shrines in India and the economic value addition that take place resultantly. It will also focus on how the entire supply chain functions from one end to another across the country.

**Keywords:** Shrines, Supply Chain Management, Value addition, Religious offerings, Religious Products, Economy.

## 1. Introduction

India, also called "Dev Bhoomi" is a land of rich cultural diversity and a home to various religious places of worship. Shrines have always been cited as a place of worship but they are not more than that the spiritual connect. Shrines in India are known for engaging the regions into religious economic activities. Having religious importance on one hand, these shrines hold economic importance on another hand. They not only have their holy importance but also add a lot to the economy of the country. The economic function of shrines have been highlighted with time but very less attention has been drawn in the context of economic value addition being done by these shrines. India has a more visible aspect of spiritual presence which becomes evident when considering numerous spaces that are thought to be sacred and holy. India hosts numerous Religious Destinations belonging to all religions. People have immense faith in these places and are keen to visit them; they find satisfaction and feel contented by visiting the religious destinations. They specially plan a trip for the places of religious importance which are located far off and feel immense pleasure and privilege in visiting these shrines. **Gupta & Kunar, (2017)** quoted in their article about a study which states that 39% of people gave preference to visit pilgrimages/holy sites for a vacation. Religious places were ranked high among the preferred tourist destinations by Indians. A journey to a shrine reflects

the spiritual importance and emotional attachments of devotees. It is often seen that people wish to carry memories in the form of substance from their trips which they share it with kith and kin as a token of love. This practice become more prominent when people visit holy places and wish to bring back things related to their duties. The memories of pilgrimage centers are accounts to food (*Prasad*), articles of religious importance and values etc. These products are either manufactured at shrines or nearby places which are distributed to devotees coming from across the world. Devotees consider these products as highly auspicious and of spiritual importance. They also consider these as the blessings of the Almighty and feel honoured and privileged to receive products. These products are mostly either made available at shrines or nearby places and are distributed/sold to the end consumers. From times shrines are playing a role of manufacturer as well as seller of various products related to the sentiments of people. The category of these religious products may be classified as *Prasad* (special food offered to god, later distributed to devotees), Incense Sticks, flowers, *Kumkum*, *Bhabhoot* etc. Looking at the sentiments of devotees and pilgrims, gradually shrines have involved into purchasing manufacturing and selling the religious products and have become an important part of the supply chain industry.

Shrines make these products for certain reasons; *firstly* to offer it to the God or Deity in different ceremonies. There are certain rituals performed at certain times and maybe multiple times in a day, each time has its own significance in terms of the performance of rituals and its offerings. Also, there are various occasions that fall in place time to time for which special preparations are made like festivals and special dates of religious importance. These offerings maybe flowers, clothes, special food preparations for invoking gods. *Secondly*, these products are then made available to devotees. People consider these products to be sacred and wish to seek blessings of the Almighty by consuming the things given to them by their own God. Shrines which are engaged in large production, sell the products to devotees. *Lastly*, to generate income for the board/

trust; body that manages the functioning of Shrines. At places, there are people who work for the Shrines and are dependent on the salary or remuneration received from the Shrines for their livelihood. In the older times and even today some of the shrines follow the practice of distribute the food in the form of grains, *prasad* or processed food as a remuneration to employees, and then these employees sell them to visitors in exchange of money.

Shrines being part of the economic cycle are a major player in the supply chain industry. Supply chain management of these shrines plays pivotal role in adding value to the economic status of each individual involved in it. With time Shrines have stepped into branding, franchising etc. which has enabled and deepen the supply chain and spiritual business. For example, the chaadar offered to *Khwaja Moinuddin Chishti's*, Ajmer is made from the flowers grown in *Pushkar*, which enables a supply chain system.

## 2. Review of Literature

**M.K.N, (2019)** in a news article said that Kerala government intended to talk to Andhra Pradesh Government for supplying over 90 tonnes of cashews to Tirupati Temple for the preparation of the *laddoos* (sweet dish offered to God and later sold to devotees). The author also highlighted the distribution of the laddoos among tens of millions of pilgrims. His article clearly pointed towards the existence of supply chain in the operations of Shrines.

**Haq & Medhekar, (2018)** stated that Shrines played an important role in sustaining the local economies of India. Pilgrimage contributes to the economic activity starting from vendors selling flowers, candles, souvenirs, sweets, fruits and other offerings made by the devotees. Spiritual tourism related businesses not only create new job opportunities in organised and unorganised sectors in the tourism and hospitality industry, but also in construction, infrastructure development, local transportation, tour guides in foreign languages, small tea shops, reviving and sustaining local handicrafts and cottage industries related to spirituality.

**Stein (1961)** observed the economic role of temples in Southern India. He found that the temples developed close economic ties with local institutions, not only as the recipient of their endowments, but as landholder, employer, consumer, and source of loan funds. Hence, temples became economic as well as religious centers.

### How do shrines manage supply chain?

There are big Shrines in India which evolved into developing their own brand and are very popular among devotees. With the growing interest of devotees, temples started manufacturing products of religious and spiritual importance. Many big shrines in India are involved into large scale production of these goods. Religious items and merchandise which are the produce of these shrines may be; books and literature, flowers and garlands, candles and incense sticks, *Prasad*, calendars, posters, *mauli / lachcha, chandan, kumkum* etc. The distribution channels that exist in the system can be categorized as: direct from religious places, retail stores and through electronic medium. According to a report given by **EMR, (2020)** the major stakeholders in the supply chain are trust or managing bodies of shrines, religious travel companies, transporters, merchandise companies, and online service providers. A few major trust or managing bodies of shrines are:

- Tirumala Tirupati Devasthanams (TTD)
- Shri Mata Vaishno Devi Shrine Board
- Sree Padmanabhaswamy Temple Trust
- ShriSaibabaSansthan Trust (Shirdi, Mumbai)
- Shree Siddhivinayak Ganapati Mandir Nyas (Prabhadevi) Trust
- Akal Takht Sahib, Amritsar
- Shrinathji Nathdwara Temple Board, Nathdwara

For the purpose of this study, a research was conducted at Shrinath Temple Nathdwara, Udaipur, Rajasthan, for understanding the supply chain mechanism. **Purohit, (2021)** in an interview stated that there are many branches of Nathdwara Temple Board situated across the country which are run by the Board. These branches also serve as one of the distribution

channels for selling the *prasad bhog* of Shrinath Ji (A self manifested divine form of Lord Krishna). The supply chain management enabled by shrines functions in following manner:

- **Tender System**

Almost all the shrine boards or trusts in India which ensures the smooth functioning of shrines and provides facilities to the devotees are public bodies running under state government. The shrine boards or trusts follow the procedure of inviting tenders from suppliers of raw materials like Ghee (refined butter), flour, sugar, dry fruits, lentils, oil, grains etc. The tender with lowest bid is selected by a purchase committee and order is placed for required quantity from time to time. Usually the tender takes place once in a year or as per the norms of the board. This procedure gives open chance to suppliers across the country to gain business opportunity and be a part of this sacred event.

- **Suppliers in the Chain**

The supply chain of shrines includes end to end stakeholders i.e. from original initiators to end consumers. For example, flowers used as ornaments for deities, does not only include the garland makers but also flower sellers as well as the farmers or gardeners growing these flowers. Similarly Clothes, *Chunri* or *Chadar* for dressing up of the deities not only help the vendor who is selling them, but the tailors, textile producer, yarn producer and the farmer. Thus, the whole economic chain is benefitted.

- **Farmers:** It is believed that farmers usually grow crops and sell them in market to retailers or consumers, but one of the major buyers of these crops is processing company which uses the crop for converting it into a more long term & useful product. The supply chain of temple benefits the very initiator or tier 3 supplier of raw material. For example, if shrine buys Ghee (refined butter) for preparing *prasad*, the cattle farmer will be benefitted who supplies milk to milk processor.
- **Processor:** The second stakeholder could be the processor or processing company which converts the originally produced raw material into usable

finished goods. Sometimes the processing company themselves directly supply their goods to the shrines or they will sell it to wholesalers or retailers for building further connections of this chain. Taking the above cited example forward, there are milk processing companies which produce *Ghee* from milk, may directly bid for invited tenders.

- **Wholesalers/Retailers:** The producer/processor sells products to wholesalers or retailers who then become a part of distribution channel and sell the products to shrines. For example, when shrine board buys material like sugar, clothes etc. it may buy it from wholesalers/retailers through inviting tenders.

#### • Shrine Board/Trust

The Shrines as discussed are the key players of the entire chain. Shrines have played a key role in building an emotional connection of the people with their deities. This is made possible when the offerings to the god are distributed among the pilgrims. These offerings are in the form of *prasad*, flowers, *bhabhoot* etc. which are taken as the blessings of Lord. Many shrines in India have a separate big area of kitchen and mess where the *prasad* is made. It employs lot of people for making the *prasad*. The Shrine boards became more active with time and keeping in concern the spiritual connection of devotees, they manufacture the *Prasad* (most preferred products by devotees) at their premises and sell it to the consumers/devotees. This act gave rise to the entire supply chain of shrines. Shrines are therefore playing the most important multitude role of buyer as well as seller in the chain. Shrines buy the raw material and manufacture the finished good or the end product to be consumed and sell it to the devotees either directly through their counters situated at/near the premises or through their branches situated at different locations.

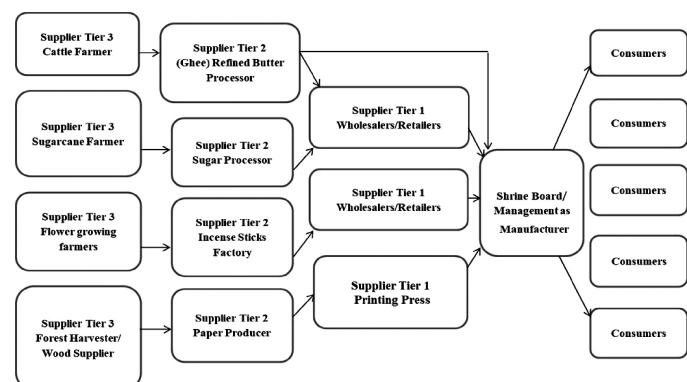
#### • Branches of Shrines

For devotees located at distant locations, some of the shrines have their multiple branches located at popular places for devotees. These branches also serve as channel in the supply chain management of the

shrines. According to **Nathdwara Temple Board, (2020)**, there are nearly 8 branches of Shrinath ji temple which act as a distribution channel for *prasad*, to be sold to devotees who are situated at different places and wish to seek blessings of the almighty through the means of *prasad*.

#### • The "e-platform"

Though pacing with time, shrines had shifted to e-platform way back and were performing e-commerce activities of shrines related to pilgrimage. But the situations now have given a boost to the IT industry, and helped the shrine boards to enable another medium in the distribution channel so that the spiritual connect of devotees and their god may be maintained. Today the *Prasad* and religious articles are made available to the end consumers through various online websites and e-commerce vendors. **Mishra, (2020)** in her article said that the Panch Badri Prasadam pack named as Badrinath Prasad Bag was made available through online booking by doing a tie up with amazon. Due to the lockdown, the footfalls of pilgrims had reduced, in order to allow the faithfuls to get *prasad* at home while they couldn't visit the holy place. She also stated that 18 self-help groups were involved in the manufacturing of *prasad*. The same practice was done at Shri Kedarnath Temple, the *prasad* pack was made available at [www.onlineprasad.com](http://www.onlineprasad.com).



**Fig. 1: Supply Chain Model of Shrines (Source: Compiled by Authors).**

### 3. Value Addition to the Economic Prosperity

Religious places have not only strengthened human beings in their spiritual pursuits but have also been a major source of economic value addition to society and country, which have been talked about very less. The Shrines have a huge impact on value addition to the economy, as it provides immense economic opportunities to the local community. Through the merchandise activity various economic opportunities are created such as generation of employment, generation of income, increase standard of living among the people involved and overall growth the economy. The economic value additions that take place through the supply chain management of Shrines are as follows:

#### ◆ Employment Generation

Shrines in India generate significant opportunities of employment, directly and indirectly. Through its supply chain management it provides employment to numerous people like farmers, wholesalers, retailers, transporters, shop keepers, street vendors, personnel at kitchen and manufacturing unit, store keepers, etc. This clearly indicates that shrines add to the economy of country through employment generation. For example, the *VenkateshwaraSwamy* Temple at Tirupati employs more than 15,000 people, including hundreds of cooks, in its *prasad* making unit. Similarly, in an interview at *Shrinathji* Temple, Ojha, (2021) said that there are nearly 2000 people employed in direct or indirect way out of which many of cooks employed for making the *prasad* at *Balbhog* (kitchen) at *Shrinathji* temple in Nathdwara. Apart from the cooks, these temples also employ supporting staff, managing staff, accounts staff and other employees etc.

#### ◆ Connectivity between Cities and Remote Areas

Many of shrines are situated in distant locations, but due to their religious importance they link the nearby cities and remote areas with each other. This results in the development of the rural area and connecting them with major cities, thereby enhancing its economic condition. For example, Rameshwaram town is

situated at south-eastern end of India, which used to lack proper transportation facilities, but due the very famous *Jyotirlinga* of Lord Shiva, *Ramanathswamy* Temple, this town is one of the most visited sacred places of India. Because of its pilgrim importance, the city and its nearby island has been connected by Indian Railway track built in the sea. There is a complete package containing religious products like *Prasad*, incense sticks, *chandan* etc. is sold at temple which enables a supply chain as well as connects the area with other cities.

#### ◆ Shrines Boost Trade

Shrines have been pivotal in enhancing trade activities which had enabled the supply chain. For example, Coconuts are offered in the temples of all deities across the country as a general practice. The number of coconuts offered in the temples across the country on a daily basis runs in millions. Coconuts grow in South India and are distributed across the country. This creates the opportunities of trade connections across the entire country. A shrine situated anywhere in the country, encourages the coconut farming in South India. This contributes directly to retailers, wholesalers, transporters, warehouse owners, farmers and middlemen and adding business worth billions on daily basis, thereby having a significant contribution to the country's economy.

#### ◆ Income Generation

Business in the city succeeds because of the popularity of the worship place and the footfall of large number of tourists. The shrines too generate huge income by various means and services to the people. Some shrines offer their own rest rooms facilities, *prasad* facility and even medical facilities. For example, *Shri Mata Vaishno Devi* Temple is situated on hill. Helicopter, battery car, refreshment, blanket, accommodation and many more services are offered to devotees which generate a lot of income for the Shrine Board. The supply chain of shrines is pivotal in generating income at individual as well as group levels.

### ◆ Economic Upliftment of the Region

Shrines contribute significantly to the economic upliftment of the city or the entire region by urbanisation and means of various economic activities like businesses pertaining to religious articles, guide services, clock rooms, hotels/rest rooms, food, adventure tourism etc. For example, the economy of the town of Nathdwara is running completely because of the shrine of *Shrinathji* or the economy of Shirdi is being run due to the presence of *Sai Baba* Temple. Through the economic activity of supplying religious goods and services, these shrines are centre pillars for economic upliftment of the entire region.

### 4. Conclusion

From years Shrines have been enabling a complete supply chain for products of religious importance. Lesser attention has been drawn towards the supply chain management of shrines. The research paper highlights that the lesser known supply chain of shrines is worth paying heed as it adds to the economic value of each individual, group and the country. The products related to religious sentiments of devotees are being either manufactured, produced or supplied by the shrines. These products are closely related to the emotions of people since they can get these directly from the places which they consider to be sacred. The products of religious importance are highly demanded by the devotees as they believe it to be a gift by their god. The demand of these products makes the supply chain stronger and hence shrines can be seen as one of the prominent part of supply chain industry. It is also observed that the shrines make the whole city a buzzing economy with the growth of trade and employment. They are now recognized as a source of diversifying the country's economy. It can be said that the shrines will continue to stimulate the economy.

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# Lean Supply Chain Management Analysis of 8 Types of Wastes: Cause - Effect & Solution

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## Abstract

A supply chain is a chain of supplies - is the network of all the individuals, organizations, resources, activities and technology involved in the creation and supply of a product, from the delivery of source materials from the Supplier to Manufacturer to Distributer to Wholesaler to Retailer and Eventually Delivery to the End User or Consumer. **Lean** is the concept of efficient manufacturing/operations that grew out of the **Toyota Production System** in the middle of the 20th century. Since then, "lean" which was started as an important concept, in the world of manufacturing first, has thrived in to other fields such as Supply Chain Management (SCM). **Lean management** is an approach to managing an organization that supports the concept of continuous improvement; a long-term approach to work that systematically seeks to achieve small, incremental changes in the processes in order to improve efficiency and quality by eliminating or minimizing the process waste and maximizing the value of the product or service to the customer. In this article we shall discuss 8 types of wastes in the entire value stream of supply chain and analyze **Cause - Effect & Solution** for improving Supply Chain Efficacy.

**Keywords:** Supply Chain, Supply Chain Management, Value Chain, Value Stream Mapping, Lean, Wastes.

## 1. Introduction

A supply chain is a Chain of Supplies - is the network of all the individuals, organizations, resources, activities and technology involved in the creation and supply of a product, from the delivery of source materials from the Supplier to Manufacturer to Distributer to Wholesaler to Retailer and Eventually Delivery to the End User or Consumer.

Supply Chain Management (SCM) is the Management of a Network of Inter-Connected Businesses involved in Receipt of Inputs, Processes and Delivery of Finished Goods or Services Required by the End Consumer. Supply Chain Management spans all Movements and Storage of Raw Materials, Work-in-Process Inventory and Finished Goods from Point of Origin to Point of Destination at Consumption.

### Supply Chain Network

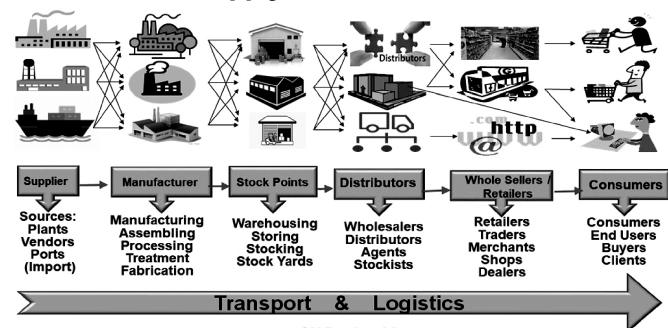


Figure 1 : Supply chain network

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).

## 2. Lean Principles

**Lean** is the concept of efficient manufacturing/operations that grew out of the **Toyota Production System** in the middle of the 20th century. Since then, "lean" which was started as an important concept, in the world of manufacturing first, has thrived in to other fields such as Supply Chain Management (SCM).

Supply chains generally are over imposed with Value Chain which refers to the process in which businesses receive raw materials, add value to them through production, manufacturing, and other processes to create a finished product, and then sell the finished product to consumers. A Lean supply chain focuses on adding value for customers, while identifying and eliminating waste—anything that doesn't add that value in the supply chain. The focus is on reducing waste in the entire chain of supplies resulting in reduction of cost and lead-time as well as an increase in quality of delivery.

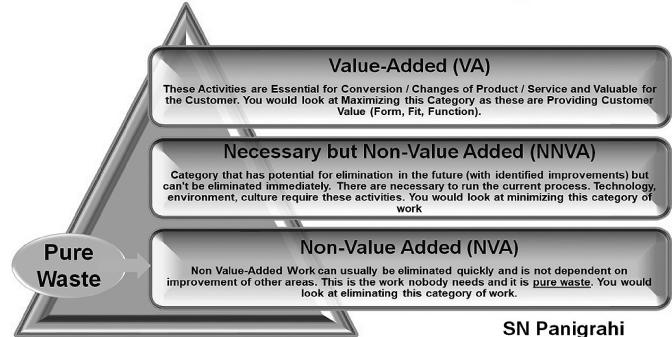
According to Womack and Jones, there are **Five Lean Principles: Define (Identify) Value, Value Stream Mapping, Create Flow, Establish Pull and Pursuit Perfection.**



Figure 2: Lean Principles

In lean, processes are configured so that they include only activities that add value to the item and ultimately to the customer, termed as **Value Added (VA)**- with everything else seen as waste. There are two forms of waste - firstly there is necessary waste, called **Necessary but Non-Value Added (NNVA)** - whereby the activity does not add value to the end product but is necessary for the process to function or for the business requirement - secondly there is **Non-Value Added (NVA)** activities that in no way necessary is treated as Pure Waste - which consume resources, increases cost or lead time as a result, but doesn't add any value. That means Any Activity or Features that **Doesn't Add Value** to the Product or Service, from the Point of View of the Customers and also not required by the Business.

### Value Stream Activities Fall into one of Three Types



SN Panigrahi

In order to Improve Efficiency, Effectiveness, Profitability and Optimize Resources, Lean methodology demands the elimination of any aspects of the process, material, effort, or expense that add no value from the customer's perspective. When Waste is removed, only the steps that are required to deliver a satisfactory product or service to the customer remain in the supply chain process. Lean Management consists of a set of tools that help to identify and eliminate waste.

### 3. Eight types of Wastes

The 8 Wastes (Abbreviated as **Down Time**) are as follows

8 Wastes : Down Time	
D	Defects
O	Over-Production
W	Waiting
N	Non-Utilization of Talent
T	Transportation
I	Inventory
M	Motion
E	Extra Processing

• Efforts Caused by Rework, Repair, Scrap and Incorrect Information  
 • Producing More than is Needed or Before it is Needed  
 • Wasted Time Waiting for the Next Step in the Process  
 • Under-Utilizing People's Talents, Skills and Knowledge  
 • Unnecessary Movements of Products or Services  
 • Excess Products and Materials being Produced or Procured  
 • Unnecessary Movement by People  
 • More Work or Higher Quality than is Required by the Customer

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Now let's discuss for each of the Waste in the Supply Chain analyze the **Cause - Effect & Solution**

#### 1. Defects



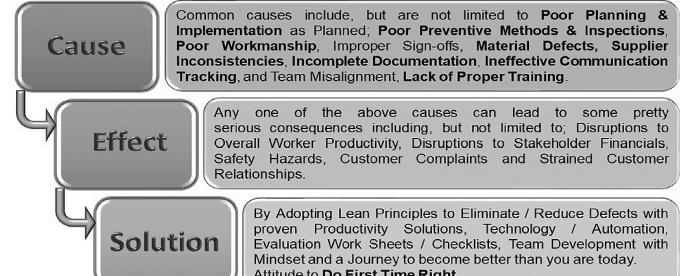
**Defects involve scrap or material that is thrown out or reworked...and much more.** Concessions may be made to a customer or Discounted-sale pricing may be used so defective material can be sold. In addition, the quality control system that must be put in place for an out-of-control process has **high inspection costs**.

**Every bit of scrap Costs Money and Time – Money for the Materials, Resource to pay staff, Utilities etc to do it again,** but also means that you have to push another planned job back in the queue in order to get the rework out! It's all cost and less cash for the business.

Paperwork (including electronic) tracking for defects and waste removal isn't free. Defects that actually reach the customer can cause greater pain, with loss of not only that customer, but many others from viral

word-of-mouth dissatisfaction. Some experts estimate defects have a 10x negative impact on a company - **Waste Related to Costs for Inspection of Defects in Materials and Processes, Customer Complaints and Repairs / Rectifications**

#### 1. Defect Waste : Cause - Effect & Solution



Tip: Evaluating the impact of some defects can be done by multiplying the cost of the scrap by a factor of ten. The resulting number can be viewed as a rough measure of the cost to your business or to your customer.

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#### 2. Over Production



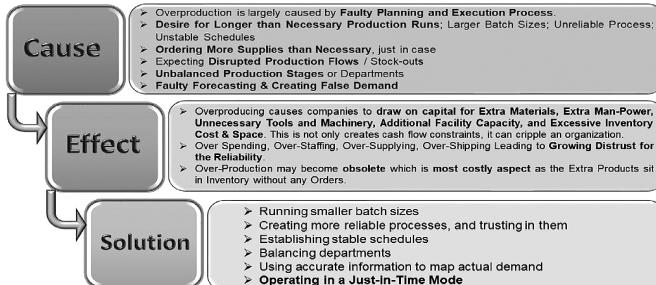
**Overproduction is**

- Making something too soon,
- Making too much of something (greater Volumes), or
- Making something faster than is needed.

It unnecessarily **consumes time, effort, money, materials and resources** that could have been better spent elsewhere, leaving your organization with the burden and logistics of dealing with **excess inventory**, Product Damage from warehouse stocking and removal, defects introduced by high-speed Processes, strain on human Interaction with Machines.

The problem is, "**the customer may want 10 items, for instance, but we will produce 20 items and store them.....**". Producing something at the Wrong Time or in Unnecessary Amounts.

## 2. Over-Production Waste: Cause - Effect & Solution



*Tip:* Implementing Lean practices and/or principles is a continuous journey. By taking small steps and working together with other Lean champions, your company will benefit and will see continuous improvements.

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## 3. Waiting



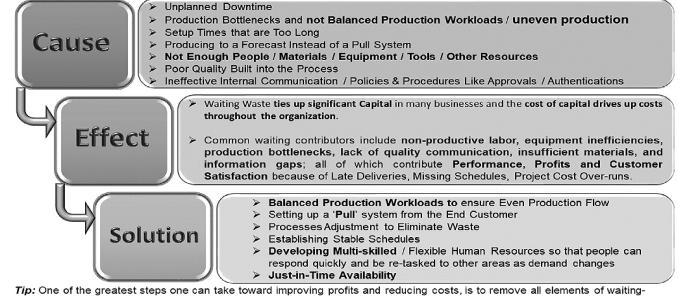
**Waiting:** When work in progress and goods are not being worked on, they sit there waiting – waiting for the next process. This is typical of traditional '**Batch and Queue**' methods. **Waiting means that product is costing the company money and not adding value.**

Waiting involves **delays to process steps**, often extending customer lead time. This may include waiting for authorization from a superior, even though the authorization is a rubber stamp rather than critical input. It can involve inefficient changeovers, poor communications, large batch processing, and uneven workstation loading.

- Parts or Assemblies waiting in queues for the next step in the operation**
- People Waiting for Authorization / Approval / Other Procedural Aspects, Waiting for Material, Equipment or Tools to Perform their Operation**
- Finished Products waiting to be Shipped or Sitting in Stores**
- Idle Equipment / Equipment Breakdowns**
- Vendor / Third-party Company Delays / Logistical Delays**

## Waiting for people or services to be delivered (time when people, processes or equipment are idle)

### 3. Waiting Waste : Cause - Effect & Solution



*Tip:* One of the greatest steps one can take toward improving profits and reducing costs, is to remove all elements of waiting-waste from all business departments, processes

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## 4. Non-utilized Talent

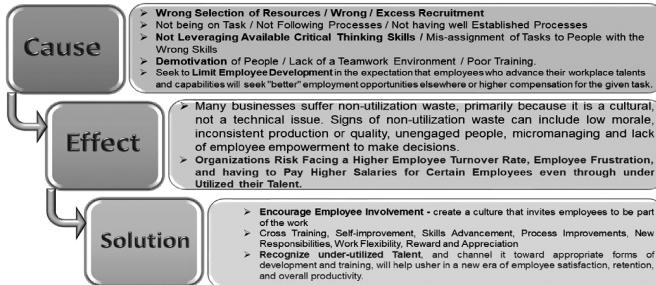


**Not fully utilized people** represent the waste of talent present in many organizations. Because operators are close to their processes daily, they can often recognize problems or opportunities that staff or superiors just don't see, but the workers may never be asked for their input. They may also have outside talents that aren't formally part of their assigned jobs, but could be of use. The recommendation? **Value people for their brains, not just their brawn.**

Non-Utilized Talent is a key waste described in the lean manufacturing ideology. This waste pertains to the loss or incomplete use of human capability and resources within a production process.

**Non-Utilization Waste is the waste of human potential, often the most costly waste of all.** It occurs when management is too separated from the role of employees and managers view themselves as the sole resource for organizing, planning, assigning, controlling or improving work processes. When the role of employees is to simply follow directions without question, non-utilization waste is bound to happen.

#### 4. Non-utilized Talent Waste : Cause - Effect & Solution



**Tip:** Employees at any level can offer valuable insights about the job they perform every day. They witness first hand certain inefficiencies and understand how it can be improved. Do not let this feedback go untapped

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#### 5. Transportation



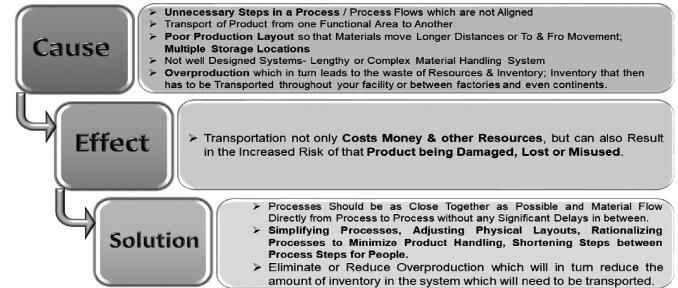
**Transportation Waste** deals with Unnecessary or Extra Movement of Products that is **Not Directly Associated with the Value Adding Process**. From a customer perspective, **Transport Adds NO Value to the Product**, as it is not being physically transformed. Transportation does not make any transformation to the product that the consumer is supposed to pay for.

Transport waste in manufacturing can include the movement of Raw Materials, Tools, Inventory, Equipment or End Products more than is absolutely necessary to achieve the production goals.

In fact, transportation can sometimes even reduce value. The more times a product is transported, the more likely it is subject to mishandling and damage. Even cosmetic packaging damage may cause customers to reject product.

**Conveying, transferring, picking up, setting down, piling up and otherwise moving unnecessary items**

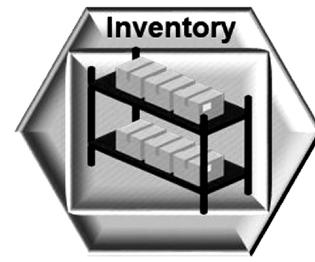
#### 5. Transportation Waste : Cause - Effect & Solution



**Tip:** Layout should be changed as per the principles of lean manufacturing, create value streams and make that value flow at the pull of the customer, that will result in huge savings in time and money

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#### 6. Inventory



**Inventory** is the **Raw Materials, Work In Progress (WIP) and Finished Goods** stock that is held, we often hold far more than is required to produce goods and services when the customer wants them using Just in Time (JIT) principles. Also Capital Goods not in use or Obsolete Items are kept in Inventory.

The waste aspects of holding large amounts of inventory are many:

- **The product made may not be what the customer ultimately wants.**
- **The product may go bad or become obsolete before the customer purchases it.**
- **The inventory may contain large blocks of nonconforming product that slipped through quality control.**
- **Holding inventory costs money (estimate 20 to 30 percent carrying cost).**
- **Tying up money in inventory limits opportunities to use funds elsewhere.**

**Excessive supplies, materials or info for any length of time (having more on hand than what's needed)**

Inventory may be in the form of **Raw Material, Work in Progress or Finished Goods**.

In any of these three forms of inventory, if it hasn't been sold, it is **cash that has been tied up into the material**, which the customer hasn't bought yet- These results in a massive drain on the cash flow.

#### 6. Inventory Waste : Cause - Effect & Solution



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#### 7. Motion



Similar to transportation, but **Motion refers to movement of operator and equipment**.

Motion Wasted in lean manufacturing is the **increased motion of machinery or a person due to an inefficient manufacturing process**. Wasted motion increases the amount of wear and tear on both workers and machinery, therefore decreasing its lifespan or ability to work on at a manufacturing site.

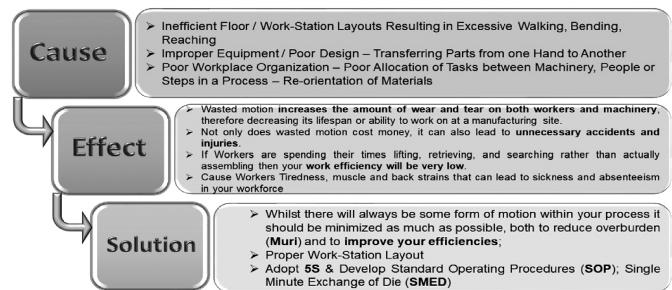
Think of the fact that operators moving around, searching and finding things cannot be adding value. Same too with equipment - if you are spending time lumping equipment around, you cannot be using it to add value and make money, plus the chances of damage increases.

Examples: Walking; Reaching; Lifting; Lowering; Bending; Stretching or otherwise unnecessary moving

Even small non-value-added motion can be very costly. Think of an extra twist of the wrist on every item many times a day that leads to a repetitive motion injury, with lost-time and disability costs.

**Unnecessary movement that does not add value (movement that is done too quickly or too slowly)**

#### 7. Motion Waste : Cause - Effect & Solution



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#### 8. Excess Processing



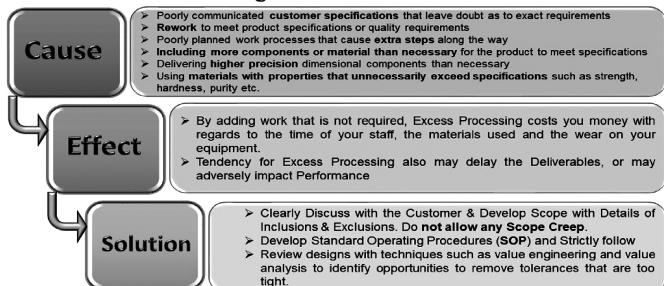
**Excess Processing** is about completing work for the customer, which is **more than the customer really wants**.

Excess Processing is **adding more value to a product than the customer actually requires** such as

- Painting areas that will never be seen or be affected by corrosion.
- Over polishing an area that does not require it.
- Tolerances those are too tight.
- Excess Processing Waste **can occur in the office as well as manufacturing areas**. Producing more detailed reports than necessary in order for one report to satisfy many users is one form of office over-processing waste.

- Not getting clear customer requirements and specifications creates excessive processing and possible repairs and re-processing.
- Excess processing might be **extra steps in a process, unnecessary customization, inefficient routings** and other things not necessary or valued by the customer.
- Organizations may want to provide the shiniest, most sparkly widget, but anything beyond a customer's spec is non-value-added, or muda.
- Unnecessary Processes and Operations Traditionally Accepted as Necessary, but Customer Doesn't want**

#### 8. Excess Processing Waste : Cause - Effect & Solution



*Tip:* Examine your process routes, are you using expensive processes where there are simpler cheaper methods?

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#### 4. Conclusion

Lean supply chain management requires businesses to examine every process in their supply chain and identify areas that are not adding any value but using efforts and unnecessarily resources, which can be measured in monetary terms, in time, or resource consumed. The purpose of such exercise is to eliminate waste in the Supply Chain. To be Lean is to provide what is needed, when it is needed, with the minimum number of resources, optimal use of materials, equipment and space. The analysis can improve a company's competitiveness, its customer service, and the company's overall profitability.

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# **Logistics Management Practices and Developments in India Post COVID-19**

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## **Abstract**

*India's supply chains will go through huge transformations in the next few years as the impact of COVID 19 continues to challenge our demand and supply frameworks. With widespread disruptions, supply chains are either broken or severely affected. As ongoing supply side issues start getting addressed, we will see demand contraction in several industry segments creating further disorder. Organizations would need to adapt to this new reality and consider some of the following thoughts to build supply chain resilience. Every entity engaged in running supply chains would need to go through severe compliances as worker, product, transport and facility sanitization protocols would have to be in place. This would not only increase efficiency but also cost containment.*

**Keywords:** Logistics, Warehouse, Transport Infrastructure.

## **1. Introduction**

Logistics is generally the detailed organization and implementation of a complex operation. In a general business sense, logistics is the management of the flow of things between the point of origin and the point of consumption to meet the requirements of customers or corporations. The resources managed in logistics may include tangible goods such as materials, equipment, and supplies, as well as food and other consumable items. The logistics of physical items usually involves the integration of information flow, materials, production, packaging, inventory, transportation, warehousing, and often security.

In military science, logistics is concerned with maintaining army supply lines while disrupting those of the enemy, since an armed force without resources and transportation is defenseless. Military logistics was already practiced in the ancient world and as the

modern military has a significant need for logistics solutions, advanced implementations have been developed. In military logistics, logistics officers manage how and when to move resources to the places they are needed.

Logistics management is the part of supply chain management and supply chain engineering that plans, implements, and controls the efficient, effective forward, and reverse flow and storage of goods, services, and related information between the point of origin and point of consumption to meet customer's requirements. The complexity of logistics can be modeled, analyzed, visualized, and optimized by dedicated simulation software. The minimization of the use of resources is a common motivation in all logistics fields. A professional working in the field of logistics management is called a logistician.

Today, logistics and distribution is a rather complicated and advanced process but it began years ago in a less advanced form. We thought these quick facts and historical background would provide for an interesting read.

Logistics refers the movement of products or services to a designated location at an agreed upon time, cost and condition. Ancient Roman and Greek wars are the basics for today's logistics systems. Rome developed a highly efficient logistic system to supply its legions. Military officers called "logistics" were responsible for ensuring the supply and allocation of resources, so that soldiers could move forward efficiently.

After World War II, logistics moved from warfare to business. Physical distribution of products began with a focus on outbound activity. Filling orders, distribution of products, storage and warehousing. Production planning and customer service are presently important aspects of the logistics process.

An entire industry was born from what started as a way to get products from point A to point B. Many companies now rely on outsourcing for some or all of their supply chain management activities, resulting in the development of third party logistics companies for efficient transport and tracking of goods.

## 2. Recent Trends logistics management practice and developments in India post Covid-19

India is facing several challenges amid country-wide lockdown. Many industries have been severely affected. One of them is logistics and supply chain management. Shortage of labor, cargo capacity challenges, and the slowdown in manufacturing, order delays, stuck shipments as well as demand and supply shocks have affected the logistics segment to the core.

The manufacturing halt has reduced demand for logistics services, which has brought down the pressure on prices across warehousing, freight and logistics. Due to lockdown in surrounding countries, minimal export-import movements during this time have amplified the crisis in the logistics space. Restrictions on air travel and international flights globally have contributed to the slowdown in the movement of goods and brought first and last-mile transportation and intermodal movement of goods to a standstill. Reduction in the capacity of vessels and shortages in the equipment to deliver the goods, related to disruptions has had a major impact on the intra-Asia trade lanes. A rapid and sudden drop in freight volumes has prompted major carriers to report service cancellations and delays and ultimately empty sailings to and from India, the Middle East and the Mediterranean took place.

But in a post-COVID-19 world, the scenario of logistics and supply chain segment will be totally different and supply chain stress tests will become a new norm. India's supply chains will go through huge transformations to challenge the demand and supply frameworks in the coming few years. Also, people are responding in a variety of ways and having different attitudes, behaviors and purchasing habits.

According to a recent industry report of India's leading logistics intelligence platform Logistics Now, a timeline of at least 1-2 months will be required for the logistics industry to recover post lifting of the lockdown. The key recommendations are to unlock inventories for retail consumers; increase transport and distribution capacity for the vaccine; build Citizen Information

Systems (CIS) powered by Artificial Intelligence (AI); build digital supply chains and logistics, mandate and further drive digital payments, etc. alongside supporting the economy through the usage of advanced technology.

The most important change will be the rise of domestic sourcing to make supply chains more local. Post lockdown, the role of government policies to promote domestic manufacturing companies should increase and this will push the establishment of global value chains in India to not only serve domestic markets but also export markets. Companies should start building more safety stock in their distribution pipelines to gain risk management and mitigation in supply chains. This will increase in more warehousing space across networks. The practice of developing, implementing multiple and robust contingency plans will be taken more seriously.

As there will be more variables in volumes, supply chains will start becoming more adaptive, especially large suppliers and logistics operators in the supply chain industry must prepare for major catastrophic events such as weather-related calamities, upcoming lethal pandemic outbreaks, strikes, social unrest and associated disruptions. Digital transformation of the industry will be hastened. Every element of the logistics process whether it is planning or execution would be reconsidered, repurposed and digitized. In most of the industries, comprehensive dashboards have been produced that states the full status of production and shipment, down to the last detail. Such technology will inevitably emerge as a norm in the coming days.

To prevent the spread of the virus, the number of touch-points any product goes through during the entire supply chain from production to handling till the doorstep of businesses and homes will be reduced drastically. Rapid automation in handling systems and management including palletization of cargo, conveyor systems, robotics, drones and drop boxes amongst others would go through an accelerated trend. A rapid shift towards omni-channel procurement would be a new trend once the lockdown is completely lifted.

Every segment, somehow attached in running supply chains, would need to go through severe compliances as a worker; product, transport and facility sanitization protocols would be the new priorities. This will not only increase the management cost but also the insurance cost. Labor will be managed as a key asset of adaptation that plays a fundamental part of a crisis response program. To deal with one of the largest global exogenous shocks to economies, almost all aspects of managing supply chains will go through substantial changes.

In the Indian logistics sector, several long horizon transformations will get accelerated and perhaps skip a generation of gradual improvements. In the post-COVID-19 situation, the main goals in the medium term should be making them more regional, modifying the supply chain as a key business driver and putting back the human asset and manpower as the most important factor for an agile business to succeed in the post-Covid-19 scenario.

### **3. Recent trends to scale up the logistics in India. They are as follows:**

**Growing Regional Integration:** Until recently, infrastructural woes had a crippling effect on the supply chain network in India. The delay in the movement of goods between state borders by the suppliers, manufacturers, and retailers which is due to complicated taxes and transport lines running over capacity, increasing overall costs. With the implementation of GST, the supply chain industry has a cascading impact on almost all aspects of trade and retail. As India opens its transparency in trade and economy further, financing the improvement of the logistics sector is vital growth in business. A modernized and efficient supply chain improves ease of doing business, scales down the costs of manufacturing, and accelerates rural and urban consumption growth due to better market access. With these new GST reforms coming into play, a gradual resolution of these problems seems imminent. And recently, E-way bill implementation by the Government of India which helps in regional connectivity by abolition of check posts, movement

of goods between the states is effectively and yields India's logistics ecosystem resulting in lesser traffic on major transportation routes.

**Better Transport Connectivity:** This sector is thus a key focus of government spending and infrastructure investments:

**a) National highways:** The National Highway Authority of India has a bidding process underway for companies to invest in highways across India. Dubai based investment firms have already started investment close to US\$9 billion (Rs 585 billion) for nine highways. This will help in increase in accountability for the update infrastructure of these roads – currently extremely under-maintained – and in future it will reduce road travel times. Recently, National Highways construction sets a record of constructing road at 28 KM per day.

**b) Freight corridors:** The country's freight corridors, covering 15 states all over India, are set to be complete by December 2019. Currently, a train carrying cargo travels at the rate of 25 km/ph; on these railway lines, trains will be able to reach speeds between 70 and 100 km/ph, and will carry double the quantity of cargo.

**Warehouse Development:** India allows 100 percent FDI in the development and maintenance of warehousing and storage facilities. Under Free Trade Warehousing Zone (FTWZ) Scheme, there are several designated zones in India reserved for warehouse development. Some of the designated FTWZs are constructed in Panvel near Mumbai, Khurja near New Delhi, and Siri City in Chennai. The connectivity of these zones along with major rail routes, roadways, airways, and ports is well established. Some of the major incentives such as duty free import, excise duty, etc., for building materials and equipment for these zones are attracting more investors to this logistics sector. During 2017-2018, the 100 acre FTWZ in Nanguneri in the southern state of Tamil Nadu began operations successfully. According to JLL India report, India needs to setup the investments close to Rs. 50,000crore for in creation of warehousing facilities in all states across the country between 2018 and 2020. Hence, there must we expected to create around 20,000 jobs in this operations across the country.

**Start Up:** The time is right for first movers to benefit from the changing landscape of India's supply chain ecosystem. With Make in India and Start Up India, greater participation from the private sector and increased government spending for ease of doing business and opportunities of foreign direct investors in the country's supply chain are come up with great effort. And also for the steady transformation of moving all sector to digital by Digital India initiative along with infrastructure as well, with federal campaigns Digital India working to promote the growth of technology startups and enterprises. For SMEs, possibilities in third party logistics abound are whether in the transportation of goods between the states and countries, new technology-based improvements like IoT, Block chain technology, etc., to make operations lean, or in warehouse management by create more number of cold storage facilities across the country. Multinational firms like L&T, Transitory, etc., are some of the major firms in construction and related industries are also take advantage of investment opportunities to start up operations in India's major ports, roads, and warehouse development.

#### 4. Conclusion

Forty-five years have seen physical distribution/business logistics/supply chain management go from individually managed activities that are product-flow related to an integrated set of processes managed across multiple echelons of a product supply chain. SCM has never been more important to business than it is currently, or will be in the near future. It has the potential of production/engineering in the industrial revolution and marketing of the 1920s and 1930s when each of these gained prominence in business. SCM often is the basis for a firm's competitive strategy, which is driven by increased outsourcing, expanding global operations, and heightened need for logistics customer service. Not only has managing supply chain costs become more important, as these costs are used in tradeoff with production costs, but supply chain strategy is increasingly viewed as a source for contributing to the revenues of the firm.

Key challenges for the future will be to better estimate the revenue contributions from the customer service levels generated by the supply chain and effectively managing the scope of the supply channel as envisioned in supply chain management. Because of the difficulty of estimation, too little attention has been given to the revenue contribution that the supply chain can make to the overall sales of the firm. It is an area of much needed research.

Proponents of SCM are making bold statements about the benefits of boundary-spanning management but offer little as to how these benefits can actually be realized. Businesses have yet to progress very far with boundary-spanning management, probably because the tools and skills are not well developed. If the promises of SCM are to be realized, an inter organizational accounting system, appropriate metrics for defining and tracking shared benefits, and acceptable methods for benefits sharing will need to be developed. Also, supply chain managers will need training in collaborative techniques, relationship and trust building, and skills for compromise. These will require major efforts by the academic, research, and business communities, but the rewards can be substantial.

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# **Progress of Self-Help Groups – Bank linkage programme in India between 2000 and 2019**

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## **ABSTRACT**

*The main purpose of Self-Help Groups (SHGs) is to create a business activity that generates regular income and to raise the standard of living of weakest section of the society. It is vital that SHGs are linked with a business activity which is in favor of the region in which SHGs are established. Women are an integral part of nation building. Indian women contribute their entire earnings for meeting the requirements of their family. This is a sure measure towards eradicating poverty. There are tremendous efforts made by members of Self - Help Groups - Bank Linkage Programme to increase their savings and invest funds which will reap benefits for them.*

*The savings are pooled together and are put in investment activities. These investments made by SHGs are essential for capital formation and economic growth in a developing country, like India. The analysis is done on loan disbursed, savings and non-performing assets with the help of basic statistical measures. Through the provision of microfinance by banks to Self - Help Groups- Bank Linkage Programme numerous people have come under financial inclusion which every government and banking system works for.*

**Keywords:** *Self Help Groups, Self - Help Groups - Bank Linkage Programme, Non - Performing Assets, Savings, Bank Outstanding.*

## **1. Introduction**

Self-help group – Bank linkage Programme (SBLP) was introduced in the year 1992 in various parts of Indian economy by the apex bank for agriculture and rural development known as National Bank for Agriculture and Rural Development (NABARD) for eradicating poverty slowly in rural areas of India. Self Help Groups (SHGs) are the financial intermediary group comprising of 10 – 20 members (female or male) who have come together to save funds and help each other to fight a common problem like poverty and unemployment. Self Help Groups are also known as mutual support groups or mutual aid groups. In India, the SHGs are linked to one or other bank to provide them funds for their activity which will help them to earn their livelihood. Each member of the SHGs saves fixed amount of funds monthly for increment of the SHG bank account.

SHGs work on co - operative principle, to extend their support to one another and provide means to empower themselves. To improve the accountability and transparency of SHGs, the Government of India with the help of National Bank for Agriculture And Rural Development (NABARD) set up SHG – Bank Linkage Programme and brought it under organized financial system. Most of the SHGs are engaged in activities such as animal husbandry, dairy production, pottery, etc.

It was so successful that even in urban areas of India this programme has been adopted by weaker section of the society. This SHG movement has brought thousands of Indians under the scanner of organized financial system known as 'Financial Inclusion'. SHGs

are formed under different federations and community institutions. These institutions have been set up to support the livelihood and empower the rural population of India. SHGs have mix of men and women but its success is mainly due to one fact: inclusion of women in income generating activities. The SHGs are provided with loan by the banks and the recovery of loans is 80%, which is highest among the loan portfolio of any bank. SHGs are mainly aimed at poor households, poor communities, marginalized community, and ST/SC tribes of Indian economy.

### Definition

Self Help Groups is a holistic programme of micro-enterprises covering all aspects of self-employment, organization of the rural poor into self-help groups and their capacity building, planning of activity clusters, infrastructure build up, technology, credit, and marketing.

### RBI & NABARD

These two apex banking institutions of India together took three policy decisions regarding SHGs. They are:

- Banks could lend to SHGs without finding out the purpose for which loan is granted to borrower.
- Banks are permitted to sanction loans to SHGs without taking physical collateral.
- Banks can lend to unregistered SHGs.

The basic objectives for linking SHGs with banks are:

- To set up a strategy of credit reaching the poor.
- To build mutual trust relationship with the bank and poor Indians.
- To encourage savings mobilization and credit management among the poor and therefore growth of the bank.

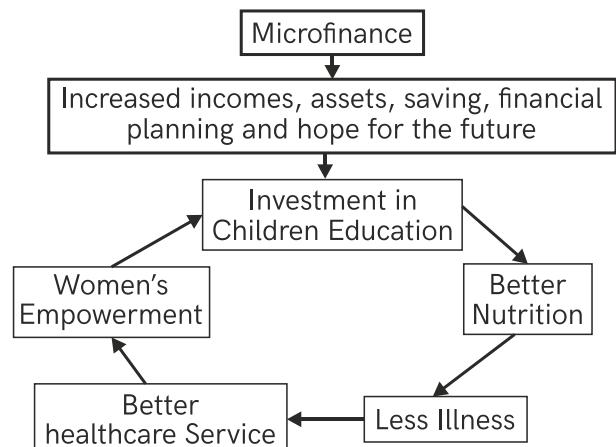
This programme was not limited to commercial banks but it has been extended to cooperative banks and regional rural banks (RRBs).

### Features of SHG

- SHG is organized on the grounds of homogeneity between the group members.

- Its ownership lies in hands of the members and run by the principles of self-help and mutual benefit.
- SHG are mostly organized by women with membership ranging from 10 to 20.
- SHGs meet up in regular intervals, help in collective decision making, pool all the savings, encourage the habit of thrift, build credit worthiness, and protect usage of their own and raise required debt funds.
- SHGs have binding code of conduct on all its members.
- SHGs functions in democracy allowing the members free exchange of thoughts.
- To inspire the savings and banking habits among its members for accumulating their capital resources.
- For productive purposes availing of loans are remade possible.
- Collective wisdom in organizing and managing the finance and distributing the benefits among themselves.
- Sensitize, build confidence, collective decision making and capabilities in women are created.
- To encourage women to grasp social responsibilities in relation to women empowerment.

### Microfinance through SHGs



**Figure 1: Microfinance through SHGs** (Source: <http://www.humanityforchildren.org/node/102>

Cited on 16-11-2013)

The following are the important key notes which explain the role of NABARD in supporting SHGs. They are as follows:

- SHGs were set up with emphasis of self-help, economic development and raising funds to promote eradication of exploitation.
- SHGs were formed with uniformity regarding caste and income generation activities.
- These SHGs were given freedom for their governing, their working and to protect their funds and for repayment of loans undertaken.
- Women's SHG were successful in mobilization of savings, credit management and promoting income generating activities.

## 2. Review of Literature

Since this study is primarily focused on the Self-Help Groups, the literature in that arena has been viewed intensively and those predominant reviews are as follows.

Singh, Ruivenkamp and Joost Jongerden(2011) states that Self Help Group is a strategy that has been adopted by the Indian Government for rural development, meeting rural population's requirements of funds and invest the funds, thereby, fulfilling and empowering the rural people. The authors found that, by creating networks in rural area will strengthen their ability of expanding the business undertaken by SHGs.

Murthy and Narasaiah (2014) explained that for rural financing there is requirement of regional rural banks, commercial banks and co - operative banks. They feel the role played by regional rural banks and co - operative banks should be more effective in catering to the financial needs of the area in which they are operating. The authors are of the opinion that most of India's population consists of poor people and to reduce this growing poverty the government and RBI should set up regional rural banks and co - operative banks which will provide credit to these people.

Navulla and Sunitha (2016) have introduced SHGs as such, to see if there is any remarkable variation between number of loans disbursed and amount of loans issued. They observed the relationship between amount of loans disbursed and number of loans issued along with appropriate suggestions to strengthen the financial assistance provided to the self-help groups. The authors found the relationship between loans disbursed in amount and number of loans disbursed is moderate.

Nagalakshmi (2017) says in India, SHG-Bank linkage measure and scheme has registered phenomenal growth under the NABARD initiatives and launching of SGSY, which led to microfinance movement. The members of self-help groups are the real owners and managers of a very small bank. They within themselves decide who will get loans, when they should get it and at what cost of interest. They are indirectly paid for all their management, time, and effort. Self-help groups are informal voluntary groups who on their own have derived characteristics from the homogenous composition of members. The author has observed women are the stronger force in working of self-help group bank linkage program.

Setia, Tandon and Brijpal (2017) concludes; A Self-Help Group is one of the measures undertaken, which has radically contributed through its efforts to the zeal, which has led to the growth of women empowerment. Self Help Groups have given opportunities to poor women to manage and bring a positive change in their lives through the mode of savings along with making them self-reliant to run their own small-scale businesses. The authors found that all women were interested in providing good financial support for their family members.

Srivastava and Rao (2017) states that self-help groups are made of 10 - 15 women who are motivated in saving their funds and found encouragement to invest the funds in income generating activities. The self-help group's bank linkage program is playing an important role to encourage the rural savings and promoting

investment activity. The authors are introducing to the audience the Self-Help Group Bank Linkage Program.

Paudmal (2018) has concluded that the efforts made by Self Help Group Bank Linkage Program have been successful due to the involvement of women in the maximum. Therefore, the government should empower women by making them as a deciding partner to bring about social and economic transformation.

Shirisha, Devi, and Devi (2018) have stated that the process of upholding and maintaining rural development will lead to the achievement of Millennium Development Goals (MDGs). Such goals can be achieved only through the modern tool to reduce poverty and ensure rural development, commonly referred to as microfinance through SHGs. Apart from savings and credit, SHGs were also able to fight and manage various social issues like health, education, sanitation, drinking water, alcoholism etc. The authors found that lakhs of the marginalized Indians are seeking for the benefits from SHGs for building their lives and improving the standard of living.

Akter, Ahmad, Jaafar, Zawani, Islam and Islam, (2018) suggests that government must empower women by increasing their knowledge, skills, and technology usage. The authors found that women were highly responsive among the members of the group.

Hundekar (2019) states that SHGs was started with multiple aims including access to loan, enabling income generation, encouraging savings, and eventually empowering the poor. This study aims to find out regarding the penetration of financial inclusion through SBLP in the state of Karnataka using financial inclusion index as a yardstick. The author's observation has been to adopt a geographical area and extend the credit to the poor through self-help group bank linkage program.

The in-depth review of literature enumerates the importance of Self-Help Groups in developing the rural areas of India by creating opportunities like new small-scale ventures by women population. Rural development has also been viewed as one of the utmost

objectives of such financial entities. Hence, the objectives of this study focus on how SHGs financially perform in India with reference to Bank Linkage Programme.

### **3. Objectives**

The main objectives of this study are:

- i. To study the financial performance of SHG - Bank Linkage Programme in India from 2000 - 01 to 2018 - 19.
- ii. To analyze the level of loans disbursed to SHG - Bank Linkage Programme in India from 2006 - 07 to 2018 - 19.
- iii. To examine the level of savings of SHG - Bank Linkage Programme in India from 2006 - 07 to 2018 - 19.
- iv. To evaluate the NPAs of SHG - Bank Linkage Programme in India from 2007 - 08 to 2018 - 19.

### **4. Research Methodology**

Type of the Research: Descriptive research type has been employed.

Sample Unit: Consists of Self-Help Groups under NABARD.

Timeline: Between April 2000 and March 2019 (Financial Years).

Data Type: Secondary data has been gathered according to the nature of the study.

Data Sources: Reports and Publication by NABARD.

Analysis: Simple Percentage Analysis and Correlation Analysis have been used to achieve the objectives.

Tools: MS Excel

### **Research gap**

The Government of India, many societal service entities and bodies are keenly looking on the opportunities to elevate the rural standard of living, women entrepreneurship and boosting rural development, and implement many initiatives in this context. One among those is Self Help Groups. It is

important for the researchers in finance area to understand the role of such initiates, the transacting abilities and the growth & development pavements for not only contributing to the literature but also to support the entities for their intensive betterment and improvement of standard of living. Thus, this study has been found relevant to the financial scenario.

### **Scope for future Research**

- i. A study of poverty removal in the regions which are not covered under financial inclusion through SBLP.
- ii. For a financially healthy India requirement of women entrepreneurship in rural areas of India via SHGs is a must.
- iii. Growth of women entrepreneurship in rural areas through SHGs.
- iv. An analysis of removing of poverty of the areas covered under financial inclusion which is the primary goal of SBLP.
- v. An evaluation of the empowerment of women in India.
- vi. A comparison of state wise loan disbursement, recovery of loans and savings of SHGs.
- vii. A comparison of region wise loan disbursement and savings of SHGs.

### **5. Analysis and interpretation**

**Table 1.1: Progress of Self-help Group-Bank Linkage Programme (*Amount in Rs Lakhs*)**

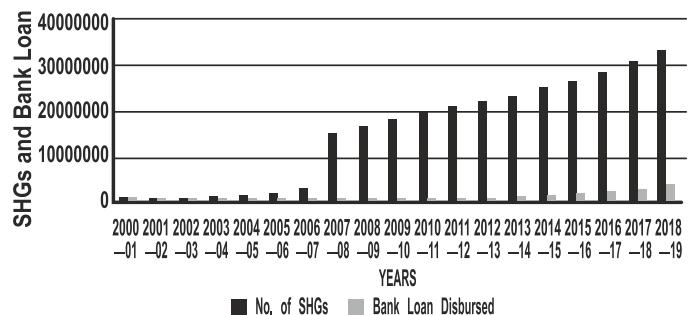
<b>Year</b>	<b>No. of SHGs Credit Linked</b>		<b>Bank Loan Disbursed</b>	
	<b>During the year</b>	<b>Cumulative</b>	<b>During the year Credit</b>	<b>Cumulative Credit</b>
2000 - 01	149050	149050	480.88	480.88
2001 - 02	197653	346703	545.40	1026.28
2002 - 03	255882	602585	1022.30	2048.58
2003 - 04	361731	964316	1855.50	3904.08
2004 - 05	539365	1503681	2994.20	6898.28
2005 - 06	620109	2123790	4499.10	11397.38
2006 - 07	1105749	3229539	6570.39	17967.77
2007 - 08	1227770	15457309	8849.26	26817.03
2008 - 09	1609586	17066895	12253.31	39070.34
2009 - 10	1586822	18653717	14453.30	53523.64
2010 - 11	1196134	19849851	14547.73	68071.37
2011 - 12	1147878	20997729	16534.77	84606.14
2012 - 13	1219821	22217550	20585.36	105191.50
2013 - 14	1366421	23583971	24017.36	129208.86
2014 - 15	1626238	25210209	27582.31	156791.17
2015 - 16	1832323	27042532	37286.91	194678.08
2016 - 17	1898120	28940652	38781.16	233459.24
2017 - 18	2261132	31201784	47185.88	280645.12
2018 - 19	2698400	33900184	58317.63	338962.74

**Source:** Compiled from NABARD Annual Reports and NABARD publications, *Progress of SHG-Bank Linkage in India* and *Status of Microfinance in India*.

From the above Table 1.1, it can be observed that banks (commercial banks, regional rural banks, and cooperative banks) are disbursing the loans to self-help groups - bank linkage. The SHGs with bank linkage grew at steady rate with bank credit availed. Since the year 2000 - 01 the 1,49,050 SHGs availed credit from banks to the extent of Rs 480.88 lakhs till the year 2018 - 19 the SHGs increased to 33,900,184 availed credit from the banks to the extent of Rs 338962.74.

### Correlation between Self-help Group-Bank Linkage Growth and Bank Loan Growth

#### SHGs Growth and Bank Loan Growth



**Figure 2: Correlation between Self-help Group-Bank Linkage Growth and Bank Loan Growth**

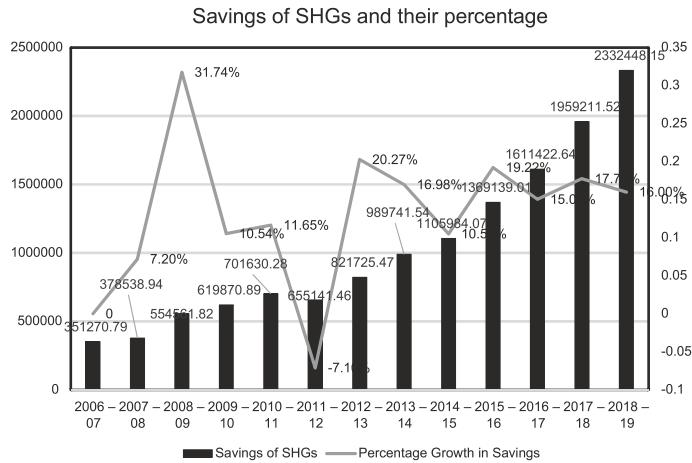
From the above figure 2 it can be clearly observed that the self-help group - bank linkage growth and bank loan disbursed growth are correlated. The coefficient of correlation gives positive result of 0.8861 between self-help group - bank linkage growth and bank loan disbursed growth. This implies to a great extent the bank loan disbursed during the 18 years has been highly dependent on growth of Self-Help Groups - Bank Linked.

**Table 1.2: Savings of SHGs with Banks (Amount in Rs Lakhs)**

Year	Savings of SHGs	Cumulative Growth in Savings	Growth of Savings	Percentage Growth in Savings
2006 - 07	351270.79	351270.79	-----	-----
2007 - 08	378538.94	729809.73	27268.15	7.20%
2008 - 09	554561.82	1284371.55	176022.88	31.74%
2009 - 10	619870.89	1904242.44	65309.07	10.54%
2010 - 11	701630.28	2605872.72	81759.39	11.65%
2011 - 12	655141.46	3261014.18	-46488.82	-7.10%
2012 - 13	821725.47	4082739.65	166584.01	20.27%
2013 - 14	989741.54	5072481.19	168016.07	16.98%
2014 - 15	1105984.07	6178465.26	116242.53	10.51%
2015 - 16	1369139.01	7547604.27	263154.94	19.22%
2016 - 17	1611422.64	9159026.91	242283.63	15.04%
2017 - 18	1959211.52	11118238.43	347788.88	17.75%
2018 - 19	2332448.15	13450686.58	373236.63	16.00%

**Source:** Compiled from NABARD Annual Reports and NABARD publications, *Progress of SHG-Bank Linkage in India* and *Status of Microfinance in India*.

### Savings and their growth of SHGs with Banks



**Figure 3: Savings and their growth of SHGs with Banks**

From the above figure 3 it can be clearly observed that the savings and percentage of growth in savings of self-help group – bank linkage in the year 2008 – 09 increased tremendously to 31.74%, in the year 2011 – 12, it deteriorated very significantly to – 7.10% and it grew at steadily thereafter, in the year 2018 – 19 it has grew up to 16%.

**Table 1.3: Bank Loan outstanding against SHGs (Amount in Rs Lakhs)**

Year	Bank Loan Outstanding	Cumulative Growth in Bank Loan Outstanding	Growth in Bank Loan Outstanding	Percentage Growth in Bank Loan Outstanding
2006 - 07	1236649.39	1236649.39	-----	-----
2007 - 08	1699990.66	2936640.05	463341.27	27.26%
2008 - 09	2267984.25	5204624.3	567993.59	25.04%
2009 - 10	2803828.07	8008452.37	535843.82	19.11%
2010 - 11	3122116.55	11130568.92	318288.48	10.19%
2011 - 12	3634000.18	14764569.1	511883.63	14.09%
2012 - 13	3937529.72	18702098.82	303529.54	7.71%
2013 - 14	4292752.40	22994851.22	355222.68	8.27%
2014 - 15	5154546.14	28149397.36	861793.74	16.72%
2015 - 16	5711923.47	33861320.83	557377.33	9.76%
2016 - 17	6158130.36	40019451.19	446206.89	7.25%
2017 - 18	7559845.12	47579296.31	1401714.76	18.54%
2018 - 19	8709815.43	56289111.74	1149970.31	13.20%

**Source:** Compiled from NABARD Annual Reports and NABARD publications, *Progress of SHG-Bank Linkage in India and Status of Microfinance in India*.

From the above Table 1.3, it can be observed that banks (commercial banks, regional rural banks and cooperative banks) have been disbursing the loans to self-help groups – bank linkage and these loans have remained

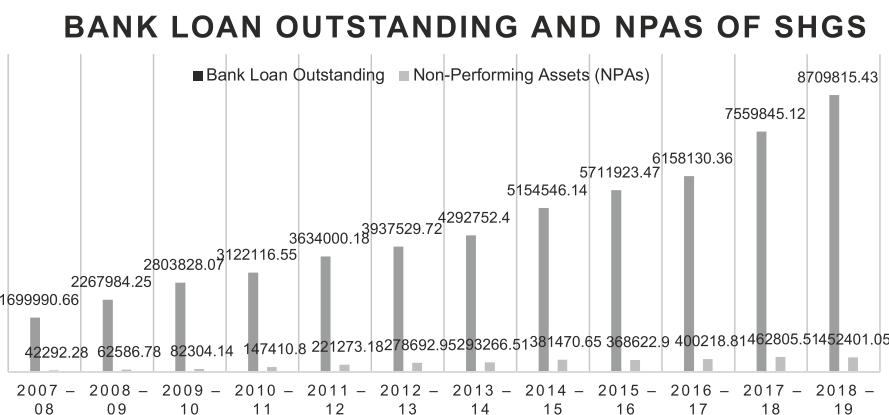
outstanding by the end of the year. The SHGs with bank linkage has outstanding loan growth with alarming numbers. Since the year 2007 - 08 the bank loan outstanding by SHGs grew at the rate of 27.26%, it reduced during the year 2012 - 13 to 7.71%, further grew again in the year 2017 - 18 to 18.54% and in the year 2018 - 19 it shows drastic fall to 13.2%.

**Table 1.4: Non-Performing Assets of Banks against SHGs Loans Outstanding**

Year	Bank Loan Outstanding	Non-Performing Assets (NPAs)	Percentage of NPA of Bank Loan Outstanding	Growth in NPAs	Percentage Growth in NPA
2007 - 08	1699990.66	42292.28	2.49%	—	—
2008 - 09	2267984.25	62586.78	2.76%	20294.5	32.43%
2009 - 10	2803828.07	82304.14	2.94%	19717.36	23.96%
2010 - 11	3122116.55	147410.80	4.72%	65106.66	44.17%
2011 - 12	3634000.18	221273.18	6.09%	73862.38	33.38%
2012 - 13	3937529.72	278692.95	7.08%	57419.77	20.60%
2013 - 14	4292752.40	293266.51	6.83%	14573.56	4.97%
2014 - 15	5154546.14	381470.65	7.40%	88204.14	23.12%
2015 - 16	5711923.47	368622.90	6.45%	-12847.75	-3.49%
2016 - 17	6158130.36	400218.81	6.50%	31595.91	7.89%
2017 - 18	7559845.12	462805.51	6.12%	62586.7	13.52%
2018 - 19	8709815.43	452401.05	5.19%	-10404.46	-2.30%

**Source:** Compiled from NABARD Annual Reports and NABARD publications, *Progress of SHG-Bank Linkage in India* and *Status of Microfinance in India*.

#### Correlation between Bank Loan Outstanding and Non - Performing Assets of SHGs – Bank Linkage Programme



**Figure 4: Correlation between Bank Loan Outstanding and Non - Performing Assets of SHGs – Bank Linkage Programme**

From the above figure 4 it can be clearly observed that the non - performing assets and bank loan outstanding of self-help groups - bank linkage are correlated. From the statistical calculation, the coefficient of correlation gives positive result of 0.9317 between the non - performing assets and bank loan outstanding of self-help group - bank linkage. This implies to a great extent the non - performing assets during the 12 years is highly dependent on bank loan outstanding of Self-Help Groups - Bank Linkage Programme.

## 6. Findings

- i. There is a very strong and positive coefficient of correlation between Self Help Groups - Bank Linkage and loans issued to the SHGs. The more of SHGs, the more is the amount of loans issued during any given period.
- ii. The savings of SHGs are increasing Year on Year, in 2007 - 08 it showed a growth of 7.2%, it decreased tremendously in 2011 - 12 to -7.1% and again showed an increase to 16% in 2018 - 19. This shows SHGs are heading towards self-dependency.
- iii. The percentage growth of bank loan outstanding was 27.26% in the year 2007 - 08 while it decreased to 13.2% in 2018 - 19. These observation further shows SHGs are achieving self-independency.
- iv. NPA among SHGs is decreasing, to an extent of - 2.3% during the year 2018 - 19. This is because the SHGs savings are increasing and they are in position to repay their loans, therefore, NPAs are decreasing.
- v. The coefficient of correlation shows that NPAs are increasing in comparison with bank loan outstanding. This means with the increase of SHGs the banks are giving increased loans and SHGs require time to get on their feet.

## 7. Suggestions

- i. There should be more encouragement to form SHGs - Bank Linkage Programme to help banks to

disburse loans to weaker section of the society and earn an interest amount on the loan given to SBLP.

- ii. Savings should be encouraged among women of the SHGs and earn an income for SHGs. Banking their savings which is good in terms of credit creation of banks. It also enables the women to earn an income through SHGs.
- iii. NPAs are decreasing for financially developed SHGs but it is increasing for the newly formed SHGs on the loan disbursed.
- iv. There should be more encouragement to set up SHGs - Bank Linkage because it can reduce poverty and provide employment to unemployed people.
- v. The SHGs should be encouraged on savings by giving a higher rate of interest on funds registered under SHGs name.
- vi. Their NPAs are declining and this should be popularized, so that these SHGs feel pride in them and continue their saving habit.
- vii. The RBI and NABARD should order the banks to set up a counter and Government of India should formulate the loan policy for SHGs.
- viii. Helping to set up the SHGs helps creating and providing employment opportunities, thereby, strengthening our nation.
- ix. One bank officer each may be appointed between every closely situated 3 SHGs. The officer may monitor their work and provide necessary advice to SHGs in their difficult times which enable the bank to take appropriate measures to reduce NPAs. He can also enable the government to fight against the unemployment problem by providing necessary information.

## 8. Conclusion

India, a developing country, requires women's active participation in development process. The government is actively involved in upliftment of women and empowerment to abolish poverty and unemployment. A self-help group which sustains for a longer period is

able to achieve financial independency. The self-help group can handle its leadership, trouble shoot and resolve their conflict successfully with minimal help from outside parties. The government should provide help whenever required by self-help groups.

Finally, the government, RBI and NABARD have been successful to achieve financial inclusion through providing SHGs microfinance. Despite facing difficulties these SHGs have sustained and are progressing well. The SHGs are savings funds for themselves and non - performing assets are declining over time. NABARD through latest technology and improved digitization of SHGs can help build our country into a developed country by tapping potential of SHGs.

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## Case Study

# Tracking in Distribution of Vaccines through IoT Sensors

Dr. R. K. Prema, Associate Professor, ABBS

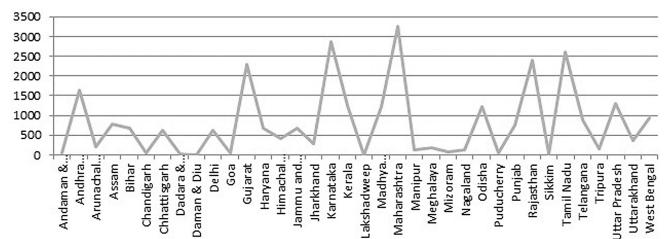
### Origin

The World Health Organization (WHO) declares Coronavirus Disease 2019 (COVID-19) pandemic on March 11th, 2020, due to its outspread globally, subsequent transmission from the Wuhan City, China December 2019. After the 1918 flu pandemic, this COVID-19 pandemic is the fifth vulnerable pandemic globally, which killed millions of lives. As we know, that the entire world is fighting with this pandemic in the development of vaccines across the globe by the initiation from pharmaceuticals companies. Generally, administering a vaccination requires years together, but this pandemic is so severe and urges the companies to embark on a race in the production and distribution of COVID-19 vaccination.

Research shows that there are currently 64 vaccines in clinical trials testing on humans, and nearly 20 vaccines reached the final testing stage-few vaccines for full use. Eight have got approval for limited/emergency use in the Immunization against Covid-19, which involves eight vaccinations for emergency use and few vaccines consent for use. Already we have come across the first wave of vaccination drive. The second stage of the drive process puts forth many challenges in logistics and supply chain facilities to ensure that the vaccines will be administered reliably. COVID-19 is the fastest ever developed vaccination, but India is still a highly populated country: how does it face the challenges in its distribution and administering the vaccination.

### Fact sheet

India is the 'pharmacy' for the entire world facing challenges and issues in distributing vaccines for the COVID-19 outbreak. The world's largest generic medicine producer is India, which accounts for 20 percent of the total global production and satisfies 62 percent of the vaccine's worldwide demand. By July 2021, the government has a plan to vaccinate nearly 25 crore people. Thirty-nine percent of the loss to the vaccine is due to the less availability of cold chain storage.



**Figure 1: Cold Chain Equipment Availability (Source: MoHFW State wise cold chain equipment availability)**

The availability of cold chain distribution will not be enough to meet our country's requirements, as displayed in the chart. Due to India's climatic conditions, it is of highly challenging task to keep the nature of medicine in cold storage. There is a need for the vaccine to be distributed through Cold chain distribution.

As programming languages shape the entire world, the business's nature and its services become more integrated. Digital initiatives benefit the service sector a lot, and the present world is more technology integrated and digitalized. Cost optimization in

production and logistics delivers substantiate benefits more than earnings.

### Digital supply chain in supporting vaccine distribution cold chain and IoT

It is astounding that the speed of vaccine invention and production is a recovery measure for COVID 19. It is possible with the advent of technology, scientific research, and investment infrastructure. The faster the vaccine is manufactured, the faster it needs to be administered. Supporting this, the supply chain plays a vital role in the distribution of vaccine globally, but then the problem is the vaccine must be kept at -94 ! (-70!), -4 ! (-20!) (Values differ concerning different vaccine producer), gaining the most real advantage or else it will get spoiled. Hence here comes the question of the discussion about the possibility of making it successful. How do the digital supply chain of cold chain and IOT support the distribution of the vaccines?

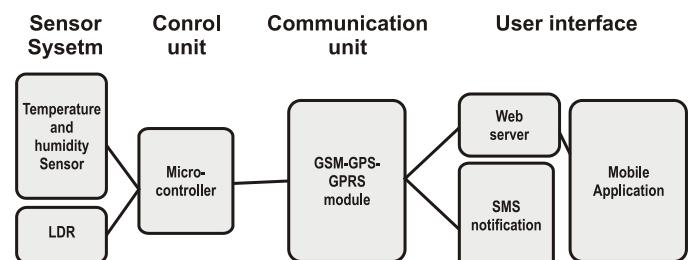
Cold chain is the provision for the vaccination to be maintained at the required temperature. Digital cold chain focuses on monitoring the cold chain storage temperature with the support of temperature monitoring devices (TMD) and digital data logger (DDL) to ensure that the required temperature is maintained at the cold chain. When a good is loaded from a production unit to airways, waterways, rail, or trucks, the platform involves risk in supply chain management because of the poor temperature management. A report from the International Air Transport Association, 2019 highlights that, 25 percent of the vaccines through waterways incurs loss due to poor temperature management issues. The digital supply chain gears the vaccine distribution for the pandemic COVID-19, with its advanced innovations and tools and the hour's need.

### IoT

Internet of Things in the digital supply chain reduces the risk in the supply chain by providing the details about location identification and the nature of the good through its GPS. IoT in the supply chain process involves updating the information wirelessly and automatically to solve temperature management and excursion issues. IoT facilitates the availability of

information on a global scale, aggregation of data will be efficient, and position data will be the added advantage, highly automation so that manual monitoring can be reduced and proactive so that the cost optimization can be possible. IoT uses GPS-enabled thermal sensors to monitor the temperature excursion throughout the supply chain using a control tower.

The pandemic brings technology and the digital supply chain closer to minimize cost and efficient operations. Though there are challenges associated with the distribution of the vaccination, there are positive signs for bettering the situation with the use of a digital supply chain. COVID 19 paves the way for many innovations in digitalization. IoT is one such thing that helps a lot.



**Figure 2: Block diagram of Monitoring System (Hasanat et al., 2020)**

### Conclusion

Mounting the vaccination, distribution, and administering it quickly is the tender goal. Administering the vaccine to billions of population in the country is not easy, considering the pandemic situation. Logistics and supply chain challenges in vaccine distribution stay top, wherein IoT can answer in streamlining the channel. Operations need to be scaled up concerning the current pandemic and the economic turbulence. An IoT sensor helps the distribution channel to fix up the errors at the early stage. The availability of IoT in the digital supply chain progress opens up the transparency of the entire process gain advantage to the healthcare. Adopting IoT in the supply chain will obviously enhance the delivery and minimize the loss involved, thereby support the supply chain practices in a more significant way.

## BOOK REVIEW

**The Digital Supply Chain Challenge: Breaking Through, Book written by Ralf W.Seifert and Richard Markoff, Published by International Institute of Management Development (IMD), Switzerland, 2020, Pages 254.**



Reviewed by Dr.C.Sengottuvelu, CPM(ISM-USA), Professor, ABBS

The Challenges faced by supply chain professions are many folds. Today, far from focusing on capital expenditures and logistics such as warehousing and distribution, supply chain managers are expected to understand all aspects of the business, appreciate the constraints and expectations of upstream and downstream partners and possess sufficient technological savvy to navigate the bewildering array of options presented by Industry 4.0 and supply chain digitalization (SCD).

This book provides a well organized framework and journey for what constitutes a digital supply chain and how to make it possible. The authors are the first to provide thought pieces that help a new generation of supply chain leaders to effectively address digital transformation. It is a sort of handbook to the essentials of digital supply chain transformation.

This book is consisting of four chapters. Chapter 1 deals with separating hype from reality, chapter 2 covers proof beyond the promise, chapter 3 addresses successful execution of the basics and chapter 4 deals with leading a digital supply chain transformation including case studies. The details covered under each chapter are as follows:

**Chapter 1**, the authors have highlighted the real Industry 4.0 challenges, demand for AI in demand planning, the leveraging e- Commerce in flections point RFID & Blockchain technology.

**Chapter 2** has been devoted for predictive maintenance Industry 4.0, AIs best path in supply chain digitization: A fresh idea for the fruit and vegetables supply chain. This is concluded with a case study: Tesco and Ocado: competing online models.

**Chapter 3**, the authors have emphasized on ABC classification right, service measures in an integrated supply chain, the hidden cost of cost to serve, the role of sales & operation planning (S&OP) governance, supply chain digitalization: IT management challenges and building an Industry 4.0 transformation roadmap.

**Chapter 4** has been devoted for case studies. Four fine case studies are included in this chapter. Case study 1: Hungrypet - Challenges to digital supply chain innovation. Case study 2: Tetra Pack - A digitally enabled supply chain as a competitive advantage, Case study 3: Faurecia digital transformation (A), (B) and (C) and case study 4: Adidas Russia/ CIS and the Russian Crisis - Retrench or double down (A) and (B). This chapter is concluded with a unit on supply chain career opportunities.

Authors of this book have received appreciation from Prof. Hau Lee and among others from SCM domain. Finally, I encourage readers to read and embrace the important learnings on digital supply chain challenges.

# **Guidelines for Paper Submission**

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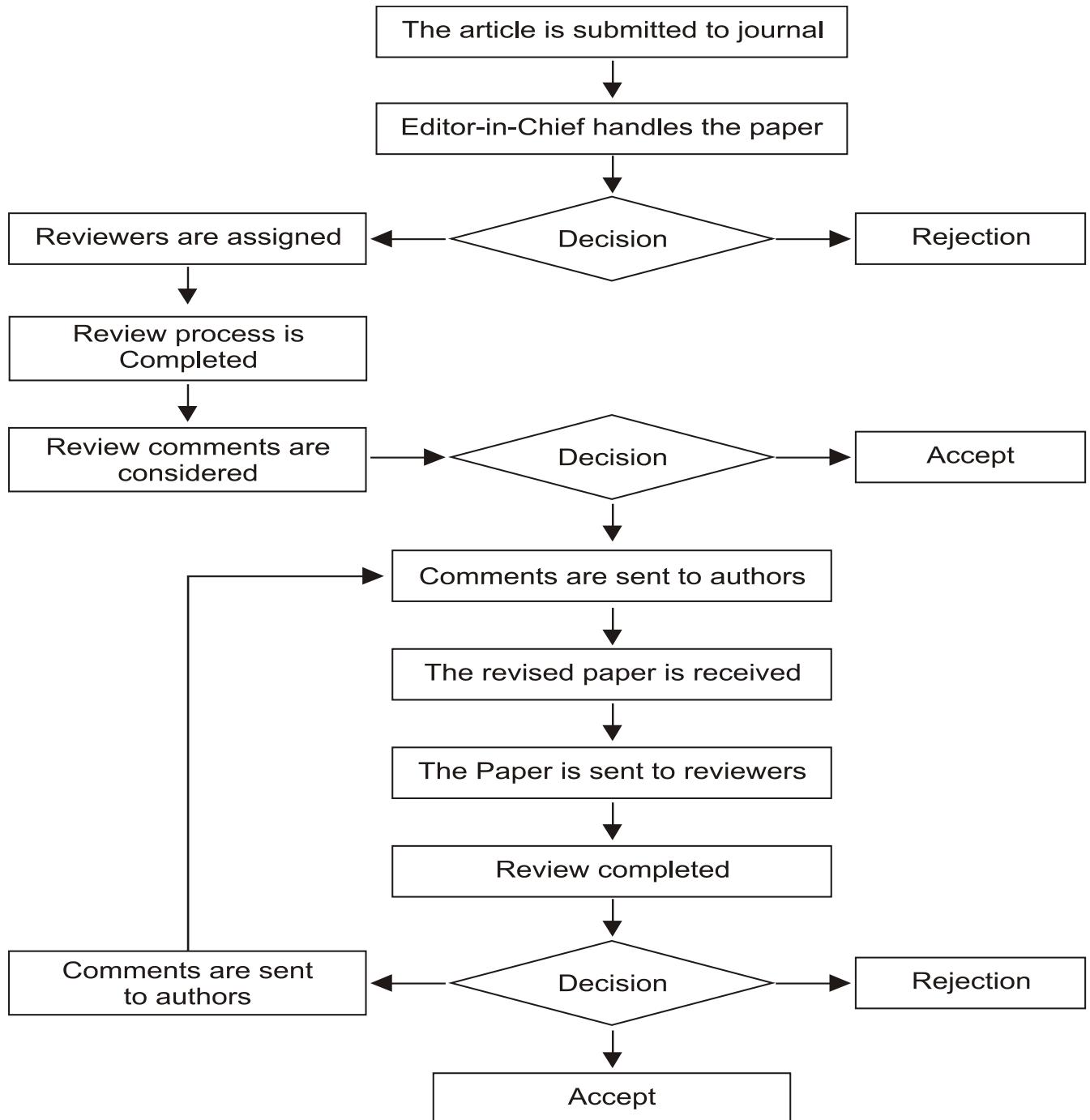
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## **Theme for the Next Issue:**

**India-Africa Business Opportunities**

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### Theme: India-Africa Business Opportunities

Historically, India and Africa have long standing relationship. Indian interest and investment in Africa have become very visible and are on the rise. In the same way, many African countries are aggressive on having trade relationship with India. There is 'level playing field' in our relationships in many ways. If India and Africa works together, there is win-win situation for both these great civilizations, and to the world. In the past five years, more than 85 Acquisitions and Equity Investments were made by Indian companies in Africa for an investment of over USD16 billion plus in highly varied sectors ranging from telecom, agriculture, energy, consumer goods, cement, textiles, etc. Africa is known as the land of untapped potential. It has incredible natural resources like oil, gas, gold, iron ore, manganese, uranium, diamonds, wildlife etc. apart from great human resource. It also has countless opportunities for infrastructural development. India, a democratic country has proven talent in IT, medicine and other service sectors. India's population 1300 million is another great attraction. Hence large, medium and small enterprises which need a presence are strategizing aggressive business plans, at both sides.

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