

# MATERIALS MANAGEMENT REVIEW

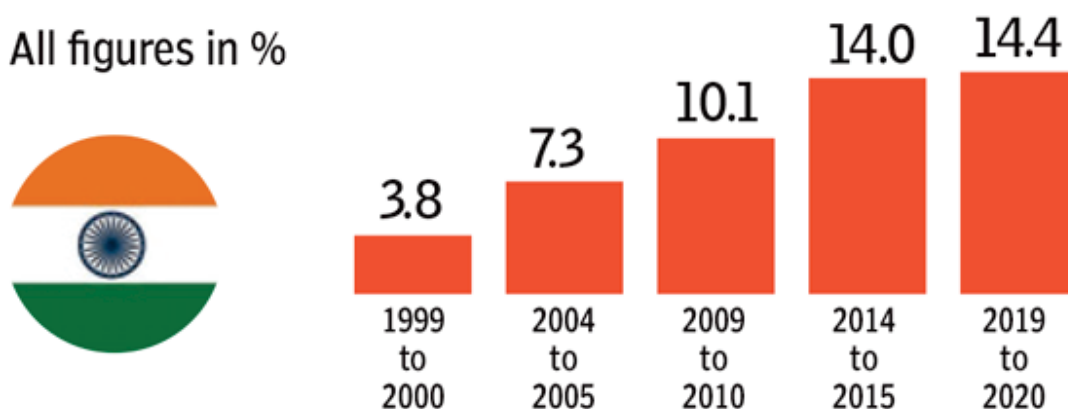


Volume 16 - Issue 10 Date of Publication: 1-8-2020 No. of Pages: 1-60 August 2020

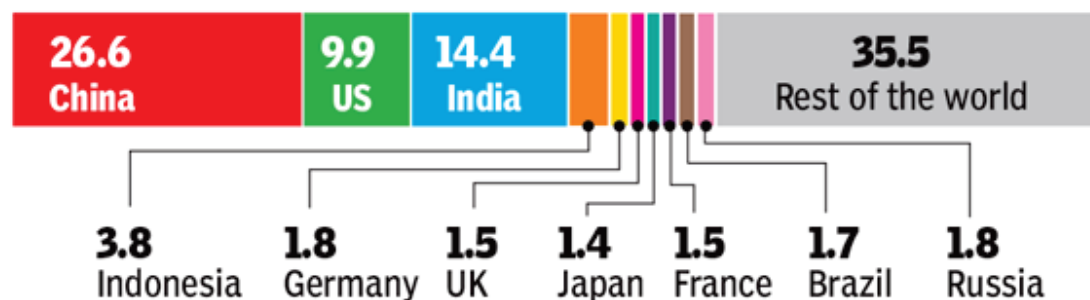
## INDIA TO POWER GLOBAL GROWTH IN THE NEXT 3 YEARS

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All figures in %



Economies projected to be chief movers of growth in 2019-20





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## *From the Desk of The National President*



Dear Members,

Greeting from National President!!

The significance of SCM was always known to common people. However Pandemic time has created such an awareness regarding SCM that Supply chain has come in the forefront in the National Agenda. IIMM fraternity had keenly observed our PMs Speech In June 20 wherein he had several times mentioned regarding SCM.

Several Key branches of IIMM have remained consistently active by organizing several webinars on various topics of SCM in the context of COVID-19. Foremost among them is Ahmedabad Branch. Besides Ahmedabad, Mumbai, Pune, Chennai, Bangalore and several other branches have conducted webinars covering important SCM topics. Recently Bangalore Branch conducted series of paid webinars on Financial Management in International Trade, Incoterms 2020 and Letter of Credit. Besides local participation, there were also NRI participation from Japan, Malaysia, UAE, Oman and Nigeria. I take this opportunity to thank the Chairman of respective branches who have made the best use of this opportunity and created visibility of IIMM.

AICTE has announced several important measures related to promoting the students to next level, conducting examination, academic calendar for next academic session etc. for PGDMM and PGDSCM&L the same is being circulated to all IIMM branches nationally. We are in regular touch with AICTE regarding their various announcements and changes which may be announce in near future. NHQ has recently completed online lecture series which was well appreciated by all. We will ensure that our students receive all cooperation and support to pursue their higher studies through IIMM. At the same time I also seek support from existing students to widely propagate our courses and help IIMM to fill up the available quota of 800 students collectively in our two PG courses viz. PGDMM & PGDSCM & L

Stay healthy and stay safe.

With Warm Personal Regards



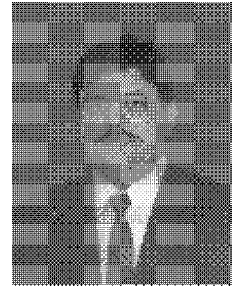
**Malay Mazumdar**

National President, IIMM

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## *From the Desk of Chief Editor*



Dear Members,

World is witnessing its most severe pandemic – Covid 19, of the century wherein crores (1.77 Crore) of people have been affected and lakhs of people (more than 6 Lakh) have died. Seldom, there is any country, who remained unscathed of the novel coronavirus disease (Covid-19). In addition to high and rising human costs, the protection measures to control this disease are severely impacting economic activities worldwide.

India is no spare from the Novel Corona Virus (Covid 19) and in order to prevent rapid spread of Corona Virus, Government, took series of steps including Nationwide Lockdown. The lockdown hit hard in the face of economy irrespective of the sectors i.e. agriculture and allied, manufacturing, logistical & supply chain services and foreign trade. Only, essential goods and services were allowed to operate. More than 70 % of economic activities in the were non-operational and it is approximated that each day during the period of lockdown, India's economy lost Rs. 45-50, 000 crore.

Various measures like food for everyone, economic stimulus, 20 Lakh Crore package for MSME Sector etc. to not only safeguard the lives of its citizens but also to ensure that MSME sector keeps floating during this tough phase. This made, India's fiscal deficit to reach \$88.5 billion in the April-June quarter, 83.2% of the target for the whole of the current fiscal year. The economy is forecast to shrink 5.1% in the current fiscal year, and 9.1% under a worst-case scenario, according to analysts in a Reuters poll, its weakest performance since 1979.

Now, we are under the phases of Unlock as severity of the pandemic recedes and economic activities have resumed in most of the states across the length & breadth of the country indicating early signs of recovery and its bouncing back in the 2<sup>nd</sup> half of the current fiscal year. The projected growth for the Indian Economy in the next fiscal year as per report of IHS Markit is 6.7%. IMF also predicted the growth rate of more than 6% in its World Economic Outlook titled "A Crisis like No Other, An Uncertain Outlook"

Despite the negative short-term shocks from the pandemic, total foreign direct investment into India has remained buoyant. Foreign direct investment by technology firms in the first seven months of 2020 has already reached around \$17 billion, boosted by the \$10 billion new investment announced by Google in mid-July. Facebook, Amazon, and Foxconn are among the other global technology firms that have committed large new investments into India this year.

India's foreign exchange reserves reach an all-time high of \$522.63 billion and are fifth largest after China, Japan, Switzerland and Russia. India's foreign exchange reserves are equivalent to almost one fifth of the country's GDP and are considered to be enough to cover 13 months of imports. This is extremely significant for the nation, especially in the wake of Coronavirus pandemic, which had a major impact on the Indian economy along with the other world countries.

Govt. has recently started various missions like Aatmnirbhar Bharat & Vocal for Local which clearly indicates the intent of boosting the Domestic sectors. National Education Policy 2020 can prove to be a pathbreaking initiative to nurture the Innovations through Quality Educational Institutions and producing highly skilled Workforce. If things go hand in hand and united, we certainly, will be able to reach 5 Trillion Economy status by 2025.

A handwritten signature in black ink, appearing to be 'M.K. Bhardwaj'.

**(DR. M.K. BHARDWAJ)**





# MATERIALS MANAGEMENT REVIEW

Volume 16 - Issue 10

(August 2020)



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## Printed at :

Power Printers,  
4249/82, 2 Ansari Road, Daryaganj,  
New Delhi - 110002

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NO. OF PAGES 1-60

## Edited, Printed & Published by :

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# SUPPLY CHAIN MANAGEMENT IN AGRICULTURE: PRACTICES, TRENDS AND POTENTIAL

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## PART I: ABOUT PLAYERS IN THE AGRICULTURAL SECTOR AND THEIR SUPPLIERS

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### Introduction

Extensive efforts are being undertaken to reengineer the agricultural sector world-wide. This is to meet the growing demand arising from population growth and increasing environmental impact from climate change which is a deterrent to agricultural productivity. [Thomasson, Santos and Basu (2016)] India too, has accorded a high priority to agricultural development as farmer suicidal rate has been a cause for concern. The Prime Minister is desirous of ensuring that farmers' incomes double in the future. To achieve this, the Mumbai based Centre for Environment & Agriculture (Centegro) and the Tata Strategic Management Group (TSMG) have urged the government to step up exports. The government has also been urged to launch the 'Grow in India' campaign in tandem with the 'Make in India' campaign. [Gupta (2017c)]

To enable larger volumes of exports, it is vital to address the economic and quality aspects of agricultural output. Effective supply chain management is therefore very vital. Information Technology and big data & business analytics could be powerful driving forces. The article provides a brief perspective on these aspects.

Some of the important players in the agricultural supply chain are suppliers of seeds, agrochemicals, cattle, poultry, shrimp and fish feed, farm equipment; farms/ plantations; logistics service providers like transport agencies, warehouses, ports and customers like retails, food processing companies, manufacturers of ayurvedic formulations, textiles and others. Sometimes, as detailed later, a firm may be in more than one business. Different players in the supply chain need to network with one another through information sharing, understanding each other's business and requirements. All players are regulated and facilitated by the government, financing agencies like banks, research organizations, industry associations, consultants and software suppliers. Startup firms have over the years enhanced the effectiveness of several businesses. Some startup firms (called agric startups) have supported the agricultural supply chain extensively.

Part I provides a brief overview of some developments in information technology that impact on the agricultural supply chain and an introduction to

startups. The article then provides a discussion on the major suppliers of various inputs to the agricultural sector and the agricultural sector itself. Specifically suppliers of seeds, agrochemicals, animal food and farm equipment and tools are major inputs to the agricultural sector. Examples of firms in these sectors and their activities and initiatives are discussed. The discussion in Part II deals with the distribution network, customers of agricultural output and the support organizations to agricultural businesses.

### Major Developments in the Agricultural Supply Chain

: Developments in technology promoted new businesses and also reengineered existing businesses extensively. In respect of agriculture, manufacturers of farm equipment like tractors emerged and this helped to automate farm operations and improve their efficiency. Information technology revolutionized the operations of several supply chains including that of agriculture. Specifically, developments like Internet of Things (IoT), Cloud Computing and Blockchain have contributed extensively. Their potential in agriculture is detailed later in this article. Broadly, the developments could be categorized into two: Precision Agriculture and Smart Farming.

WHATLS.COM defines Precision agriculture (PA) "as an approach to farm management that uses IT to ensure that crops and soil receive exactly what they need for optimum health and productivity. The goal of PA is to ensure profitability, sustainability and protection of health"

Wikipedia states "Precision agriculture, satellite farming or site specific crop management is a farming management concept based on observing, measuring and responding to in-field and intra field variability of crops".

Nitrogen, for example is essential for crops like corn. However, excess nitrogen does not produce good results and adversely impacts the environment. Required quantity of nitrogen should be based on the field conditions and weather. An array of sensors enables farmers to ascertain the existing environmental conditions. Appropriate software could be used to determine the optimum amount of nitrogen. [Byrum (2016b)]

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Smart Farming is the deployment of IoT and cloud computing to operate farms drawing on alerts like inclement weather or diseases using smart devices like sensors added on to farm equipment like tractors. Thus humans are assisted by machines and machines may even become autonomous. [Wolfert et. al. (2017)]

Thus, whereas PA addresses infield field variability, Smart Farming extends further to incorporate real time information and better manage operations.

Large volumes of data generated from every day operations of businesses are referred to as Big Data. The Mc Kinsey Global Institute (MGI) defines Big Data as “databases whose size is beyond the ability of typical database software tools to capture, manage and analyze” [Mehrotra (2012)]

According to Wikipedia, “Big Data is a term for data sets that are so complex that traditional data processing application software is inadequate to deal with them. Big data challenges including capturing data, data storage, data analysis, search, sharing, transfer, visualization, sharing, up-dating and information privacy.”

Thus, Big Data is characterized by large volumes of a variety of data and where the velocity of data generation is astronomical.

Besides data such as weather and temperature, other examples of Big Data in agriculture are market data and benchmark data from other farms. Certain data like temperature directly lend themselves for action when feedback mechanisms are deployed. Sometimes however, data need further analysis. For example, algorithms assist in decisions such as crop protection strategy. [Wolfert et. al. (2017)] Systematic use of data is referred to as analytics.

Davenport and Harris (2007) define analytics as “the effective use of data, statistical and quantitative analysis, exploratory and predictive models and fact-based management to drive decisions and actions.”

Applications of Big Data and Analytics in agriculture are further detailed in subsequent discussion. Farmers like some other business managers need awareness and support to use Big Data and Analytics. Besides consultants and possibly other players in the supply chain, a new breed of entrepreneurs has offered required support. They are referred to as start-ups.

Two definitions of Startups are cited below:

**Wikipedia definition :** “A startup or start-up is a company or a project initiated by an entrepreneur to seek, effectively develop and deploy and validate a scalable business model”

**Investopedia definition :** “The term startup refers to a company in the first stage of its operations. Startups are founded by one or more entrepreneurs who want to develop a product or service for which they believe

there is a demand”

Start-ups in India are eligible for tax concessions for certain periods of time. For this, Department of Industrial Policy and Promotion, Government of India has stipulated certain requisites in respect of upper limits on annual turnover and years of existence. The requisites however, are subject to revision. However, one of the requirements is that such firms work towards innovation, development, deployment or commercialization new products or services driven by technology or intellectual property. [Joshi, (2017)]

There are around 500 agri tech companies in India who assist farmers in stepping up farm productivity. The nature of support of different players however, varies. Some examples of agri tech startups are cited later. [Gera (2019a)]

**Suppliers of Seeds :** Seeds play a vital role in promoting agriculture and hence effective management of the seed sector is equally critical. Extensive developments in this sector have occurred over the years. Some of the major International players include Syngenta, Bayer, Monsanto and Dupont. Some players in India are Kaveri Seeds, Nuziveedu Seeds Limited (NSL), Rallis, DCM Shriram and Advanta. Since India has opened the sector to FDI, Indian players have to compete with those in China, Japan, Korea and other countries. [Joseph (2017)] This section highlights the role of National Seeds Corporation and briefly details the use of analytics at Monsanto and Syngenta.

The National Seeds Corporation (NSC), a key arm of the Ministry of Agriculture and Farmers Welfare undertakes various activities for seed business to ensure agri-input for agricultural production of food and nutritional security in the country. A brief overview of some of the activities of NSC is detailed below:

NSC is focused on systematic and scientific multiplication of seeds and planting material and production of Test Stock, Breeder Seed, Foundation Seed and Certified Seed of various crops and making quality seed available to farmers for increasing their production and productivity; NSC is also involved in production of Tissue Culture Plants of Banana and saplings of Citrus, Guava, Ber, Pomegranate and Bael. Further, farmer training programmes are being organized by showcasing new technologies in the farms.

At farms, NSC has seed storage go-downs, seed processing plants, water storage tanks (for preserving water) and micro-irrigation systems (sprinkler, linear and centre pivot for efficient water usage and conservation). Every year, NSC is continuously establishing infrastructure facilities at farms and other units in a phased manner to have sustainable growth and to improve quality of seeds.

Since 1963, NSC is involved in Distribution of Quality Seeds. About 627 varieties of 80 crops are being made

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available to farmers. NSC has around 55000 acres of land in its farms where parental lines of seeds are produced. The foundation seed is also given to about 12,500 seed growers to produce quality certified seed with the supervision of state seed certification agencies. The company has more than 2500 dealers for sale of its product. Through different Government schemes, NSC is supplying Seed minikits and seeds of newly released varieties of Pulses and Oilseeds to promote cultivation of newly released high yielding varieties. Participation in Exhibition, Melas, etc has enabled them to create awareness about usage of quality seeds and to showcase the latest technology in seed production for the benefit of farmers. NSC also exports seeds to Asian and African countries.

NSC plans to invest around Rs 360 crores till 2024-25 in CAPEX covering seed processing plants, storage godowns, micro-irrigation facilities, other infrastructural facilities, farm machines, etc. With implementation of ERP, NSC expects a revolution in seed industry as it will have total control from initial production till seed distribution. Seed traceability through QR code is going to play a major role through which fake seed suppliers will be eliminated in the country.

The company is focusing on production of pulses, oilseeds, nutri-cereals, fodder and vegetables, keeping in view the priorities of Government of India. Focus is also being planned on climate-resilient varieties. To ensure accurate seed availability in remote areas, dealers' appointments are being continuously planned. To contribute to doubling farmers' income, seed is being made and will be made available at reasonable prices so that input cost is reduced. [Pathak (2020)]

Analytics offer extensive promise for the seed producing firms. This could be illustrated by the example of Monsanto, an agrochemicals and agricultural biotechnology corporation founded in 1901. Its mission is to develop integrated solutions enabling farmers to grow crops while using energy, water and land efficiently. (In 2018, it was acquired by Bayer as part of its crop science division)

Monsanto has used analytics extensively. For example, analytic approaches helped to better understand, model and predict the impact of genetics, environmental conditions and agronomic practices on yield. This in turn enables setting the production levels to match requirements and operate in a sustainable manner. Yield could be stepped up by planting a product in the best zone within the existing areas, reducing yield uncertainty and sometimes area of growth. [Jagarmulli (2018)]

Monsanto operates in several countries. The Indian subsidiary, Monsanto India Limited (MIL) is assisting farmers to step up production. Specifically, a team from MIL contacts farmers extensively to share improved agronomic practices to enable the latter to optimize yields.

Syngenta, a leading Swiss company in the seed and crop protection industry too, developed analytics tools to improve its distribution system [Comhaire and Papier (2015)] and in decision making for creating commercial varieties of soybean seeds. Specifically, analytics guides in deciding which plant varieties to mate, which traits to select for breeding and where, when and how to evaluate varieties. These initiatives are expected to save Syngenta more than \$287 million dollars in product development costs over a four-year period. Syngenta won an award for this initiative from a professional body. [Byrum et.al (2016)] The Indian operations and initiatives of Syngenta are detailed in Part II.

Probably, seed manufacturers in India could also explore the potential of analytics possibly by assimilating best practices of international players. For example, NSC as detailed earlier is planning to capitalize on its ERP systems and also make large investments in operating capacity. The potential for analytics could then be significant.

Similarly, through Public Private Partnership, collaboration and CSR initiatives, seed manufacturers could capitalize on hybridization for crops like rice, corn, horticulture, which in India is currently on a low key. This initiative would offer promise as hybrid seeds use less water for cultivation as compared to traditional varieties, can withstand diseases, insects, pests and increased levels of water salinity. Yield levels rise and farmers' incomes consequently increase. [Narain, (2020)].

**Suppliers of Agrochemicals :** Agrochemicals including fertilizers, insecticides, fungicides, herbicides, plant regulators and micronutrients are important inputs to farms. Some players in this sector in India are UPL, Rallis, Indofil Industries Limited, Crystal Crop Protection Private Limited (CCPL) and Insecticide India Limited. A brief overview of some players is detailed below. Subsequently, the trend and initiatives to customize supplies to specific market needs is discussed.

Coromandel International Limited, and CCPL, a 34-year-old company produces several herbicides and fungicides and expects to come out with a number of new patented products of which 17 are already in the pipeline. The products of CCPL served as substitutes for costly imports and are offered in liquid, granulated and powder form. Product quality also exceeded that of China. CCPL also exports products to Africa, Gulf and South East Asia. CCPL focuses extensively on R&D and continuously updates farmers, dealers and the marketing team on the latest developments through an app called MINE, illustrating the scope and power of Information Technology. Their mission is to revolutionize agriculture through scientific farming practices. [Seli (2017)]

Similarly Insecticides India Limited (IIL); one of the fastest growing companies in the agrochemicals sector produces a variety of insecticides, weedicides and



fungicides for all types of crops. It has seven manufacturing facilities and a large network of distributors and dealers. Also, a techno commercial team of over 400 agro experts spread awareness towards safe and judicious use of agro chemicals. By producing in India and through extensive R&D, quality products could be offered to farmers. In 2014, it entered into a joint venture with OAT Agrio Co Ltd, a Japanese company and also set up an R&D unit in Bhiwandi. This is India's first discovery centre to bring about new agrochemical molecules. [www.insecticideindia.com]

In respect of fertilizers, the government is capitalizing on Information Technology to enable fertilizer manufacturers to supply customized fertilizers to farmers for crops like rice, maize, sugarcane and potato. As a first initiative, The Department of Agriculture & Cooperation under the Ministry of Agriculture and Farmers' Welfare promoted the scheme of Soil Health Cards (SHC). The card which is provided to farmers records the soil health. These data collected over a period of time helps to assess how health is impacted by land management. [www.india.gov.in]. Data are collected using remote sensing technology. Based on the quality of soil, customized fertilizers are offered to farmers so that nutrition levels are balanced. Thus, site specific nutrient is used to achieve cost efficiency. The government has identified Nagarjuna Fertilizers and Indo Gulf Fertilizers to produce customized fertilizers. [Mohan (2018)]

Using Soil Health Cards, Pasaal, a Bengaluru based start-up provides real time updates using several kinds of data via their farm sensors. Pasaal works on micro-climatic, solar intensity. These data collected every half an hour or every hour is used to offer recommendations to farmers based on disease and pest assessment and irrigation information. Farmers are informed via mobile app, SMS or WhatsApp in different languages. While investments in sensors or equipment are needed, the returns are commensurate. It enables low and timely fertilizer usage and increased productivity. [Gera (2019b)]

Similarly, Coromandel International Limited through its diversified portfolio of products and services is working towards improving the farm yields. It is providing customized recommendations based on soil fertility and crop requirement, farm monitoring and farm mechanization services.

Since manufacturers of insecticides and fertilizers operate plants at several locations and transport their produce to a number of distributors, use of analytic techniques enable cost effective and reliable operations of their production distribution networks. The scope and application of such techniques are discussed in Part II using the example of the dairy distribution system in Quebec, Canada.

**Suppliers of Animal Feed :** Suppliers of inputs to farmers with cattle, poultry, shrimp and fish too have

played an important role in enhancing the productivity of farmers' operations and clearly constitute important players in the supply chain.

Consider for example, Godrej Agrovet Limited, (GOAGRO), a subsidiary of Godrej Industries. GOAGRO is a diversified agri company with pan India presence and operations spread across verticals. It comprises (i) the crop protection business, where it is a dominant player in plant growth regulators and triazole chemistry (via its subsidiary Astec Life Science) (ii) palm oil, where it enjoys leadership in India (iii) animal feed, amongst the top players in cattle feed (iv) dairy (v) processed foods. [Oswal (2019)]

GOAGRO is trying to improve productivity through a better Feed Conversion Ratio by experimenting with feed mixes, lower mortality rates through better farm management practices and trying to improve hatchability and average weight gain. Similarly, Venkateshwara Hatcheries which is in the poultry business also produces poultry vaccines, bio security vaccines, poultry feed and equipment and soybean extract. [Gupta (2017a)]

Since some of the operations of such suppliers include growth of crops, these players could also use I.T and analytics to enhance their business prospects and that of other farmers.

**Suppliers of Agricultural Machinery and Tools :** In agriculture, several machineries like sensors, drones, robots, tractors, hand tools, power tools, hydroponic machines, agro thrashers and sprinklers are used. Such tools are used to mechanize certain tasks. Robots for example, have been introduced for tasks like cultivation and plant thinning for high value crops. [Thomasson, Santos, Basu (2016)]. Some suppliers of agricultural machinery are Terra Sentia, Agrobot, Mahindra & Mahindra Tractors, Tractors & Farm Equipment Limited (TAFE), Escorts and Agri Machinery, John Deere, Ayurvet Limited and CNH Industrial. Some examples of use of agricultural machinery and tools together with their manufacturers are detailed below:

Fasel, an agritech startup that is focused on horticulture sells sensors for Rs 15,000 – 20,000 per hectare. Fasel also deploys sensors in the fields. Besides readings for soil texture, water retention, temperature, moisture and weather prediction, it provides its solution via its app at a cost between Rs 300-700 per month. Whatsapp groups created in every state are working well and farmers are able to cope with the technology. Farmers use Whatsapp to trade and collect information on prices from the mandis.

New technologies like drones are revolutionizing the world of small holder farming. Drones can help identify weeds, pests and diseases and localize applications of agrochemicals. Farmers in China and South East Asia have already started using drones. Significant benefits will accrue to farmers once use of drones is approved

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for use in India. [Narain (2020)]

A robot named Terra Sentia that resembles a lawn mower was developed by Girish Chowdhury, a U.S. agricultural engineer who later stated a spinoff company "Earth Science" to innovate and produce robots. The robot navigates a field by sending out thousands of laser pulses to scan the environment. It measures the height of each plant, generates the most detailed portrait possible of a field, from the size of the plant, to the number and quality of the plant that will be produced by the end of the season, so that agronomists can breed even better crops in the future. The robot can also measure stem diameter, leaf area index and other parameters.

The data collected by the Terra Sentia is changing breeding from a reactionary process to a more predictive one. Using the robot's advance machine learning skills, scientists can collate the influence of hundreds or even thousands of factors on a plant's future traits. This helps to identify the best yielding plants and cut half the time needed to breed a new cultivate from roughly eight years to just four. [Sheikh (2020)]

TAFE, an Indian manufacturer incorporated in 1960 is the third largest tractor manufacturer in the world and the second largest in India. TAFE has 25% market in the Indian tractor industry with annual sales of about 15000 tractors in the domestic and international market. Besides tractors, TAFE and its subsidiaries are also in the related businesses like farm machinery, engineering plastics gears and transmission components, hydraulic pumps and cylinders, etc. Its distribution network spans 1000 dealers. TAFE firm also has operations in Turkey and China.

Through acquisitions, collaborations and R&D initiatives, TAFE's business has witnessed significant growth. Its wide range of quality products enables low cost operations for users. The products have met the expectations of farmers and needs arising from farm mechanization. The initiatives have won recognition from the Department of Scientific and Industrial Research.

Specifically TAFE's products are widely known for durability, fuel economy, productivity, ergonomics, safety, and easy maneuverability. The R&D function has been proactively instrumental in enabling the design and development of advanced products and processes to satisfy and exceed customer expectations.

TAFE has a Product Training Centre which offers training in operations and maintenance of farm machinery and tractors to around 10,000 people on an annual basis. In addition, J-Farm, an adaptive research centre established by TAFE offers support to the farming community. Farmers in Rajasthan now use J-Farm Services, a mobile app based aggregator platform to hire tractors and modern machinery. The app offers a

fair and transparent rental process and ensures quality, dependability and on-time delivery of farm solutions. Together with physical Custom Hiring Centres, the J-Farm has created a hub by which farmers gain access to specialized equipment and knowledge of modern farming practices. [www.tafe.com]

John Deere has enhanced its equipment capabilities to draw on the power of big data. Specifically, in 2012, they developed equipment that communicates with one another and to owners, operators, dealers and agricultural consultants. This helps farmers to enhance productivity. Sensors in equipment enable farmers to better manage their fleet by reducing downtime of tractors. These together with historical and real time weather data, soil conditions, crop features and other data sets can assist managers in determining what crops to plant and when and also when and where to plough so that the best returns are obtained. [http://datafloq.com]

As discussed later, aquaponic and hydroponic methods of agriculture have gained popularity owing to the scope to cope with soil infertility and water shortage. The Ministry of Agriculture's subsidy programmes have in fact, encouraged farmers to invest in these lesser known techniques, Ayurvet Ltd manufactures and markets hydroponic machines. The company is helping dairy farmers, educational institutes, corporate houses and even gaushalas to set up hydroponics systems. It is also working with NABARD for hydroponics projects to set up paddy nurseries, where the seedlings can be grown in 10 days compared with 30-40 days in conventional methods. [Sally (2019)]

North Holland is a global brand of agricultural machinery produced by CNH Industrial. Its headquarters is in Italy and it has operations in India too. The company's products include tractors, harvesters, balers, seeding equipment, utility equipment etc. Through continuous developmental efforts, products have been customized to the needs of Indian conditions. For instance, harvesting machines cause minimum damage and wastage of grains. Sugar cane harvesting machines have offered benefits to sugar mills besides farmers. The machines clean the cane, remove trash and chop cane into pieces. Mills therefore receive cleaner material with more sugar content and without trash and hence their productivity increases. North Holland therefore prides itself as being a Complete Solutions Provider' rather than just a tractor manufacturer. For the future, plans are to bring technologies to users of farm products besides farmers. [Bimal (2020)]

There is also scope for global sourcing. In response to India's ambition to promote the farmers' community and raise their income, the agricultural Embassy of Netherlands, is exploring opportunities to increase export of agricultural machineries and spare parts to India. A Dutch delegation consisting of 17 top executives

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of agriculture and food processing machinery manufacturing companies came to participate in the Global Potato Conclave 2020 in Gandhinagar. [F.E. Bureau (2020)]

Exhibitions serve equipment suppliers an opportunity to market their products. Farmers too, learn of the latest technical developments. For example, Kisan Agri Show is hosted at Pune every year. The 30<sup>th</sup> edition of the expo in 2020 is expected to have participation of over 700 exhibitors and, over 200,000 farmers from across India are expected to visit the fair over five days. Exhibitors will display their products and services at the expo. In addition, conferences, live demonstrations, and theme arenas are planned. A B2B pavilion is planned to initiate a business dialogue to bring new technology and services to Indian Agriculture. Farmers would be able to explore a far wider choice of technologies, innovations and opportunities. They would also be able to interact with technocrats and scientists, as research and educational institutions will display innovative thoughts and advance technologies in agriculture at the show. [www.kisan.in]

Similarly, India Cold Chain show was held during December 4-6, 2019. Over 250 exhibitors from China, Italy, Germany and several other countries besides India showcased their products, market trends and latest technologies on cold storage, refrigerator, reefer transport, packaging, etc. [www.indiacoldchainshow.com]

**The Agricultural Sector:** The produce from the agricultural sector in India has over the last couple of decades included fruits, vegetables, dairy products, poultry and fisheries rather than predominantly focus on food and other crops. In fact, the former contributes to about 50% of the country's GDP. The inclusion of a multi-seasonal product mix helps to cope with problems arising from rainfall deficiency. Specifically, in 2010-11 when there was a 20% deficiency in rainfall, a fair revenue was generated. [Gupta (2017c)] The vast spectrum of activities executed by the agricultural sector is discussed with examples. The decisions involved in operating the sector and some analytic approaches are also cited.

An important decision in farming is the selection of the mix for cultivation. A simple and yet powerful illustration of this is the example of a decision by an agriculturist, Renny Jacob in Kerala. Jacob decided to discontinue growth of rubber as returns began to diminish. Instead he opted to grow a fruit called rambutan (like litchi grown in the north) which has similar climatic and crop needs as rubber. Both yield and revenue increased for the first few years but later reduced owing to congestion that caused by congestion and lack of space and light needed for branches. Jacob cut down some trees to alleviate this problem which again resulted in higher yield and consequently revenue. Jacob also learnt and adopted best farming

practices, crop protection methods and harvesting methods. Cultivation of rambutan is attractive as the life span of a tree exceeds 100 years. Also, the fruit can remain on the tree for around 20 days after it is ready for harvest leading to a longer shelf life. The fruit is now also grown in Karnataka and Central Travancore. [Iqbal, (2017)]

Anil Kumar, founder of Samunnati, a financial services provider focused in the agri value chain expressed that agriculture is impacted by monsoon, pest and disease, Hence diversification of livelihoods of rural households in terms of farm, off farm and non-farm sectors is vital. In respect of farm sector, since millets withstand the vagaries of weather, its cultivation can be promoted. This could be important as millets have great demand in the market as super foods. [Bhatt, (2019)]

When the area under cultivation is large, it is, as stated earlier, desirable to include a mix of crops. An analytic approach has been developed for a farmer to enable him to plan the mix of crops for cultivation in a given area. Specifically, the methodology helps to determine the number of hectares to assign to each of several crops and determine the timing to execute the operations involved like ploughing, sowing, harvesting and others. While identifying a plan, it is required to incorporate several uncertainties and restrictions. For each crop there are uncertainties in respect of the yield rate owing to uncertain weather conditions and the unit selling price after harvest. Besides restriction on the total area for cultivation, other restrictions exist. Operations that are to be executed involved use of limited available machinery and tools like tractors, ploughs and others. The sequence of operations for a crop is fixed and each had to be executed during specific time periods. In addition, the farmer's attitude to risk had to be incorporated. This was owing to higher variations in the revenue generated for certain crops as compared to others as the impact of uncertainty in yield and prices on revenue varied. The performance of the methodology was tested using past data. It was found that the revenues are more stable as compared to that obtained by the farmer who selected the mix based on judgment and experience. [Filippi, Mansini, Stevanato (2017)]

Farmers also need to select an optimal mix of inputs, possibly through technological up gradation. In Tamil Nadu, empirical studies have enabled the estimation of the technical efficiency of agricultural production at the farm level. These studies have mainly focused on rice, maize, cotton and sugarcane. Such initiatives are also vital for crops like turmeric, as India produces 75-80% of the world's output and is the largest exporter of turmeric in the world. Enhanced efficiency could offer promise in respect of increased foreign exchange earnings and higher incomes for farmers. While Tamil Nadu is the top ranking turmeric producer in India, the productivity is low. Louis and Joel (2010) therefore conducted a study drawing data from 180 households

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in the North Western region of Tamil Nadu. The objective was to assess the current efficiency standards of the farms owned by these households so as to obtain possible insights for stepping up efficiency using a scientific approach “Data Envelopment Analysis” (DEA)

The 180 households considered included a marginal farmer operating less than 1 hectare and others comprised a mix of small, medium and large farms of varied sizes. Farmers were of different ages and varied periods of experience. While few were graduates, most others completed school education. Thus, the sampled households represented a heterogeneous mix.

Historically, productivity is defined as the ratio of output to input, often expressed as a percentage. This may be interpreted as the output per unit input. When several inputs and/ or outputs are considered, weighted sums of inputs and outputs are used. In this study, inputs included the monetary expenses on seeds, labor, machines, organic manure, organic fertilizers, pesticides and post harvest operations. Turmeric produced constituted the exclusive output and was expressed in kilograms.

DEA indicated that the values of technical efficiency of the 180 farms varied in the range 55- 95%,. Adoption of organic farming was found play a major role for the farm in the study that achieved the highest value. The farmer operating that farm had undergone three trainings on turmeric cultivation. It was felt that his practices could be disseminated to others. Specifically, others could step up the efficiency by 17%. [Louis and Joel (2010)]

Besides enhancing the profitability of an agricultural business, analytics is also useful in obtaining insights needed to improve land valuation. Information from remote sensing and satellite technologies provide real time information on the chemical and biological conditions of fields. These data along with models of weather patterns, nutrient and resources availability could be used to estimate the range of output of crops. These estimates and data on economic factors like commodity prices and taxes provide for more logical approaches to land valuation. [Byrum (2017)].

Similarly, CropIn, a startup helps banks and insurance companies to assess the creditworthiness of farmers by providing digital solutions. For instance, CropIn uses satellite imagery to create a crop signature that can be used to assess crop damage and productivity. CropIn also helps conduct field trials to determine crop sustainability in the region and is working with a base of 1.6 million farmers. These operations span 46 countries. The company provides food traceability by assessing seed quality, fertilizer use and other parameters that help farmers meet requirements for exports. [Gera (2019a), (2019b)]

The emergence of aquaponic and hydroponic methods of farming has helped to alleviate problems of water

scarcity and soil infertility. The Wikipedia definitions of the terms are as follows:

“Aquaponics refers to any system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) in a synthetic environment. In normal aquaculture, excretions from the animals being raised can accumulate in the water, increasing toxicity. In an aquaponic system, water from the byproducts are broken down by nitrifying bacteria into nitrites and subsequently into nitrates that are utilized by the plants as nutrients. Then, the water is circulated back to the aquaculture system.”

“Hydroponics is a subset of hydro culture which is a method of growing plants by using mineral nutrient in a water solvent.”

Some businesses that use the aquaponic and hydroponic methods are detailed below:

- Red Otter Farms in Kotabagh village at the foothills of Nainital grows several green leafy vegetables on an one-foot bed of flowering water in a specially designed 10,000 sq feet greenhouse at Red Otter Farms. No soil is required and insecticides, pesticides and fertilizers are not used. The nutrition for plant growth comes from aquatic animals kept in water tanks inside the greenhouse. The produce is sold to Taj Hotel, Modern Bazaar and families in South Delhi and Gurgaon
- Madhav Farms in Bengaluru operates a 20 acre farm. About 14 varieties of leafy vegetables and a range of assorted tomatoes, brinjals and French beans are grown. Their principal customers are Big Basket, Big Bazaar, the Marriott and Sheraton group of hotels and occasionally Oberoi and Leela hotels besides housing societies through Whats App group. The produce is generally harvested early in the morning and delivered through solar powered refrigeration trucks the same afternoon.
- The Dharmapal Satyapal Group, (DS Group) in the NCR popularly known for Rajanigandha Pan Masala has been cultivating roses and jasmine in hydroponics farming since 2015 to cater to its captive need of essential oil. Recently, it launched the Nature's Miracle Brand of vegetables, which are being cultivated in an eight acre farm 30 kms from Delhi by using hydroponics. Around 11000 kg of fruits and vegetables, including snake cucumbers, cherry tomatoes, bell peppers and strawberries are sold every month. Food retailers like Food Hall, Le Marche and others are selling these branded veggies.

While investments are needed to operate such systems, the returns are very high. The farmer recovers the investment in 2-3 years owing to savings in cost of feed, land and labor. [Sally (2019)]



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As the examples illustrate, a captive market, retail or people are required and quick sales is vital owing to the limited shelf life of produce.

The agricultural sector, as stated earlier has also focused on poultry products besides crops. The poultry sector overall has grown at 5-6%. Broiler production has grown at 8%. The tempo is expected to continue owing to micro and macro-economic factors. The per capita egg consumption has increased from 30 to 60 per annum and chicken from 400 grams to 3 kg. Poultry business however, is subject to volatility as demand is seasonal and is also impacted during festive periods. Also, soybean and maize serve as poultry feed and their levels of production is a determinant of poultry business. High vulnerability to disease is also an impediment to the business.

However, a double-digit growth is being registered due to favorable socio-economic conditions and increasing penetration of Quick Service Response chains. Mr. Raghav Rao, M.D. of Kohinoor Hatcheries, Hyderabad expressed that the industry is now more organized and mature and has a well-defined business model to leverage various developments in terms operational scale and adoption of technology. The industry is trying to adjust and face inherent challenges.

Poultry farming involves breeding and raising chicks for various purposes. Breeding farms hatch and raise poultry for sale to other farms. Breeding farms rear chickens for their meat, procuring day-old chicks (DOCs) and keeping them for around six weeks. Layer farms keep hens to produce eggs. Another category of operators, which can be loosely termed as integrators (primarily corporates) keep breeding stocks and operate hatcheries and commercial broiler farms. There has been a trend towards integration in the broiler industry which has helped increase production, set up an efficient base, understand risk factors such as fluctuation in feed availability and its prices, variable and inconsistent consumption pattern. These integrators are large corporates and MNCs like Venkateshwara Hatcheries, Pune; Sugana Group, Coimbatore, Godrej Agrovvet, Skylark group in the north, CP group, Thailand (agro industrial & food business) etc. Companies like VH and Sugana have a presence across the entire spectrum of the value chain. These companies normally enter into a contract farming arrangement across the entire spectrum of the value chain. Under this arrangement, the integrator provides extension and advisory services (EAS), supplies the DOCs, feed, medications, veterinary supplies and implements (such as water dispensers, feeders etc.) as may be required. The integrator also bears the marketing responsibility (risks) and the expense involved in transportation (to and from the farm).

The contract farmer provides his labor and space for the shed and other related services or equipment that may be required. Since the integrator makes a major

part of the investment, he is the owner of the movable stocks while the farmer's role is that of a caretaker. The farmer receives a predetermined fixed price in the contract as well as incentives for outperforming in respect of various parameters such as the feed conversion rate, mortality of the birds, etc. However, penalties are levied if there are shortfalls on any agreed upon criteria. This system is beneficial to farmers who do not have make capital investments, are assured of regular income, not impacted from fluctuations in the selling process, get price insurance and protected from intermediaries. This has attracted several farmers in the small to medium category to enter the poultry business to supplement their income without too many risks. About 70% of the Indian poultry business is under the integration model.

The growth of the poultry sector has also led to the growth of the feed sector where several large companies have played a key role. One of the largest animal and poultry feed producers in the world, CP group of Thailand has also created a substantial base in India with multi location feed production facilities. The company has also forayed into the packaged food business in India, with a new chicken processing plant in Chittoor, AP. Since feed constitutes a big chunk of production costs, several players are working towards sustainable business models.

The processing segment has been a laggard; only 4% of the total poultry is processed. Due to limited cold chains and other infrastructural related facilities, any change in supply-demand dynamics and input price variations gets prominently reflected on the realization of farmers at the farm level as well as at the retail level.

Effective processing would lead to an efficient supply chain owing to the reduction in the volatility arising from fluctuation in price and poultry consumption. The industry has thus far focused on productivity improvement. Efforts are now needed to enhance distribution infrastructure and increase value additions to operate efficient supply chains.

The per capita consumption of poultry products is lower than the global average although it is a source of protein. This is expected to change both with the changing demographics and increasing income. This would lead to the growth of the industry. [Gupta (2017b)]

Thus, diverse activities are undertaken by the agricultural sector. Efforts to modernize the sector through technological up gradation and better management practices could lead to significant payback.

**Conclusions** : Both the agricultural sector and suppliers to the agricultural business need to and in fact, do play an important role in the development and reengineering of the sector. The initiatives lead to payback to all the players. These initiatives should be

ongoing. Part II of the article deals with players whose operations span activities post agricultural production.

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# THEORY OF CONSTRAINTS IN SUPPLY CHAIN

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**B**usiness process improvement developed from the prospective logistic improvement, lean management, quick response management, Theory of Constraints, is on reducing time in supply chain, applied at a strategic level.

Theory of constraints, is a methodology identifying, the most limiting factor, that stands in the way, achieving goal, systematically improving until it does not become a limited factor in supply chain.

Supply chain main objective in theory of constraints is used in the best way to achieve the necessary goals, reducing operating expenses, reduce inventory, and increase the infrastructure in supply chain.

Supply chain approach to Theory of Constraints varies according to the requirement of the problem; the difference is focusing the problem in the same condition in supply chain. Theory of constraints drives to find the lacuna, while the concepts of lean management focus on the continuous improvement.

Supply chain collaboration among many firms that are individually operating, are unable to provide effectively, satisfaction to customers in supply chain, with the lack of awareness, about the existence of Theory of Constraints, along with the supply chain, preventing for going into collaboration, with organizations. This must be realized by applying the theory of constraints, approach to overcome the difficulties of realizing the potential, benefit in supply chain, as it is able to expose the inherent features in theory of constraints in supply chain, to establish a good collaboration in supply chain.

Supply chain contributing to the benefit of large scale manufacturing organization, using the Theory of Constraints, that have limited performance, in the organization, mainly in the areas of production, distribution, the supply chain, have to necessarily identify, what is to be eliminated, but with the help of Theory of Constraints. The unique approach that help the organization to achieve the significant reduction in finished goods, raw materials, at various levels in supply chain, and if it is identified that the items are stock out, any excess in distribution, would be completely avoided to be taken into stock, and make sure that there will a drastic reduction in the availability of the items, whether the possibility of increase, or decrease in inventory levels in supply chain.

Supply chain effective inventory replenishment method, implemented in supply chain, is found to be one of the key success factors to achieve low inventory maintaining high customer delivery performance of the Theory of Constraints, is ideally suited to get the solution improved in a multi-dimension method for

organization in supply chain. The methodology is to concentrate on critical issues that maintain inventory availability, for consumers to hold enough stock, in order to cover the required demand, during the time it takes to replenish the necessary stock in supply chain. The performance is to be implemented in the organization to bring reduction in inventory, transportation cost, increase the forecasting accuracy, and build good customer service in supply chain.

Supply chain in its ability to enhance the response, the capability, to supply chain using the best technology, aims to strengthen the forecast speed up information.

Supply chain can mitigate change in the accuracy of the forecast from the organization, on the future sales, but if the sales volume is found to be lowest in the distribution warehouse, the accuracy of having higher stock may be the forecast has to be conducted at each of the sales point of the organization. It is become necessary to maintain the forecast at of the each distribution warehouse or centre, in order to determine better sales based on the forecast, with necessary inventory to be placed at every sales point. In supply chain, with an orderly rule to replenish the stock level, and to maintain the necessary Theory of Constraints' the movement of stock, becomes a must in supply chain.

Theory of Constraints' have certain proposal: 1, Inventory required should be available within the source of necessary supply chain, not to deliver the product to the organization immediately, by the time the procedures are completed, warehouse should maintain stock, not to deliver the products to the required organization, as and when the products are received from the manufacturers, wholesalers in supply chain. 2. Sales point at each warehouse should store enough inventories, related to the replenishment of the stock. 3. Each warehouse sales point should necessarily make the replacement according to sales, replenishing the items, with quantities of goods sold in supply chain. 4. In order to monitor the conditions it is necessary to maintain Buffer stock mechanism, to be prepared for the contingency if there is a sudden spurt in sales volume, resulting in low inventory, then it is necessary to have Buffer stock, which becomes applicable for replenishment of stock in supply chain.

Supply chain theory of constraints covers the areas of operations, production, and management, Make or Order conditions, Make or Availability of the products in Project Management, distributions, supply chain integration, inventory management, reverse logistics, Just-in-Times, delivery, storage, with distribution to end-user, pick-n-pack items, track-trace materials, products,

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finance, measurement, sales, development of market, offers to manage people, stakeholders, strategy, the tactics of developing of the organization.

Supply chain organization is to make profit; any activity in supply chain that does not make profit is not utilizing the resources, the time as each of these system envisaged in supply chain is liable to have a constraint, that have to challenge in the current state of business practice, as its location with the resources, suppliers knowledge competencies, in which absence of the system could produce unlimited of profits. The identification of exploitation of constraints with its bottleneck remains a focus on Theory of Constrains to get closer to be known as its performance objectives in supply chain.

Theory of constraints is one of the most important theories which were made to attend to the problems, in an organization, which include distribution, engineering, finance, marketing, sales, strategy, change management, which was considered as thinking process applicable for solving problems in supply chain.

Supply chain revenue concerning the use of utility earning through the production, distribution of power, services, that provides the necessary infrastructure, to the customer, with a combination of transmission and distribution. It becomes necessary in supply chain, when the power gets generated, has the liability to increase the capacity, as and when required, while trying to grow on the customer base, as this would create a high volume of capacity, bringing back to the customer the required capacity, which is able to satisfy one part of the goal, to make profit, as this may not be guaranteed, on the high return of investment, through the Theory of Constrains, to achieve the goal of the utilities, focusing on the asset management, which will again focus on increasing efficiency.

The basic Theory of Constraints is to identify the system of constraints, which help the organization to remove the constraints, thereby helping them to advice the overall organization objective. The constraints can be a machine, human resources process, or procedure which restricts throughout the system. Theory of Constraints management technique is used to identify, exploit subordinate, and elevate the constraints in some of the organization, which becomes the main objective of the organization to achieve the ultimate goal in supply chain.

In supply chain theory of constraints is applied in distribution, marketing, as the mechanism, makes it possible to analyze, the systems, to identify, remove constraints, which becomes an obstacle, presenting the organization achieving goals, as constraints include, the bottlenecks, in critical situation have the weakest link in supply chain.

Implementation of Theory of Constrains should be made possible to induce cost of material flow allocation to an appropriate stock, with different links, within the supply chain, with the application of suitable stock, replenishment on the basis of the cost optimization in supply chain.

In the era of competitive supply chain the difficulty of

overlooking the profitability performance, of the overall supply chain performance in supply chain is tend to implement a procedure which is beneficial to the performance of supply chain. Supply chain should focus on cost minimization, leading to the poor quality, which ultimately leads to poor performance in supply chain. In order to improve the performance bringing in new innovative ideas, better improvement solutions, in supply chain with the help of Theory of Constraints improvement program to enhance the supply chain performance. Theory of Constraints main approach is to focus on constraints to resolve the problems in supply chain.

Theory of constraints is considered to be an overall subject on the concept of management, the performance of the organization in Theory of Constraints, identifies constraints the ups and downs, in production, suggesting systems, suitable methods to manage the constraints, eliminate the calamities, in supply chain.

Theory of Constraints, implementation, resulting in reduction inventory levels, reduction in transportation, lead times, costs, improved forecasting, accuracy leading to better consumer service. In supply chain proper implementation of Theory of Constraints result in a positive outcome of increased output, reduced inventory levels, reduction in operations expenses, Theory of Constraints helps in improving production efficiency.

Procurement in supply chain is considered a great part in the organization, the crucial role in making sure that the required components, raw materials, are procured, made available at the plant, so as to see that the products is not affected. Supply chain procurement has different requirements patterns, different suppliers, different lead times, Theory of Constraints is considered to be helpful in the functional areas, tries to find the major drawback, which helps to take the right action for the critical item procured. Supply chain is considered to be the best by the production methods adopted on which the focus should be on the entire chain of suppliers, aligned so as is to be considered to be not shifting, if one supplier is found to be weak, the whole disruption, can mishap the end consumer. Supply chain with inappropriate information network, can also deter supply chain for efficient responsive in supply chain, with seamless flow of information among the limits, essential, delays in order request between the stakeholders of the chain, internal or external can affect planning in supply chain.

In supply chain the process of replenishment in the process the Theory of Constraint is the speed at which the material should move through the system in order to avoid necessary blockages, delay, being out of stock, the size of the inventory is considered to be important that is required, the finished goods, so as to have an on-time delivery supply chain. Replenishment in Theory of Constraints is considered to be most important, remarkable contribution for improving performance in supply chain.

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# PROCUREMENT PERFORMANCE INDICES (PPI'S)

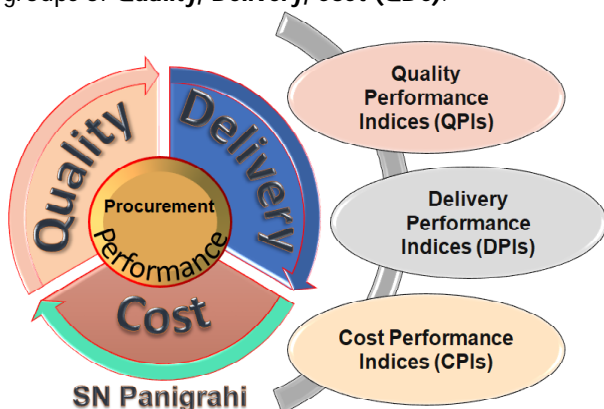
SN PANIGRAHI, PMP, PROJECTS, LEAN SIX SIGMA,  
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**P**erformance Measurement is generally defined as Regular Measurement of outcomes and results, which generates reliable data on the Effectiveness and Efficiency of Performance.

Performance indices are derived based on the trade-off between a constraint and the free variable. Performance Index is a measurable value that demonstrates how effectively a company or functional department is achieving key business objectives.

Procurement Performance analysis sets its focus on Measurable Parameters to Gauge Performance of Procurement Functions. **Procurement Performance Indices (PPI's)** presented here are used to assess progress in achieving pre-established procurement performance goals and targets in the three major groups of **Quality, Delivery, Cost (QDC)**.



Accordingly, there are three broad categories of indices.

- **Quality Performance Indices (QPIs)**
- **Delivery Performance Indices (DPIs)**
- **Cost Performance Indices (CPIs)**

Some of the major Performance Indices for each of the QCD are discussed below.

**Quality Performance Indices (QPIs):** These indices identify performance of goods or services using certain attributes to improving level of quality.

Products and services of low quality would affect an organizations product quality which might add additional costs. **Quality Performance Indices (QPIs)** Metrics sets quality standard such as percentage of rejections. Some of the Quality Performance Indices (QPIs) are shown here.

$$\text{Percentage of Rejections} = \frac{\text{No. Of Defects Received}}{\text{Total No. of Items Received}} \times 100$$

$$\text{Defects Per Million Opportunities (DPMO)} = \frac{\text{No. Of Defects Found}}{\text{Total No. of Items Tested}} \times 10^6$$

$$\text{Supplier Rejection Percentage} = \frac{\text{No. of Rejections}}{\text{Total No. of Supplies}} \times 100$$

$$\text{Percentage Non-Compliance} = \frac{\text{Number of Non-Compliances}}{\text{Number of Observations}} \times 100$$

$$\text{Percentage Non-Compliances Rectified} = \frac{\text{Number of Non-Compliances Rectified}}{\text{Total Number of Non-Compliances}} \times 100$$

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**Delivery Performance Indices (DPIs):** Delivery performance provides an indication of how successful the supply base is at providing products and services to the concerned stakeholders to improve delivery as well as continuity of supply. These metrics are most important in the measurement of performance of the procurement function and are important for organizations, as late deliveries might affect supply chain continuity, early deliveries can result in higher operational/Inventory costs. The goal is to have lower number of errors against the requested time frame for deliveries. Deliveries that are on time helps to Maintain continuity, improve inventory management which leads to cost savings. Some of **Delivery Performance Indices (DPIs)** are shown below:

$$\text{Supplier On Time and in Full (OTIF) Delivery} = \frac{\text{No. of purchase orders fulfilled on time \& in full}}{\text{Total No. of purchase orders placed per period}} \times 100$$

$$\text{Transportation provider On Time and in Full (OTIF) Delivery} = \frac{\text{No. of times trucks placed on time \& Full Capacity}}{\text{Total No. of times facility requested per period}} \times 100$$

$$\text{Delivery In Full, On Time (DIFOT)} = \frac{\text{Percentage Delivery-in-Full} \times \text{Percentage Delivery-in-Time} - \text{Percentage Rejects}}{100}$$

$$\text{Supplier Lead Time Variability} = \text{Actual Delivery Time} - \text{Lead Time as Per PO}$$

$$\text{Overall Lead Time Variability} = \text{Actual Delivery Time} - \text{Required Lead Time}$$

$$\text{Percentage of Shipments Arriving in Good Condition} = \frac{\text{Number of shipments arriving with no damaged product}}{\text{Total number of shipments received}} \times 100$$

$$\text{Average Delivery Time} = \frac{\text{Sum of total number of hours/days from dispatch to receipt at destination for all shipments}}{\text{Number of Shipments}}$$

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**Cost Performance Indices (CPIs):** These are measures of the efficiency of expenses spent and also effectiveness of the procurement function on cost related aspects like actual cost spend and savings etc.

One of such Indices is Measuring the percentage of managed spend against total spend on purchases for external products and services. Managed spend can be calculated as the sum of all spend run by an organization. Goal of these Indices are to have more spend standard procedures, thereby saving on costs.

Similarly Reducing Consumption to determine if it's necessary, an organization can exclude things that they can do without or substitute, for example the reduction of travel expenses by deployment of video conferencing. Consolidation of spend hidden costs can arise if specifications are harmonized or Standardized.

Some of Cost Performance Indices (CPIs) are

$$\begin{aligned} \text{Percentage of Managed Spend} &= \frac{\text{Managed Spend}}{\text{Total Spend}} \times 100 \\ \text{Product Price Variance} &= \frac{\text{Price Paid for Focus Item} - \text{Target or Reference Price of Item}}{\text{Target or Reference Price of Item}} \times 100 \\ \text{Category Spend} &= \frac{\text{Annual spend for purchase category}}{\text{Total annual spend of all purchases}} \times 100 \\ \text{Procurement Operational Unit Cost by Value of Purchases} &= \frac{\text{Total costs allocated to Procurement Operation}}{\text{Total value of annual purchases}} \times 100 \\ \text{Procurement Operational Unit Cost by Number of Purchases (Cost of Purchasing Order)} &= \frac{\text{Total costs allocated to Procurement Dept.}}{\text{Total Number of Annual Purchases}} \times 100 \\ \text{Procurement Cost Savings} &= \sum \left[ \left( \frac{\text{Unit Cost of Current Period Procurement for Focused Item}}{\text{Qty Procured in the Current Period}} \times \text{Qty Procured in the Reference Period} \right) - \left( \frac{\text{Unit Cost of Reference Period Procurement for Focused Item}}{\text{Qty Procured in the Reference Period}} \times \text{Qty Procured in the Reference Period} \right) \right] \\ \text{Procurement ROI} &= \frac{\text{Cost Avoidance} + \text{Cost Reduction}}{\text{Cost of Procurement Operation}} \\ \text{Cost Avoidance} &= \text{Actual Purchasing Price} - \text{Lowest Price Quoted} \\ \text{Cost Reduction} &= \text{Actual Purchasing Price} - \text{Last Price Paid} \\ \text{Procurement ROI} &= \frac{(\text{Cost Reduction} + \text{Cost Avoidance})}{\text{Cost of Procurement Operation}} \\ \text{Procurement Cost as Percentage of Sales} &= \frac{\text{Total Costs of Procurement}}{\text{Total Value of Sales}} \times 100 \end{aligned}$$

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These indices also serve as KPIs (Key Performance Indicators) to gauge performance of Procurement personnel. Procurement KPIs are management tools designed to monitor procurement department performance and help meet goals, strategies and objectives. The primary goal of every procurement organization is keeping the procurement sustainable and constantly looking for ways on how to improve the procurement processes and performance. Some of these Indices may be used by procurement functions by suitably modified as per the individual organizational requirements.

The article can be Viewed on SlideShare @ Below Link  
<https://www.slideshare.net/SNPanigrahiPMP/procurement-performance-indices-ppis-measures-to-improve-performance-by-sn-panigrahi>

Also can be Viewed on YouTube @ Below Link

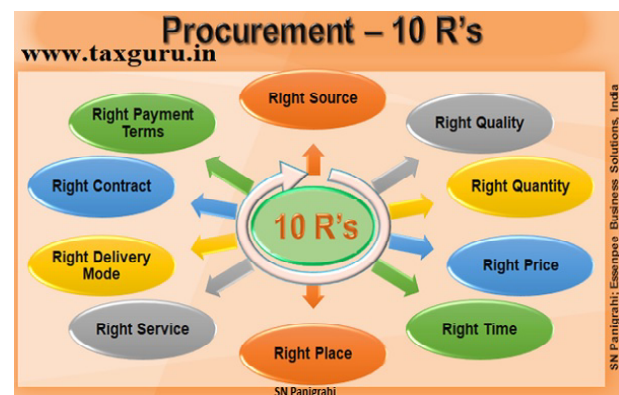
<https://www.youtube.com/watch?v=JlcnU3V6jKM>

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## GUIDING PRICIPLES OF PROCUREMENT

Procurement is the business function concerned with Sourcing and Acquiring (Purchasing) the goods and services from an external source to support the operational activities that are vital to an organization in accordance with the quality, quantity and timeframe at the best price with applied risk management control. Procurement Objectives are generally represented in 10 R's as shown below :



Procurement is involved in supplier selection, evaluation, negotiation, contracts sign off and awarding business to suppliers and usually have control over large sums of money that an organization spends. When interacting with suppliers, procurement should treat them in fair and unbiased manner. Therefore, Ethics play a major role in procurement and are considered more important in conducting business that helps in establishing a long-term relationship and goodwill with suppliers and sustainable image in the public. It's not only for Organization as a whole, but also reflects individual Procurement Professionals who earns a reputation within an industry, as Brand Stamping.

Failing to abide to ethical practices can lead to immoral and illegal practices such as bribery, favoritism, illegal sourcing etc. and any such unethical behavior will have a negative impact on the brand image of the organization and individuals.

Procurements are Conducted based on certain Guiding Principles which establish the Fundamental Norms, Rules, or Ethics that represent what is desirable (values) and affirmative of the profession and help to determine the rightfulness or wrongfulness of the actions.

These Guiding Principles are based on certain Values and in fact are more explicit than values, and are meant to govern action.

The principles are intended to guide the professional practice of procurement. Of course, no statement of principles can anticipate all situations that arise in the practice of procurement. However, principles are not just guidelines for action when something goes wrong or when a dilemma is found. Rather, principles should proactively guide the behaviours of professionals in everyday practice.

The principles are broadly intended to cover all levels and variations of procurement.

Procurement Operations shall be carried out in accordance with the basic principles. These principles are intended to set the standard of practice for procurement professionals. Some of Standard Practicing Principle are stated below:

Guiding Principles of Procurement Policy	
Principles	Meaning
Accountability	Effective Mechanism should be in Place to Enable Officers to Discharge their Responsibility on Issues of Procurement
Competitive Supply	Procurement should be carried out by Competition unless there are Convincing Reasons to the Contrary
Consistency	Same Procurement Policy should apply across all the units and ensure Continuity of the Policy & to bring Consistency to Procurement Practices
Effectiveness	Procurement should seek to attain balance of Commercial, Regulatory & Socio-Economic Goals
Efficiency	Procurement Processes should be Cost Effective
Fair Dealing	Suppliers should be treated fairly and without unfair Discrimination. They should not be required to meet unnecessary burdens or constraints
Integration	Procurement Policy should integrate with Company's overall Vision & Mission; Strategies & Broad Long Term Goals; and other Company Policies & Procedures
Integrity	Ethical aspect of Procurement & Professional codes of conduct such as honesty, truthfulness, fidelity, probity and freedom from corrupting influences, should be Impartial and fair
Informed Decision Making	Decisions should be based on true and factual information
Legality	Must Conform to all Legal & Regulatory requirements
Responsiveness	Should meet the aspirations, expectations, needs & requirements of the stakeholders served by the procurement
Transparency	Should ensure Openness and clarity in procurement policy and its delivery

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Tags: Government Policy

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## COMMODITY INDEX

Commodities	Days's Index	Prev. Index	Week Ago	Month Ago
Index	3255.3	3179.9	3198.5	3034.5
Bullion	8559.9	7943.7	7931.1	6463.0
Cement	2547.5	2547.5	2547.5	2547.5
Chemicals	1642.5	1642.5	1768.6	1785.9
Edible Oil	2102.3	2101.6	2082.4	2006.6
Foodgrains	2279.0	2279.4	2283.4	2438.1
Fuel	2963.5	2963.5	3072.0	3042.8
Indl Metals	1919.0	1919.0	1919.0	1918.9
Other Agricom	2384.0	2380.3	2376.7	2403.8
Plastics	1631.0	1631.0	1631.0	1625.9

Source: ETIG Database dated 6th August, 2020

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# A TREATISE ON MSME IN INDIA

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In India, we have appx 70 crores of Micro Small and Medium Enterprises.

In fact MSME is the largest employer in the country and next only to Agriculture. Even the Govt. of India and other State Govt. Industries come only after MSME. Particularly presently Start Up companies are also joining MSME sectors.

Govt. of India is giving lot of fillips to MSME. Just to define them, they are classified as Manufacturing Enterprises and Enterprises rendering Services.

**Micro:** Investment in Plant and Machinery or Equipment not more than Rs. 1 crore and Annual Turnover not more than Rs. 5 crores.

**Small:** Investment in Plant and Machinery or Equipment not more than Rs.10 crores and Annual Turnover not more than Rs.50 crores.

**Medium:** Investment in plant and Machinery or Equipment not more than Rs.50 crores and Annual Turnover not more than 250 crores.

There are various schemes such as

1. Prime Minister Employment Generation Programme and other credit support schemes.
2. Development of Khadi, Village and Coir industries.
3. Technology Upgradation and Quality Certification.
4. Marketing promotion scheme
5. Entrepreneurship and Skill Development Programme
6. Infrastructure Development Programme
7. Scheme of Surveys, studies and Policy Research.
8. National SC-ST- Hub.
9. Scheme of Information, Education, and Communication.

Now MSME is the growth engine of New India. The total No. of MSME are MICRO. 60,32,100. SMALL.7,28,516. Medium. 28,611. While Maharashtra has highest MSME 11,04,189/-

The Govt. of India has taken several measures to strengthen the MSME with an allocation of \$1Bn. MSME SAMPARK is a digital platform that connects MSME technology Centre trainees/students and recruiters. MSME SAMBANDH is a portal to help monitor the implementation of the public procurement policy for MSME. The annual procurement of goods and services from MSME by the Central Public Sector Enterprises is appx. \$4 Bn.2.

MSME is the backbone of developing our country INDIA. The sector contributes to 45% of India's total Industrial Employment, 50% of India's total Exports and 95% of all industrial units of the country and more than 6000 types of products are manufactured in these industries. When these Industries grow, the economy of the country grows as a whole and flourishes. MSME are agile in volatile global market.

Insufficient resources & lack of skill required to design, build, and managed Supply Chain. Without sound understanding of currency fluctuations, trans-border transactions and associated costs struggle to compete. Strategic alliance with core suppliers are very beneficial like larger companies.

At present due to COVID 19 and subsequent Lock Down all MSME are under serious problem all round. High interest, liquidity crunch is hitting MSME. The retail sector, which employs 46 million people in the country, is stated to be, one of the most affected sectors. As many as 12 million retailers across the country transacts business worth Rs.5000 Cr per day. Now with 2 months of Lock Down, the sector has become severely impacted with majority of them are not in a position to pay salaries to their employees, rent their landlords. Many lack the working capital to restart their business. In Karnataka alone, estimated 1.5 lakhs MSMEs are facing distress. According to MSME Minister, Central and State Govt. owe more than 5 Lakhs crores to MSMEs and clearing this pending bills alone can help them a great deal at this juncture. The Finance Minister has been urged for providing direct financial grants to MSME by paying 50% of the salaries of their employees for at least 3 months. This will help these units survive and benefit labor by achieving dual purposes stimulating the economy in multiple ways.

As I was reading New Paper, Banks have sanctioned loans of over Rs.79,000 crores to 19 lakhs MSMEs of which Rs.35,000 crores have already been disbursed. As a part of ATHMA NIRBHAR BHARATH (Self-reliant India) package, the Govt. had last month announced its plan for Rs.3 lakhs crore as an additional credit in MSMEs and small businesses. Such enterprises were eligible to receive upto 20% of their existing borrowing as additional loans at interest rates which were capped. The intervention by Govt. for MSMEs has been gaining rapid traction. Under the emergency credit Kline backed by a Govt guarantee, Banks from public and private sectors have so far already sanctioned loans worth over Rs.79,000 crores as of June 2020 of which more than Rs.35000 crores has already been disbursed.

This has helped 19 lakhs MSMEs restart their businesses post the lockdown. I also read that Finance Ministry



has sanctioned Rs.1.14 lakh crore loans under their newly formed (ECLGS) Emergency Credit Line Guarantee Scheme. For MSME sector reeling under economic slowdown caused by COVID 19 pandemic. This scheme is the biggest fiscal component of the Rs.20 lakhs crore 'ATHMANIRBHAR BHARATH ABHIYAN' package announced by the Finance Minister Nirmala Sitharaman earlier. Under this scheme

Public Sector Banks have increased the loan disbursement. At the same time, Private Sector Banks have also increased.

In Global uncertain & complex business environment SCM is life line of all MSME which is the backbone of Indian economy.

As stated earlier, 68 billion in India which is the largest employers next only to Agriculture in India, because India is basically Agricultural country. Hence MSMEs are Engine for job creation. Promote Business Ownership & Entrepreneurial skills.

With the Lock Down in force, 30% MSME units are yet to resume operations. Many industries, especially in the manufacturing sectors has slowly started operating in second shift in last few days to service Export orders. Further Lock Down will destroy the morale of the Management and workers as per MSME Industry Association.

Right now Pune, Chennai, and Delhi have social lock down but Industries are allowed to operate with adequate safeguards.

In regards to SCM challenges, it is necessary to conduct

1. MDP programs through professionals.
2. Training programs for skill worker
3. Effective dealings with Govt. agencies.
4. Easy credit availability & Bank loan.
5. Use of better technology to manage transaction.
6. Efficient procurement from producers.
7. Branding the products.
8. Investment in R & D and product development.
9. Better storage & use of modern IT practices in Logistics and storage.
10. Imports and Exports knowledge.

Import is referred to as purchase of goods from overseas countries. In India present import trade is governed by Foreign Trade Policy 2015-2020 of Govt. of India. Policy is common to all 125 WTO member countries. Imports have been liberalised. All items are freely importable except regulated.

- A. Freely importable
- B. Restricted.
- C. Prohibited.
- D. Canalised.

Just to familiarize the process, the following are the cycle and guidelines.

- a. I E C NO. IS A MUST.
- b. RFQ TO GET ALL TERMS.
- c. IMPORT LICENCE IF REQUIRED.

- d. FOREIGN EXCHANGE .
- e. PLACING CONTRACT.
- f. PAYMENT TERMS.
- g. FOLLOW UP.
- h. RECEIPT OF DOCUMENTS.
- i. CUSTOMS CLERANCE.

1. Import Licence will have FE copy and Customs copy.
2. Importer has to pay as per agreed terms and currency.
3. Banks are authorized to release Foreign Exchange.
4. All payment terms are through Bank only.
5. Advance Payment through Bank against Bank Guarantee.
6. Partial advance and balance on receipt of goods against documents.
7. 100% on receipt and acceptance goods.
8. Documents thru Bank.
9. Thru Letter of Credit.
10. Parties involved are Traders, Issuing Bank, Advising Bank, Confirming Bank, Negotiating Bank.
11. Contract copy given to Bank to check documents. One set to consignee.
12. Documents are a. Bill of Lading or Airway Bill or GC Note in case of Land Locked Countries..c. Commercial Invoice. d. Certificate of Origin. e. Inspection Certificate f. Insurance Certificate. g. Guarantee/Warranty Certificate.

However, there are few problems to MSME like adequate funds will not be available when required. Banks ask for various documents. Competition from MNC is more whose products may be at lower prices at good quality. Infrastructure problems. Non-availability of raw materials. Non-availability of advanced technology etc.,

As mentioned earlier, the sector contributes to economic development of the country such as employment

generation in rural and urban areas. Govt has been continuously striving in making MSME more vibrant. The sector accounts for about 45% of Industrial output. 40% of total exports are from MSME sectors.

There are modern technology being used by MSME and particularly we find even service sectors like Software and other services are now included in Start Up companies.

In one of my Training Programs in Bangalore on Supply Chain Challenges and MSME, there were good no. employees/Officers/Managers who are dealing sourcing, purchase, stores and logistic areas. Out of about 40 participants 20 were the owners of MSME who said that Purchasing is the area where their maximum money is spent and hence they themselves are handling Purchasing and related activities.

This article is mostly based on my experience WITH MSME companies and few data are collected from Ministry of MSME.

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## IMPROVING COMPETITIVE EDGE IN CONSTRUCTION INDUSTRY – 7 C'S APPROACH

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**Today's business type:** Covid 19 has changed the world economics to a large extent. The biggest job creator industry itself faced the challenge of acute shortage of labor for the first time in history. Immediately after the lockdown was declared, all the site activities have come to a grinding halt. This includes government as well as private projects.

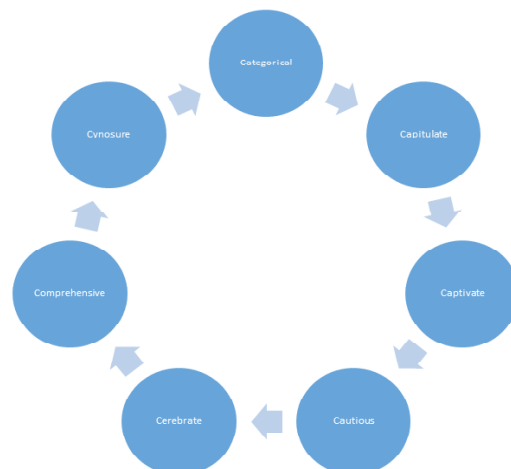
- An analysis made by KPMG has estimated loss due to corona virus to the tune of Rs 30 thousand crore per day.
- This pandemic has led to curtail down the investment in construction industry by 20-25% approximately.
- The loss is not just restricted to the Construction industry, but also to the entire economy as well.
- As per Economic times the construction industry alone employs 12% out of the total working population.
- CREDAI has indicated in May the estimated loss would be around 1Lakh Crore.
- This loss has badly affected the ongoing projects with a backdrop of labor reverse migration.

To estimate the losses in monetary terms for the impact of corona virus pandemic on construction industry still lies a challenge. Apart of economic losses like disinvestment, unemployment, pay cuts, the industry has to also overcome few major challenges like loss of business opportunity, high level of uncertainty, dismal business, sudden change in priorities of the customers (prolonging the purchase of properties or outright cancelling the bookings), diversion of funds (Government funds now getting diverted to health care sector) and so are the major challenges for the next few months or for a year or two. This has resulted in loss of jobs, pay cuts, and increased working man hours to the work force, and other professionals engaged into this industry.



**The real pain:** The workers who migrated from the cities to their home towns suffered a lot during this pandemic phase. Lakhs of workers left the cities & migrated to their respective villages also suffered during the journey. Many of them got stuck at relief centers. Projects which are under development have been badly hit with a projection of further delay of four to six months for completion. Here it becomes more important to understand that every delayed day is going to add up additional interest cost on working capital loans taken. This anyhow will be borne by the contractor or developer himself. Revised operating norms, safety measures, social distancing, demand for specialized equipment and specialized materials all adding further add as disruptions to the supply chain in this industry. On the back drop of reverse migration skilled workers available at work places or sites may demand a wage rise by 20 to 25 percent, which itself will again be monetary burden on account of developer. The material supplies have either stopped or getting delayed due non availability of transport vehicles or shortfall of drivers. The contractors are continuously facing the challenge of mobilizing the resources. The work force, plant & machinery, and the systems are idle which in turn is adding to the losses. The sales and sales revenue has been a major hit dropping it to more than 40% to 42%. The outstanding payment got defaulted on and such numbers got increased and widespread, resulting many construction companies are facing bankruptcy.

### 7 C's Approach



The strategy to quickly recover from the present crises and perform outstandingly and prove ourselves to be more competitive will only help us to survive in the future adapting 7C's

- I. **Categorical**—be completely clear and direct in communication with your suppliers. Be open and frank in your thoughts and explain the present liquidity crises like situation to the supplier and find out a solution which will be acceptable to both of you.
- II. **Capitulate**—We as a channel partner need to give back to the society by providing employment, business, opportunities, and money into the economy
- III. **Captivate**—we need to now attract and at the same time hold the interest of the stake holders in the entire construction eco system.
- IV. **Cautious**—Follow all the new regulations laid by the government w.r.t. safety norms
- V. **Cerebrate**—Think and define your future actions with new norms, new technology, new work standards, new specifications for raw materials, construction, and processes as well.
- VI. **Comprehensive** approach—work by including all or nearby all for business growth. Include all the individuals involved in the industry, company, organization for better positive engagement & effective performances of the available resources
- VII. **Cynosure**—create your own identity, try to have some USP, and be noteworthy for others by setting up new normal or new success model. When all other market players are finding it difficult to withstand and sustain during this locked down period, we need to recover fast and create our unique place and stand firm in the competitive world. For example, you can make the payment to the suppliers during the locked down, or ensure to make payments to the employees in time. These few things will spread a positive signal to all stakeholders and will help you get your own USP

**How to bring the industry/organization quickly into Revival stage:**



The construction industry has slowly started recovering and moving towards the revival stage. The work force has rejoined the sites, designers, developers; contractors are trying to overcome the day to day operational challenges. The project work has restarted to the possible extent.

15 simple ways of improving upon competitive edge – navigating in the present crises and surviving to thrive the new normal I propose 10 following simple ways to be on competitive edge

- 1) Engaging Work force:
  - A) The construction companies now quickly need to absorb the work force and provide better, safe, and secured work place.
  - B) Fair payment and dues: ensure the dues are paid quickly after the work resumes.
  - C) Prompt payment to labor contractors
- 2) Provide proper shelter
  - A) Now construction industry needs to provide proper shelter to the labor in their premises, which will ensure uninterrupted work flow even during the pandemic like situation in future.
  - B) On site medical aid, making available potable drinking water, electricity, supply of free/subsidized groceries, making available other few basic necessities, will keep the workers bonded with the organization for a longer time.
  - C) Imparting safety training at work place, practicing yoga and exercise at site, educating healthy habits, will help to develop a feeling of moral bonding and strengthen the company-workforce relationship.
- 3) Increase the work force: Try to increase the manpower shortfall if any to cover up and speed up the project execution work at sites considering site progress.
- 4) Reallocate the employees from those sites which have not yet started or temporarily postponed for execution.
- 5) Payment to the supplier's: Try to make the old outstanding payment to all the creditors. Make and ensure to pay them may be partially but in time. This will result into boosting confidence & positivity in the market.
- 6) Sign up for new capital & infra projects, enabling picking up some momentum in the economy

- 7) Do not depend much upon relief packages as the industry is still not clear about? Property developers and consultants still feel that this loss could still be minimized by announcing a relief package.
- 8) Increase digitization: Make use of digital tools like Building information Module, 3D, 4D, 5D simulation to re-plan the projects resulting rescheduling of the projects, use of integrated digital twin solutions which helps to monitor the projects right from the conception stage to the final completion stage.
- 9) WFH: Developers, architect's, consultants, bankers, legal liasoning teams, supply chain professionals are adapting new hardware's, and new online channels, various apps ensuring real work flow management, real time tracking, as well monitoring the site progress. Procurement teams can now order construction materials online & can manage critical resources more accurately.
- 10) Focus on long lead inventories and alternative suppliers: Companies now need to think about developing alternative supplier's keeping view of availability of raw materials both from containment & non containment zones respectively.
- 11) Invest in automation: many players are investing in automation of onsite and back office processes
- 12) Accelerate gradually towards thinking or using prefabricated subassemblies in place of fabrication process considering the speedy execution of the projects and shortage of manpower.
- 13) Designers now to plan and developers need to construct healthy lifestyle homes focusing more upon scope for customization at the buyers end.
- 14) Create a return business plan quickly and act upon
- 15) Think of new normal, draft in detail and execute it as quick as possible.
- 16) Attract property buyers and try to convert every lead into actual sales and earn profit.
- 17) Ensure to lease out properties with better commercial terms and prosper the business.

By implementing the above measure the organizations, construction industry and economy of the country as well start rolling in the revival stage and gradually will lead INDIA to become one of the strongest economies of the world in future.

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## Indian Institute of Materials Management

### MISSION

- To promote professional excellence in Materials Management towards National Prosperity through sustainable development.

### OBJECTIVE

- To secure a wider recognition of and promote the importance of efficient materials management in commercial and industrial undertakings.
- To safe guard and elevate the professional status of individuals engaged in materials management faculty.
- To constantly impart advanced professional knowledge and thus improve the skill of the person engaged in the materials management function.
- Propagate and promote among the members strict adherence to IIMM code and ethics.

### CODE OF ETHICS

- To consider first the total interest of one's organisation in all transactions without impairing the dignity and responsibility of one's office :
- To buy without prejudice, seeking to obtain the maximum ultimate value for each rupee of expenditure.
- To subscribe and work for honesty and truth in buying and selling; to denounce all forms and manifestations of commercial bribery and to eschew anti-social practices.
- To accord a prompt and courteous reception so far as conditions will permit, to all who call up on legitimate business mission.
- To respect one's obligations and those of one's organisation consistent with good business practices.

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# EQUIPMENT PART – ITS LOCATION BASED FUNCTIONS AND FUNCTION-CENTRED SELECTIVE INVENTORY CONTROL

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## 1. INTRODUCTION

As any other management technique, Inventory Control technique also has to be applied according to the situation. This article focuses on the flow of an Equipment Part (Item in this case) in a typical Supply Chain and the basis of application of Inventory Control techniques for the Stocking of this Item at various locations. During this flow, the Equipment Part occupies different locations (organizations) which determine the **functions** to be executed by it. Since the functions are different, it gets various names depending on the functions to be performed. Further this author argues that these functions should decide in setting the relevant Inventory Control Policies, Decision Rules and Techniques to be applied to achieve Inventory Optimization at the various locations. This article emphasizes the fact that Selective Inventory Control should be **Item-Function Centred** to reap real dividends while Optimizing Inventory.

### 1.1. ABBREVIATIONS AND DEFINITIONS OF SELECTED TERMS AS USED IN THIS ARTICLE:

- ❖ **Materials:** All items used or needed in any business, industry, or operation as distinguished from personnel (Joseph D. Patton, Jr).
- ❖ **Item:** Item is a generic term used to identify a distinct product or specific entity of materials, kept in stock in an organization. Items may be any unique manufactured and or purchased materials, products, parts, components, assemblies, subassemblies, accessories, groups, equipments, intermediate or attachments [Donald Waters, Joseph D. Patton, Jr. and APICS Dictionary, 9<sup>th</sup> Edition].
- ❖ **Materials** and **Items** are used synonymously as is practised in Manufacturing Industry.
- ❖ **Inventory Control:** Inventory Control is the function responsible for Stocking decisions in an organization, dealing with policies, procedures and techniques to make sure the desired levels of stock of Items are maintained economically at any time, to have predefined customer service level as per Managerial decisions.  
  
Inventory Management, Inventory Control, Material Control and Stock Control are used interchangeably.  
  
(CD Lewis, Donald Waters and APICS Dictionary, 9<sup>th</sup> Edition).
- ❖ **Selective Inventory Control (SIC):** Selective Inventory Control is a method of applying Inventory Control Techniques based on the Relative Importance of the Items in a Store (Warehouse) for better results without additional effort and resources.
- ❖ **FSIC-method:** Function-Centred Selective Inventory Control method.
- ❖ **Stock:** 1] Stock consists of all the goods and materials that are stored by an organization for internal consumption and or sales in future. (Sources: IIMM Glossary, Donald Waters and APICS Dictionary, 9<sup>th</sup> Edition)  
  
2]The total amount of goods or the amount of a particular type of goods available in a shop (Cambridge Dictionary and Collins Dictionary).
- ❖ **Inventory Categorisation and Inventory Category (or Category):**  
  
It is the process of arranging or grouping the Inventory Items into Categories (Classes not preferred in this article) based on single criterion or multiple criteria for the purpose of efficient and effective Selective Inventory Control.
- ❖ **Criterion:** A Measuring Standard or Scale or Yard Stick used for judging or deciding something. In this case, particular value or range of values of a **Characteristic** of an Item, selected for **Inventory Categorisation**.

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- ❖ **Characteristic or Attribute:** Quality or Feature of an Item acting as its **Inherent Identifier**.
  - ❖ **System and Plant** imply Production System and Production Plant respectively.
  - ❖ **OEM:** Original Equipment Manufacturer.
  - ❖ **OCM:** Original Component Manufacturer.
  - ❖ **Vitality (V-E-D) Analysis:** Vital-Essential-Desirable Analysis.
  - ❖ **Critical Item:** Critical Item is that one, the unavailability of which when needed, is highly detrimental to the operations of the organization. The operations include the functions of Production, Services, Sales, Health, Safety and Environment Management, Quality Management etc. **Vitality** Analysis is the first stage in identifying the **Criticality** of the Item.
  - ❖ **BoM:** Bill of Materials.
  - ❖ **Dependent Demand Quantity:** Demand of Quantity of an Item derived from the demand of another Item or Items. It is the demand for parts or subassemblies or assemblies or any other items forming integral parts of the Parent Items.
  - ❖ **Parent Item:** Item causing the dependent demand for Items is termed Parent Item.
  - ❖ **Independent Demand Quantity:** Demand of Quantity of an Item is said to be Independent Demand Quantity when the demand for such an item is not dependent on the demand of another Item. Quantity of Finished Products based on Customer Orders or forecasts is called Independent Demand Quantity.
  - ❖ **Function:** The very Purpose of Stocking the Item by the User (Owner or End User).

## 2. EQUIPMENT AND ITS PART

Equipment, Machinery, Production System and Plant in general constitute the Production Plant or Production Facility which is one of the Drivers of Supply Chain to satisfy the Customer Demand by producing the needed Products and or Services with required quality level and in demanded quantity economically, when needed. This is possible, only when the Production Plant is functioning at the required level of Overall Plant Effectiveness (OPE). Higher OPE is achieved when individual Equipment units are functioning at the highest Overall Equipment Effectiveness (OEE) level. It is an established fact that availability of Equipment Part plays a vital role in achieving and maintaining the required OEE level. Equipment and Equipment Part are defined below in two stages.

### 2.1. EQUIPMENT - ITS DEFINITION

There are several definitions of Equipment and Machine given in various dictionaries (Cambridge dictionary, businessdictionary.com, Oxford dictionary, Engineering Dictionary -McGraw Hill, Collins dictionary, Handbook of Mechanical Engineering Terms etc.). Many definitions equate them to Apparatus, Device, Instrument and Tool also. The analysis of definitions of Equipment, Machine, Apparatus, Device, Instrument, Tool etc. showed that they are intertwined and overlapped in their meanings. Hence, for all practical purposes, this author prefers to declare a definition of **Equipment** as given below:

**EQUIPMENT:** An **Equipment** is built with **Parts** also known as **Components**, consisting of single piece Part, subassembly, assembly or any functional unit of the equipment in particular configuration as required by the design parameters to enable the human being to carry out a specific operation. The Parts used can be either Captive or Standard or Commercial ones in the needed structures. The Equipment is created to magnify the physical and or mental capabilities of the human being to carry out the operation, at the needed Location with the desired level of Safety, Precision, Speed and Automation. Machine, Device, Apparatus, Implements, Tools, Instruments, Gadgets etc. are subsets of Equipment which is an umbrella term.

In this article, System and Plant imply Production System and Production Plant respectively. It can be stated that Production System and Production Plant are mainly configurations of Equipment combinations made for producing particular Products and or Services.

### 2.2. EQUIPMENT PART - ITS DEFINITION

When defining Equipment Part, in the present context, special emphasis is given in identifying the ones required by the End User for repairing and maintaining the Equipment. Table 2.2.a. shows four (4) definitions of **Part** and five (5) definitions of **Component** from standard sources for analysis and review. From the definitions, it can be seen that Part and Component are synonyms in all respects. A definition of Equipment

Part is given below:

Definitions or Descriptions of Part and Component		
Term	Source of Definition	Definition or Description
Part	Dictionary of Engineering, McGraw-Hill	# 1] An <b>element</b> of a subassembly, not normally useful by itself, and not amenable to further disassembly for maintenance purposes.
	APICS Dictionary, 9th Edition	# 2] Generally, a material item that is used as a <b>component</b> and is not an assembly, subassembly, blend, intermediate, etc.
	Oxford Dictionary	# 3] A manufactured object assembled with others to make a machine; a <b>component</b> .
	Cambridge Dictionary	# 4] One of the <b>pieces</b> that together make a machine, a vehicle, or a piece of equipment.
Component	IIMM Glossary of Purchasing and Materials Management	# 5] One of a number of <b>items</b> which collectively make up an assembly.
	APICS Dictionary, 9th Edition	# 6] The raw material, <b>part</b> , or subassembly that goes into a higher level assembly, compound, or other item.
	Maintainability and Maintenance Management	# 7] A constituent <b>part</b> .
	Oxford Dictionary	# 8] A <b>part</b> or element of a larger whole, especially a part of a machine or vehicle.
	Cambridge Dictionary	# 9] A <b>part</b> that combines with other parts to make a machine or piece of equipment

Table 2.2.a.

**EQUIPMENT PART:** It is that Item which is used to manufacture the **Equipment** by assembling them in the required configurations. This Item is either known as **Part** or **Component**. The **Part** can be Captive or Standard or Commercial one. The Part may be in the form of a single-piece object or subassembly or assembly or any functional unit of the equipment. All these Items which are used in building the Equipment are termed **Equipment Parts**.

### 3. LOCATION BASED FUNCTIONS AND FUNCTION CENTRED NAMES OF EQUIPMENT PART

There are at least seven (7) locations or organizations the Equipment Part can occupy in a typical Supply Chain and those are given numbers from 'S' to 'f\$' as given in figure 3.a. Further, Location based Functions and Function dependent Names of Equipment Part are given in table 3.a. In addition to the Functions and Names, Table 3.a. contains details of Business Impact of Stock-out of a Part, Financial Impact of Stock-out of a Part and Ranking of Losses at the Locations at Supply Chain Level.

The journey of **Equipment Part** in a typical Supply Chain is depicted in figure 3.a. below:

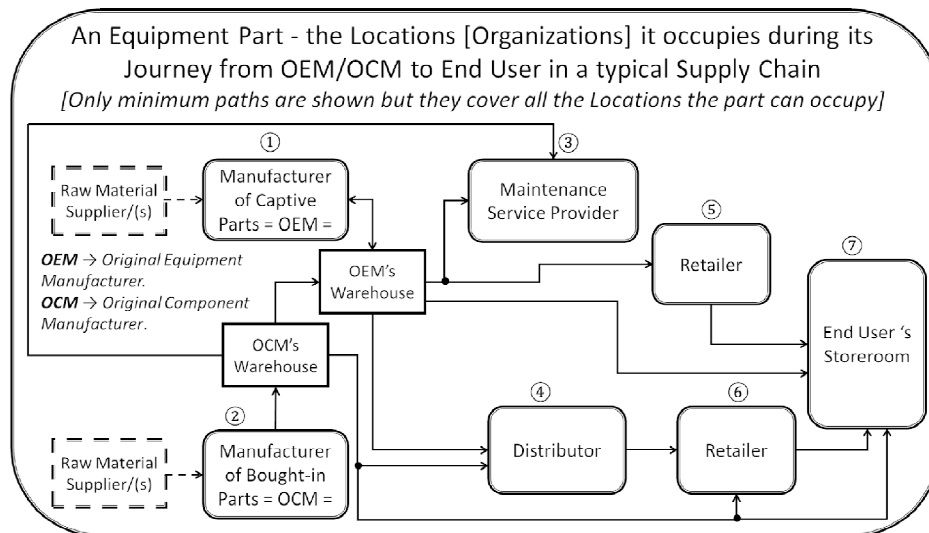


Figure 3.a.

The Equipment Part is Manufacturing Component for OEM and OCM, Spare Part for End User and Service Part for the other organizations in the path of its journey. The contents of table 3.a. are prepared very lucidly



and hence the table is self-explanatory. However, Financial Impact of Stock-out of a Part and Ranking of Losses at the Locations at Supply Chain Level need special mention. Based on financial impact, it is very clear that the **End User** is the **greatest loss-maker** when the required Spare Part [Equipment Part] is not available when needed. This is because of the very fact that the Function of the **Spare Part** is Equipment / Asset Maintenance Support to make the Production Equipment/Line/Plant **available** with maximum Overall Effectiveness for production as scheduled. The impact of financial loss due to non-availability of production equipment varies from Service to Service within an organization and from organization to organization at the industry level.

Equipment Part - its Location based Functions, Names and its Stock-Out Impact on Business and Finance					
<b>Location (Organization)</b>	<b>Function of the Part at the Location</b>	<b>Name</b>	<b>Business Impact of Stock-out of a Part</b>	<b>Financial Impact of Stock-out of a Part</b>	<b>Ranking of Losses at the Locations at the Supply Chain Level</b>
① Original Equipment & Captive Part Manufacturer [OEM]	To Satisfy Production Requirements	1] Component (Captive, Standard and Commercial Parts)	1] Not able to <b>produce the Equipment Unit/(s)</b> as per Schedule.	1] <b>Loss of Profit due</b> to non-production of Equipment Unit/(s).	<b>High</b>  <i>Loss is linked to the Selling Price of the Equipment and not to the Sales Price of the Part.</i>
			2] Not able to <b>honour the schedule of supplying the equipment Units</b> as per the Contract.	2] <b>Loss of Profit due</b> to Cancellation of present Contract /ban of Future Contracts with the particular Client.	<b>Very High</b>  <i>Loss is linked to future business</i>
	To Satisfy Customer Demand	2] Service [Captive] Part	3] Not able to <b>supply service [captive] part as per Demand.</b>	3] <b>Loss of Profit because of not selling</b> the Service Part.	Low  <i>Loss is linked to selling price of Service Part.</i>
② Original Component [Standard and Commercial Parts] Manufacturer [OCM]	To Satisfy Customer Demand	1] Component (Standard & Commercial Part)	1] Not able to <b>supply Component as per Schedule.</b>	1] <b>Loss of Profit due</b> to Cancellation of Current Contract / ban of Future Contracts with the particular Client.	<b>High</b>  <i>Loss of future business</i>
	To Satisfy Customer Demand	2] Service Part (Standard & Commercial Part)	2] Not able to <b>supply Service Part.</b>	2] <b>Loss of Profit because of not selling</b> the Service Part. <i>Loss is linked to selling price of Service Part.</i>	Medium  <i>Loss is linked to selling price of Service Part.</i>
③ Maintenance Service Provider	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	1] Service Part (Captive, Standard & Commercial Parts)	1] Unable to <b>provide Maintenance Service to the client.</b>	1] <b>Loss of Profit because of not providing service.</b> <i>Loss is more than the Purchase Price of the Part.</i>	<b>High</b>  <i>Loss is linked to selling price of Service.</i>
				2] <b>Loss of Profit due</b> to Cancellation of Current Contract / ban of Future Contracts with the particular Client.	<b>Very High</b>  <i>Loss is linked to future business</i>
④, ⑤ & ⑥ Part Distributor and or Part Retailer	To Satisfy Customer Demand	1] Service Part (Captive, Standard & Commercial Parts)	1] Not able to <b>supply Service Part as per Demand.</b>	1] <b>Loss of Profit because of not selling</b> the Service Part.	Medium  <i>Loss is linked to selling price of Service Part.</i>
⑦ Actual End User Organization (Actual Consumer)	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	1] <b>Spare Part</b>	1] Unable to <b>Operate</b> Equipment which can cause <b>Production Interruption</b> at Equipment level, which in turn can cause <b>Production Loss</b> at <b>Line and or Plant level</b> also.	1] <b>Loss of Profit because of No Output (Products or Services)</b> from Equipment / Line / Plant.	<b>Extremely High</b> <i>Loss is linked to selling price of PRODUCT / SERVICE.</i> <i>(Varies from Product to Product OR from Service to Service.)</i>
				2] <b>Loss of Goodwill and Future Business.</b>	<b>Extremely High</b> <i>(Varies from Industry to Industry.)</i>

Table 3.a.

#### 4. INVENTORY CONTROL

Dr CD Lewis in his book Scientific Inventory Control states: “**Inventory Control** is the science-based art of controlling the amount of stock held, in various forms, within a business to meet economically the demands placed upon that business”. Further he affirms that “The aim of an inventory control system is to maintain the quantities of stock held by a business at a level which **optimizes** some management criteria such as minimizing the costs incurred by the whole business enterprise as a result of holding stocks, maximizing the business's profits or **providing a stated minimum customer service**”. This is corroborated by Donald Waters in his book Inventory Control and Management as: “Inventory management is the function responsible for all decisions about stock in an organization. It makes decisions for policies, activities and procedures to make sure the right amount of each item is held in stock at any time”. He further states that “This function is also called stock control or inventory control”. APICS Dictionary, Ninth Edition makes it very simple and clarifies clearly the Inventory Control function, when it explains the term: “Inventory Control – The activities and techniques of maintaining the desired levels of items, whether raw materials, work in process, or finished products”.

Remaining part of this article, suggests that the Inventory Optimization Practices in the various Organizations of the Supply Chain, occupied by the same **Equipment Part**, should depend on the functions to be carried out by the Item.

#### 5. SELECTIVE INVENTORY CONTROL

Selective Inventory Control, a variant of Inventory Control system, came into existence for achieving more efficient and effective Control of Stocking of Items, by treating them selectively. It was a natural development in satisfying the quest of better method of Inventory Control. The basic concept is described below:

##### 5.1. SELECTIVE INVENTORY CONTROL – AN EXAMPLE

Let us analyse a situation when there are multiple items to be replenished on an ongoing basis with an objective of keeping the Average Stock Value at a minimum level. The present practice is to treat all the Items alike with equal importance and execute the replenishment activities by expending equal resources of effort and time for all the Items. Though it is unscientific, this method is practised in the hope that it will minimize the Average Stock Value, when all items are treated identically. In the present method, which is arbitrary in nature, all Items are reviewed and ordered 4 times a year. A new method is proposed to treat items differently. In other words, it is suggested to review and fix the number of yearly orders proportionate to the Annual Demand Value. It means that the Items are to be treated with relative importance of Annual Demand Value by expending resources and time commensurate with the Annual Demand Value of Items. The below given table 5.1.a. shows an example of Inventory Reordering of three Items using the present and the proposed methods.

Advantage of Selective Stock Control - An Example											
Item No	① Present Method Items Controlled with Equal Importance. Hence 4 orders per year = 12 Orders/Year.				Annual Demand Value	Profit at 10%	② Proposed Method Items Controlled with Selective Importance. Hence Orders 8, 3 & 1 = 12 Orders/Year.				Demand Value Class Code
	Stock Review and Reorder Cycles (Days)	Average Stock Value [ASV]	Order Value	Orders per Year [OpY]			Orders per Year [OpY]	Order Value	Average Stock Value [ASV]	Stock Review and Reorder Cycles (Days)	
1	90	₹ 33,750.00	₹ 67,500.00	4	₹ 2,70,000.00	₹ 27,000.00	8	₹ 33,750.00	₹ 16,875.00	45	H
2	90	₹ 6,000.00	₹ 12,000.00	4	₹ 48,000.00	₹ 4,800.00	3	₹ 16,000.00	₹ 8,000.00	120	M
3	90	₹ 500.00	₹ 1,000.00	4	₹ 4,000.00	₹ 400.00	1	₹ 4,000.00	₹ 2,000.00	360	L
	ASV Total →	₹ 40,250.00	OpY Total →	12	₹ 3,22,000.00	₹ 32,200.00	12	← OpY Total	₹ 26,875.00	← ASV Total	

Working Capital Released = ₹40,250.00 - ₹26,875.00 = ₹13,375.00. Cost of Capital = 18%. Hence Additional Profit = ₹13,375.00 x 18% = ₹2,407.50.

Table 5.1.a.

This example is only a probable case from a trading environment. The objective of the company is to maximize profit. The profit is generated from the selling prices of Items sold and is directly linked to the Annual Sales Value or Annual Demand Value of Items. Hence the Characteristic to be used for fixing the Relative Importance is naturally the Annual Demand Value of Items. Also profit maximization is possible only when investment is minimised or in other words, Sum of Average Stock Value of Items is minimised.

##### 5.2. ITEMS CONTROLLED WITH EQUAL IMPORTANCE - THE PRESENT METHOD

All the three Items are ordered 4 times per year with Stock Review Period of 90 days, irrespective of Annual

Demand Value. With this method, the sum of Average Stock Value is ₹ 40,250.00. Please refer to the computations given in the table 5.1.a. Now, if the Average Stock Value has to be brought down, these items have to be ordered differently, with different Order Values.

### 5.3. ITEMS CONTROLLED WITH SELECTIVE (UNEQUAL) IMPORTANCE – THE PROPOSED METHOD

In this case, reduction of Sum of Average Stock Value is the objective and hence the very Characteristic to be considered to fix relative importance of Items, is their **Annual Demand Value [ADV]**. This objective is achieved in a few steps:

1] The criteria for classifying Items into High, Medium and Low Demand Value Classes and their Codes are fixed as in below given Table 5.3.a.:

Characteristic of the Item	Criterion Based on Range of Present Values of the Characteristic	Prioritization Class Name	Prioritization Class Code
Annual Demand Value [ADV]	≥ ₹ 10,000	High Importance	<b>H</b>
Annual Demand Value [ADV]	< ₹ 10,000 but ≥ ₹ 2,500	Medium Importance	<b>M</b>
Annual Demand Value [ADV]	< ₹ 2,500	Low Importance	<b>L</b>

Table 5.3.a.

2] The highest ADV gets the value of High, the lowest ADV gets the value of Low and the one in between gets the value of Medium. Assign Codes of **H**, **M** and **L** in cells corresponding to Item No 1, 2 and 3 respectively under column heading **Demand Value Class Code**.

3] For Item No 1, the number of orders is increased to 8 from 4, for Item No 2, the number of orders is reduced to 3 from 4 and in the case of Item No 3, the number of orders is decreased to 1 from 4. Please note that changes in number of orders are done arbitrarily with the intention of showing the example of reducing the Average Stock Value. Accordingly, the sum of Average Stock Value has reached to ₹ 26,875.00 from that of ₹ 40,250.00. Please refer to the computations given in the table 5.1.a. Also please be aware, that this is **not an optimum solution**, but only an example to show, how Selective Inventory Control can be advantageous to achieve the objective of Reduction of Average Stock Value, while keeping the resources of Time and Effort expended at the same available level. In other words, Orders Per Year in the Present and Proposed methods are one and the same at 12. In this case more resources are expended for placing higher number of orders of relatively more important Item 1 than the other two less important ones. This is achieved by keeping the total of resources at the same available level but **redistributing** them among the Items commensurate with their relative importance within the organization [store].

### 5.4. THE CONCEPT OF SELECTIVE INVENTORY CONTROL

Professor P Gopalakrishnan writes about Selective Inventory Control in the book **Inventory Management** ([1978]1981 – Revised Edition) co-authored with Professor Sandilya that “in inventory management also, classification is resorted to, so that **a major portion of effective managerial time is spent on those materials which are more important**. The motive behind any selective control is that an equally critical analysis of all items will be very expensive. Moreover, such a concentration on all items will have a diffused effect regardless of the priorities”. It is observed that in Selective Inventory Control (SIC), ABC Inventory Analysis is invariably the first Classification of Items. Then other Classifications are done to create inventory Categories (section 1.1.). Professor P Gopalakrishnan has used the phrase **Always Better Control** to glorify the importance of ABC Inventory Analysis in his book mentioned above. However, based on the decades of experience in Inventory Control of more than 100,000 items at a time in an Oil and Gas company, this author finds it difficult to agree with him on the use of the phrase “Always Better Control” to glorify ABC Analysis, as it has only limited application in Spare Part Inventory Control. Professor Prem Vrat in his book **Materials Management - An Integrated Systems Approach** (2014) writes on Selective Inventory Management: “It enables the management to focus on **few important control points** so that with limited control efforts very significant outcomes are realized”. He further says that “major system performance can be achieved by focusing only on a small percentage of total items carried in stock”. Then he emphasizes that Selective Inventory Management is an “**operating necessity**”. Professors Gopalakrishnan, Sandilya and Prem Vrat have thus explained the concept of Selective Inventory Control in a highly comprehensible manner.

It is an established fact that Selective Inventory Control method (SIC-method) is the widely used Inventory Control method to accomplish many of the Inventory Optimisation objectives by deployment of available resources in a suitable manner. Professor P Gopalakrishnan has given an unique categorisation technique for SIC-method, in his **Handbook of Materials Management** co-authored with Professor Abid Haleem. It is termed Multi Unit Selective Inventory Control (**MUSIC-3D**), a three dimensional - finance, operations and materials approach for categorisation of Items for SIC-method. This excellent technique is purely dependent on the characteristics of the Item irrespective of the **Process Function** the item is expected to execute. Hence this author does not subscribe to his idea completely.

## 5.5. ACTIVITIES OF SELECTIVE INVENTORY CONTROL METHOD

Some of the major activities of Selective Inventory Control relevant to Equipment Part (Item) are listed below:

- ◆ Inventory Categorization
- ◆ Inventory Planning
- ◆ Order Triggering
- ◆ Lot Sizing of Order Quantity
- ◆ Inventory Record Keeping and
- ◆ Performance Metrics etc.

The first two activities are explained in detail as examples in ensuing sub sections 6.1. and 6.2., to show the variation of decision criteria and techniques to be employed according to the Part's function/(s) at different locations for effective Selective Inventory Control.

## 6. INVENTORY CONTROL AT LOCATION 'S OEM – MIXED DEMAND

The Equipment's **Captive** Part at Location 'S OEM, has to perform two Functions: **To Satisfy Production Requirement** and **To Satisfy Customer Demand** as shown in table 6.a. It means that Dependent Demand Quantity is to be used for Satisfying Production Requirement and Independent Demand Quantity is for Satisfying Customer Demand.

Equipment Part at Location ① OEM						
Function of the Item	Name of the Part	Criticality Characteristics	Data Source	Financial Loss due to Non-availability of the Part	Demand Quantity Type	Inventory Planning and Control Technique
① To Satisfy Production Requirement	Component (Captive, Standard and Commercial Parts)	Average Lead Time.	Confirmed Orders for <b>Equipment</b> converted to <b>Part Quantity (BoM)</b> .	Amount equivalent to the <b>Profit from the Sale of the Equipment</b> .	<b>Dependent</b> Demand Quantity	<b>Material Requirements Planning =MRP=</b> . (Lot For Lot, EOQ, PPB Quantity etc.).
② To Satisfy Customer Demand	Service Part (Captive Part)	Annual Demand Value, Average Lead Time and Annual Movement Frequency	Forecast Quantity based on <b>Previous Sales Data of Part</b> .	Amount equivalent to the <b>Profit from the Sale of the Part</b> .	<b>Independent</b> Demand Quantity	<b>Scientific Inventory Control</b> . (Safety Stock, Reorder Level, Maximum Stock, EOQ, Order Quantity etc.).

Table 6.a.

### 6.1. V' TO SATISFY PRODUCTION REQUIREMENT

The quantity required for Satisfying Production Requirement has to be derived from the quantities of Equipment units given in the confirmed Orders and based on **Material Planning BoM (Matrix BoM)**. The Service Level for Production Requirement is mandatorily 100%. All Items required for the Manufacture of the Equipment Units should be available at the same time. The amount of financial loss due to non-availability of a part is not linked to its selling price, but to the Selling Price of the Equipment Unit and it can be many times the selling price of the Part. However the Criticality of a part, in this case is determined by its Buying or Manufacturing Lead Time only. **Material Requirements Planning** is the technique used for Material Planning, Ordering and Control.

### 6.2. W' TO SATISFY CUSTOMER DEMAND

The Independent Demand Quantity intended for Customer Satisfaction, is arrived at by forecasting the demand based on the Previous Sales Data. The Service Level for Customer Demand can be say 97 to 99%. The amount of financial loss due to non-availability of a part is nothing but the profit it can fetch and hence linked to its

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selling price only. The Criticality of a part, in this situation is determined by the Part's Annual Demand Value, Lead Time and Annual Movement Frequency. **Scientific Inventory Control Techniques** are used for Material Planning, Ordering and Control.

### 6.3. OBSERVATION BY THE AUTHOR

From the explanations of the scenarios in sub sections 6.1. and 6.2.; it is clearly evident that both these quantities of the same Item cannot be planned and controlled employing identical Inventory Control techniques because of the very fact that these quantities are derived in distinct manners and the required Service Level objectives are quite disparate. Logically two different sets of Inventory Control techniques have to be used **based on the functions to be executed** by these two quantities of the same item. In fact, the same logic is applicable to the Item at other locations also as the **Functions are different from Location to Location**. Hence this author strongly recommends **FUNCTION-CENTRED SELECTIVE INVENTORY CONTROL** which is described in the ensuing sections. However the implementation of FUNCTION-CENTRED SELECTIVE INVENTORY CONTROL is quite challenging to the Inventory Control Manager.

## 7. FUNCTION-CENTRED SELECTIVE INVENTORY CONTROL METHOD – FSIC-METHOD

This author with decades of experience in managing more than hundred thousand Inventory Items at a time, in various capital intensive continuous process industries, is of opinion that the selection of the characteristics of Items for SIC-method in an organization has to be done considering the functions to be executed by the Items. Then only it will be really **Selective** in nature for fulfilling the objectives of SIC-method and Inventory Optimisation. In other words, this author emphasises and recommends that **Function-Centred Selective Inventory Control Method (FSIC-method)** is the best suited method for Inventory Optimization at organisational level. Accordingly its two activities of Inventory Categorisation and Inventory Planning are explained in detail as examples, in sub sections 7.1. and 7.2. This concept has to be applied logically to all other activities of FSIC-method.

### 7.1. INVENTORY CATEGORIZATION

The Inventory Categorisation is the first activity of FSIC-method. This has to be prepared for Items linked to each Store. There are a few tasks involved in this as explained below:

#### 7.1.1. Identification of Function of the Item

All items in an organization are purchased and or produced and stocked for executing their intended major functions with respect to **Production, Maintenance, Sales, Communication, HSE management, Security, Administration** etc., in the present and or future time periods. This highly important information has to be stored in the Inventory Item records in database with appropriate codes up to sub / sub-sub function level, for judicious Categorisation of Items. For example, in the case of Production function, it has at least two sub functions namely **Production - Raw Material (Pr-RM)** and **Production – Component (Pr-Co)**.

#### 7.1.2. General Characteristics (or Attributes) of Items Selected for Analyses

The Characteristics to be selected for fixing various Grades of Relative Importance among the total Items linked to a particular Store, can be Annual Demand/Usage Value, Vitality Analysis, Movement Frequency, Unit Price, Failure Type, Part Design Type, Average Lead Time, Failure Rate etc.

#### 7.1.3. Inventory Prioritization

This task starts with scanning the values of a selected characteristic, for example Annual Demand Value (ADV) in a Retail environment, of all the Items in a particular store. Then **demarcation** of the available Annual Demand Values is done to create **Criterion** for fixing **Grades of Relative Importance** among the available Items in the Store. Further each Grade of Relative Importance is to be denoted by appropriate Name and Code. Accordingly in this case, there are three Grades of Relative Importance shown with Name and Code respectively: A-Class (High ADV) with code **A**; B-Class (Medium ADV) with code **B** and C-Class (Low ADV) with code **C**. Now Priority and Action can be fixed for applying Selective Inventory Control techniques based on ADV Classes as follows: High Level of Inventory Control for A-Class Items, Medium Level of Inventory Control for B-Class Items and Low Level of Inventory Control for C-Class Items. Thus Inventory Prioritization is the process of determining the order of precedence of application of Selective Inventory Control on the basis of Grades of Relative Importance of Items depending on the selected Characteristic of Items in relation to the appropriate Criterion. The Values and or Ranges of Values of the selected Characteristic which determine the Grades of Relative Importance of Items and their corresponding Names and Codes are **purely relative and specific** to the items currently linked to the particular store.

#### 7.1.4. Inventory Classification

The Items having the same Grade of Relative Importance, can be grouped together to form a Class. In this example we have A-Class, B-Class and C-Class. And this process of grouping the Items on the basis of Grades of Relative Importance of Items is defined as Classification. The Classification Codes for various Grades of Relative Importance of Items with respect to the above selected Characteristics are shown in **bold font**: Annual Demand/Usage Value [**A** Class - **B** Class - **C** Class], Vitality [**V**ital - **E**ssential - **D**esirable], Movement Frequency [**F**ast - **S**low - **N**on-moving], Unit Price [**H**igh - **M**edium - **L**ow], Failure Type [**R**andom - **W**earing-out - **A**ged], Part Design Type [**C**aptive - **S**tandard - **C**ommercial], Average Lead Time [**L**ong - **N**ormal - **S**hort], Failure Rate [**F**ast - **M**edium - **S**low - **V**ery Slow] etc. Updating **Inventory Classification Data** in the Database, is the process of mapping the corresponding **Codes** for various grades of relative importance of items per each characteristic, to the appropriate fields of the item records in the database.

#### 7.1.5. Inventory Categorisation

Further to the completion of Inventory Classification, all Equipment Parts are to be linked to the appropriate Equipment/Systems in use. George W. Plossl in the 2<sup>nd</sup> edition of ORLICKY'S Material Requirements Planning emphasises under the topic "Reappraisal of Concepts", that **Classification of inventory by function** is important and is a commonly accepted idea. Many authors use Classification and Categorisation synonymously. And hence, this author considers Classification mentioned by George W. Plossl as Categorisation in the present context. In accordance with the respective Functions of the Item as entered in the Item record (7.1.1.), the Characteristics relevant to the particular function of the Items or quantity of the Items (7.1.4.) have to be selected for building the **Function-Centred Criteria Matrix**. This stage is the beginning of the **Function-Centred Categorisation** of Items.

**INVENTORY CATEGORIZATION** is the technique to group Inventory Items into a meaningful as well as manageable number of Relative importance-wise **Categories** based on their **Function-Centred Criterion/Criteria matrix** so that efficient and effective Inventory Optimization can be achieved by employing the category specific Business Rules such as Stock Warning Frequency, Stock Review Frequency, Replenishment Status Warning, Procurement Status Warning, and Inventory Control Parameters like Safety Stock, Reorder Level, Order Quantity, Maximum Stock, etc.

#### 7.1.6. Specimen Inventory Categories of Equipment Parts at Location '\$ OEM

The names of categories generally suggest the functions, the Items are expected to perform **to satisfy the User** (Owner or End User) **Requirements**. These categories are formed by selecting the characteristic/(s) of the Items appropriate for their intended function. In some cases, one item has to execute more than one function. In our example, there are two functions to be carried out by the item at Location '\$ OEM. It means that dependent quantity has to **Satisfy Production Requirement** while independent quantity has to **Satisfy Customer Demand**. Accordingly the **dependent quantity** is classified into categories **Extreme Critical Item**, **Critical Item** and **Normal Item** based on **single criterion matrix** of Lead Time only. In the case of **independent quantity**, the categories identified are also **Extreme Critical Item**, **Critical Item** and **Normal Item** but based on **triple criteria matrix** of Annual Demand Value, Lead Time and Annual Movement Frequency. Please refer to table 7.1.6.a.

Specimen Inventory Categories of Equipment Parts at Location - ① OEM						
Equipment Part at ① OEM <i>Dependent Quantity</i> Single Criterion Matrix (Lead Time)			Equipment Part at ① OEM <i>Independent Quantity</i> Triple Criteria Matrix (Demand, Movement and Lead Time)			
LLT	NLT	SLT	Criteria	Typical Inventory Categories		
<b>Extremely Critical Items</b>	<b>Critical Items</b>	Normal Items	A, FM & LLT	<b>Extremely Critical Items</b>		
Typical Inventory Categories			A, FM & NLT			
Classification - Typical Class Codes with Descriptions			A, SM & LLT	<b>Critical Items</b>		
Class Code	Class Name		A, SM & NLT			
A	A Class - High Demand Value Item		B, FM & LLT			
B	B Class - Other than High Demand Value Item		B, FM & NLT	<b>Normal Items</b>		
FM	Fast Moving Item		B, SM & LLT			
LLT	Long Lead Time Item		B, SM & NLT			
NLT	Normal Lead Time Item					
SLT	Short Lead Time Item					
SM	Slow Moving Item - Other than Fast Moving Item					

Table 7.1.6.a.

### 7.1.7. Typical Inventory Categories

The recommended typical Categories of Items to be created based on **Functions** the Items are expected to perform, are:

- ◆ Insurance Item
- ◆ Extremely Critical Item
- ◆ Critical Item
- ◆ Normal Item
- ◆ User Controlled Stock Item
- ◆ User Controlled Non-Stock Item
- ◆ Obsolescent (Going to be Obsolete) Item
- ◆ Obsolete Item and
- ◆ Dead (Unwanted) Item etc.

It is important to realize that the Categories shown in table below are typical ones only. In fact, Inventory Categories are **relative** to the prevailing environment at the time of decision making and not at all **absolute or permanent**. Table 7.1.7.a. shows a list of recommended typical activities and the techniques to be employed in the Inventory Categorization process which is the very first step in the successful implementation of Function-Centred Selective Inventory Control.

Inventory Categorization of Equipment Parts at Various Locations (Specimen)				
Location (Organization)	Function of the Item	Equipment Part's Name based on Function	Classification Characteristic/(s)	Classification Characteristic/(s)
				Categorisation Basis
				Typical Categories
① Original Equipment Manufacturer =OEM=	To Satisfy Production Requirements. <i>Dependent Demand Quantity.</i>	Component (Captive, Standard and Commercial Parts)	Lead Time	1- Average Buying / Manufacturing Lead Time Classification: Long, Normal and Short Lead Times (L-N-S). Categorization based on single Criterion Matrix: Long Lead Time (LLT), Normal Lead Time (NLT) and Short Lead Time (SLT). 1] Extremely Critical Items, 2] Critical Items and 3] Normal Items.
	To Satisfy Customer Demand. <i>Independent Demand Quantity.</i>	Service Part (Captive Part)	Annual Demand Value, Lead Time and Annual Movement Frequency	1- Annual Demand Value - A-B-C Classification into A Class & B Class, 2- Annual Movement Frequency Classification into Fast Moving and Slow Moving (FM-SM) & 3- Average Buying / Manufacturing Lead Time Classification: Long Lead Time and Normal Lead Time (LLT & NLT). Categorization based on triple Criteria Matrix: Demand Value (A & B), Lead Time (LLT & NLT) and Movement Frequency (FM & SM). 1] Extremely Critical Items, 2] Critical Items and 3] Normal Items.
	To Satisfy Customer Demand	Component (Standard & Commercial Part)	Lead Time	1- Average Manufacturing Lead Time Classification: Long and Normal Lead Times (L-N-S). Categorization based on single Criterion Matrix: Lead Time 1] Extremely Critical Item, 2] Critical Item and 3] Normal Item
	To Satisfy Customer Demand	Service Part (Standard & Commercial Part)	Annual Demand Value and Annual Movement Frequency	1- Annual Demand Value - A-B-C Classification into A & B Classes and 2- Annual Movement Frequency Classification into Fast and Slow Moving (F-S). Categorization based on double Criteria Matrix: Demand Value and Movement frequency 1] Critical Item and 2] Normal Item
③ Maintenance Service Provider	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	Service Part (Captive, Standard & Commercial Parts)	Vitality, Lead Time and 5 Year Movement Frequency	1- Part Vitality [Global] - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Normal Lead Times (L-N) 3- 5 Year Movement Frequency [Global] - Classification into Fast and Slow Moving (F-S) & 4- 5 Year Demand Value - Classical A-B-C Analysis Categorization based on triple Criteria Matrix: Vitality, Lead Time and 5 Year Movement Frequency. 1] Extreme Critical Item, 2] Critical Item, 3] Normal Item and 4] Obsolete Item.
				1- Annual Demand Value - Classical A-B-C Analysis and 2- Annual Movement Frequency Classification into Fast and Slow Moving (F-S). Categorization based on double Criteria Matrix: Annual Demand Value and Movement Frequency. 1] Extremely Critical Item, 2] Critical Item and 3] Normal Item
				1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.
④, ⑤ & ⑥ Part Distributor and or Part Retailer: <i>Resellers</i>	To Satisfy Customer Demand	Service Part (Captive, Standard & Commercial Parts)	Annual Demand Value and Annual Movement Frequency	1- Annual Demand Value - Classical A-B-C Analysis and 2- Annual Movement Frequency Classification into Fast and Slow Moving (F-S). Categorization based on double Criteria Matrix: Annual Demand Value and Movement Frequency. 1] Extremely Critical Item, 2] Critical Item and 3] Normal Item
				1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.
				1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.
⑦ Actual End User Organization (Actual Consumer)	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	<i>Spare Part</i>	Vitality, Lead Time, 5 year Movement Frequency and Unit Price.	1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.
				1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.
				1- Part Vitality - Classical V-E-D Analysis, 2- Average Buying Lead Time Classification into Long and Short Lead Times (L-S) 3- Five Year Movement Frequency Classification into Fast, Slow and Non Moving (F-S-N) and 4- Unit Price of the Item: H-M-L Classification. Categorization based on quadruple Criteria Matrix: Vitality, Lead Time, 5 Year Movement Frequency and Unit Price. 1] Insurance Item, 2] Extremely Critical Item, 3] Critical Item, 4] Normal Item and 5] Obsolete Item.

Table 7.1.7.a.



## 7.2. INVENTORY PLANNING

Inventory Planning has two stages and they are Demand Data Collection and Materials Planning. It is very important to collect the required data without latency. Table 7.2.a. clearly shows Location, Function of the Item, Equipment Part's Name based on Function, Demand Type of Quantity to be Planned & Data Sources and Planning Methods.

The Equipment Part in our example has to execute two functions at Location 'OEM'. One function is to Satisfy Production Requirement with **Dependent Demand Quantity**. The second function is to Satisfy Customer Demand with **Independent Demand Quantity**.

Inventory Planning: Demand Data Sources and Materials Planning				
Location (Organization)	Function of the Item	Equipment Part's Name based on Function	Demand Type of Quantity to be Planned	Data Sources and Planning Methods
① Original Equipment Manufacturer =OEM=	To Satisfy Production Requirement	Component (Captive Part)	Dependent	Demand Data Source: <b>Confirmed Orders</b> . Material Planning: <b>Material Requirements Planning = MRP = based on Manufacturing - BoM</b> .
	To Satisfy Customer Demand	Service Part (Captive Part)	Independent	Demand Data Source: <b>Confirmed Orders</b> and <b>Forecast</b> . Material Planning: <b>Order Quantities</b> and <b>Forecast Quantities</b> (Normal Distribution) - <b>Scientific Inventory Control</b> .
② Original Component Manufacturer =OCM=	To Satisfy Customer Demand	Component (Standard & Commercial Part)	Independent	Demand Data Source: <b>Confirmed Orders</b> . Material Planning: <b>Order Based Planning - OBP</b> .
	To Satisfy Customer Demand	Service Part (Standard & Commercial Part)	Independent	Demand Data Source: <b>Confirmed Orders</b> and <b>Forecast</b> . Material Planning: <b>Order Quantities</b> and <b>Forecast Quantities</b> (Normal Distribution) - <b>Scientific Inventory Control</b> .
③ Maintenance Service Provider	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	Service Part (Captive, Standard & Commercial Parts)	Dependent	Demand Data Source: <b>Confirmed Orders</b> . Material Planning: <b>Material Requirements Planning = MRP = based on Repair - BoM</b> .
④, ⑤ & ⑥ Part Distributor and or Part Retailer	To Satisfy Customer Demand	Service Part (Captive, Standard & Commercial Parts)	Independent	Demand Data Source: <b>Confirmed Orders</b> and <b>Forecast</b> . Material Planning: <b>Order Quantities</b> and <b>Forecast Quantities</b> (Normal Distribution) - <b>Scientific Inventory Control</b> .
⑦ Actual End User Organization (Actual Consumer)	To Increase Overall Equipment Effectiveness [Asset Maintenance Support]	Spare Part	Dependent	Demand Data Source: <b>Preventive Maintenance Schedule, Overhauling Schedule and Annual Plant Shutdown Schedule</b> . Material Planning: <b>Material Requirements Planning = MRP = based on Repair - BoM</b> .
			Independent	Demand Data Source: History of <b>Unplanned Corrective Maintenance (Breakdown), Planned Corrective Maintenance (Predictive Maintenance) and Emergency Plant Shutdown</b> . Material Planning: <b>Forecast Quantities based on adequate period Demand (or Consumption) History</b> , - (Normal Distribution and Poisson Distribution) - <b>Scientific Inventory Control</b> .

Table 7.2.a.

### 7.2.1. Planning Dependent Demand Quantity

Demand Data Source: Confirmed Orders. There is no need to Forecast the demand as the equipment units are manufactured as per Confirmed Orders (Requirement) only.

Material Planning: The Technique employed is Material Requirements Planning =MRP= based on Manufacturing BoM and Material Planning BoM (Matrix BoM).

### 7.2.2. Planning Independent Demand Quantity

Demand Data Source: Confirmed Orders for Parts and Forecast of Parts. In this case, Confirmed Order Quantity and Forecast Quantity are to be merged.

Material Planning: Order Quantities and Forecast Quantities are added to implement Scientific Inventory Control techniques containing Business Rules and Inventory Control Parameters.

## 8. CONCLUSION

Section 6 described the scenario in which an item has to perform two functions at the same time at a location (table 6.a.) and established the need for Function-centred Selective Inventory Control method (**FSIC-method**). The situation in which the same Item has to discharge different functions at various locations as shown in table 7.1.7.a. is nothing but an extension of the first scenario described in table 6.a. Thus it has

become highly evident that **FSIC-method** is the best method for Inventory Optimization. However the implementation of **FSIC-method** is quite challenging when the same Item has to carry out multiple functions at the same time in the same location. The following sub sections describe the recommended courses of action in this regard.

### 8.1. TWO STORES

It is advisable to store the quantity (procured and or purchased) for Production purposes in the Production store. The other quantity (procured and or purchased) meant for satisfying the customer demand, is to be stored in the Finished goods store. Thus Inventory Optimization of these quantities can be achieved independently. These stores have to be physically separated to safeguard the correct storage and issue procedures with respect to the quantities.

### 8.2. TWO ITEM CODES FOR THE SAME ITEM

Another way to solve this problem is to have two Item codes for the same item indicating two functions to be executed. In a 10 digit Item Code structure, the last digit can be an **indicator** and this information can be included in it so that two Item Codes can be created for the same Item, one for each portion of the quantity. Thus the challenge in implementing Function-Centred Selective Inventory Control system can be solved.

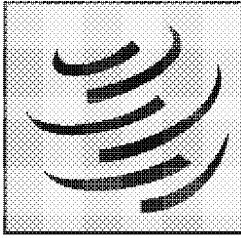
### 8.3. TIME PHASED ORDER POINT – TPOP

Even though MRP is primarily designed for handling Dependent Demand quantity, it can be employed to process Mixed Dependent and Independent Demand Quantities. Time Phased Order Point technique can be used to forecast Independent Demand which in turn can be added to the proper time periods containing Dependent Demand. Then MRP Processor will take care of both the Demands. This is Technically feasible but Operationally (Storage, Issue, Costing, Accounting etc.) confusing and difficult to practise, as observed by this author. Hence Time Phased Order Point (**TPOP**) Technique is not recommended.

#### References

Sl No	Author / Editor	Title of Book / Article	Edition	Year	Publisher
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3	Donald J Waters	Inventory Control and Management	2 <sup>nd</sup>	2003	John Wiley & Sons Ltd.
4	George W. Plossl	ORLICKY'S Material Requirements Planning	2 <sup>nd</sup>	1994	McGRAW-HILL Inc.
5	Gopalakrishnan P, et al	Inventory Management, Text and Cases	1 <sup>st</sup> (Rev)	1981	Macmillan India Limited
6	Gopalakrishnan P, et al	Handbook of Materials Management	2 <sup>nd</sup>	2015	PHI Learning Private Ltd.
7	James F. Fox et al	APICS Dictionary	9 <sup>th</sup>	1998	APICS
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10	Lewis CD	Scientific Inventory Control	2 <sup>nd</sup>	1981	Butterworth & Co Ltd
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12	Richard Koch	The 80 / 20 Principle	1 <sup>st</sup> (Rev)	1998	Nicholas Brealey Publishing
13	Robert Goodell Brown	Advanced Service Parts Inventory Control	2 <sup>nd</sup>	1982	Materials Management Systems Inc.
14	Starr & Miller	Inventory Control : Theory and Practice	1 <sup>st</sup>	1974	Prentice-Hall of India Private Ltd.
15	Tony Arnold, JR et al	Introduction to Materials Management	6 <sup>th</sup>	2014	Pearson

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## WTO UPDATE :

### MINISTER STRESSES ON REMOVING MULTIPLE HURDLES IN ACCESS TO MEDICINES AT AFFORDABLE PRICES; WTO REFORM PROCESS SHOULD BE INCLUSIVE, BALANCED AND CONSENSUS BASED; SHRI GOYAL PARTICIPATES IN THE 10TH BRICS TRADE MINISTERS VIRTUAL MEETING

The Commerce and Industry Minister Shri Piyush Goyal has called for all nations to enhance transparency in their trade and build trust to prevent losing their role as a preeminent trade partner. Addressing the 10th BRICS Trade Ministers virtual Meeting today, he said that for trade to play its part in the recovery process, all the partners must be trustworthy and transparent. "It is trust and transparency which determines the sustainability of global supply chains and nations must demonstrate their compliance with global rules of trade to remain a part of global trade flow. Increasingly, nations which trust each other are coming together to build global supply chains with corresponding investments in manufacturing and services," he said.

The Minister said that the ongoing crisis has exposed the world to vulnerabilities, forcing us to explore ways to support each other. He said that Trade can be an engine of reviving growth in such a scenario and this is premised on strengthening of the WTO based on its principles of openness, fairness, transparency, inclusivity, and non-discrimination.



The Minister called for removing multiple hurdles in access to medicines at affordable prices created by the lopsided WTO rules for protecting intellectual property. He mentioned that the TRIPS Agreement did not envisage a pandemic where demand for vaccines and medicines would come from several countries simultaneously, with the requirement changing at a rapid pace. He said that IPRs should not block access to critical medicines and other devices required for the treatment of the disease.

Shri Goyal said that the pandemic has quite paradoxically provided us with a window of opportunity - to strengthen ourselves by building capacities, expanding manufacturing as well as plugging into the global value chains. The Minister said that as BRICS members are among the most affected countries in the world, we must collectively demonstrate a determined will to emerge stronger, while being prepared to face any such unknown crisis.

Shri Goyal said that the multilateral rules-based trading system is facing serious and grave challenges, including a spate of unilateral measures and countermeasures, deadlock in key areas of negotiations and an impasse in the Appellate Body. He said that for a large majority of WTO members, preserving its fundamental principles and objectives is crucial to ensuring the credibility of the multilateral trading system. He said that the WTO reform process should take into account these existing realities in the world and should, therefore, be inclusive, balanced and consensus based, leading to prosperity for all. He said "It is disheartening that we are seeing some proposals at the WTO seeking to ride on the pandemic for pursuing commercial ends. It will essentially support the quest

of developed countries' firms to have unhindered access to the markets in developing countries, while putting constraints on developing countries to establish domestic manufacturing capacities."

Describing 2020 as a turning point in the history of multilateralism, especially for the BRICS grouping, the Minister said that any economic partnership must keep in mind the different size and population of each country, unequal levels of economic development and human development indicators, contrasting levels of prosperity, cultural diversity and significantly different political and judicial systems. He said that we place humanity at the centre of our global engagement and thus despite being hit hard by the virus ourselves, we have not shied away from providing humanitarian relief to those who sought it. India provided critical medical supplies to around 150 countries in these troubled times. As the 'Pharmacy of the World' we have catered to the spike in demand for drugs such as Hydroxychloroquine and Paracetamol being used for the treatment of Covid-19.

Talking about India's proactive role in assessing and dealing with the challenges caused by the pandemic, he said that saving lives has been India's highest priority. "Despite being home to nearly 17% of the world population, we have only 8% of COVID-19 affected patients worldwide. Under the leadership of Hon'ble Prime minister Narendra Modi, we implemented one of the severest lockdowns at an early stage thereby breaking the Corona Virus transmission chain and prepared the country to become self-reliant in Covid Care facility. We have done significantly better than many other countries, with a lower death rate and higher recovery rate." As a response to the pandemic, India has significantly enhanced its capacities in the healthcare sector with the development of healthcare facilities, emergency rooms, provision of protective equipment and medical supplies, and training of healthcare professionals. Our people are also sensitised to maintain social distancing and wear face masks in public at all times.

About the steps taken to mitigate the economic challenges posed by the pandemic and bring economy back on track, Shri Goyal said that Prime Minister announced a stimulus package of over \$300 billion, called Aatma Nirbhar Bharat, which is defined as a Self-Reliant India, which includes fiscal and monetary measures. He said that the edifice of this mission stands on five pillars of the economy: massive infrastructure building, technology, aspects of good governance, leveraging the demographic dividend, and promoting demand.

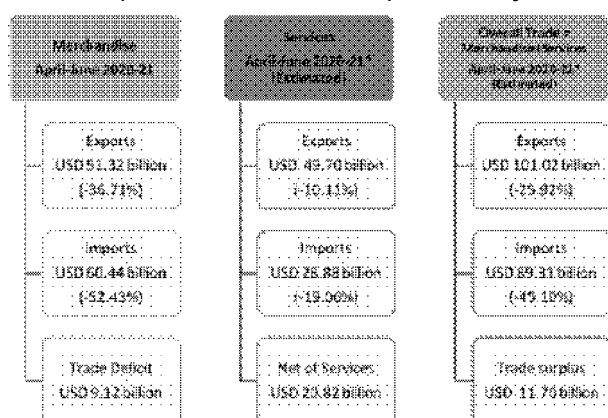
Calling upon BRICS to support responsible investment, Shri Goyal said that it should be aimed at balanced outcomes and create gains even for recipient countries and, most importantly, employment generation. The Minister said that amidst this turmoil, the BRICS nations must prepare, act and stand in solidarity with each other and seize the opportunities that come our way to build a strong, resilient, and reformed trading system that lays the foundation for our shared aspirations.

Source : WTO Website

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# INDIA'S FOREIGN TRADE: JUNE 2020

India's overall exports (Merchandise and Services combined) in April-June 2020-21\* are estimated to be USD 101.02 billion, exhibiting a negative growth of (-)25.92 per cent over the same period last year. Overall imports in April-June 2020-21\* are estimated to be USD 89.31 billion, exhibiting a negative growth of (-)45.10 per cent over the same period last year.



\*Note: i) The latest data for services sector released by RBI is for May 2020. The data for June 2020 is an estimation, which will be revised based on RBI's subsequent release ii) the figures in bracket are growth rates vis-à-vis corresponding period of last year.

## I. MERCHANDISE TRADE

### EXPORTS (including re-exports)

Exports in June 2020 were USD 21.91 billion, as compared to USD 25.01 billion in June 2019, exhibiting a negative growth of (-)12.41 per cent. In Rupee terms, exports were Rs. 1,65,898.85 crore in June 2020, as compared to Rs. 1,73,682.55 crore in June 2019, registering a negative growth of (-) 4.48 per cent.

Major commodity groups which have recorded positive growth during June 2020 vis-à-vis June 2019 are Iron Ore (63.11%), Oil seeds (50.48%), Rice (32.72%), Oil meals (27.36%), Spices (22.92%), Other cereals (19.35%), Organic & inorganic chemicals (19.06%), Cereal preparations & miscellaneous processed items (13.8%), Fruits & vegetables (11.01%), Drugs & pharmaceuticals (9.89%), Tobacco (3.56%) and Coffee (2.58%).

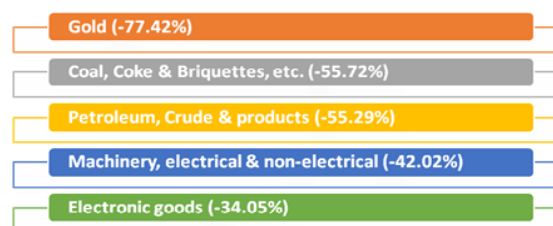
Major commodity groups which have recorded negative growth during June 2020 vis-à-vis June 2019 are Gems & jewellery (-50.06%), Leather & leather products (-40.47%), RMG of all textiles (-34.84%), Man-made yarn/

fabs./made-ups etc. (-31.98%), Petroleum products (-31.65%), Cashew (-27.02%), Meat, dairy & poultry products (-25.88%), Handicrafts excl. hand-made carpet (-23.95%), Electronic goods (-22.52%), Jute mfg. including floor covering (-14.06%), Ceramic products & glassware (-10.91%), Carpet (-10.46%), Marine products (-9.74%), Tea (-8.01%), Engineering goods (-7.5%), Plastic & Linoleum (-4.4%), Cotton yarn/fabs./made-ups, handloom products etc. (-3.83%) and Mica, Coal & other ores, minerals including processed minerals (-1.13%). Cumulative value of exports for the period April-June 2020-21 was USD 51.32 billion (Rs. 3,89,016.27 crore) as against USD 81.08 billion (Rs. 5,63,984.51 crore) during the period April-June 2019-20, registering a negative growth of (-)36.71 per cent in Dollar terms (negative growth of (-)31.02 per cent in Rupee terms).

Non-petroleum and Non-Gems and Jewellery exports in June 2020 were USD 18.48 billion, as compared to USD 19.15 billion in June 2019, exhibiting a negative growth of (-) 3.51 per cent. Non-petroleum and Non-Gems and Jewellery exports in April-June 2020-21 were USD 43.91 billion, as compared to USD 60.10 billion for the corresponding period in 2019-20, a decrease of (-) 26.94 per cent.

### IMPORTS

Imports in June 2020 were USD 21.11 billion (Rs. 1,59,892.42 crore), which was 47.59 per cent lower in Dollar terms and 42.85 per cent lower in Rupee terms over imports of USD 40.29 billion (Rs. 2,79,771.07 crore) in June 2019. Cumulative value of imports for the period April-June 2020-21 was USD 60.44 billion (Rs. 4,58,395.18 crore), as against USD 127.04 billion (Rs. 8,83,652.93 crore) during the period April-June 2019-20, registering a negative growth of (-)52.43 per cent in Dollar terms (negative growth of (-)48.12 per cent in Rupee terms).



Major commodity groups of import showing negative growth in June 2020 over the corresponding month of last year are:

## CRUDE OIL AND NON-OIL IMPORTS:

Oil imports in June 2020 were USD 4.93 billion (Rs. 37,341.70 crore), which was 55.29 percent lower in Dollar terms (51.24 percent lower in Rupee terms), compared to USD 11.03 billion (Rs. 76,586.73 crore) in June 2019. Oil imports in April-June 2020-21 were USD 13.08 billion (Rs. 99,259.42 crore) which was 62.47 per cent lower in Dollar terms (59.05 percent lower in Rupee terms) compared to USD 34.85 billion (Rs. 2,42,398.55 crore), over the same period last year.

In this connection it is mentioned that the global Brent price (\$/bbl) has decreased by 36.92% in June 2020 vis-à-vis June 2019 as per data available from World Bank.

Non-oil imports in June 2020 were estimated at USD 16.18 billion (Rs. 1,22,550.72 crore) which was 44.69 per cent lower in Dollar terms (39.68 percent lower in Rupee terms), compared to USD 29.26 billion (Rs. 2,03,184.34 crore) in June 2019. Non-oil imports in April-June 2020-21 were USD 47.36 billion (Rs. 3,59,135.76 crore) which was 48.63 per cent lower in Dollar terms (43.99 percent lower in Rupee terms), compared to USD 92.19 billion (Rs. 6,41,254.38 crore) in April-June 2019-20.

Non-Oil and Non-Gold imports were USD 15.57 billion in June 2020, recording a negative growth of (-) 41.37 per cent, as compared to Non-Oil and Non-Gold imports of USD 26.57 billion in June 2019. Non-Oil and Non-Gold imports were USD 46.67 billion in April-June 2020-21, recording a negative growth of (-) 42.20 per cent, as compared to Non-Oil and Non-Gold imports of USD 80.75 billion in April-June 2019-20.

## II. TRADE IN SERVICES EXPORTS (Receipts)

As per the latest press release by RBI dated 15<sup>th</sup> July 2020, exports in May 2020 were USD 16.77 billion (Rs. 1,26,851.39 crore) registering a negative growth of (-) 10.24 per cent in dollar terms, vis-à-vis May 2019. The estimated value of services export for June 2020\* is USD 16.48 billion.

**IMPORTS (Payments)** : As per the latest press release by RBI dated 15<sup>th</sup> July 2020, imports in May 2020 were USD 9.94 billion (Rs. 75,190.81 crore) registering a negative growth of (-) 20.45 per cent in dollar terms, vis-à-vis May 2019. The estimated value of service import for June 2020\* is USD 9.64 billion.

## III. TRADE BALANCE

**MERCHANDISE:** The trade surplus for June 2020 was estimated at USD 0.79 billion as against the deficit of USD 15.28 billion in June 2019. This is the first time in the last decade that India is a net exporter.

**SERVICES:** As per RBI's Press Release dated 15<sup>th</sup> July 2020, the trade balance in Services (i.e. Net Services export) for May 2020 is estimated at USD 6.83 billion.

**OVERALL TRADE BALANCE:** Taking merchandise and services together, overall trade surplus for April-June 2020-21\* is estimated at USD 11.70 billion as compared to the deficit of USD 26.32 billion in April-June 2019-20.

\*Note: The latest data for services sector released by RBI is for May 2020. The data for June 2020 is an estimation, which will be revised based on RBI's subsequent release.

## MERCHANDISE TRADE EXPORTS & IMPORTS : (US \$ Billion) (PROVISIONAL)

	JUNE	APRIL-JUNE
<b>EXPORTS (including re-exports)</b>		
2019-20	25.01	81.08
2020-21	21.91	51.32
<b>%Growth 2020-21/ 2019-20</b>	<b>-12.41</b>	<b>-36.71</b>
<b>IMPORTS</b>		
2019-20	40.29	127.04
2020-21	21.11	60.44
<b>%Growth 2020-21/ 2019-20</b>	<b>-47.59</b>	<b>-52.43</b>
<b>TRADE BALANCE</b>		
2019-20	-15.28	-45.96
2020-21	0.79	-9.12

## EXPORTS & IMPORTS: (Rs. Crore) (PROVISIONAL)

	JUNE	APRIL-JUNE
<b>EXPORTS (including re-exports)</b>		
2019-20	1,73,682.55	5,63,984.51
2020-21	1,65,898.85	3,89,016.27
<b>%Growth 2020-21/ 2019-20</b>	<b>-4.48</b>	<b>-31.02</b>
<b>IMPORTS</b>		
2019-20	2,79,771.07	8,83,652.93
2020-21	1,59,892.42	4,58,395.18
<b>%Growth 2020-21/ 2019-20</b>	<b>-42.85</b>	<b>-48.12</b>
<b>TRADE BALANCE</b>		
2019-20	-1,06,088.52	-3,19,668.42
2020-21	6,006.43	-69,378.91

## SERVICES TRADE EXPORTS & IMPORTS (SERVICES) : (US \$ Billion) (PROVISIONAL)

	May 2020	April-May 2020-21
<b>EXPORTS (Receipts)</b>	16.77	33.22
<b>IMPORTS (Payments)</b>	9.94	19.24
<b>TRADE BALANCE</b>	6.83	13.98
<b>EXPORTS &amp; IMPORTS (SERVICES): (Rs. Crore) (PROVISIONAL)</b>		
	May 2020	April-May 2020-21
<b>EXPORTS (Receipts)</b>	126,851.39	252,260.43
<b>IMPORTS (Payments)</b>	75,190.81	146,098.38
<b>TRADE BALANCE</b>	51,660.58	106,162.05

Source: RBI Press Release dated 15<sup>th</sup> July 2020, PIB

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## INDIA HAS BEEN A RELIABLE PARTNER IN THE GLOBAL SUPPLY CHAIN: AMBASSADOR TARANJIT SINGH SANDHU

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**S**ynopsis : Sandhu said there has been expanded collaboration, between India and the US in areas such as health, vaccine development, science and technology and innovation.

Asserting that India has been a reliable partner in the global supply chain, Ambassador **Taranjit Singh Sandhu** said the country has supplied COVID-19 related medicines and medical equipment to over 100 countries, including the US.

Addressing the virtual India Ideas Summit organized by US India Business Council, India's Ambassador to the US on Wednesday said every crisis presents itself with a new opportunity.

The pandemic has made the world realize, the need for resilient and reliable partnerships, which can withstand shocks and uncertainties, Sandhu said.

"India has been a reliable partner, in the global supply chain. When the need arose, we stepped up and supplied COVID related medicines, and medical equipment to over 100 countries, including the United States," he said.

Addressing the summit, immediately after Prime Minister **Narendra Modi** delivered his key note speech, Sandhu said there has been expanded collaboration, between India and the US in areas such as health, vaccine development, science and technology and innovation.

"We are learning from each other's best practices. I firmly believe, that technology will play an important role, in the Covid and post-Covid world. Already, it is providing innovative solutions, to work, education, business, health-care and even diplomacy. The free and open exchange of ideas, and information, has been one of the biggest strengths, of our partnership," he said.

Noting that India has undertaken a series of structural

reforms to attract investment, and improve, the ease of doing business in India, Sandhu said that recent investments announced by American companies, including **Google, Facebook** and others, reflect the confidence, of foreign investors in the economy.

Observing that today India is one of the fastest digitizing countries, he said the reforms and initiatives undertaken by the government have facilitated creation of infrastructure in the sector, which has led to improved digital connectivity, achieved near universal coverage of telecom services and made available adequate spectrum for a range of activities.

This is also an area where there has been long standing cooperation between India and the United States. The potential for deepening is immense and sky is the limit, Sandhu said.

The need for faster internet, smart city plants, industrial automation, connected devices, etc. make it imperative for India to adopt 5G. Moving beyond connectivity services, 5G even provide solutions for consumers and industry, the ambassador said.

Sandhu said the global economy will see major restructuring of supply chains in the future.

With the recent disruption and risks, security management of supply chains has become a priority, he said, adding that India has been a reliable partner to many countries, including the United States during the current pandemic.

"As global MNCs, including US companies look for relocating and diversifying their supply chains, we welcome them to invest in India," Sandhu said. LKJ AD

Source : *The Economic Times*.

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## FULLY PAVED WAY FOR ENERGISING THE MSME SECTOR THROUGH ENTIRE GAMUT OF 'ATMANIRBHAR BHARAT PACKAGE'

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**Cabinet approves Upward revision of MSME definition and modalities/ road map for implementing remaining two Packages for MSMEs (a)Rs 20000 crore package for Distressed MSMEs and (b) Rs 50,000 crore equity infusion through Fund of Funds**

In line with Government of India's top focus on energising MSMEs in the country, a special meeting of Cabinet Committee on Economic Affairs (CCEA) was convened under the Chairmanship of Prime Minister Shri Narendra Modi, here today, which approved the upward revision of MSME definition and modalities/ road map for laying down effective implementation mechanism for the remaining two announcements under the Atmanirbhar Bharat Package. These include:

In the package announcement, the definition of micro manufacturing and services unit was increased to Rs. 1 crore of investment and Rs. 5 crore of turnover. The limit of small unit was increased to Rs. 10 crore of investment and Rs 50 crore of turnover. Similarly, the limit of a medium unit was increased to Rs 20 crore of investment and Rs. 100 crore of turnover. It may be noted that this revision was done after 14 years since the MSME Development Act came into existence in 2006. After the package announcement on 13th May, 2020, there were several representations that the announced revision is still not in tune with market and pricing conditions and it should be further revised upwards. Keeping in mind these representations, it was decided to further increase the limit for medium manufacturing and service units. Now it will be Rs. 50 crore of investment and Rs. 250 crore

of turnover. It has also been decided that the turnover with respect to exports will not be counted in the limits of turnover for any category of MSME units whether micro, small or medium. This is yet another step towards ease of doing business. This will help in attracting investments and creating more jobs in the MSME sector. The following table provides the details of revised limits:

Category	Old Capital	Old Turnover	New Capital	New Turnover
Micro	25 Lakh	10 Lakh	1 Crore	5 Crore
Small	5 Crore	2 Crore	10 Crore	50 Crore
Medium	10 crore	5 Crore	50 Crore	250 Crore

Approval for provisioning of Rs 20,000 crore as subordinate debt to provide equity support to the stressed MSMEs. This will benefit 2 lakh stressed MSMEs.

Approval for equity infusion of Rs. 50,000 crore for MSMEs through Fund of Funds (FoF). This will establish a framework to help MSMEs in capacity augmentation. This will also provide an opportunity to get listed in stock exchanges.

With today's approval, implementation Modalities and Road Map for entire components of the Atmanirbhar Bharat Abhiyan package are in place. This will help in attracting investments and creating more jobs in the MSME sector.

In the aftermath of COVID-19 pandemic, Prime Minister Shri Modi was quick to recognise the



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role of MSMEs in building the Nation. As such, MSMEs formed a very prominent part of the announcements made under the Atmanirbhar Bharat Abhiyaan. Under this package, the MSME sector has not only been given substantial allocation but has also been accorded priority in implementation of the measures to revive the economy. To provide immediate relief to MSME sector, various announcements have been made under the Package. The most important ones also included:

Rupees Three lakh crore collateral-free automatic loans for MSMEs to meet operational liabilities, buy raw material and restart businesses.

Revision of MSME definition to render maximum benefits to the sector;

Disallowing global tenders in procurements upto Rs. 200 crores- to create more opportunities for domestic players,

And clearing of MSME dues by the Government and Public Sector Units within 45 days.

Government of India has been taking all necessary steps to ensure that the benefit of these landmark decisions reaches to the MSMEs at the earliest. In this regard, following necessary policy decisions have been already taken and the implementation strategy has been put in place.

The scheme for Rs. Three lakh crore collateral-free automatic loans was earlier approved by CCEA and has been formally launched.

Modalities have been worked out for Upward revision of MSME Definition making it more inclusive broad-based providing greater avenues to MSMEs to harness their potentials.

Similarly, amendments in General Financial Rules mandating no global tenders for procurement upto 200 crore have been carried

out. The new rules have already been issued and effected. This will open up new business avenues for Indian MSMEs.

To ensure that MSME payments are released within the timeframe of 45 days, directions have been issued at the level of Cabinet Secretary, Expenditure Secretary and Secretary, MSME.

To further ease the burden on MSMEs, RBI has extended moratorium on repayment of loans for another three months.

To manage all this, a robust ICT based system called CHAMPIONS has also been launched by the Ministry of MSME. The portal is not only helping and handholding MSMEs in the present situation, but is also providing guidance to grab the new business opportunities and in the long run, become national and international Champions.

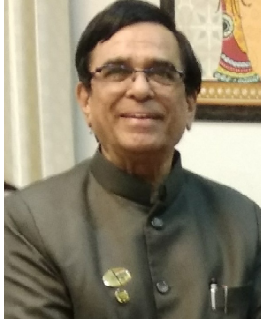
MSME Ministry is committed to support the MSMEs, and the people who depend on them. All efforts are being made to encourage MSMEs to take benefit of the initiatives under the Atmanirbhar Bharat package and our other schemes.

### **Background:**

Micro, small and Medium Enterprises (MSMEs) popularly called as MSMEs are the backbone of Indian economy. Silently operating in different areas across the country, more than 6 crore MSMEs have a crucial role to play in building a stronger and self-reliant India. These small economic engines have a huge impact on the country's GDP-making a contribution of 29 percent. They contribute to almost half of exports from the country. Additionally, more than 11 crore people are employed in the MSME sector.

**CCEA**





# SUPPLY CHAIN CONTROL TOWERS TECHNOLOGY – AN UNDERTAKING FOR REAL TIME VISIBILITY – EVERY SUPPLY CHAIN MANAGER TO KNOW

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1. SCM Technologies with applications, are coming up in leaps and bounds to stand with Supply Chain Managers to improve their work efficiency, to control cost, to control inventory, to improve timely deliverables. One such technology is Supply Chain Control Towers and its application said to be as “work in progress”. On the other side it is also said that Globally it has made good penetration and companies are creating number of “ monitors ” to control SCM operations.
2. Here it goes, at one organization - *Two senior executives walk into a place , where monitors are there to detect the trouble spots across the company's supply chain and they see -*
  - \* *On one scree : alerting about a delayed raw material delivery that threatens to slow down production and suggesting three alternative course of actions.*
  - \* *On next screen : one warning that a machine on the production line needs urgent maintenance to avoid a possible breakdown and indicates where production could be relocated.*
  - \* *They see on another large screen : trucks, ships, and smaller vehicles moving towards delivery destinations, highlighting those that are behind schedule in red and noting whether the deliveries will meet customer needs.*
3. That's the kind of strategic information hub many leadership teams visualize when they think to invest in control tower technologies. The promise is a seamless, real-time visibility that improves decision making and performance.

For many executives, taking the first steps forward may feel like walking in the dark. The market is full of conflicting information about what control towers can do and cannot do. Building a control tower that covers the entire supply chain is a huge strategic effort, but there's no need to wait for the perfect solution. The management can lay the foundations for future control towers in a series of logical steps

expecting good gains. Successful companies look beyond discrete IT solutions by developing a strategy that incorporates business objectives, available technology, the company's legacy technology, supply chain processes, and governance.

4. **SUPPLY CHAIN CONTROL TOWERS :** The meaning, concept, as solution provider, what SCM can do , what user can see for, right time to invest- when ?, how to deploy ?, The answers that supply chain manager to know :

Supply Chain Control towers are like the Artificial Intelligence of supply chain. With a view to be update globally, generally , everyone wants to have it, but many do not know, how it works.

The term “control tower” means many things to many people, which already constitutes a major challenge.

As defined by one expert, “control towers” are with the concept, combining five elements : people, process, data and organization supported by a set of technology-enabled capabilities for transparency and coordination.

Control towers are becoming popular because they are marketed as the solution for binding together complex and siloed Supply Chains, providing better visibility and insights into the overall performance. Under this hope, Buyers expect lower costs and higher efficiency.

Control Towers- What is that SCM can do with these Control Towers : The answer is, ideally, a control tower utilizes data to create insights and enables its users to make smarter decisions. It is the entry point for all relevant people with a supply chain mandate, which also makes it the starting point for all decision-making. Therefore, A good control tower allows its users to:

- Sense: Get real-time, end-to-end supply chain visibility

- Analyze: Understand and leverage incoming signals
- Predict: Utilize advanced analytics for predictions and prescriptions
- Solve: Do exception management and scenario modeling
- Execute: Leverage a collaborative intelligent response framework
- Learn: Continuously learn, sense and respond

When is the right time to invest for Control Towers ? : A control tower only makes sense when the supply chain organization already has a certain degree of cross-functional integration in place — internally and with business partners. Otherwise, the tower won't be able to observe enough signals to support accurate decision-making.

How to deploy Control Towers : There are three possible ways: outsource to a provider, build own through a data lake or — this is the most common one — subscribe to a supply chain management platform that has the desired capabilities.

Keeping in view the Global Supply Chain multifold spread for ease of business, the hidden point is that, What a lot of supply chain organizations don't know is that control tower capabilities might already be a in-built part of their core business system.

The concept of the Control Tower is increasingly becoming widespread in Supply Chain Management, and Control Tower technologies are a popular topic right within the supply chain community. Every research firm and vendor has their own definition, but all share the common theme of visibility.

A traditional control tower provides visibility only to immediate trading partners. The advanced intelligent control tower is a hub for visibility, decision-making, and action, based on real-time analytics which monitor, manage, and control decisions and execution across functions and across companies to optimize the entire network.

The Intelligent Control Tower uses AI (Artificial Intelligence) and serves as a system of engagement across trading partners, and orchestrates companies, people and things to work together in real-time to serve the end consumer.

Supply chain control towers have been all about providing visibility to your immediate trading partners. But with the development of multi-party, consumer-driven networks, advanced control towers now provide real-time visibility, collaboration and powerful AI capabilities to move

beyond decision-support to decision-making and autonomous control..

5. Having seen the background on Supply Chain Control Towers, it is apt to deal few users of control towers.

- First example : Taking the case of a global consumer-packaged-goods company suffering from rising network costs and lack of visibility across the entire supply chain, especially in inventory and logistics shipments. A review revealed that the firm had a limited ability to prevent bad orders. The company had deployed a limited number of digital solutions in siloed operations, but they were not linked and didn't provide a complete picture of supply chain activities in real-time.

To address the above, the management had developed a Roadmap, covering 5 years period, to invest in digital technologies and link solutions together in a Supply Chain Control Tower. First, concentrated on four areas that existing software could greatly improve, including network planning and shipment visibility, based on real-time data about the location of trucks, trains, and ships. Next, the team rolled out solutions to reduce errors and increase the speed of billing and order management. The Roadmap provided a path to build end-to-end visibility in total supply chain, reduce forecasting errors, improve customer service responsiveness and eliminate warehousing inefficiencies.

- \* Second example : A global leader in wireless telecommunications designed an interim control tower focused on product portfolio and inventory management. It launched one pilot program to increase the availability of devices in retail outlets, and another to improve inventory management of more than 4,000 stock-keeping units. After one month, the demand-planning pilot had reduced inventory days by 30% and increased the availability of the firm's top devices in better-performing retail shops by 5 percentage points

6. FOUR PRINCIPLES, to help executive teams, to cut through the noise about control towers, to focus the first critical investments and construct a well-designed Roadmap.

- i. Define key business objectives : Successful companies view control towers as a solution to a business problem rather than a technology implementation. Select five or six performance objectives that will deliver the greatest improvement in supply chain efficiencies - such as improved visibility between order processing and

inventory, or real-time tracking of the distribution fleet.

- ii. Set priorities : Identify the business problems that offer the company the greatest opportunity to increase value today using existing software solutions that are easy to implement across the entire supply chain.

- iii. Taking an agile and modular approach : Many control tower solutions are still built on enterprise-centric technology - the very technology that has resulted in disconnected supply chains. When selecting vendors, choose those that are able to adapt solutions over time or can be easily replaced. And expect the plan to change over time as technologies continue to evolve.

- iv. Embrace flexibility and new ways of working : Ensure that legacy processes are appropriately redesigned to take advantage of the software solutions you are installing.

#### 7. CAPABILITIES OFFERED BY CONTROL TOWERS : Following are some of the key capabilities to look for, in a control tower solution:

- End to end visibility: Visibility across supply chain partners/service providers, including suppliers, manufacturers, logistics providers.
- Real-time tracking through collaborative information sharing
- Early warning alerts and exception management : Resolves supply chain disruptions, before they disrupt business.
- Predictive and perspective decision support : By using analytics.
- Autonomous decision making and control: Boost productivity , by taking the Robot out of human.
- Cognitive : The self correcting Supply Chains with decision – making and machine learning.

#### 8. ADVANTAGES OF SUPPLY CHAIN CONTROL TOWERS:

- \* Order fulfillment : Easy to configure, flexible, secure and reliable order data integration – reducing cost to serve
- \* Logistics management : Planned and optimized shipments with streamlined communication between all customers.
- \* Inventory management : Reduction in shortages/ stock-outs & Improved warehouse and transport inventory
- \* Visibility & monitoring: Real time supply chain transparency for improved service levels and

traceability

- \* Freight settlement : Reduction in expediting costs with accurate & reliable management of billing, audit and payment

#### 9. FLAWS IN SUPPLY CHAIN CONTROL TOWERS : When there are many positives on Supply Chain Control Towers, the knowledge experts have also identified few flaws in those towers , ie.,

- \* Control towers offer a very limited form of visibility, emphasizing visibility into one part of the chain at the expense of another.
- \* Control towers create visibility by crudely stitching together multiple applications together with one-off connections between trading partners that aren't reusable.
- \* Control towers also require a lot of manual processes with more people to operate. This is because the control tower does nothing to change the fact that , an enterprise is still using separate systems for planning and execution. So even when a control tower provides an alert about an issue somewhere else in the chain, a human planner is still needed to evaluate the alert, translate its effect on the strategic, operating and execution plans, and determine the optimal response.

#### 10. CONCLUSIONS:

- \* The business demands and the technology advancements provide both the need for, and the ability to deliver, a Digital Supply Chain. To make that end to end Supply Chain work, real Control Tower applications are required.
- \* With a Control Tower enabled by full visibility across the entire supply chain there is an opportunity for higher efficient management and decision making.
- \* Finally, building a Supply Chain Control Tower, that provides a complete picture of supply chain performance and optimizes processes in real-time is a journey, not a quick win. Looking to out of box, in today's globalized, outsourced supply chain era no single company owns more than a small slice of the fulfillment process, which in general has allowed companies to reduce costs. The problem is that the supply chain management systems were not designed to see and manage anything beyond the four walls of a single enterprise, and the result is increasing amounts of risk in their extended supply chain. So, control towers are an attempt to combat it with real time visibility.

(REF: Research topics, Global webinars, Internet linked discussions etc.)

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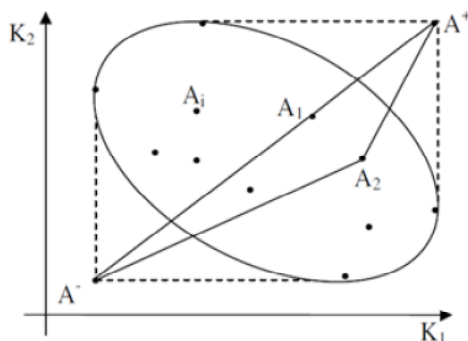
# TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION

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**A. Introduction :** Decision making is one of important processes that human being encounters many areas of the real world such as Option / alternative selection, Supply Chain Management and Logistics, Design, Engineering and Manufacturing Systems, Business and Marketing Management, Health, Safety and Environment, Management, Human Resources Management, Energy Management, Chemical Engineering etc. But in real life, necessary information for decision making may not be certain always.

Multi-Criteria Decision Aid (MCDA) or Multi-Criteria Decision Making (MCDM) methods have received much attention from researchers and practitioners in evaluating, assessing and ranking alternatives across diverse industries. Among numerous MCDA/MCDM methods developed (MAXMIN, MAXMAX, SAW, AHP, TOPSIS, SMART, ELECTRE) to solve real-world decision problems, the **Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)** continues to work satisfactorily across different application areas.

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a multi-criteria decision analysis method. The alternative is considered best if there is a minimum distance in relation to the ideal solution and the greatest distance from the anti-ideal solution. The next figure (Figure 1) is a spatial distribution of alternatives defined by two criteria of the max type. With A<sup>+</sup> and A<sup>-</sup> respectively, ideal and anti-ideal solutions are marked.



**B. Methodology :** The TOPSIS method, Technique for Order of Preference by Similarity to Ideal Solution, was proposed by Hwang and seeks to choose an alternative that is closest to the ideal positive solution and farthest to the ideal negative solution. The former consists in maximizing benefits while minimizing the cost, while the latter is the opposite, a maximization of cost and minimization of benefits. The following steps are used

for the TOPSIS method:

1. Define a decision matrix D made of alternatives and criteria. A<sub>i</sub>, i = 1, ..., n represent the feasible alternatives, while C<sub>j</sub>, j = 1, ..., m represent the decision criteria, x<sub>ij</sub> indicate the assessment of alternative A<sub>i</sub> over criterion C<sub>j</sub>. The weight vector W = w<sub>1</sub>, ..., w<sub>m</sub> represent the individual weight of each criterion, with the condition w<sub>j</sub> ≥ 0 and  $\sum_{j=1}^m w_j = 1$  is mandatory for the evaluation of the criteria.

$$D = \begin{matrix} & C_1 & C_2 & \dots & C_j & \dots & C_m \\ \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_n \end{matrix} & \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1m} \\ x_{21} & x_{22} & \dots & x_{2j} & \dots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \dots & x_{nj} & \dots & x_{nm} \end{bmatrix} \end{matrix}$$

..... (i)

2. Determine the normalized decision matrix (NDM) from the matrix D that represents the score of the alternatives. The normalized value r<sub>ij</sub> is calculated through the following formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^m x_{ij}^2}} \dots\dots\dots (ii)$$

3. Determine the weighted normalized decision matrix (WNDM). The weighted normalized value is calculated by the multiplication of each column of the normalized decision matrix (NDM) by the weight of each criterion.

$$v_{ij} = w_j \cdot r_{ij} \dots\dots\dots (iii)$$

4. Determine the Positive Ideal Solution (PIS, A<sup>+</sup>) and the Negative Ideal Solution (NIS, A<sup>-</sup>) using the following equations:

$$A^+ = \{ \max_i v_{ij} | i \in J' \}; (\min_i v_{ij} | i \in J'') \}$$

$$A^- = \{ (\min_i v_{ij} | i \in J'); (\max_i v_{ij} | i \in J'') \} \dots\dots (iv \& v)$$

where J' is associated with a benefit criterion and J'' is associated with a cost criterion.

5. For each evaluated alternative, calculate the distance D<sub>i</sub><sup>+</sup> between the weighted normalized performance values of matrix (iii) and the PIS values and the distance D<sub>i</sub><sup>-</sup> and the NIS values.

$$D_j^+ = \sqrt{\sum_{i=1}^n (v_{ij} - v_i^+)^2}$$

$$D_j^- = \sqrt{\sum_{i=1}^n (v_{ij} - v_i^-)^2} \dots\dots\dots (vi \& vii)$$

$$CC_i = \frac{D_i^-}{D_i^+ + D_i^-} \dots\dots\dots (viii)$$

6. Calculate the Closeness Coefficient,  $CC_i$  according to equation (viii), which corresponds to the global performance of the alternatives.

7. Sort in descending order the alternatives. The alternative with the  $CC_i$  closer to 1 is the best classified.

**C. EXPANATIONS :** The management has made short listed manufacturers of Equipment-Q, so called alternatives. It is necessary to make a decision between four Equipment-Qi. The selection of four Equipment-Qi is done on the basis of certain criteria defined by the management of company.

1. First of all, invite relevant experts for evaluation index (qualitative and quantitative indicators) scoring. The scoring results are then expressed in the form of mathematical matrix, and established eigenvalue matrix is as shown in:

Equipment-Type	Cap	Battery Life	Lifting Height	Travel	Price
Equipment-Q1	1300	5	3.3	4.91	14000
Equipment-Q2	2500	4	4.5	4.44	14200
Equipment-Q3	2000	5	2.8	4.44	13600
Equipment-Q4	1800	6	5.4	4.91	15800
Min/Max	Max	Max	Max	Max	Min
Weightage %	0.321	0.158	0.216	0.061	0.244

2. The feature matrix is normalized and build standardized matrix about normalized vector as per above equation (ii)

Equipment-Type	Cap	Battery Life	Lifting Height	Travel	Price
Equipment-Q1	0.334	0.495	0.400	0.524	0.485
Equipment-Q2	0.642	0.396	0.545	0.474	0.492
Equipment-Q3	0.513	0.495	0.339	0.474	0.471
Equipment-Q4	0.462	0.594	0.654	0.524	0.548
Min/Max	Max	Max	Max	Max	Min
Weightage %	0.321	0.158	0.216	0.061	0.244

**3. Building standardized matrix of weight:** Determining the weight of each index through entropy weight method and the calculation process is as follows, as per above equation (iii)

Equipment-Type	Cap	Battery Life	Lifting Height	Travel	Price
Equipment-Q1	0.107	0.078	0.086	0.032	0.118
Equipment-Q2	0.206	0.063	0.118	0.029	0.120
Equipment-Q3	0.165	0.078	0.073	0.029	0.115
Equipment-Q4	0.148	0.094	0.141	0.032	0.134
Min/Max	Max	Max	Max	Max	Min

4. Determine the Positive Ideal Solution (PIS,  $A^+$ ) and the Negative Ideal Solution (NIS,  $A^-$ ) using the above equations (iv) & (v):

	Cap	Battery Life	Lifting Height	Travel	Price
$A^+$	0.206	0.094	0.141	0.032	0.115
$A^-$	0.107	0.063	0.073	0.029	0.134

**5. Calculating distance scale:** Distance scale calculated by Euclidean distance is the distance between each objective and ideal solution or anti-ideal solution from above equations (vi) & (vii). Also, calculating closeness degree of ideal solution from equation (viii)

Equipment-Type	$D^+$	$D^-$	CC	Rank
Equipment-Q <sub>1</sub>	0.114	0.0206	0.1530	4
Equipment-Q <sub>2</sub>	0.039	0.1084	0.7340	1
Equipment-Q <sub>3</sub>	0.081	0.0598	0.4242	3
Equipment-Q <sub>4</sub>	0.058	0.0855	0.5972	2

Now, when the obtained distance results are alternatives to the ideal solution, their ranking is done, from the best to the worst.

**D. Conclusion :** Technique for order preference by similarity to an ideal solution (TOPSIS) is a multi-attribute decision making technique, used to evaluate alternatives and find an ideal solution. Practically, it has been successfully applied to identify the best alternative for decision making process from a finite set of alternatives in different industries. It can be used for evaluation of the performance of different entities like suppliers/processes/ designs/locations/ standards and many others

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# CABINET APPROVED NATIONAL EDUCATION POLICY 2020, PAVING WAY FOR TRANSFORMATIONAL REFORMS IN SCHOOL AND HIGHER EDUCATION SYSTEMS IN THE COUNTRY

DR. M K BHARDWAJ  
CHAIRMAN GOVT. LIAISON & FORMER PRESIDENT - IIMM

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**T**he Union Cabinet approved the National Education Policy 2020 today, making way for large scale, transformational reforms in both school and higher education sectors. This is the first education policy of the 21st century and replaces the thirty-four year old National Policy on Education (NPE), 1986. Built on the foundational pillars of Access, Equity, Quality, Affordability and Accountability, this policy is aligned to the 2030 Agenda for Sustainable Development and aims to transform India into a vibrant knowledge society and global knowledge superpower by making both school and college education more holistic, flexible, multidisciplinary, suited to 21st century needs and aimed at bringing out the unique capabilities of each student.

## Important Highlights

### School Education

**Ensuring Universal Access at all levels of school education :** NEP 2020 emphasizes on ensuring universal access to school education at all levels- pre school to secondary. Infrastructure support, innovative education centres to bring back dropouts into the mainstream, tracking of students and their learning levels, facilitating multiple pathways to learning involving both formal and non-formal education modes, association of counselors or well-trained social workers with schools, open learning for classes 3, 5 and 8 through NIOS and State Open Schools, secondary education programs equivalent to Grades 10 and 12, vocational courses, adult literacy and life-enrichment programs are some of the proposed ways for achieving this. About 2 crore out of school children will be brought back into main stream under NEP 2020.

**Early Childhood Care & Education with new Curricular and Pedagogical Structure :** With emphasis on Early Childhood Care and Education, the 10+2 structure of school curricula is to be replaced by a 5+3+3+4 curricular structure corresponding to ages 3-8, 8-11, 11-14, and 14-18 years respectively. This will bring the hitherto uncovered age group of 3-6 years under school curriculum, which has been recognized globally as the crucial stage for development of mental faculties of a child. The new system will have 12 years of schooling with three years of Anganwadi/ pre schooling.

NCERT will develop a National Curricular and Pedagogical Framework for Early Childhood Care and Education (NCPFECCE) for children up to the age of 8. ECCE will be delivered through a significantly expanded and strengthened system of institutions including Anganwadis and pre-schools that will have teachers and Anganwadi workers trained in the ECCE pedagogy and curriculum. The planning and implementation of ECCE will be carried out jointly by the Ministries of HRD, Women and Child Development (WCD), Health and Family Welfare (HFW), and Tribal Affairs.

**Attaining Foundational Literacy and Numeracy :** Recognizing Foundational Literacy and Numeracy as an urgent and necessary prerequisite to learning, NEP 2020 calls for setting up of a National Mission on Foundational Literacy and Numeracy by MHRD. States will prepare an implementation plan for attaining universal foundational literacy and numeracy in all primary schools for all learners by grade 3 by 2025. A National Book Promotion Policy is to be formulated.

**Reforms in school curricula and pedagogy :** The school curricula and pedagogy will aim for holistic development of learners by equipping them with the key 21st century skills, reduction in curricular content to enhance essential learning and critical thinking and greater focus on experiential learning. Students will have increased flexibility and choice of subjects. There will be no rigid separations between arts and sciences, between curricular and extra-curricular activities, between vocational and academic streams.

**Vocational education will start in schools from the 6th grade, and will include internships :** A new and comprehensive National Curricular Framework for School Education, NCFSE 2020-21, will be developed by the NCERT.

**Multilingualism and the power of language :** The policy has emphasized mother tongue/local language/regional language as the medium of instruction at least till Grade 5, but preferably till Grade 8 and beyond. Sanskrit to be offered at all levels of school and higher education as an option for students, including in the three-language formula. Other classical languages and literatures of India also to be available as options. No language will be imposed on any student. Students to participate in a fun project/activity on 'The Languages of India',

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sometime in Grades 6-8, such as, under the 'Ek Bharat Shrestha Bharat' initiative. Several foreign languages will also be offered at the secondary level. Indian Sign Language (ISL) will be standardized across the country, and National and State curriculum materials developed, for use by students with hearing impairment.

**Assessment Reforms :** NEP 2020 envisages a shift from summative assessment to regular and formative assessment, which is more competency-based, promotes learning and development, and tests higher-order skills, such as analysis, critical thinking, and conceptual clarity. All students will take school examinations in Grades 3, 5, and 8 which will be conducted by the appropriate authority. Board exams for Grades 10 and 12 will be continued, but redesigned with holistic development as the aim. A new National Assessment Centre, PARAKH (Performance Assessment, Review, and Analysis of Knowledge for Holistic Development), will be set up as a standard-setting body.

**Equitable and Inclusive Education :** NEP 2020 aims to ensure that no child loses any opportunity to learn and excel because of the circumstances of birth or background. Special emphasis will be given on Socially and Economically Disadvantaged Groups (SEDGs) which include gender, socio-cultural, and geographical identities and disabilities. This includes setting up of Gender Inclusion Fund and also Special Education Zones for disadvantaged regions and groups. Children with disabilities will be enabled to fully participate in the regular schooling process from the foundational stage to higher education, with support of educators with cross disability training, resource centres, accommodations, assistive devices, appropriate technology-based tools and other support mechanisms tailored to suit their needs. Every state/district will be encouraged to establish "Bal Bhavans" as a special daytime boarding school, to participate in art-related, career-related, and play-related activities. Free school infrastructure can be used as Samajik Chetna Kendras

**Robust Teacher Recruitment and Career Path :** Teachers will be recruited through robust, transparent processes. Promotions will be merit-based, with a mechanism for multi-source periodic performance appraisals and available progression paths to become educational administrators or teacher educators. A common National Professional Standards for Teachers (NPST) will be developed by the National Council for Teacher Education by 2022, in consultation with NCERT, SCERTs, teachers and expert organizations from across levels and regions.

**School Governance :** Schools can be organized into complexes or clusters which will be the basic unit of governance and ensure availability of all resources including infrastructure, academic libraries and a strong professional teacher community.

**Standard-setting and Accreditation for School**

**Education:** NEP 2020 envisages clear, separate systems for policy making, regulation, operations and academic matters. States/UTs will set up independent State School Standards Authority (SSSA). Transparent public self-disclosure of all the basic regulatory information, as laid down by the SSSA, will be used extensively for public oversight and accountability. The SCERT will develop a School Quality Assessment and Accreditation Framework (SQAAF) through consultations with all stakeholders.

### Higher Education

**Increase GER to 50 % by 2035 :** NEP 2020 aims to increase the Gross Enrolment Ratio in higher education including vocational education from 26.3% (2018) to 50% by 2035. 3.5 Crore new seats will be added to Higher education institutions.

**Holistic Multidisciplinary Education :** The policy envisages broad based, multi-disciplinary, holistic Under Graduate education with flexible curricula, creative combinations of subjects, integration of vocational education and multiple entry and exit points with appropriate certification. UG education can be of 3 or 4 years with multiple exit options and appropriate certification within this period. For example, Certificate after 1 year, Advanced Diploma after 2 years, Bachelor's Degree after 3 years and Bachelor's with Research after 4 years.

An Academic Bank of Credit is to be established for digitally storing academic credits earned from different HEIs so that these can be transferred and counted towards final degree earned.

Multidisciplinary Education and Research Universities (MERUs), at par with IITs, IIMs, to be set up as models of best multidisciplinary education of global standards in the country.

The National Research Foundation will be created as an apex body for fostering a strong research culture and building research capacity across higher education.

**Regulation :** Higher Education Commission of India (HECI) will be set up as a single overarching umbrella body for entire higher education, excluding medical and legal education. HECI to have four independent verticals - National Higher Education Regulatory Council (NHERC) for regulation, General Education Council (GEC) for standard setting, Higher Education Grants Council (HEGC) for funding, and National Accreditation Council (NAC) for accreditation. HECI will function through faceless intervention through technology, & will have powers to penalise HEIs not conforming to norms and standards. Public and private higher education institutions will be governed by the same set of norms for regulation, accreditation and academic standards.

**Rationalised Institutional Architecture :** Higher education institutions will be transformed into large,

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well resourced, vibrant multidisciplinary institutions providing high quality teaching, research, and community engagement. The definition of university will allow a spectrum of institutions that range from Research-intensive Universities to Teaching-intensive Universities and Autonomous degree-granting Colleges.

Affiliation of colleges is to be phased out in 15 years and a stage-wise mechanism is to be established for granting graded autonomy to colleges. Over a period of time, it is envisaged that every college would develop into either an Autonomous degree-granting College, or a constituent college of a university.

**Motivated, Energized, and Capable Faculty :** NEP makes recommendations for motivating, energizing, and building capacity of faculty through clearly defined, independent, transparent recruitment, freedom to design curricula/pedagogy, incentivising excellence, movement into institutional leadership. Faculty not delivering on basic norms will be held accountable

**Teacher Education :** A new and comprehensive National Curriculum Framework for Teacher Education, NCFTE 2021, will be formulated by the NCTE in consultation with NCERT. By 2030, the minimum degree qualification for teaching will be a 4-year integrated B.Ed. degree. Stringent action will be taken against substandard stand-alone Teacher Education Institutions (TEIs).

**Mentoring Mission :** A National Mission for Mentoring will be established, with a large pool of outstanding senior/retired faculty – including those with the ability to teach in Indian languages – who would be willing to provide short and long-term mentoring/professional support to university/college teachers.

**Financial support for students :** Efforts will be made to incentivize the merit of students belonging to SC, ST, OBC, and other SEDGs. The National Scholarship Portal will be expanded to support, foster, and track the progress of students receiving scholarships. Private HEIs will be encouraged to offer larger numbers of free ships and scholarships to their students.

**Open and Distance Learning :** This will be expanded to play a significant role in increasing GER. Measures such as online courses and digital repositories, funding for research, improved student services, credit-based recognition of MOOCs, etc., will be taken to ensure it is at par with the highest quality in-class programmes.

**Online Education and Digital Education:** A comprehensive set of recommendations for promoting online education consequent to the recent rise in epidemics and pandemics in order to ensure preparedness with alternative modes of quality education whenever and wherever traditional and in-person modes of education are not possible, has been covered. A dedicated unit for the purpose of orchestrating the building of digital infrastructure, digital content and capacity building will be created in the

MHRD to look after the e-education needs of both school and higher education.

**Technology in education :** An autonomous body, the National Educational Technology Forum (NETF), will be created to provide a platform for the free exchange of ideas on the use of technology to enhance learning, assessment, planning, administration. Appropriate integration of technology into all levels of education will be done to improve classroom processes, support teacher professional development, enhance educational access for disadvantaged groups and streamline educational planning, administration and management

**Promotion of Indian languages :** To ensure the preservation, growth, and vibrancy of all Indian languages, NEP recommends setting an Indian Institute of Translation and Interpretation (IITI), National Institute (or Institutes) for Pali, Persian and Prakrit, strengthening of Sanskrit and all language departments in HEIs, and use mother tongue/local language as a medium of instruction in more HEI programmes.

Internationalization of education will be facilitated through both institutional collaborations, and student and faculty mobility and allowing entry of top world ranked Universities to open campuses in our country.

**Professional Education :** All professional education will be an integral part of the higher education system. Stand-alone technical universities, health science universities, legal and agricultural universities etc will aim to become multi-disciplinary institutions.

**Adult Education :** Policy aims to achieve 100% youth and adult literacy.

**Financing Education :** The Centre and the States will work together to increase the public investment in Education sector to reach 6% of GDP at the earliest.

**Unprecedented Consultations :** NEP 2020 has been formulated after an unprecedented process of consultation that involved nearly over 2 lakh suggestions from 2.5 lakhs Gram Panchayats, 6600 Blocks, 6000 ULBs, 676 Districts. The MHRD initiated an unprecedented collaborative, inclusive, and highly participatory consultation process from January 2015. In May 2016, 'Committee for Evolution of the New Education Policy' under the Chairmanship of Late Shri T.S.R. Subramanian, Former Cabinet Secretary, submitted its report. Based on this, the Ministry prepared 'Some Inputs for the Draft National Education Policy, 2016'. In June 2017 a 'Committee for the Draft National Education Policy' was constituted under the Chairmanship of eminent scientist Padma Vibhushan, Dr. K. Kasturirangan, which submitted the Draft National Education Policy, 2019 to the Hon'ble Human Resource Development Minister on 31st May, 2019.

(Source : PIB, Gol)

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## GOVT PLANS TO BUILD COLD STORAGE, SUPPLY CHAIN FOR COVID-19 VACCINES

SAUBHADRA CHATTERJI

**T**he authorities are carefully watching the development of at least nine Covid-19 vaccines—including two Chinese candidates— of which the brightest hope is the candidate of Oxford AstraZeneca.

As Covid-19 vaccine trials enter a defining stage worldwide, Indian authorities have started preliminary discussions on a wide range of issues, from logistics to ethical questions, to set the stage for a smooth supply and effective use of a vaccine when it is ready.

Multiple ministries and authorities across India's science and technology spectrum are involved in these discussions, said functionaries involved in the process, adding that the country's Covid management team doesn't expect a vaccine to be available before early next year.

"At least two meetings have taken place on preparing the ground for the first vaccine. There will be more talks in the next few weeks. There are complex issues" said a government official involved in the discussions who asked not to be named.

The authorities are carefully watching the development of at least nine vaccines—including two Chinese candidates— of which the brightest hope is the candidate of Oxford AstraZeneca. The Pune-based, Adar Poonawalla-led Serum Institute has partnered with AstraZeneca for manufacturing the vaccine in India. Human trials on this vaccine (combined phase2/3 trials) are to begin in India next month.

"The internal discussions have started so that we are fully prepared and to avoid any last-moment glitches. One of the key issues is distribution in remote areas such as North East India and how we have to set up large-scale cold storage facilities in such areas," added the official.

Data, analysis of Covid cases across the country, and information technology and scientific inputs will go into these discussions that deals with a pandemic situation which has already seen more than 1.39 million cases in India.

Discussions have also begun on how to distribute the vaccine — whether it should only be given through government hospitals and public health care facilities at the district level, or if private hospitals should also

be involved.

While some countries, including the US have struck large deals with companies developing vaccines (the US has, for hundreds of millions of doses), India is yet to finalise any such agreements.

The authorities are also clear that the entire production from Serum Institute can't be consumed domestically. India, the largest of the SAARC countries, also has an obligation to see that its neighbours get a share of the most-coveted vaccine. "This again, brings us to helping neighbouring countries to set up logistics and infrastructure to distribute the vaccine."

Like many other countries, India too has allowed accelerated trials, especially in the animal toxicity tests—the stepping stone for human trials—for a faster development of vaccines that generally takes years to develop.

Government functionaries are also debating the issue of who should be the beneficiaries for the first batch of vaccine—frontline health workers or the country's aged population.

"This question has triggered a huge debate worldwide. We have to carefully make this sensitive decision," said another functionary who asked not to be named, adding that no final decision has been arrived at.

Talks of creating a central database of all those who are vaccinated across states are also going on.

With the vaccine candidate of China's Sinovac Biotech also reaching the third stage of human trials Indian officials are hoping the country doesn't have to depend on China with whom relations are at an all-time low right now. "We just hope such a situation doesn't arrive when we have no other choice but to depend on the Chinese," the first official said.

It's for this reason that officials are closely following the progress of two indigenous vaccines, Covaxin and ZyCov-D, developed by Bharat Biotech and Zydus Cadila respectively. Both are in Stage 1 of trials.

Source : *Hindustan Times*

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# LOOKING BEYOND SUPPLY CHAIN VISIBILITY - 2020

AMIT KUMAR GOENKA AND  
NISHITH RASTOGI

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**As the world moves towards efficiency, automation, and lean operations, we are poised to be a part of the next wave of supply chain digitization - automating decision-making.**

As the world comes to a standstill, Covid-19 has shuttered economies and irreversibly changed consumer behavior. The world has witnessed unprecedented events like zero revenue, drastic government regulations, and critical decision making without certainty.

Though companies are on their knees right now, the pandemic has hugely impacted supply chains, both globally and locally. It has exposed the supply chain's weakest links – lack of collaboration, lack of coordination, and lack of visibility.

War rooms have been set-up across various organizations, where executives and operational managers come together and dissect the impact of Covid-19 on their supply chains. The intention is to bring all the experts on a single drawing board and foster critical thinking and decision making.

However, a lack of digital visibility of the supply chain operations coupled with not enough time to draw a long breath has crippled this process.

## **Strategic, Tactical, and Operational decisions**

A lot of decisions are taken in the supply chain every day, every month, every year and in frequencies in between them. Few of these decisions have been automated with the advent of ERP (like demand forecasting), yet a majority of these still remain to be manual in nature. And manual decisions are always subject to individual skill and intelligence. It's important to understand the impact of these decisions on the organization's success and the decision-making process in itself. Let's put this to perspective by looking at a flow problem. Consider the image below.

Consider a network of 5 factories, warehouses, and customers. There are 125 ( $5 \times 5 \times 5$ ) possible combinations for one product to flow across this network. If the company manufactures 5 products,

the combinations shoot up to 625 possibilities.

Supply planners need to define the value chain for 5 customers ordering 5 different products, which translates to 25 decision points from 625 combinations. While this is a simple example, realistically speaking, one of the top three FMCG companies in India has around 13 factories, 25 warehouses, 2500 customers and 500 SKUs. The superset of the total number of decision points now becomes a staggering 406 million combinations.

While a smart planner might use excel solvers to arrive at a fair solution to the flow problem, there is, however a world of possibilities (like multi-echelon inventory placement, new location considerations, etc.) that he or she cannot factor into the solution modeling process, given the limitations of manual and excel computation. The flow of products is just one of the many supply chain decisions executives take. Other notable examples are delivery route planning, capacity planning, inventory planning, and customer base clustering.

## **Impact of Covid-19 on the decision-making process**

A black swan event like Covid-19 forces these decisions to be made in a matter of a few hours, instead of a few weeks and as the impact seeps into various geographies, creating more variables, the decision-making process in itself becomes dynamic. Couple this with raw material unavailability, limited fleet availability with ground restrictions, lack of on-ground visibility, and mass- migration of workers.

It would be safe to assume; most supply chain executives do not fully know how to approach this problem given its overwhelming and unprecedented impact.

## **The new realm of decision-making: (Macro)**

The supply chain world is dominated with 'predictive' techniques like demand forecasting, long term truck contracts based on anticipated demand, or even minimum order quantities. The pandemic is forcing businesses to re-think this strategy and move towards a nimble 'reactive' approach. Short to medium term

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is slowly replacing long term activities as the future becomes more and more uncertain.

One quick supporting fact is the importance SaaS-based products have gained, over the traditional one-time investment heavy software solutions, over the past few weeks/months. The primary reason being, users get the flexibility of pay-as-you-go kind of a model, which is aligned perfectly with the conditions of the user's business demand and monetary health.

### **The new realm of decision-making: (Technology)**

An advanced 'Deterministic solution modeling' methodology is emerging with the overlap of Machine learning and mathematical modeling techniques. A problem statement is mathematically modeled to replicate the ground reality. Variables are created and associated solvers provide desired solutions that confer to an objective function. These objective functions can be anything from minimizing costs to increasing service levels. These techniques can be scaled both from a size of parameters to a number of parameters level.

It's natural to think that such solutions are vital in times of crisis, but may have little to medium impact in terms of time reduction or efficiency incorporation during business-as-usual periods. To understand the importance of mathematical modeling techniques in supply chain decision making, we need to understand it's applicability and value addition.

### **Mathematically the most optimized solution**

There is a huge difference between a fair solution and the mathematically most optimized solution. Let's understand this using a relevant industry example. Consider an E-commerce platform, the order intake has three high-level variables, random drop locations, random SKUs, random quantities ordered, meaning there might not be any pattern amongst the orders. A logistics manager, when planning this manually needs to plan and execute routes while keeping in mind - pick and sort time, available fleet and manpower, route restrictions, and delivery slots. We will leave it to your imagination to develop a manual framework to solve this problem on a daily basis.

Meanwhile, a mathematical model can be developed, to solve this problem and achieve the mathematically most optimized solution. Not going into the technical bits, the algorithm will have the following characteristics:

**Objective function** - Minimise the total cost of logistics

**Input parameters** - Vehicle type and vehicles available, vehicle space and capacities, customer drop points, and customer order details

**Constraints (Governing rules)** - Delivery slots, route restrictions, vehicle-specific constraints

This solution can be compared with a manual effort and based on the available data till now, a stark 10-20% of cost reduction has been realized. Alongwith the efficiency build-up in operations and cost reductions, a significant amount of time reduction happens in the planning end, automating all the decisions in planning and scheduling of delivery routes.

### **Understanding technology and adoption**

Technology cycles are becoming short, making it almost impossible for companies to follow and adopt. Choosing the right technology solution is absolutely vital to reap benefits. While most executives look at only the cost of the software package, the right way to evaluate is to understand the tangible and intangible benefits the business would realize in comparison with the cost of the package.

For example, a 10 million dollar software package sounds expensive on the face of it, but if the package saves 5 percent of the supply chain cost of \$2 billion (Saving \$100 million), the money spent is just a fraction, in addition to the intangible benefits like automation, reduction in time, reduction in resources, etc.

Enterprise systems have revolutionized the way organizations operate by providing valuable data on a single platform to collaborate and innovate.

While big data solutions convert unstructured data into inferences, the manual component of decision-making persists. As the world moves towards efficiency, automation, and lean operations, we are poised to be a part of the next wave of supply chain digitization - automating decision-making.

The authors are Amit Kumar Goenka, Associate Vice President, Locus Consulting and Nishith Rastogi, Founder & CEO, Locus.

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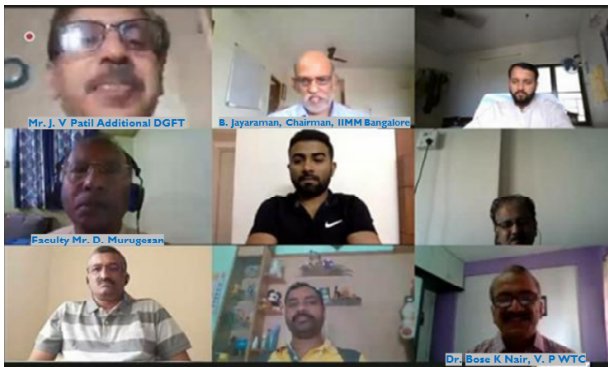
# BRANCH NEWS

## ■ BANGALORE BRANCH

### BANGALORE BRANCH

**MMR August 2020 :** IIMM, Bangalore with World Trade Centre, Bengaluru, Kochi, and Chennai jointly organised two **Online Certification Workshops** in July 2020. The workshop on **'Financial Management in International Trade'** was conducted on 18th and 25th July and **53 paid delegates** participated.

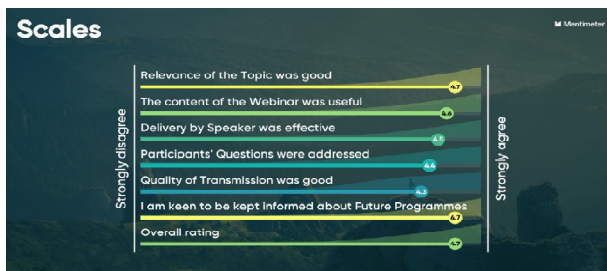
The **Inaugural Address** was delivered by **Mr. J.V. Patil, Additional Director General of Foreign Trade, Government of India.**



The workshop on **'Incoterms 2020 and Letter of Credit'** was conducted on 25th July and attended by **80 paid delegates**. (an integral part of the Two-day workshop offered as a One-day workshop)

**The workshops were conducted on Microsoft Teams App**

**Mr. D. Murugesan**, Senior Faculty, IIMM, Bangalore Branch conducted the sessions in a **brilliant and easy to understand manner** and we have received **excellent feedback** about the program.



The **highlight** of the Workshop was the **participation by 6 NRIs** from Japan, Malaysia, UAE, Oman, Nigeria. and **request** to keep them informed **about our future programs**.

### PUNE BRANCH

An online Webinar Lecture on **"How to Train our Brain**

## ■ PUNE BRANCH

**to Manage Uncertainties** "was held on Friday, 31<sup>st</sup> July 2020 from 7.30pm to 8.30 pm, as part of monthly knowledge sharing lecture for branch members.

**Mr. D. K. Rai, the Guest Speaker, is a Director at CHEP India Pvt. Ltd, with more than 20 years of experience in Sales, Marketing, and Supply Chain.**

Branch Chairman, Mr. Terrence Fernandes welcomed all the members for the session & appealed to members to take active part in the activities of the branch to scale the branch to greater heights.

The Speaker focused on how to train our brain under various circumstances through four different amazing and unique concepts.

- The first concept is **"Mirror box "**. During Vietnam & US war, thousands of people were killed. The alive people were living with this trauma for many years. Many of amputated people were feeling the pain in the limbs which were not there. None of the medications worked for those people. After tremendous research and efforts, they came up with this therapy which gave relief to all of them. It was introduced by William James and defined as **"AS IF"** therapy which says that once we start we believe in something, it soon becomes are reality.
- The second concept is **"Aggregation of Marginal Gains"** which states that break your task in smaller pieces. Then visualize and plan it accordingly to achieve it.
- The third concept **"Priming"** gives emphasis on our behavior. The words which we choose make a lot of impact and influence on us and environment around us. It will decide the course of the day and if used wisely will give tremendous results explained with the example of Sam Walton (CEO of Walmart) and Sachin Tendulkar.
- The fourth concept explained was **"Rave"** which says that if we associate with any bigger purpose with anyone, the behavior will change. It is further based on S-curve. The best time to change anything is when a person is really doing and feeling good which the Speaker explained citing the example of Tiger Woods.

Finally to conclude, the Speaker shared his three principles which he believes are very important in today's context named as, Physical Energy (PE), Emotional Energy (EE) & Intellectual Energy (IE). After the presentation, there followed a session of questions & answers with members & speaker.

Mr. Hitendra Admuthe, National Councilor presented a digital copy of Memento online to the speaker Mr. D. K. Rai as a token of gratitude, followed by vote of thanks by Mr. Prasad Rao, Hon. Secretary. The program was attended by 27 members.





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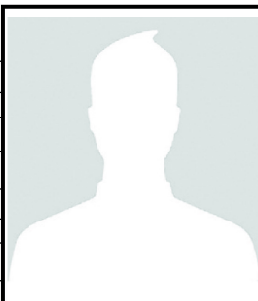
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# EXECUTIVE HEALTH

## TIME TO FOCUS ON PRIMORDIAL PREVENTION

DR SRIVATS BHARADWAJ

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Primordial prevention addresses the root cause of risk factors to prevent the onset and growth of illnesses and diseases. It refers to measures taken to stem the development of these ailments, rather than reacting to control their effects.

Time to focus on primordial prevention : Dr Srivats Bharadwaj By Dr. Srivats Bharadwaj, Chairman & CEO, Vatsalya Dental, Bengaluru

We are living through what is perhaps the worst collective nightmare in recent times, one with no end in sight. Covid-19 has spread with alarming speed and intensity infecting millions, killing hundreds of thousands, and leaving many in recovery with debilitating side effects. The pandemic has had unprecedented socio-economic implications.

Yet, the most glaring observation of the pandemic is also the most ironical - any knowledgeable medical professional will tell you that they saw this coming for a while now. Global spending on health has risen drastically in recent years to US\$ 7.8 trillion in 2017, or about 10% of GDP – mostly on intervention led research and care.

Covid-19 has focused the spotlight on the sheer unpreparedness and inability of our healthcare systems to cope with threats of this magnitude. It has also driven home the lacunae in infection control measures at the individual and institutional levels, forcing people and households to embrace a highly clinical approach to infection control. There is a dire need to recast our individual lifestyles, healthcare policies, research and infrastructure to shift gears to primordial prevention and preventive research.

### What is primordial prevention?

Primordial prevention addresses the root cause of risk factors to prevent the onset and growth of illnesses and diseases. It refers to measures taken to stem the development of these ailments, rather than reacting to control their effects.

These preventive measures are rooted in the intersection of environmental, economic, social,

cultural and behavioral conditions and practices. In fact, the traditional Indian socio-cultural ethos has always incorporated primordial preventive healthcare as a way of life. If you grew up in India in the last century, you would have likely followed some of the following practices at home:

- Leaving your footwear outside the house, and washing your hands and feet at the tap outside before entering the house
- Eating from individual plates and strictly avoiding sharing of food while eating
- Segregating cooking vessels from the ones used to serve and eat

What were considered rigid social mores were actually primordial infection control and hygiene practices rooted in science. In fact, a regular South Indian meal always comprised of all food elements essential for good health, and there was valid rationale behind the order in which these preparations were served and consumed. For e.g.: South Indians often served meals on plantain leaves. The science: The food will absorb the polyphenols, a characteristic cancer-preventing agent found on plantain leaves. What's more - the leaves are said to have antibacterial properties that can kill germs in the food, and they are eco-friendly, decomposing very quickly.

With advancement in sciences and lifestyle, however, a lot of these practices changed as we blindly aped the western way of life. Despite tremendous appreciable progress in modern medicine, the focus in the last few decades has shifted drastically from preventive medical support to reactive, intervention-led care.

In today's world of instant gratification, we have begun to glorify acute care measures as the results are obvious and immediate, and this has become the norm. But the focus on intervention only provides short-lived results and the healthcare system falls apart in the face of a true challenge such as the pandemic we are now living through.

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## The case for investing in primordial prevention

Primordial prevention is an intangible entity and therefore, not given its due value as it is tough to quantify the benefits and outcomes of preventive measures. Comparison against other parameters also becomes difficult with no immediate, visible results.

Added to this is the natural tendency of the human mind and our conditioning (and modern media focus) to associate and drive cause-benefit correlations only between recent events and occurrences. This is driven by our strong recall of immediate events and poor long-term memory. Consider this: Until Coronavirus surfaced, we had mostly forgotten the devastating effects of the 1918 Spanish Flu, one of the worst epidemics that we could have learnt so much from.

It is also human nature to overreact to immediate problems staring us in the face and under-react to long-term threats that build up slowly over time. However, if one needed numbers to substantiate the import of investing in primordial preventive healthcare, take this. Preliminary estimates in May 2020 by the Asian Development Bank suggests a USD 5.8 – 8.8 trillion loss to the global economy due to Covid19. And actuals could be much worse depending on how long the pandemic lasts. Not to mention the loss of over 610,000 lives at the time of drafting this article.

Covid-19 will not be the last pandemic we see in this century. Healthcare globally needs a thorough rehaul and we must shift gears from reactive panic to preventive preparation. Here's how:

Healthcare must immediately diversify investments into preventive research and infrastructure to focus on long term defense against possible new pathogens and diseases. It will not only prepare us for the next pandemic but will also pay-off in the long term during non-pandemic times.

Industrialists, policy makers, and VCs must make a concentrated effort to invest in long-term, preventive research and academics in healthcare. In fact, the present pattern of VC funding which is strongly focused on software firms and technology ideas that can find a big, "immediate market", needs to change. They need to instead focus on supporting innovations and research in healthcare for long-term good. "The true challenge", to quote VC Zack Gray, "is to build a business that does good and can raise money." Governments too must apportion larger amounts to primary, preventive public healthcare research and

infrastructure.

The medico-socio-educational segments of society must consciously collaborate to drive home the importance of primordial prevention. Philanthropic foundations need to invest more in educating and building awareness about preventive healthcare and hygiene amongst children, adolescents, and families, particularly the under-privileged sections of the society. The mass media can contribute in driving health education programmes.

There needs to be a global focus on making policy changes impacting lifestyle. Take for instance, stringent regulatory approvals on passive-gaming technology for kids vs promoting active sports funding, tighter food and nutrition certification guidelines promoting the wellbeing of the society, tighter restrictions on tobacco, alcohol and narcotics distribution and consumption, and more. On the contrary, governments and regulatory bodies must also provide a boost to products and inventions that can further positive lifestyle changes.

The next pandemic is only just around the corner. And given the rate and speed of globalization and lifestyle evolution, there will be many more to come in this century. The healthcare industry, corporates, governments, and citizens need to come together and consciously shift gears in our approach to healthcare, and to life at large. Undoubtedly, the investments required in research, training, planning and implementation will be enormous – both monetarily and otherwise.

The cost and effort of prevention is extremely high – can we afford it? But then, the present nightmare also begs us to ask, can we afford to not do it? The medical fraternity needs to stop focusing on treating heart attacks and strokes, and instead, focus on preventing them. At the individual and social level, we need to re-establish some of the validated lifestyle practices from yore that aid infection control. The time to shift focus to primordial preventive healthcare is NOW. And the way to do it is to take a step back in time and lifestyle practices, in order to move forward.

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