IIPE

Manufacturing News

MONTHLY NEWSLETTER OF THE
INDIAN INSTITUTION OF PRODUCTION ENGINEERS
VOLUME 08 – ISSUE 06 JUNE 2012 12 Pages Annual Subscription Rs. 180
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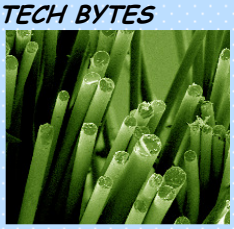


What is ISO 14001 and Should I Care?

ISO 14000, which was initially released in 1996 and updated in 2004, is a global series of environmental management systems (EMS) standards. As a continuation of the standardization process that was initiated with the ISO 9000 series, the ISO 14000 series of international standards have been developed so that organizations may incorporate environmental aspects into operations and product standards. It is a set of voluntary environmental management standards, guides and technical reports, which specifically focuses on corporate environmental management systems, operating practices, products, and services. The ISO standards in general aim to facilitate international trade and commerce. Companies can implement any or all of the ISO 14000 series standards. They do not prescribe environmental performance targets, but provide organizations with the tools to assess and control the impact of their activities, products or services on the environment.

The ISO 14000 series addresses the following aspects of environmental management:

- Environmental Management Systems (EMS)
- Environmental Auditing & Related Investigations (EA&RI)
- Environmental Labels and Declarations (EL)
- Environmental Performance Evaluation (EPE)
- Life Cycle Assessment (LCA)
- Terms and Definitions (T&D)

Compliance to an ISO 14000 EMS:

- Assures customers of your commitment to demonstrable environmental management
- Maintains excellent public relations
- Satisfies investor criteria and improves access to capital
- Obtains insurance at reasonable cost
- Enhances your image and market share
- Meets your clients' registration requirements
- Improves cost control by identifying and eliminating waste and inefficiency
- Lessens incidents that result in liability
- Reduces your consumption of materials and energy
- Facilitates the attainment of permits and authorizations
- Decreases the cost of complying with environmental regulations
- Improves industry-government relations

ISO 14000 registration

With respect to ISO 14000, registration is the formal recognition of an organization's ability to conform to the requirements of an EMS. Organizations may simply declare that their EMS meets the requirements of ISO 14001 ("self-declaration"). However, many organizations choose to have their EMS registered, usually to provide greater assurance to clients and the public, or because regulators and clients require it.

ISO 14000 standards- "Organization" and "Product" oriented

The ISO 14000 series fall into two major groupings: organization-oriented and product-oriented documents. The organization-oriented standards provide complete guidance for establishing, maintaining and evaluating an EMS. They are also concerned with other organization-wide environmental systems and functions.

These standards assist an organization in assembling the data needed to support planning and decision-making, and to communicate specific environmental information about a product/service to customers, end-users, and other interested parties.

ENVIRONMENT DAY SPECIAL

LEAD PAGE

CHAIRMAN'S MESSAGE

The Global Investors Meet 2012 organised by Karnataka State government during 7th to 9th June 2012 has succeeded in attracting promised investments to the tune of Rs 7.6 lakh crores. 730 memoranda of understandings have been signed with a potential to create 15 lakh jobs. All 30 districts have attracted project proposals. The energy sector has attracted investment of more than 21,930 crores with capacities exceeding 18,000 Megawatts. 34 proposals call for investments above 5,000 crores with a combined investment of Rs 3,36,555 crores. NMDC with Rs 25,000 crores and Tata Metaliks with Rs 20,000 crores for setting up steel plants for 6M Tonnes per annum are major highlights. The renewable energy sector has promised investments of Rs 15,000 crores primarily for wind energy.

Bangalore emerging as a major Aerospace capital of Asia is a welcome prospect with investments promised in creating strong base for MRO activities within 10 years. Also a Karnataka Aerospace Research and Innovation Centre housing modern laboratories and incubation centres for nurturing entrepreneurship among budding aerospace engineers, is on the anvil in PPP model. Visvesvaraya Technological University will promote Aerospace engineering studies and research in academic institutions in partnership with industries. An Aerospace university and Aerospace SEZ at Devanahalli and Mysore airports hosting MRO activities are some of the promising proposals made during the Meet.

The MSME sector has attracted proposals from 6,800 entrepreneurs with investments touching Rs 35,000 crores. The role of MSME was highlighted in a separate session and had overwhelming participation. The global scene, opportunities for Indian MSMEs, infrastructure support, IPR and export promotion were some of the topics discussed. On the whole, the GIM 2012 has achieved the objectives of the Meet but turning these MoUs into reality is the most challenging task. Hope there is concerted effort by all concerned to accomplish these projects as targeted!

While we are aiming high, the stark realities of slowing down of industrial production, power shortages and petroleum crude prices increase hampering production and falling of rupee value against dollar, and Euro crisis affecting exports, are calling for immediate attention by government as well as industry bodies. The pessimistic prediction of India losing its leading position among the BRIC countries calls for resolution urgently. In this context one also has to take note of the New Telecom Policy 2012 announced now, which has indicated a market for Rupees 250,000 crores for telecom equipments to make every Indian to own a device and provide him with 2MB bandwidth .The opportunity is there in the manufacturing of electronics & communication and computing devices, and it should be grabbed by Indian industry.

Let IIPE fraternity ponder over these developments and take needed initiatives to play active role in making things happen at the right time!

With best wishes ***R. M. Vasagam***

Investors losing confidence in INDIA?

In an effort to boost the sagging economy, the Prime Minister **Manmohan Singh**, who had convened a meeting of infrastructure ministers, has set an investment target of at least Rs 2 lakh crore for the sector in the current fiscal to revert back to 9% economic growth. India's economic growth rate slowed to a nine-year low, both in the March quarter at 5.3% as well as in 2011-12 at 6.5%. "At a time when the Indian economy is going through a tumultuous phase, this meeting was a clear indication of the government's commitment to improve coordination among different ministries to give a boost to infrastructure sector," CII Director General **Chandrajit Banerjee** said.

Terming Prime Minister Manmohan Singh's initiative to give a push to India's infrastructure sector as an extremely positive step**, CII** said it is a clear indication of the government's commitment to boost investors' confidence and attract investments. It, however, said there is a need for better coordination among different departments and ministries to speed up clearances and implementation of the projects.

Rating agency **Standards and Poor's** said that India lacked strong political will in economic policy making. It warned that roadblocks to economic policymaking are pushing up the risk that **India could lose its investment-grade rating**.

NEWS NUGGET

India is poised to occupy the sixth position in the top 10 wealth markets this year *after edging out Spain for 10th slot in 2011, says a report.*

"Uncertainty about the future of the euro and the worsening of the sovereign crisis in Europe are predicted to cause continuing problems, but many emerging markets are expected to continue marching ahead," according to ***Datamonitor's 2012 global wealth market report.***

The report further said the world order of wealth markets is witnessing a tilt towards emerging economies which are expected to overtake their Western European counterparts going forward. The top 10 wealth markets, in terms of dollar millionaire holdings at the end of 2011, in descending order, were the US, Japan, China, the UK, Germany, Italy, Canada, France, Brazil, and India, it said.

Moreover, the cumulative value of the liquid assets held by millionaires in the emerging economies of Brazil, China, and India are likely to triple to $4.6 trillion from $1.5 trillion between 2006 and 2015. India, in particular, will experience explosive growth, and is anticipated to jump sixth place by the end of 2012, the report said.

Top 10 wealth markets in 2015 will be the US at number one, with China in second place, followed by Japan, the UK, Germany, India, Brazil, Italy, Canada, and France, it added.

IIPE UP Centre Mathura

WORKSHOP ON RAPID RESPONSE MANUFACTURING

Manufacturing has undergone revolutionary changes in the past decade in its objective, philosophy and methods. Keeping in view the increasing focus on a satisfied customer, **the UP State Centre, Indian Institution of Production Engineers**, in collaboration with **Department of Mechanical Engineering, GLA University, Mathura**, had organized a two day Interactive Workshop on **"Rapid Response Manufacturing"** during **28-29 April, 2012**.

The Vice-Chancellor of GLA University, **Prof. Jai Prakash** inaugurated the workshop, expressing his happiness on the occasion and stressed the importance of keeping the students and faculty in touch with realities of manufacturing sector, by organizing such workshops on latest technologies used in manufacturing. To be successful and competitive in the future all manufactures must adopt next generation manufacturing practices like Agile, JIT, CIM, Additive manufacturing and Rapid Response Manufacturing.

Dr. Surender Kumar, Professor of Mechanical Engineering and **Chairman UP State Centre of IIPE**, highlighted the importance of Rapid Response Manufacturing, its applications and technologies for industries to remain competitive. He also highlighted the importance of time based competition in the battle ground of the current millennium.

About **80 delegates** were present during the workshop. During five technical sessions about **15 papers** were presented by the experts/delegates, from Jabalpur, Ghaziabad, Jaipur, Gwalior, Agra and Mathura. A **Brain Teaser session** in the area of manufacturing was conducted for student members of IIPE on 29th April 2012. During the workshop interactive discussions were held between experts and the delegates.

The meeting of the **Executive Council of UP State IIPE Centre** was held **on 29.04.2012** to decide on the issues for the next session. **Mr. Piyush Singhal** summed up the proceedings of the workshop during the valedictory session.

During valedictory session **Prof. G.K. Srivastava**, Head, Department of Mechanical Engineering has distributed the prizes and mementos to the paper presenters and the winners of Brain Teaser Session. **Mr. Vikas Kr. Sharma**, the organizing secretary has proposed the vote of thanks.

Table of

LIFE COMPOUNDING FEES

as from 1ST June 2012

Age next birthday	*Life Fellow Rs.*	*Life Member Rs.*
31 - 35	*NA*	*5000*
36 - 40	*5500*	*4375*
41 - 45	*4750*	*3750*
46 - 50	*4000*	*3125*
51 - 55	*3250*	*2500*
56 - 60	*2500*	*1875*
60+	*1750*	*1250*
These rates will be subject to review from time to time.		

IIPE NHQ NEWS

MANUFACTURING COMPETITIVENESS LECTURE SERIES

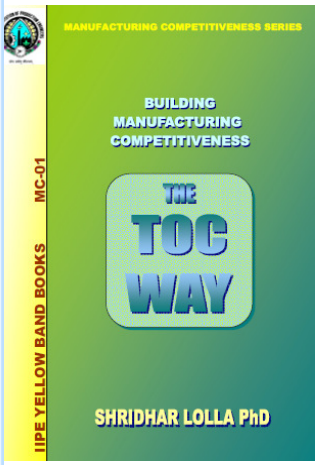
The current Indian Economic scenario is not a bright one, with hopes of high growth rates plummeting to an all time low. The spirit behind constituting the National Manufacturing Competitiveness Council (NMCC), headed by Shri V. Krishnamurthy, is a lofty one - since any sustained national growth can come only from manufacturing. For which, our industries have to turn highly productive, and become globally competitive. We at the IIPE are constantly planning to bring in the awareness about techniques available for this purpose, and also hand-hold the industries to attain the competitiveness.

With this in mind, we have decided to pursue two ideas, in association with like minded bodies like IEI and AIMO –

1. To hold preview lectures on various practical techniques available, followed by workshops on achieving Manufacturing Competitiveness.

2. To bring out a series of Guide Books (60 to 80 pages & priced at Rs. 125) to back up the lectures.

The lectures are planned at four venues initially - Bangalore, Chennai, Pune and Delhi (each lecture will be repeated at all the venues) - and also release the corresponding book. A wide range of techniques like Theory of Constraints, Value Stream Mapping, OEE, Poka-Yoke & SMED, Leveraging HR for Intellectual Assets, and so on - all by thoughtfully chosen experts in each field, to deliver simple methodologies for attaining competitiveness. (One lecture every month - 8 such lectures are on the anvil)



As you may be aware, we have planned the first lecture on **20th June** on **Building Manufacturing Competitiveness - the TOC Way** By **Dr. Shridhar Lolla** who has extensive experience in implementing **Theory of Constraints** in many industries. At the same occasion, the book on **"the TOC Way"** will be released by **Shri O.P. Khanna.**

Having said all these, we understand the magnitude of this task. So, we are counting on the valued active participation of all IIPE members all over India for this endeavour. **Kindly look around for success stories in industries, and please choose experts who have practically applied certain specific techniques for the same. We would like to invite them to give lectures and also bring out books on such practical techniques.** We would like to know your active views about the whole idea. So please mail your responses to **iipenhq@yahoo.co.in**

IIPE-TN Centre Chennai

MOTIVATING THE MOTIVATOR

K.V. KRISHNA SASTRY, Professor and HOD of Mechanical Engineering, Arupadai Veedu Institute of Technology, and also **Vice-Chairman, IIPE-TN Centre**, gave a Lecture on **"Motivating the Motivator"** - Motivation with Reference to Engineering Education – on **11th May 2012** at the **Institution of Engineers India, TN State Centre.**

Motivation is an act of stimulation and inspiration among the people to intensify their desire and willingness to do their duty to achieve goals. It is originated from a Latin word 'movere', which means 'to move'. The main objective of a motivator is to achieve the result from the work intended. Leaders, Teachers, Engineers and managers are basically motivators. They expect and extract the result from the followers and subordinates. They can lower the absenteeism and attrition rate of personnel from the organization. They should have motivational skills. The inspirational skills may be either intrinsic or extrinsic.

The performance of any person in work environment will depend on three factors. They are motivation, ability and knowledge. The importance of motivation over other two factors were explained by the speaker with various illustrations and also with the help of life histories of various leaders belonging to spiritual and political and also from national and international regions.
The speaker also emphasized the importance of motivation from various mythological characters. He gave the examples of life histories of persons, who overcame their personal disabilities and created histories.

The speaker gave the classification of motivation and also various theories of motivation such as need theory, process theory and reinforcement theory. He explained the various theories of motivation with suitable examples.

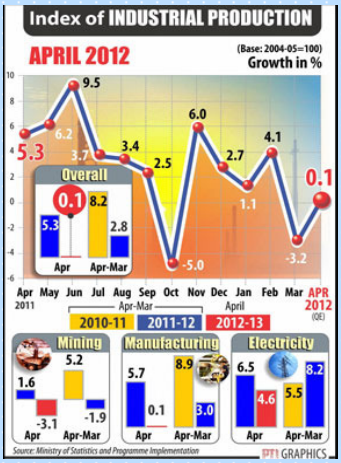
The speaker also gave a number of examples to substantiate teachers and engineers as motivators. He highlighted the importance of engineering teachers. He proposed 11 commandments to engineering teachers for effective teaching. He requested engineering teachers to have passion for teaching and clearly mentioned the difference between the terms 'profession' and 'occupation'. He also requested the engineers and teachers to see their work as a proud profession and not as a mere occupation.

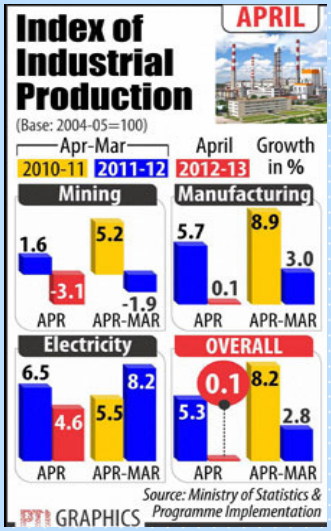
MINDSET

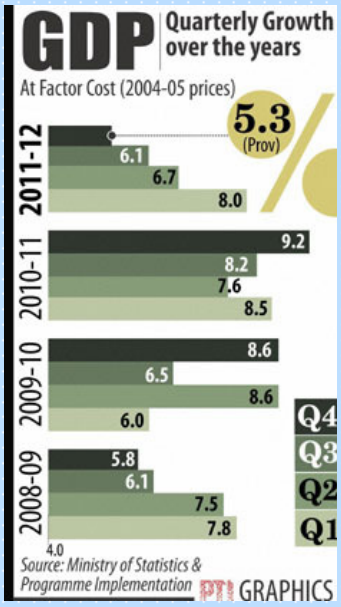
A Selection of Quotable Quotes

- *The secret of success is constancy of purpose*
- *Self distrust is the cause of most of our failures*
- *Truth must have no compromise*
- *Genius is only a great aptitude*
- *He who wants does more than he who can*
- *Everyone who wills can hear the inner voice*
- *It is within everyone*
- *They can conquer who believe they can*
- *Humility is the foundation of all virtues*
- *We can not see outside what we are not inside*
- *Nothing is more difficult than to be self-demanding*

Contributed by
Er.G.Venkatarathnam
Chairman,
IIPE-Karnataka Centre







Industrial Output Flat at 0.1% in April

MOSPI New Delhi – June 12, 2012

➢ The Quick Estimates of **Index of Industrial Production** (IIP) with base 2004-05 **for the month of April 2012** have been released by the Central Statistics Office of the Ministry of Statistics and Programme Implementation. IIP is compiled using data received form 16 source agencies viz. Department of Industrial Policy & Promotion (DIPP); Indian Bureau of Mines; Central Electricity Authority; Joint Plant Committee; Ministry of Petroleum & Natural Gas; Office of Textile Commissioner; Department of Chemicals & Petrochemicals; Directorate of Sugar; Department of Fertilizers; Directorate of Vanaspati, Vegetable Oils & Fats; Tea Board; Office of Jute Commissioner; Office of Coal Controller; Railway Board; Office of Salt Commissioner and Coffee Board.

➢ The General Index for the month of April 2012 stands at 166.4, which is **0.1% higher** as compared to the level in the month of April 2011. The **cumulative growth** for the period April-March 2011-12 stands at **2.8%** over the corresponding period of the previous year.

➢ The Indices of Industrial Production for the Mining, **Manufacturing** and Electricity sectors for the month of April 2012 stand at 124.4, **176.2** and 152.7 respectively, with the corresponding growth rates of (-)3.1%, **0.1%** and 4.6% as compared to April 2011 (Statement I). The cumulative growth in the three sectors during April-March 2011-12 over the corresponding period of 2010-11 has been -1.9%, 3.0% and 8.2% respectively.

➢ In terms of industries, twelve (12) out of the twenty two (22) industry groups (as per 2-digit NIC-2004) in the manufacturing sector have shown positive growth during the month of April 2012 as compared to the corresponding month of the previous year (Statement II). The industry group 'Publishing, Printing and Reproduction of Recorded Media' has shown the highest growth of 52.7%, followed by 29.4% in 'Medical, precision & optical instruments, watches and clocks' and 21.4% in 'Radio, TV and Communication Equipment and Apparatus'. On the other hand, the industry group 'Electric Machinery and apparatus n.e.c.' has shown a negative growth of 49.2% followed by 14.9% in 'Office, Accounting and Computing Machinery' and 9.1% in 'Wearing apparel; dressing and dyeing of fur'.

➢ As per Use-based classification, the growth rates in April 2012 over April 2011 are 2.3% in Basic goods, (-) 16.3% in Capital goods and (-)1.4% in Intermediate goods (Statement III). The Consumer durables and Consumer non-durables have recorded growth of 5.0% and 5.4% respectively, with the overall growth in Consumer goods being 5.2%.

➢ Some of the important items showing high positive growth during the current month over the same month in previous year include 'Telephone Instruments including Mobile Phone & Accessories' (30.0%), 'Newspapers' (56.7%), 'Conductor, Aluminium' (42.3%), 'Boilers' (38.1%), 'Polythene Bags including Hdpe & Ldpe Bags' (194.0%), 'Cement Machinery' (193.1%), 'Aerated Water & Soft Drinks' (35.3%), 'Cashew Kernels' (31.9%) and 'Generator/ Alternator' (37.2%).

➢ Some of the other important items showing high negative growth are: 'Cable, Rubber Insulated' [(-) 85.2%], 'Sugar' [(-) 21.4%], 'Vitamins' [(-) 55.9%], 'Colour TV Sets' [(-) 29.5%], 'Furnace Oil' [(-) 26.0%], 'Woollen Carpets' [(-) 47.0%] and 'Textile Machinery' [(-) 40.9%].

WPI inflation rises to 7.23% in April 2012

The official **Wholesale Price Index** for All Commodities (Base: 2004-05 = 100) **for the month April, 2012 rose by 2.1 percent to 163.1** (Provisional) from 159.8 (Provisional) for the previous month.

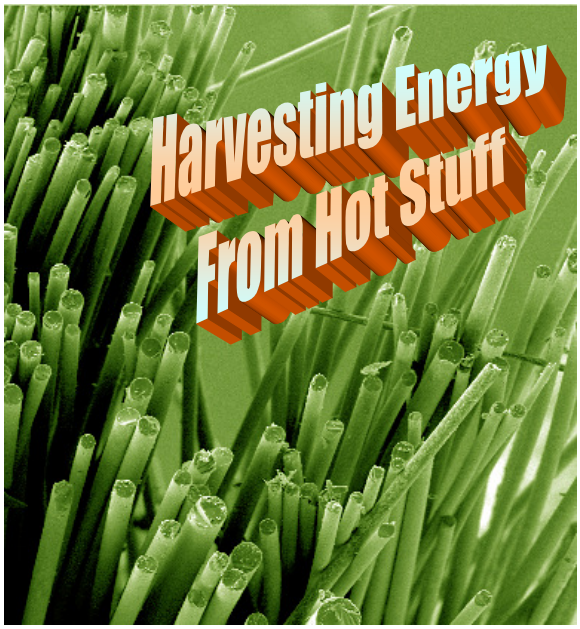
INFLATION: The annual rate of inflation, based on monthly WPI, **stood at 7.23%** (Provisional) **for the month of April, 2012** (over April, 2011) as compared to 6.89% (Provisional) for the previous month and 9.74% during the corresponding month of the previous year. **Build up inflation in the financial year so far was 2.07%** compared to a build up of 1.74% in the corresponding period of the previous year.

Industry Bitter over Govt Inaction

The Index of Industrial Production (IIP) for April rose just 0.1 percent, corroborating fears that economic slowdown will persist in the current quarter. The consensus expectation was 1.7 percent growth in April as compared to the same period in the previous fiscal year.

The slowdown in March IIP had triggered a demand for strong government action on the policy front while the industry had asked for rate cuts to promote growth. The government has so far blamed global reasons such as the Euro debt crisis and the global slowdown for the slackening Indian economy.

However, analysts feel that strong government action can turn the economy around. They opine that it is time the RBI gave monetary as well as fiscal support to boost growth.



WEST LAFAYETTE, Indiana, USA – Researchers are developing a technique that uses nanotechnology to harvest energy from hot pipes or engine components to potentially ***recover energy wasted in factories, power plants and cars****.*

"The ugly truth is that 58 percent of the energy generated in the United States is wasted as heat," said **Yue Wu**, a Purdue University assistant professor of chemical engineering. "If we could get just 10 percent back that would allow us to reduce energy consumption and power plant emissions considerably."

Researchers have coated glass fibers with a new "thermoelectric" material they developed. When thermoelectric materials are heated on one side, electrons flow to the cooler side, generating an electrical current. Coated fibers also could be used to create a solid-state cooling technology that does not require compressors and chemical refrigerants. The fibers might be woven into a fabric to make cooling garments. The glass fibers are dipped in a solution containing nanocrystals of lead telluride and then exposed to heat in a process called annealing to fuse the crystals together.

Such fibers could be wrapped around industrial pipes in factories and power plants, as well as on car engines and automotive exhaust systems, to recapture much of the wasted energy. The "energy harvesting" technology might dramatically reduce how much heat is lost, Wu said.

Findings were detailed in a research paper appearing last month in the journal *Nano Letters*. The paper was written by Daxin Liang, a former Purdue exchange student from Jilin University in China; Purdue graduate students Scott Finefrock, Haoran Yang and Wu.

The new flexible devices would conform to the irregular shapes of engines and exhaust pipes while using a small fraction of the material required for conventional thermoelectric devices.

"This approach yields the same level of performance as conventional thermoelectric materials but it requires the use of much less material, which leads to lower cost and is practical for mass production," Wu said.

In addition to generating electricity when exposed to heat, the materials also can be operated in a reverse manner: Applying an electrical current causes it to absorb heat, representing a possible solid-state air-conditioning method. Such fibers might one day be woven into cooling garments or used in other cooling technologies.

The researchers have shown that the material has a promising thermoelectric efficiency, which is gauged using a formula to determine a measurement unit called ZT. A key part of the formula is the "Seebeck coefficient," named for 19th century German physicist Thomas Seebeck, who discovered the thermoelectric effect.

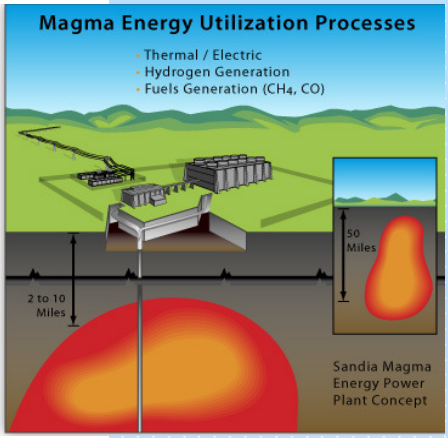
ZT is defined by the Seebeck coefficient, along with the electrical and thermal conductivity of the material and other factors. "It's hard to optimize all of these three parameters simultaneously because if you increase electrical conductivity, and thermal conductivity goes up, the Seebeck coefficient drops," Wu said.

The nanocrystals are a critical ingredient, in part because the interfaces between the tiny crystals serve to suppress the vibration of the crystal lattice structure, reducing thermal conductivity. "This means that, as electrons carry heat through the structures, the average voltage of those heat-carrying electrons is higher than it would be in larger structures," Finefrock said. "Since you have higher-voltage electrons, you can generate more power." This confinement can raise the ZT number.

Future work could focus on higher temperature annealing to improve efficiency, and the researchers also are exploring a different method to eliminate annealing altogether, which might make it possible to coat polymer fibers instead of glass. "Polymers could be weaved into a wearable device that could be a cooling garment," Wu said

Energy from the Earth

What could be more natural or plentiful? The source of geothermal power is ***the heat contained inside the Earth****; heat so intense that it creates molten magma.*



There are a few different types of geothermal energy that can be tapped. "Some geothermal systems are formed when hot magma near the surface (1,500 to 10,000 meters deep) directly heats groundwater." The heat generated from these hot spots flows outward toward the surface, manifesting as volcanoes, geysers, and hot springs..

Naturally-occurring hot water and steam can be tapped by energy conversion technology to generate electricity or to produce hot water for direct use. "Other geothermal systems are formed even when no magma is nearby as magma heats rocks which in turn heat deeply-circulating groundwater."

In order to maximize the energy gleaned from these so-called "hot dry rocks," geothermal facilities will often fracture the hot rocks and pump water into and from them in order to use the heated water to generate electricity.

Simply Stated……

Powder metallurgy

- *uses sintering process for making various parts out of metal powder.*
- *The metal powder is compacted by placing in a closed metal cavity (the die) under pressure.*
- *This compacted material is placed in an oven and sintered in a controlled atmosphere at high temperatures and the metal powders coalesce and form a solid.*
- *A second pressing operation, repressing, can be done prior to sintering to improve the compaction and the material properties.*

Next to casting, mechanical forming and machining, powder metallurgy (P/M) technology is an important method of manufacturing metal parts.

Undesirable characteristics of ingot based metals can be greatly reduced, and desired properties of metals which would normally not alloy easily can be achieved by combining different metal powders or mixtures of metal and non metal powders.

The process of making powders, then compacting them into useful shapes and then sintering them is costly – but the finished parts have some specific advantages over wrought or cast parts.

The main advantages are:

- the possibility to make fine grained homogenous structures
- the ability to form complicated shapes with close dimensional tolerances
- and the ability to produce parts with a superior surface finish.

Costly machining processes are thus reduced or eliminated and consequently there is less scrap loss compared to other forming methods. It is therefore most economical to use powder metal for the high volume production of small, intricately shaped, and/or very precise parts such as gears and links.

In addition, the process offers the potential to produce a wide variety of alloys with different material properties such as high temperature toughness and hardness. High speed cutting tool bits from sintered tungsten carbide powder are an example of the variety of different properties which can be achieved with the powder metallurgical process.

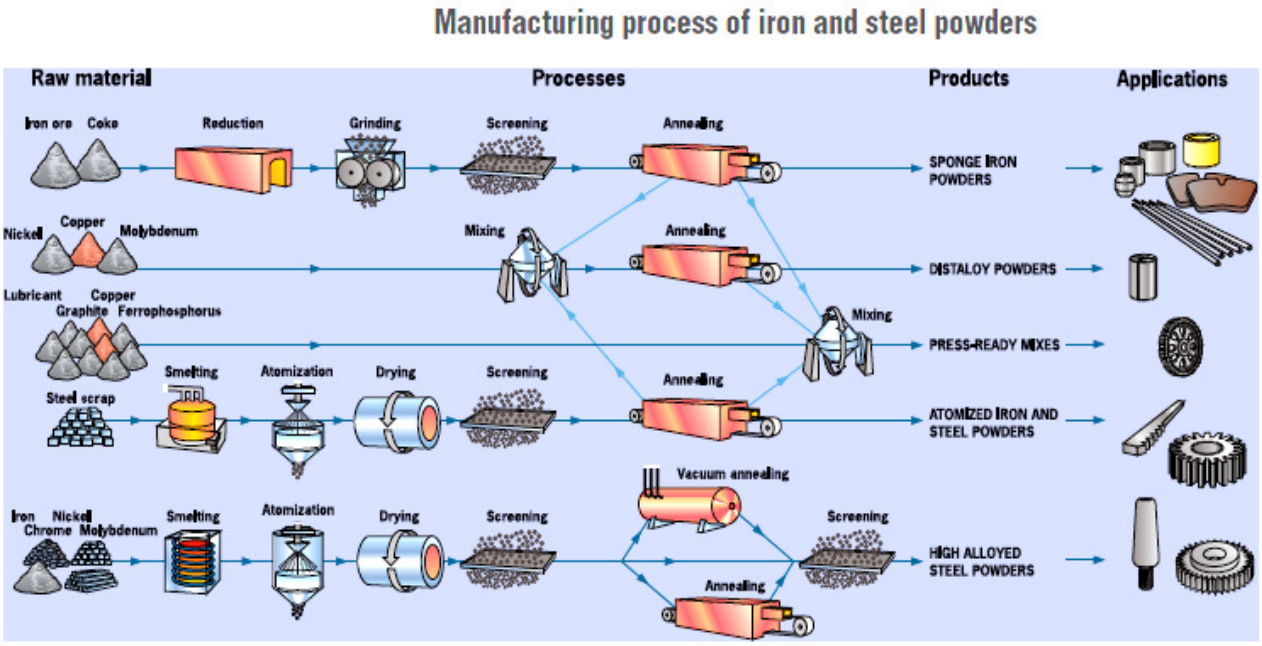
As the density of the compacted and sintered part influences its key properties of strength, ductility and hardness, a specific porosity is critical. For process control, metallography is used to check porosity, non-metallic inclusions and cross-contamination. In research and failure analysis, metallography is a major tool used to develop new products and improve manufacturing processes.

In addition to chemical analysis, quality control also includes physical methods for checking density, dimensional changes, flow rate etc.

Production Process

To achieve the desired structure and near net shape of a powder metal part, stringent process control of the following production steps is required:

- Making the powder
- Mixing the powder with additions such as lubricant, carbon and/or alloying elements
- Compacting the powder in carbide dies
- Sintering at high temperature (1100-1200°C) in a protective atmosphere



PROCESS BASICS

Chemical and atomisation methods are the two most common methods for powder production. The chemical method converts metal from ore oxides directly to metal powder at a temperature below the melting point. For example, iron powder is made through direct reduction from iron ore into sponge iron. The sponge iron is then mechanically crushed to powder, which is further refined through annealing under reducing atmosphere to produce pure iron powder. It is used for alloying and low density applications, such as bearings.

In the atomizing process molten metal of the desired alloy flows through a nozzle and is struck by high pressure water or gas jet. Small droplets are formed which solidify into particles. Atomized powders result in higher densities than mechanically crushed powders, therefore all steel powders are produced by atomizing.

Copper powder is made by atomizing or electrolytic methods. Tungsten carbide powder is produced by adding controlled amounts of carbon to the tungsten powder and carburizing it at 1400 - 2650°C

Powder production and mixing is a highly specialized and complex process which produces custom made powder mixes designed to satisfy the needs of a specific application. A good powder mix not only has the ability to produce the required properties of a specific alloy, but also needs to facilitate handling, compacting and sintering.

For instance,

- the easy flow of powder and its capability to mix evenly with other powders is important
- this enables even powder distribution before pressing, and
- ensures uniform properties of the finished part.

For the production of components the mixed powders are first compacted under high pressure in a carbide die. At this stage the part has the geometrical features of the finished component, but not its strength and is called the "green" part.

In order to develop the mechanical and physical properties of the material, metallurgical bonding has to take place through sintering at high temperature in a sintering furnace. The bonding occurs through diffusion between adjacent particles.

To avoid oxidation, which would impair the inter-particle bonding, the sintering process is conducted in a protective atmosphere. The bonding increases the density, and pressed and sintered powder metal parts generally contain between 5 and 25% residual porosity.

Depending on the application some parts may need an additional hot iso-static pressing for better dimensional accuracy, or surface finish or impregnation with oil. Final treatments, such as surface hardening, plating or coating can be applied.

The sintering of cemented carbides is carried out in a vacuum sintering process. The carbide powder is mixed with 3-25 w% cobalt and small amounts of titanium and tantalum carbides are added to inhibit grain growth. This mixture is pressed and sintered.

At 1280 – 1350°C the liquefaction of cobalt takes place and results in the formation of a eutectic-like phase of WC/Co. Densification begins at lower temperatures and reaches a theoretical 100% shortly after the liquefaction has occurred. During liquefaction the part shrinks up to 40% in volume.

Applications

Components made by powder metallurgy are mainly used for the following applications:

- Mechanical and structural parts, mainly iron based, but also from copper, brass, bronze and aluminium. The largest user of P/M parts is the automotive industry. Component suppliers make connecting rods, synchronizing hubs, chain sprockets, cams and gears.
- Refractory metals which, due to their high melting points, are diffi cult to produce by melting and casting.
- Porous material in which controlled porosity serves a specifi c purpose, for instance self lubricating bearings.
- Composite materials that do not form alloys, for instance copper/tungsten for electrical contacts, cemented carbide cutting tools (Fig. 3), materials for brake linings and clutch facings, diamond cutting tools, or metal matrix composites.
- Special high-duty alloys, such as nickel and cobalt based super alloys for jet engine parts, and high speed tool steels, which have an even distribution of carbides and have isotropic qualities (Figs. 4 and 5).

In addition, different powders and powder mixtures for thermal spray coatings are produced and are also subject to metallographic quality control.

Design Considerations

- *Part must be so designed to allow for easy ejection from the die. Sidewalls should be perpendicular; hole axes should be parallel to the direction of opening and closing of the die.*
- *Holes, even complicated profiles, are permissible in the direction of compressing. The minimum hole diameter is 1.5 mm (0.060 in).*
- *The wall thickness should be compatible with the process typically 1.5 mm (0.060 in) minimum. Length to thickness ratio can be upto 18 maximum-this is to ensure that tooling is robust. However, wall thicknesses do not have to be uniform, unlike other processes, which offers the designer a great amount of flexibility in designing the parts.*
- *Undercuts are not acceptable, so designs have to be modified to work around this limitation. Threads for screws cannot be made and have to be machined later.*
- *Drafts are usually not desirable except for recesses formed by a punch making a blind hole. In such a case a 2-degree draft is recommended. Note that the requirement of no draft is more relaxed compared to other forming processes such as casting, molding etc.*
- *Tolerances are 0.3 % on dimensions. If repressing is done, the tolerances can be as good as 0.1 %. Repressing, however, increases the cost of the product.*

The Challenge in Transforming Manufacturing

*This article is the first in the series on building superlative Manufacturing Competitiveness of Indian Industry. It deals with a holistic management techniques for **Operational Excellence**, which is just what Indian Industry needs -to overcome its challenges and meet the objective of* **the New Manufacturing Policy**.

Dr Shridhar Lolla *is a practitioner of Operational Excellence and specializes in the implementation of Theory of Constraints. He handholds organizations in rapidly achieving breakthrough performance.*

He is also the Author of IIPE's yellow band series, "Building Manufacturing Competitiveness - the TOC Way". Recently, he launched an online platform at **http://www.time2change.co.in** *as the Hub of Operational Excellence; where practitioners of operational management from various industries are collaborating to write a unique soon to be published book on Operational Excellence, titled* **"Time2Change"**. *The entry to the Hub is restricted and by invitation.* ***Members of IIPE interested in participating*** *at the Hub can send their request quoting IIPE membership number to* ***admin@time2change.co.in***..

Building a higher order of production capabilities at the firm level means organizational transformation. ***Transformation involves significant Change***, not only in the way things are done but also in the behaviour and culture of the organization; it involves people. Making Change happen and stick is not easy, since there is often a lot of resistance to change. A vast majority of the community engaged in Organizational Transformation, therefore, finds and believes that *most of the* ***Organizations embrace Change only when they are under Crisis*****.**

The only other way (than being driven by Crisis), organizations have been found to transform is because of a ***good Leadership***. And, there are several case studies on Leaders as change agents.

However, in today's connected world, the business environment has become increasingly *complex*. Due to which, any significant improvement initiative by an organization, despite having best leadership takes painfully long time, exhausts organizational resources, disrupts ongoing business and costs huge money… and at the end, the resistance to change becomes even stronger.

Irrespective of historical and current performance, today, Managers are in a hurry to improve performance levels of their organizations on an ongoing basis. The question of why to improve performance does not exist. But trying to approach improvement initiatives the same way again and again, does not take them anywhere.

Perhaps, it makes sense to search out for the next level of concept in Organizational Transformation. It means an approach of transformation that is suitable in today's ever changing and unpredictable dynamic world of business. *Such an approach must give quick results that are sustainable, without taking too much of risk and without being too expensive*.

The Paradigm in Improving the Process of Improvement

There is a recognition that

1. Work orders processed in the shop floor must be sold as early as possible, since the market conditions change too fast.
2. Improvement Programs must deliver quick business results, since the business environment change too fast.

Since, businesses are built to achieve growth NOW as well as in FUTURE, it is important that the near term situations at the shop floor and sustainability aspect of the process of improvement within business (including manufacturing) must be aligned. **Eliyahu Goldratt** the management Guru provided a methodology to deal with the process of alignment and improvement in an ever changing world. His thought process appeared in a landmark whitepaper "Standing on the shoulders of the Giants" that presented the most salient developments in operations and linked them together to bring an insightful methodology. This is typically called as the Principles of Flow. It proposed to pick flow (speed) as the base metric and follow the methodology to improve overall performance of Operations.

Principles of flow

1. The prime objective of Operations is to 'ever improve flow'.

It means that the role of Operations is to create and deliver value as fast as possible. In manufacturing it is about goods, in other organizations it is service. Translated into a metric, it means that Operations must be guided by the metric of Lead Time and must strive to ever shrink it. Lead Time is the duration between the moment a process order is created to the moment it is delivered to the customer. Reducing the Lead Time means faster response time and an ability to respond faster to the changes in the demand of the customer.

Insight from this principle: ***Flow is the prime objective.***

2. Avoid Over Production.

Now, if an organization has to respond faster (have shorter Lead Time), trying to be busy in doing something that is not required NOW (in short time) often cause the process orders that are important and urgent to be delayed.

When it is said 'Do not overproduce', it means that operations must have a mechanism to not over produce, which means that organizations have a good understanding of what to produce in near term and what not.

For example, Production Systems where supplies are delivered from stocks, having a signal of consumption of stock frequently is a good enough indicator to know when to produce and what to produce. Such a mechanism is called replenishment based production.

Insight from this principle: ***Time is a key constraint*** in an ever changing world, do not work on things that are less important and urgent when there are things that are more important and urgent.

3. Single Priority System

Even when production does not produce what is not required and plans to produce what is required in near terms first, at any moment, there will always be more work to do than the instantaneous capacity of the plant. Now if all the orders have to flow seamlessly (without staying too long on the floor), priority for all the processes across the flow line must be same.

In a Production System, the gating process must ensure that the priority of an order it intends to release has the highest priority in the respective lines. The single priority system is required not just for the shop floor, but also for the material procurement, material warehouse, QC, FG warehouse, dispatch and transport. A single priority system provides alignment and synchronization across the organization, reduces chaos and improves On Time Delivery and Product Availability dramatically.

Insight from this Principle: At any time, a plant operates with limited resources while the process orders would be too many. The chaos that a Production System is often characterized with, can be dramatically reduced by following a single priority system across the flow, which also improved other key metrics of the organization.

4. Follow a Focusing Approach to Balance the Flow

Once the key metric for Operations is agreed to be the Lead Time, overproduction is avoided and all processes are aligned, taking a step back and looking at the system reveals that something limits the overall flow, the rate at which the operations delivers value (money). Also, some products will still find their supply short of the demand placed on the system. There would be a need to increase capacity of the plant. Traditionally, raising a CAPEX request is the way to increase capacity.

He propounded the Theory of Constraint, to allow organizations to reveal hidden capacity in the plant quickly, without taking too much risk and without exhausting costly resources. It is based upon System's concept, which postulates that at a moment, performance of a system (an organization is a system) comprising a set of interdependent components, is determined by the performance of one or just a few components, called Constraints. In a proverbial saying, ' the Strength of a Chain is determined by the Weakest Link'.

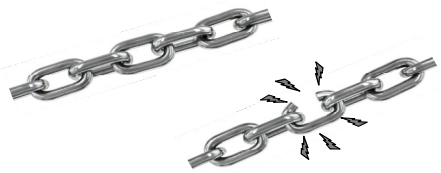


Figure 2 The strength of a Chain is limited by its Weakest Link, trying to improve any other link without first improving the strength of weakest link will not help.

It means that managers, who are responsible for improving systems, must therefore focus on just one or the few elements of the system which limit their performance. Alternatively, trying to improve everything, everywhere and every time, does not give proportionate benefits and improve the system. Eli's work carried out across industries revealed that capacity expansion through investment can be postponed for a long time with extremely beneficial consequences, if an organization manages its operations by managing constraints.

Apart from his observation on organizations trying to be enamoured by CAPEX expenses, Eli stated that organizations undertake try to run after every new techniques and tools to improve their systems everywhere, rolling out multiyear improvement programs, only to see very little benefit. He suggested that organizations need not attempt to roll out different techniques like Lean, Six Sigma, TPM etc., all across the organization and exhaust their scarce resources. Rather, they should let the constraint indicate, which technique to be used where, so that the capacity of the organization can be increased in a focused way, quickly with minimum effort.

Thus, he proposed a focusing methodology called **five focusing steps** to place an organization on the path of managing by constraints, (The TOC Way).

Step 1. Identify the System's Constraint.

Step 2. Decide how to Exploit the System's Constraint.

Step 3. Subordinate everything else to the above Decision.

Step 4. Elevate the System's Constraint.

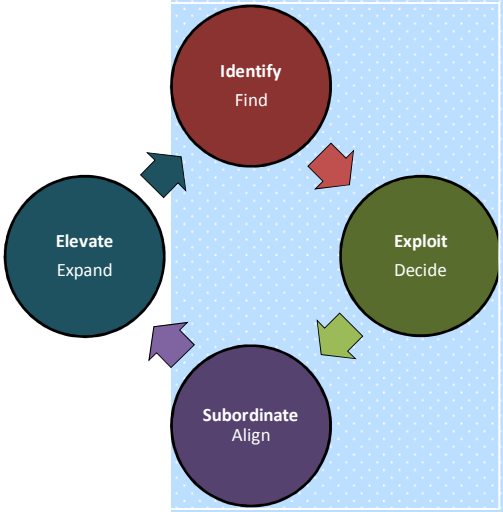
Step 5. If a Constraint is broken, go back to Step 1. But don't allow inertia to become a Constraint.

Enshrined in these five focusing steps is a process of ongoing improvement (Step-5), that helps managers in identifying the weakest link in the system (Step-1), taking the right decision to improve the link (Step-2), formulate the right policies to align and synchronize the organization to get maximum benefits from the system Constraint (Step-3) and sufficient time to add capacity (Step-4).

Conclusion

Why are these five focusing steps so important? It is important because they drive the organization to reveal capacity of the entire system quickly, with minimum cost and without diluting management attention. It allows management to focus on those vital few things that determine growth of the organization and provides a process of improvement that give rapid results.

When the Principles of Flow are followed, it helps in aligning the complete operations to the market demand and develops a culture (long term factor) to achieve ongoing sustainable growth, which is important for the competitiveness in today's ever-changing business environment. Although, the focus is on Flow (which indeed is objective of operations), the methodology helps in improving cost, quality and flexibility of the system, all together.

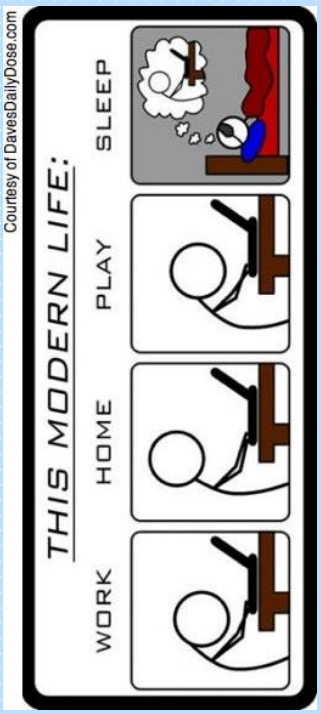


That is why it is said, all parameters must improve, but it is not necessary that we must improve all. Having a focused way of ***improving one parameter, allows the process to 'tag along' other parameters to improve.***

Have you ever seen such a mega-dosa!

TOON

Of the Month



TICKLERS

ONLY ONE MOVE

A 10-year-old boy decided to study judo despite the fact that he had lost his left arm in a devastating car accident.

The boy began lessons with an old Japanese judo master. The boy was doing well, so he couldn't understand why, after three months of training the master had taught him only one move.

"Sensei," (Teacher in Japanese) the boy finally said, "Shouldn't I be learning more moves?" "This is the only move you know, but this is the only move you'll ever need to know," the sensei replied.

Not quite understanding, but believing in his teacher, the boy kept training. Several months later, the sensei took the boy to his first tournament.

Surprising himself, the boy easily won his first two matches. The third match proved to be more difficult, but after some time, his opponent became impatient and charged; the boy deftly used his one move to win the match. Still amazed by his success, the boy was now in the finals.

This time, his opponent was bigger, stronger, and more experienced. For a while, the boy appeared to be overmatched. Concerned that the boy might get hurt, the referee called a time-out.

He was about to stop the match when the sensei intervened. "No," the sensei insisted, "Let him continue." Soon after the match resumed, his opponent made a critical mistake: he dropped his guard. Instantly, the boy used his move to pin him. The boy had won the match and the tournament.

He was the champion. On the way home, the boy and sensei reviewed every move in each and every match. Then the boy summoned the courage to ask what was really on his mind.

"Sensei, how did I win the tournament with only one move?"

"You won for two reasons," the sensei answered. "First, you've almost mastered one of the most difficult throws in all of judo. And second, the only known defense for that move is for your opponent to grab your left arm."

The boy's biggest weakness had become his biggest strength.

A QUESTION OF EXERCISE

If walking and cycling is good for your health… The postman would be immortal.

A whale swims all day, only eats fish, and drinks water… And is still fat.

A rabbit runs and hops… And only lives 15 years.

But a tortoise doesn't run and does nothing - yet it lives for 150 years.

And you tell me to exercise??

TEASER

This month's Question:

Use a very sensitive balance to weigh an hourglass when all the sand is in the lower bulb, and again at the moment the hourglass is turned over. You will notice that the two weights are different. Why? Which one of the two weights will be higher?

Last month's Question:

We know that below a temperature of approximately 4° C, water begins to expand before freezing to ice at 0° C. Why is this fact important for the fish in a pond?

And The Answer is …..

Most liquids have a quite simple behaviour when they are cooled (at a fixed pressure): they shrink. The liquid contracts as it is cooled; because the molecules are moving slower, they are less able to overcome the attractive intermolecular forces drawing them closer to each other. When the freezing temperature is reached liquid solidifies, which causes it to contract some more because crystalline solids are usually tightly packed.

Water is one of the few exceptions to this behaviour. When liquid water is cooled, it contracts like one would expect until a temperature of approximately 4 degrees Celsius is reached. After that, it expands slightly until it reaches the freezing point, and then when it freezes **it expands by approximately 9% resulting in ice being lesser in density than surrounding water**. So, frozen ice floats on the top of a pond, leaving the fish to live peacefully underneath in water that **is insulated by the top layer of ice**, preventing any further solidification.

TEA TIME

BOOKS

THE TOC WAY

Building Manufacturing Competitiveness

Shridhar Lolla PhD

During the last two decades, Indian economy saw a significant growth, and it is a well established fact that the growth was largely driven by the high skill Service sector, at the neglect of Manufacturing and Agriculture sectors.

It has also become clear that the only way India can give its vast population a higher quality of life and a sustained GDP growth is by increasing its Manufacturing GDP dramatically. Hence, Manufacturing sector has become the Bottleneck for the complete economy. (Remember, a bottleneck decides the flow of liquid out of the bottle, similarly, for today's Indian Economy, Manufacturing decides its growth).

In his new book "**Building Manufacturing Competitiveness – The TOC Way**," **Shridhar Lolla** talks about the initiatives of NMCC to increase the share of manufacturing sector to Indian GDP. There is a lot of stress on Indian MSMEs adopting Lean practices in a serious way.

According to Shridhar, the main difficulty is the confusion prevailing in the minds of industrialists about where to start, what kinds of investments are required, and whether it is worth it. Various Lean techniques and tools of continuous improvement have been used successfully in several organizations. However, for an organization that begins its journey of Manufacturing Excellence, such a mind boggling number of tools and techniques available across disciplines, becomes over whelming.

Then he talks about Theory of Constraints (TOC),

Given that the major constraint to improvement was the resistance to changing the performance measures, **Eli Goldratt** (1994) developed a set of tools known as **Thinking Process (TP)** that enable people to tackle organizational behavior or policy constraints. The Drum-Buffer-Rope (DBR) scheduling system, together with the five-step focusing process for continuous improvement.

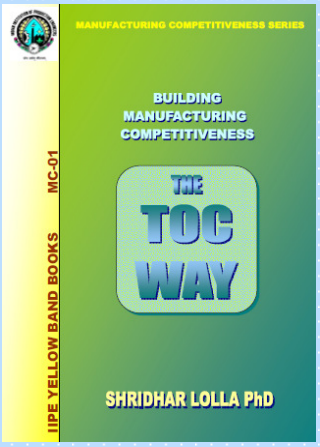
The **Theory of Constraints** (TOC) is a management philosophy focusing on continuous improvement process. The central idea of TOC lies in the identification and exploitation of the system constraint in improving a system. **TOC is based on the assumption that the performance of a system is determined by the system constraint, which is anything that blocks the system from accomplishing its stated goal,** or in achieving a higher level of performance with respect to this goal. As the first step in improving a system, managers need to determine what constrains the system from reaching its goal.

Constraints can be physical or nonphysical. When the constraints are physical, such as resources, raw materials, or supplies, they can be relatively easily identified by undertaking a capacity analysis.

Then, Shridhar explains how simple it is to apply the process of TOC. The improvement process focuses on three questions: ***What to change? What to change to? How to cause change?*** These three questions must be answered in sequence to make the improvement process effective. As you read on, you get the impression how we missed the art of simple thinking.

As a matter of fact, the improvement in performance of a manufacturing system, comprising a number of interconnected subsystems, at any time is dictated **not by each and every subsystem, rather by one or just a few**. What it means in real life situations is that a system can be improved at a given time, **by influencing performance of just a few blocks** and it is futile to improve all the building blocks of the system.

We can say that TOC is the first step towards a Lean journey.



Building Manufacturing Competitiveness – The TOC Way

Author: Shridhar Lolla PhD

Published by: *IIPE Yellow Band Books*
Date: *June 2012*
Pages: *72 Paperback*
Price: *Rs. 125.00*

4 or more copies at 20% discount + postage free

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Edited and Published by R. Chandrasekar on behalf of the Indian Institution of Production Engineers, 16, Park Road, Bangalore 560051, and Printed by P. Rangarajan, Director, Grafiprint (P) Ltd, at W.Q.Judge Press, 97, Residency Road, Bangalore 560025

To

IIPE MANUFACTURING NEWS
If undelivered return to -
Indian Institution of Production Engineers
16, Park Road, Tasker Town, Bangalore 560 051
RNI Regn. No. *KARENG/2005/14740*
Postal Regn. No *KA/BGGPO/2509/11-13*
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Posted at GPO Bangalore, on the 25th of every month