A system approach to manufacturing

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What should be the ideal strategies to survive, succeed and achieve competitive excellence in today's volatile global economy?

First of all, there is a need to understand "what is global economy?" and "why it is volatile?" The economy has been "global" for a long period of time. The "global economy" that we speak of today has two features: ability to deploy the capital across the globe – global capitalism - and ability to transport information across the globe at the speed of electrons, i.e. digital technology enabled business processes and global logistics. These two enablers and their effectiveness are further conditioned by national economic policies as per the individual interests of different countries. Also, as the developing nations become emerging economies, outsourcing & offshoring are growing. It is the combined effect of all these we call as the global economy.

In this context, anyone – any company, organisation or individual – is rewarded the highest for his outputs, if these outputs are unique and better than that available anywhere across the globe. Conversely, if the output is not unique and hence available from anyone else, then its value (price or cost) that is acceptable will be the lowest price or lowest cost at which it can be acquired from anywhere across the globe! This constant need to swim against the current (to reach the highest and unique added value output) or be swept away to the lowest cost point, is what we perceive as the "volatility" in the global economy. Increasingly, there is little or no opportunity today to rest, relax and bask in the glory of yesterday.

Hence, to survive and succeed in the global economy we need to understand and keep this big picture in mind constantly. Then we need to exploit resources available across the globe to create and implement a constant stream of new high value addition solutions. This should be in parallel to creating means and mechanisms to exploit a few such solutions at the largest possible volumes. Everyone and at every level of a company or organisation needs to adapt to this bi-modal strategy.

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What is the "Systems Thinking of the Manufacturing Processes"?

There is a tendency to treat manufacturing processes as a collection of "Black Boxes". There is also a tendency to treat manufacturing as a collection of tasks, random (statistical) events and as parts of a jig-saw puzzle. Every manufacturing process is an "input/transformation/output" system. Such comprehensive view and treatment of every manufacturing process is what we call as the "System Approach".

In the System Approach, every manufacturing process has four clearly defined input categories: (A) investment / capital equipment / machine tool; (B) expenses / variable cost resources / consumables; (C) need / work being processed / job or part; (D) constraints / process specifications / operational parameters.

Organised and orderly effort to bring these inputs together, to deploy the transformation (science behind the process) leading to the outputs we seek is the "engineering" behind the process.

The outputs themselves can be technical specification or their outcome, i.e. the economic benefits. Distinction between these outputs (technical vs economic) and ability to deliver both as required is called the "management" of the process.

"System Thinking" for manufacturing processes implies an ability to focus simultaneously on the science, engineering and management aspects pertaining to that process. This in turn leads to large scale improvements to the process outputs. This is a parallel and an alternative methodology to the current approaches to treat manufacturing processes as statistical events. The system thinking emphasises on focusing on the big picture, as a whole and see the patterns through science, engineering, management, instead of our mere focus on the tasks or on the pixels. It is also rooted in the axiom that the "whole is larger than mere sum of its parts".

Tell us more about your program with IMTMA to train manufacturing professionals at all levels?

STIMS Institute conducted a successful week-long workshop on "The System Approach for Precision Components Manufacturing – Grinding Processes" in May 2012. This is part of a series of such workshops planned, organised and executed under the auspices of the IMTMA. The System Approach framework was used in this workshop. The workshop included classroom lectures and laboratory style experiments. Manufacturing process equipment fitted with diagnostic tools and software solutions were used. The students collected and analysed the data obtained during the grinding process. They were required to make presentation in groups on the lessons learned and how they will apply for their specific situations. About thirty manufacturing professionals – senior engineers and managers – attended this workshop. The idea is to bring together the knowledge available from all sources – from the suppliers, academic resources, from inside the company (from the engineering department as well as the production floor) and also from the suppliers – such that the students get a comprehensive understanding of the process and the science, engineering and management aspects pertinent to the process. As a result, the students can zoom into the technical details and also zoom out and focus on the strategic and management issues as required. This course was conducted with support from IIT–Chennai, IMTMA and Micromatic Grinding Technology Ltd. It is planned to conduct this course once a year in the future.

Can you brief us on your proposed manufacturing eco-system – an approach that can create synergy from all sectors, much needed for a sustainable growth in the manufacturing industry?

The "System Approach" requires that we begin to recognise that every process is enabled by certain "transformation" or phenomena. This may be surface generation phenomena (such as cutting, grinding, lapping, CMP, etc) or deformation processes (such as forming, forging, extrusion, stamping, etc) or additive processes (such as welding, soldering, sintering,

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casting, etc), and so on.

For each of these processes, we have suppliers of machine tools, cutting tools or consumables suppliers, blanks or components suppliers, tooling and gaging suppliers, automation companies, and many more. Hence, for every process used in manufacturing, we have scores of companies that depend on that process for their business. Then there are manufacturers (users of the process), their customers, etc. There is another way to look at manufacturing as well. For example, steel billet are cut to blank stock, ground to bearing components, bearings are manufactured, which are assembled in an engine, which is assembled into a car, which we drive. Hence, the quality of ride we experience, reliability of the car and fuel economy are all influenced by the many manufacturing processes such as the grinding process that went into the manufacture of the bearing and its components. You can already imagine scores of suppliers and many other companies and ultimately the consumer – everyone – is connected by the same transformation or phenomena in the grinding process, in our above example. All these participants are intimately connected and hence influenced by the science, engineering and management (the technology) of the grinding process.

But, the phenomena that are exploited when all these suppliers products are brought together – the enabler of what we seek at the end – is often left as an orphan or a black box. Instead, it is possible to deliberately focus on the science, engineering and management - the technology - aspects pertaining to the common phenomena that connects so many companies and across the industry. Better strength and capabilities related to that technology brings all these companies into a common fold – as a mutually dependent eco-system - for their collective success. Through the exploitation of the specific technology of interest to all of them, they can achieve sustainable and synergistic long-term growth with this manufacturing eco-system approach.

How to set up a suitable supply chain eco-system and acquire capabilities for machine tool components so as to make the overall production more dynamic and growth oriented?

Take for example, the castings for beds. There is a severe shortage of quality castings that limits the capabilities and growth of machine tool companies in India. Every machine tool type is unique. Hence, casting manufacturers have limited capacity and demand for the specific needs of their few customers. But, if we think more broadly, castings are "structural elements" that enable machine tools in a number of ways: working platform, frame of reference for slides and their motion, structural rigidity, stability over time and temperature variations, etc. The same requirements exist for a family of machine tools: cutting, grinding, punching, bending, laser or water jet cutting, EDM, etc. All these diverse machine tool manufacturers are connected by a common need: the machine tool bed and its properties as listed above. All these diverse set of machine tool companies can develop supplier resources to meet their common needs, even though they may not be seen as alliance partners in other circumstances. Such a consortium of manufacture/supplier and the users / machine tool companies - the eco system - can also benefit from inclusion of academic or research resources focused on the "science" pertaining to the design and production of machine tool beds. Machine tool companies can adapt such models for supplier development to meet their individual needs and for collective growth.

What should be the role of a CEO in strategy and planning towards operational excellence?

In today's world of globalisation, outsourcing, offshoring, the operational strategy of a CEO, particularly in the manufacturing sector, can no longer be only focused on cost reduction and increase volume at all cost. Instead, this strategy has to be judiciously supplemented and/or balanced with strategies for integration of technical skills, knowledge and resources from across the globe to deliver very high value-added solutions (where the cost tolerance will be very high commensurate with the unique added value delivered). □

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