



Manufacturing in the 21st Century:

- Labor intensive Vs. Skill Intensive
- “Science” and “System Thinking”
- Their impact on:
Total Cost, Quality and Productivity

Higher Productivity and Lower Total Cost in Manufacturing Operations

(An evening of Interaction and Dialogue with CEOs and Senior Executives)

21st Nov.2014
from 5:30 PM to 8 PM

Venue
Hotel Blue Diamond
(Taj Vivanta), Pune

**Dr. K. (Subbu) Subramanian,
President, STIMS Institute Inc., USA**

(Science based Technology, Innovation and Management Solutions)

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Fulfilling the promise of India's manufacturing sector

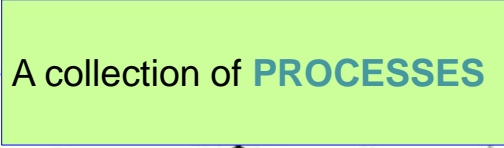
- *India's manufacturing sector could grow six fold by 2025, to \$1 trillion, while creating up to 90 million domestic jobs.*
- *For an average company, the potential productivity improvements represent about 7% increase returns on sales.*
- India's manufacturers must also improve the productivity of their capital, in some cases by 50 percent or more.
- While such improvements are challenging, they are possible if companies set bold targets and adopt an “owner–entrepreneur” mind-set

https://www.mckinseyquarterly.com/Operations/Performance/Fulfilling_the_promise_of_Indias_manufacturing_sector_2943#top

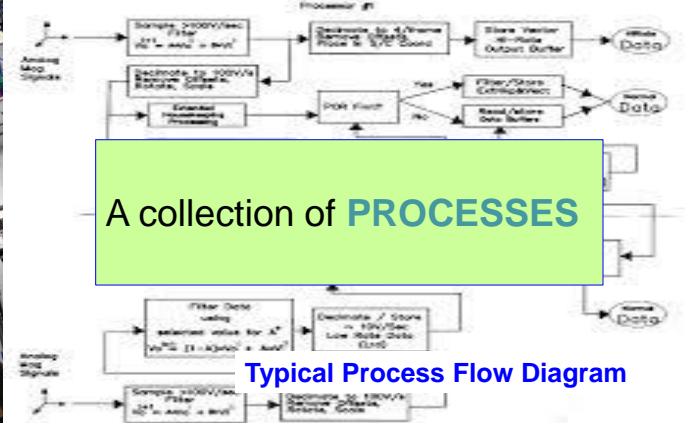
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What is Manufacturing?



A collection of **PROCESSES**



Typical Process Flow Diagram

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Manufacturing: A collection of Physical and Service Processes

Physical processes:
 e.g. Casting, forging, grinding, machining, etc.
 where energy is applied for physical change of work material



Chemical Mechanical
 Electrical Thermal

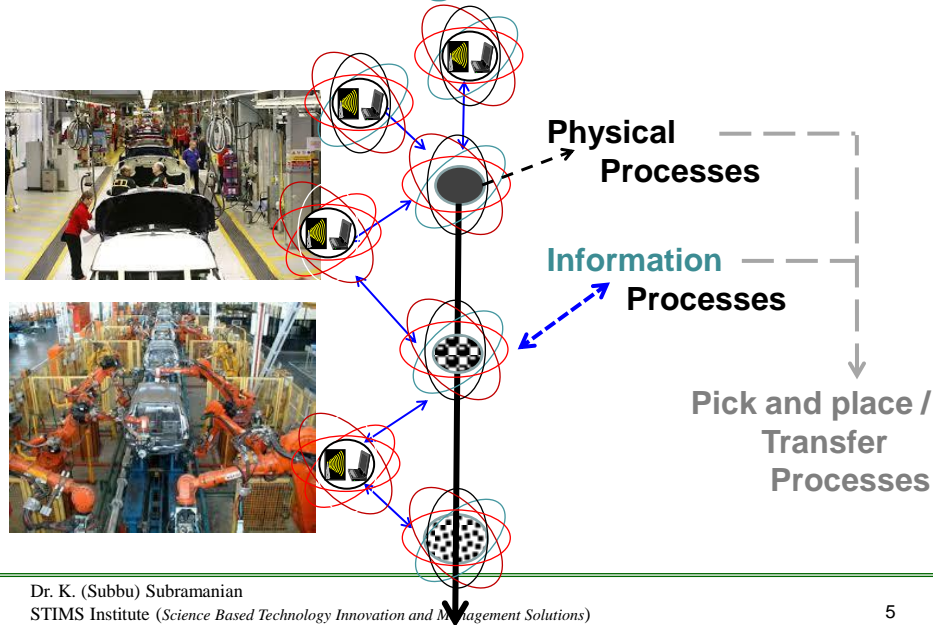


Service Processes

- e.g. Engineering, order entry, customer service, inventory, production planning, etc.
- Where information, Pick and Place and transfer/logistics play a crucial role.

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Manufacturing: Process Flow



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Manufacturing: Knowledge/Skill Intensive Vs. Labor Intensive ?

Physical Processes


- Process Knowledge;
- Diagnostics;
- Data and Analysis

Information Processes

- IT;
- Data base;
- Big data; Analytics

Pick and place / Transfer

- CNC, Robots;
- AGV, Drones

Knowledge/ Know - how	IT Know-how/ Platforms / Systems	Labor Skills
Licensed / Reverse Engineered Process Science 	Customized Modules and Process Data	<u>System Thinkers;</u> <u>Solution Providers</u>
Licensed (together With Physical Processes)	Generic; Outsourced SAP,	White collar workers Out sourced. Out sourced IT with <u>in-house data &</u> <u>Process Knowledge</u>
Skilled Labor		Low Cost Labor (Direct Labor) <u>System Thinkers;</u> <u>Solution Providers</u>

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System Thinking:

- **Focus on the big picture, and not merely on the pixels!**
- **Awareness:**
 - Comprehensive knowledge of the problem or opportunity.
- **Analysis:**
 - Relentless drive to ask “Why?” and find the answers
- **Synthesis:**
 - Ask “Why not?” and create a new solution.

Solution:

- **Every Solution is an Input/Transformation/Output system**
- **Every new manufacturing solution has to result in**
 - **New Product**
 - **New Process**
 - **New Application /USE.**

Process Science:

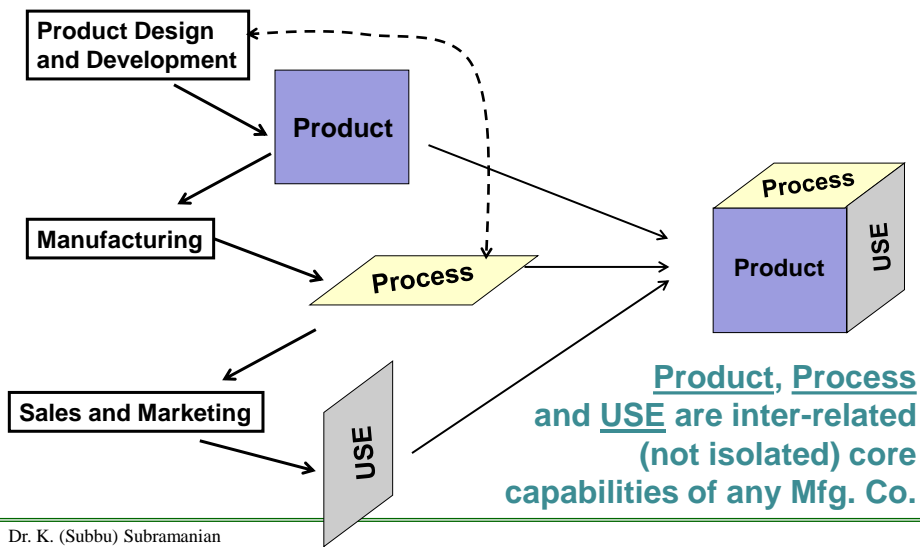
- **Knowledge of the Transformation and its use.**

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What is MANUFACTURING?

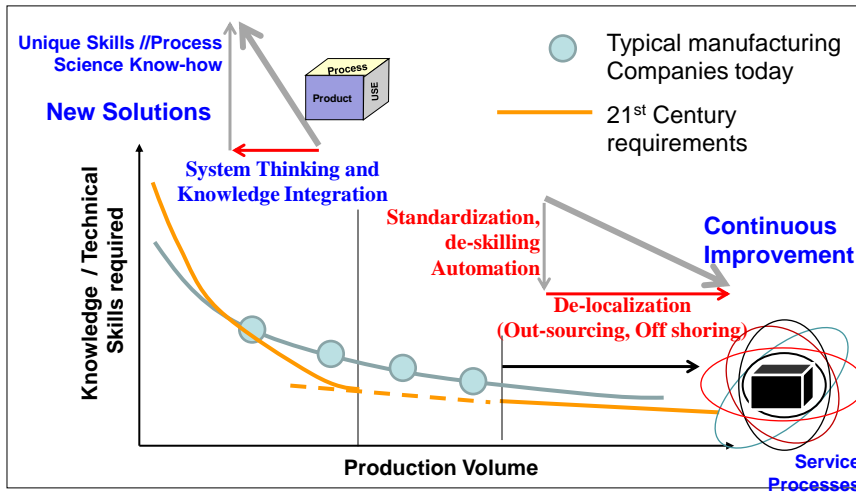
REPEAT the **PROCESSES** to achieve the **PRODUCT** at the right quantity, time and place that meet the End **USER** needs.



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To be a leader in your business : You need a constant stream of “new Solutions”

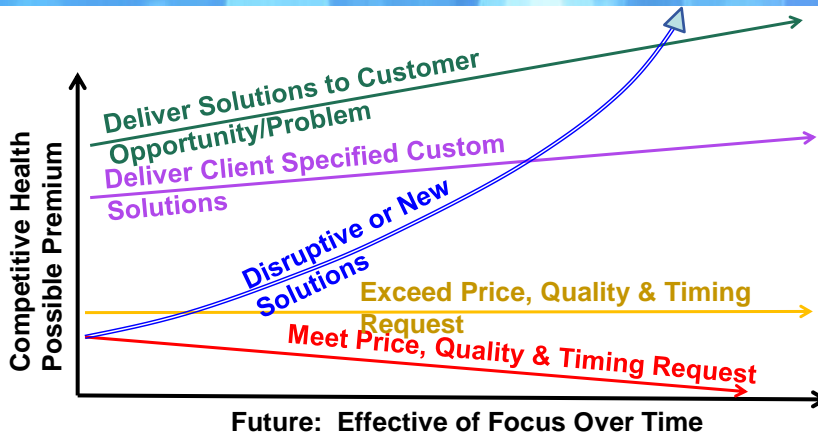


Source: <http://stimsinstitute.com/2013/07/17/learn-to-swim-against-the-tide-of-binary-economy/>

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The Innovation Audit – What’s In Your Future?



Source: MassMEP - <http://massmep.org/innovative-growth-solutions/enterprise-strategy-transformation/>

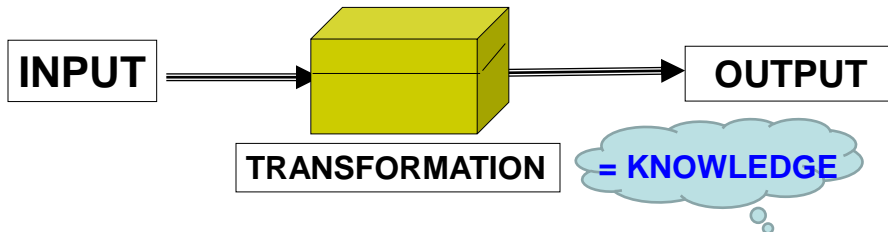
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What is a Solution?

Solution:

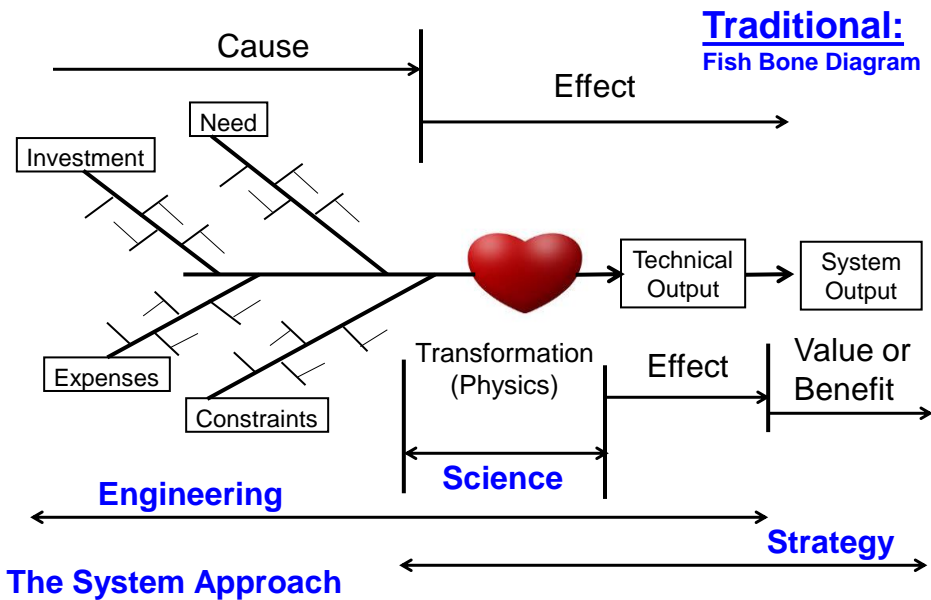
“input/transformation/output” System,
leading to added value with reward for such value addition!



**Solution: KNOWLEDGE and its USE!
 SYSTEM THINKING.**

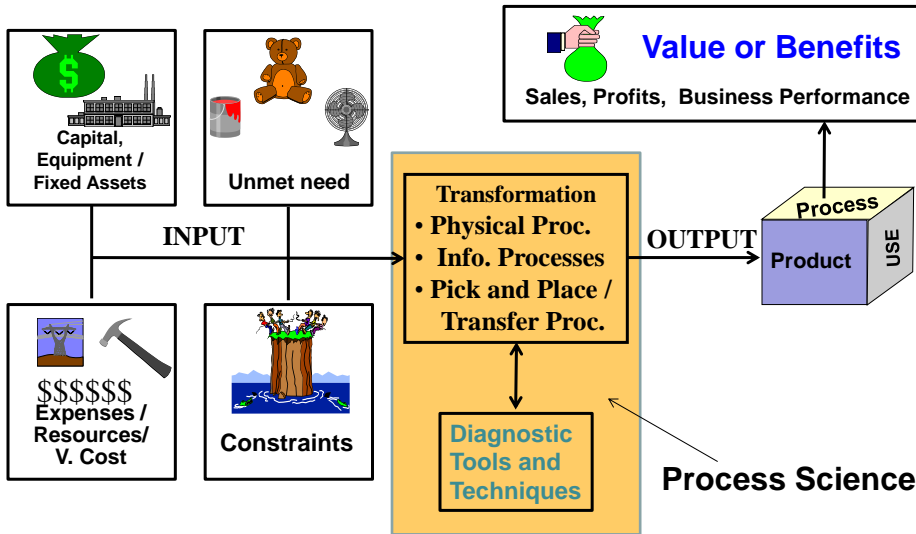


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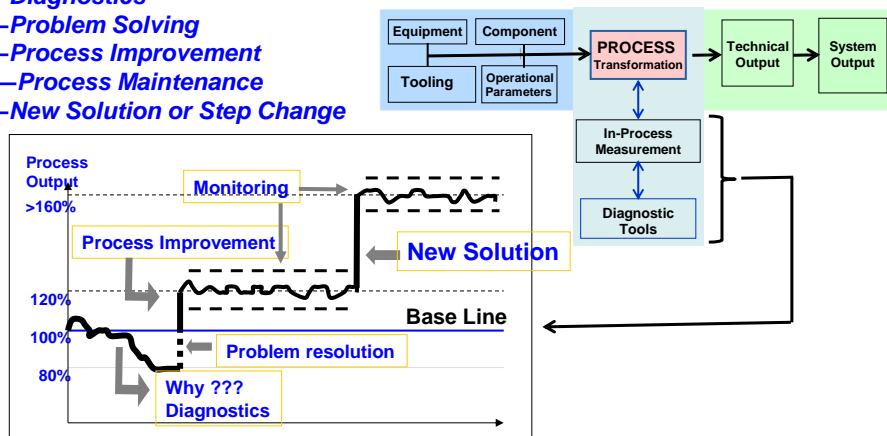
Production Unit, viewed as a System



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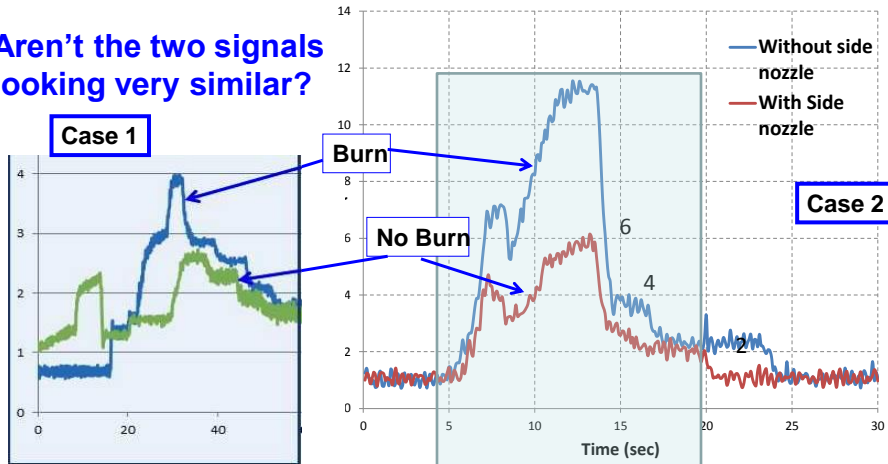
Progressive Impact of “Process Science” backed up by Diagnostic Tools

- Diagnostics
- Problem Solving
- Process Improvement
- Process Maintenance
- New Solution or Step Change

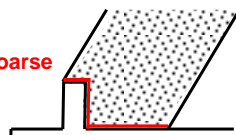


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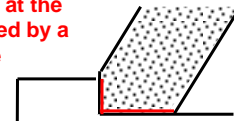
Aren't the two signals looking very similar?



Grinding Burn at the Shoulder solved by coarse dressing the wheel

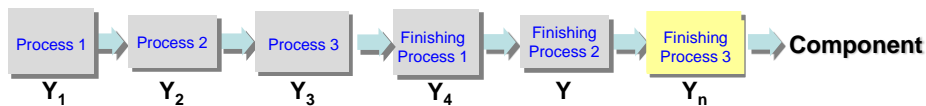


Grinding Burn at the Shoulder solved by a second nozzle



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Manufacturing Axioms - to reduce Total Cost:



Whenever Possible

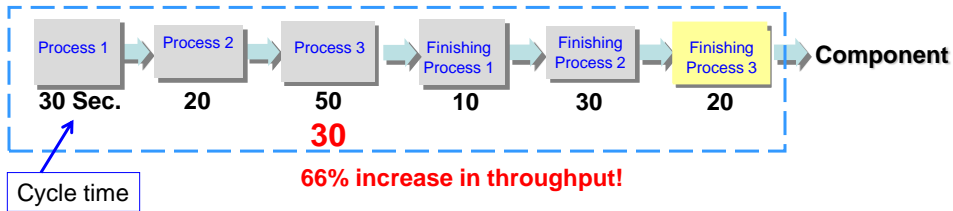
- A. Do everything Necessary to make the last operation the most efficient and Highest Yield Operation in the entire Manufacturing Line !!
- B. Constantly add value through the last operation leading to New Products and Applications / USE.

The above is true for all customers in **established markets** or **products**.
(e.g.): Automotive, Aerospace, MRO, Tool Production, Bearings,

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Manufacturing Axioms - to improve productivity or throughput:



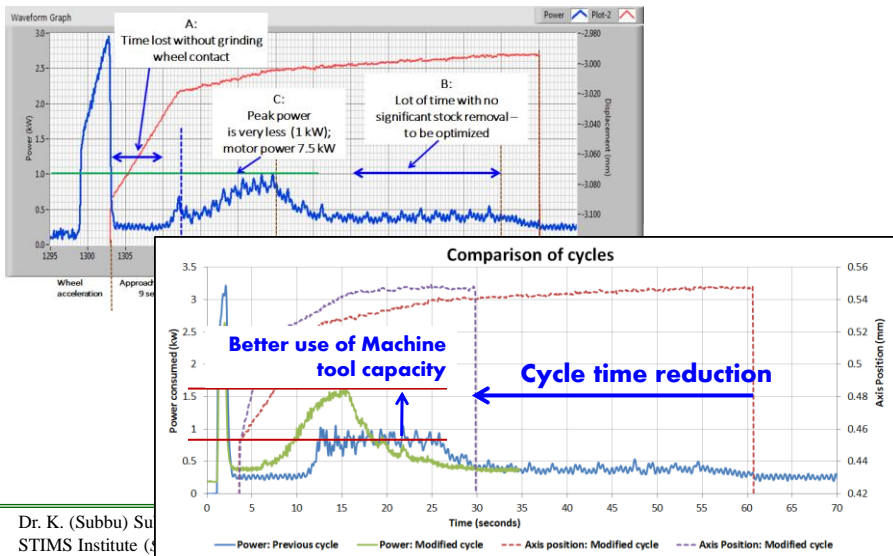
C. Constantly attack the BOTTLE NECK operation of the Manufacturing Line using System Thinking, process data and science that reflects the “Transformation” and its analysis.

The above is true for all customers in **established markets** or **products**.
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Process Diagnostics and System Thinking used to reduce cycle time in bottle neck operation: 40% increase in production line through put.

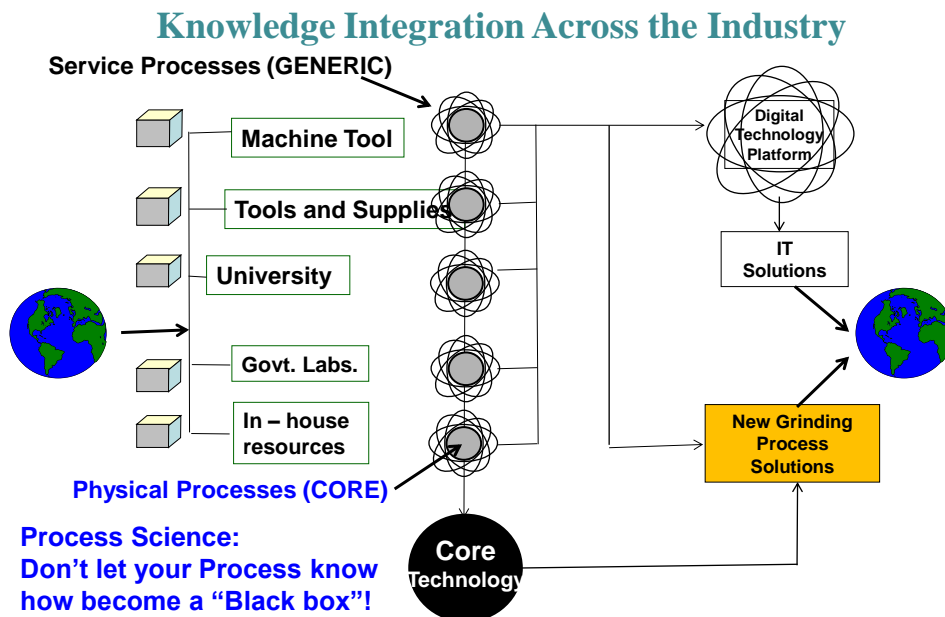


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For Disruptive Innovation: What are the resources available to you?

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Grinding Process Solutions

(MGTL - STIMS / GPS)

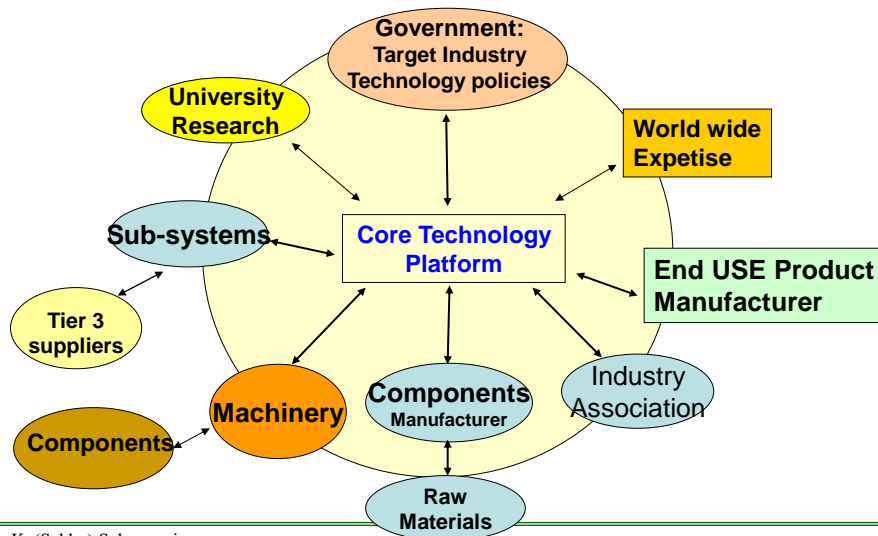
Diagnostics



Benefits


- **Factory:** Total cost, quality, productivity; eliminate "Fire – fighting"; safety
- **Plant / Operations:** Use assets and suppliers better, "Design and manufacture"; more capacity; New Capability.
- **CEO or MD:** Better ROI, Compete with global players, Next Generation Manufacturing.

Eco System Development: Your resources



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SKILL DEVELOPMENT



System Approach for Precision Components Manufacturing: Grinding processes

- 2012 -- Bangalore
- 2013 -- Ghaziabad, UP
- 2014 -- Pune

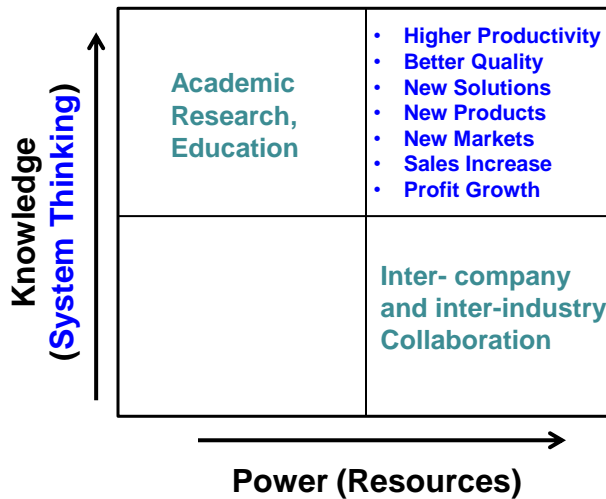
IMTMA, MGTL, End users, GNO, Zeiss

Collaborative Research at IIT – Chennai, MGTL, AMTTF, End users

System Approach for Engineers – Optional course Offered at Thyagaraja College of Engineering / TVS @ Madurai

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Knowledge Integration : Using the power together with Knowledge.



Manufacturing Companies - Growth Opportunities

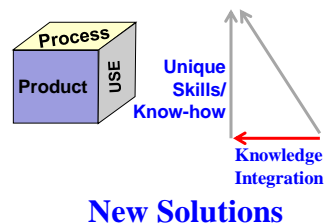
Replication Solutions (Traditional)	New Solutions – which depend heavily on the knowledge integration and skilled workers			
	Product	Process	IT	Use
Cost Reduction and Continuous Improvement in solutions already in place: --- Lean --- Six Sigma --- Supply Chain Solutions	- Re – Design	Re-design & Innovate to: - Reduce Cost - Better Quality - New Capability	Leverage data from SAP, ERP, etc. (large Data and Analytics)	--- New Customers --- Add value to current customers
	-- Granular Growth in adjacencies	Leverage core capabilities for New Product / Process Solutions		CNC, Robot Integration
		Radical cost reduction for Current customers and markets		Application Services for New Revenue Stream
	Leverage all core capabilities for New Product / Process / Applications Solutions			
	Eco – system solutions that combine many companies to focus on an industry-wide “Solution” offering to end customers			

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Summary:

- **Manufacturing: A collection of:**
 - Physical Processes
 - Information Processes
 - Transfer / logistics Processes
- **Physical processes determine your core outputs: Products. Processes, Application / USE.**
- **Next Generation Manufacturing**
 ≠ Continuous Improvement alone;
 = Disruptive Innovation for New Solutions.



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Summary:

- **Disruptive Innovation in manufacturing will occur through “New Solutions” enabled by**
 - **Process Science**
 - **Knowledge Integration through**
 - **System Thinking and Diagnostics**
 - **Data and its analysis (Science driven analytics)**
 - **Custom IT together with Process Science**
 - **Automation (CNC, Robotics, Drones, ...). This will pose a challenge to the economics of low cost labor.**
- **Mfg. Axioms to reduce total cost, improve Quality and Productivity:**
 - A. Modify all other operations in the line, to make the last operation the most productive and highest yield operation.**
 - B. Constantly add “value” through the last operation**
 - C. Constantly attack the bottle neck operations using Process Science, Diagnostic tools and analysis.**

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Thank You!

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