Keynote Speech
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The Future of Industrial Engineering in Business…..Speed, Innovation and Creativity

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Industrial Engineering and Operations Management

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Industrial Engineering the Heart and Soul of Progress

The industrial revolution began with the spinning jenny and the steam engine and this led to free trade and an exponential growth in productivity, standards of living and improved health and wellbeing

We are ready for the next wave but it requires strategic thinking and improved human relationships

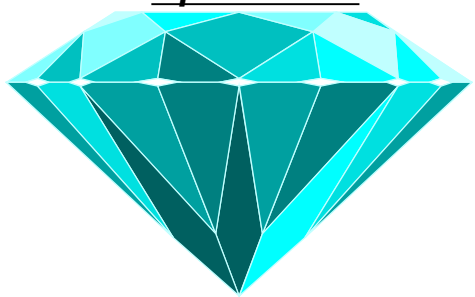
Strategic Thinking

- is not rearranging the deck chairs on the Titanic.
- is intuitive, visionary, requiring a leap into the unknown.
- Requires leadership, focus, positive thinking, process knowledge, creativity, continuous improvement

The New Business Approach
Real Time Data

Strategic Thinking…….

<u>Operational Management (Strategic & Operational</u>



Logic and Imagination

- *"Logic takes you from A to B, imagination takes you anywhere"*
- *"Ask not what your country can do for you, ask what you can do for your country"*
- *"I have a dream"*
- *"I have nothing to offer but blood toil tears and sweat"*
- *"I believe this nation should commit itself, before the decade is out, to landing a man on the moon and returning him safely to earth"*

Honda's ASIMO

Eratosthenes born 276 BC

Measured the circumference of the earth at approx 40,000 km with a stick!

Cycle Time Reduction, 2.4%, Profit up 80%

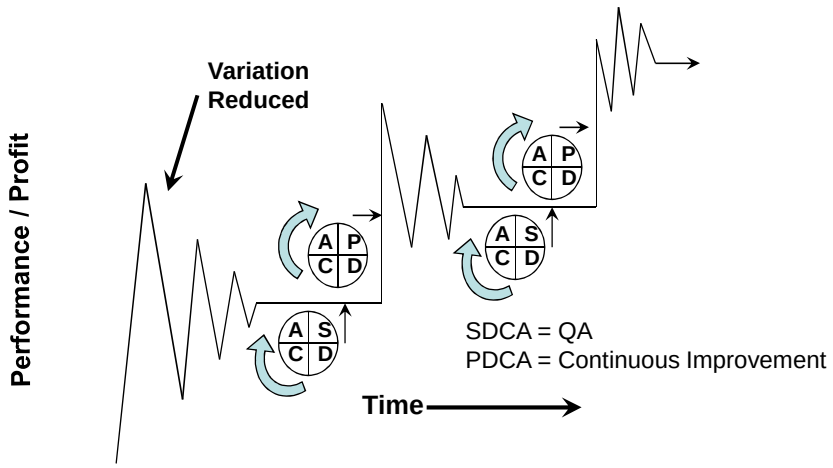
Power of Cycle Time Reduction

Sales	100	106
Raw materials	40	42
Labour	20	20
GM	40	44
Exp	35	35
NPBT	5	9
Cycle Time days	42	
New CT	41	41
Prod Inc		2
Sales Factor		3

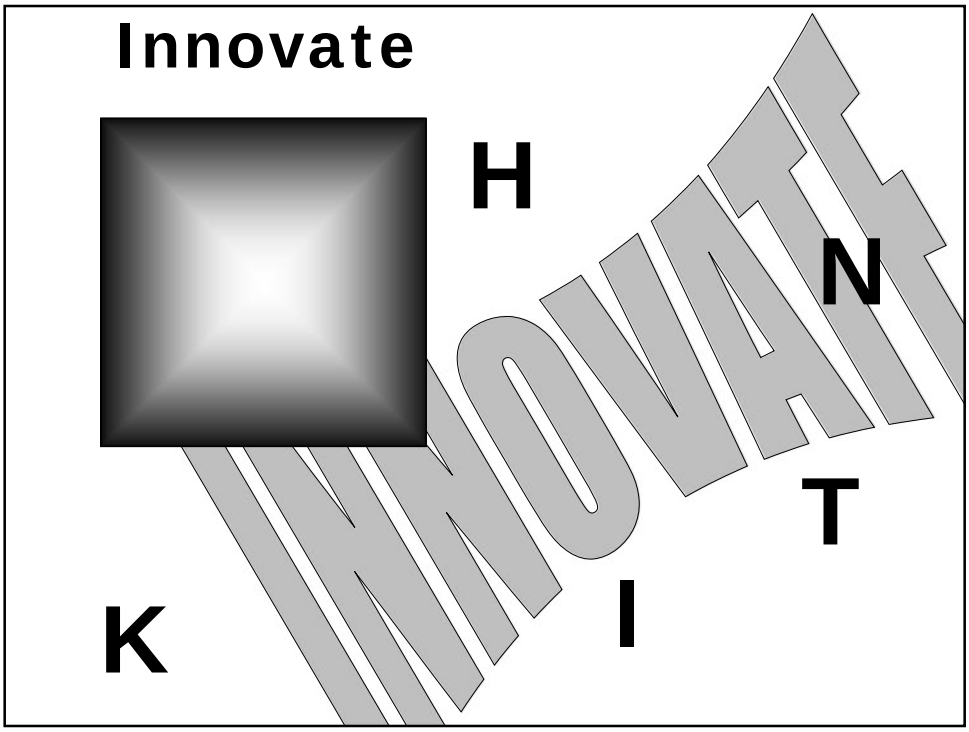
The Limitations are Human

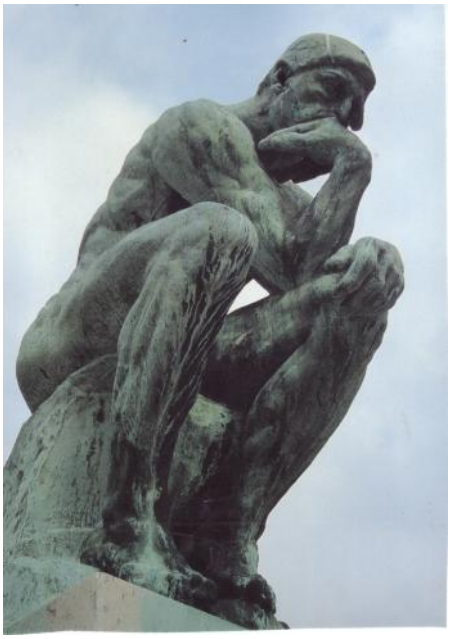
- "the idea is there locked inside, all I have to do is remove the excess Stone…..Michelangelo
- "Computers in the future will weigh no more than 1.5tonnes"….Popular Mechanics 1949
- "it is impossible for anything heavier than air to fly"…The Royal Society London 1895
- "640k should be enough"….Bill Gates 1981
- "I think there will be world market for 5 computers" ….
- Tomas Watson CEO IBM 1943

Profit from Innovation



Innovate





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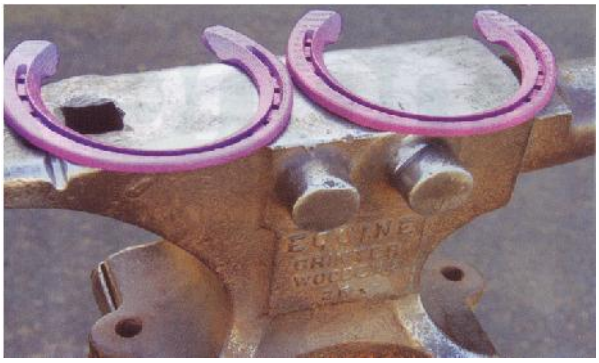
3 D Printing Titanium Horse Shoes Custom built on the spot at the Race Track



Japan R&D Product and Process

Comparison of Research Expenditures Between G8 Countries

Rank	Country	% of GDP	Research expenditures (100M USD)	FY
1	**Japan**	3.67	1,626	2011
2	United States	2.90	4,016	2009
3	Germany	2.82	863	2010
4	France	2.25	500	2010
5	United Kingdom	1.76	391	2010
6	Canada	1.74	243	2011
7	Italy	1.26	243	2010
8	Russian Federation	1.16	328	2010

Demand = Supply

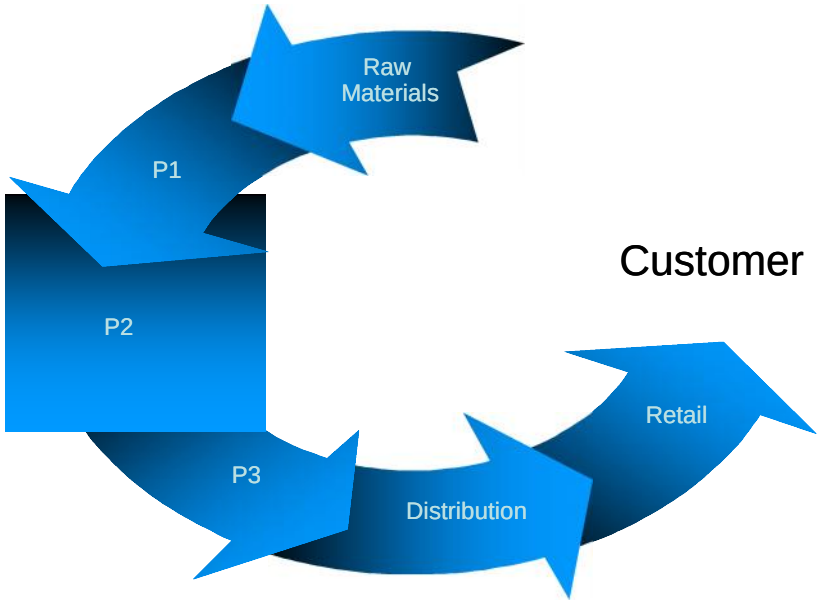
1. Match production rate to sales rate
2. Ideally (Production Rate/ Sales Rate) = 1
3. Sometimes called Takt Time
4. Work in Process(WIP) inventory minimised.
5. No overproduction Productivity maximised.
6. Low Finished goods inventory
7. Low Raw Materials Inventory
8. Focus on Quality, Delivery on Time,
9. Aim to match production lead time and customer expected Lead Time (LP = LE)
10. Continuously reduce cycle time

The Basic Manufacturing Equation

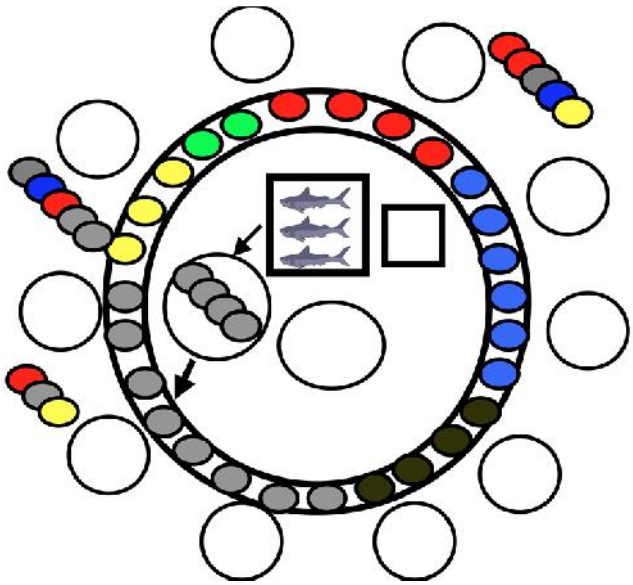
Aim for P = D at 100%
On Time Deliveries At the
Correct Quality Level
with VELOCITY

P = Production Lead Time
D = Acceptable Demand Lead Time
If P>D then MTS at EPR
If P<D then MTO no stock

Flow



Sushi Bar



26 Rules for Velocity and 22 Ideas for Creativity

Creativity can be innate but it can be taught

Velocity in Business is the result of the continuous elimination of Non value added steps in the process and system

26 Rules for Velocity

People (1 to 3)

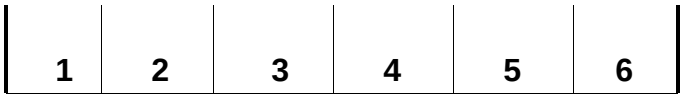
Integration (4 to 9)

Planning (10 to 16)

Operations (17 to 26)

Value Added

PROCESS PARTS (6)



1 - Setup(Preparation)
2 - Run(The Value Added Step)
3 - Maintenance (Preventive)
4 - Breakdown(Errors & rework)
5 - Idle(available to run but not utilised
6 - Cleanup

VA = 2,(3)? = Run + Preventive Maintenance

Eliminate • Breakdown • Idle • Setup? (i ***SMED)***
• Cleanup ì ***Concurrent Engineering***

Simulation of Creative Flow Information and Product

Simulation Results					
		Production	Time	Err/Rew	WIP
1	Traditional Processes	3	9.6	17	18
2	Cellular Proc Interaction	7	7.6	31	30
3	Pull Batch One	14	1.9	4	6
4	Flexible Pull Batch One	22	1	3	6
	Gain Loss Percent	733%	-89%	-82%	-67%

22 Creative Ideas to Aid Innovation

1. Define the Objective
2. Summarize what is known
3. List and prioritize the parameters
4. Now think outside the square with the 22 creative ideas

- Win the Americas Cup
- A large sail area with a small wetted surface and optimum max length when heeling will lead to a faster boat if crew well trained
- Examine the 12 metre formula
- Now. How do we create a strategic advantage? ….the winged keel

Sailing Boat Innovation

Stage	**Change**
• ***Displacement Hull***	• ***V = k√L***
• ***Planing Hull***	• ***V = 2 x W plus***
• ***Foil Elevation***	• ***V = 50kn in 15 kn wind,***
	• ***V = approx 3.5 W***
• ***Next??***	• ***V = ?***

1983 Americas Cup 12 Metre Formula
Simple IE Principles led to Australia 2's success..not just speed but creativity..winged keel

$$\frac{(LWL+2(G1-G2)-F+\sqrt{SA}}{2.37} = 12$$

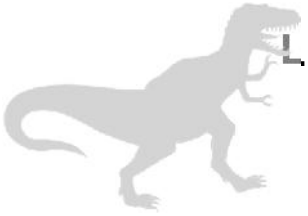
where:

LWL = Length on Waterline (m)
G1 = Surface Girth at Beam (m)
G2 = Surface Girth Side Extrapolated (m)
F = Freeboard (m)
SA = Sail Area (sq m)

Table 3: Summary of important dimensions determining the speed of Australia II and Liberty

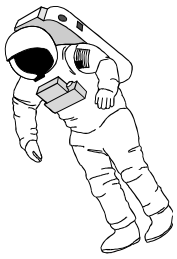
Australia II Liberty Comparison in the 1983 America's Cup				
	Liberty	Australia II	Diff%	Australia II
LOA (m)	19.3	19.6	1.53	Assist in increasing stem rake
LWL (m)	14.0	13.4	4.48	Disadvantage running
Beam (m)	3.6	3.6	0.00	Neutral
Draft (m)	2.7	2.6	3.85	Wing keel extra draft working
Weight (Tonnes)	25.2	23.8	5.87	Lighter
Sail Area (square metres)	167.2	170.0	1.65	More power

Change is Inevitable



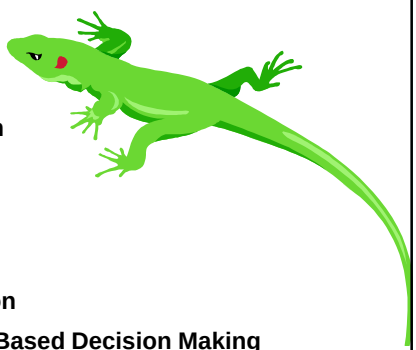
Liberal Democracies

Year	Liberal Democracies
1790	3
1850	5
1900	14
1919	25
1940	13
1960	36
1975	30
1990	61

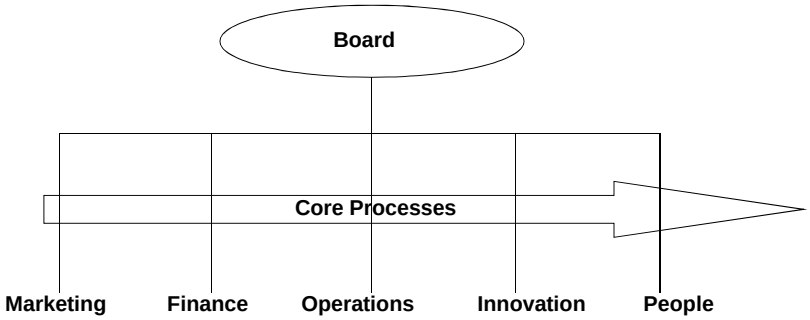


Major Elements of Change
Globalisation of Business

- Free Trade Agreements
- Asian domination
- Technological Explosion
- International Consumerism
- Brain not Labour
- Systematic Networks
- Digital Speed
- Triumph of Fact over Fiction
- Supremacy of Knowledge Based Decision Making
- Team Creativity……etc➔250



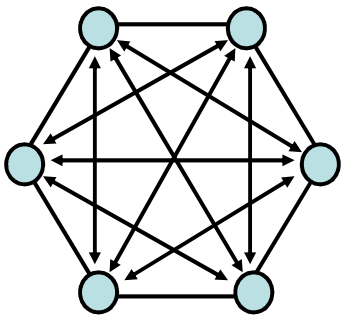
Organizations Will need to be More Flexible to be fast



- **Functional model is rigid** (The above are examples only)
- **Process model embraces all functions**

The Future ….

Competition will be among Networks, Partnerships with flexible, fast but controlled organisations, systems & processes using digital data fast and effectively and as robotically as possible Labour inequalities must be removed



The Future….Strategic Advantage

Winning in the Future will be based on:

- ***Knowledge and human skill***
- ***Control and technology***
- ***Logistics capabilities***
- ***Speed***
- ***Strategic Interpretation of Data in Real Time***

Speed and Creativity
Sensorisation and robotics

business@the speed of thought…..Bill Gates

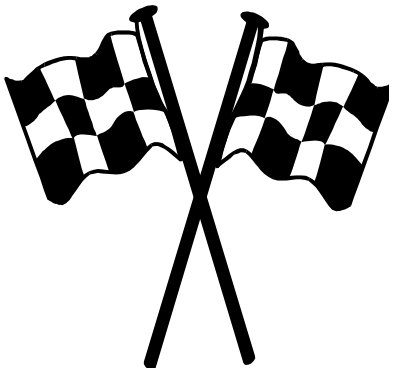
Strategic Advantage For Winning!

Ability to learn faster than the opposition

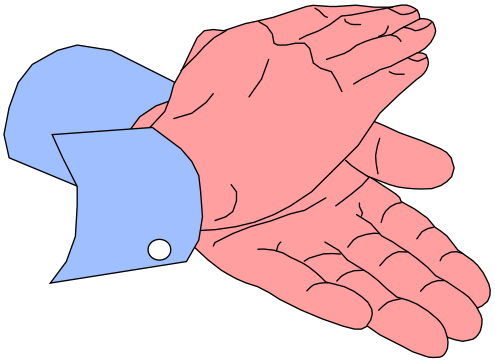
Tight control of integrated processes will lead to fast generation of o*pportunities*

Speed and Innovation

Industrial Engineering and Operations Management



The End



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