SAPICS 2008 Conference

Applying Theory of Constraints to achieve Viable Vision for Tata Steel

Bimlendra Jha
Principal Executive Office
Tata Steel

1st July 2008


TATA STEEL
TATA
Welcome to the
World of Steel

- **About Tata Group – People Before Profits**
- **About Tata Steel**
- **Viable Vision @ Tata Steel**
  - -Developing Improvement Philosophy at Tata steel
  - -VV Template for Tata Steel – What's different?
  - -Learning

Tata Group





Introduction

- India's *largest* Business Group
- Operations in over 80 countries. Exports to over 85 countries.
- Main companies in *7 business sectors*
- *Largest employer* in the private sector (289,500 employees)
- *Aggregate revenues* of US$ 28.8 bn (FY07), Profit $ 2.8 bn
- Revenues equivalent to *3.2% of India's GDP*
- *International income 38%* of group revenue
- *Total market capitalization* of US$ 69.8 bn (as on Nov 1st, 2007)

Our purpose in Tata is to improve quality of life of the communities we serve through Leadership in sectors of national economic significance.

What comes from the people goes back to the people many times over.

National Institutions built by Tata

. Indian Institute of Science.

. Tata Institute of Social Sciences

. Tata Memorial Hospital for Cancer Research

. Tata Institute of Fundamental Research

. National Centre for the Performing Arts.

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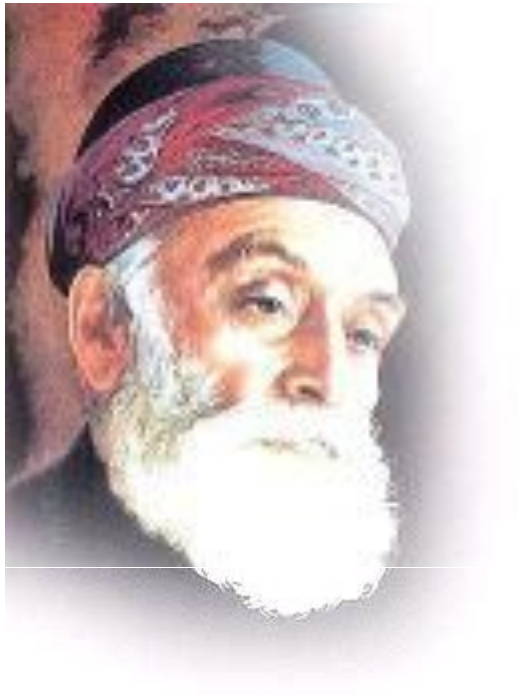
Tata Steel - Values



"In a free enterprise, the community is not just another stakeholder in business, but is, in fact, the very purpose of its existence." – J N Tata

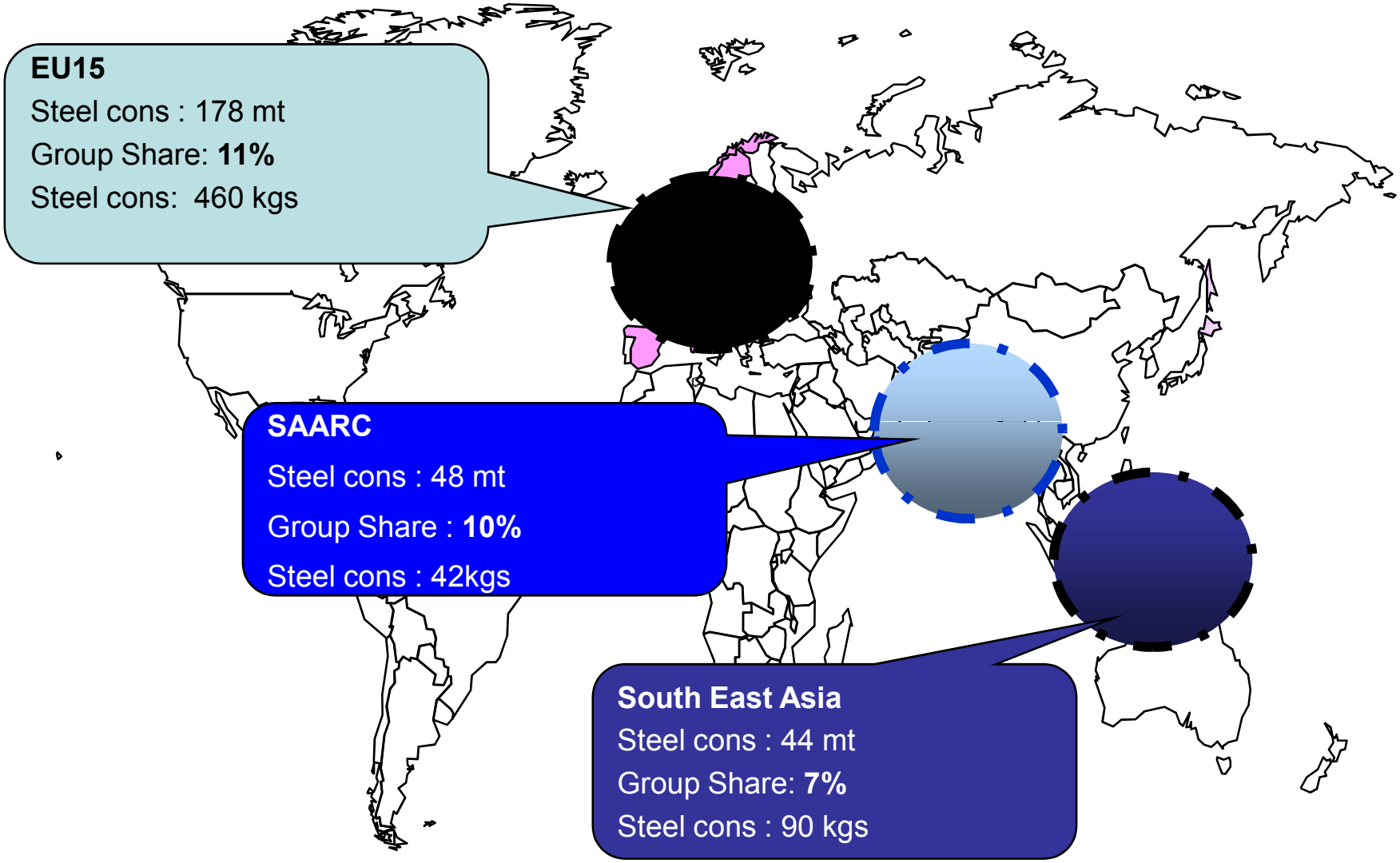
Founder of Tata Steel

A visionary ahead of his times

Industrial practices

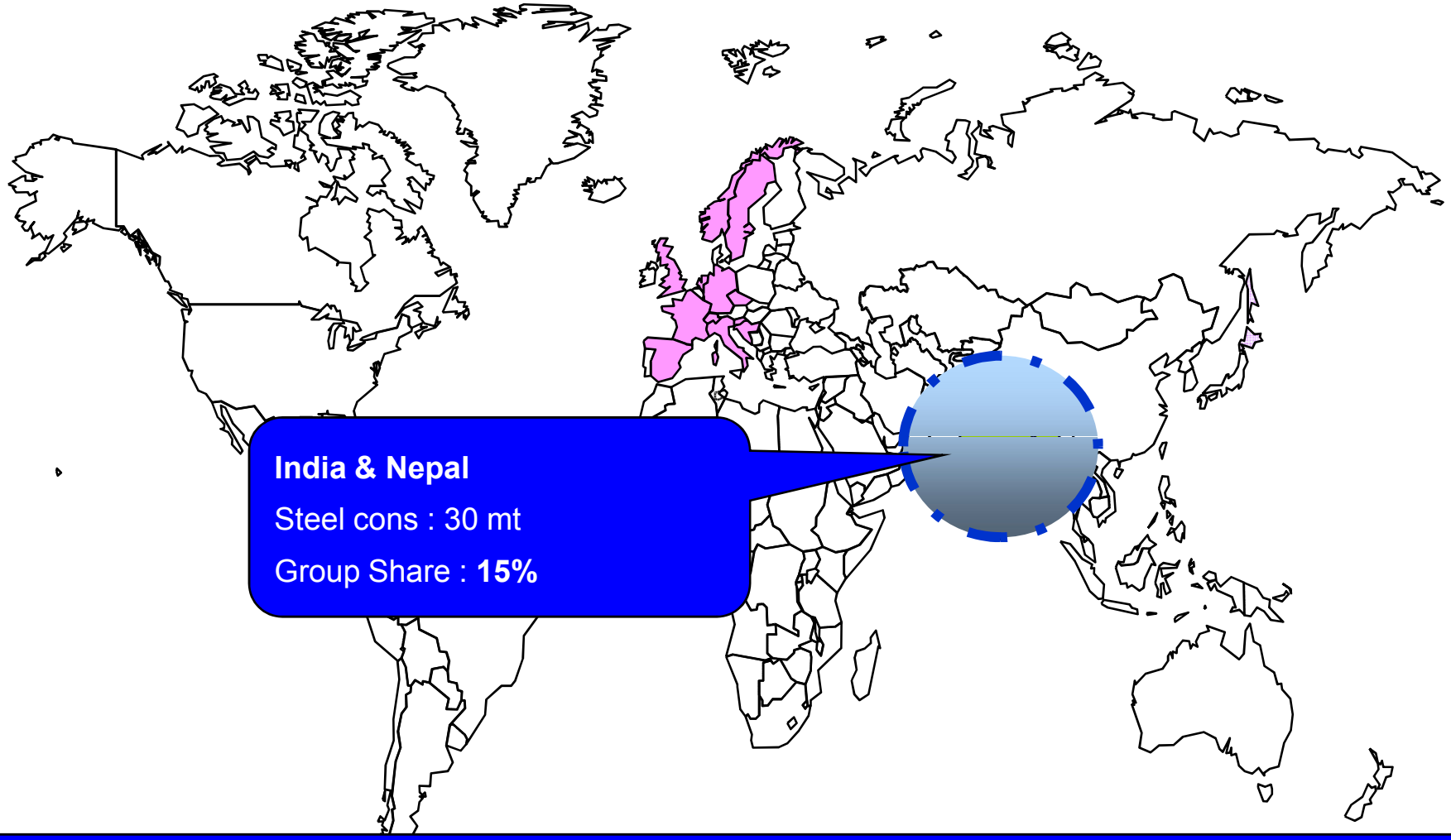
1912	Eight hour working day
1915	Free medical aid
1917	Schooling facilities for children
1920	Leave with pay, workers Provident Fund Scheme
1928	Maternity Leave with pay, Historical Labor Accord
1934	Profit sharing bonus granted first time in India
1937	Retiring gratuity introduced

The Tata Steel Group Today



Source: IISI

The Tata Steel Group 2002



2001-02 was one of the worst times for Global Steel Industry in general and Tatas were advised by a renowned Management Consultant to exit Steel. The employees and management of the company, however, had other plans.

It is not cash that fuels the journey to the future,
But the emotional and intellectual energy of every employee.

- Competing for the future, Hamel & Prahalad

Tata Steel: Co-creating a Vision in 2002

Internal Communication Document 2002

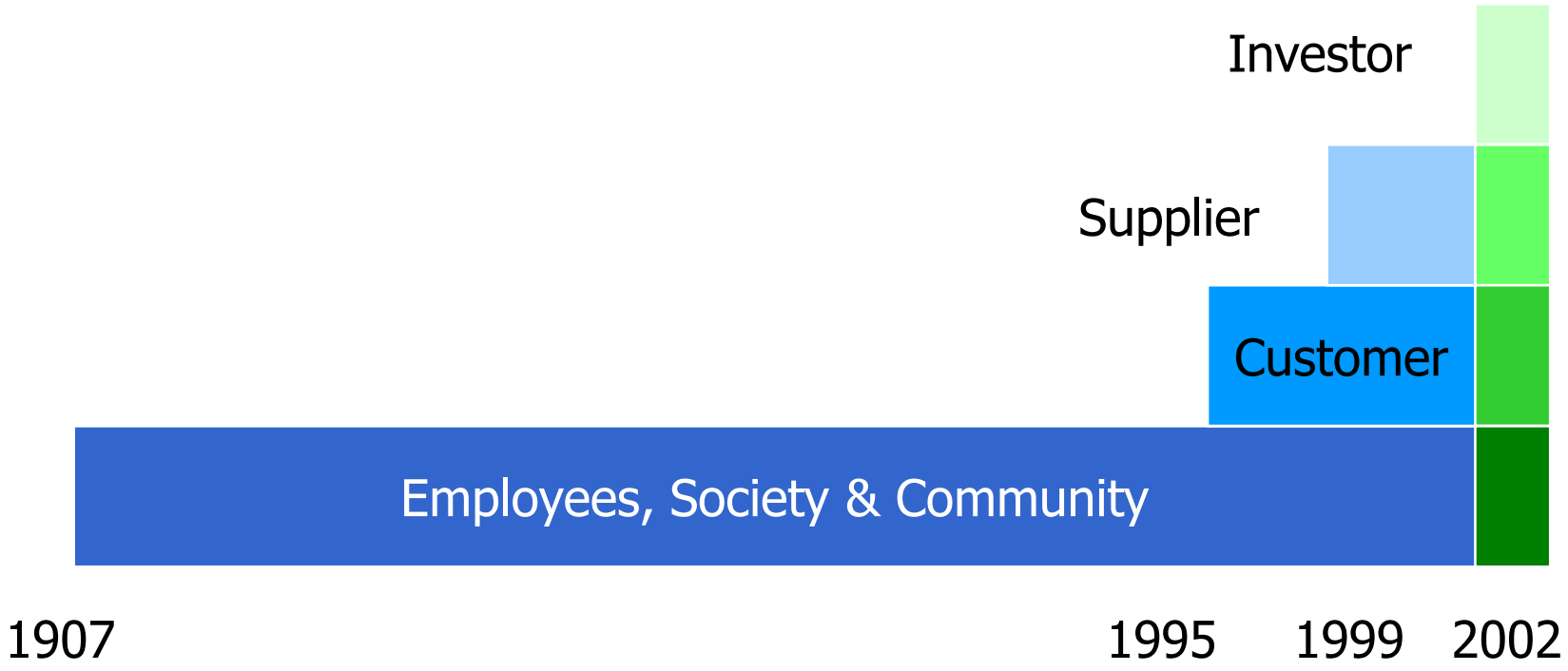
You are taking the responsibility at a historic moment.

Tata Steel is going to turn 100 years during your tenure.

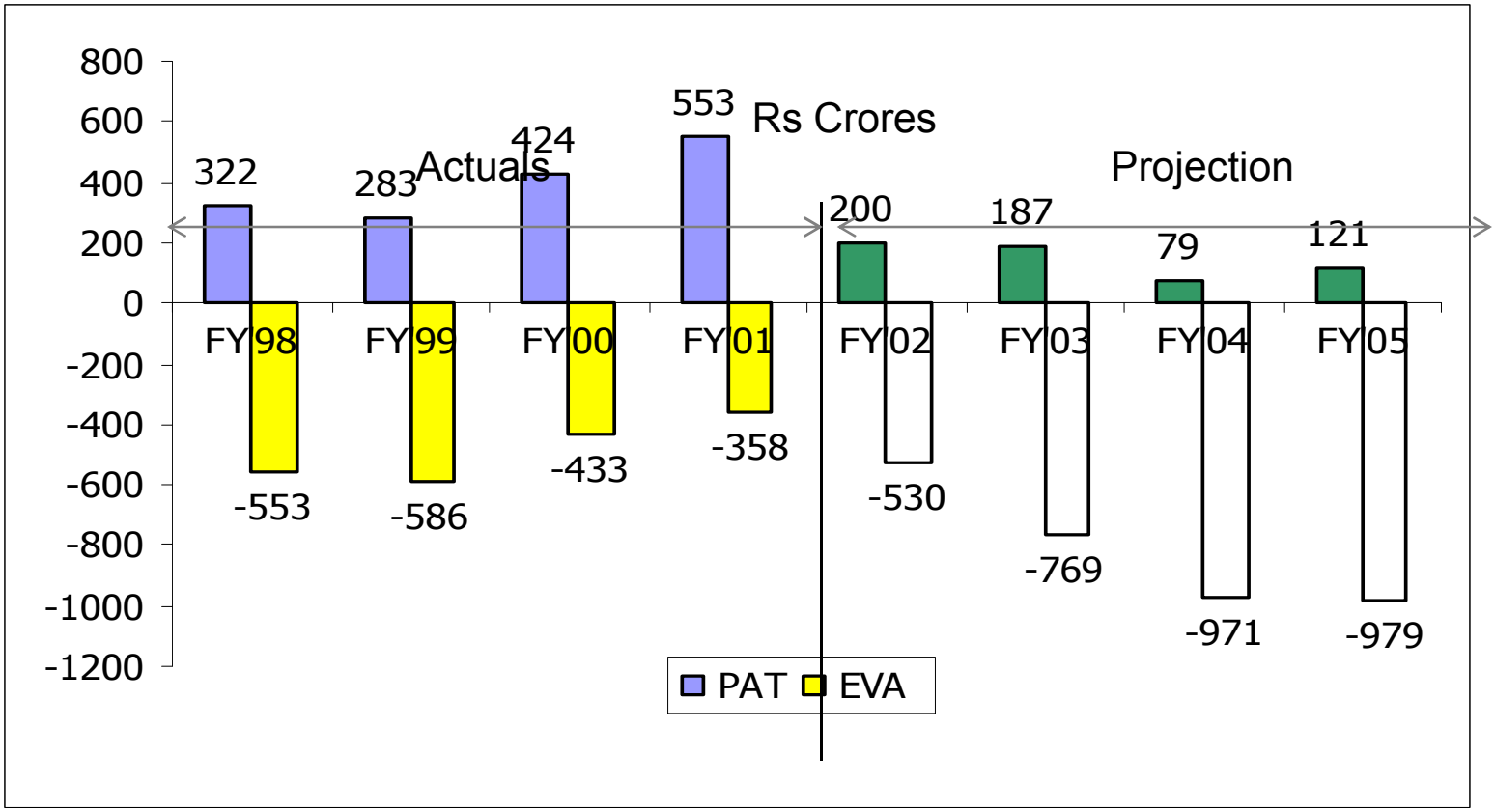
Survival

- Tata Steel has lived for 95 years
- We can make it live for another 100 years, at least.
- What will allow Tata Steel to survive so many years?

At different points in time in our long History, we have focused on different Stakeholders:



PAT & EVA Of Tata Steel If The Present Trend Continues



Vision Focus

Our New Vision Focuses on building value for the Investor without losing our aspiration of improving the quality of life of our employees and the Communities we serve

Tata Steel – Vision Launched on 2nd May, 2002

How can we create Value?

EVA = (ROIC - WACC) Invested Capital

1. Increase ROIC by Increasing Revenues, Reducing Costs and improving productivity
2. Profitable Growth - New Investment with ROIC > WACC
3. Divest from Value Destroying Activities
4. Increase Competitive Advantage Period over which ROIC>WACC
5. Reduce WACC

COST COMPETITIVENESS, QUALITY & THROUGHPUT can help us survive on a long term basis

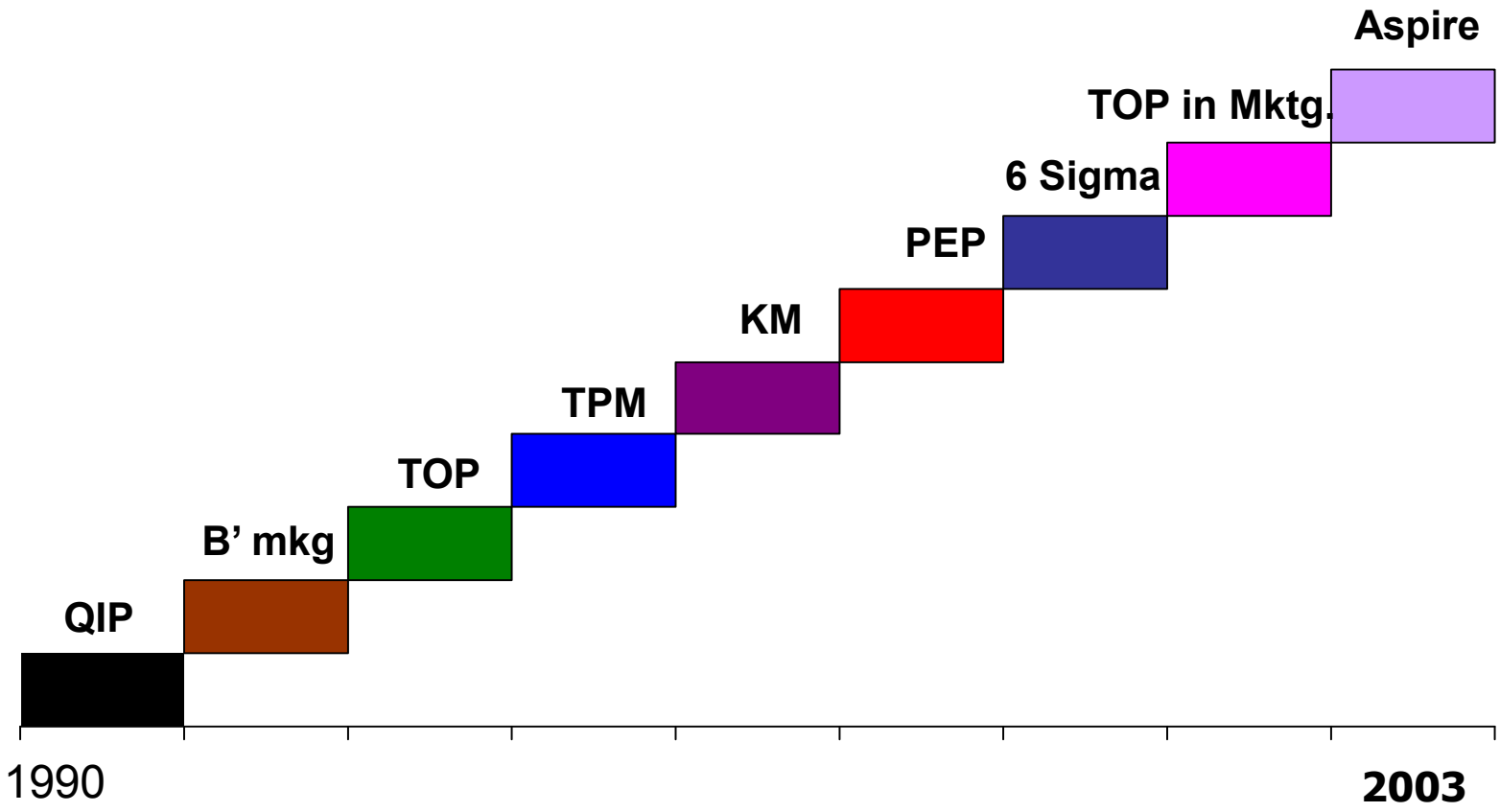
How can we create Value?

Improving Competitive Advantage Period

1. Customer Satisfaction
2. Products & Service Quality
3. Employee Safety
4. Efficiency & Productivity
5. Employee Satisfaction
6. Market Share
7. Process Improvement, Innovation & Re-engineering
8. Employee Development & Training
9. New Product Development

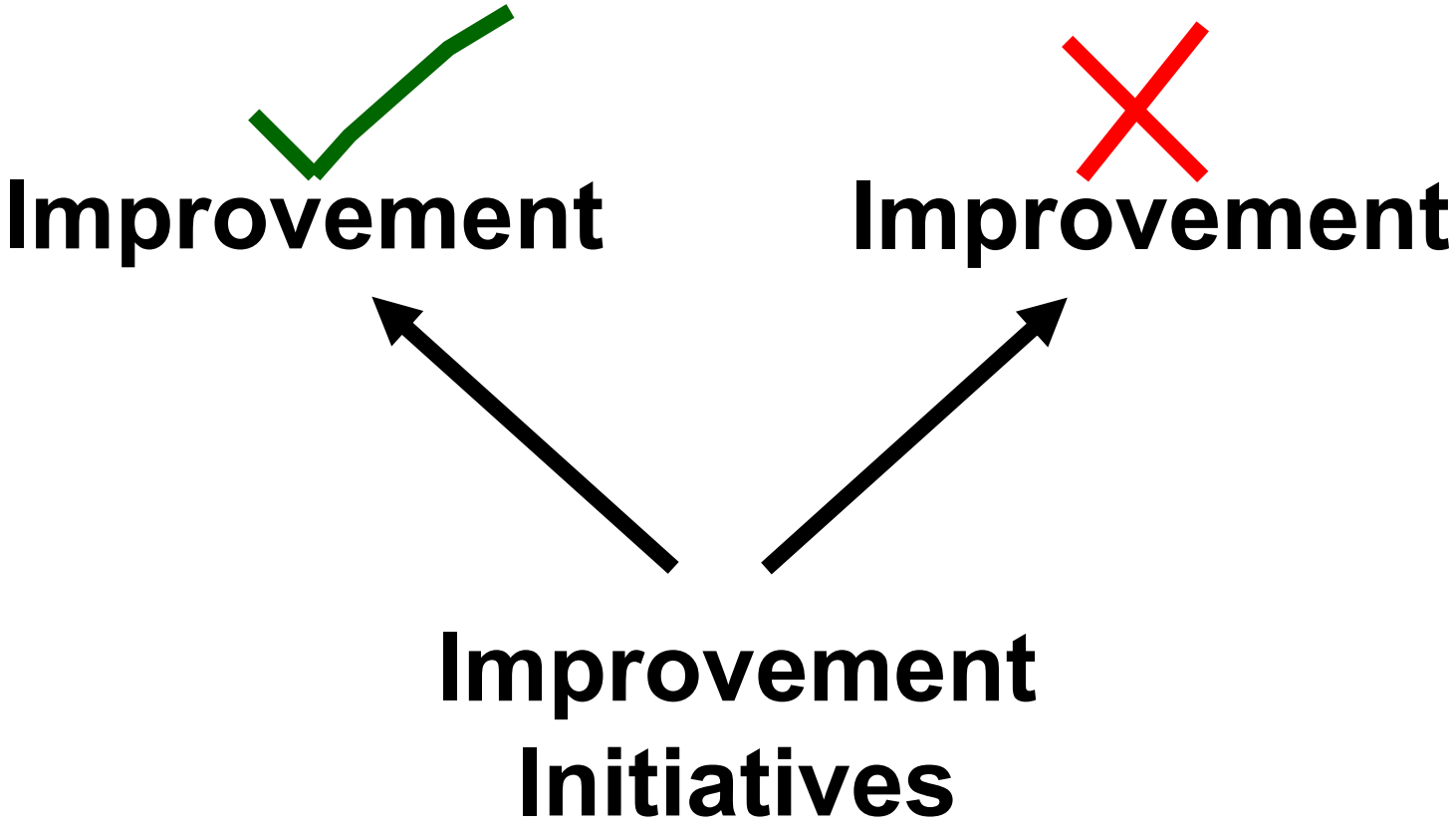
EVA means conducting our business better

History of Improvement Initiatives 1990-2003



Improvement Challenge

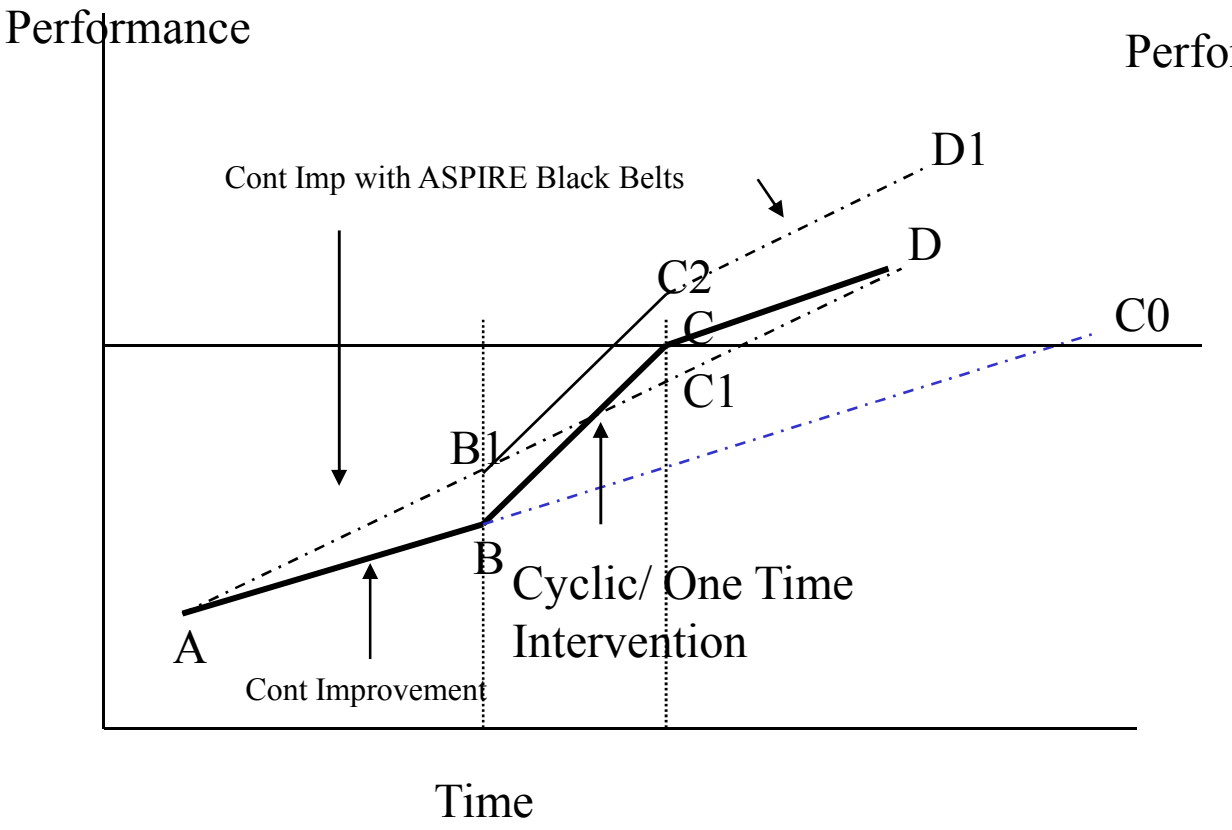
We know that every improvement results from a change (improvement initiative), but why do so many improvement initiatives not result in improvement?"

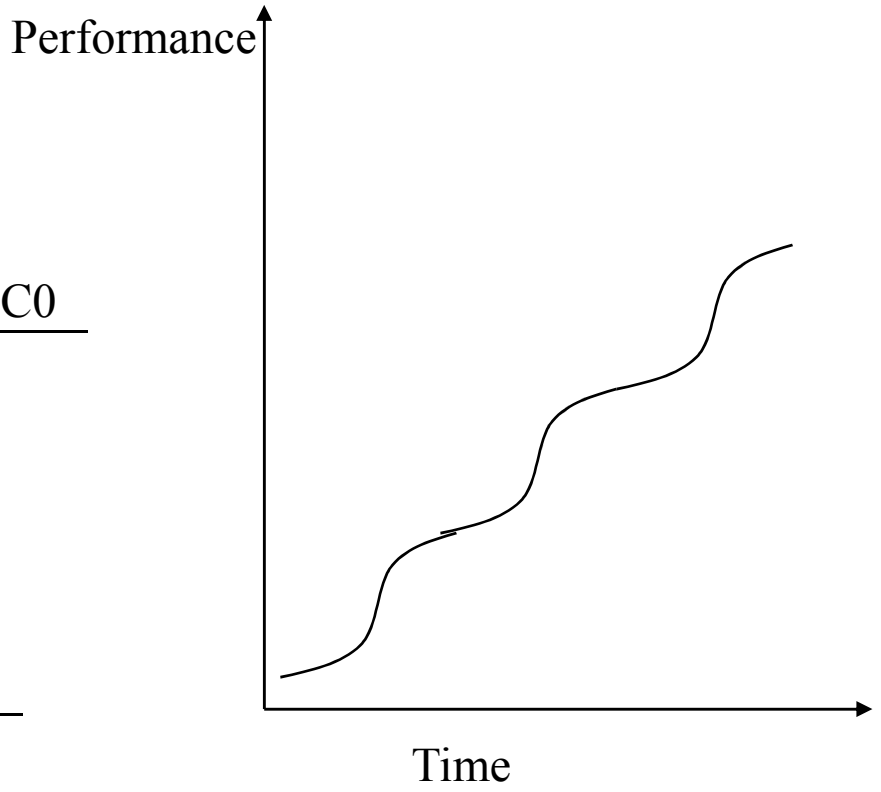


Source: © Alan Barnard, Goldratt Group

Internal Communication Document 2002

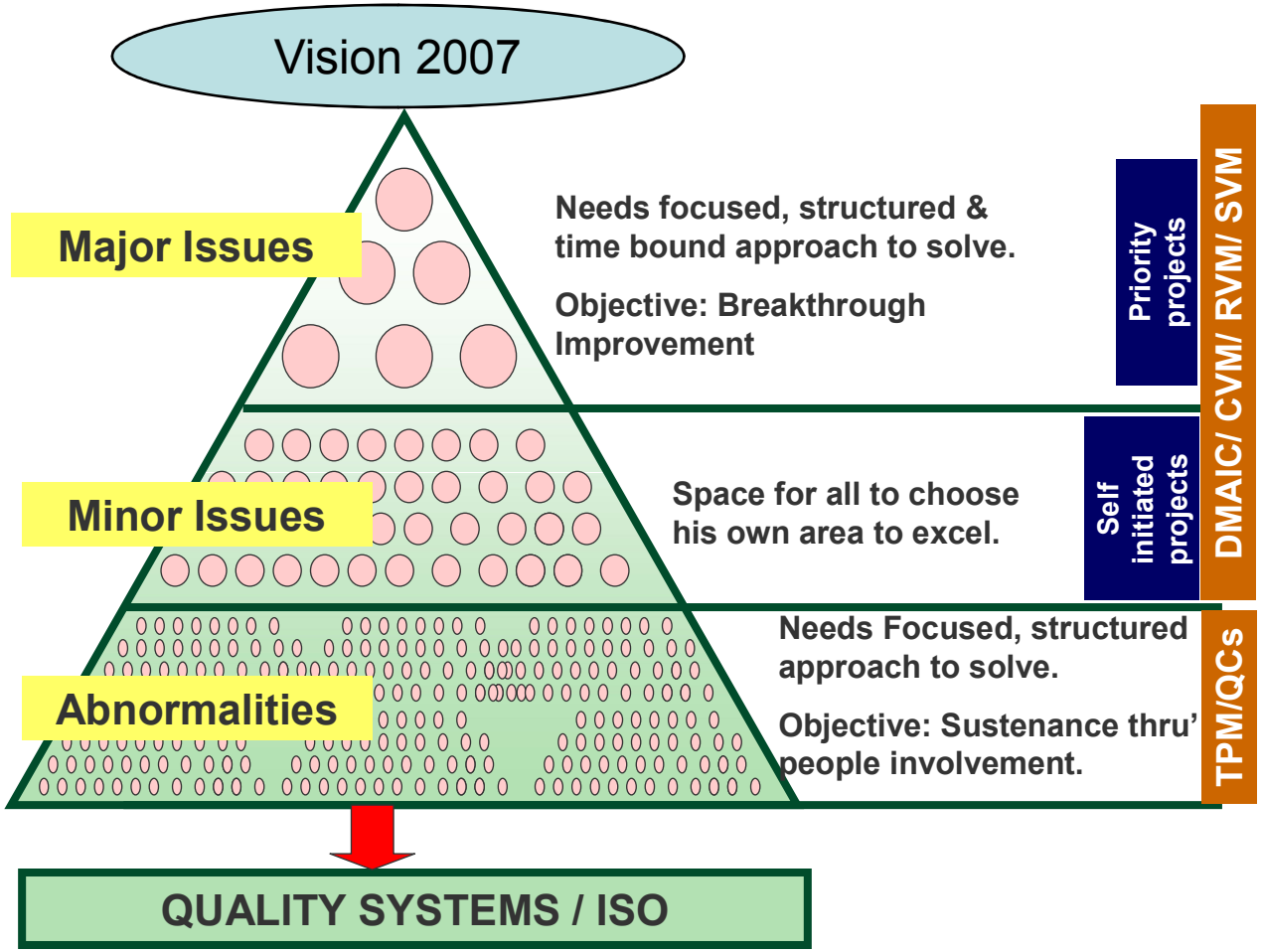
Conceptualizing a new ASPIRE Framework:

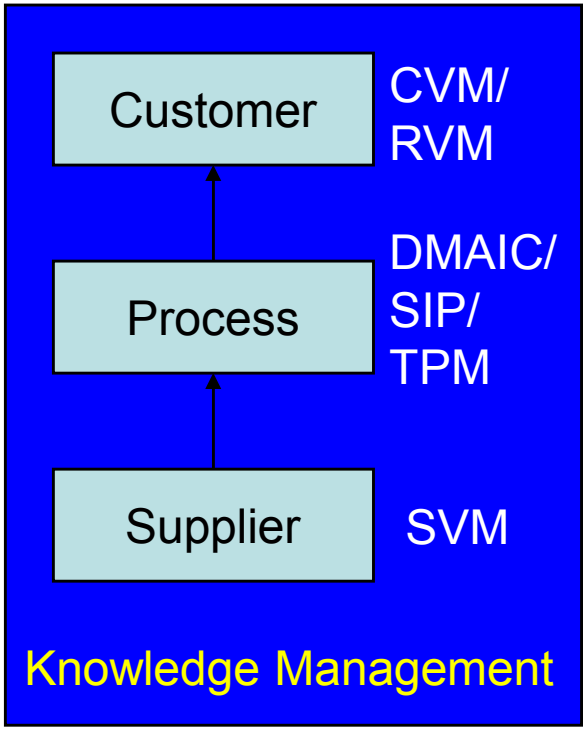




A combination of Continuous and Cyclic Improvement Intervention will accelerate our rate of improvements and not allow habits to establish.

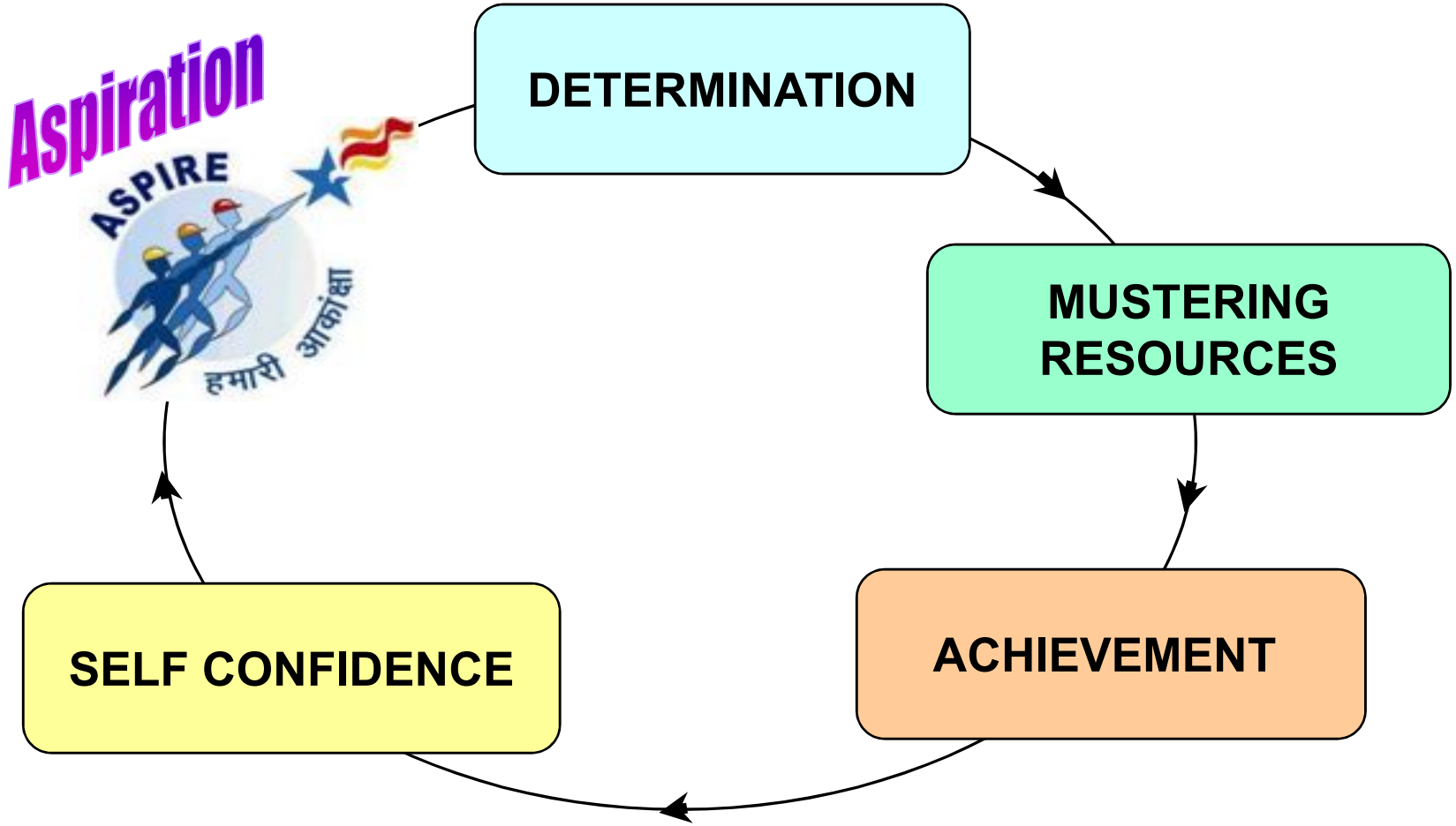
ASPIRE Before Viable Vision





Missing links: Envisioning, Value Innovation & Systems Approach

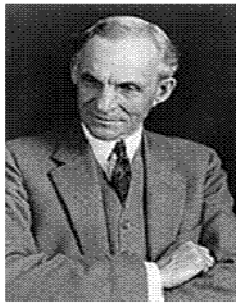
ASPIRE Philosophy



"It is essential for the top management to set out aspiration that creates, by design, a chasm between ambition and resources."

- C K Prahlad

"Aspire" is not based on "Seeing is believing"...



"Whether you believe you CAN or CAN'T…you are right ! "

Henry Ford

"Science isn't a matter of believing only what you see. Science is a matter of believing and seeing by believing. If you believe only what you see, you won't see very much…"

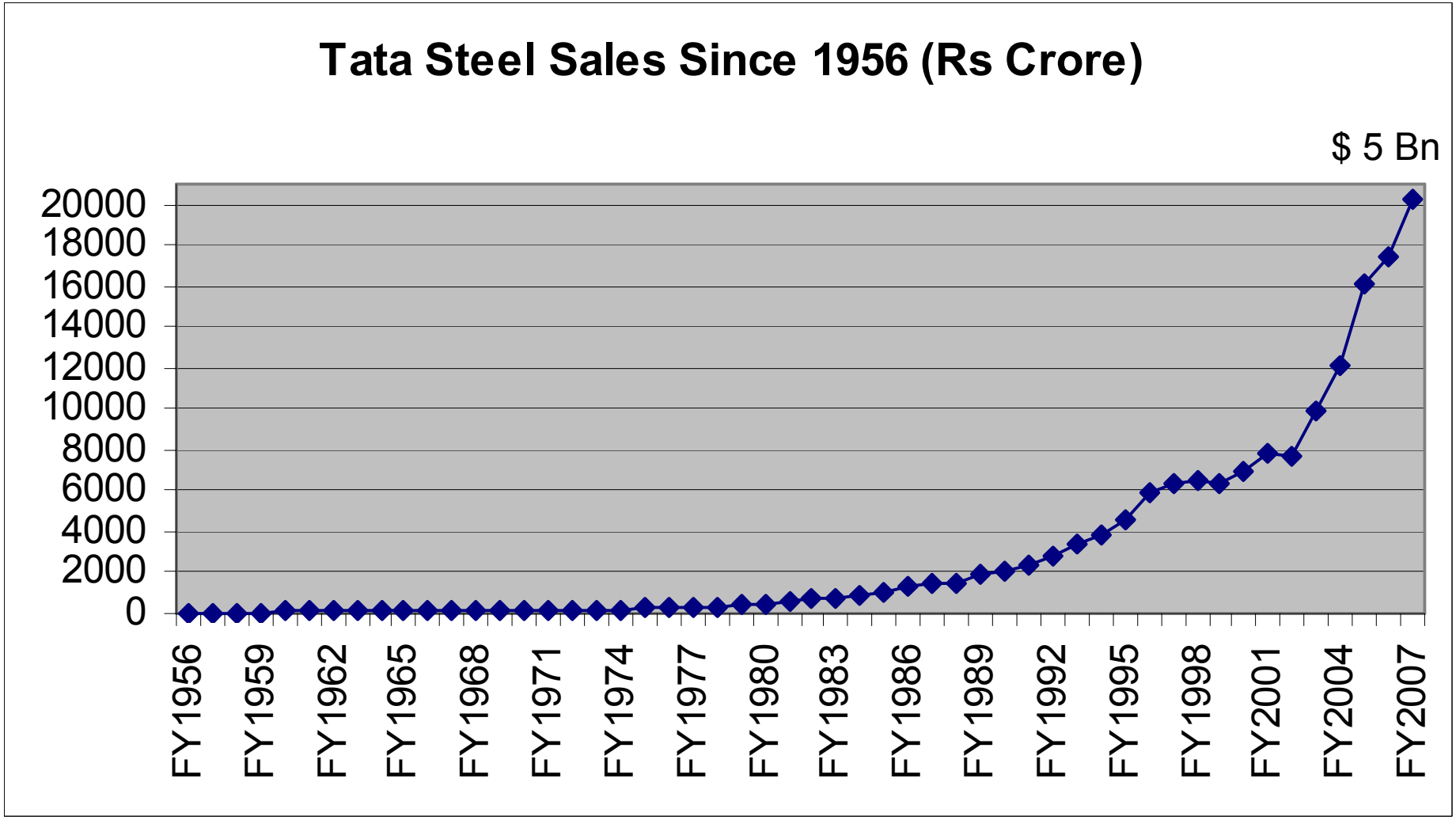
Dr. Eli Goldratt

…contrary to the popular belief of "Seeing is Believing", both visionaries seem to think:

"**Believing is seeing**"…

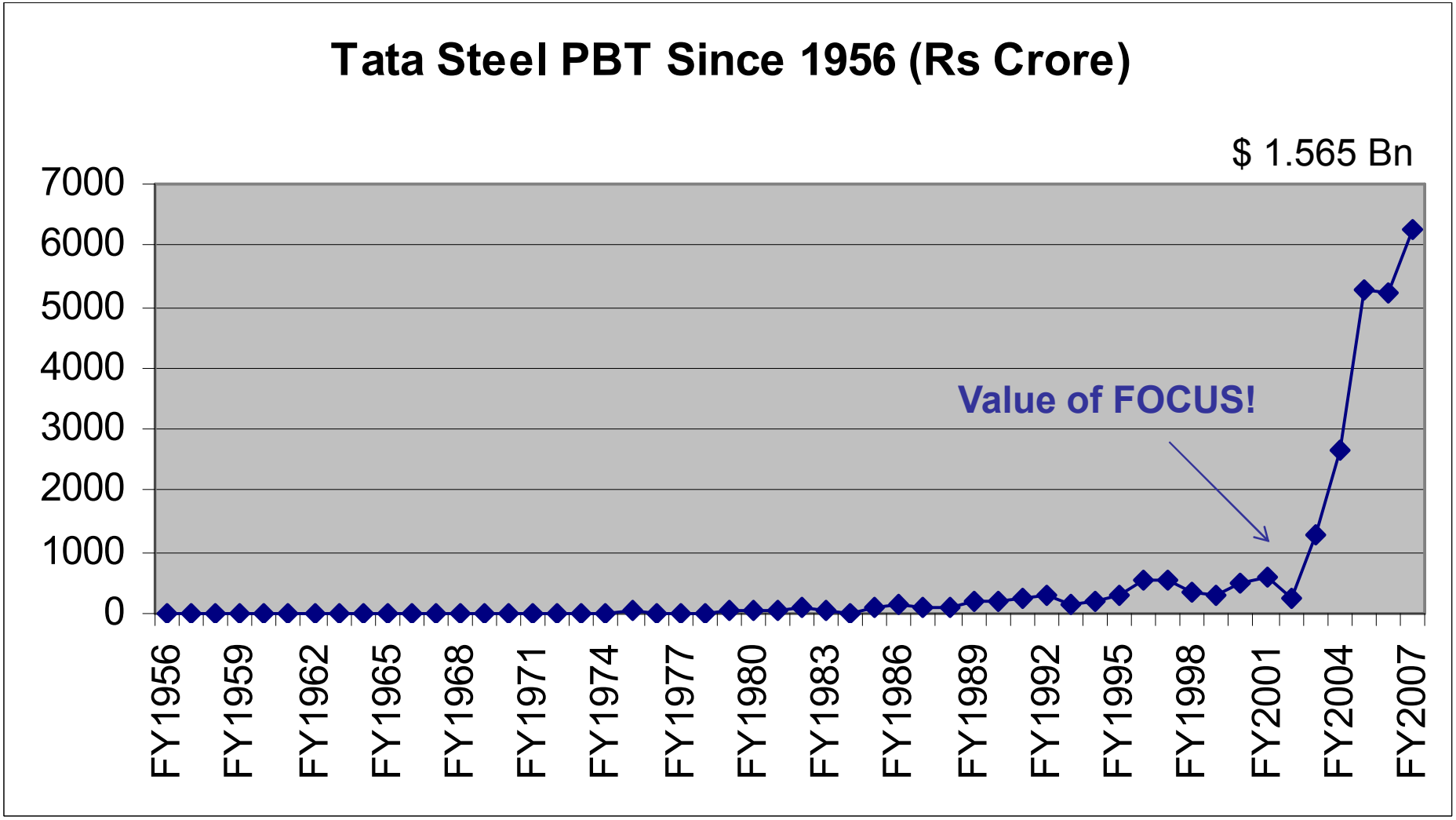
Source: © Alan Barnard, Goldratt Group

Tata Steel Sales since 1956



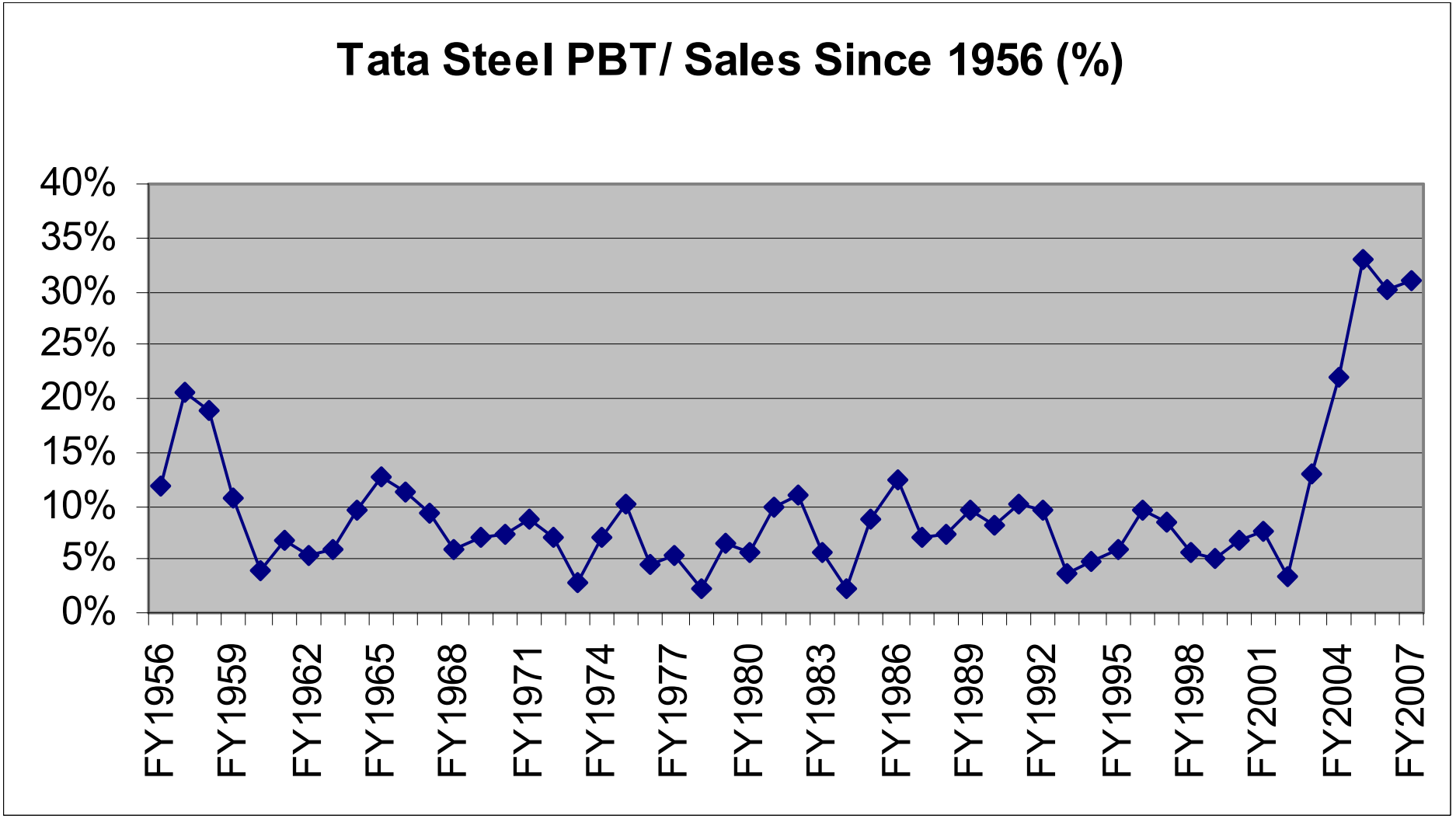
Presently 1$ = Rs 40, Also 10 Million = 1 Cr

Tata Steel Profit before Tax since 1956



Presently 1$ = Rs 40, Also 10 Million = 1 Cr

Tata Steel % PbT vs. Sales since 1956



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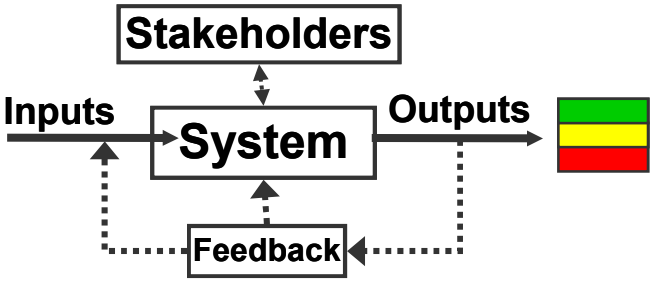
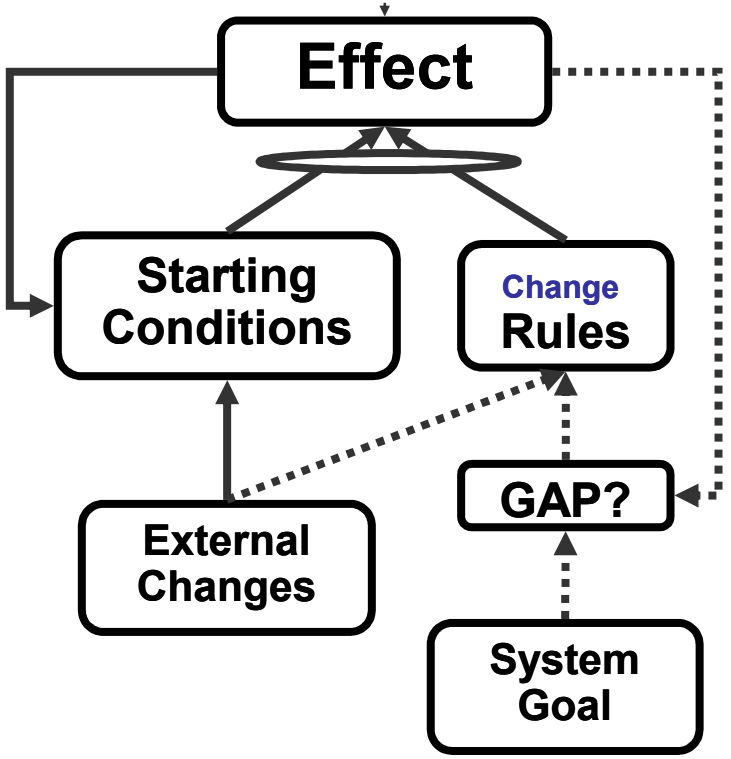
Finding the Leverage Points with Theory of Constraints

Physical System View



System Logical Model



System Leverage Points

1. The STARTING CONDITIONS of the System
   a. System Inputs
   b. Influencing Stakeholders
   c. Resources (Capability & Location)
2. The RULES used to manage the System
   a. Planning
   b. Execution
   c. Feedback
3. The GOAL/TARGET of the System

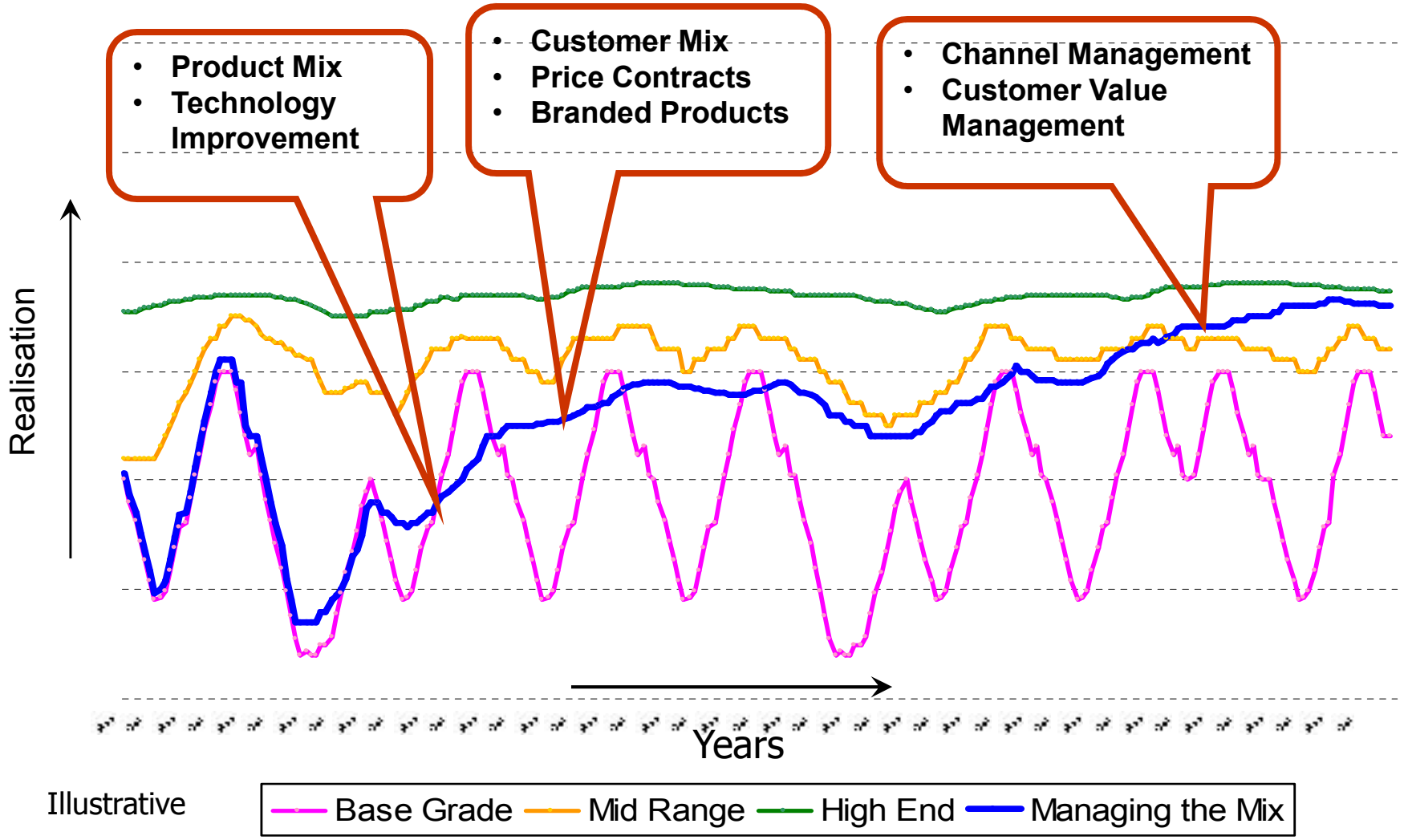
How should we set GOALS for our Company…?

"When I do an analysis of a company, I am satisfied only when I clearly see how it is possible to bring the company to have, in less than four years, net profit equal to its current total sales."

Dr. Eli Goldratt, March 2003

In 2004, Tata Steel Executive team met with Dr. Eli Goldratt to jointly analyze what improvement potential could be unlocked within Tata Steel by applying Theory of Constraints

Beating steel price cycle: A Challenge beyond VV



This is a conceptual slide discussed between Dr. Eli Goldratt and B. Muthuraman (MD, Tata Steel)


The Economist Commodity Price Index
Industrial Metals
All Commodities
Food
Index
325
300
275
250
225
200
175
150
125
100
04
05
06
07
08
Source: Reuters EcoWin

Competitiveness: drivers

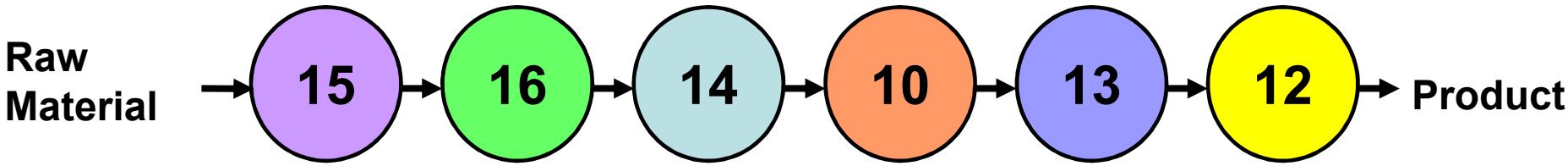
- **Raw Materials**
- **Energy, Renewable sources**
- **Environment: CO_2**
- **Process Efficiency**
- **Capital productivity**
- **Differentiated products**
- **Market**
- **Speed**

Unlocking Capital productivity

- **Sweating the assets**
- **Benchmarking productivity & setting Benchmarks**
- **Process Improvements**
- **Innovation**

What new insights did Tata get from TOC?

A Very Basic Operation



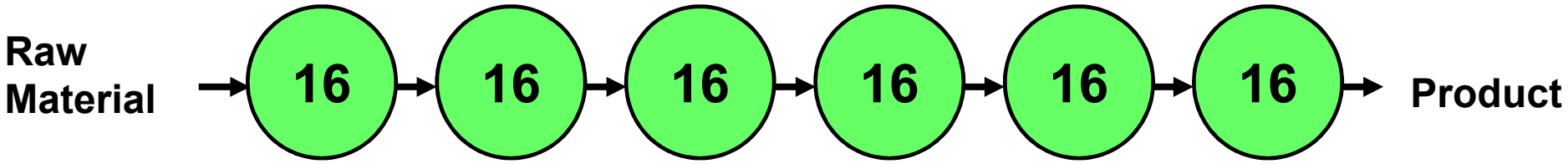
Expected output of this chain = ….?

How will you go about improving it?

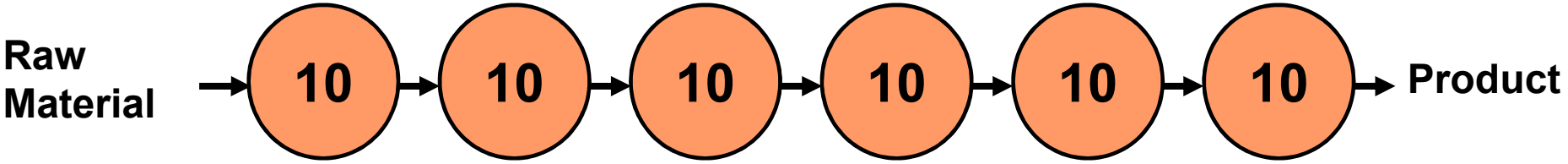
Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

A Perfectly Balanced Chain



Output of the chain = ?



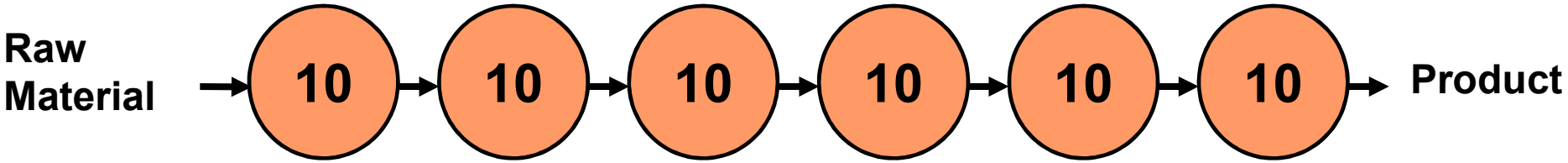
Output of the chain = ?

What are the deep rooted beliefs that causes us to develop chains like these?

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

A Perfectly Balanced Chain?



We believe that:

A If all the resources in the chain are optimised, we will have an optimised chain

B Balanced Capacity = Balanced Flow

C A resource standing idle is a major waste

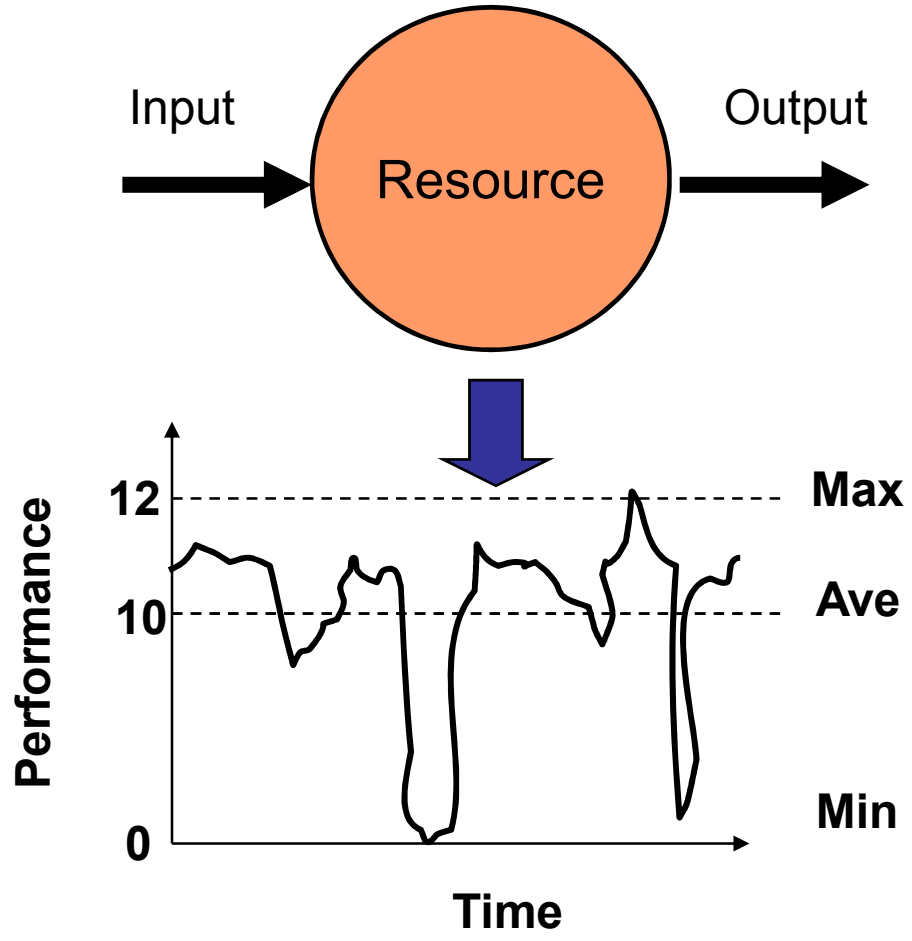
Any mistake in our logic?

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

Fact No1 in a Chain:

ALL RESOURCES VARY OVER TIME



Source: © Henning du Preez, Goldratt Group

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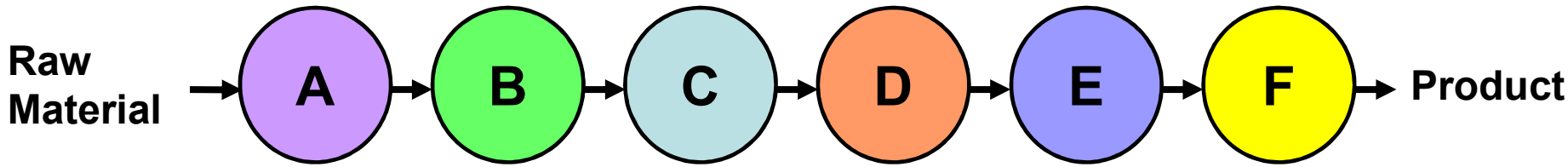
Fact No2 of a Chain:

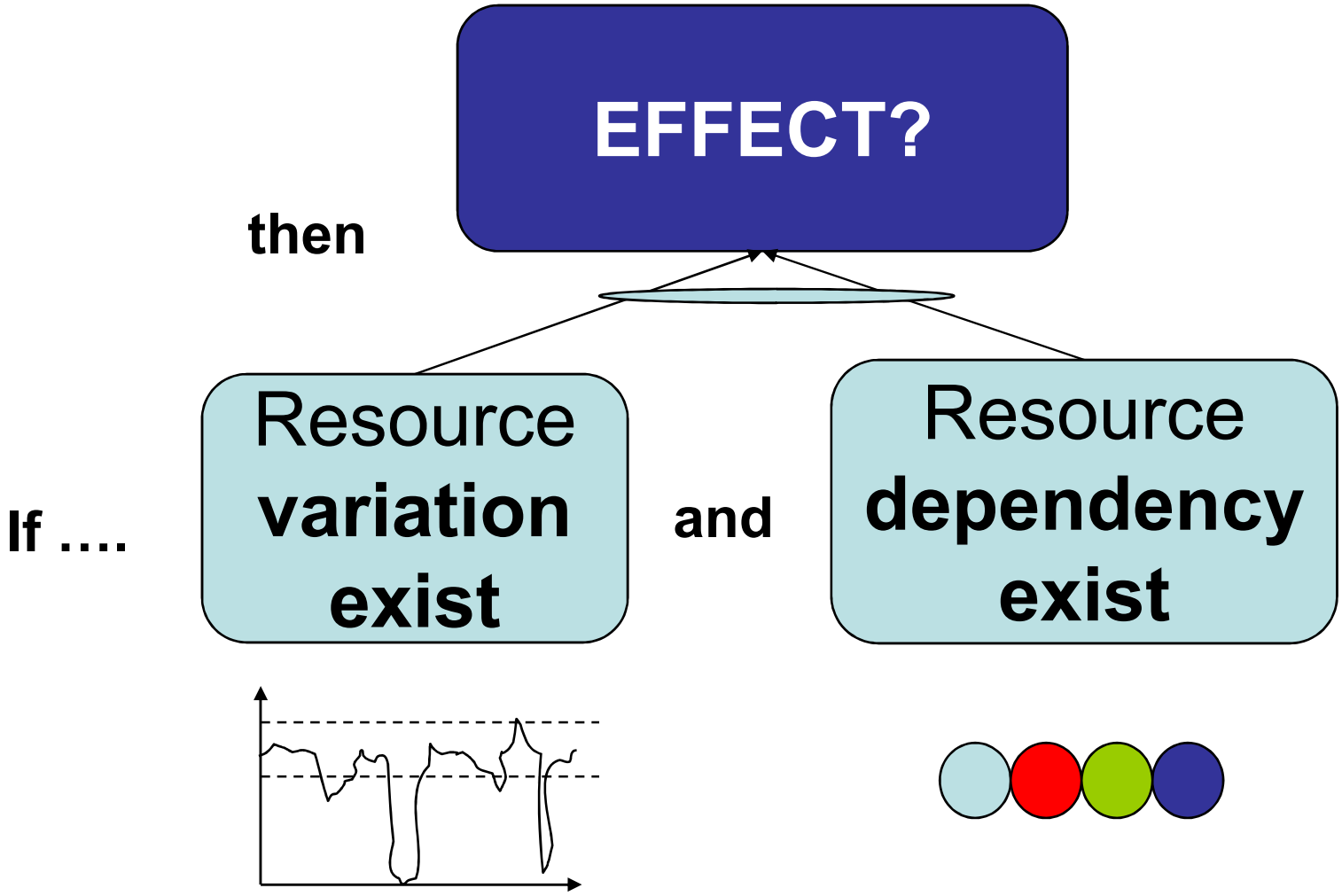
RESOURCE DEPENDENCY IS REAL



Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

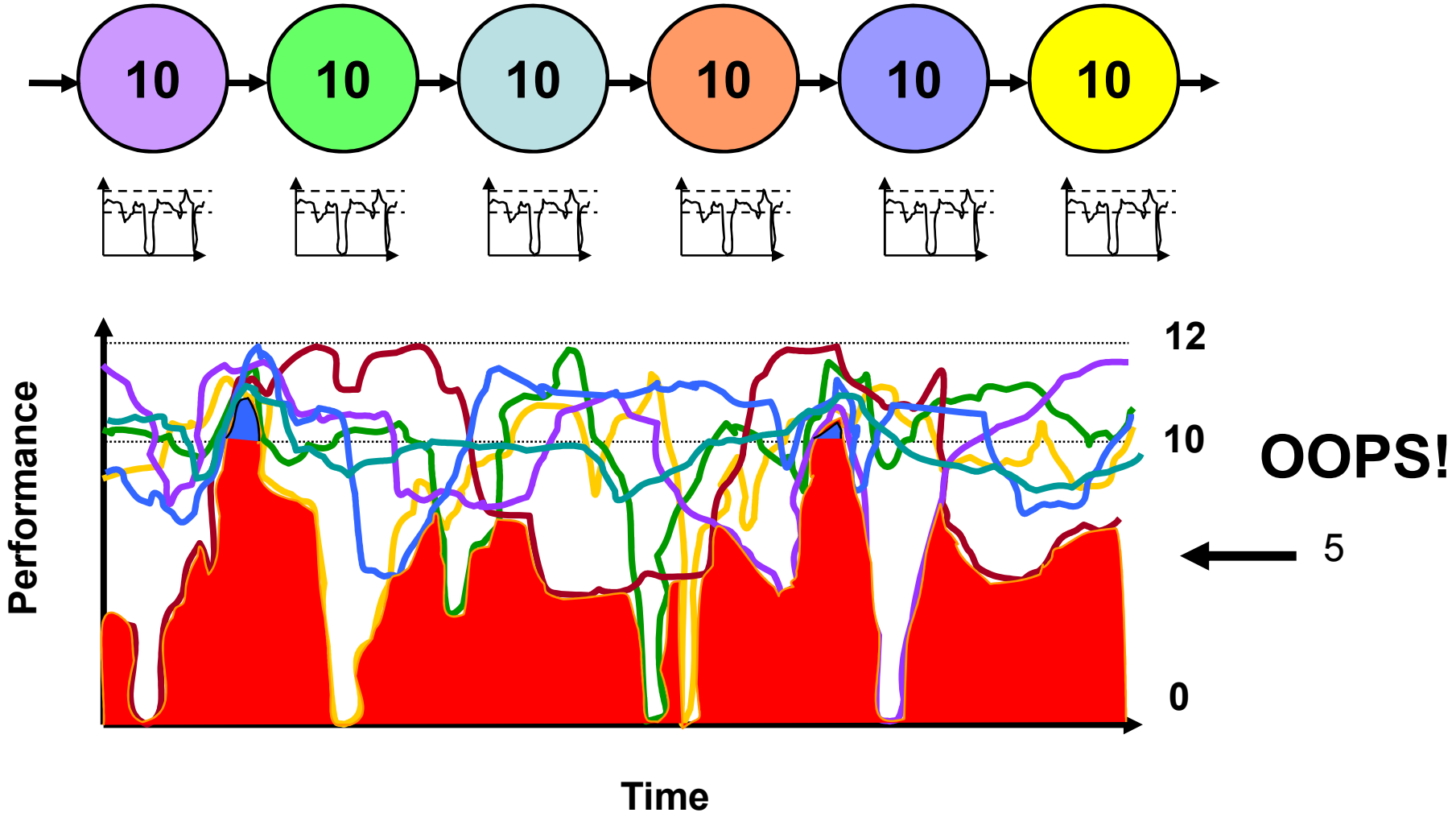
In Combination?



Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

In Combination: The Effect



Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

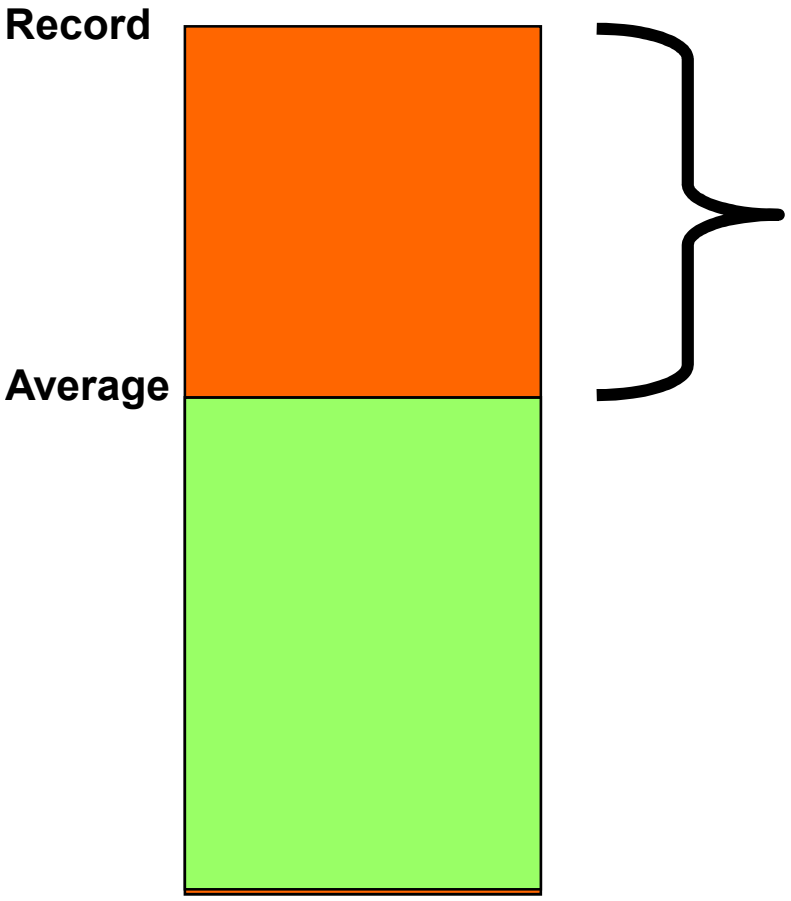
In Other Words.....

A chain is only as strong as its weakest link

The law of the WEAKEST LINK is a given.
It determines the FLOW.

Source: © Henning du Preez, Goldratt Group

In Combination: The Effect

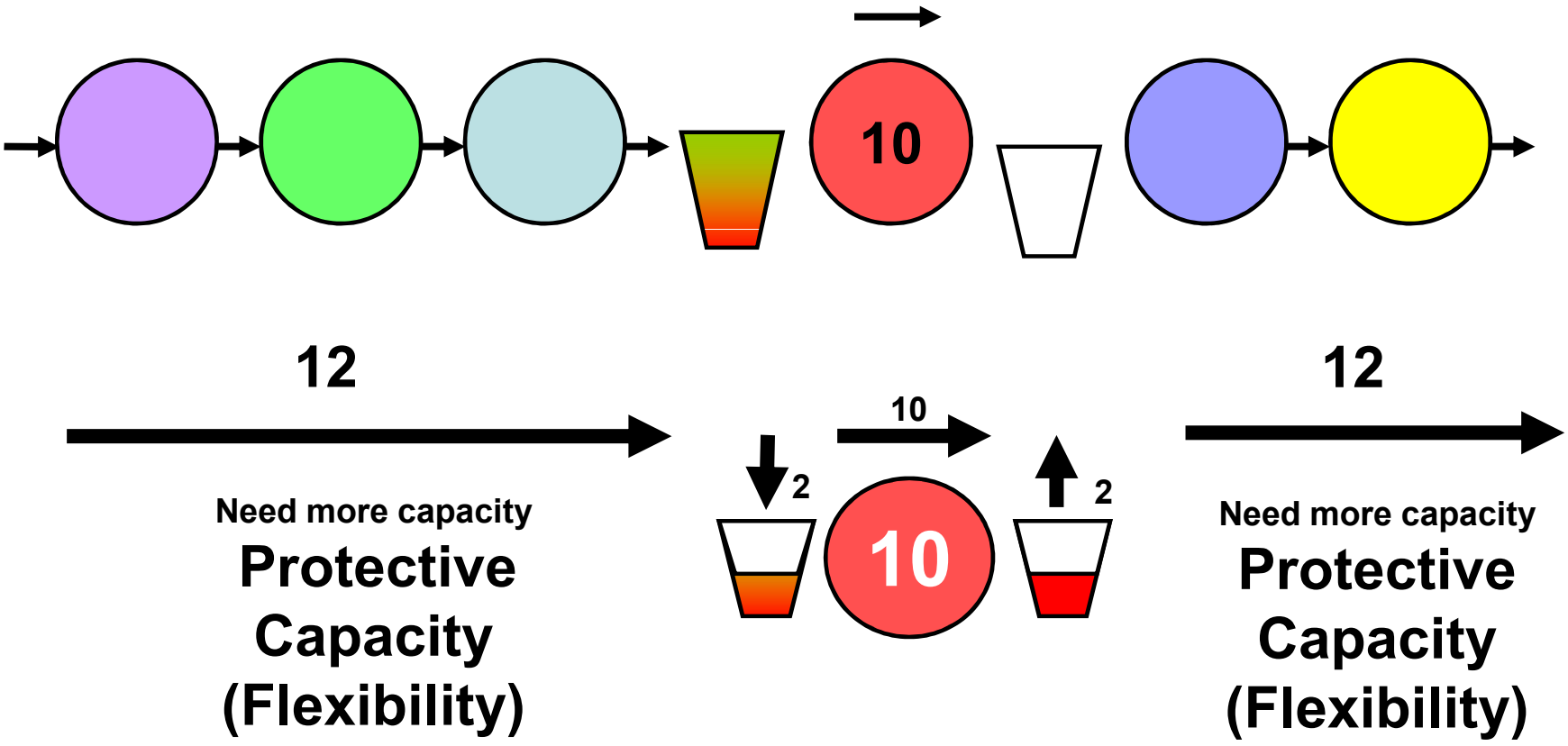


What are the main reasons for the gap?

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

Start by at least Getting One Resource to 100% Efficiency



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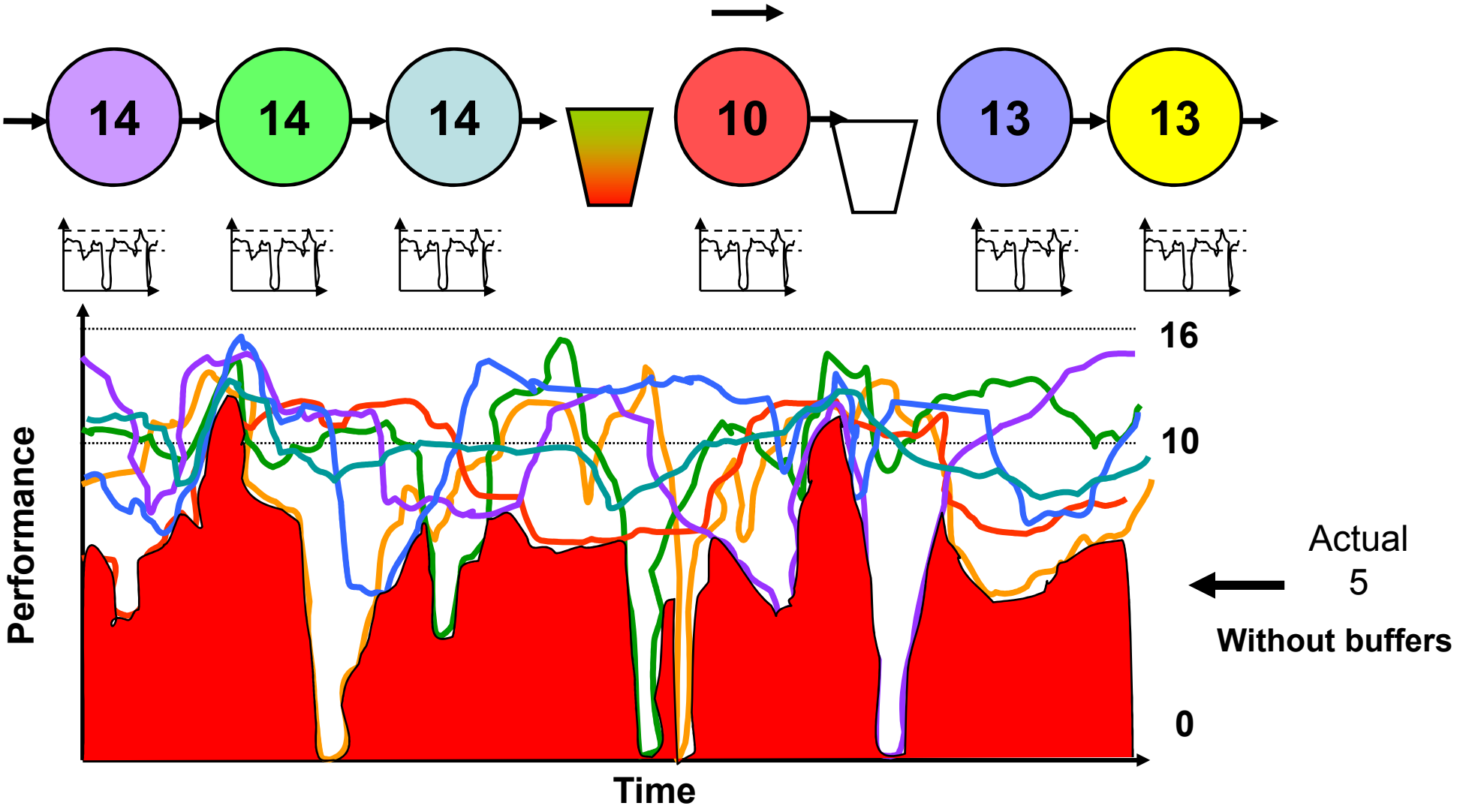
What new insights did Tata get from TOC?

The Impact of BUFFERS



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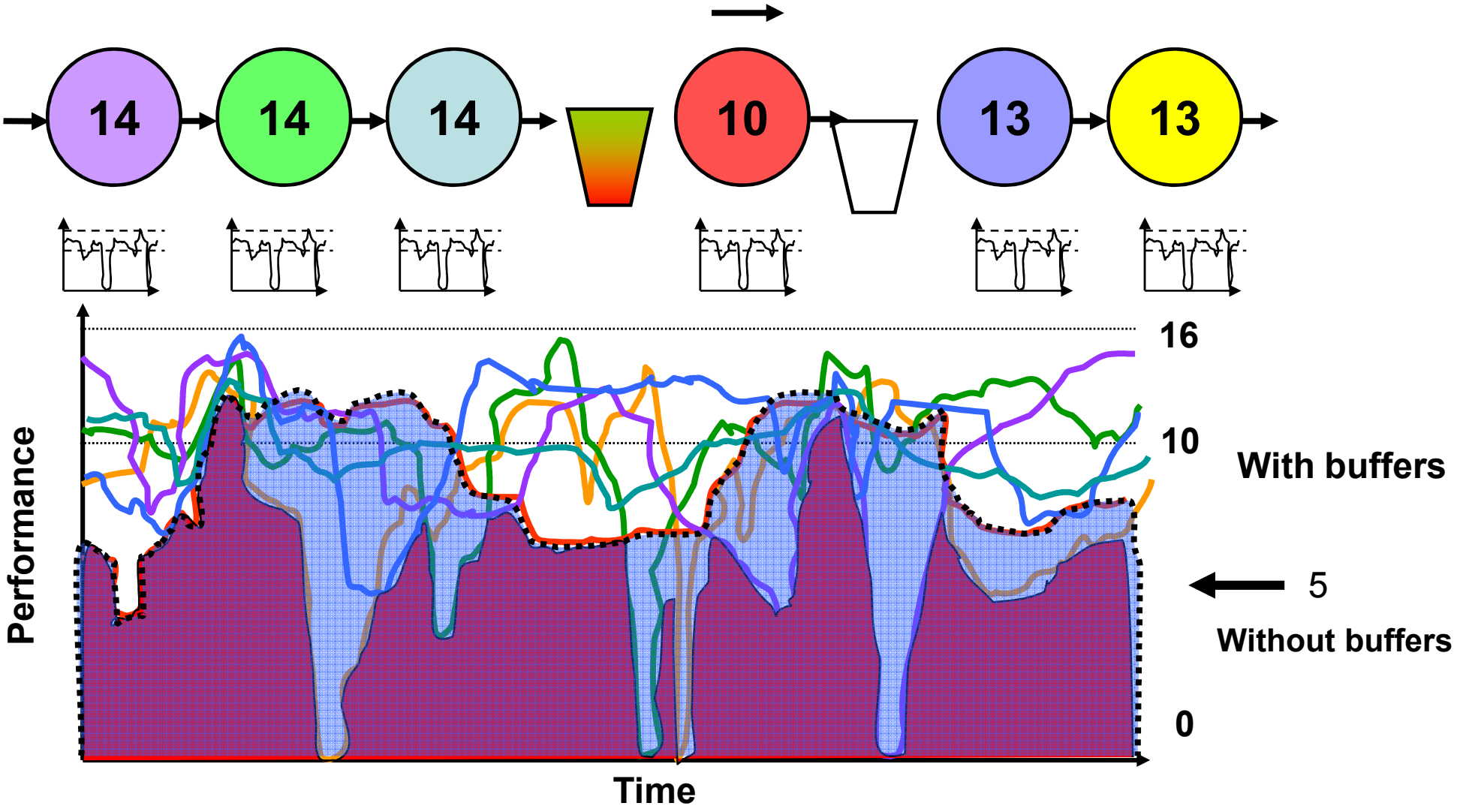

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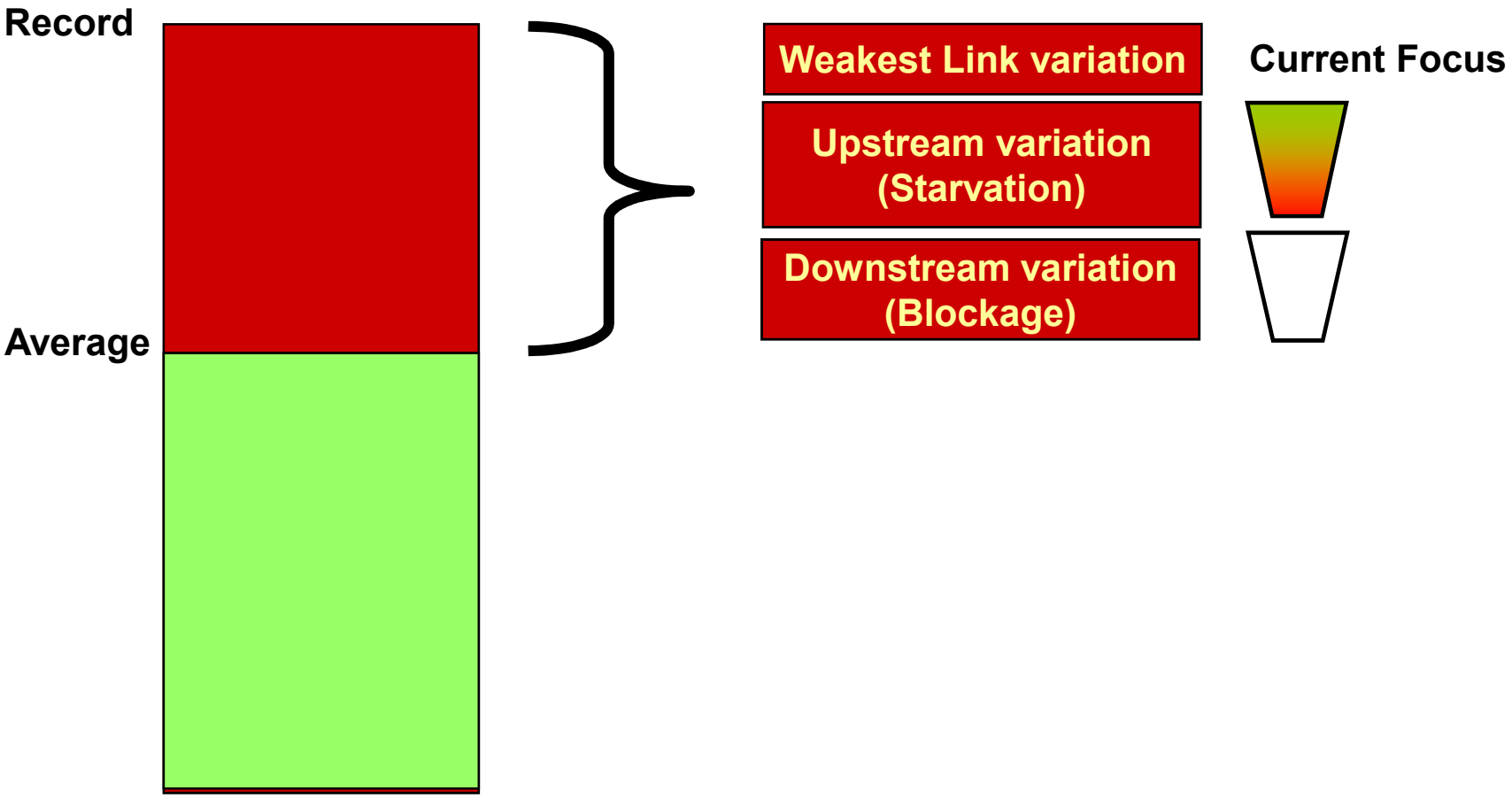
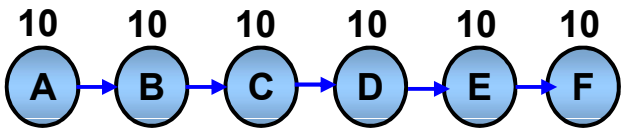
What new insights did Tata get from TOC?

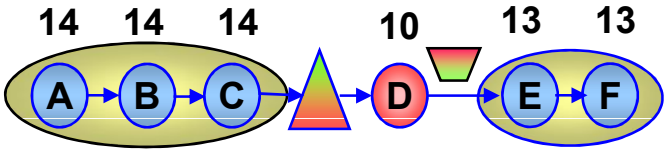
The weakest link: Exploited



Source: © Henning du Preez, Goldratt Group

Comparing the Production Costs



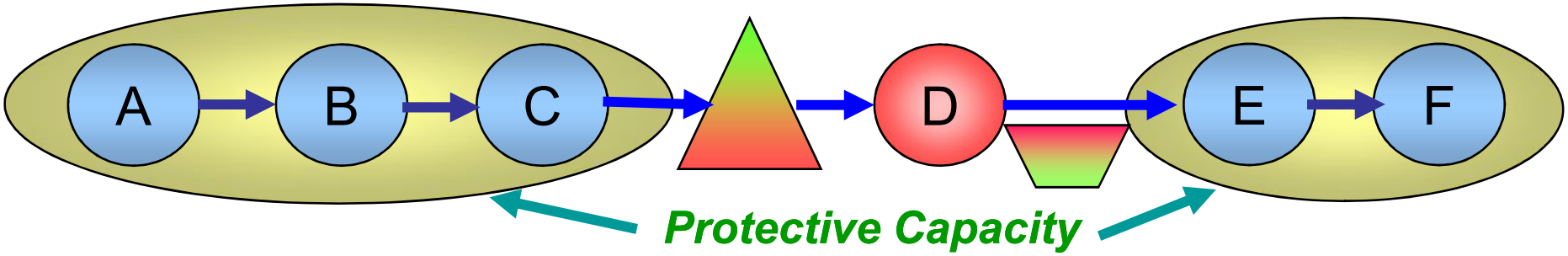


Costs	6 x 10 = **60**
Output	**5** Units
Cost/Unit	60/5 = **12**

(3x14)+10+(2x13)= **78**
10 Units
78/10 = **7.8**

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?



We believe that:

A If all the resources in the chain are optimised, we will have an optimised chain

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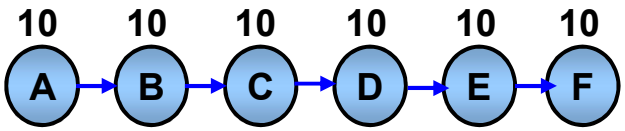
C A resource standing idle is a major waste

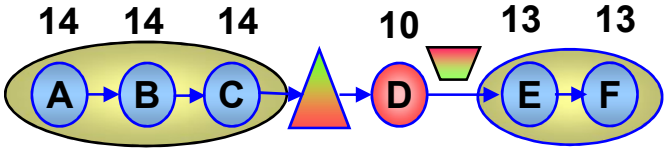
Any mistake in our logic?

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

Comparing the Chains: Operation



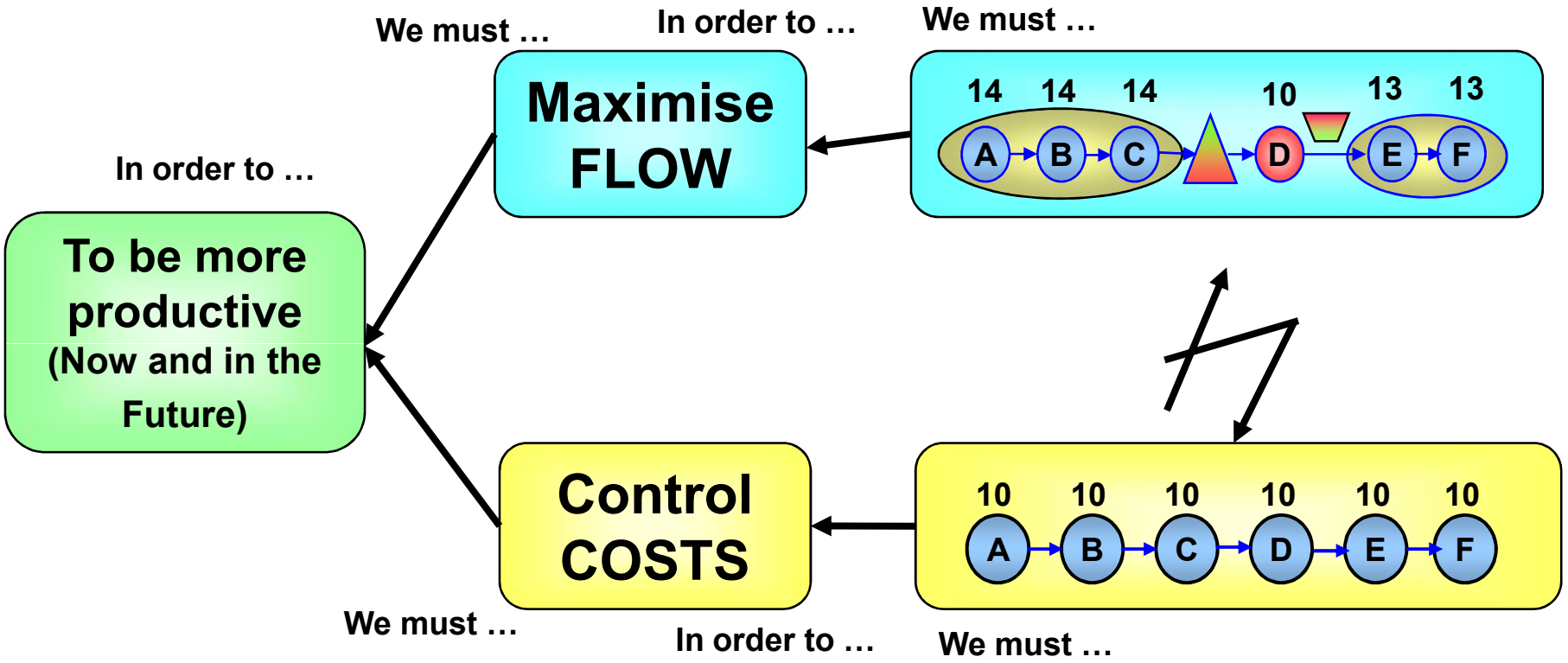


Balanced Capacity	Balanced FLOW
Murphy Exposed	Murphy Protected
Unstable Flow	Stable Flow
Unpredictable Output	Predictable Output
Uncontrolled Idle Time	Managed Idle Time
Higher Cost/Product	Lower Cost/Product
Control everything	Control the leverage points

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

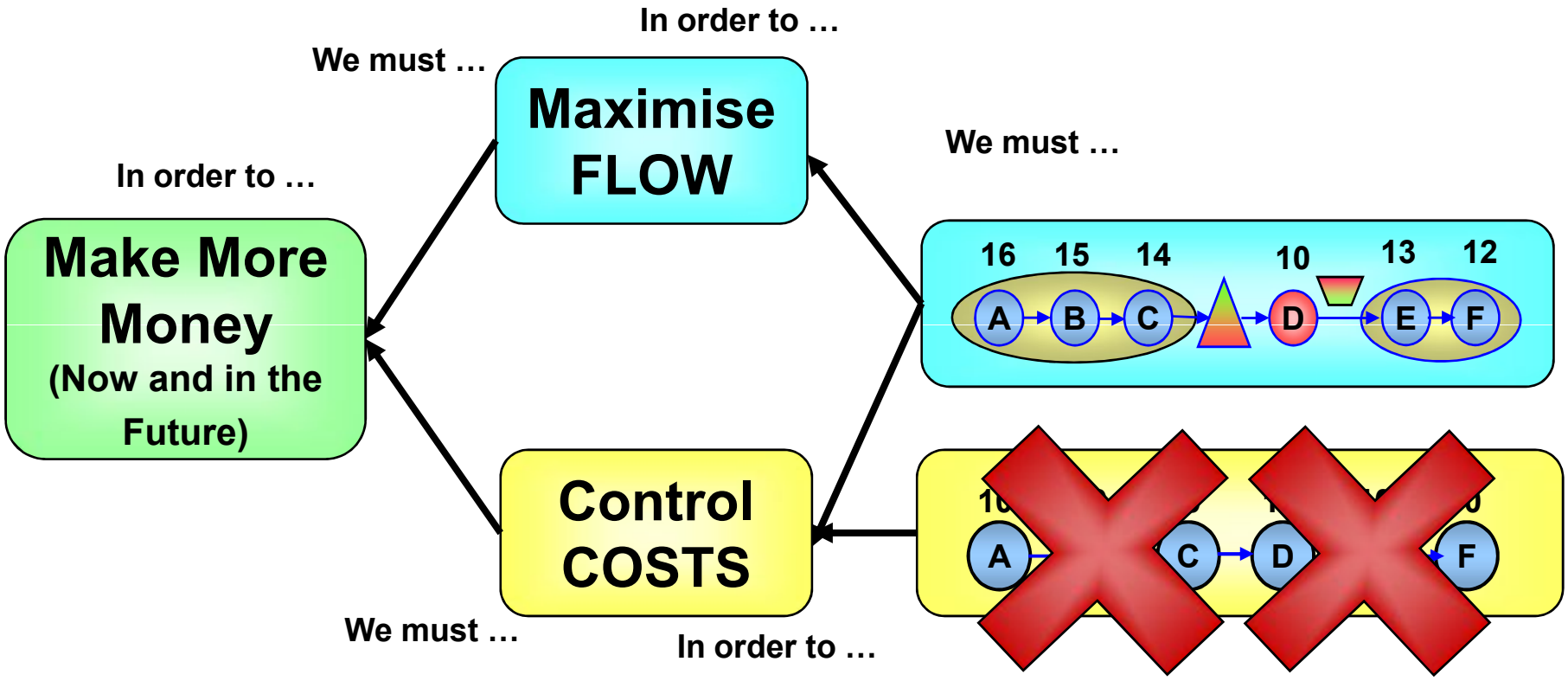
Two Conflicting Mental Models?



The real breakthrough will come when we can see how to break this conflict … and not allow it to arise again

Source: © Henning du Preez, Goldratt Group

Direction Forward?



DIRECTION: Mental frameworks that are aligned with the LAW that Governs Flow

Source: © Henning du Preez, Goldratt Group

What new insights did Tata get from TOC?

Can we improve upon this logic?

EFFECT?

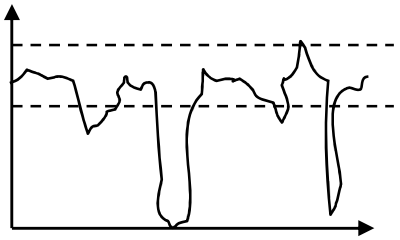
then

If ….

Resource **variation exist**

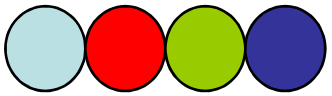
and

Resource **dependency exist**



Focus efforts:

1. Reduce variation using Six Sigma or TQM
2. Exploit/ reduce dependency using Lean & TOC
3. Change the whole equation using Technology



Source: © Henning du Preez, Goldratt Group

ASPIRE After Viable Vision: Focus on T3

- About Tata Group – People Before Profits
- About Tata Steel
- **Viable Vision @ Tata Steel**
  - -Developing Improvement Philosophy at Tata steel
  - -VV Template for Tata Steel – What's different?
  - -Learning

Viable Vision @ Tata Steel

Uniqueness of Goldratt Team's Incentive Bonus:

Most of the Goldratt Fee is conditional bonuses based on the Profit created **above** the Expected Net Profit (ENP), where the ENP is the Net Profit (before depreciation, interest, exceptional items and tax), that it is reasonable to expect Tata Steel will achieve without TOC implementation and is calculated from the following formula:

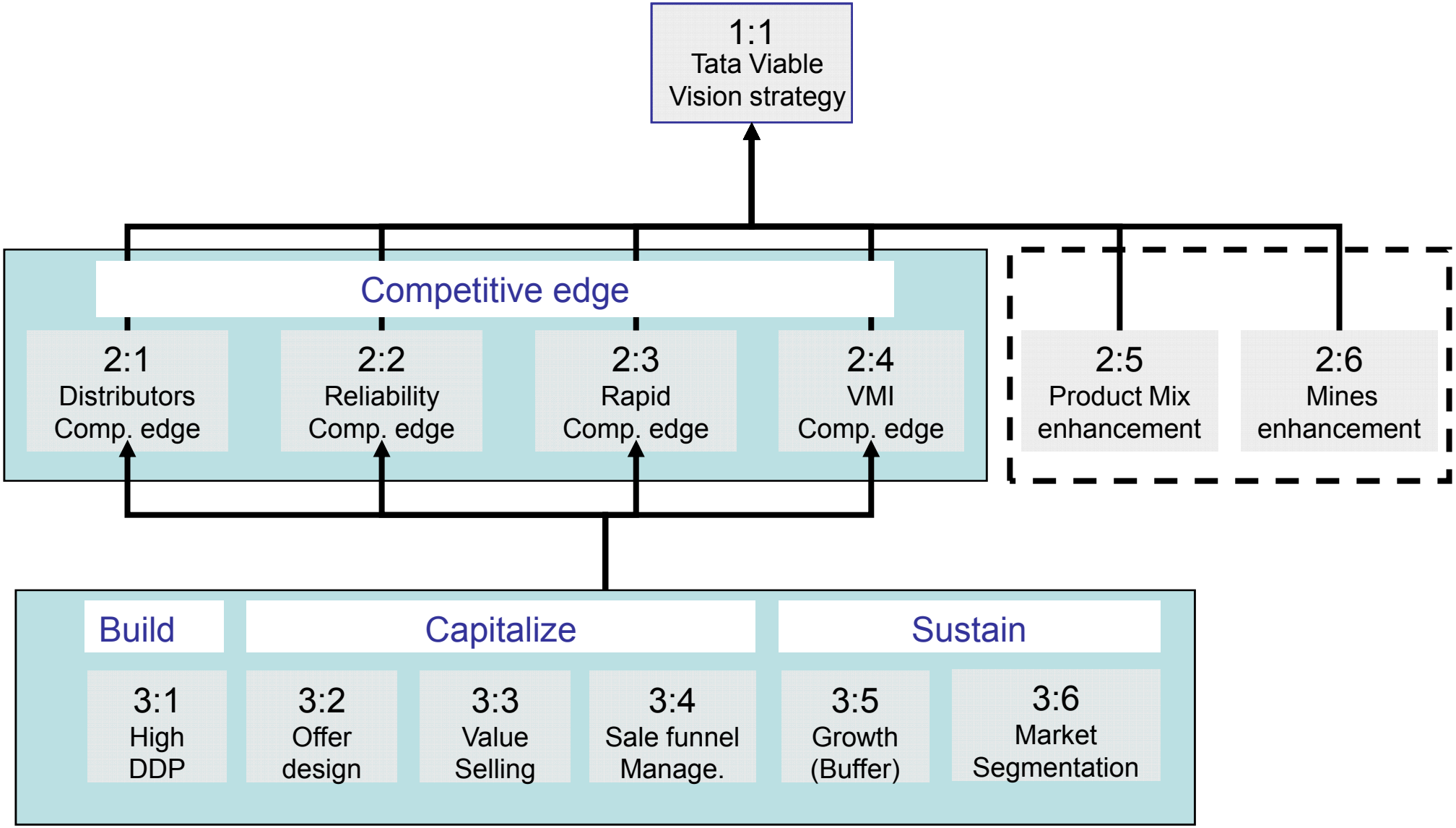
ENPy = base year profit + change in profit due to change in prices + change in profit due to change in planned available capacity + Tata Steel's self improvement factor

ENPy = NP04/05 + (MPy–TPy)TSy + NP04/05x(TAy-T04/05)/T04/05 + SIFxN

Two scenarios:

1. Market prices high – then contribution will mainly come from getting higher prices
2. Market prices low – then contribution will come from holding prices and higher prices

Tata Steel Viable Vision Strategy & Tactic



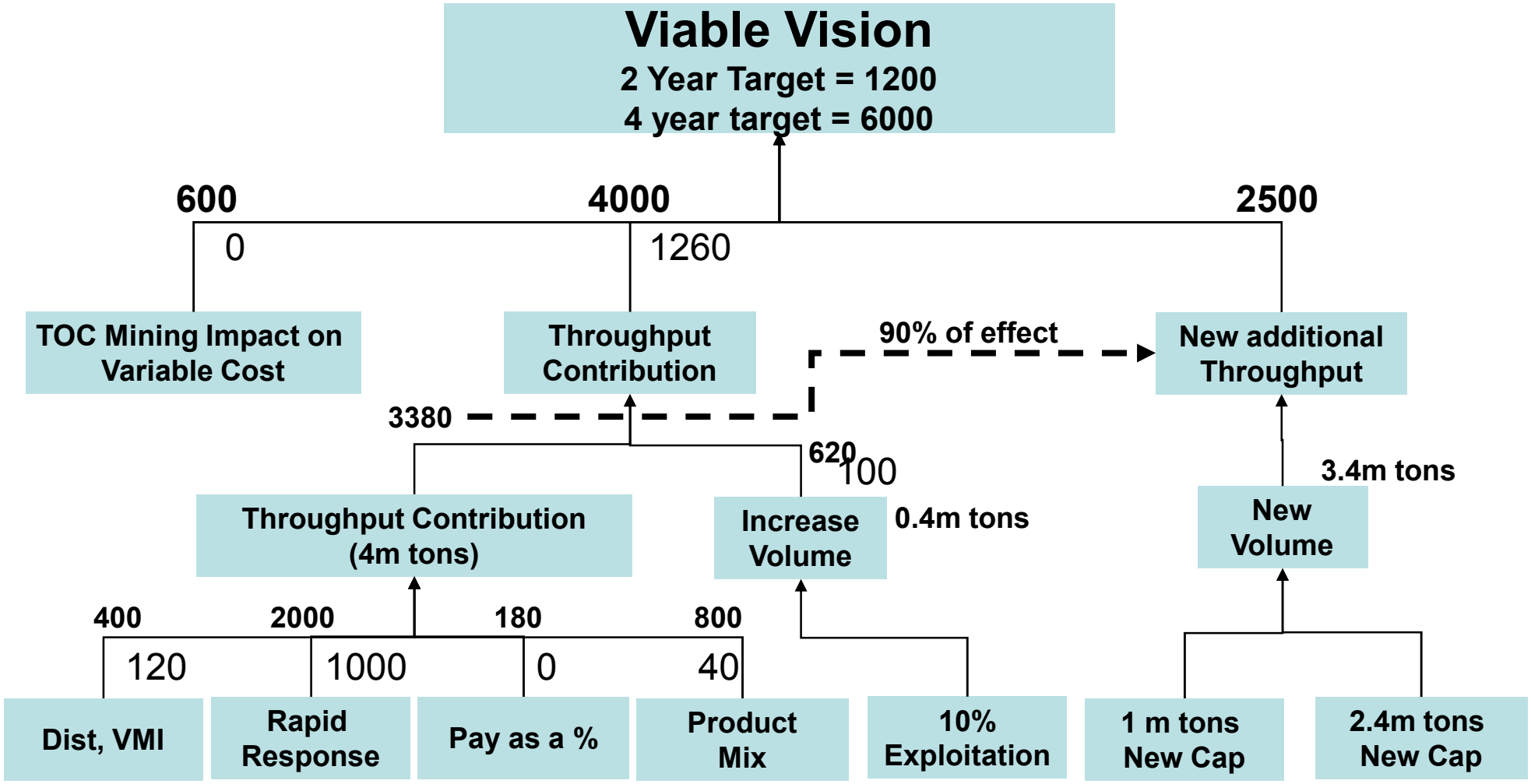
Source: Developed by Dr. Eli Goldratt as part of Tata Steel Viable Vision Analysis

1:1	**Tata Steel Viable Vision**
Strategy *Objective of Change*	(The Company is solidly on POOGI (Process Of OnGoing Improvement)) **The aggressive growth of Tata Steel is (almost) not effected by market price oscillations.**
Parallel assumptions *Viability Logic of Change*	- To ensure aggressive growth (also in profit and ROI) Tata Steel's T (Throughput*) must grow, and continue to grow, faster than OE (Fixed cost). **Throughput = Sales – Variable Cost* - **A competitive edge that is not based on low prices enables a company to hold its prices against cheaper offers.** - Exhausting the Company 's resources and/or taking too high risks severely endangers the chance of reaching the strategy.
Tactic *"How to" achieve Change*	Build a decisive competitive edge (which is not based on low prices) and the capabilities to capitalize on it, on big enough markets without exhausting Tata Steel's resources and without taking too high risks.
Sufficient assumptions	- The way to have a decisive competitive edge is to satisfy a client's significant need to an extent that no significant competitor can. **-Different clients have different significant needs.** **-Not all the current customers will fit nicely into selected competitive edge**

3:1	Achieving High Due Date Performance
Necessary assumptions	In the steel industry, being able to service all demand (not just a few key accounts) with high due date performance (in the high 90%) is almost unheard of. Doing it for a mix of make-to-order and make-to-stock and also for short lead time orders is unheard of.
Strategy	Tata Steel has very high due-date performance (in the high 90%)
Parallel assumptions	DBR (Drum Buffer rope) with Buffer Management (both in production **and in the various finished goods stocks locations**) enables operations to provide high availability (in the high 90%)
Tactic	Tata Steel implements DBR and Buffer Management (both in production and in Finished Goods stock locations) and establishes the necessary inventory buffers. Only when excellent Due Date performance is guaranteed for a market segment* is the green light given to sales to sign corresponding competitive edge based deals (competitive edge based deals should start much earlier since the lead time to get contracts is sometimes long). * Market segment is defined by: type of offer, type of product, geographic location, type of client

Viable Vision Financial Breakdown

(amounts in Rupees Crore)



- About Tata Group – People Before Profits
- About Tata Steel
- **Viable Vision @ Tata Steel**
  - -Developing Improvement Philosophy at Tata steel
  - -VV Template for Tata Steel – What's different?
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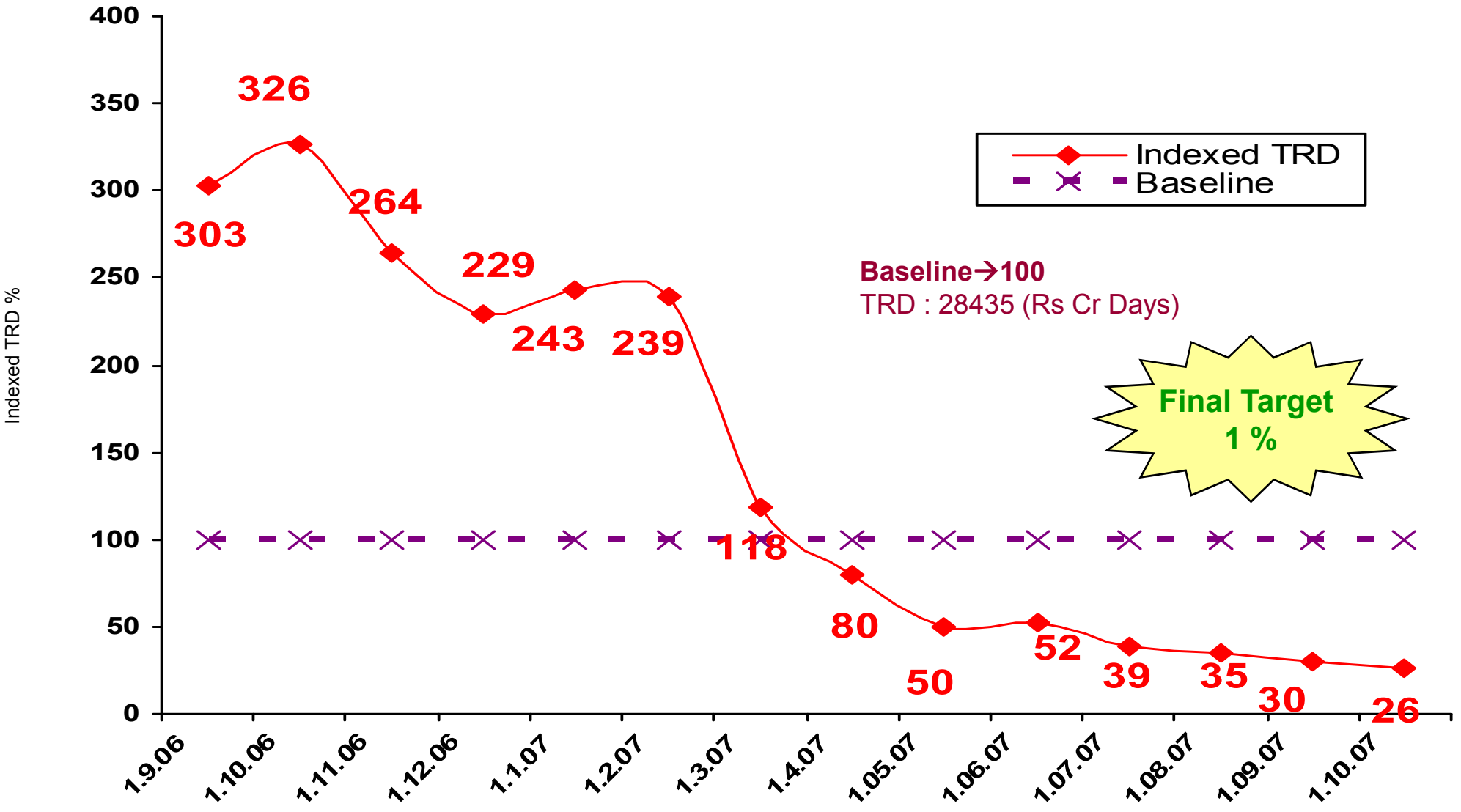
3:1 in Strategy & Tactic

Building High DDP

Improvement achieved to date with TOC
in TOC's Prime Measurement of Due Date Performance:

Throughput Rupee Days (TRD)

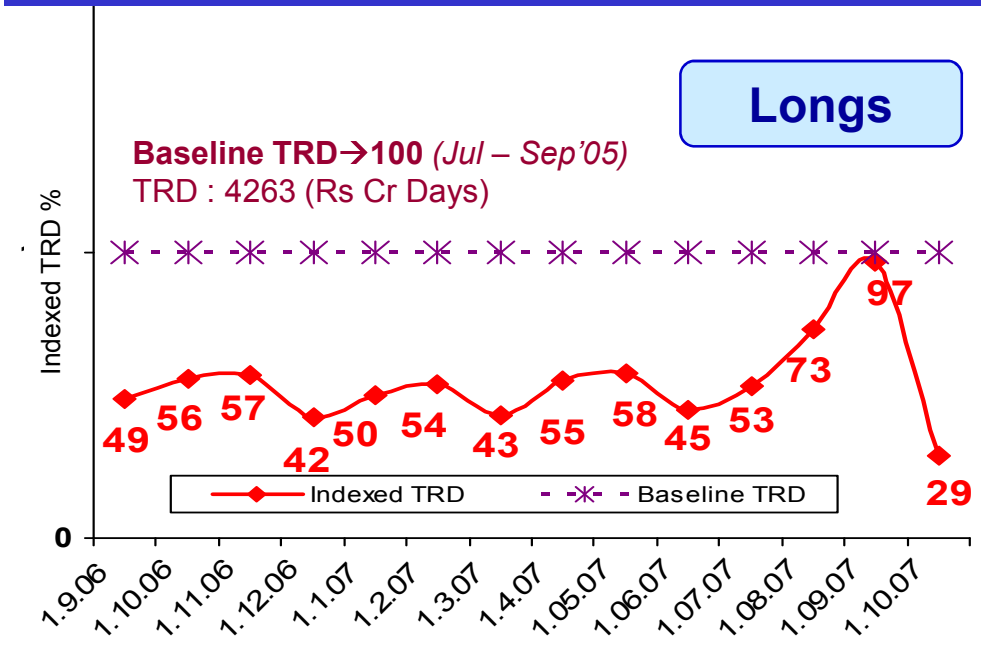
TRD Indexed TRD % of Baseline* (as on 1st October'07)

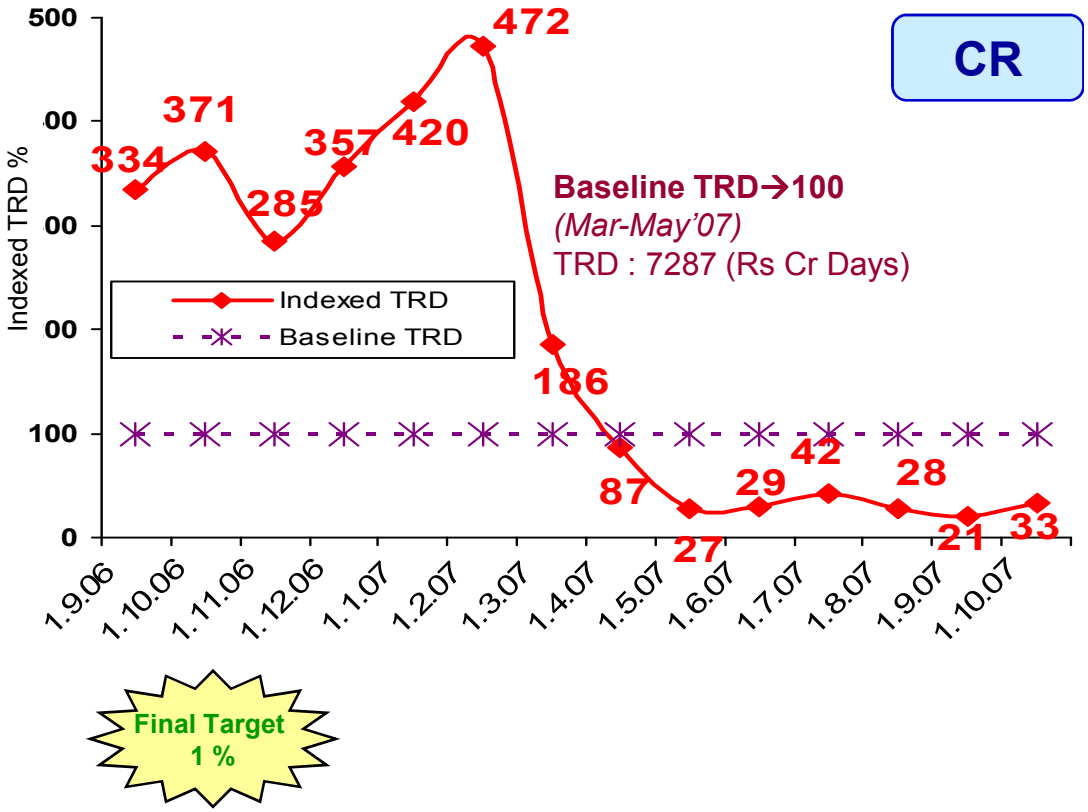


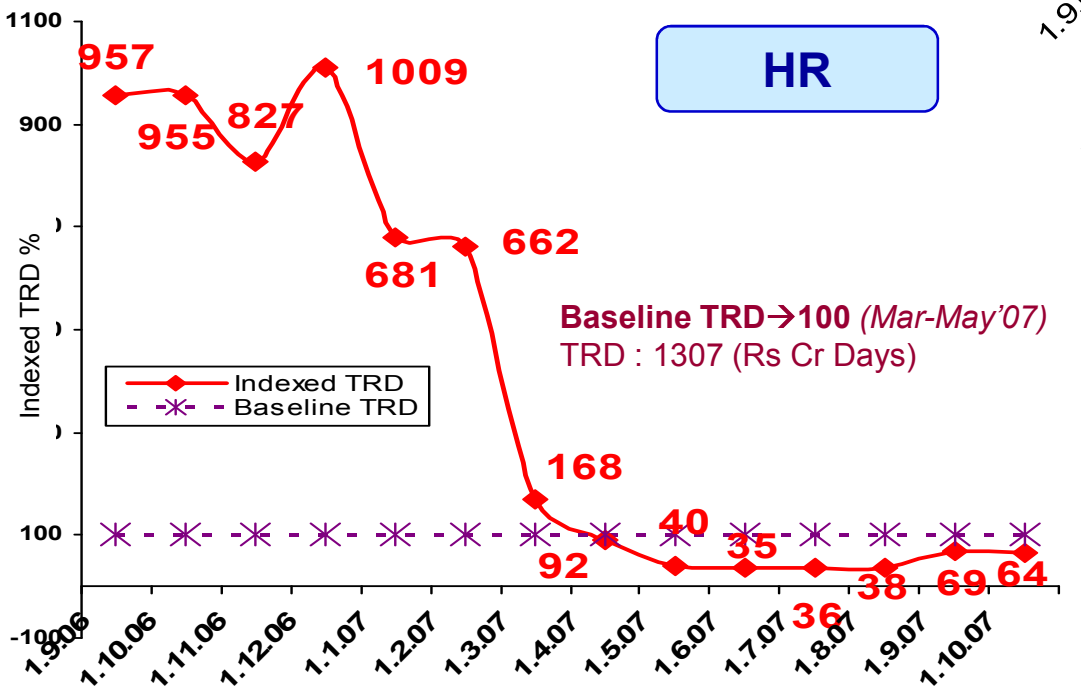
***Baseline Period**

CR & HR: Mar-May '07, Longs & Tubes: Jul-Sep'05, Wires: Dec'06-Feb'07

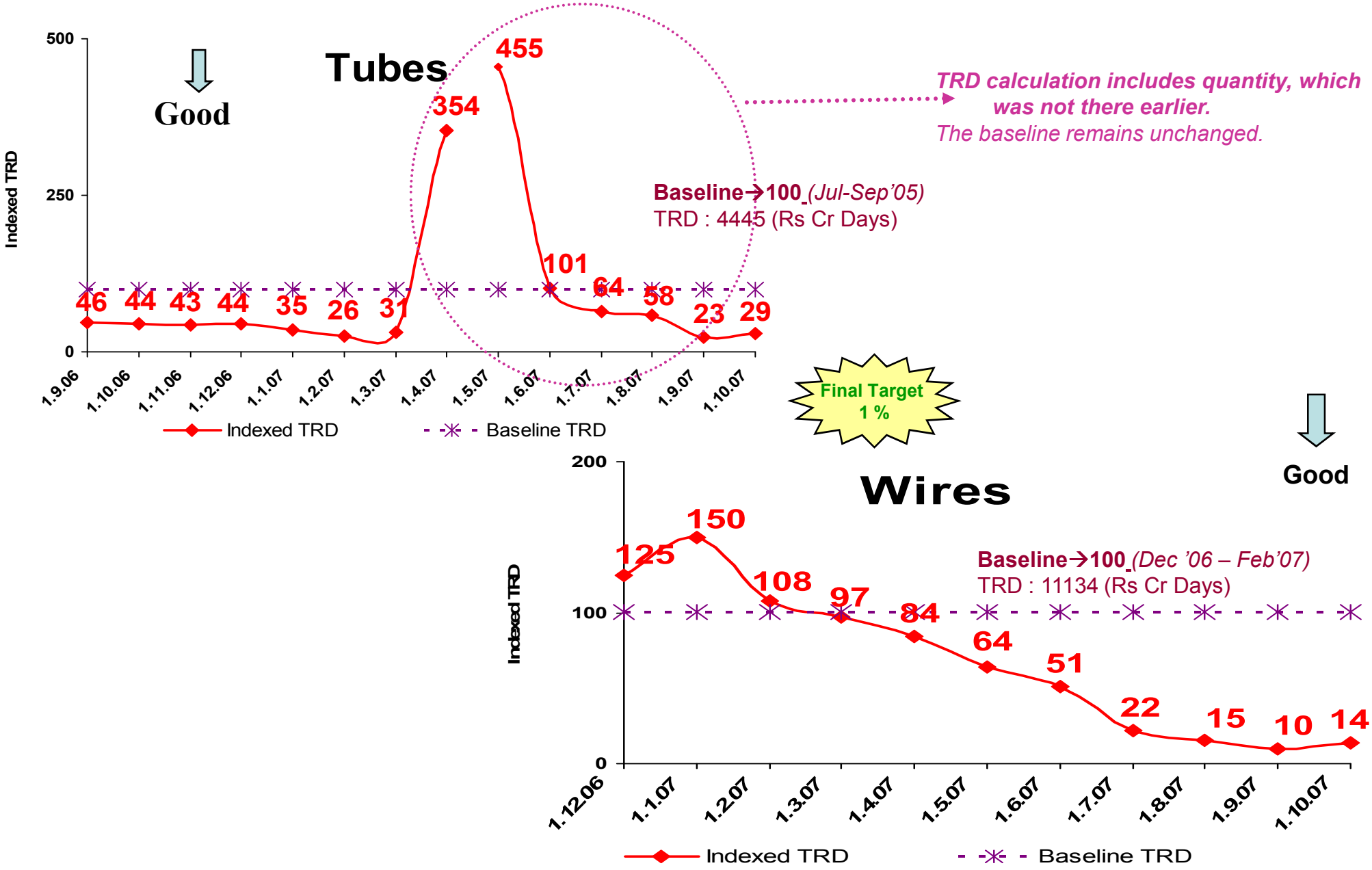
TRD: Product category-wise (as on 1st October'07)



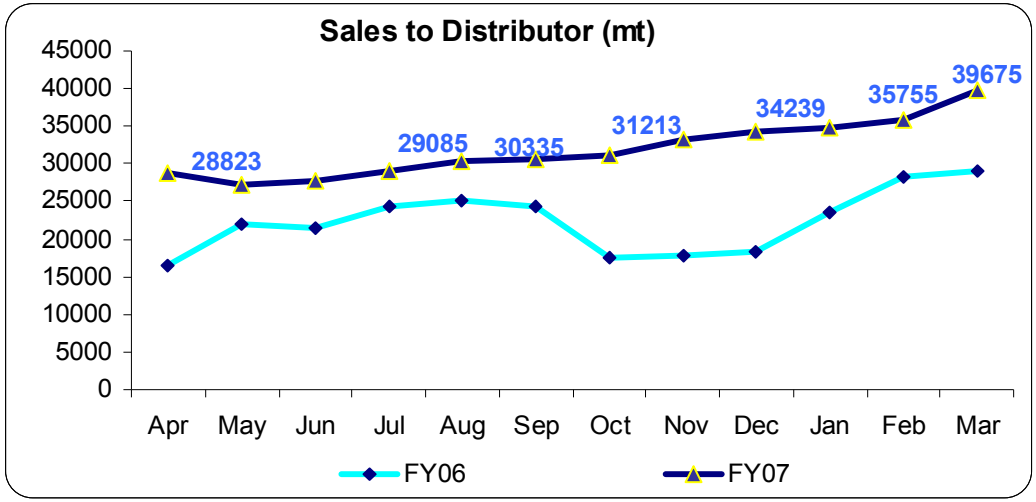




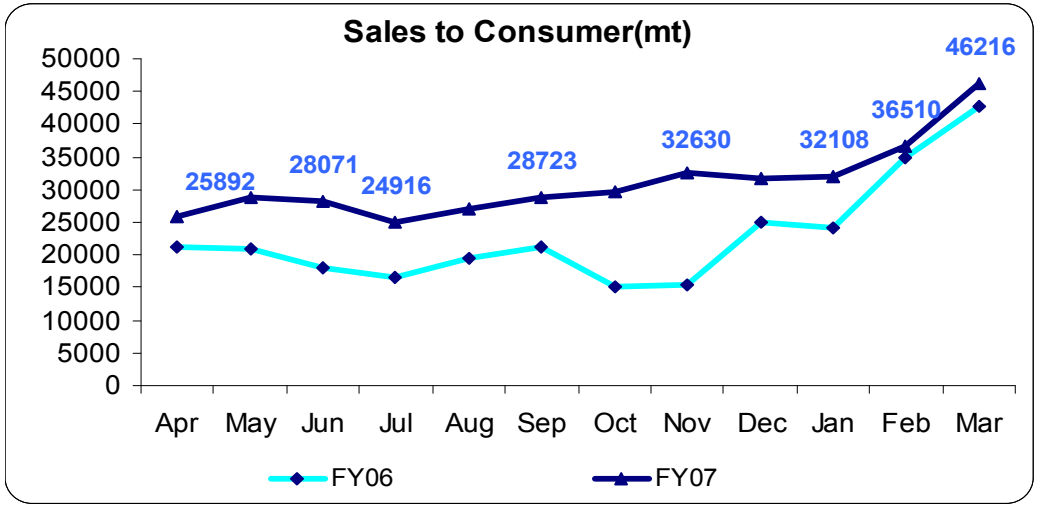
TRD: Product category-wise (as on 1st October'07)



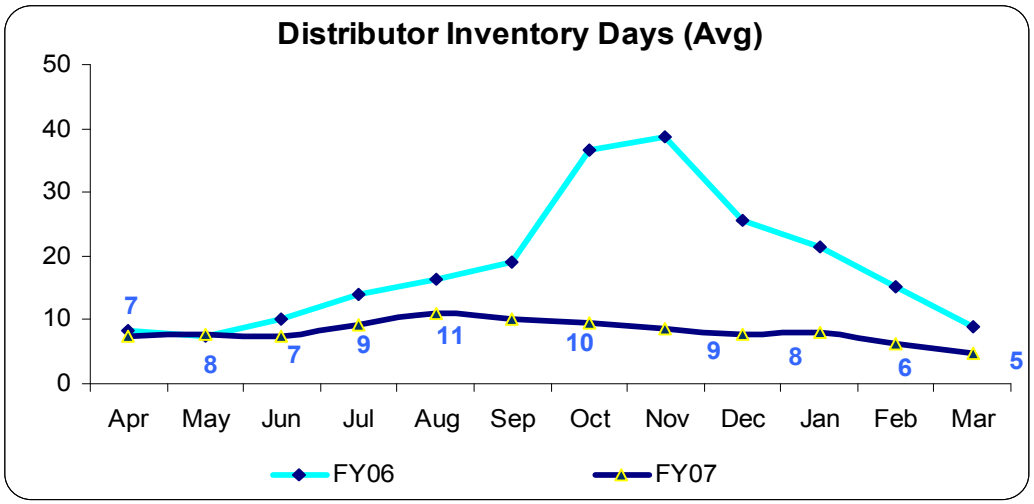
KPI MONITOR



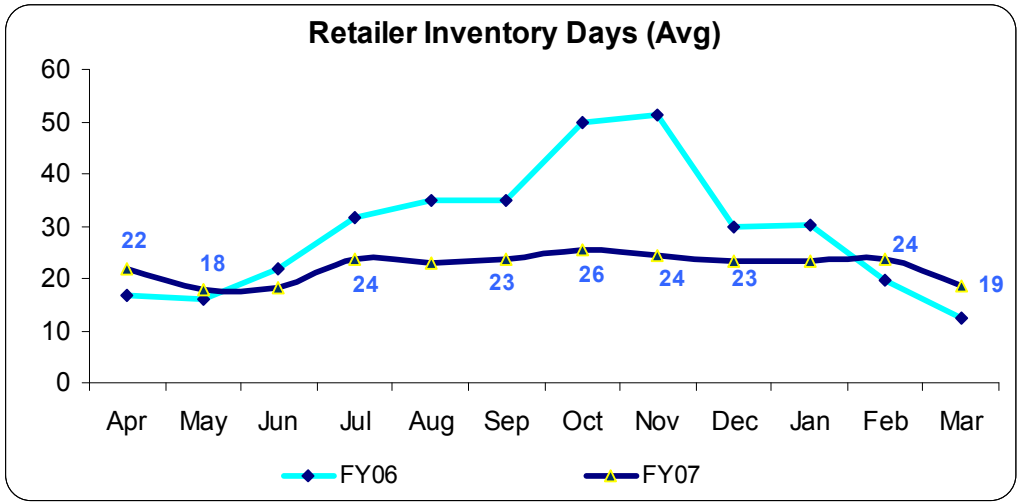
Significant increase in sales !!



35% increase in Sales – Rs.328Cr.



Uniform Stock levels, and a 12days Reduction



7days Reduction in Inventory, Scope for more!!

FINANCIAL IMPACT

Distributors	**FY06**	**FY07**	**Benefit**
Reduction in Working Capital – Avg. Stocks – Avg. Debtors	 20 days 17 days	 8 days 14 days	**Rs.150/ton**
Release of Buffer Capital - Peak Stock Levels	48 days	12 days	**Rs.200/ton**
Increase in Sales to Dealers (Avg)	4%	36%	**Net Margin increase**
ROCE *(12month Rolling avg)*	11%	24%*	**Doubled**
Tata Steel			
Increase in Price Premiums	**Rs 400/t**	**Rs 1100/t**	**Net Price Realization up by Rs**

Rs 50Cr p.a

Benefits are Ploughed-back to Grow the Business further…

Process of institutionalisation

- **Process:**

1. TOC implementation plan is part of ABP finalisation process
2. Roll-out through cross functional teams
3. Full time task force for ensuring implementation rigor, training and removing implementation issues

- **Training:**

1. TOC fundamental training
2. TOC supply chain training
3. TOC SFS/Value selling training
4. TOC training to distributors
5. TRD Training
6. TOC operations training

GOLDRATT TRAINING

- TOC Fundamentals (TOCICO Certification) by Alan Barnard: All Executives, Snr Managers & internal TOC team (60 persons)
- Mini Jonah by Henning du Preez: 10 persons (CSI & Steel Making)
- 'S-DBR' by Eli Schragenheim: 65 persons
- CCPM Application experts by Dr. James Holt: 30 persons
- 6 week Application Expert program by Goldratt Schools: 34 persons certified by TOCICO as 'Certified Practitioners' in Supply-Chain and Logistics
- TRD Training: 200 officers

- **Reviews:**

1. Review by Sr. VV team: Monthly
2. Apex TQM review: Quarterly
3. Daily management through war rooms and concerto status review: Daily
4. IT status review: Fortnightly / Monthly
5. COMS review: Fortnightly

2.6 in Strategy & Tactic

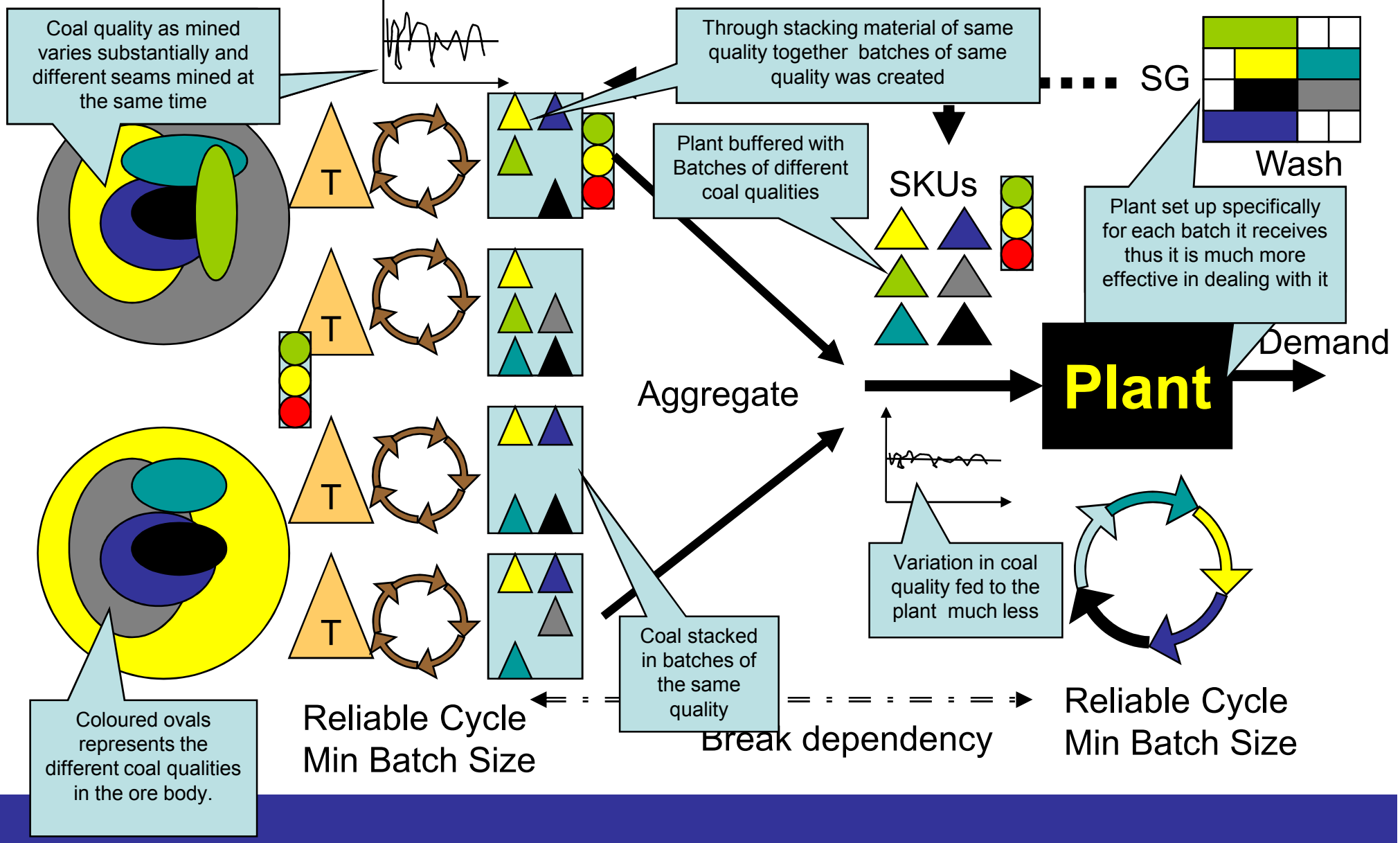
Mine Enhancement

with

TOC in Mining

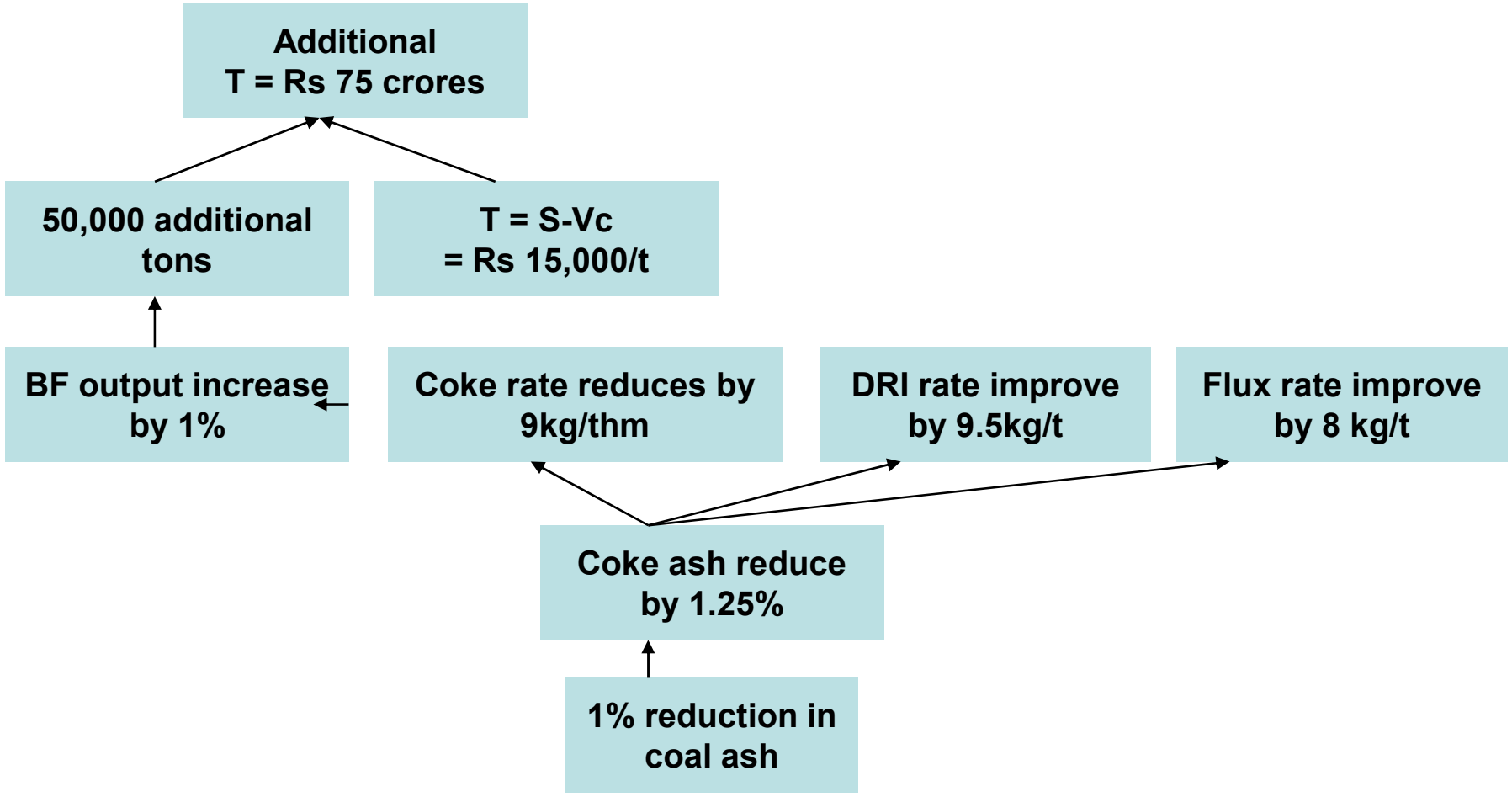
Source: Andy Anderson, Goldratt Group

Mine to Plant Reverse Distribution Model



Decide how to Exploit the constraint

Clean Coal : Low ash advantage



Applying TOC in Mining

TOC MINING OBJECTIVES

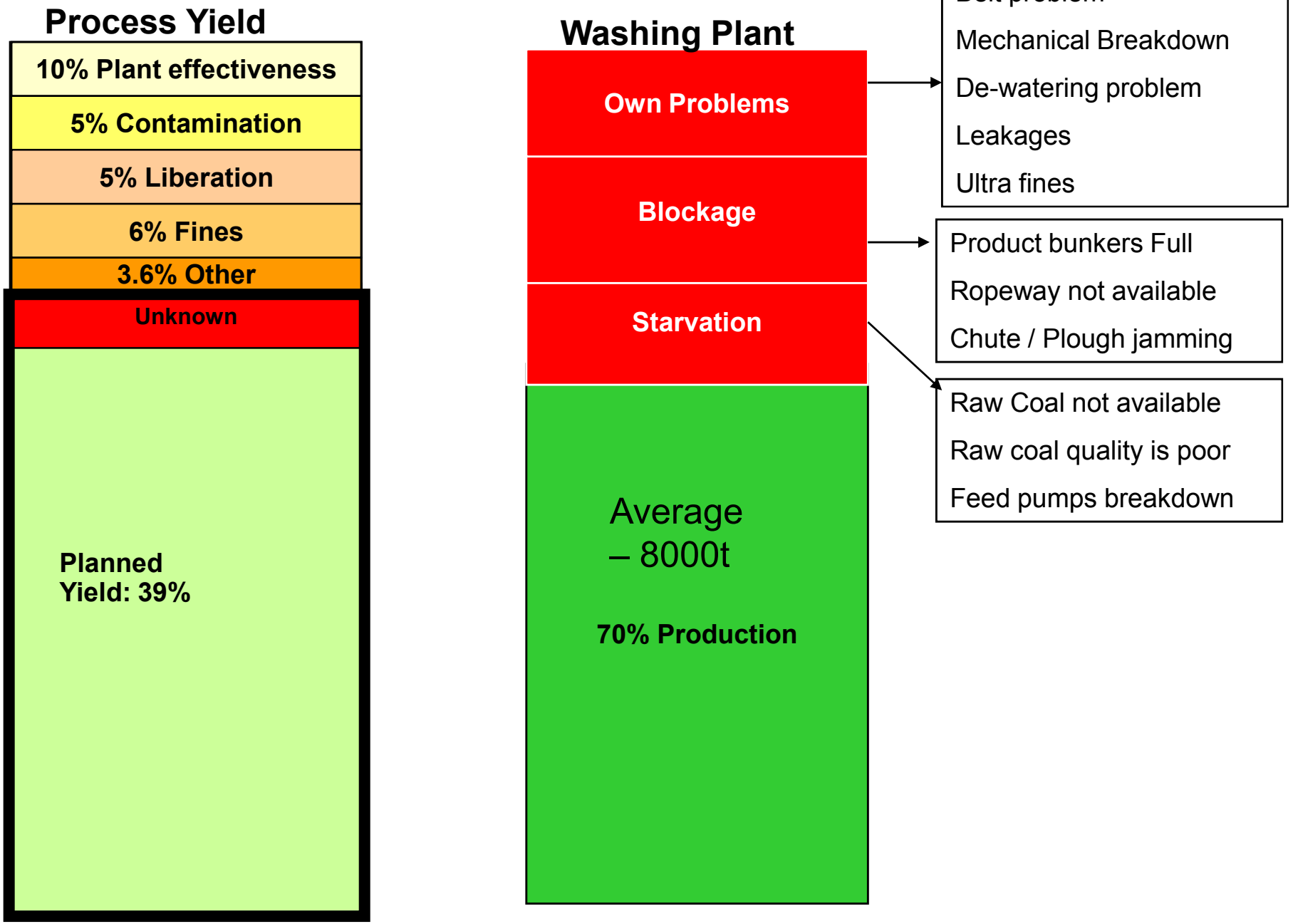
1. **IMPROVE THE THROUGHPUT**
   - ✓ Ensuring right quality
   - ✓ Improving reliability of dispatches
   - ✓ Improving volumes to meet demand
   - ✓ Reducing cost/t w/o compromising above
2. **IMPROVE THE MINE LIFE**
   - ✓ Maximizing mineral recovery
   - ✓ Improving yield

IMPROVE FLOW

Life of the mine is the maximum value that can be recovered now and in future from all its mineral reserves given to us by the nature.

Source: Andy Anderson, Goldratt Group

IDENTIFYING FACTORS IMPEDING FLOW



Applying TOC's **Critical Chain Project Management (CCPM)** to Maintenance & Sustenance Projects

Maintenance & Sustenance Projects

Definition

Maintenance Projects	▪ Maintenance to overcome normal wear & tear of equipment Inspect the components which need repair or change (CDT) ▪ Cleaning and painting
Sustenance Projects	▪ Based on the need, equipment need to be upgraded for - Higher production - Meet certain quality requirement of enriched product mix - Modification to reduce cost of operation - Modifications to comply with new environmental and safety regulations.

Maintenance & Sustenance Projects

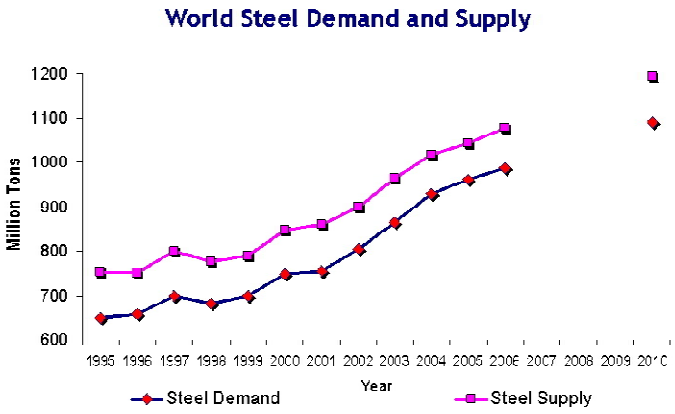
Need to apply CCPM (Performance gap)

Maintenance - In terms of statistics:

- We have about 10% down time / year
- About 8% to 9% of which is Planned
- Industry Benchmark ??
- 1% increase in availability – 38 Mil USD in Sales

Sustenance

- Huge demand
- Need to augment capacities to meet demand
- Capture desired market segments
- All this would lead to higher down time



Maintenance & Sustenance Projects

Classification of Maintenance & Sustenance Projects	
Project Management	**Time**
1. Manage & execute ourselves – some contractor labor used for low end jobs. 2. Manage ourselves but use external expertise for execution 3. Offload the entire project including project management 4. Work coordinated by us – executed by petty contractors but offload project management & engineering	A. Short term project - 5 days to 1 month B. Long Term Project - 1 month to 1 year *We have not applied CCPM in projects spanning more than 1 year*

Results Achieved with CCPM

Summary of Results - Fy'07 (year ending 31st March 07)

- **CCPM adopted as a process of planning, executing most maintenance projects (14) & some sustenance project (4).**
- **Project durations were reduce from 10% to 32% of time in maintenance projects.**
- **Project duration reduced for 7 to 15 % of time for sustenance projects.**
- **Savings Rs 35 Crs (US $ 8.7 Mil)**

Summary of Results - Fy'08 Q1 (year ending 31st March 08)

- **CCPM applied in all maintenance (10) & sustenance projects (4).**
- **Project durations were reduce from 5% to 27% of time in maintenance projects.**
- **Project duration reduced for 18 to 25 % of time for sustenance projects.**
- **Savings (cost accounting) Rs 19 Crs (US $ 4.7 Mil)**

Discussion

“Did we get the desired results?”

“W W W / W W W”

Discussion

"***This is the way steel has to be sold***"

"***It is such a joy to implement the TOC concepts in our Distribution. Why do you spoil the show by asking for money***?"


TATA STEEL
ASPIRE is a Journey…
Not a destination
Thank you for your time
And attention