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# *UPADI Conference Atlanta, GA 2006*

## *The Financial impact of improved maintenance*

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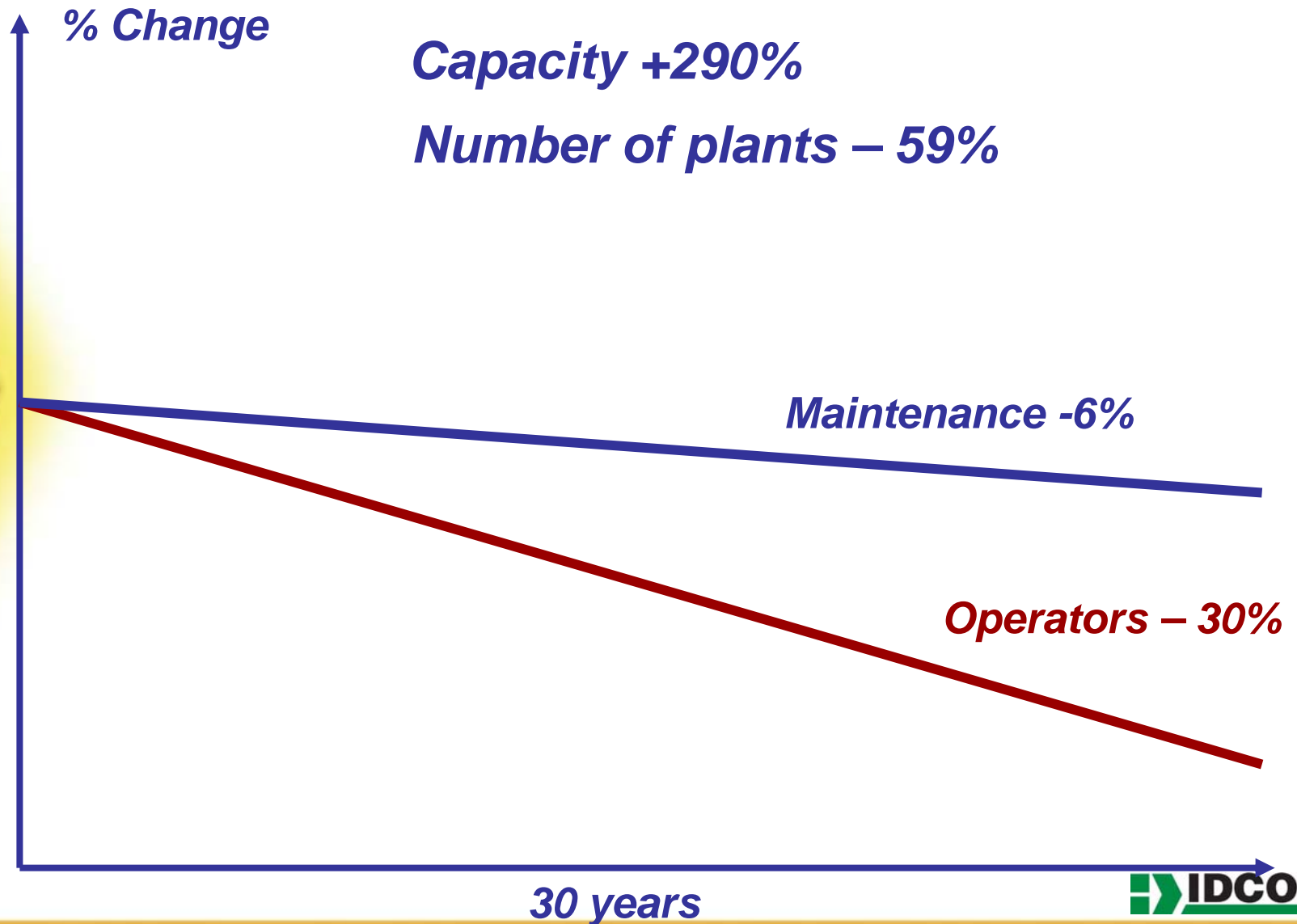
*Results Oriented*

*Reliability and Maintenance*

*Consulting and Training*

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# Equipment Reliability is becoming more important.

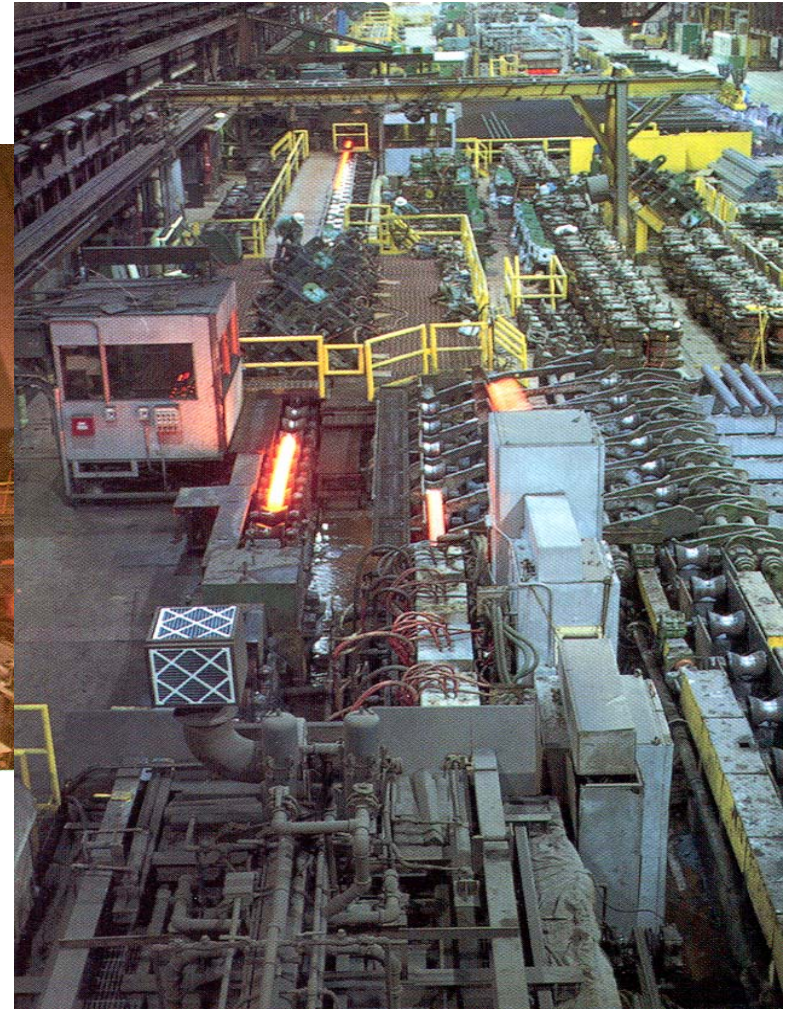


## Reasons why portion of maintenance employees increases



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## *Increased Automation*



## Reasons why portion of maintenance employees increases

- *Maintenance organizations are driven by costs instead of what drives costs.*
- *Maintenance Managers are in a “budget jail”.*
- *The total cost of maintenance is often hidden. (Lost production, increased capital spending, safety, late deliveries)*
- *The results of maintenance are not understood.*

# Three ways to reduce maintenance costs

## **1. Cut costs**

*Short term savings.*

- *Long term loss in Reliability and higher costs.*
- Valid maintenance work is postponed, not eliminated*

## **2. Maintenance Prevention**

*Alignment, balancing, lubrication, operating practices, filtration...*

- *Increased Reliability drives down maintenance costs.*

## **3. Execute remaining maintenance more efficiently.**

*Identify early, prioritize, plan work, schedule work, execute work, record, analyze, improve.*

- *Increased Reliability drives down maintenance costs.*

## Results of maintenance work

- *Improved maintenance performance drives up Reliability and drives down Maintenance costs.*
- *Cost Reductions drives down Reliability.*

## What is Reliability?

**“Trusted to do what is expected or has been promised”**

## Value of Reliability

*Average market price over five years = \$700/unit.*

*Average variable cost over five years = \$450/unit.*

*Contribution = \$250/unit.*

*Production today = 100,000 units/year.*

*Reliability today = 88%*

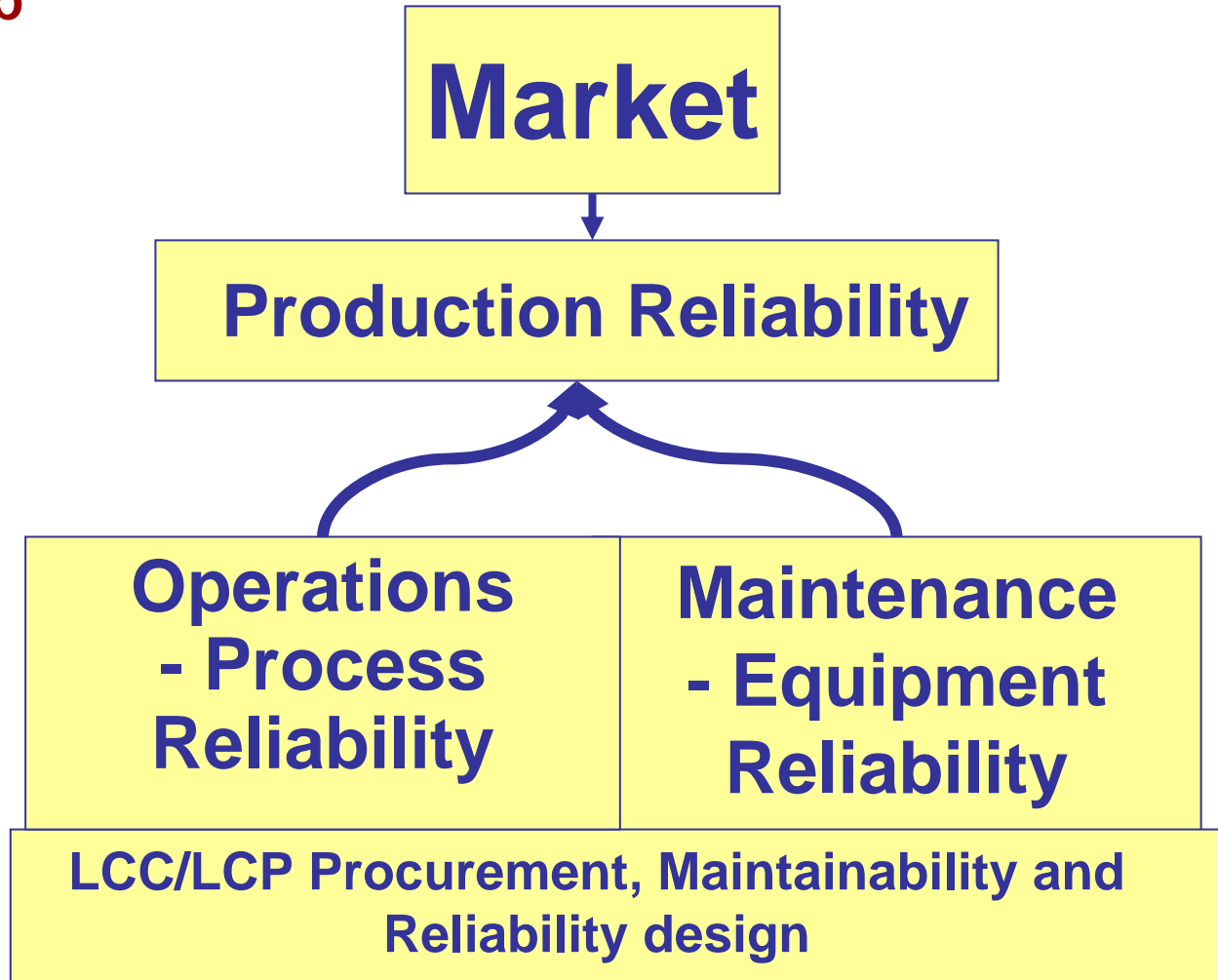
*Reliability goal = 94%*

*6% = 6,000 units x \$250 contribution = \$1,500,000/year.*

*And lower costs for maintenance, capital spending,*

*Safety, late deliveries.*

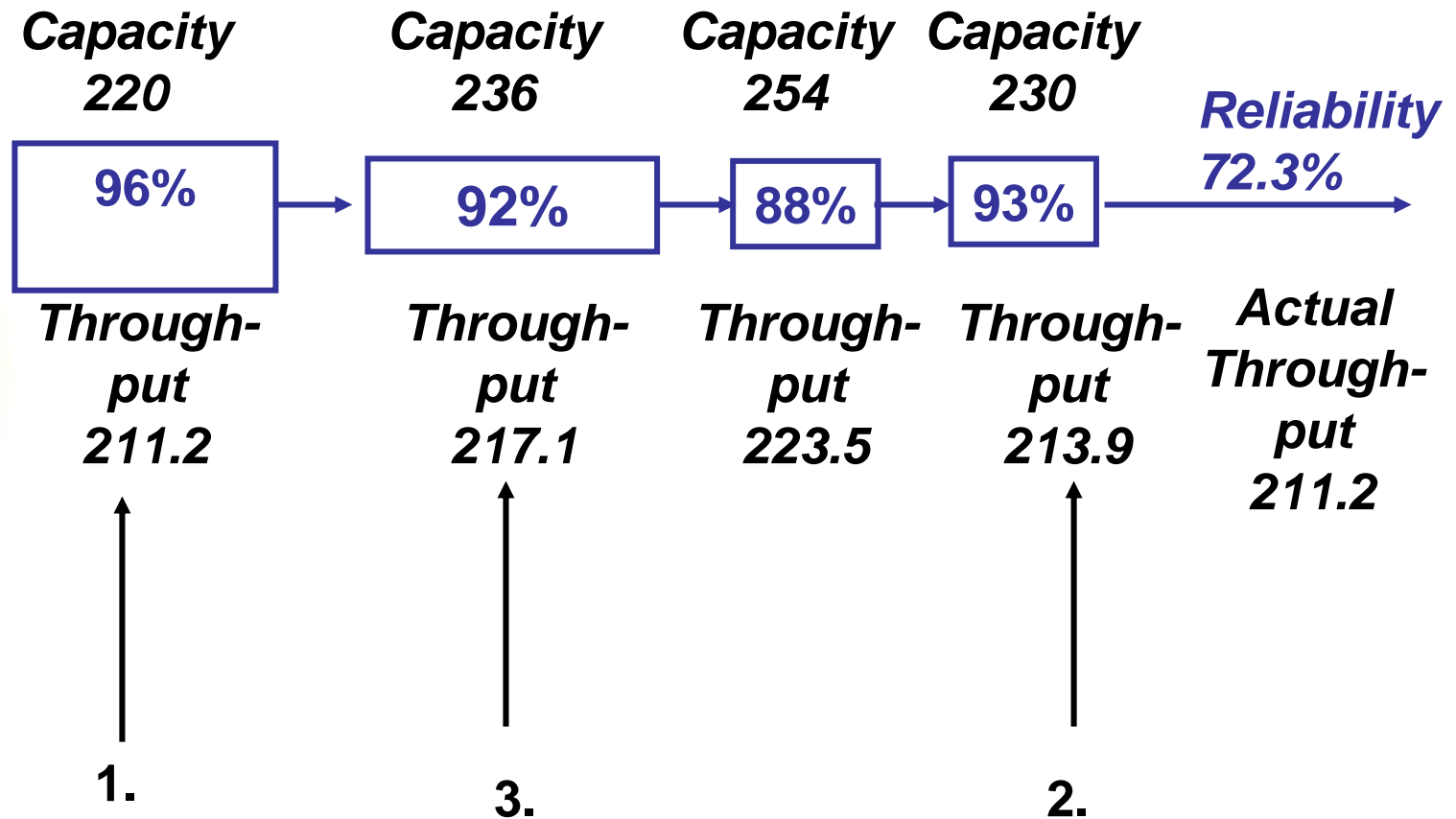
# Process and Equipment Reliability must be practiced as a partnership



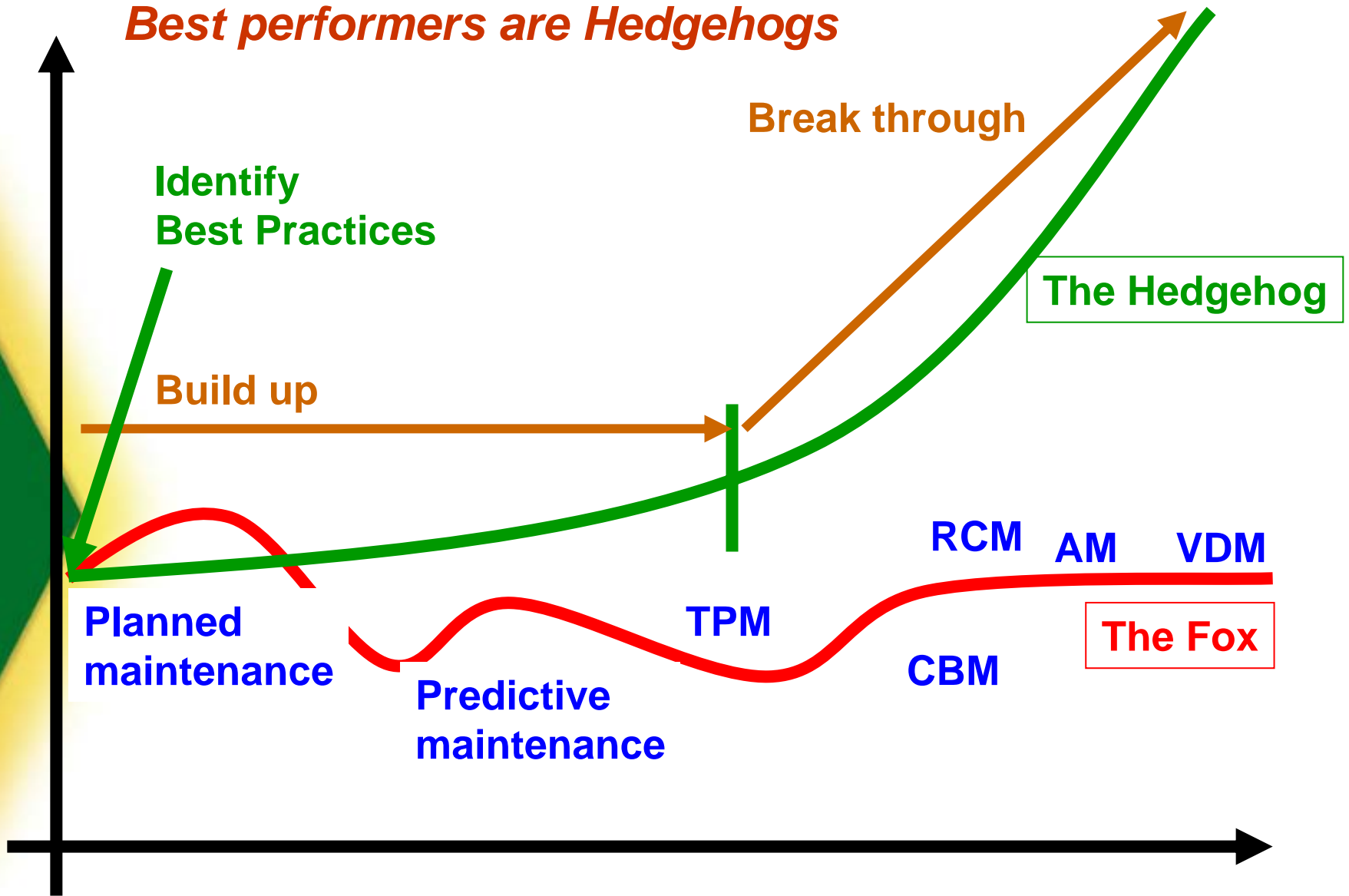
# Example Maintainability Design



# Capacity x Reliability = Quality Production Throughput.

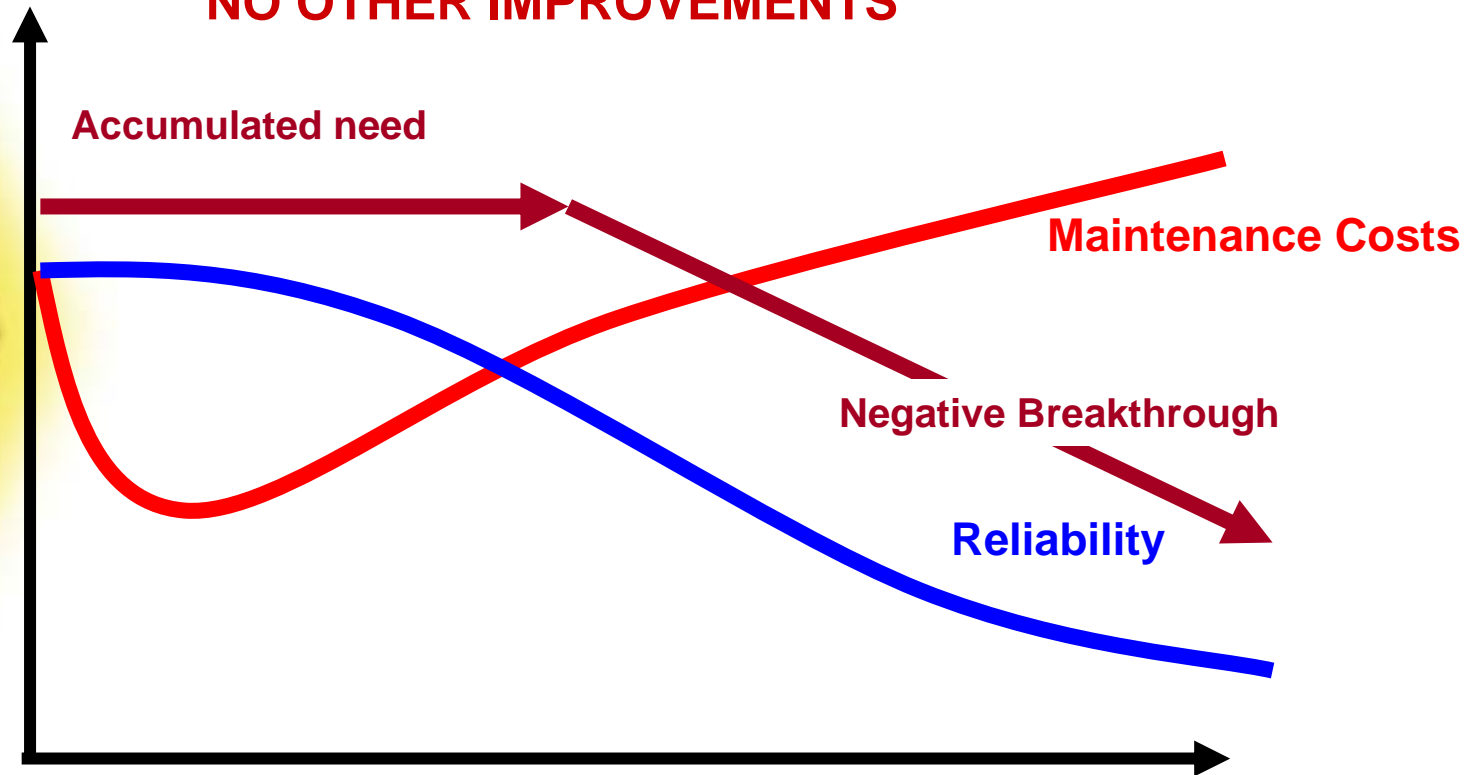


# Best performers are Hedgehogs

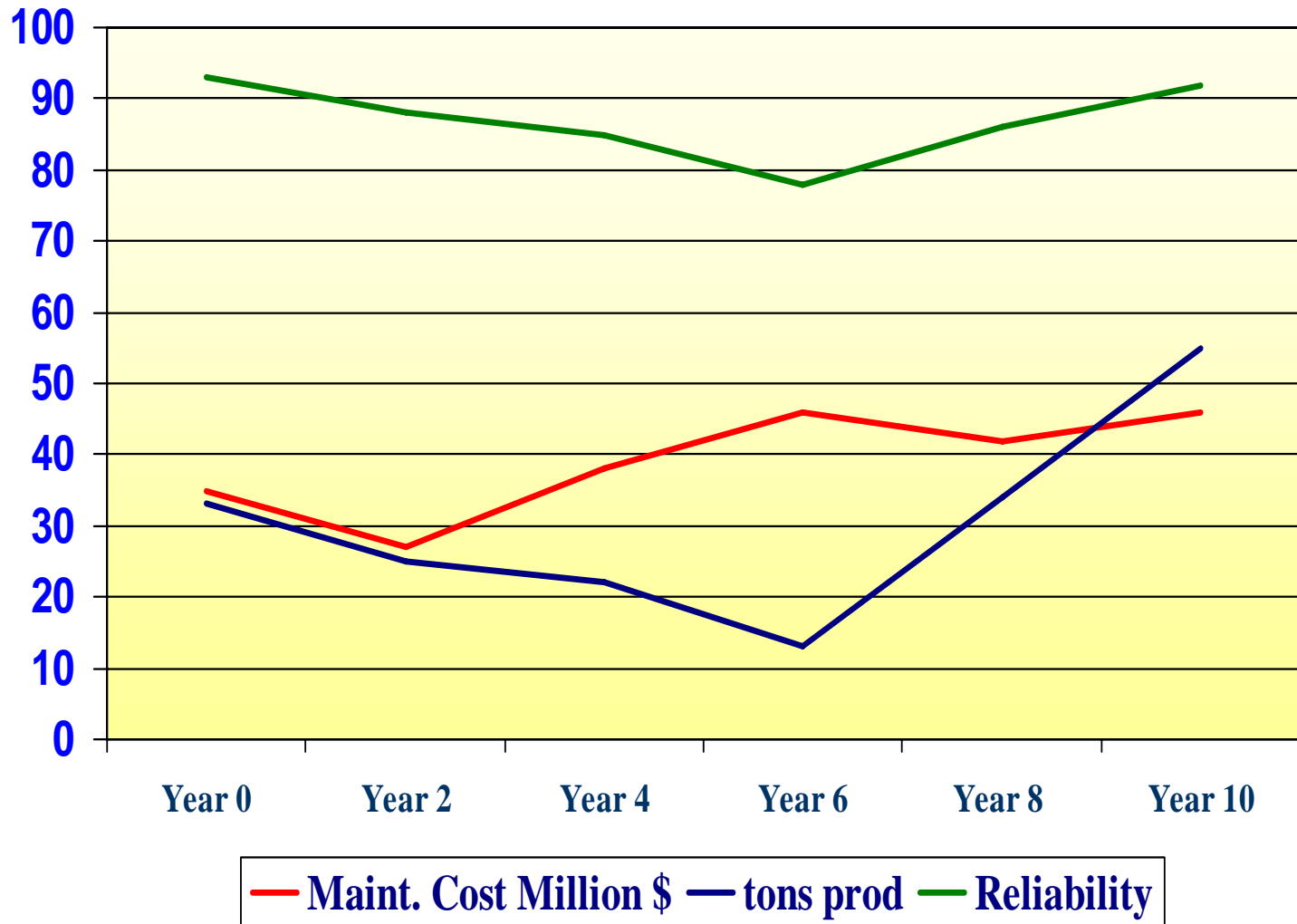


# Fox approach

## CUT (Postpone) MAINTENANCE COST NO OTHER IMPROVEMENTS

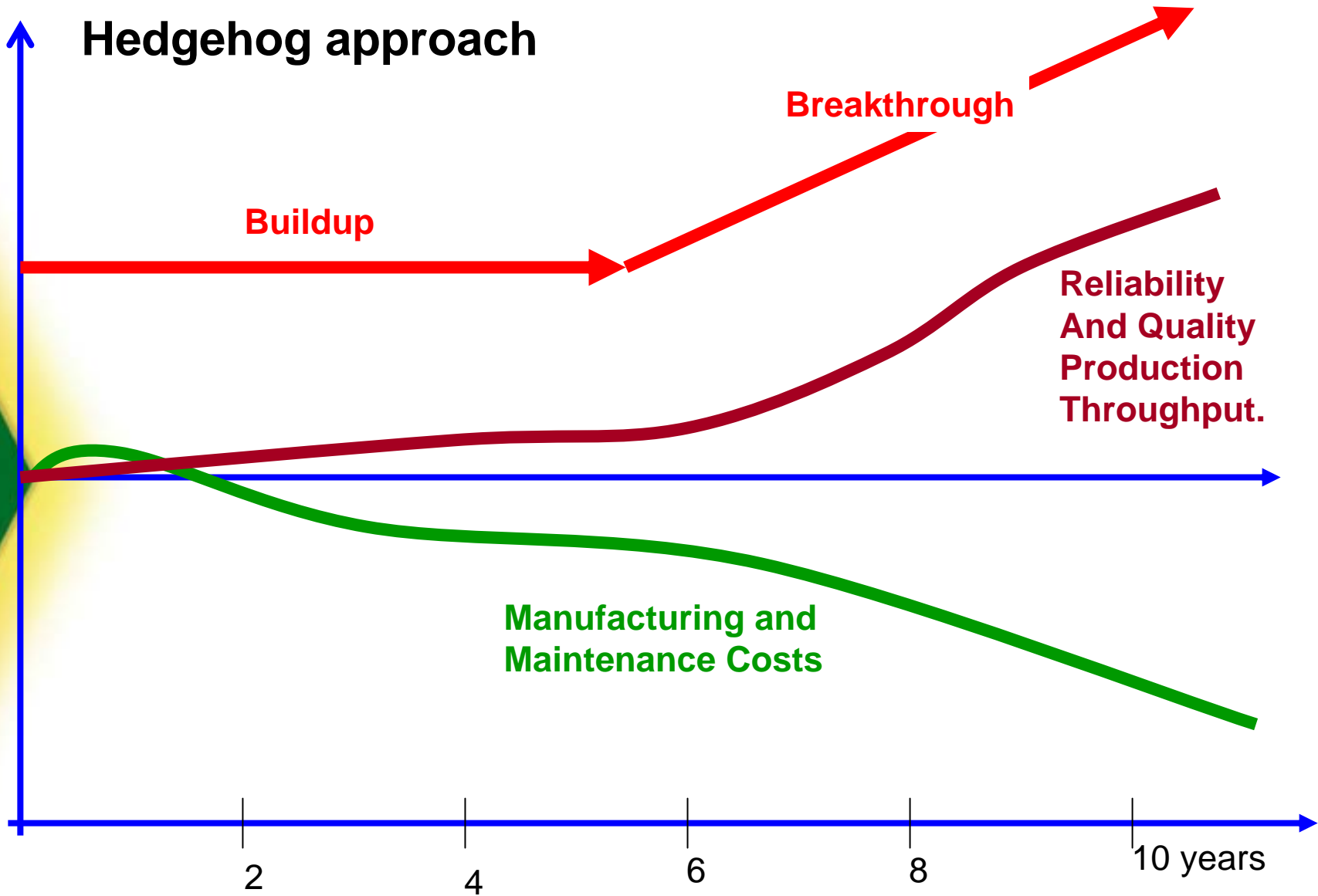


## Ten years effect of two years cost cutting focus

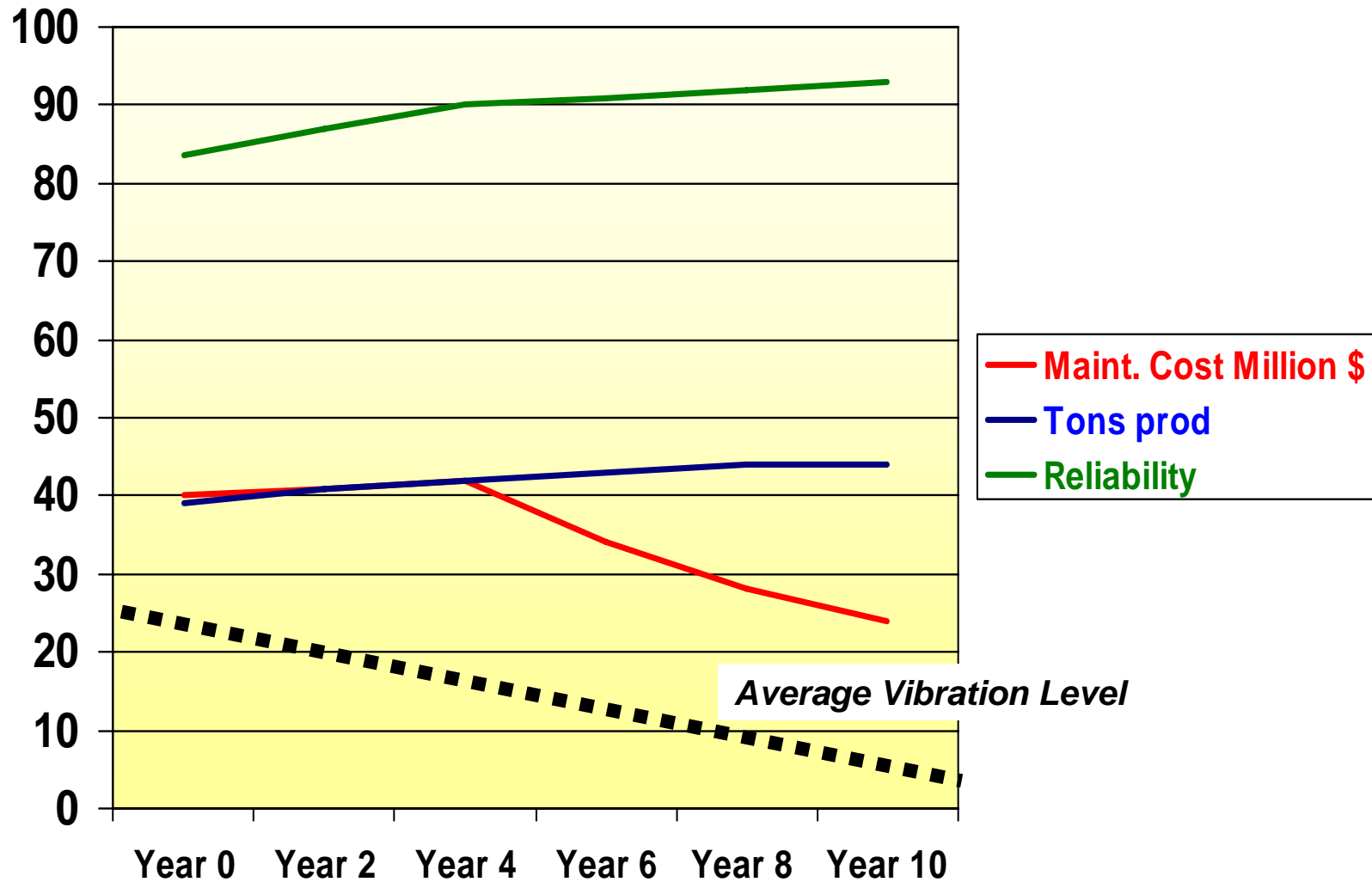


Maintenance cost.

# Hedgehog approach



## Ten years effect of a reliability improvement focus.

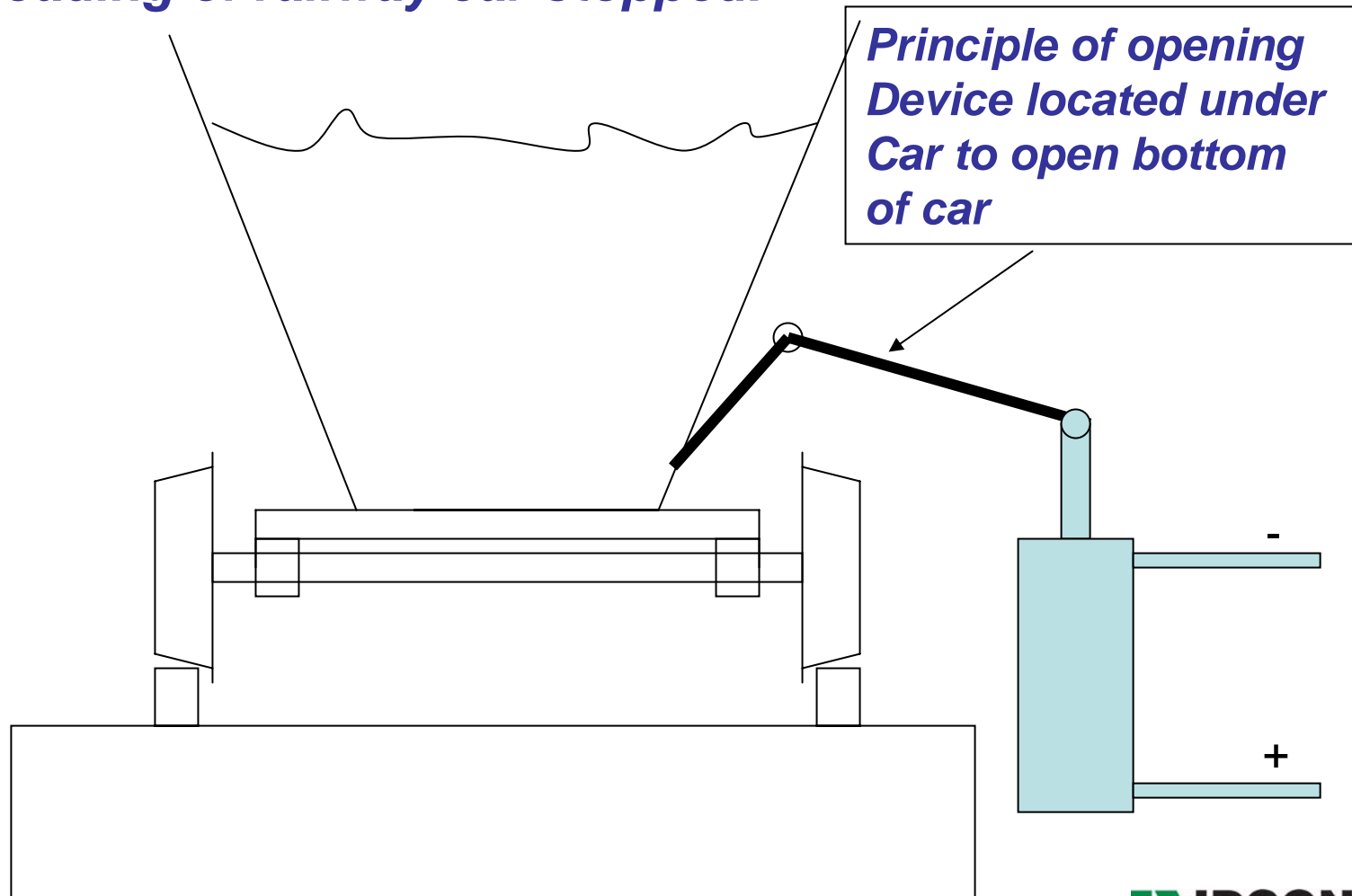


## Examples

***Use some realistic examples***

# Unplanned and Unscheduled Example

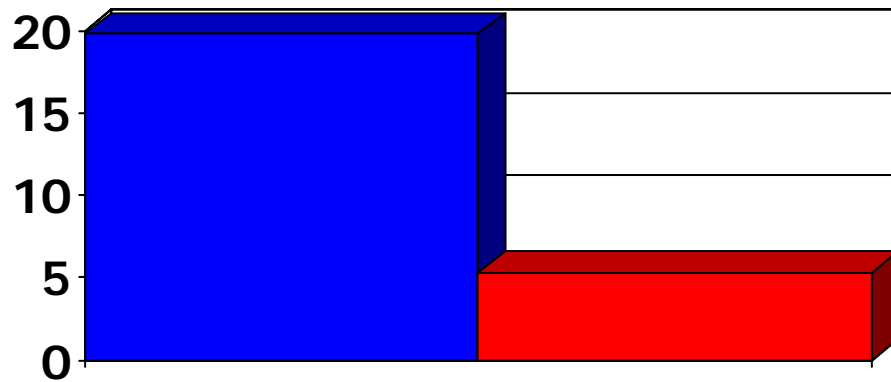
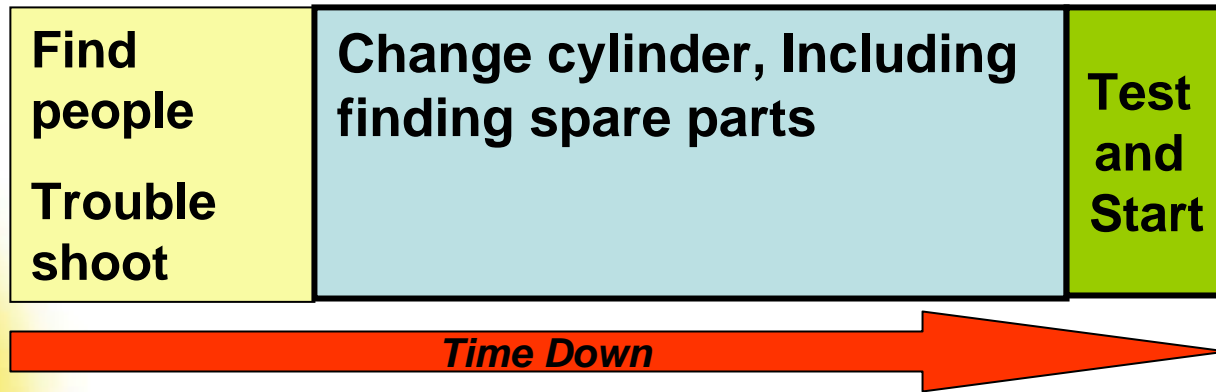
*Problem: At 11:30 am operator calls and reports that unloading of railway car stopped.*



# Unplanned and Unscheduled Example

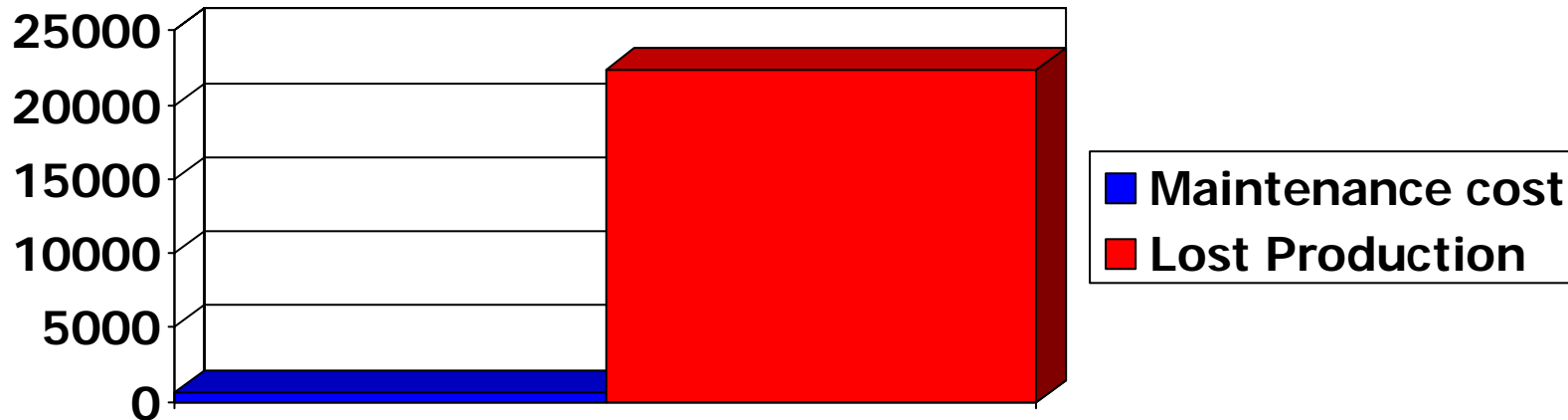
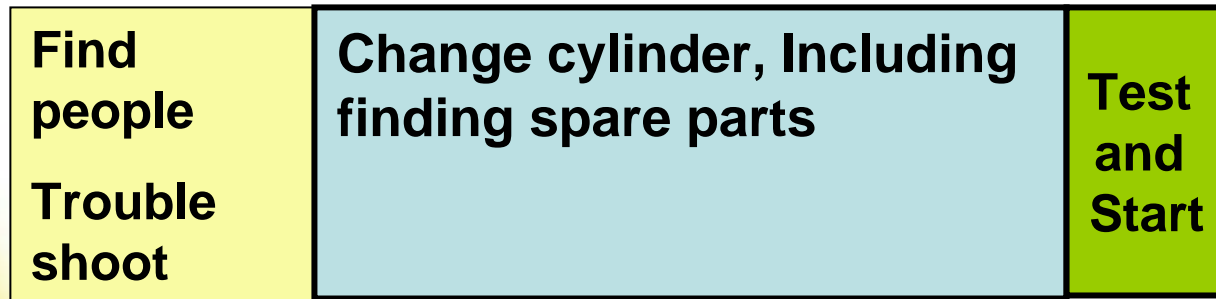
<i>Time</i>	<i>Activity</i>	<i>Minutes</i>
11:30	Unloading stops, Operator calls maintenance	2 x 10
11:50	Two mechanics and one electrician arrives	3 x 20
11:50	Trouble shooting starts	
12:40	Finds that pressure OK. Cylinder moves only half way. Cylinder hot.	3 x 50
12:50	Decides to change cylinder because of internal leak. Calls store to find out if they have a spare cylinder. Name plate missing. Equipment record is missing data on type of cylinder. Store sends three possible choices of cylinders Start disconnecting cylinder after locking out hydraulic system.	5 x 40
13:30	One more mechanic is called to get the right tools including rigging tools.	
14:45	Cylinder removed	4 x 75
16:10	New cylinder in place	4 x 85
16:50	Unlock, remove air from system, start up and test completed	4 x 30
<b>Time Down</b>	<b>5 Hrs and 20 Minutes</b>	
	<b>Maintenance Hours 19 Hrs and 50 Minutes</b>	

# Unplanned and Unscheduled Example



■ Maintenance Hrs  
■ Production Hrs

# Unplanned and Unscheduled Example



**What we can do better**

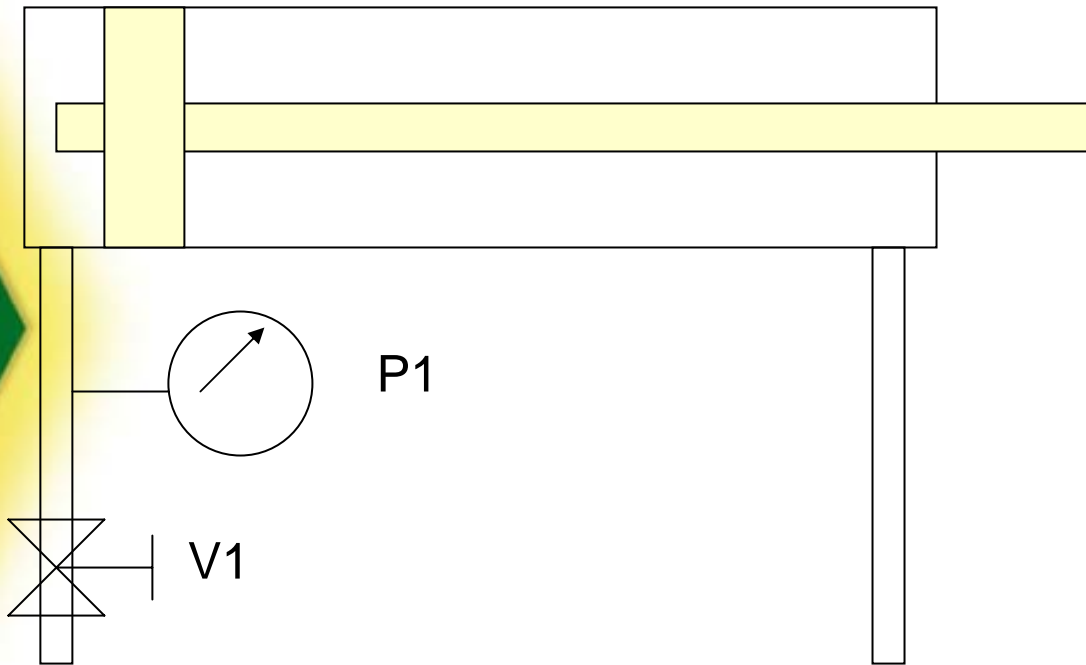
***We can reduce Down Time to Zero  
and reduce maintenance  
cost by at least 50%.***

**What we can do better**

***Maintenance Prevention:  
Root Cause Problem Elimination.  
Filtration, Hydraulic Fluid Temperature.***

***Preventive Maintenance:  
1. Inspect Cylinder Weekly  
for internal leakage.***

# *Inspect Cylinder*



1. Operate the piston to minus position
2. Close valve V1. If pressure P1 increases the cylinder is leaking.

## What we can do better

- 1. Inspect Cylinder Weekly for internal leakage.***
- 2. Plan replacement of cylinder.***
- 3. Document and save plan.***
- 4. Schedule replacement when unloading station is available.***

## New Scenario

- *Operator inspects cylinder as part of his/her work – Cost = “0”*
- *Planning replacement of cylinder four hours \$40 = \$160. Job plan will be documented and saved.*
- *Organized store delivery of parts one hour = \$20.*
- *Two people will replace cylinder safely in two hours = \$240.*

**•Total Maintenance Cost \$420.**

## New Scenario

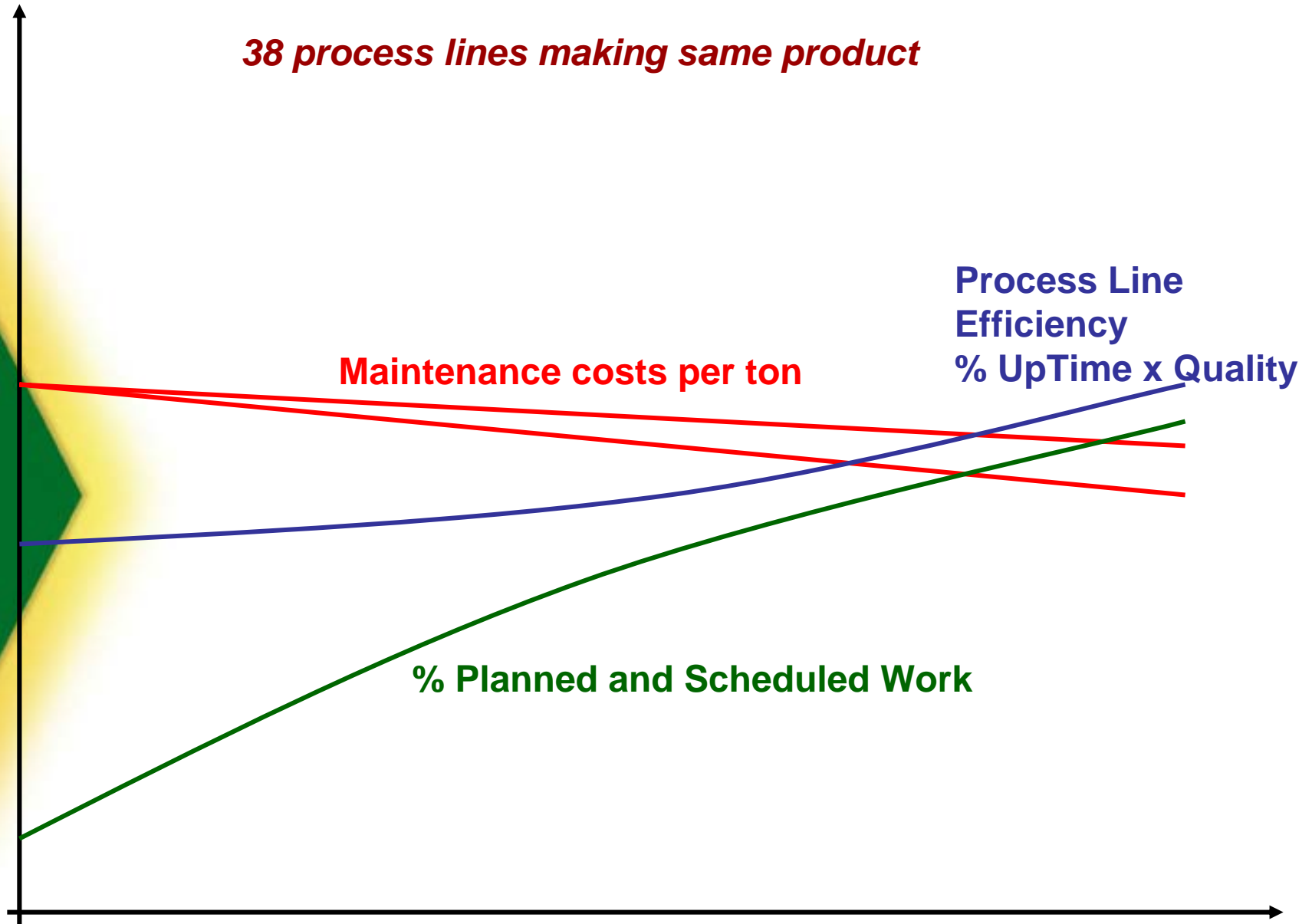
- ***Before: Maintenance costs = \$800.***
- ***After : Maintenance costs = \$420.***
- ***Maintenance Cost Savings: \$380***
- ***Reliability savings = \$22,386***

## *People efficiency*

	<i>% Unplanned Unscheduled Work.</i>	<i>% Wasted Time</i>	<i>% Total Wasted</i>
<i>Present</i>	<i>70</i>	<i>60</i>	<i>42</i>
<i>Future</i>	<i>10</i>	<i>40</i>	<i>4</i>

*38% Improvement potential*

**38 process lines making same product**

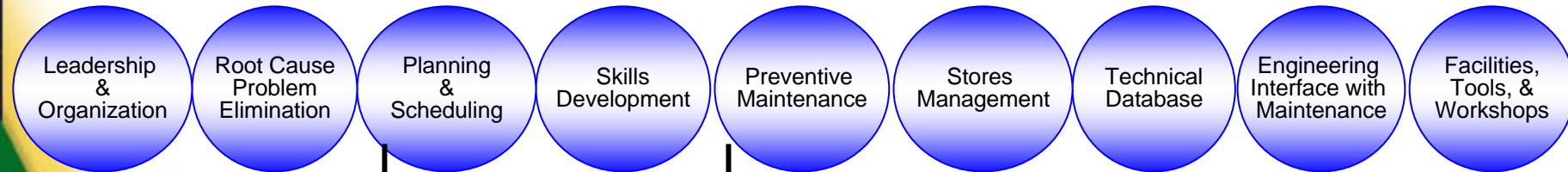


## **Selling Maintenance to Management**

- ***Do you know how good you are?***
- ***Do you know how good you can become?***
- ***Do you know how you can close the gap?***
  - ***Do you have a plan?***

# Current Best Practices (CBP)

## KEY PROCESS



## SUB PROCESSES

Work Request  
Prioritization  
Backlog  
Planning  
Scheduling  
Execution  
Recording  
CMMS Tool

Maintenance Method Selection  
Cleanliness  
Lubrication  
Alignment  
Balancing  
Operating Procedures  
Filtration  
Condition Monitoring

## ELEMENTS

Example 2: A few example "Planning elements"

- 32. Standard job plans are used for all repetitive and critical jobs
- 33. Jobs are always planned before they are scheduled
- 34. Operations support the planning process

Example 1. A few sample "Lubrication Elements"

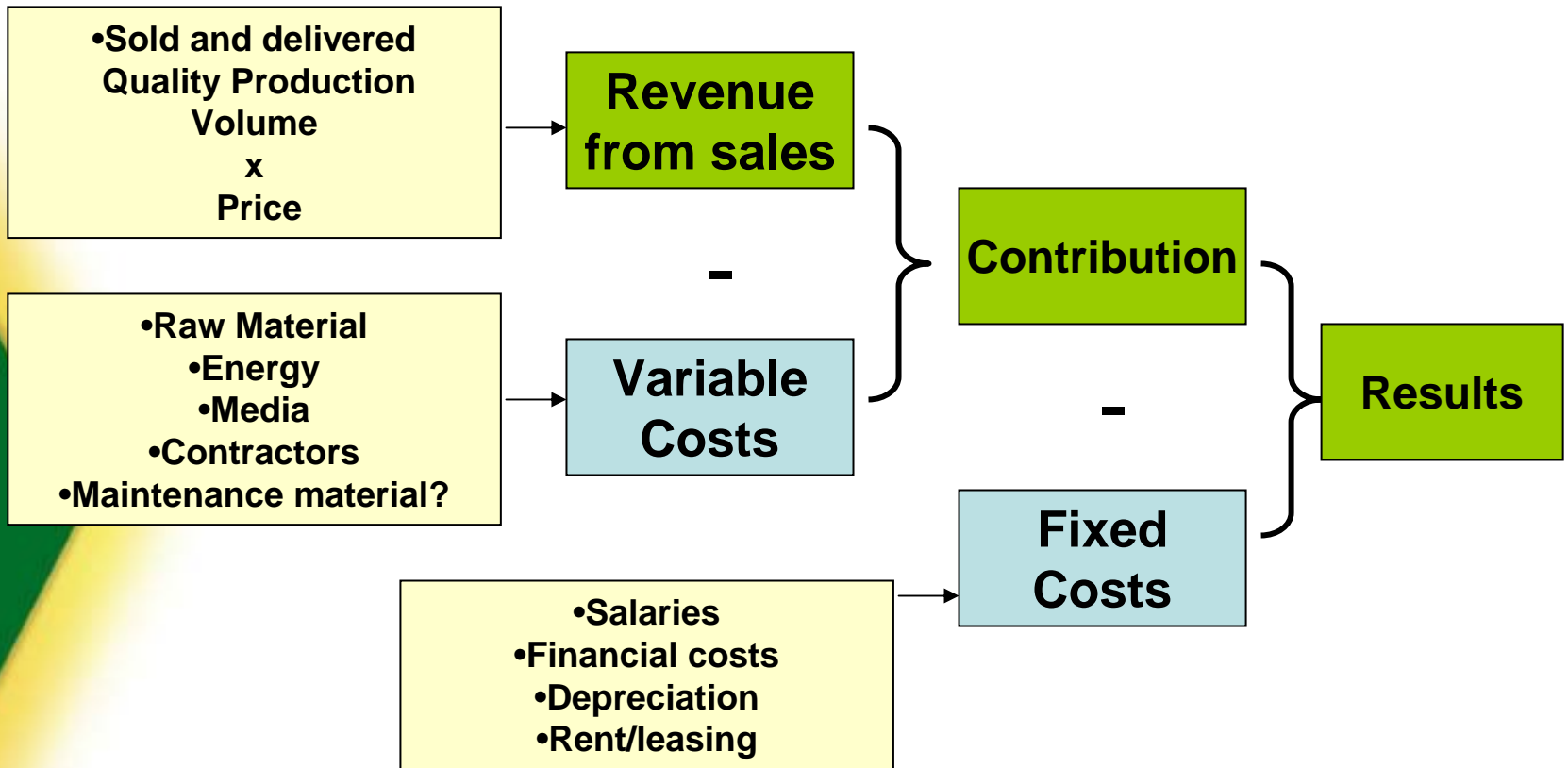
- 26. Lubricants are stored properly in clean, organized storage areas.
- 27. Filtration is used to maintain lubricant cleanliness.
- 28. Ferro graphic analysis is used to identify oil contaminants and contamination levels.

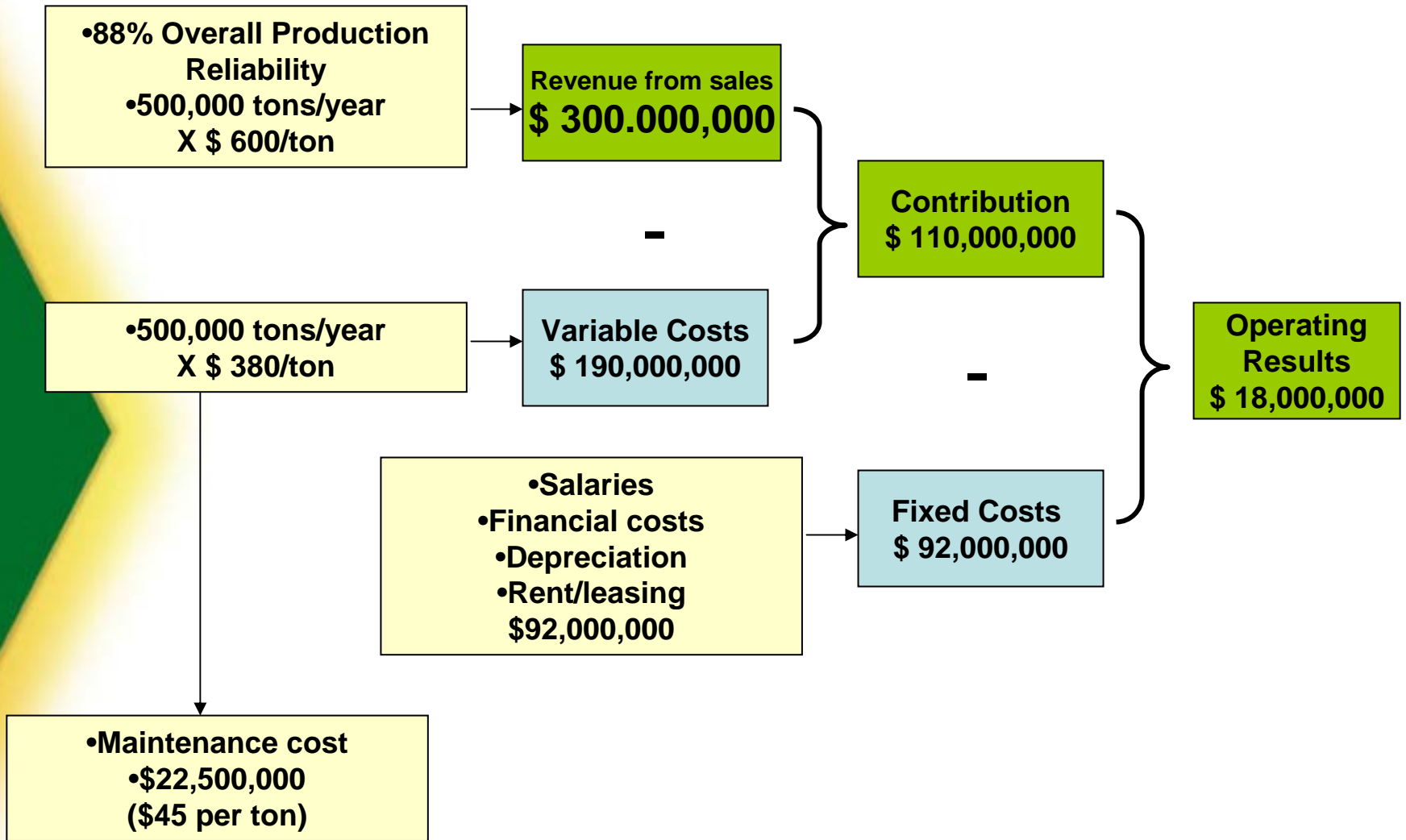
## **“World Class” Proposed definition**

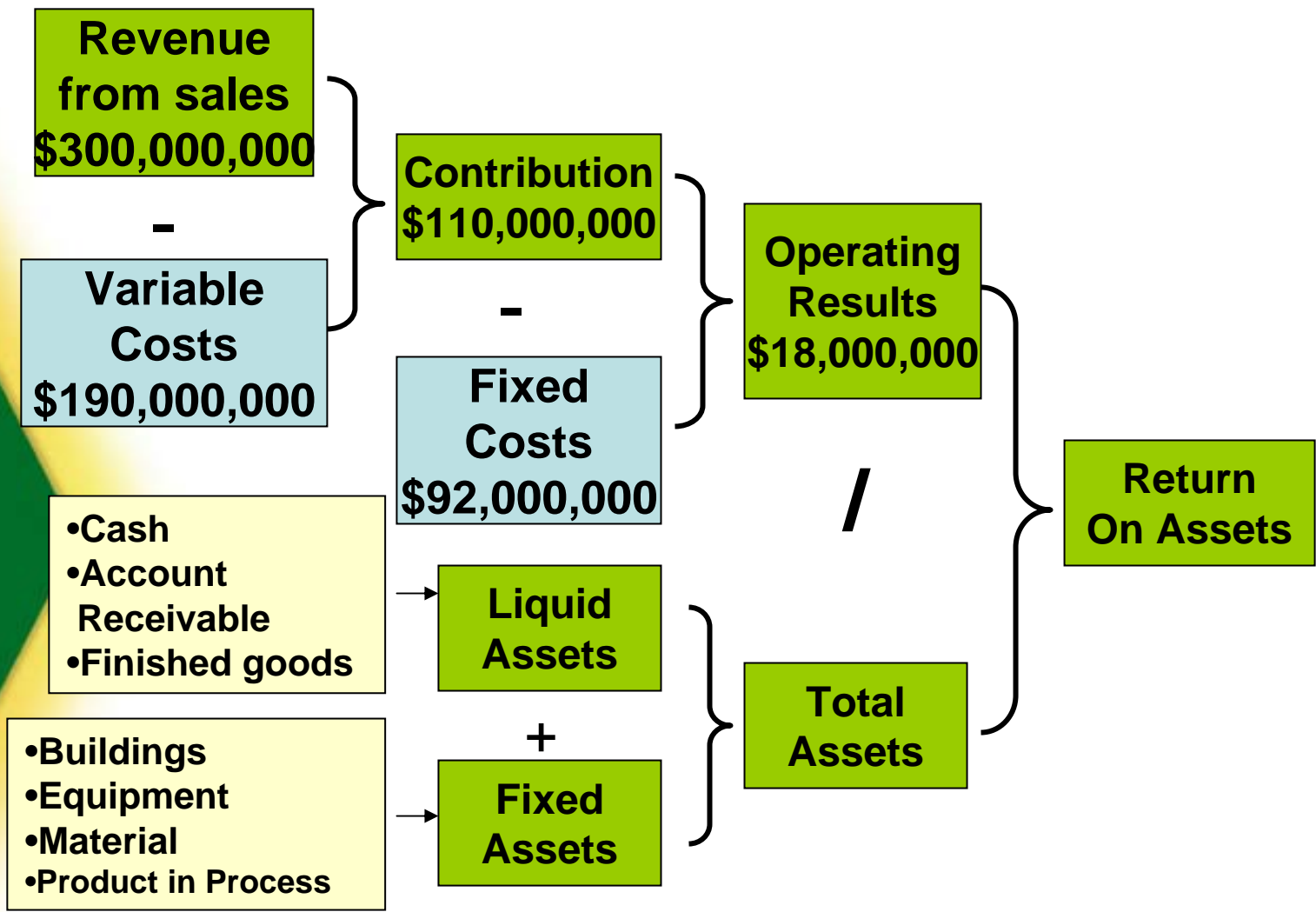
***A CBP score over 75.***

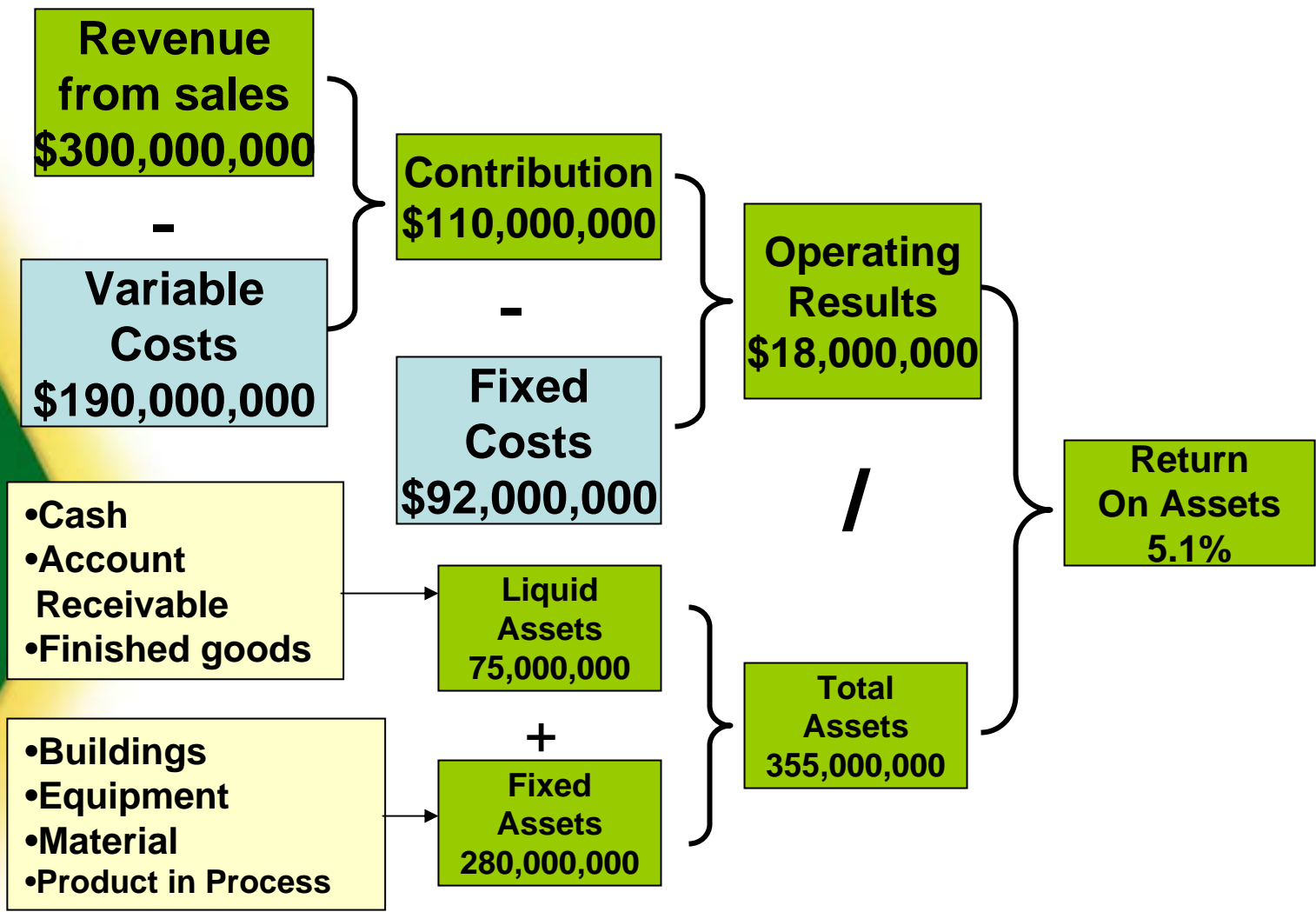
**Financial language**

**Financial Impact of  
improved maintenance.  
RONA**

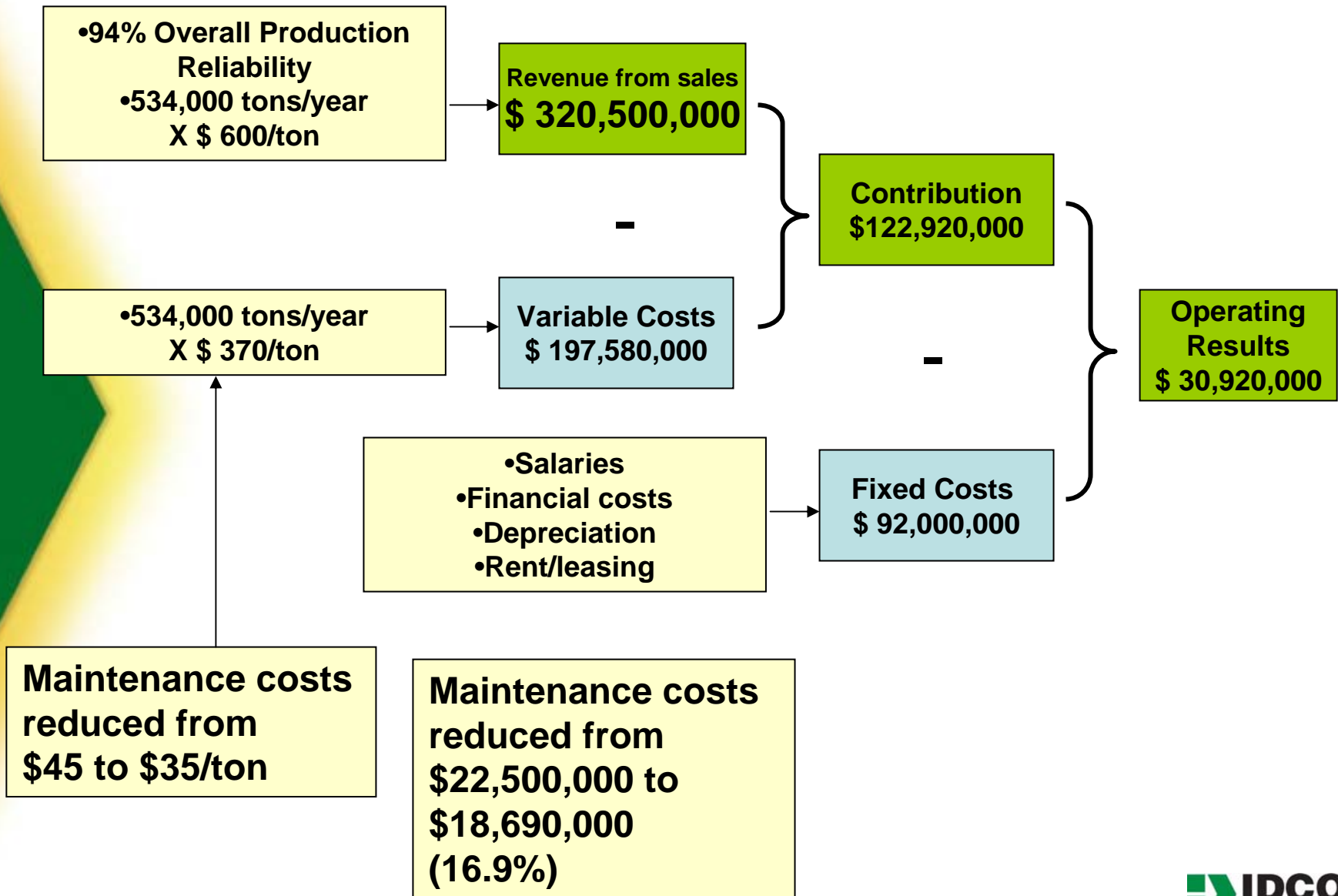




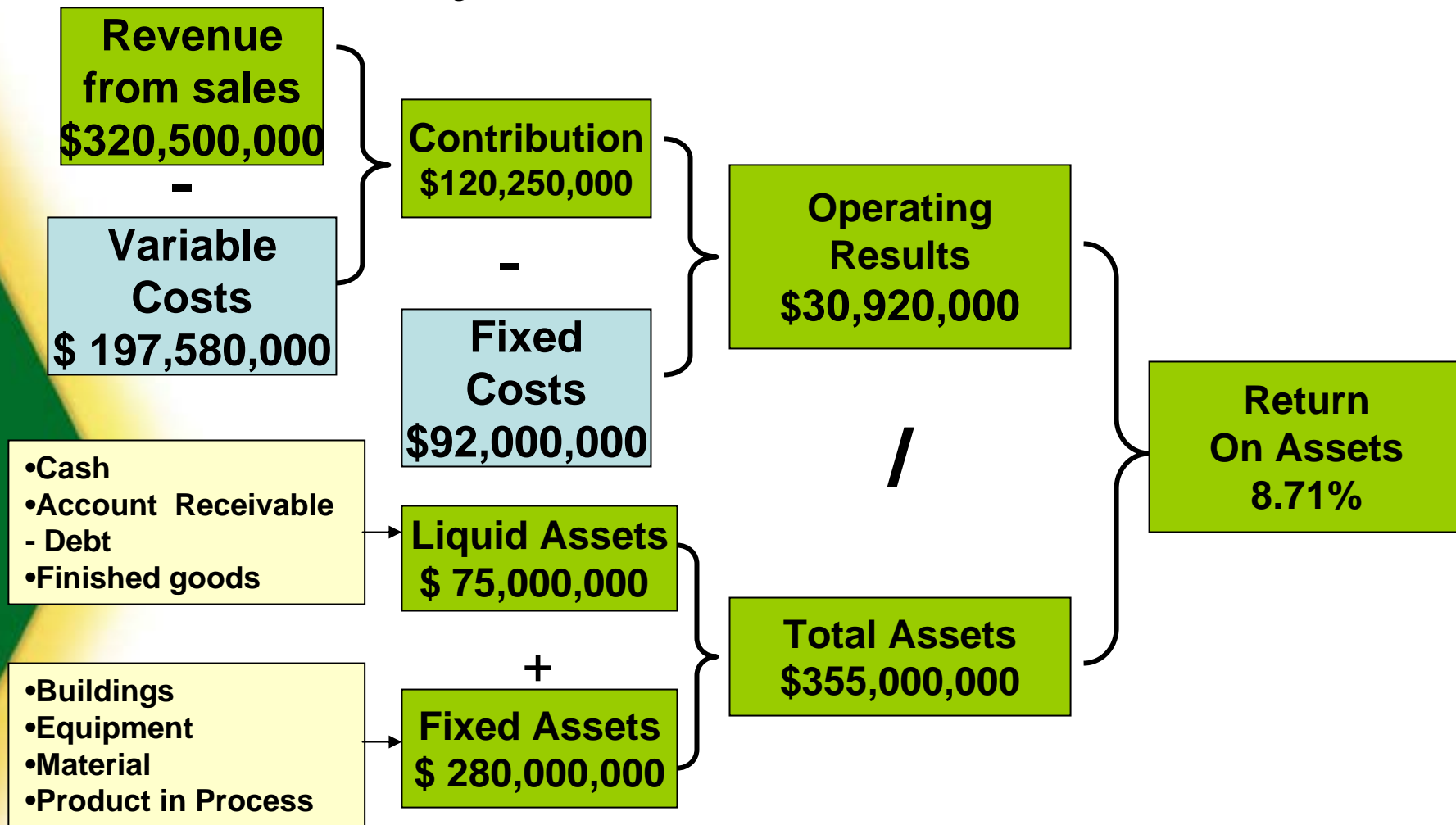




# Increase Reliability 6% from 88% to 94%



# Increase Reliability 6% - ROI





# Thank You for Listening!

For more information

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