



Lean and Six Sigma in Logistics/Supply Chain Management

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Agenda for Research

- Resilient Supply Chain Enterprise
- Lean/Six Sigma Approach to Supply Chain Operations

SCM and Financial Statement

Corporate attempts to enhance one or more of the following in their financial statement

Profit Margin (Net Operating Revenue After Tax/Net Sales)

Return on Investment (Profit/Capital)

Economic Profit (NOPAT – Capital Charge)

Return of Asset (Profit Margin * Asset Turnover)
(Asset Turnover = Sales/Total Asset)

How Lean/Six Sigma improve Financial Ratios?

Fact

It has been reported that a typical business enterprise accumulates approximately 25% waste due to duplicated works and inefficient work processes

Fact

- Deployment of supply chain alone does not assure the most efficient operations.
- There are many inefficient (wasteful) activities along the supply chain pipelines especially in global operations.
- Supply chain auditors may be needed to assess the efficiency of supply chain operations.

Fact

1. Error-ridden product information costs automotive after-market suppliers and distributors about \$1.5b, or about 1% of sales.
2. Manufacturers submitted 26,873 part numbers for analysis, of which 55% did not match equivalent reseller files.
3. About \$40 billions or 3.5% of total sales are lost each year due to supply chain information inefficiency (A.T. Kearny)

What is Lean?

A philosophy that shortens the time between the customer's order and the shipment by eliminating waste thereby enhancing customer's as well as shareholder's value.

What is Six Sigma Approach?

Reduce variation thereby eliminating waste and enhancing customer's as well as shareholder value.

This concept is based on Statistical Thinking

Statistical Thinking

- All processes are interconnected
- Each process has variations
- Recognition and reduction of variation is a key to success

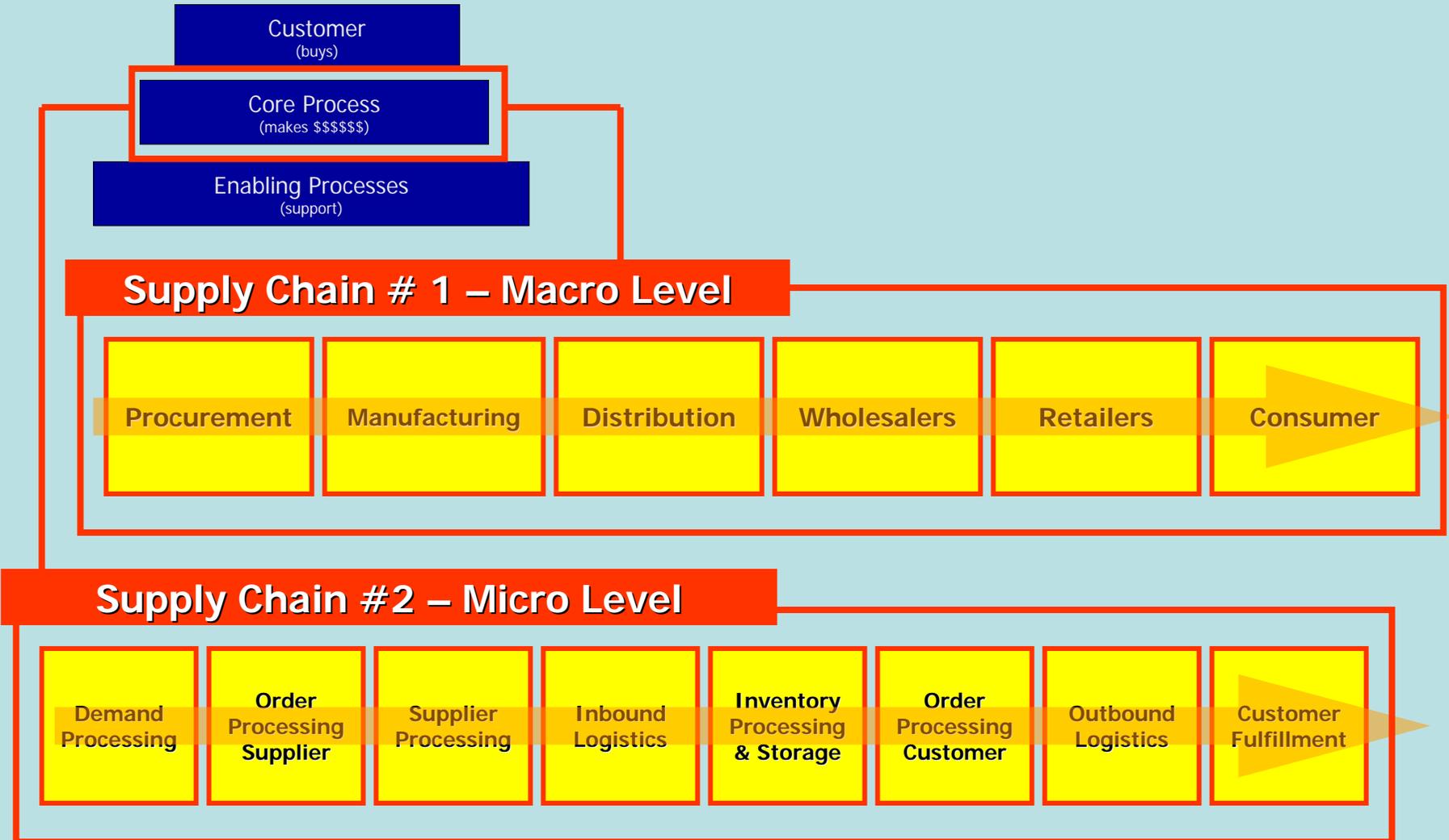
Back to Basics – Lean Logistics Starts with the Following Questions

1. ***Right Materials*** (product design/specs) in the
2. ***Right Quantity*** (ICC costs) for delivery at the
3. ***Right Time*** (meet delivery window) and
4. ***Right Place*** (location) from the
5. ***Right Source*** (reliable supplier) with the
6. ***Right Service*** (before and after sale) at the
7. ***Right Price*** (maximize value) in the
8. ***Right Quality***

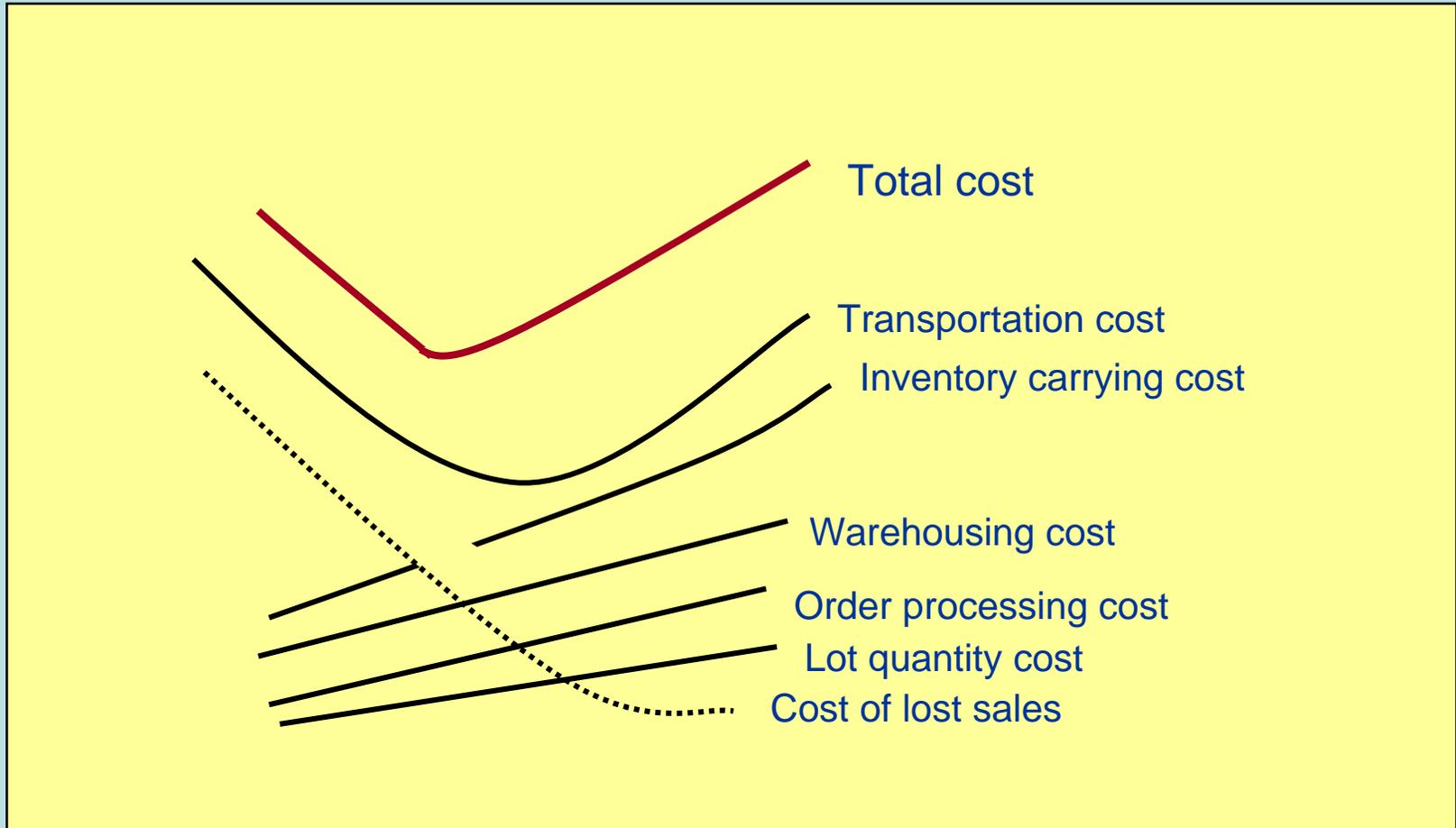
Question: What explicit processes are in place in your organization/division to reduce/eliminate waste?

Total Logistics Cost

How does the system work in your work place now? – From Macro to Micro Level



Total Logistics Cost



Impact of Waste Reduction in Logistics Cost on Financial Statement

• Average Days of inventory on-hand = 10

• Raw Material Spend = \$250,000,000

• Inbound Transportation Budget = \$9,000,000

• Productivity Improvement = 0%

Ordering	1.00%	of Total Cost	\$	128,571.43
Supplier Management	0.50%	of Total Cost	\$	64,285.71
Logistics Design	0.00%	of Total Cost		
Logistics Operations	70.00%	of Total Cost	\$	9,000,000.00
Yard Control	1.00%	of Total Cost	\$	128,571.43
Receiving Management	3.00%	of Total Cost	\$	385,714.29
Raw Material Storage				
(Inventory Carrying Cost)				
Admin. Overheads	2.00%	of Avg RM OH	\$	200,000.00
Cost of Capital	9.00%	of Avg RM OH	\$	900,000.00
Damage	1.00%	of Avg RM OH	\$	100,000.00
Insurance	1.00%	of Avg RM OH	\$	100,000.00
Interplant Shuttles	1.00%	of Avg RM OH	\$	100,000.00
Obsolescence	3.00%	of Avg RM OH	\$	300,000.00
Shrinkage	2.00%	of Avg RM OH	\$	200,000.00
Space	8.50%	of Avg RM OH	\$	850,000.00
Storage Systems	1.00%	of Avg RM OH	\$	100,000.00
Taxes	3.00%	of Avg RM OH	\$	300,000.00
	28.50%		\$	3,150,000.00
Total Inventory Costs	24.50%			
Total Logistics Costs		100.00%		\$ 12,857,142.86

• Average Days of inventory on-hand = 5 (Lean)

• Raw Material Spend = \$250,000,000

• Inbound Transportation Budget = \$9,000,000

• Productivity Improvement = 0%

Ordering	1.11%	of Total Cost	\$	128,571.43
Supplier Management	0.56%	of Total Cost	\$	64,285.71
Logistics Design	4.32%	of Total Cost	\$	500,000.00
Logistics Operations	77.71%	of Total Cost	\$	9,000,000.00
Yard Control	1.11%	of Total Cost	\$	128,571.43
Receiving Management	3.33%	of Total Cost	\$	385,714.29
Raw Material Storage (Inventory Carrying Cost)				
Admin. Overheads	2.00%	of Avg RM OH	\$	100,000.00
Cost of Capital	9.00%	of Avg RM OH	\$	450,000.00
Damage	1.00%	of Avg RM OH	\$	50,000.00
Insurance	1.00%	of Avg RM OH	\$	50,000.00
Interplant Shuttles	1.00%	of Avg RM OH	\$	50,000.00
Obsolescence	3.00%	of Avg RM OH	\$	150,000.00
Shrinkage	1.00%	of Avg RM OH	\$	50,000.00
Space	8.50%	of Avg RM OH	\$	425,000.00
Storage Systems	1.00%	of Avg RM OH	\$	50,000.00
Taxes	3.00%	of Avg RM OH	\$	150,000.00
	28.50%		\$	1,525,000.00
Total Inventory Costs	11.87%			
Total Logistics Costs	100.00%		\$	11,582,142.86

• Average Days of inventory on-hand = 5

• Raw Material Spend = \$250,000,000

• Inbound Transportation Budget = \$9,000,000

• Productivity Improvement = 10% (Six Sigma)

Ordering	1.09%	of Total Cost	\$	115,714.29
Supplier Management	0.55%	of Total Cost	\$	57,857.14
Logistics Design	4.71%	of Total Cost	\$	500,000.00
Logistics Operations	76.33%	of Total Cost	\$	8,100,000.00
Yard Control	1.09%	of Total Cost	\$	115,714.29
Receiving Management	3.27%	of Total Cost	\$	347,142.86
Raw Material Storage (Inventory Carrying Cost)				
Admin. Overheads	2.00%	of Avg RM OH	\$	100,000.00
Cost of Capital	9.00%	of Avg RM OH	\$	450,000.00
Damage	1.00%	of Avg RM OH	\$	50,000.00
Insurance	1.00%	of Avg RM OH	\$	50,000.00
Interplant Shuttles	1.00%	of Avg RM OH	\$	50,000.00
Obsolescence	3.00%	of Avg RM OH	\$	150,000.00
Shrinkage	1.00%	of Avg RM OH	\$	50,000.00
Space	8.50%	of Avg RM OH	\$	425,000.00
Storage Systems	1.00%	of Avg RM OH	\$	50,000.00
Taxes	3.00%	of Avg RM OH	\$	150,000.00
Total Inventory Costs	28.50%		\$	1,525,000.00
Total Logistics Costs	100.00%		\$	10,611,428.57

Summary

Avg. Days On Hand	Productivity	Inventory Cost	Total Cost	% Reduction
10	0.0%	\$3,150,000.00	\$12,857,142.86	
5	0.0%	\$1,525,000.00	\$11,582,142.86	9.9%
5	10.0%	\$1,525,000.00	\$10,611,428.57	17.5%

Estimate Effect To Bottom Line:

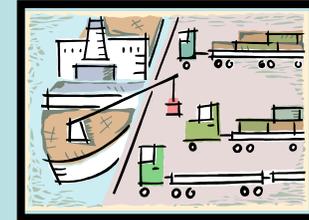
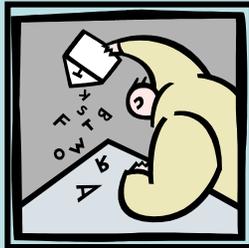
- **Total Inbound Costs as Percentage of Revenue = 2.0%**
- **Overall Benefit to Corporate Contribution = 17.5% X 2.0% = 0.35 %**
- **A small improvement in logistics operations yields almost \$4,000,000 revenue increase on \$1 billion sales**

Where Can We Find Waste?

INVENTORY



KNOWLEDGE



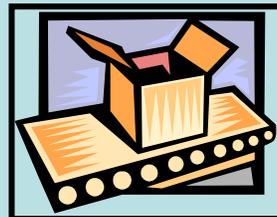
TRANSPORTATION

**LOGISTICS
WASTES**

ADMINISTRATION



*SPACE AND
FACILITIES*



PACKAGING



TIME

The Waste of Time: Throughput Case

$$\text{Logistics Throughput Efficiency} = \frac{\text{Value-Adding Time}}{\text{Total Lead Time}}$$

- A typical measure of throughput efficiency is < 10%
- Some companies will be as low as 2% - 5%
- Just because “touches” are placed on inventory does not mean that value is added – You could be making the wrong products or positioning products in the wrong location.

The Waste of Transportation

Transportation facts:

- Needs:
 - Speed
 - Timelines
 - Reliability
 - Flexibility
 - Availability
 - Safety
 - Capacity
 - Cost
 - Efficiency
- Modes
 - Motor
 - Rail
 - Maritime
 - Air
 - Pipeline

Which mode will best meet those needs?

The Waste of Space and Facilities

- **How much space?**
 - How do you determine how much square footage and facilities are needed to cover current and future demand?
 - What does it look like with seasonality and cyclical nature of most businesses?
 - Private or public warehouse space?
 - Do we pay by the touch, by the square foot?

The Waste of Packaging

(Remix Program by Wal-Mart)

- **What do we know:**

- Most organizations, as well as logisticians if pressed would say they rarely think of packaging.
- Packaging is usually equated with quality or marketing, not logistics and waste.
- Packaging is a broad terms that refer to all the forms of containerization at the item and bundle levels.
- It includes the outer packaging for an item as well as the dunage that secures the item within the package.
- Packaging must be functional as well as provide appeal to the buyer.

The Waste of Administration

- **What do we know:**
 - Administration is a resource that is viewed by many people in business as non-value added yet a necessary evil within logistics or any other function.
 - Administration is a necessary to run a law abiding, tax paying, upstanding business, even if it means a departure from the optimal flow.
 - The question is how much do we need, not whether it is necessary.

The Waste of Knowledge

- **What do we know:**

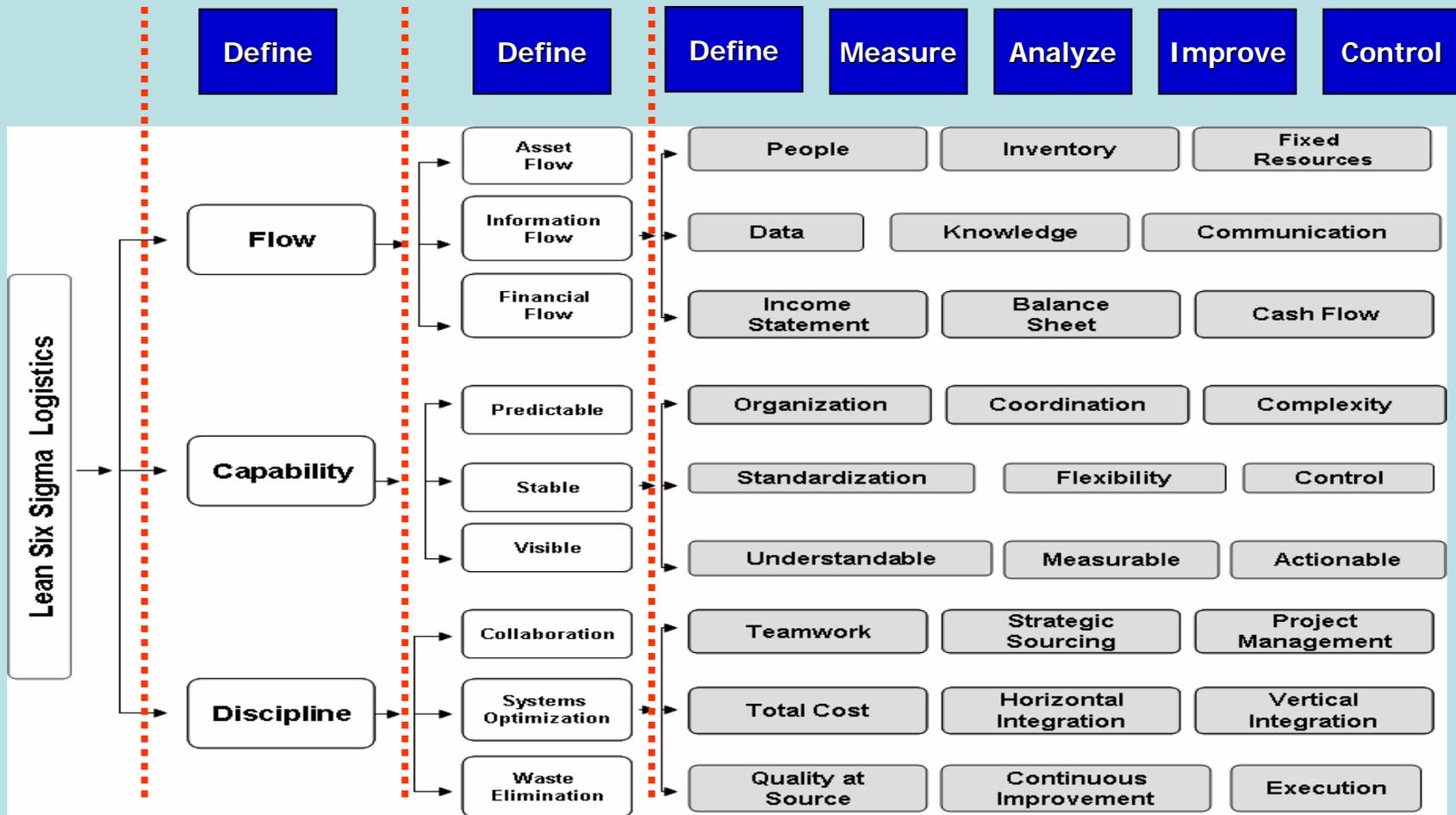
- Knowledge is probably the least understood and recognized resource.
- It is hard to quantify, see, or touch.
- Knowledge is the resource that is most often wasted in organizations
- Knowledge may be better understood in areas such as research & development, engineering, or marketing.
- In operational areas it is often thought of as subordinate, from strategies that cascade down.
- This does not mean these areas in the business should be devoid of creativity and search for new and better ways to conduct business.

Lean Tools in Logistics: Logistics Bridge Model

- **There are three main principles:**
 - 1. Logistics Flow - People, communication, financial statement, fixed asset**
 - 2. Logistics Capability - Organization**
 - 3. Logistics Discipline-Standardization, control**
- These guiding principles help guide us through any environment allowing us to create the map that helps us get to our destination in the most **effective** and **efficient** manner, **lean way**.

The Implementers Map

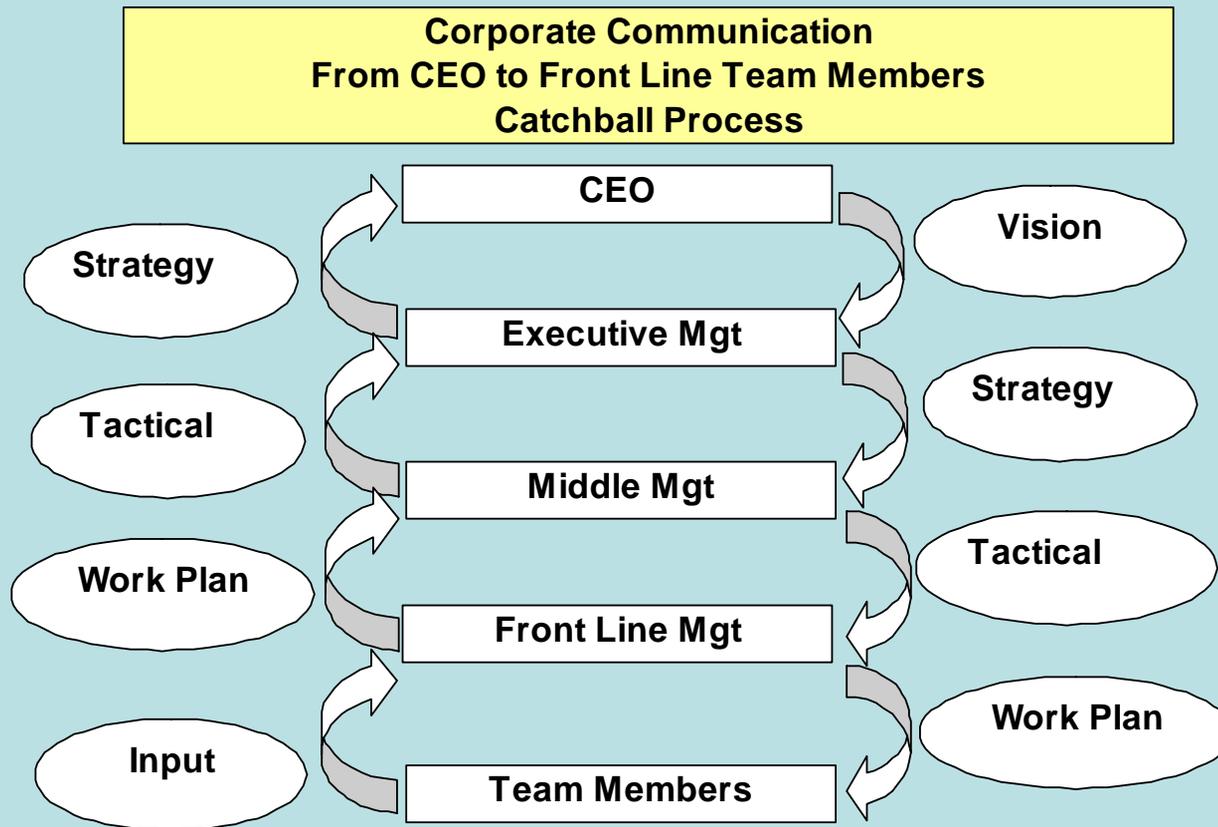
The Logistics Bridge Model + DMAIC



Flow > Asset > People

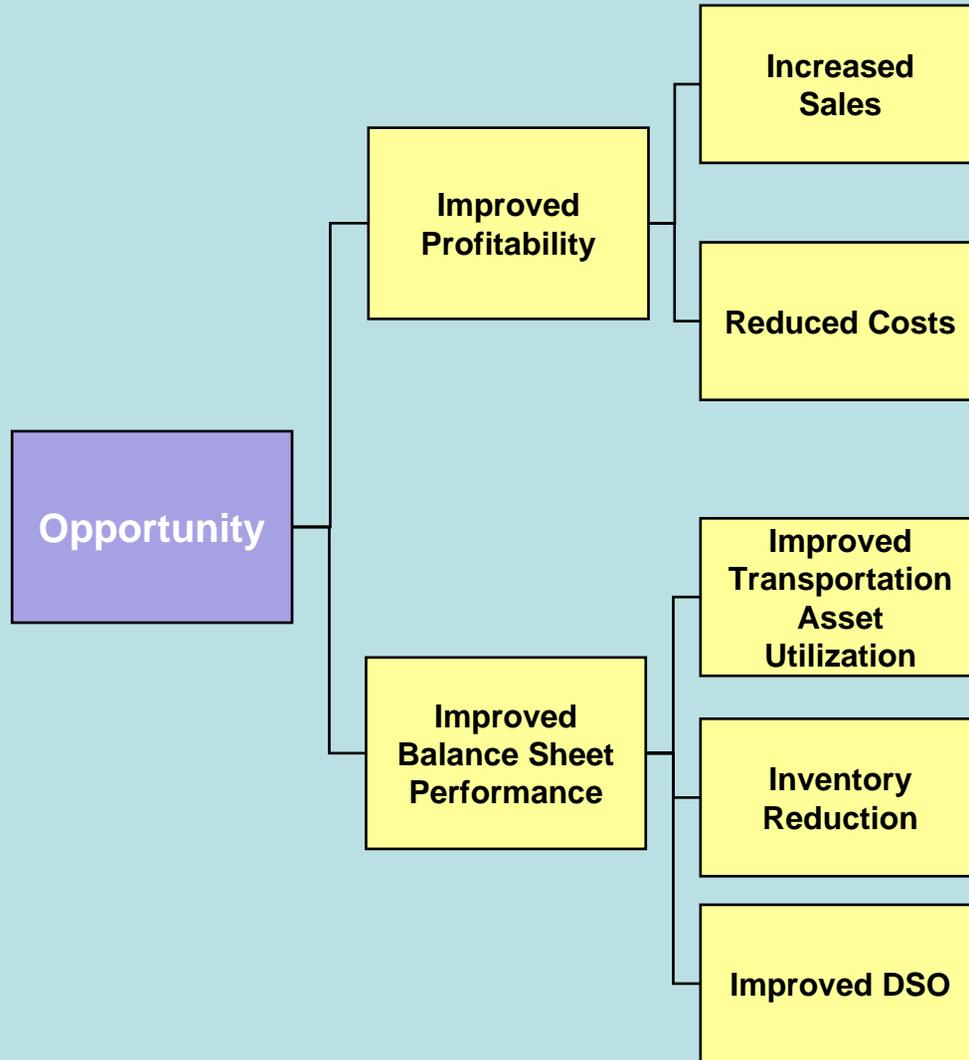


Flow > Information > Communication



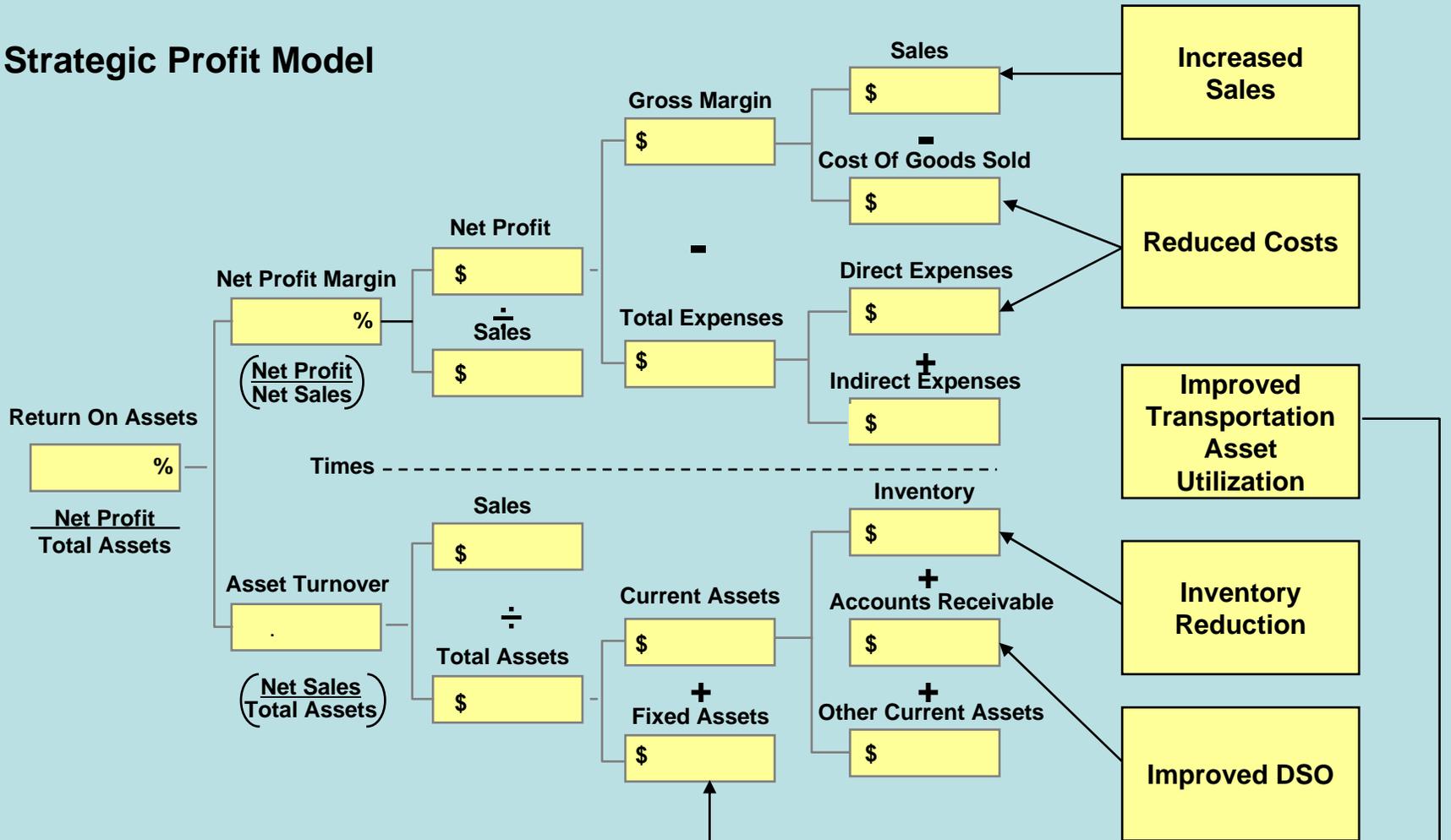
Logistics strategy should be an iterative process that starts with a vision and involves all levels of management.

Flow > Financial

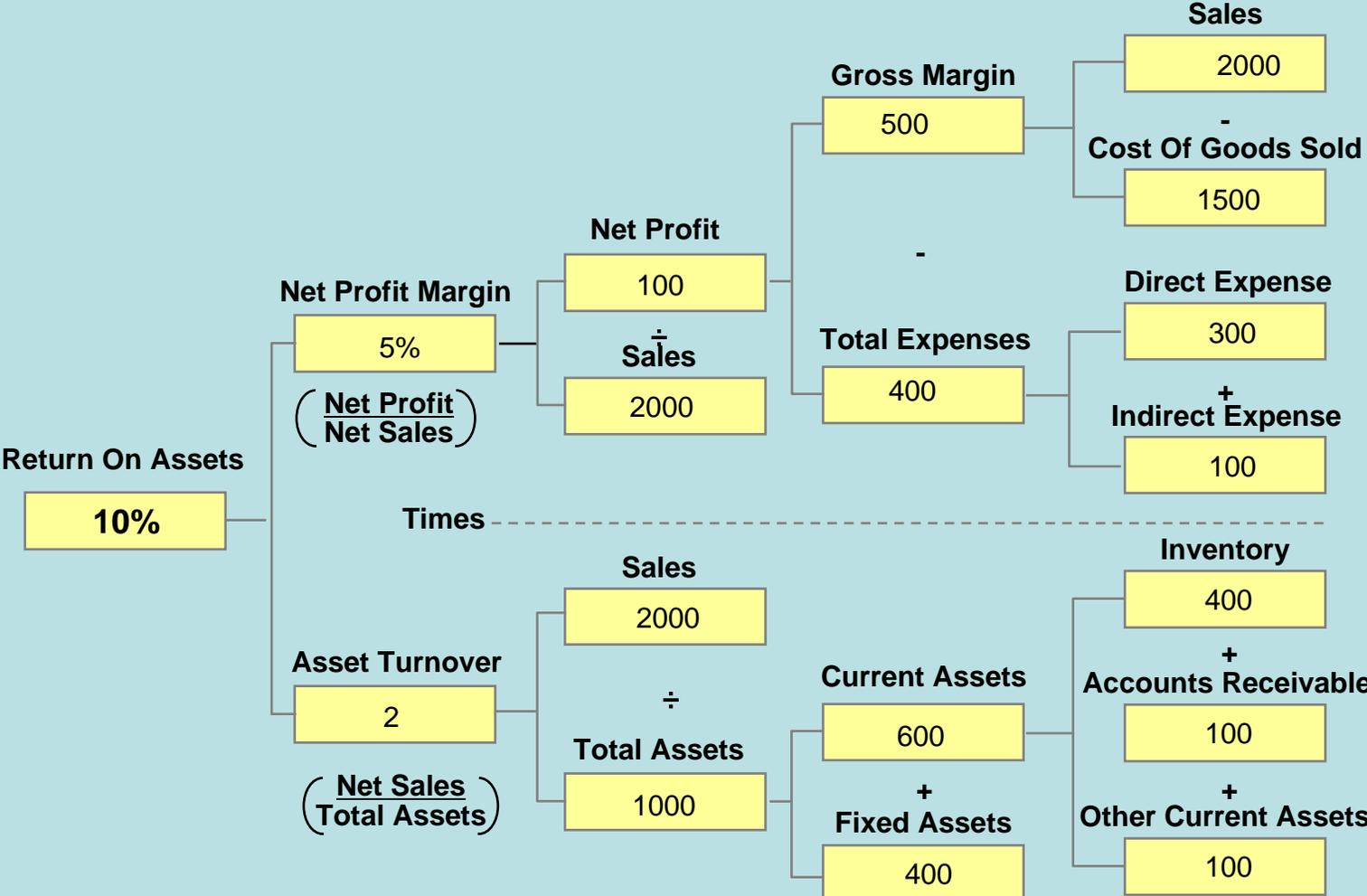


Converting the Benefits to "C" Level Metrics

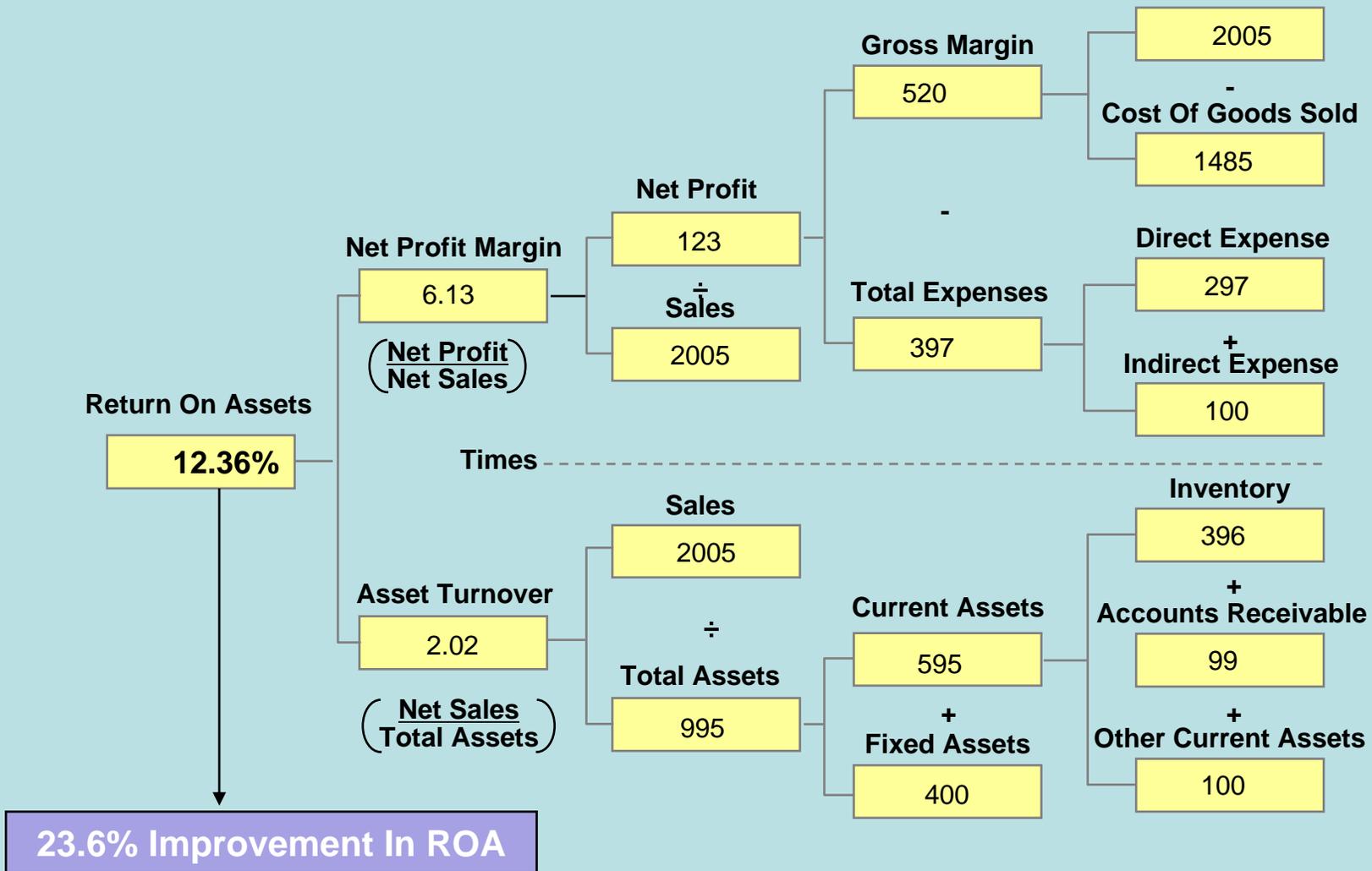
Strategic Profit Model



CTM Financial Impact: Base Case



What if: A 0.25% Improvement In Sales, 1% Reduction In Costs, Asset Utilization, Inventory, and DSO



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Flow > Asset > Fixed Resources

Logistics Fixed Resources - Prioritization of Waste Elimination

Priority for Elimination

- Priority # 1: Warehouses and Space
- Priority # 2: Transportation Equipment
- Priority # 3: Material Handling Equipment
- Priority # 4: Racking - Storage Equipment

Fix Resources- Interrogation Questions

1. What is this resource costing us ?
2. Why do we need this resource ?
3. How could we operate if we were forced to do without this resource ?

When dealing with fixed resources we must first identify the resource and seriously question the need and value of the resource. Although, we may not eliminate the resource immediately, brainstorming how we would operate without the resource is a very worthwhile exercise.

Capability > Predictable > Organization (transparency)

The Organized Workplace

Box A What Number is Missing ?

2	5	12	23	1	15	25
3	9	18	24	8	7	22
4	13	17	14	6	10	20
21	11		16			

Adapted From Achieving Basic Stability - LEI

What Number is Missing? Transparency

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	<input type="text"/>	20	21
22	23	24	25			

What Number is Missing? Transparency

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	<input type="text"/>	20	21
22	23	24	25			

Capability > Stability > Standardization

Standardization provides a flexibility in responding to supply chain disruption (Dell, HP)

Standardization tends to reduce variation in process

Capability > Stability > Control (Quick Response)

Questions for Out of Control Processes

Processes will not go out of control randomly. Some event has happened that resulted in the process going out of control. If a process seems to be out of control, ask yourself:

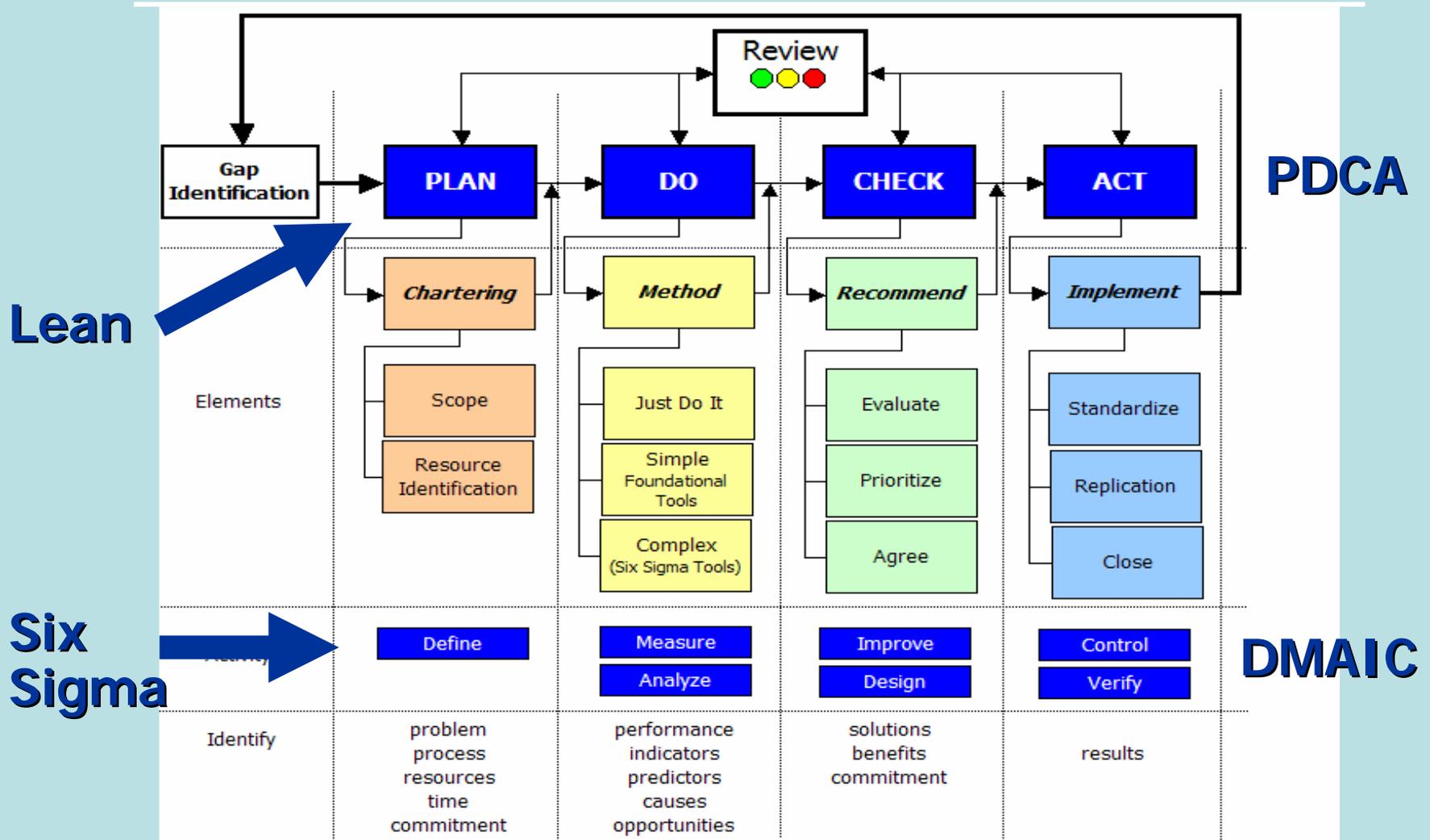
1. Have we changed the way we measure this process ?
2. Has there been an environmental change (weather, supplier location) ?
3. Have we changed the people that manage this process ?
4. Has there been a change in the procedures of the process ?
5. Have we changed suppliers to the process ?

Back to Basics - The Ultimate Objective

1. ***Right Materials*** (specs) in the
2. ***Right Quantity*** (ICC costs) for delivery at the
3. ***Right Time*** (meet delivery window) and
4. ***Right Place*** (location) from the
5. ***Right Source*** (reliable supplier) with the
6. ***Right Service*** (before and after sale) at the
7. ***Right Price*** (maximize value) in the
8. **Right Quality**

This is all you need ! But how to do it ?

Problem Solving Process



THANK YOU

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<http://cscms.slu.edu>