APICS The Association for Operations Management

Advancing Productivity, Innovation, and Competitive Success

# Integrating 6 Sigma, Lean and Supply Chain

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# What is the purpose of “Lean”?

To make money!!!

Lean is intended to improve the processes

6 Sigma is used to remove the variability

Supply Chain is used to extend those tools to your partner companies

**Lean, Six Sigma & Supply Chain share much in common**.

**At least 30% of the principles cross over to the other areas.**

**Primarily because they are all influence by TQM.**

# TQM Principles

- Quality defined by the customer – finding out needs and requirements
- Development of closer supplier relationships – collaborative / partnerships
- Benchmarking – measuring against the competition
- Open organizations – open communications and empowerment
- Increased training – team skills and problem solving

# TQM Principles (Cont)

- Employee participation – greater autonomy in decision making
- Zero defects – eliminate defects rather than inspect for defects
- Flexible manufacturing – JIT, cellular, DFM, SPC & DOE
- Process improvement – reduce waste and cycle times
- Measurement – goal oriented with performance measurement

# TQM Origin

**"Total Quality Control"** was the key concept of Armands Fiegenbaum's 1951 book, *Quality Control: Principles, Practice, and Administration.* This was followed by a release in 1961 of *Total Quality Control.* In addition, W Edwards Deming, Joseph Juran, Phillip B. Crosby also contributed to the body of knowledge now known as **TQM.**

The first actual use of the term **"TQM"** was used by Koji Kobayashi former CEO of NEC in speech after receiving the Deming award in 1974

**6 Sigma** formulated by Bill Smith of Motorola 1984

The term **“Lean”** was first applied in the book *Machine that Changed the World,* Daniel T Jones, Daniel Roos & James P. Womack 1992

**SCM** was based from different sources but some point to Peter Drucker's (Oct 1998) Forbes article *Management's New Paradigms*, a concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

**All are tools for managing change**

Integrating those elements are now generally are required to remain competitive.

Why is that necessary?

**Because of the increase in competitive forces!**

# Competitive Forces

Globalization – Extended Supply Chain

More Choices in the Market Place

Stronger Competition - Global

Decentralization – Dispersed Resources

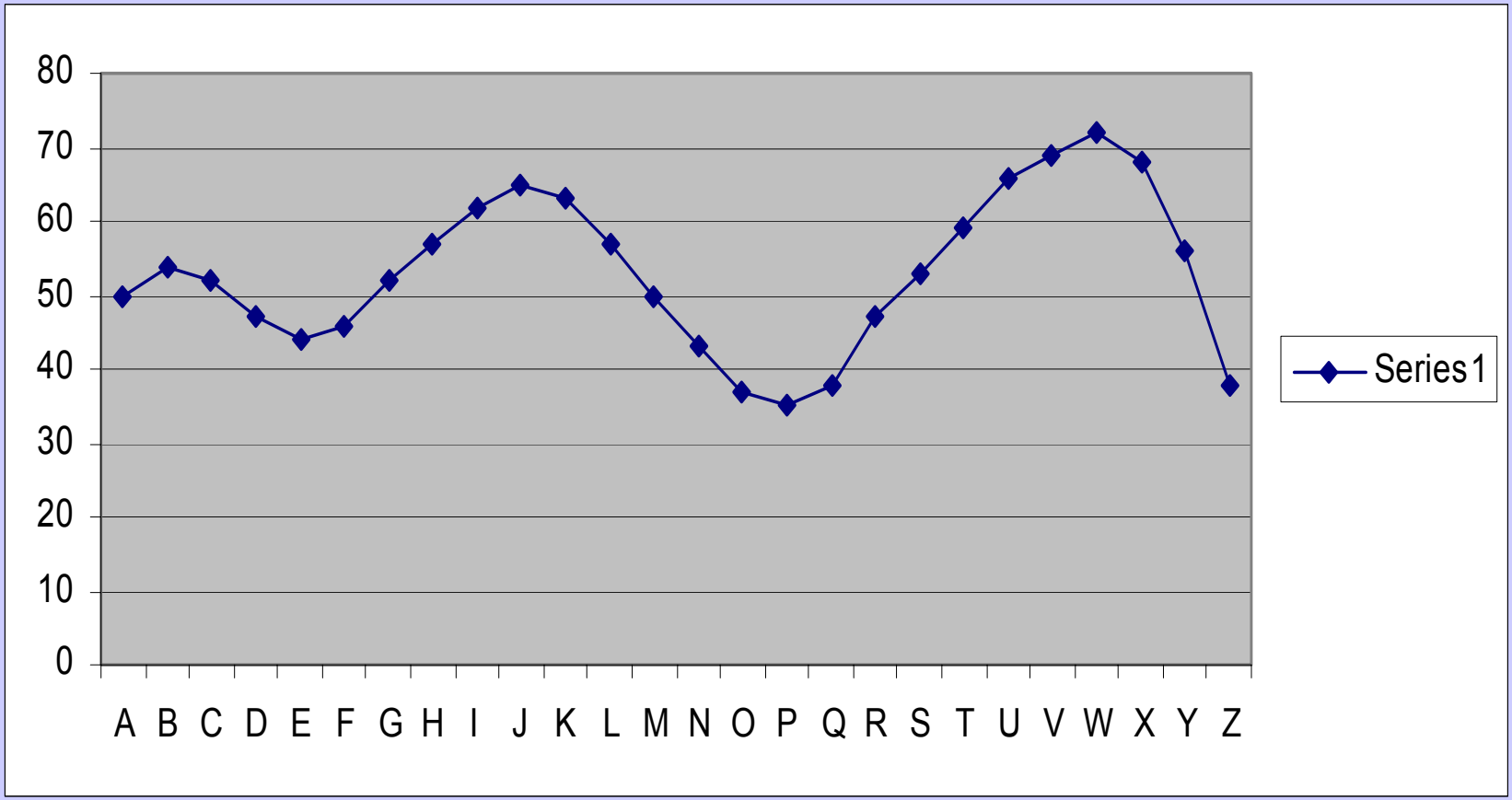
Increased Availability of Technology

Lower Profit Margins

Faster Market Responses

Increased Customer Focus

# Bull Whip Effect or Forrester Effect




Customer Distributor Supplier1 Supplier 2

# Schedule Fluctuation

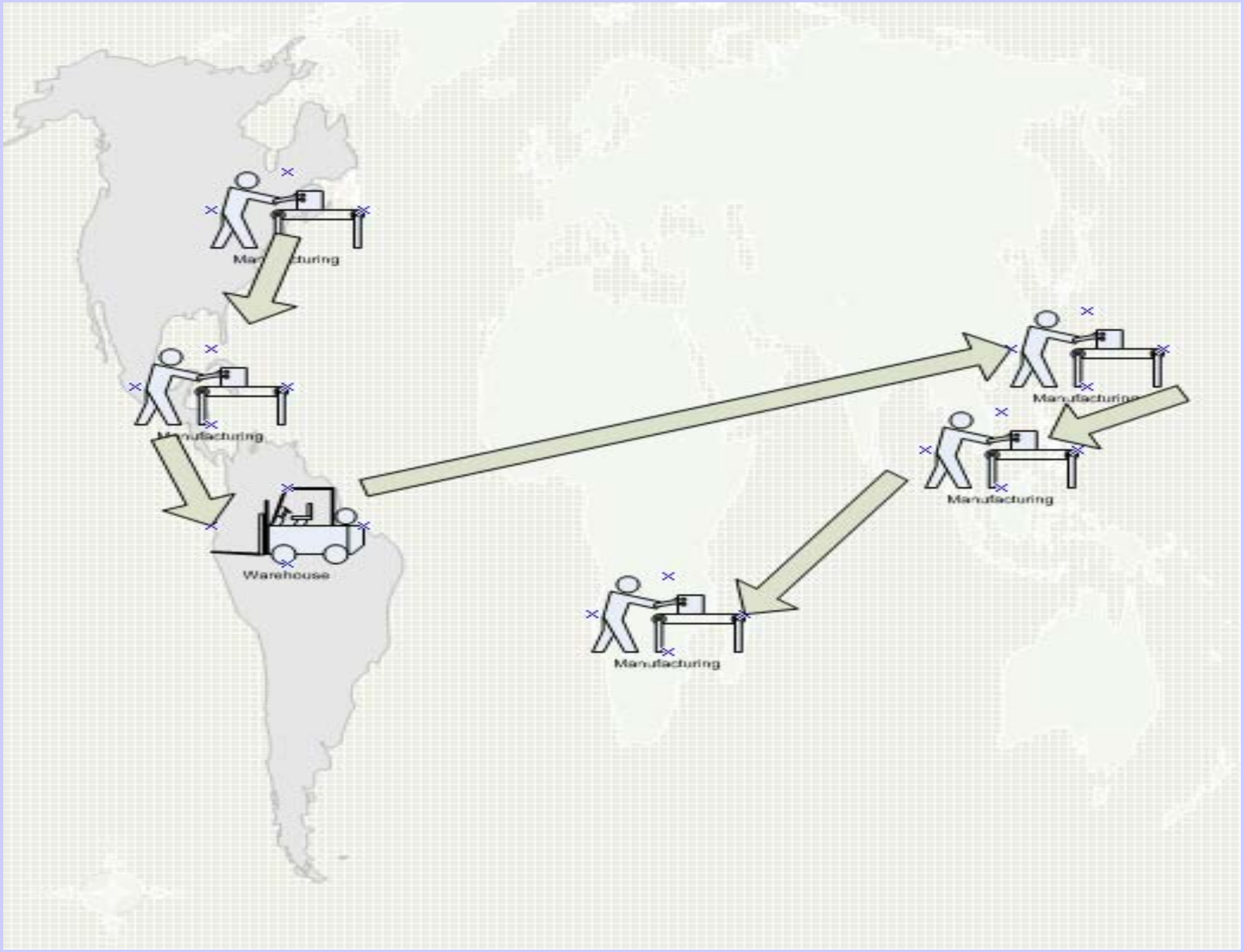
Disruption of the supply chain

Expensive supplier overtime

Inbound freight premiums

Internal scheduling disruptions

Capacity constraints


Manufacturing
Manufacturing
Warehouse
Manufacturing
Manufacturing
Manufacturing

# Demand Driven, not Forecast Driven

Pull versus Push

- Reduce lead times
- Reduce the size of batch orders
- Exchange information for inventory
- More efficient transportation models
- Use “Lean” throughout the SC

Use Forecast for Raw Material Commits

# Integrated Supply Chain

Visibility of demand and inventory

Sharing of knowledge not just data

Joint problem solving (cross-functional)

Jointly developed metrics

Clear roles and responsibilities

Commitment to the relationship

# Collaborative Relationships

Quick Response /information sharing (POS)

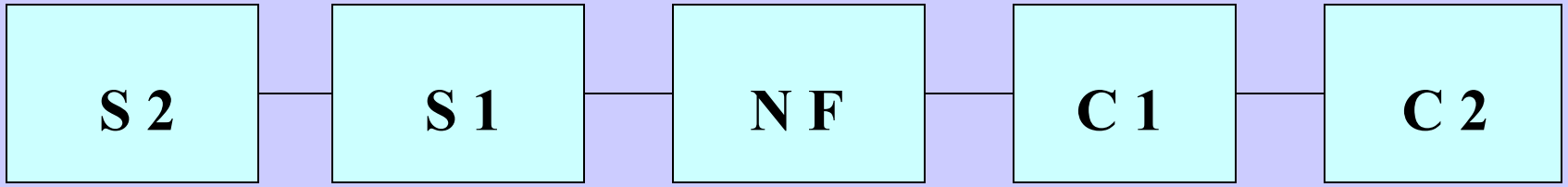
Continuous Replenishment (Joint forecasting)

VMI (Vendor Managed Inventory)

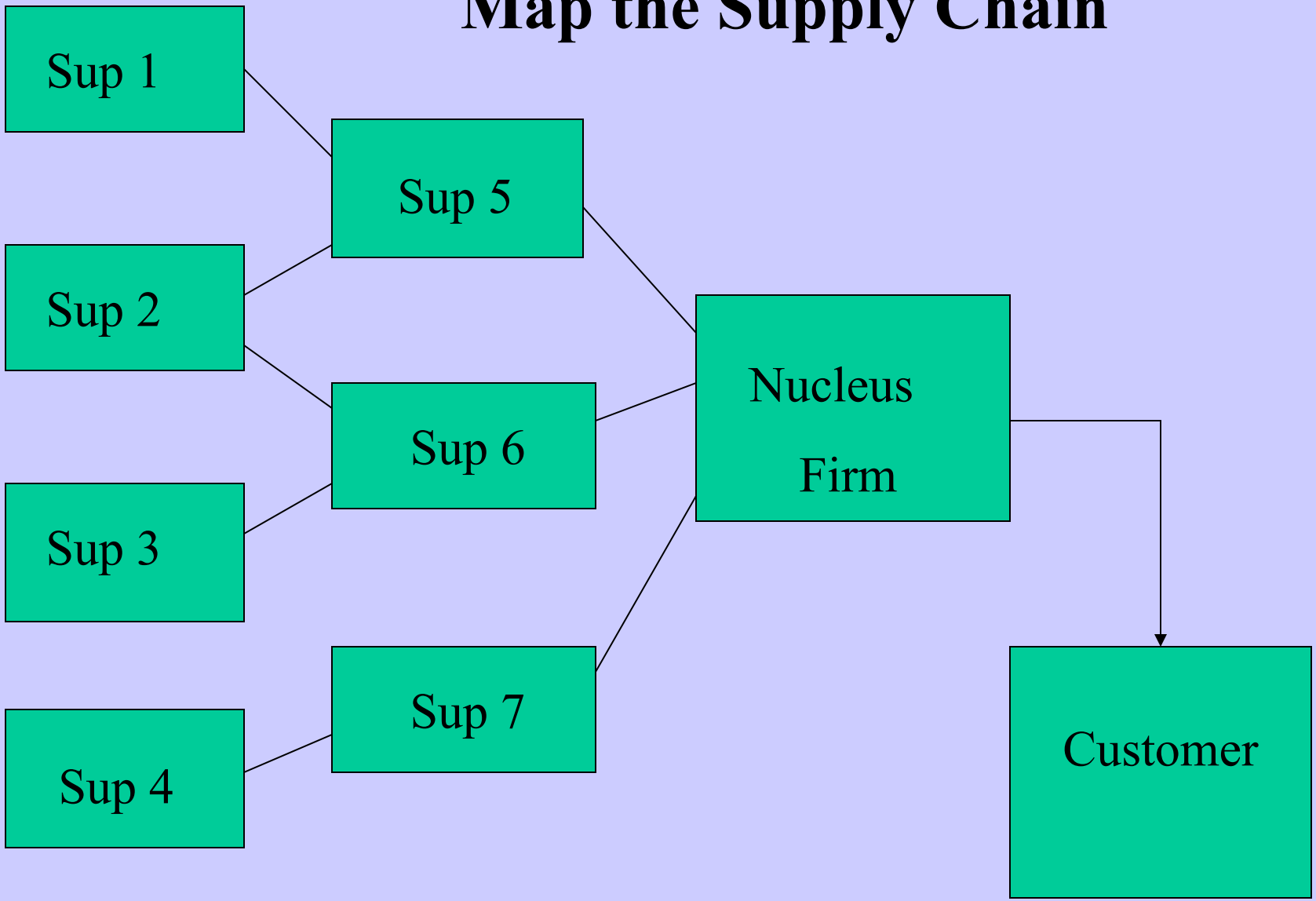
- Improved visibility of the flow of material
- Reduction and elimination of stock-outs
- Increased inventory turns
- Greater percentage of on-time deliveries
- Reduced inventory cost throughout the network
- Better profitability for all partners

# Extended Enterprise

(Collaborative Relationships)



# Map the Supply Chain



# Knowledge of the Supplier

Know your supplier as well as you possibly can

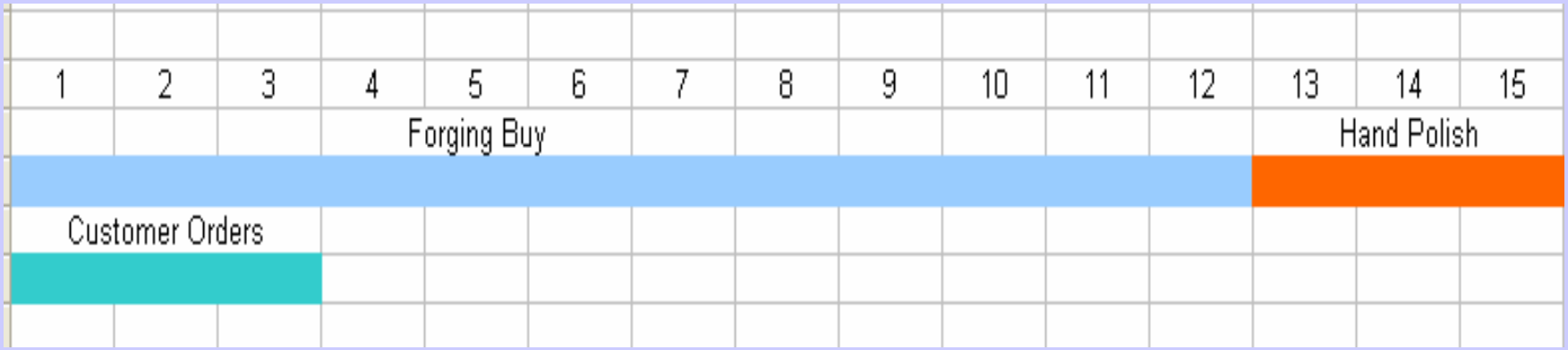
Tour their factory with the plant manager

Ask lots of questions

- Tooling and tool maintenance
- Machine back-up capability
- Outsource capability

Know what the options are in case of failures

# Supply Chain Problem

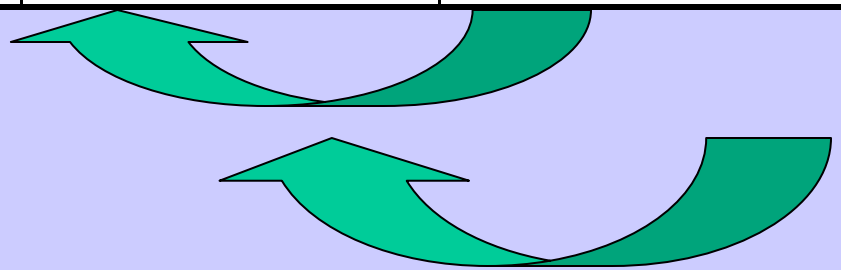



Rules:

- Forecast is not accurate
- Don’t use forecast error as an excuse
- Do not build excess inventory

| Part # | Size of Press |
| --- | --- |
| X-003 | 100 Tons |
| Y-004 | |
| Z-003 | |
| W-001 | 500 Tons |
| W-002 | |
| X-002 | |
| Y-002 | |
| Y-003 | |
| Z-002 | |
| W-003 | 600 Tons |
| X-001 | |
| Y-001 | |
| Z-001 | |

| | 500 Tons Press Schedule | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Date | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 |
| Part # | W-001 | Y-002 | X-002 | W-002 | Y-003 | Z-002 | Y-002 |
| Qty | 500 | 400 | 500 | 400 | 500 | 350 | 400 |



As a buyer I was basically performing mixed model scheduling for their factory floor.

Why can't they just make the switch without you asking?

# Four Basic Flows

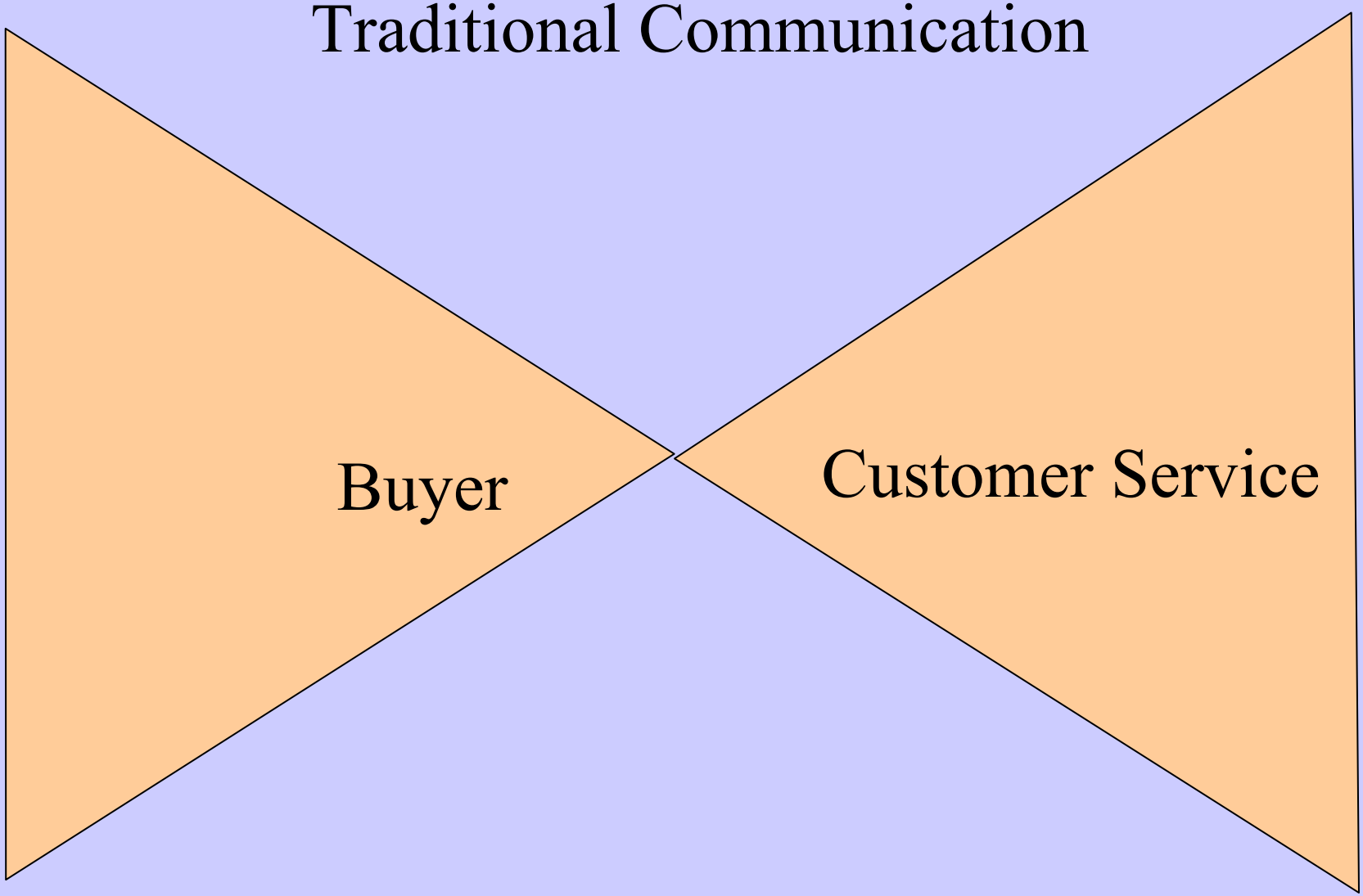
Flow of Materials from Raw to Finished Product

The Flow of Cash back “Upstream”

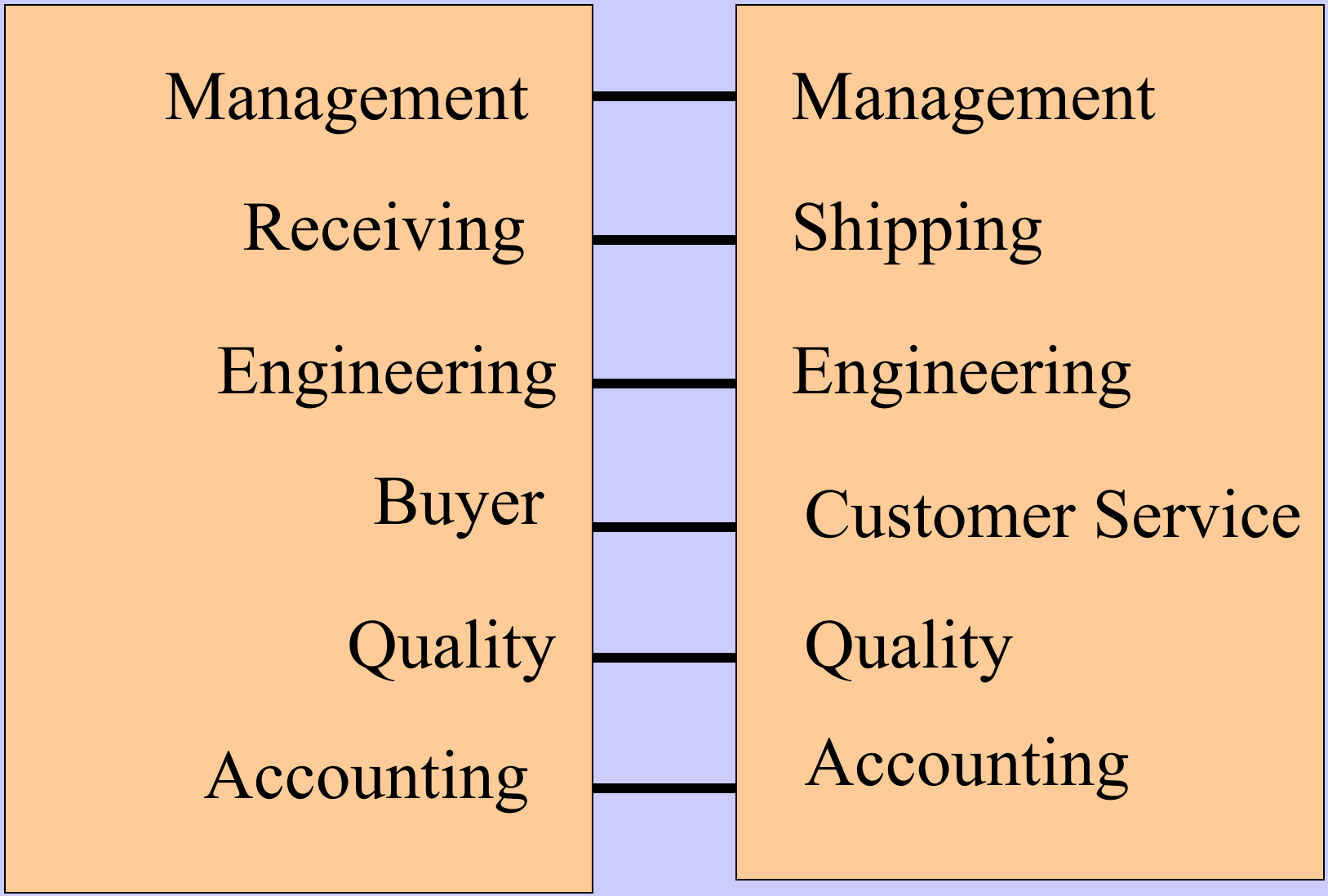
The Flow of Information in Both Directions

Reverse Flow of Material for Repairs, Recycling & Disposal

# Traditional Communication



# Collaborative Communication



# Aspects of Communication

Transactional with Information Sharing

Shared Processes and Technologies

Linked Competitive Vision and Strategic Alliance

Backward Integration (Mergers and Acquisitions)

# Benefits

Lower Costs

Improved Quality

Better Customer Service

Reduced Inventories

Rapid Project Results

Reduced Cycle Times and Lead Times

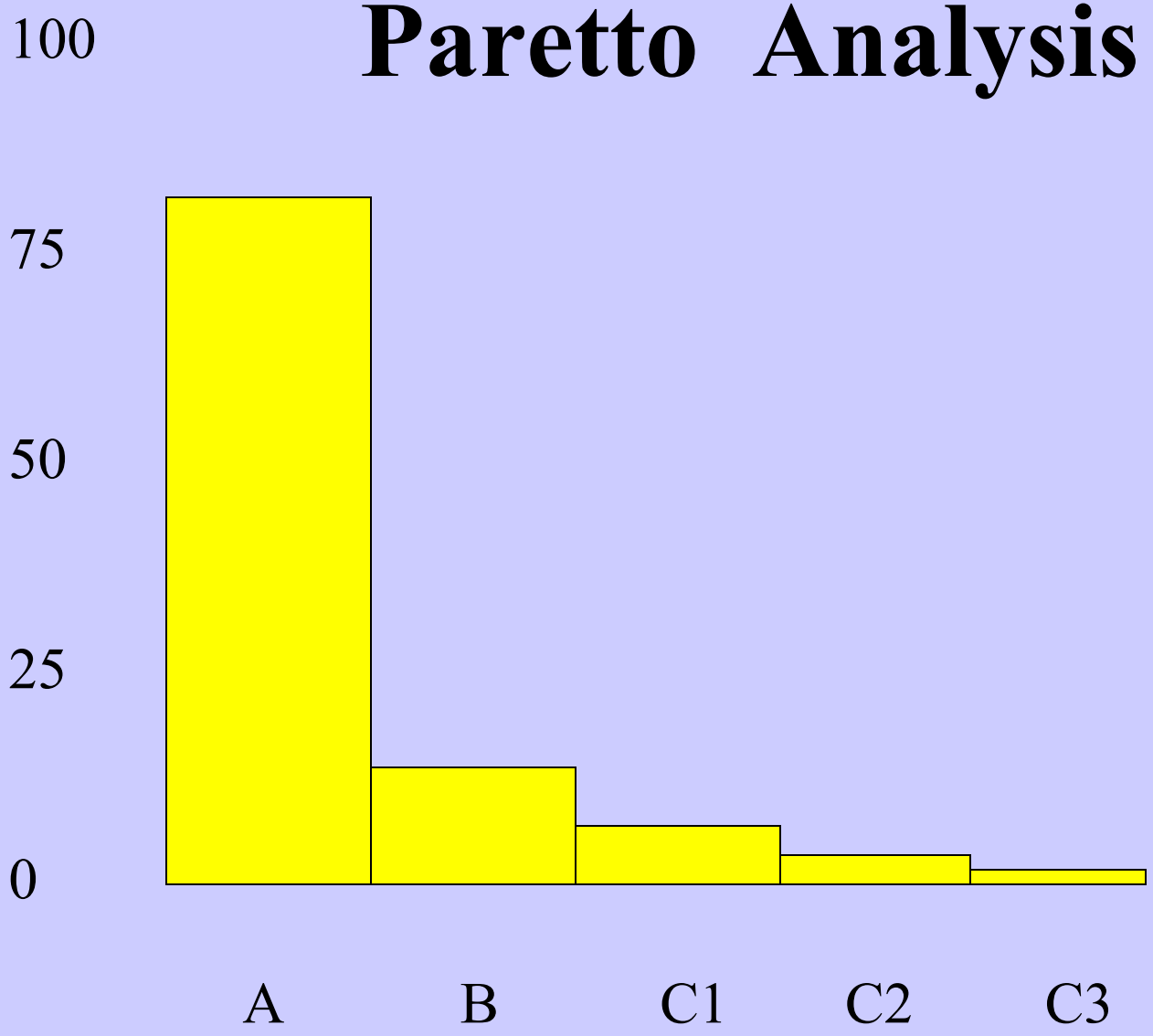
More Effective Working Relationships

Enhanced Commitments to One Another.

Do we want a collaborative relationship with all suppliers?

**No!**

# Paretto Analysis



# Types of Material

Core Material (Competitive Advantage)

Critical but Non-Core (Leveraged)

Commodity (Price and Availability)

Or Blue Print Product (Non Leveraged)

# Levels of Strategy

**Strategic** – mission, goals and objectives (5 –10 years)

**Tactical** – functional plans (2- 5 years)

**Operational** – planning & execution (12 month)

# Operational Strategy

Kaizen projects (improve the process)

DMAIC 6 Sigma projects (reduce variability)

Lean Training

Six Sigma Training

Integrated Supply Chain Training

# Tactical Strategy

Upgrade or revamp the product line

Develop new processes

Develop two 6 Sigma Black Belts

Develop 1 Master Black Belt

Undertake major “Lean” initiatives

Re-organize your operations structure

# Strategic Initiatives

New Product Line

New technologies

New factory

Revamp current factory with new processes

# BHAG

Big Hairy Audacious Goal

Being # 1 in your industry in

- Quality
- Earnings
- Product Innovation
- Etc.

# Ideas for Strategic & Tactical Strategies

Trade Shows / Business Conventions

ASQ Technical meetings / APICS PDMs

Customers / Sales team

Suppliers

- developing technologies and processes
- recent trends in the market place
- bench marking the competition
- development of joint initiatives

# Relationships

Lifetime Customer

Value versus Price

Agreements over Contracts

- participate in joint investment
- develop linked processes
- share in the rewards (cost savings)

# Integrating Strategies

Current production activity has limited opportunity

New product development has great opportunity

- emphasize lean principles
- incorporate 6 sigma design principles
- improve the competitive aspect of the product

# New Product Design

The concept and design phases account for small portion of the development cost.

Decisions made during those phases account for nearly 80% of the product.

Details and decisions made in the early design phases will greatly impact:

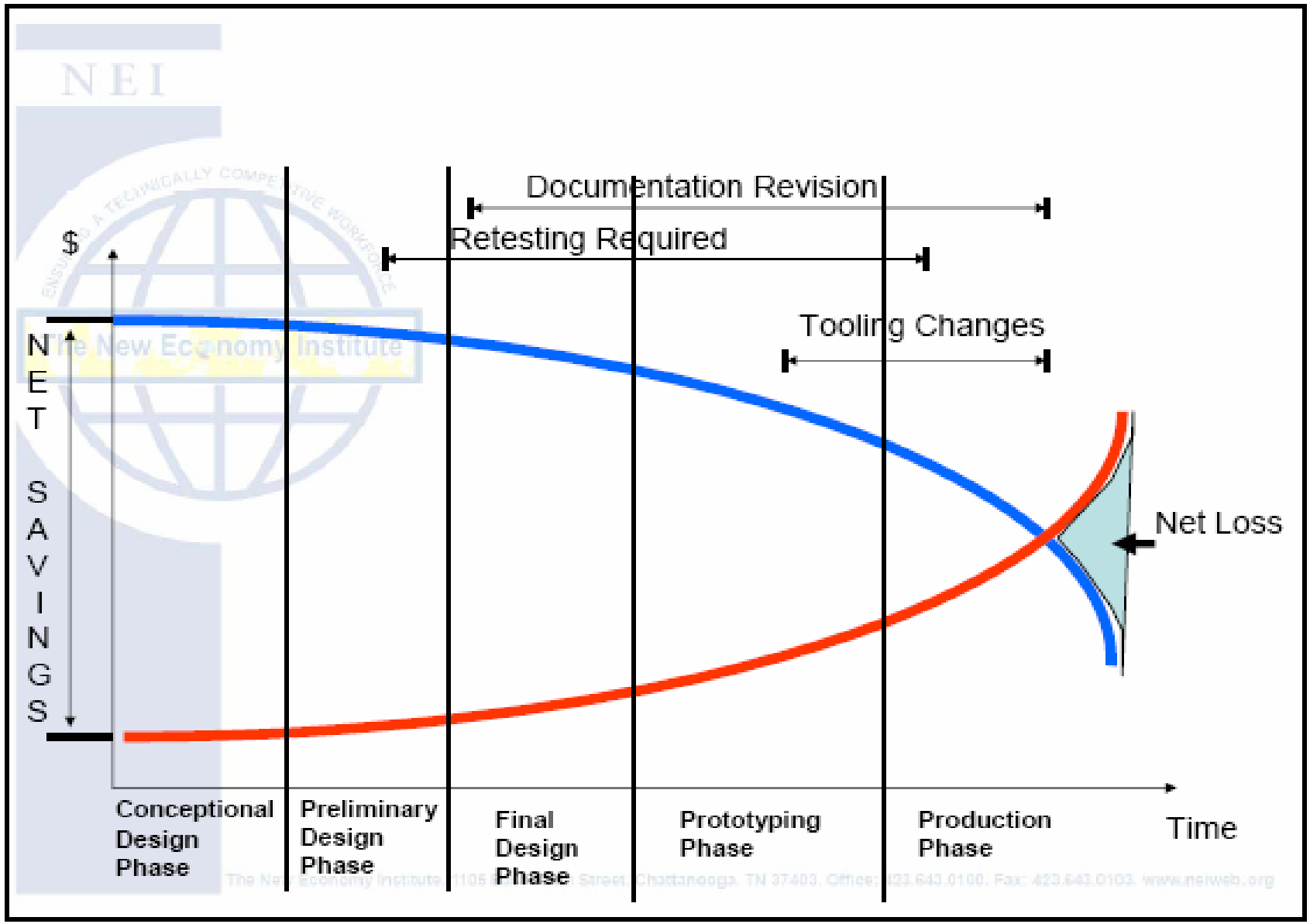
Product Quality

Cycle Time

Labor Costs

Material Costs

Life Cycle Costs


Documentation Revision
Retesting Required
Tooling Changes
$
NET SAVINGS
Net Loss
Conceptional Design Phase
Preliminary Design Phase
Final Design Phase
Prototyping Phase
Production Phase
Time

We need to apply as much product, process and technical expertise as possible to the design process.

How can a company maximize possible design expertise?

**Integrate the supplier in the design process!**

# Levels of Supplier Integration

No Supplier Involvement (Core)

Informal Supplier Integration

Formalized Supplier Integration

Supplier Controlled Design

Of those 4 approaches which method have studies shown can achieve the greatest result?

# Supplier Controlled Design!

# Supplier Designs Reduce Costs

Simplify the Design (Value Engineering)

Reduce the Number of Parts

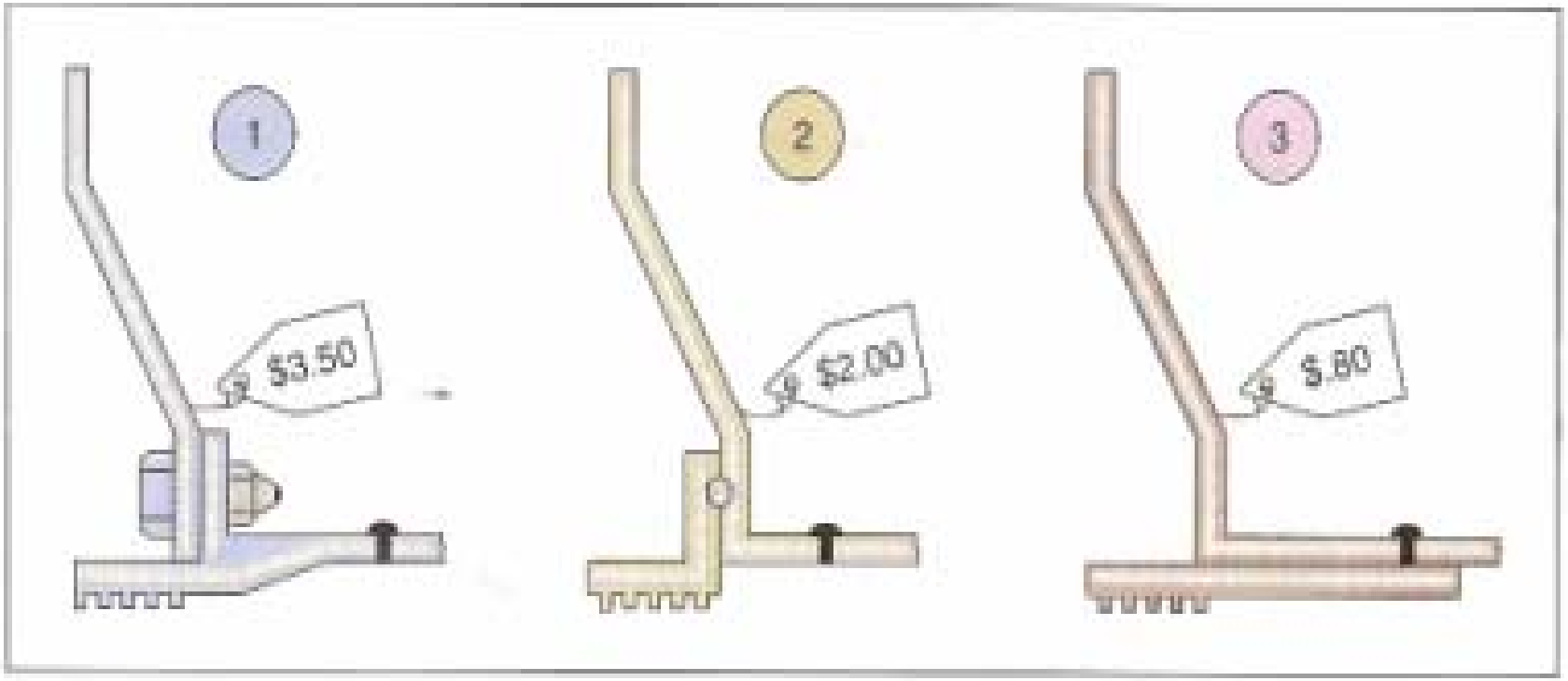
Improves Reliability

Improves the Quality

Increases the Application of Modular Design

Reduce the Logistics Cost

# Value Engineering / Value Analysis




[6] "Best Practices Survey 1994: Product Definition," *Target* 11, no. 3 (May–June 1995): 22–24.

# Principles of 6σ / Lean Design

Keep Designs Simple (Toyota, Honda etc,)

Avoid Un-needed / Overly Critical Specifications

Component Commonality

Modularity

Universality (standardization / interchangeable)

Mass customization (postponement)

# Strategic Elements for Supplier Integration

Encourage and support continuous improvement

Supplier integration into non-core, critical systems

Technical competence in the purchasing organization

Collaborative effort to involve suppliers in NPD

Alignment of goals and strategies with suppliers

Joint identification of customer requirements.

Joint development of product concepts

# Core Team vs. Sub Team

Core team is made up of internal company personnel only.

Under the core team are multiple sub-teams whose lead may be supplier personnel.

This approach allows for maintaining confidentiality of core issues while integrating supplier involvement for non-core activities.

## 3PL Opportunities

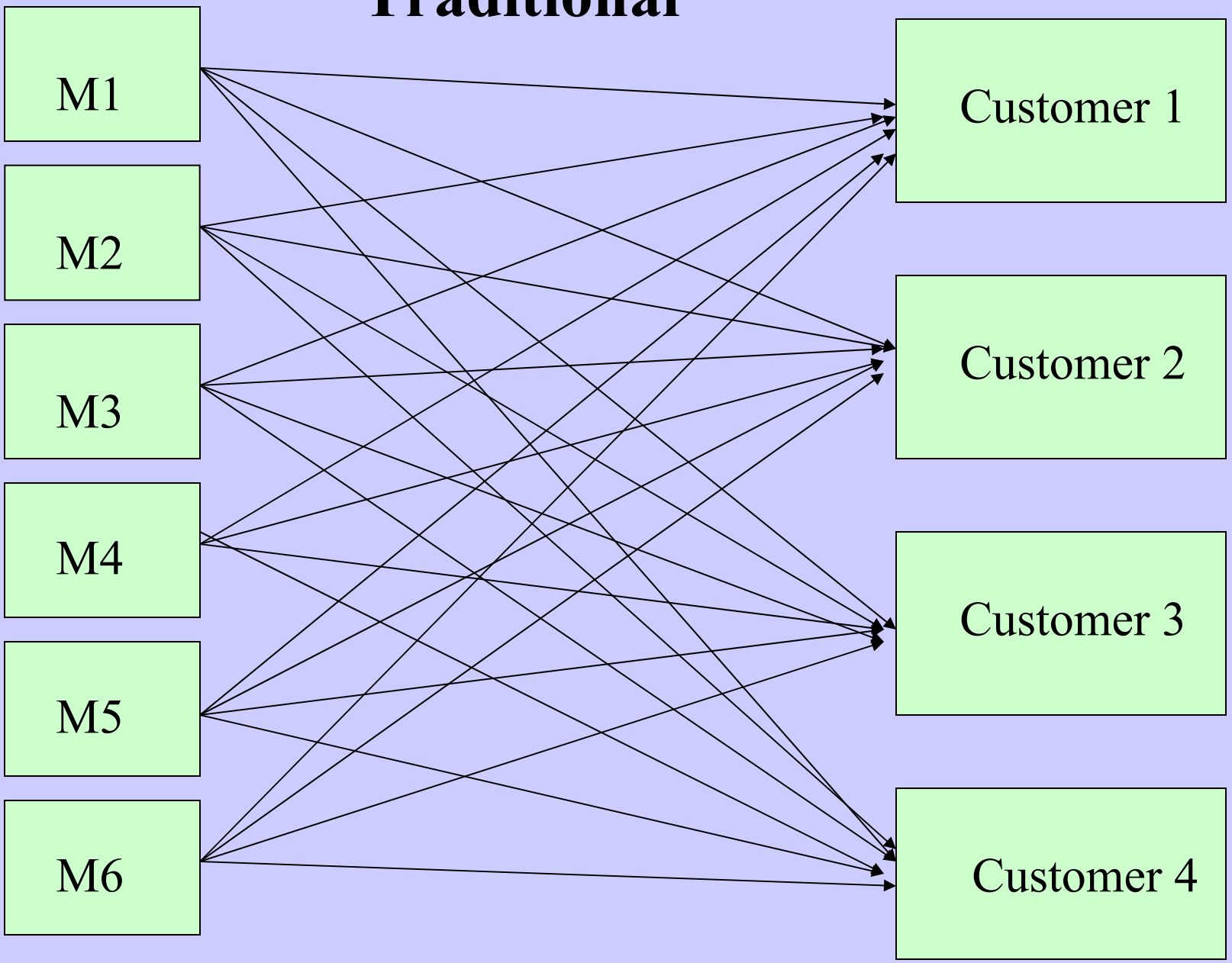
Lean Manufacturing Activities like:

- Response Manufacturing
- Mixed Model Scheduling
- JIT Inventories
- SMED etc

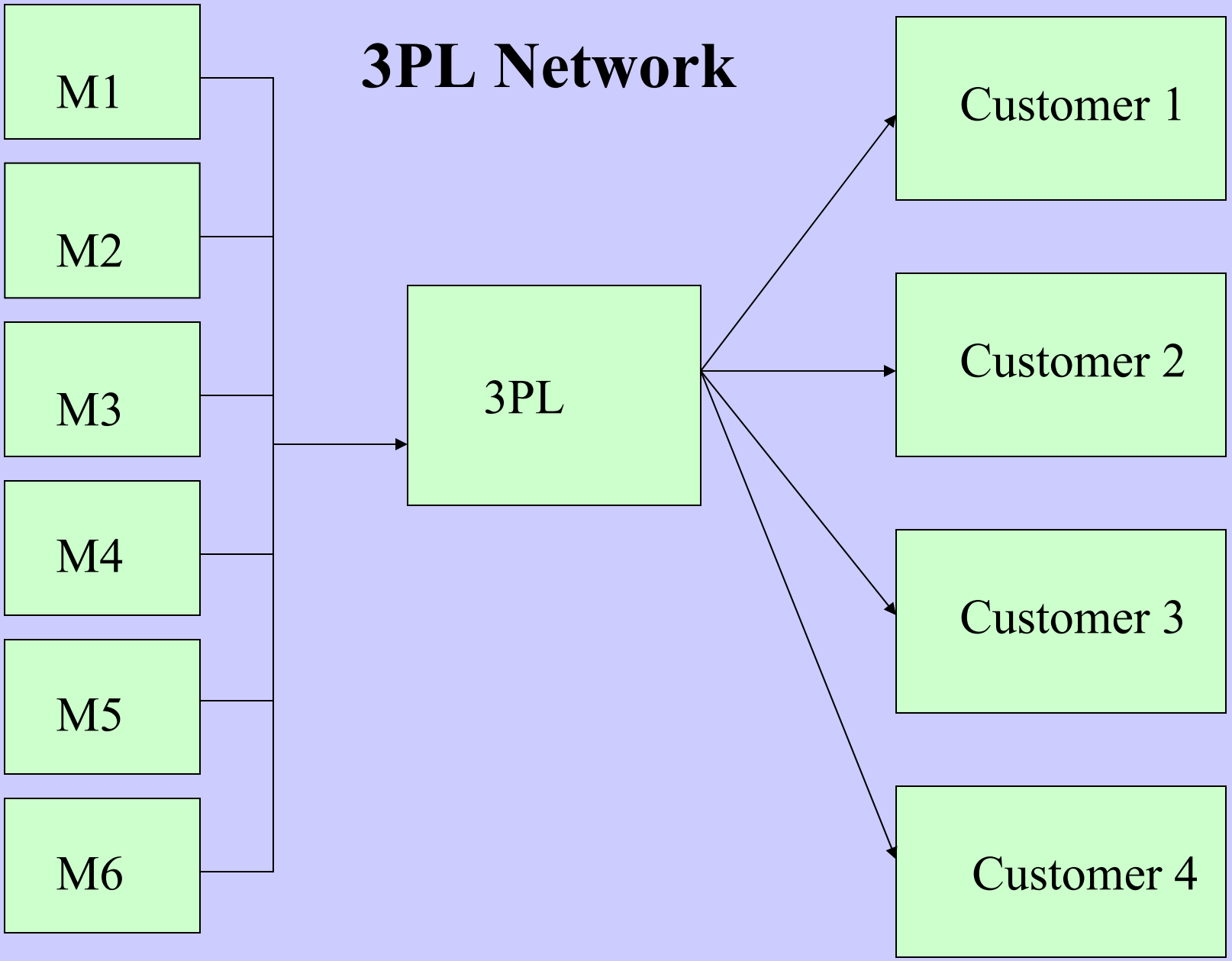
Result in smaller more frequent shipments.

Significantly increase in shipping costs

# Traditional



# 3PL Network


M1
M2
M3
M4
M5
M6
3PL
Customer 1
Customer 2
Customer 3
Customer 4

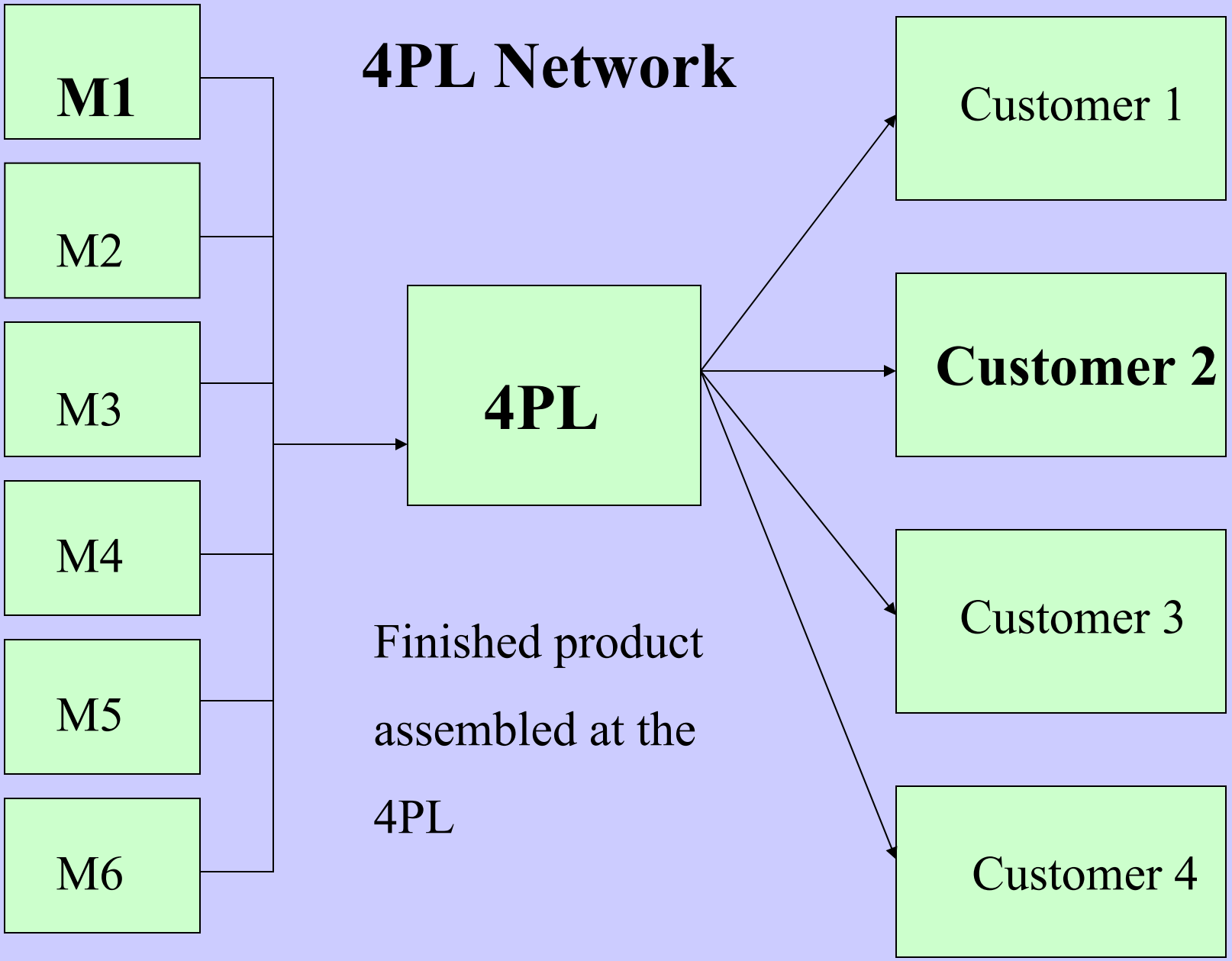
# Logistic Strategies

**Cross Docking –** from many suppliers to one customer

**Bulk Break –** from one supplier to many customers

**Mixing –** From many suppliers to many customers

**Postponement –** disassembled product that is completed based on the actual customer order and shipped out.


4PL Network
M1
M2
M3
M4
M5
M6
4PL
Finished product assembled at the 4PL
Customer 1
Customer 2
Customer 3
Customer 4

# Export – Import Agents

**Custom House Brokers** – get product & documents thru customs

**Freight Forwarders** – arrange for shipment

**Consolidators** – combine smaller shipments into larger shipments

**Export Management Company** – Export consultant

# Enterprise Application Integration (EAI):

**BPM – Business Process Management** – Smart middleware

- Provides for multiple systems with common communication

**Custom Linkages** – can be less expensive than middleware

**SCEM / APS** – Internet enabled communications

**Online trade exchanges or marketplaces:**

- Enable integration and collaboration between multiple partners.

**Integration suites:**

- Software packages offered by ERP and other software companies that are already internet enabled

# Stages of supply chain development

Functional Focus

Internal Integration

Extended Integration

Cross-enterprise collaboration and optimization

# Functional Focus

Disconnected legacy systems

Systems cannot easily communicate

Paperwork or data re-entry

Divisions have functional silos

Should work towards becoming internet capable

# Internal Integration

Completed ERP implementation

Demonstrate cross-functional integration of functional processes.

Share information internally relatively easy

Should move towards external connectivity

# Extended Integration

Can share real-time or near real-time information

- between divisions
- first tier customers
- first tier suppliers

Some sharing of risks and rewards of collaboration

# Cross-enterprise collaboration and optimization

Have automated and seamless information sharing

Use of collaborative planning and forecasting

End-to-end integration allows for total visibility

Whole network can function as a virtual company

# 6σ, Lean & SC Summary

Work with current suppliers rather than find to new ones

Invest in design and redesign than re-bid the same parts

Establish an appropriate strategy mix between

- Operational
- Tactical
- Strategic

Use 3PLs and 4PLs to cut transportation costs

Use low-cost communication links to integrate your lean supply chain