

## Decision Tools for an Enhanced Supply Chain Part 1

# Why Should I Optimize My Supply Chain?

“Better me than my competitor”

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Prepared for ANTEC 2003



# Trends in Industry

- Globalization
- Increased Competition
- Speed to Market
- Outsourcing
- Leverage
- Partnerships

# Manufacturing is Facing New Challenges

## ➤ Past

- Get material, make product, stock warehouse
- Development was sequential
- Decisions discrete
- Product life cycles reasonably long
- Manufacturing has a component focus
- Products manufactured for specific customers, regions
- Vertical integration

## ➤ Present

- Collaborate on design, obtain material, create product, distribute
- Outsource non-core competencies
- Development is concurrent
- Manufacturing has a system level focus
- Products manufactured for global markets
  - “Think global, manufacture locally”
- Advanced manufacturing integrates people, process and technology

# Product Requirements

## ➤ Past

- Specifications were unique for each intended market
- Specifications were geared to specific manufacturing plants
- Agency regulations were not harmonized for here and overseas
- Product specifications were geared to trained installation professionals
- Energy efficiency and recyclability recommendations not furnished
- Requirements referenced extensive documentation

## ➤ Present

- Specifications describe global products
- Specifications not over-constrained, manufacture anywhere
- Agency regulations are harmonized to a greater degree
- Ease of installation, use and servicing (lower weight, lower cost, complexity)
- Expectations of lower operating costs, data for total cost of ownership
- Products with diagnostics, intelligence (high electronic component)
- Environmental regulations in place (Take back requirements)
- Product data management(PDM) files replace paper documentation

# Technology/Product Life Cycle Compression

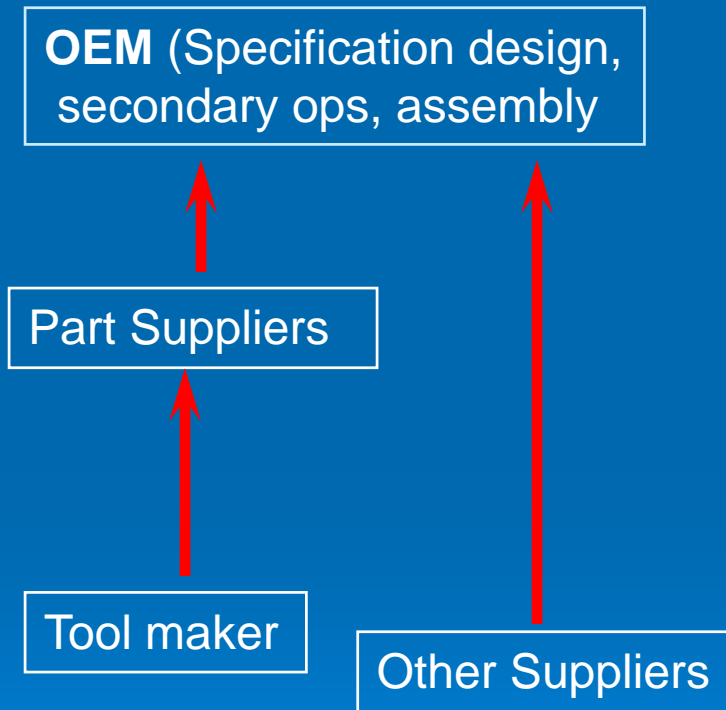
- The pace of technology improvements bring about faster product obsolescence
- Product life cycles are shortened in every industry
- Outsource non-core activities
- Optimize products for cost, quality and time to market

# Implications

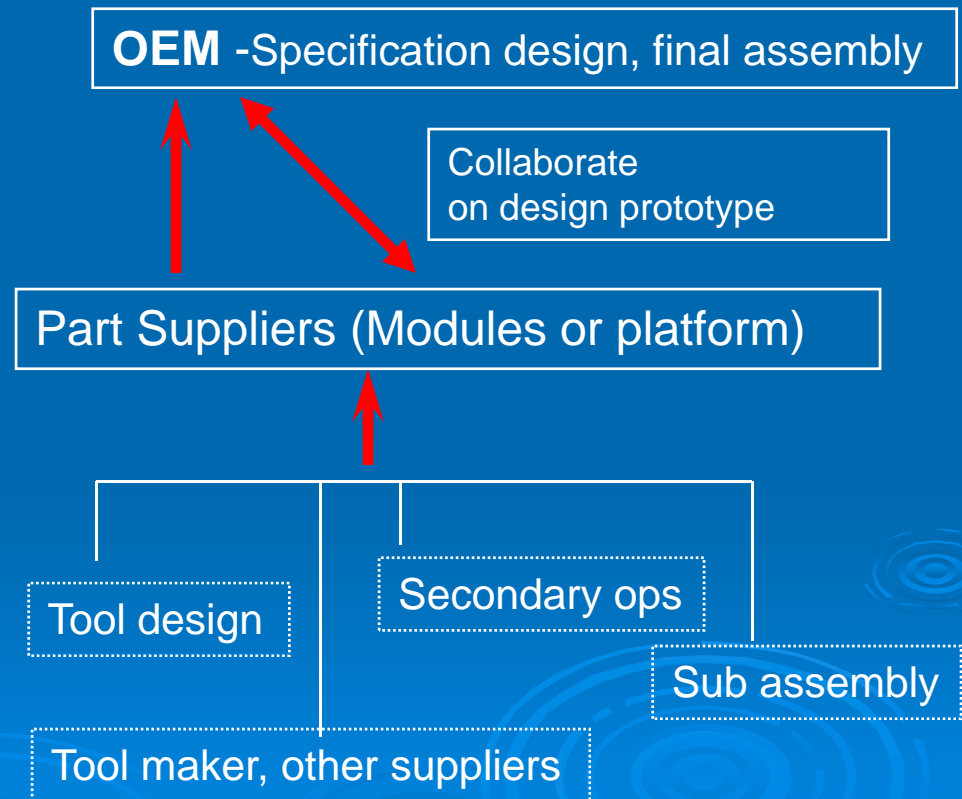
- Trend to modularity and platforms
- Integrate marketing, manufacturing and design input at the critical concept stage
- Address the product variety vs. production complexity trade-off
- Enable “build to order” environment
- Give suppliers the needed outcome, not a process

# Evolution in the Supply Chain

## Traditional Process/Supply Chain



## Present —————> Future Extended Enterprise Supply Chain



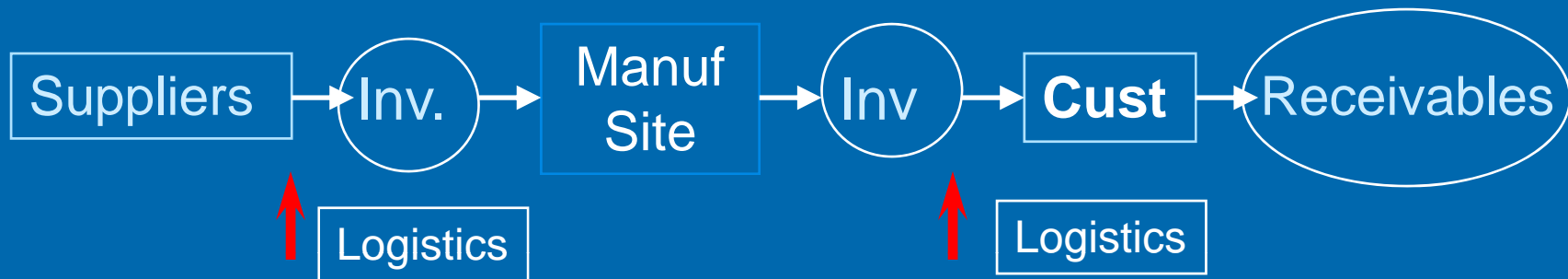
# Implications

- Lean Manufacturing
  - Cost reduction
  - Improved efficiency/productivity
  - Reduced waste
- Customers as partners
- Suppliers must become friend/partner

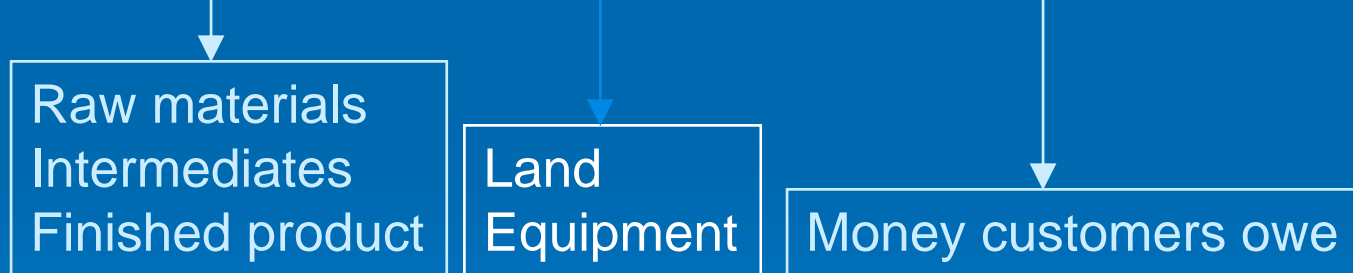
# Supply Chain Management

- Becoming an important core competency
  - Doesn't just involve the procurement process
  - Encompasses any function that can improve the internal process to satisfy customer orders
  - From manufacturing to marketing should be involved

# Supply Chain-Our Definition



$$\uparrow \text{Assets} = \uparrow \text{Inv} + \uparrow \text{Fixed Assets} + \uparrow \text{Receivables}$$



# Managing the Supply Chain

- Initially offers a competitive edge
- Supports lean manufacturing
- Leverage
- Best practices

Will insure survival in an increasingly competitive world

# The Supply Chain as “Extended Enterprise”

- Reaches beyond the organization
- Strategic planning tool
- Views suppliers and customers as “partners”
- Critical to enable company to become an Agile Manufacturer.

# Enhanced Supply Chain

- Strategic sourcing
- Distribution and logistics
- Review asset/inventory management
- Demand forecasting
- Manufacturing, assembly and testing
- Field service support

# Chemical and Plastics Products

- Most globally traded products worldwide (\$1.7 trillion/yr)
- Facing slow growth and pricing pressures
- Industry undergoing increasing mergers and acquisition to achieve economics of scale
- Increased pressure to improve innovations rate, outsourcing and collaborative product development

# Results & Trends

- Leading firms spending increasing percentage of R&D on co-developments with suppliers
- Requires enhanced collaboration and management capabilities
- Opportunities at all steps of process

# Opportunities

- R&D collaboration
- Order management fulfillment
- Invoicing & payment
- Manufacturing process and capacity utilization
- Inventory and work in process
- Management of customer portfolio

# Identify the Needed Changes

- Which will have the biggest profitability impact
- Need understanding of market and customer profile to formulate strategies and predict outcome using real world facts
- Developing supply chain strategies to perform in the real world is the key challenge

# Supply Chain Strategies

- Manufacturing improvement strategy
- Logistics strategy
- Capital investment strategy
- Keeping customer satisfied

# What is an “Agile Manufacturer”?

- A philosophy for effectively dealing with customer unpredictability through mass customization
- Needs tools taking into account impact of customer need and manufacturing unpredictability
  - Capital cost
  - Cost for inventory
  - Manufacturing cost structure and meeting the market’s expectations for service

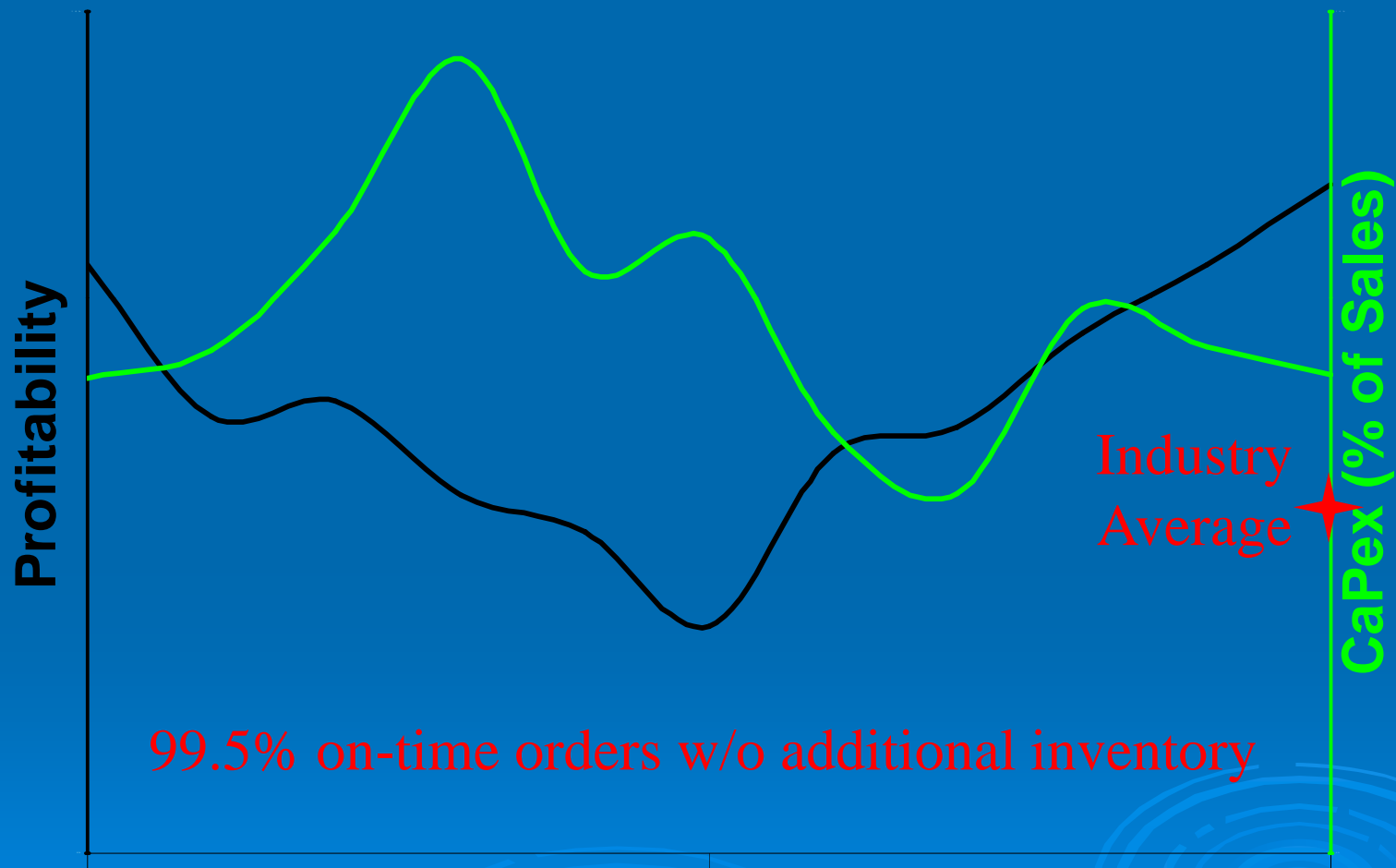
# Supply Chain Impact

- Research presented by V. Parunak conducted at the Center for Electronic Commerce
  - A single change at the top of the supply chain generates disturbances that persist long after the original change
    - Occur even when the top-level supply is constant and bottom-level supply is completely reliable because of dynamic interactions within the supply chain

# Examples of Unexpected Outcomes

- Chemical manufacturer experienced deterioration of customer service after reducing inventory...
- Durable good manufacturer launched a new product that was expected to be highly successful...but... lost market share
- Semi-conductor manufacturer rapidly expanded capacity through capital additions...net income grew slower than asset base

# Case Study: Overall Results



99.5% on-time orders w/o additional inventory

88

93

98

# Prevention of the Unexpected

- Define Customer need and satisfaction
- Decision-makers need to predict the impact of decision on key supply chain variables and profitability
- Tools available for evaluation
- Case study

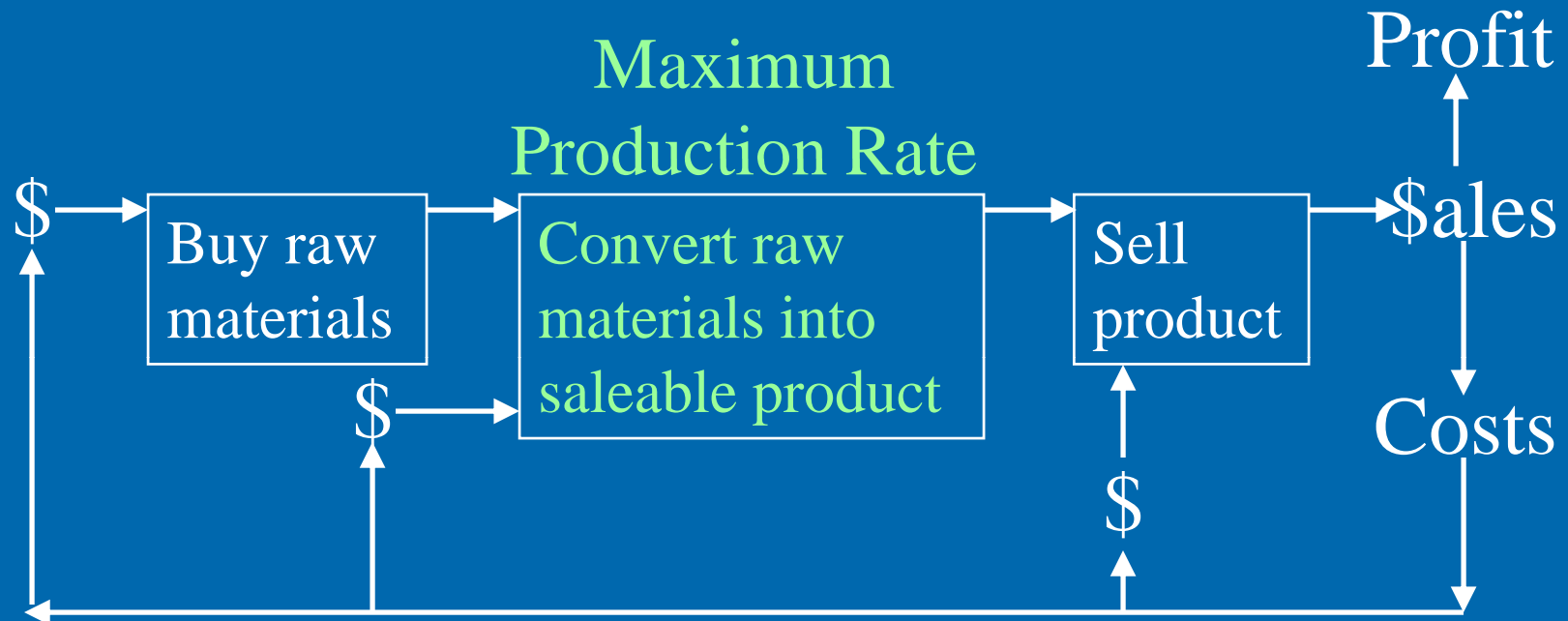
# Decision Tools for an Enhanced Supply Chain- Part 2 How and What

***“How can managing/eliminating  
unpredictability in the supply chain  
make my company more profitable?”***

*Carol Vesier, Ph. D.*

*RonaMax, LLC*

# Unpredictability Effect on Supply Chain

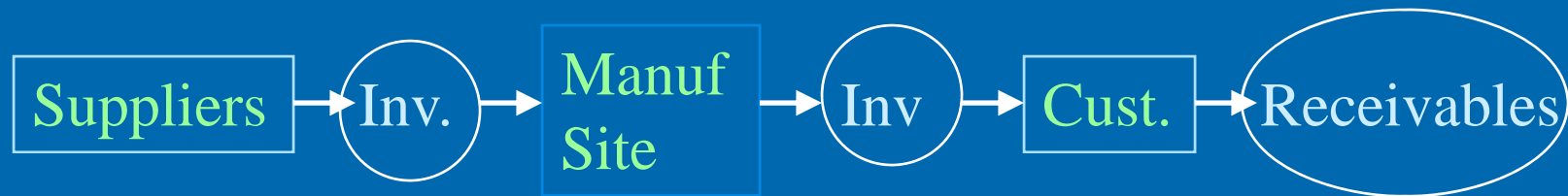


Production = Maximum Rate \* ↓ Utilization \* 1 year

↓ Profit = ↓ Annual Production \* ( SellingPrice - ↑ Cost)

*What happens with more unpredictability?*

# Unpredictability Effect on Supply Chain



$$\uparrow \text{Assets} = \uparrow \text{Inv} + \uparrow \text{Fixed Assets} + \uparrow \text{Receivables}$$

Raw materials  
Intermediates  
Finished product

Land  
Equipment

Money customers owe

*What happens with more unpredictability?*

# Good Design

- Eliminate/reduce unpredictability
  - Manufacturing, Raw materials, Customers, etc
- Manage unpredictability
  - Supply chain heuristics, Inventory, Manufacturing capacity, etc

*Will this reduce or better manage unpredictability?*

*If not, what is the impact?*

# Approach

- Predict “real-world” outcome of proposed change
  - Capital investment
  - Inventory changes
  - Supply chain restructuring
- Requires simulation tools to select best approach for mitigating risk and maximizing profitability.

# Simulation Tools

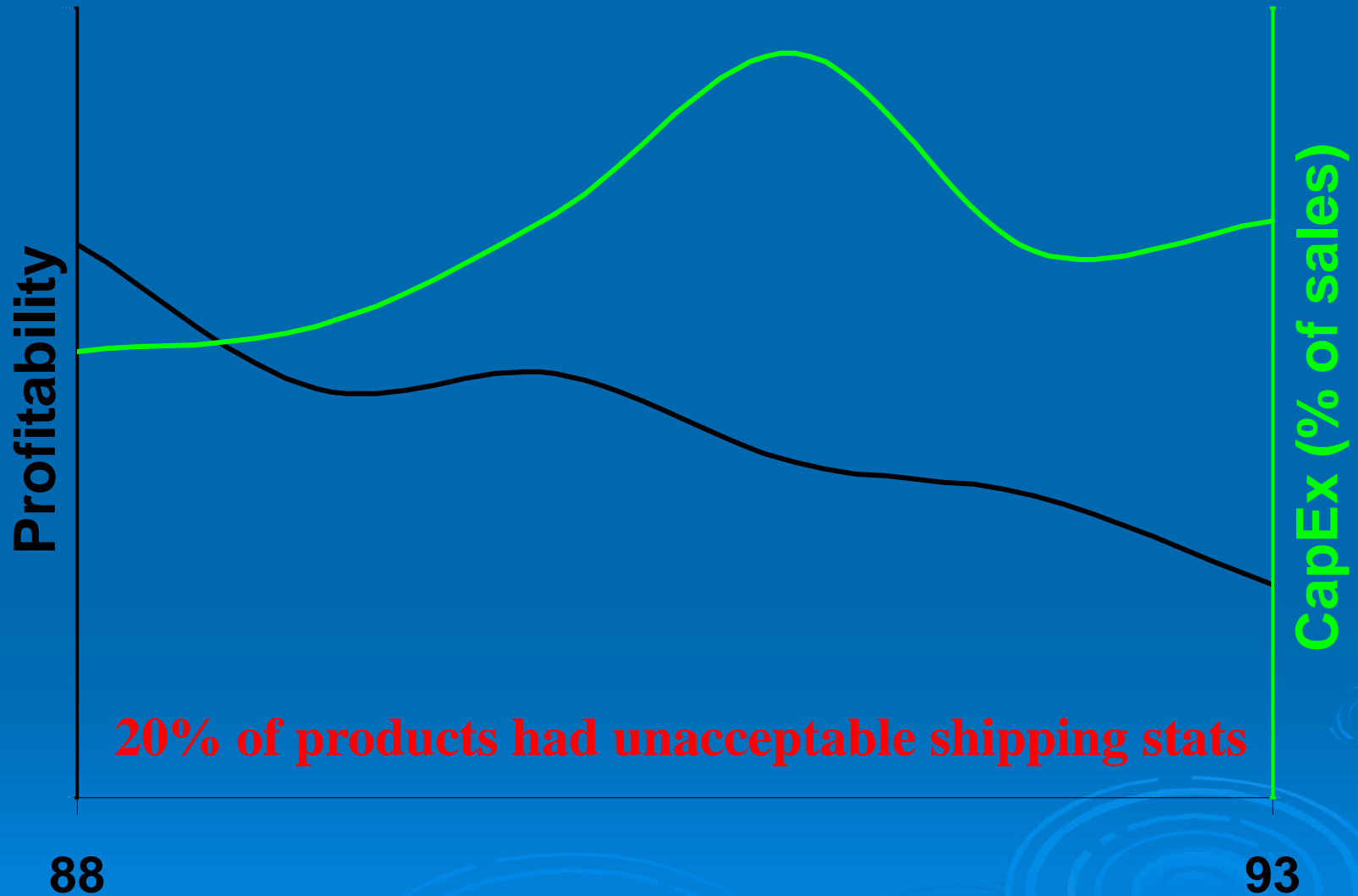
- Simulate flow of materials through supply chain
  - Supply chain data
    - Inventory rules, sourcing, customer priority, etc.
  - Manufacturing data
    - Cycle times/rates, recipes, scheduling logic, failures, etc
  - Raw material data
    - Quality, predictability, etc
  - Customer data
    - Requirements, order patterns, etc

# Simulation Tools

## ➤ Predict

- Usable capacity
- Response times
- Inventory requirements
- Required capital investment

# Case Study: Fortune 500 Chemical



**20% of products had unacceptable shipping stats**

88

93

# Phase 1: Control Capital Spending

- Acquire additional capacity by reducing manufacturing unpredictability / changing product mix.
- Test strategy in single site.
  - Developed simulation model of a site
  - Actual plant specific history
    - Product mix
    - Product recipes
    - Manufacturing upsets
  - “Best in class” performance

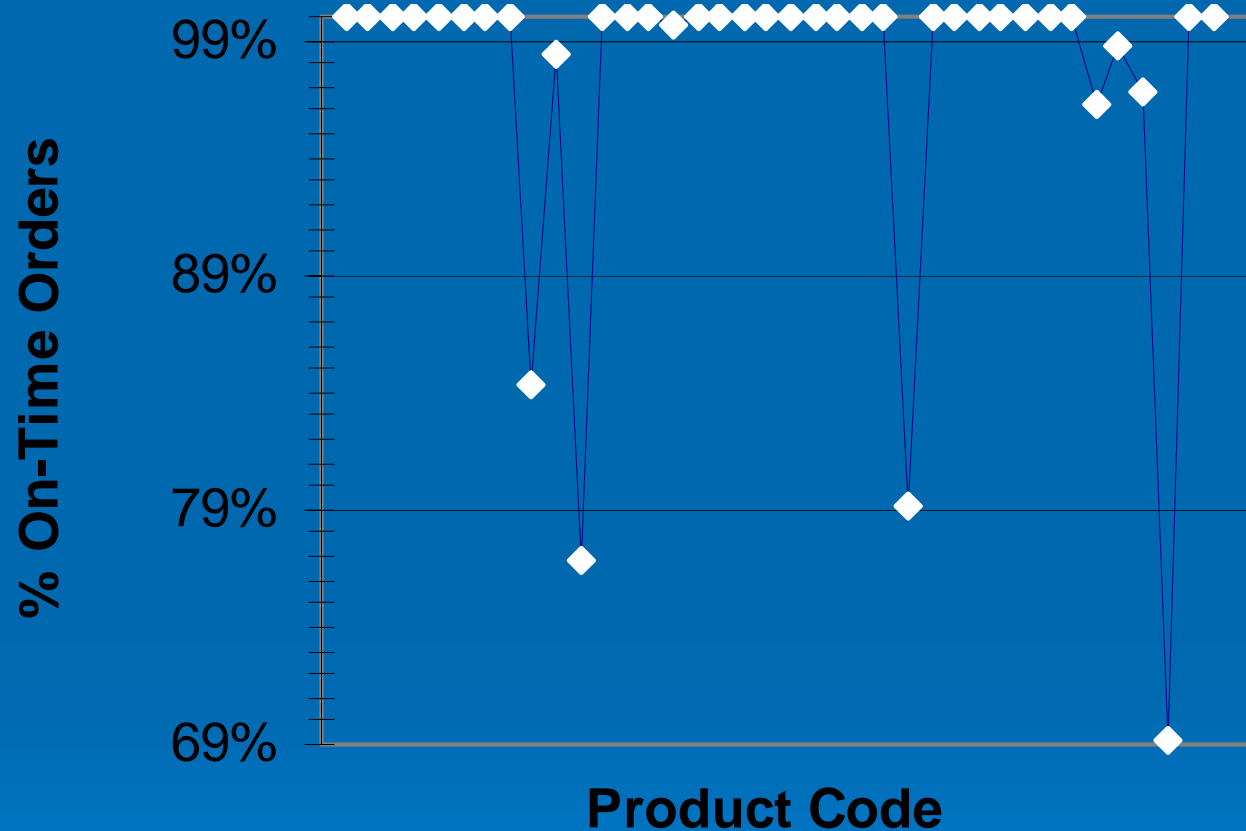
# Pilot Outcome

- Model could accurately predict impact of changing product mix and eliminating manufacturing unpredictability.
- When held accountable, manufacturing could deliver improvements.

# Phase 1: Results

- Work process for capital approval changed
  - Management refuse requests if eliminating unpredictability can provide capacity.
  - Simulation tool kit deployed world-wide to support new work process.
- Reduced CapEx while maintaining volume growth
  - Cost of capacity 10% of traditional purchased capacity.

# Phase II: Improve Customer Service



# Phase II: Improve Customer Service

- Expand the model to include customer orders and finished product inventory.
- Use model to support redesigning supply chain.
  - Inventory
  - Achievable standard shipping times

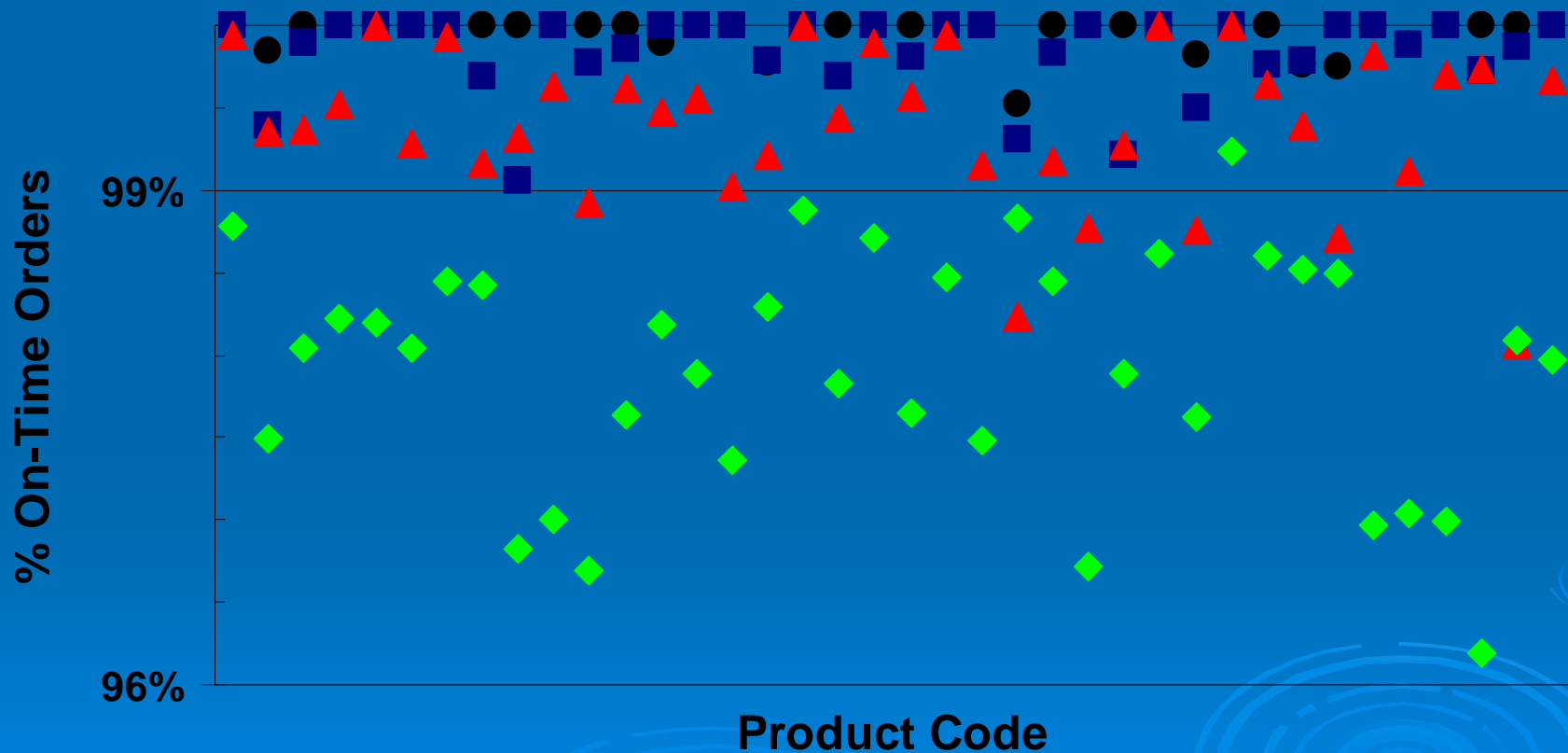
# Computer Model

● Base Case

▲ Safety Stock Target = 50% Base

■ Safety Stock Target = 75% Base

◆ Safety Stock Target = 25% Base



# Phase II: Result

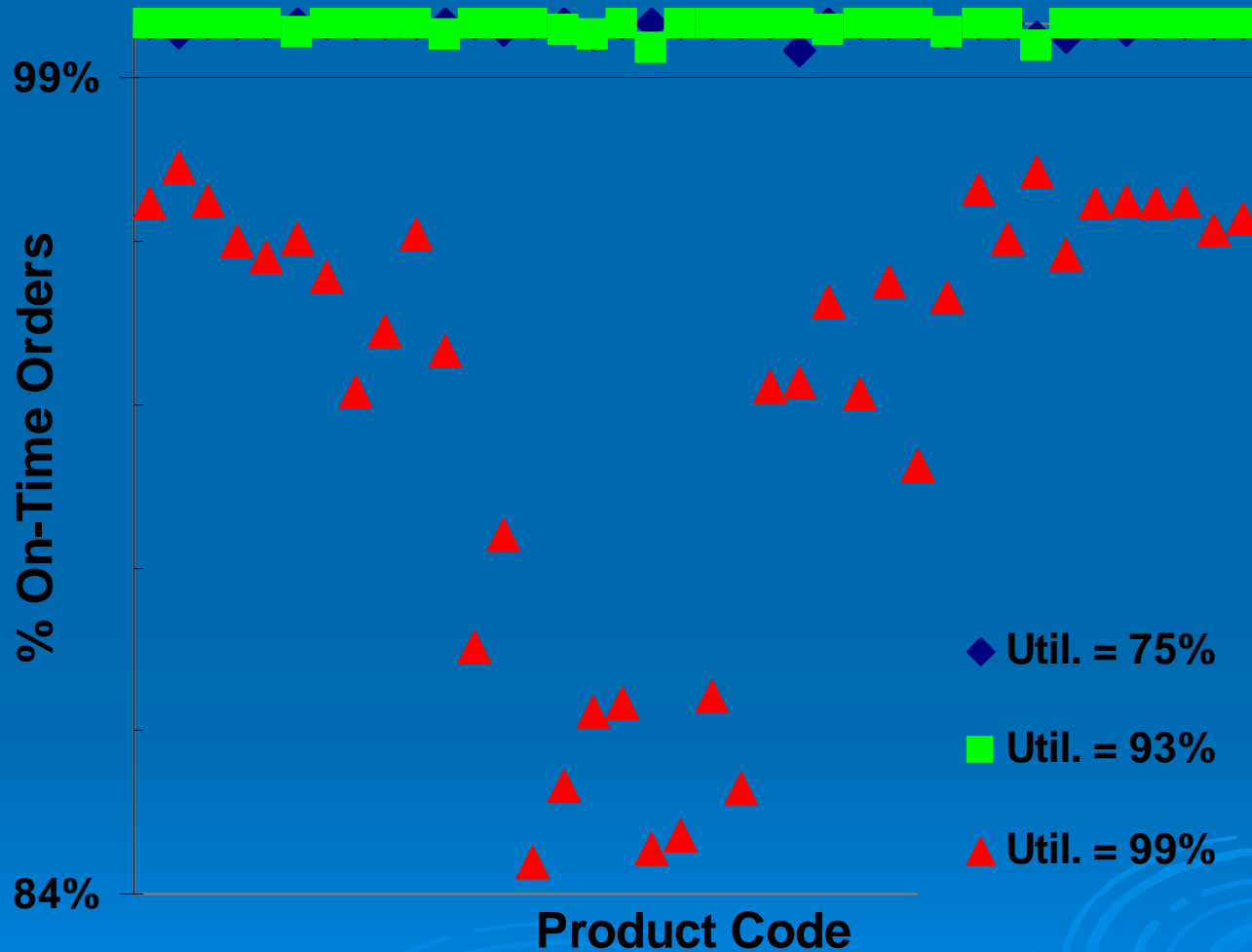
- Acceptable shipping stats
  - 99.5% of orders *by product* shipped in 2 days or less.
- Average site inventory unchanged.
  - Inventory shifted between products.
- Volume in more desirable products began to grow.

# Phase III: Manage Growth

- Growth required capital investment.
  - When?
    - Too late: lose customers
    - Too early: lose profitability
  - How big?
    - Too small: lose customers
    - Too big: lose profitability

*Model used to answer these questions.*

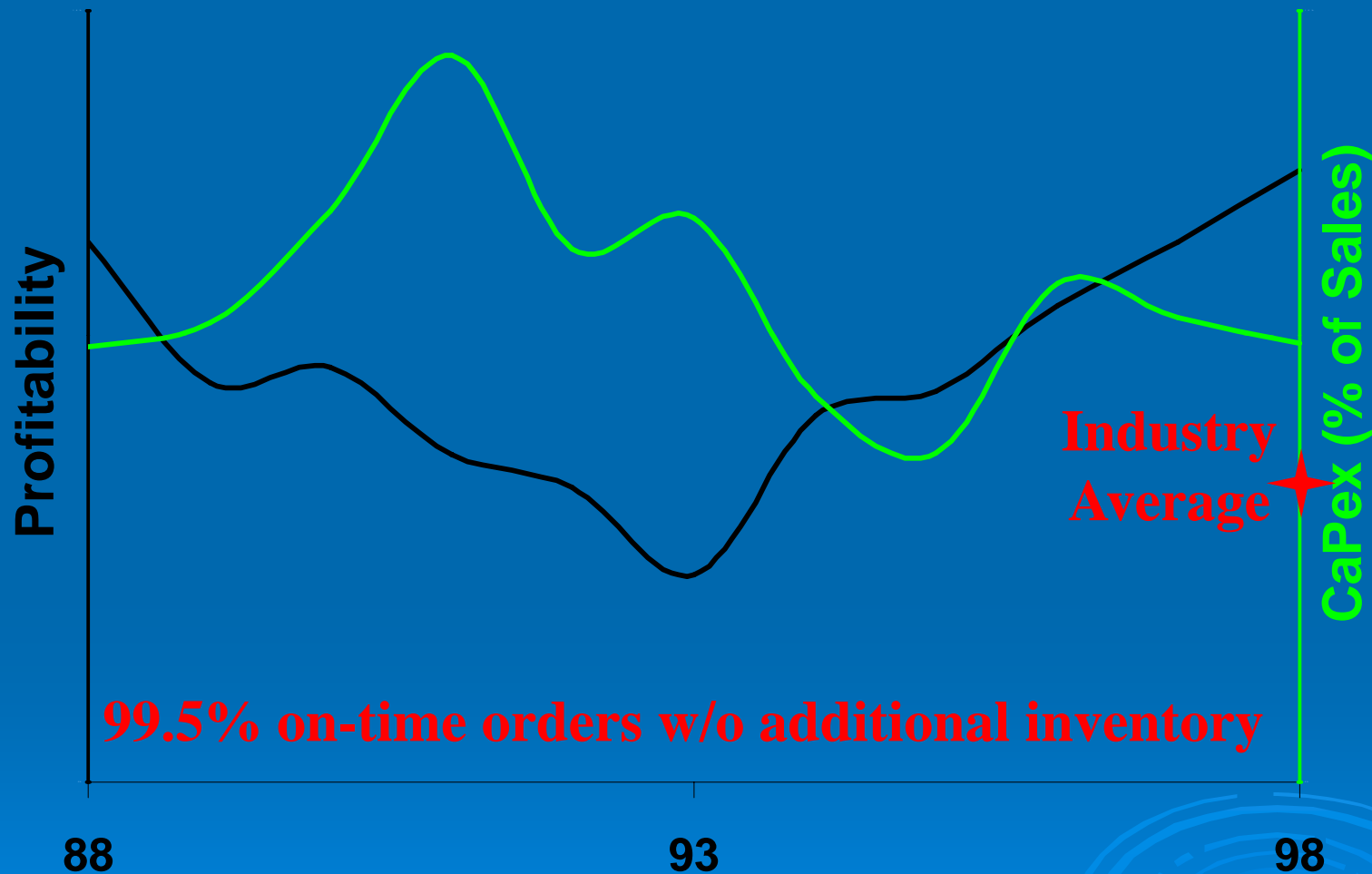
# When to add capacity



# How much capacity

- Model used to size new installations.
  - Size based on actual customer and manufacturing history.
- Capital investment reduced 25%

# Case Study: Overall Results



**99.5% on-time orders w/o additional inventory**

# Cornerstones to success

- Clear understanding of your market and customer needs
- Recognizing
  - The powerful role unpredictability plays in determining profitability.
  - Unpredictability must be managed or eliminated.
- Having the ability to predict real world outcomes of supply chain strategies/projects
  - Simulation tools similar to those developed by RonaMax.

# Conclusions

- There is a relationship between unpredictability, inventory, customer response time, and throughput.
- Understanding this relationship is key to increasing profitability.
- Decision support tools are needed to understand this relationship.
- Need to develop a strategy to optimize the supply chain and meet customer needs