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Lean Manufacturing

Lean Operating Principles and Techniques

Introduction to Lean Concepts

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Objectives

- Define the concept of Lean
- List the objectives of Lean implementation projects
- Discuss the principles of Lean
- Define the concept of total quality management (TQM)

Objectives (cont.)

- Describe the strategic importance of Lean and TQM
- Discuss the applicability of Lean to different environments
- Identify the need for Lean throughout a product's life cycle, from introduction to obsolescence

What Is Your Definition of Lean?

Elements of Lean

- Inventory only when needed
- Improve quality to zero defects
- Reduce lead times through setup time reduction
- Reduce queue lengths and lot sizes
- Incrementally revise operations
- Accomplish improvements at minimum cost

Definition of Lean

- ➔ Planned elimination of all waste
- ➔ Continuous improvement of productivity
- ➔ Includes
  - ☑ Product design
  - ☑ Conversion of raw materials
  - ☑ Delivery of product to customer

Sources of Waste

- Personnel
- Equipment
- Time
- Space
- Energy

Why Adopt a Lean Strategy?

- Negative factors
  - ☑ Higher costs than competitors
  - ☑ Loss of repeat purchases of products
  - ☑ Loss of market share
- Positive factors
  - ☑ Reduction in costs
  - ☑ More repeat customers
  - ☑ Gain of new market share

Quality Costs

- Quality costs can be divided into four categories
  - ☑ Internal failure costs
  - ☑ External failure costs
  - ☑ Appraisal costs
  - ☑ Prevention costs

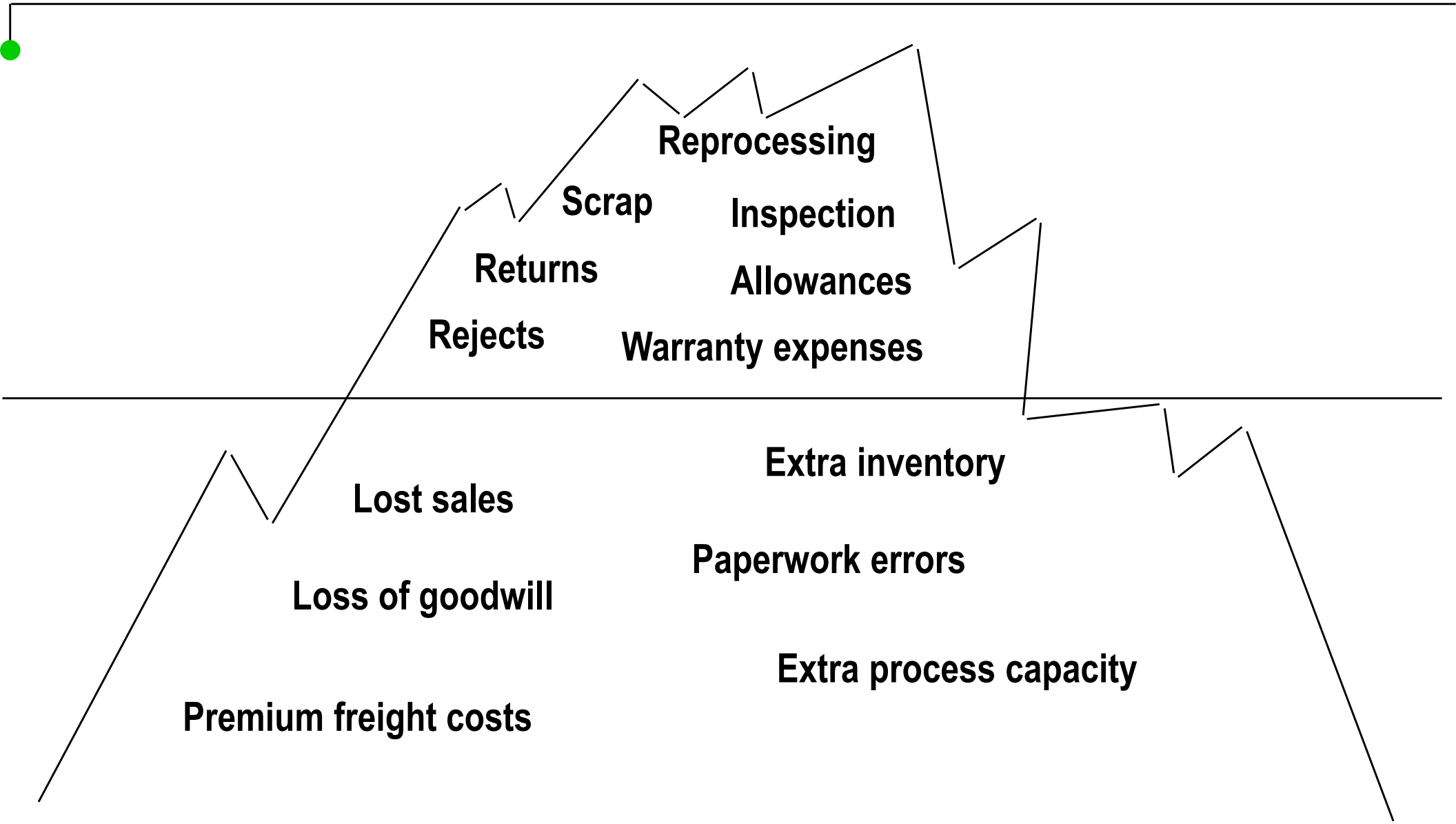
Hidden Quality Costs

- Costs of redesign or changing processes
- Costs of software changes
- Costs included in standards
- Extra manufacturing costs
- Excess process costs for acceptable product
- Potential lost sales

Measuring Quality

- Quality Costs
  - ☑ As a percentage of sales
  - ☑ Compared to profit
  - ☑ Per share of common stock outstanding
  - ☑ As a percentage of cost of goods sold
  - ☑ As a percentage of total manufacturing costs

Hidden and Obvious Quality Costs



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Cost of Quality

Defects Found at:	Own Process	Next Process	End of Line	Final Inspection	End User's Hand
Cost to Company:					
Company Impact:	• Very minor	• Minor delay	• Rework • Reschedule work	• Significant of rework • Delivery delay • Inspection costs	• Warranty costs • Loss of market share • Reputation

Results of a Lean Focus

- 50-90% reduction in throughput times
- 50-90% reduction in work in process
- 60-80% reduction in scrap and rework
- 50-90% reduction in setup times
- 30-60% reduction in manufacturing space required

Source: Adapted from W. A. Sandras, Jr. *Just-in-Time: Making It Happen (Unleashing the Power of Continuous Improvement)*. John Wiley and Sons, 1989.

Lean at Hewlett-Packard

- 20% increase in shipments
- 82% decrease in work in process
- 40% decrease in space utilization
- 30% decrease in scrap and rework
- 33% decrease in labor standards

Source: Adapted from Robert W. Hall, *Attaining Manufacturing Excellence.* Dow Jones-Irwin, 1987.

Major Benefits of Lean

Improved

- Quality
- Productivity
- Service
- Capacity
- Standardization
- Transport systems
- Flexibility

Reduced

- Inventory
- Lot sizes
- Lead times
- Unit costs
- Design time
- Space
- Energy

Source: Adapted from K. A. Wantuck, *Just in Time for America*. KWA Media, 1989.

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Objectives of Lean Implementations

- Gain a competitive advantage
- Improve responsiveness to customer
- Achieve perfect quality
- Improve quality of work life
- Improve flexibility
- Improve asset productivity
- Use time-based management
- Reduce product cost

Principles of Lean

- Quality at the source
- Elimination of waste
- Respect for the individual
- Simplification
- Visual control
- Focus on customer needs
- Production to customer demand

Total Quality Management

- Works hand in hand with Lean
- Total
  - Everyone
- Quality
  - Waste elimination in products, services, and processes
- Management
  - Predictable control, reliability of processes

Quality Imperative

- Strategic role of quality
- Quality and productivity
- Cost of quality
- Quality and market share

Definition of Quality

- Whose definition?
  - ☑ Customer?
  - ☑ Engineering?
  - ☑ Manufacturing?
- Two components of quality
  - ☑ Conformance
  - ☑ Design

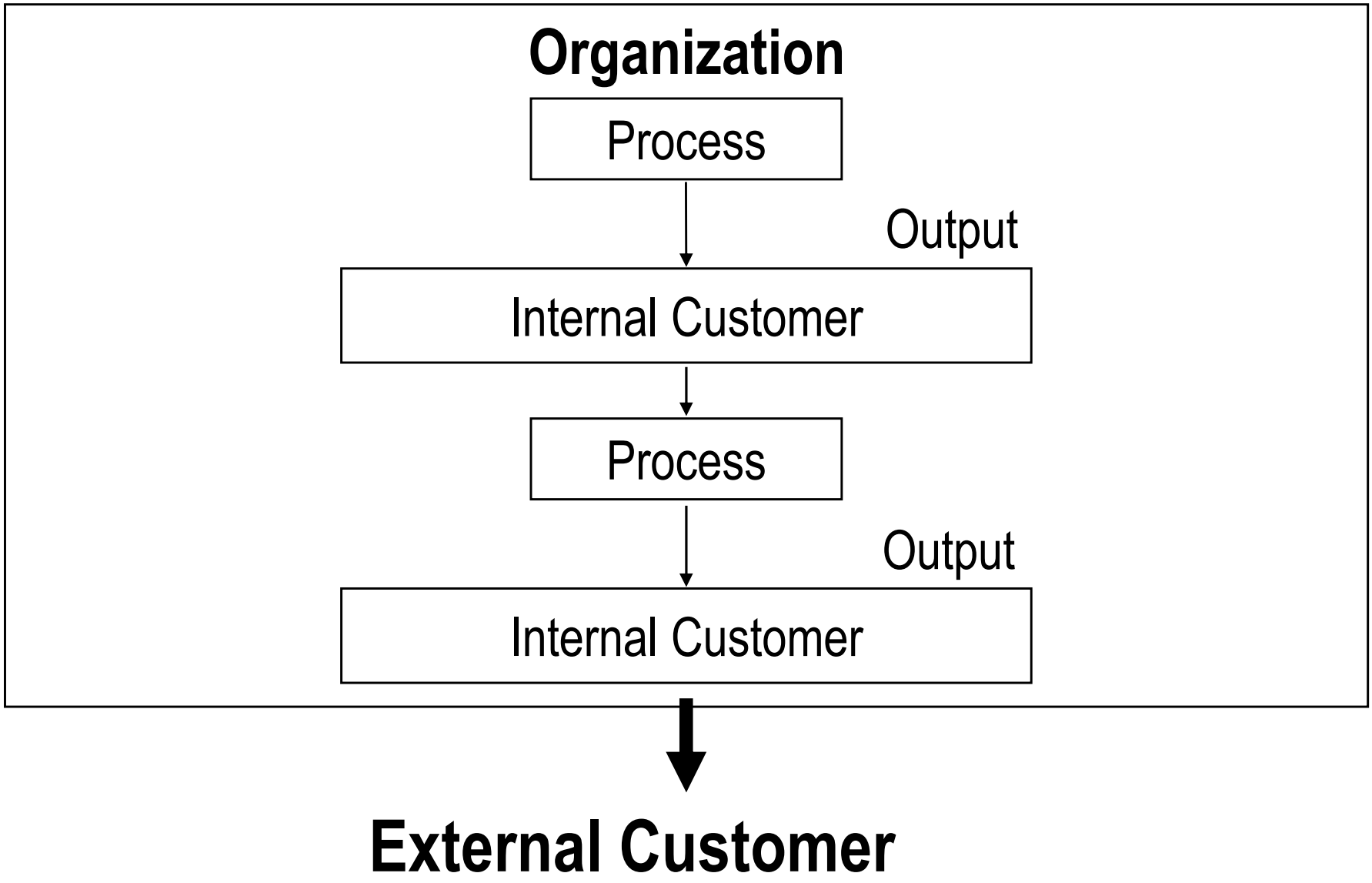
Quality Function Deployment

- Ensures major customer requirements are met
- Employs customers in the design of products
- Provides a set of tools

Six Steps of House of Quality (HOQ)

1. Identification of customer attributes
2. Identification of supporting technical features
3. Correlation of customer attributes and technical features
4. Assignment of priorities
5. Evaluation of competitive stances and products
6. Technical features to be deployed in final design

Internal and External Customers

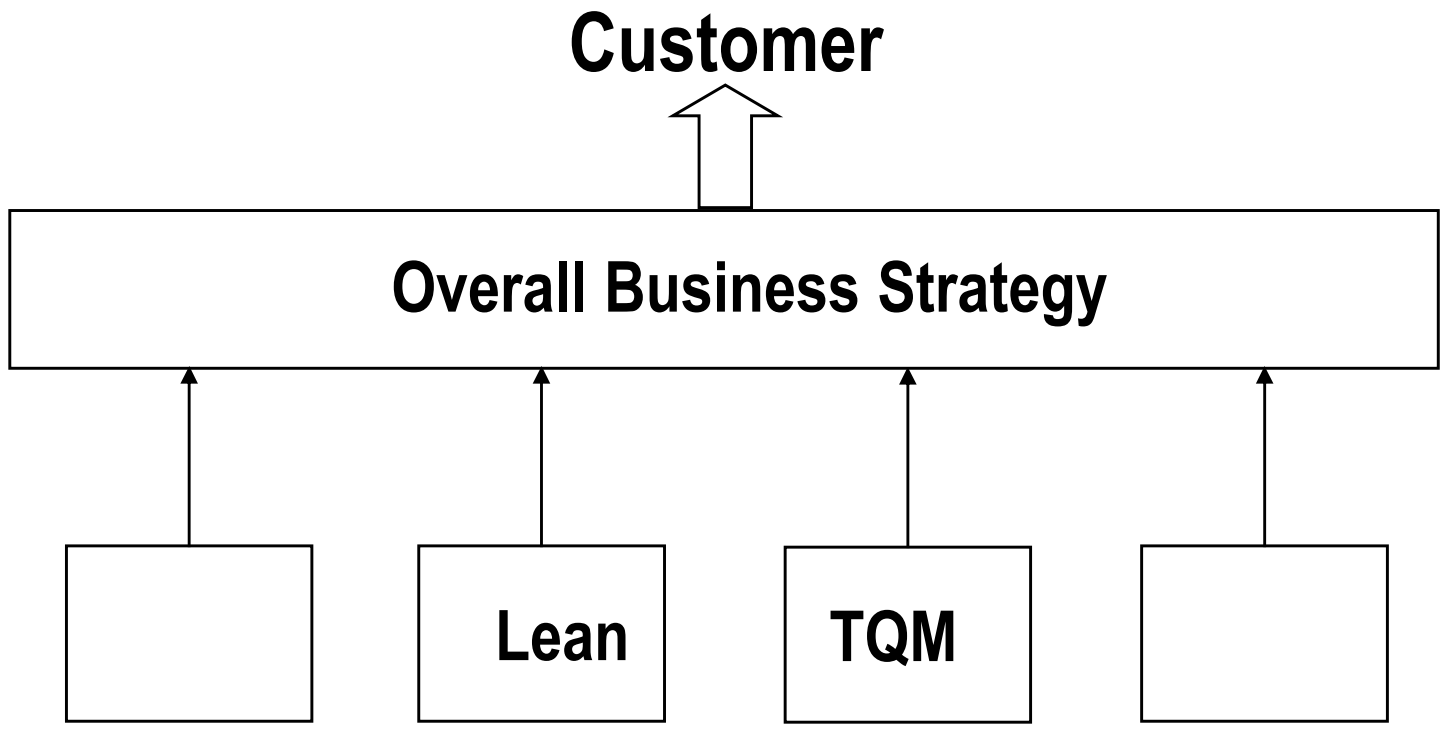


Quality at the Source

- Companywide involvement
- Employee empowerment
- Development of world-class suppliers
- Prevention orientation

Strategic Importance

- Customer focused, customer driven
- Necessary for survival, competitive advantage



Scope of Lean

- Applicable to
  - ☑ Make-to-order
  - ☑ Make-to-stock
  - ☑ Assemble/configure-to-order
  - ☑ Repetitive
- Necessary from identification of market need to final product obsolescence

Summary of Session 1

- Definition of Lean and TQM
- Objectives of Lean
- Principles of Lean
- Strategic importance of Lean and TQM
- Applicability to different manufacturing environments and type
- Integration into entire product life cycle

Preview of Remaining Course Topics

- Lean methodologies and techniques
- Human resources development and involvement
- Lean integration into business processes
- Lean implementation considerations