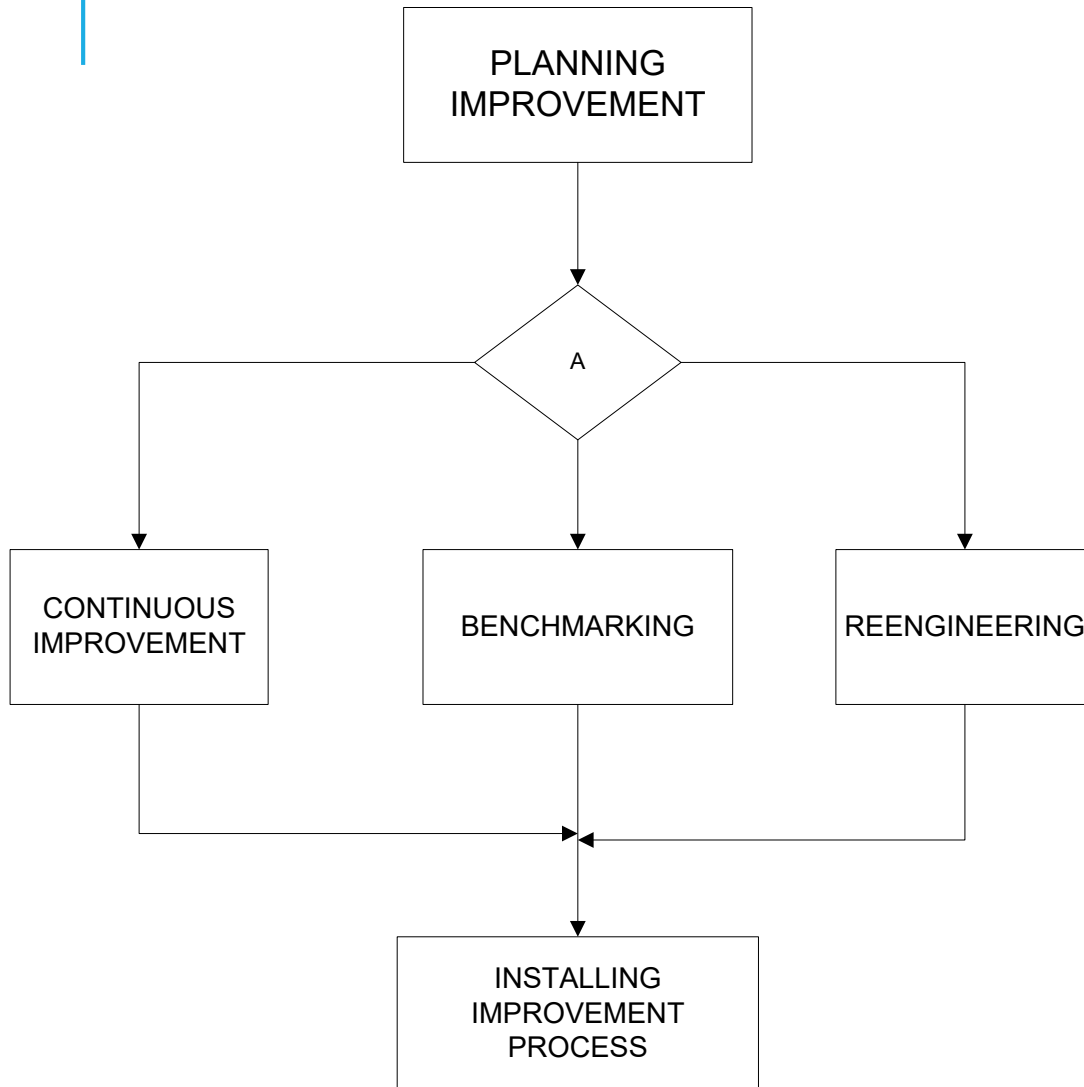




ENGINEERING BUSINESS PROCESS

Continuous
Improvement (Business
Process Improvement)

Schematic View of Process Improvement Blocks



DECISION A : SELECT A PATH

CHANGE PATH REQUIRED

INCREMENTAL → CONTINUOUS
IMPROVEMENT

LEAPFROG → BENCHMARKING

DRAMATIC → REENGINEERING
BREAKTHROUGH

PLANNING THE IMPROVEMENT

1. Identify the Improvement Subject
 - Recognize Improvement Triggers
 - Clarify the Improvement Project
 - a. Map the Process
 - b. Review Direction Setting Statements
 - c. Rank Output Priorities
2. Select Improvement Alternatives
 - Set a Target
 - Select an Improvement Path
 - Determine Feasibility
3. Launch Improvement Team (Team Members)

SIX STEPS CONTINUOUS IMPROVEMENT

- 1. Understand the Customer** (requirements, wants, needs and expectations)
- 2. Asses Efficiency**

Select internal process measures that reveal how well the process is performing. Gather data and determine how well it meets internal requirements like cost, variability and cycle time
- 3. Analyze the Process**

Rate the condition of the process, is it effective but inefficient, ineffective but efficient, or worse (ineffective and inefficient), the select the best improvement path

SIX STEPS CONTINUOUS IMPROVEMENT

4. **Improve the Process**

Diagnose root causes, understand sources of variation, Plan-do-check-actions

5. **Implement Changes**

pilot the revised process before adopting it on a full scale, simulate the new process or critical facets, make appropriate adjustment

6. **Standardize & Monitor**

implement the changes, continue to track performance, monitor cycle time, cost and variation. Continuously improve the process to sustain your competitive edge

STEP 1: UNDERSTAND THE CUSTOMERS

- 1.1 Identify the final output (what your process produces)
- 1.2 Identify the End Customer
- 1.3 Determine the Customer's Requirements
- 1.4 Convert Requirements to Specifications
- 1.5 Determine Effective Measures
- 1.6 Design a Data Collection System
- 1.7 Collect and Analyze Data
- 1.8 Set New Performance Targets
- 1.9 Report Findings

Determine the customer requirements

REQUIREMENT	MEASURES
Customer Satisfaction	<ul style="list-style-type: none">• Percentage of reorders• Number of customer referrals• Number of complaints• Number of commendations• Market Share
Reliability	<ul style="list-style-type: none">• Number if service calls• Percentage of equipment downtime
Availability	<ul style="list-style-type: none">• Percentage of backorders
Delivery	<ul style="list-style-type: none">• Percentage of on-time deliveries• Average delivery time
Conformance (defects)	<ul style="list-style-type: none">• Percentage of customer returns• Number of customer complaints
Durability	<ul style="list-style-type: none">• Percentage of warranty claims• Average product life
Ease of Use	<ul style="list-style-type: none">• Number of service calls• Average time to learn use

Convert Requirements to Specifications

Determine Effectiveness Measures

REQUIREMENTS	SPECIFICATIONS	MEASURES
Prompt Delivery	30 Days from order	<ul style="list-style-type: none">• Customer complaints for late deliveries• Number of late deliveries• Average delivery time
Correct Quantity	No over-or undershipment	<ul style="list-style-type: none">• Customer complaints for incorrect quantities• Number of incorrect shipments

DESIGN A DATA COLLECTION SYSTEM

Identify sources from which data can be obtained and build a database

Three components sources of data on customer satisfaction (product or service effectiveness)

INTERNAL	THIRD PARTY	CUSTOMERS
Complaints Warranty Claims Field-service reports Credits and refunds issued Lost Customer Reports Delivery receipts	Independent surveys Industry analysis Trade Magazines surveys	Interviews Focus Groups Mail Survey Telephone Surveys Comments Card

COLLECT AND ANALYZE DATA

Process : Order Fulfillment
 Product : Model 96-A

Customer Group: Western Region
 Date:

REQUIREMENTS	PRIORITY	SPECIFICATIONS	MEASURES	PERFORMANCE	GAP
Correct quantity shipped	2	<ul style="list-style-type: none"> As per purchase order – no short order 	<ul style="list-style-type: none"> Percentage of correct shipments 	95.3	4.7
Timely Delivery	1	<ul style="list-style-type: none"> 2 business days from order 	<ul style="list-style-type: none"> Percentage of on-time deliveries 	65	35
			<ul style="list-style-type: none"> Average time (days) 	1.5	-
			<ul style="list-style-type: none"> Maximum time (days) 	4.0	2.0
Product Availability	1	<ul style="list-style-type: none"> Available at order – no back orders 	<ul style="list-style-type: none"> Percentage of orders filled completely 	92.1	7.9
Responsive to inquiries	1	<ul style="list-style-type: none"> Return calls within 15 minutes 	<ul style="list-style-type: none"> Percentage of on-time responses 	89	11
			<ul style="list-style-type: none"> Average time (minutes) 	15	-
			<ul style="list-style-type: none"> Maximum time (minutes) 	30	15

REPORT FINDINGS

Integrate the findings into a status report

Update team's charter as needed

Communicate findings to all stakeholders, including the team's sponsor

STEP 2: ASSESS EFFICIENCY

2.1 Determine Efficiency Measures

Select efficiency measures that quantify how well the process satisfies internal requirements (cycle time, unit costs, defect and rework, productivity, asset utilization and cost of quality)

2.2 Design a Data Collection System

Determine your sources of efficiency data and establish a baseline representing current performance of each key indicator

2.3 Analyze Costs

Identify and measure the resources used for producing and delivering products or services. Consider using ABC costing for attributing costs to each process step

STEP 2: ASSESS EFFICIENCY

2.4 Analyze Variation

Analyze the spread of the data (Variability) to understand the underlying capabilities of processes and to determine whether limitations and defects are the results of common causes of variation or special causes

2.5 Analyze Cycle Time

Calculate the elapsed time in activity and sub-process. Identify the non-value-added activities, business value added activities and real value added activities and allocate the associated cycles time among these categories

Identify opportunities to eliminate non-value-added, minimize business value-added, and streamline real-value-added activities

STEP 2: ASSESS EFFICIENCY

2.6 Set New Efficiency Targets

Identify your industry's best performers and learn how efficiently they perform as part of your plan for setting targets

Compare current performance to these benchmarks, calculate gaps, and set improvement targets for each efficiency measure

2.7 Report Findings

As with step 1, integrate the findings of step 2 into a status report and update the team's charter as needed

2.1 DETERMINE EFFICIENCY MEASURES COMMON EFFICIENCY MEASURES

OVERALL

- Cost
- Output Variation
- Cycle Time
- Incremental cost added by each work step
- Variation in output conformance to specification
- Time consumed performing each work step

OUTPUT CONFORMANCE

- Defects
- Scrap
- Rework
- Percentage of outputs that are defective or rejected
- Percentage of outputs that are scrapped (not recycled)
- Percentage of outputs that are recycled for repair

2.1 DETERMINE EFFICIENCY MEASURES

COMMON EFFICIENCY MEASURES

PROCESS

- Cost of quality
- Productivity
- Inventory Turns
- Asset Utilization
- Costs for prevention, detection, and failure of nonconforming outputs
- Quantity produced per employee per unit time
- Frequency of sale and restocking
- Resources used in work process, including capital, materials, personnel, space, equipment, and materials

INPUTS

- Meet Specification
- On time deliveries
- Percentage of materials rejected
- Percentage of late deliveries

2.2 DESIGN A DATA COLLECTION SYSTEM SAMPLE EFFICIENCY WORKSHEET

Process :

Product:

Date: _____

OBJECTIVE	MEASURE	PERFORMANCE	EXPECTATION	GAP	TARGET
Defects	% of rejects				
Scrap	% total units				
	% of unit costs				
Rework	% of total units				
	Avg. rework cost				
Costs	Avg. unit cost				
	Avg. gross margin				
Cycle time	Avg. days/unit				
Asset Utilization	Output units/day				
	Floor spaces/process				
Productivity	Workhours/unit				
Cost of quality	% of revenues				

2.3 ANALYZE COSTS COST OF QUALITY CHECKLIST

PREVENTION (COST OF CONFORMANCE)

Activities designed to prevent poor quality *before* production

- Design reviews
- Double-checking drawings
- Specifications reviews
- Quality audits
- Planning
- Supplier managements programs
- Pilot or prototype studies
- Product qualifications
- Training
- Process Capability studies
- Preventive Maintenance

DETECTION (COST OF APPRAISAL)

Activities designed to measure, evaluate, and audit products *during* production

- Inspection of raw materials
- Inspection of finished products
- Proofreading
- Products audits

FAILURE (COST OF NONCONFORMANCE)

Internal Failures:

- Scrap and rework
- Engineering changes
- Corrective action
- Adjustments
- Over-or-underproductions
- Redesigns

External Failures incurred *after* production:

- Misshipments
- Redeliveries
- Recalls
- Service calls
- Billing adjustments
- Retrofits
- Replacements
- Warranty costs

LOST CUSTOMERS/OPPORTUNITY (COST OF NONCONFORMANCE)

Cost incurred when customers do not reorder or when buy from competitor

- Lost customer
- Lost revenues
- Lost Goodwill

EXAMPLE: PARTIALLY COMPLETED EFFICIENCY WORKSHEET

Process : Order Fulfillment

Product: Model 96-A

Date: _____

OBJECTIVE	MEASURE	PERFORMANCE	EXPECTATION	GAP	TARGET
Defects	% of rejects	4.0	0.02	3.98	1.0
Scrap	% total units	1.5	0.5	1.0	
	% of unit costs	3.8	2.3	1.5	
Rework	% of total units	5.7%	4.0%	1.7%	
	Avg. rework cost	\$11	\$6	\$5	
Costs	Avg. unit cost	\$109	\$100	\$9	
	Avg. gross margin	29	40	11	
Cycle time	Avg. days/unit	3.4	2.3	1.1	
Asset Utilization	Output units/day	250	325	75	
	Floor spaces/process	18 sq.ft.	10 sq. ft.	8 sq. ft.	
Productivity	Workhours/unit	275	320	55	
Cost of quality	% of revenues	8.0	2.5	5.5	

STEP 3: ANALYZE THE PROCESS

3.1 Assess Process Condition

3.2 Prioritize Improvement Opportunities

3.3 Prioritize Sub Process Opportunities

3.4 Select an Improvement Paths

3.5 Report Findings

STEP 4: IMPROVE THE PROCESS

1. **Attack the vital few**
Find numerous things to improve
2. **Diagnose Root Causes**
3. **Understand sources to reduce of variation**
4. **Plan-do-study-act**

STEP 5 AND 6 : IMPLEMENT CHANGES, AND STANDARDIZE AND MONITOR

Pilot the improved process

Test the new process in a scaled-down version or test critical facets to identify unanticipated problems. Make appropriate adjustments after reevaluating results of the pilot test

Implement Plans

Install the improved process, manage the changeover and update documentation

Monitor Results

Track performance, monitor cycle time, costs and variation. Continue to measure customer satisfaction

STEP 5 AND 6 : IMPLEMENT CHANGES, AND STANDARDIZE AND MONITOR

Reward Participants

Reward and recognize successful team contribution

Identify next steps

Define where the next increment of improvement will be obtained, and the repeat the improvement cycle to sustain your competitive edge