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# Management and Industrial Strategy

# אסטרטגיה ניהולית ותעשייתית


**פרופ' רון קנת**

**ד"ר יוסי רענן**

Professor Ron Kenett - ron@kpa.co.il

Dr. Yossi Raanan - yossir@kpa.co.il


**Part III**



## מטרת הקורס

- הבנת חשיבות אסטרטגיה ניהולית ותעשייתית בסביבה עתירת טכנולוגיה להשגת:
  - כושר תחרות
  - התאמה לסביבה משתנה
  - יציאה ממשבר
  - כניסה לשווקים חדשים

# מבנה הקורס

**תנאי קדם**: אין

**שיטת הלימוד:**

- הרצאות פרונטליות
- ביצוע פרויקט במסגרת צוות

**הרכב הציון:**

- עבודת גמר – 60% (40% עבודה, 20% מצגת)
- מבחן סיום – 40% (נדרש ציון עובר לשקלול)




# נושאי הקורס - 1

**מבואות:**

התפתחות תפיסות ניהוליות ומיצוב הטכנולוגיה בתעשייה תוך ניתוח משמעויות המהפכה התעשייתית ומהפכת המידע (סולם האיכות).

מבוא לאסטרטגיות הניהוליות העיקריות המיושמות בתעשייה: ניהול איכות, שש סיגמה, מערכות ייצור גמישות, מערכות תוכנה תעשייתיות ומיכון ארגוני.

**אסטרטגיה עסקית ושיווקית:**

מודלים לניתוח אסטרטגי כגון: BCG, מקינזי, ארטור ד. ליטל, בוז אלן, אופציות ריאליות.

**אסטרטגית שרות:**

מערך השירות ותפקידו במחזור חיי המוצר. התמיכה הטכנולוגית הנדרשת במערך השירות. הצגת האסטרטגיות הניהוליות העיקריות בשירותים: שירות מבוזר / מרוכז, מוקדי שרות.

**אסטרטגית משאבי אנוש:**

מודלים למיפוי ארגוני, סקרי עמדות עובדים, מודלים למיפוי משאבי אנוש, הערכת עובדים ממוקדת תהליך.

# נושאי הקורס - 2

**אסטרטגית התפעול והאיכות:**
ניהול זמין ושיטות ייצור ארגוניות יפניות. שש סיגמה.
מערכות ייצור גמישות, ייצור ברשתות ועקרונות הניהול הרב - מוצרי בתעשיות עתירות מיכון.

**אסטרטגית מו"פ וניהול סיכונים:**
CMMI, ניהול סיכונים, פרויקט MUSING.

**אסטרטגית מערכות מידע ותקשורת:**
אסטרטגית IT. תקשורת לסוגיה והשפעותיה על ההיערכות התעשייתית והשירותית.

**ניהול השינוי:**
מתודולוגית BEST ו EKD




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# תפעול ואיכות

# What is Quality?

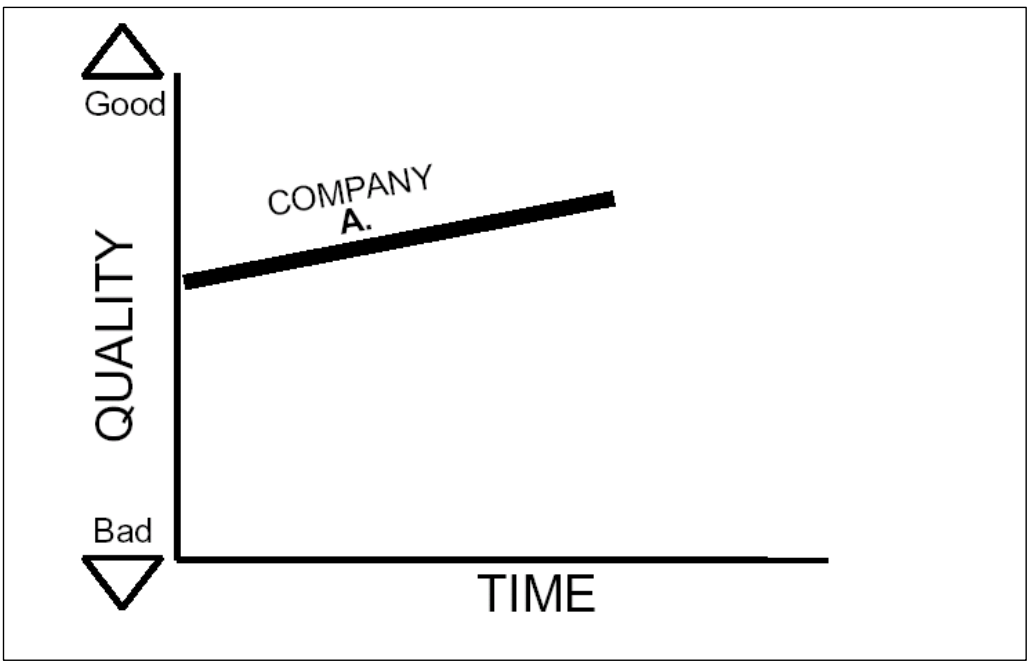
| | Effectiveness | Efficiency |
|---|---|---|
| | *Features* | *Free from Deficiency* |
| *Needs* | Right thing | Done right |
| *Customer* | Satisfaction | Dissatis-faction |
| *Effect* | Income | Costs |
| *Higher quality costs* | More | Less |



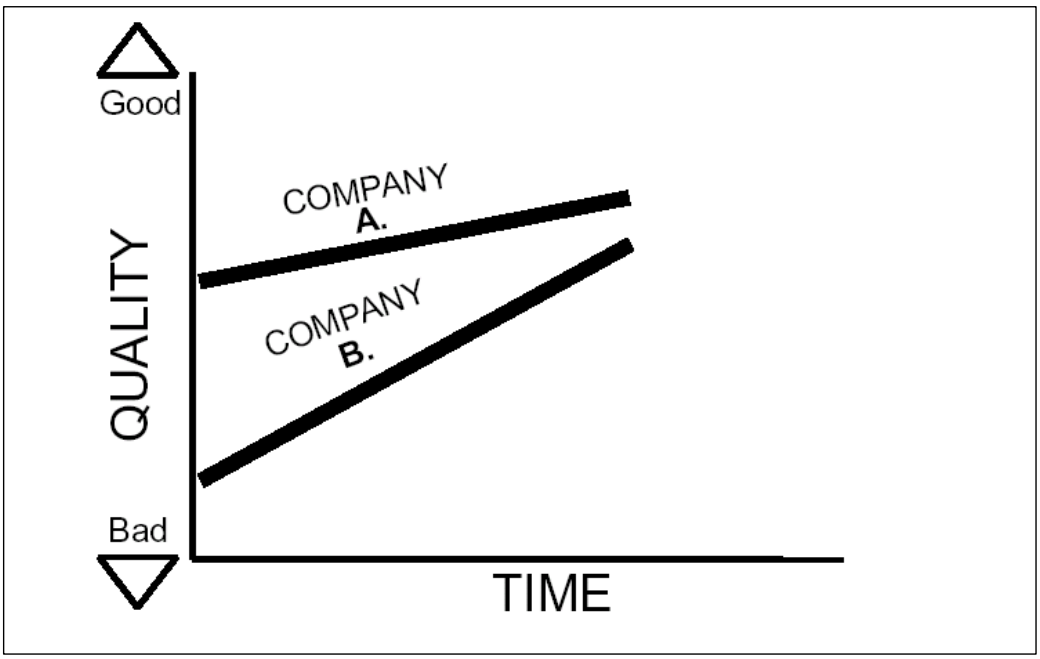




# Improvement



# Competitive improvement

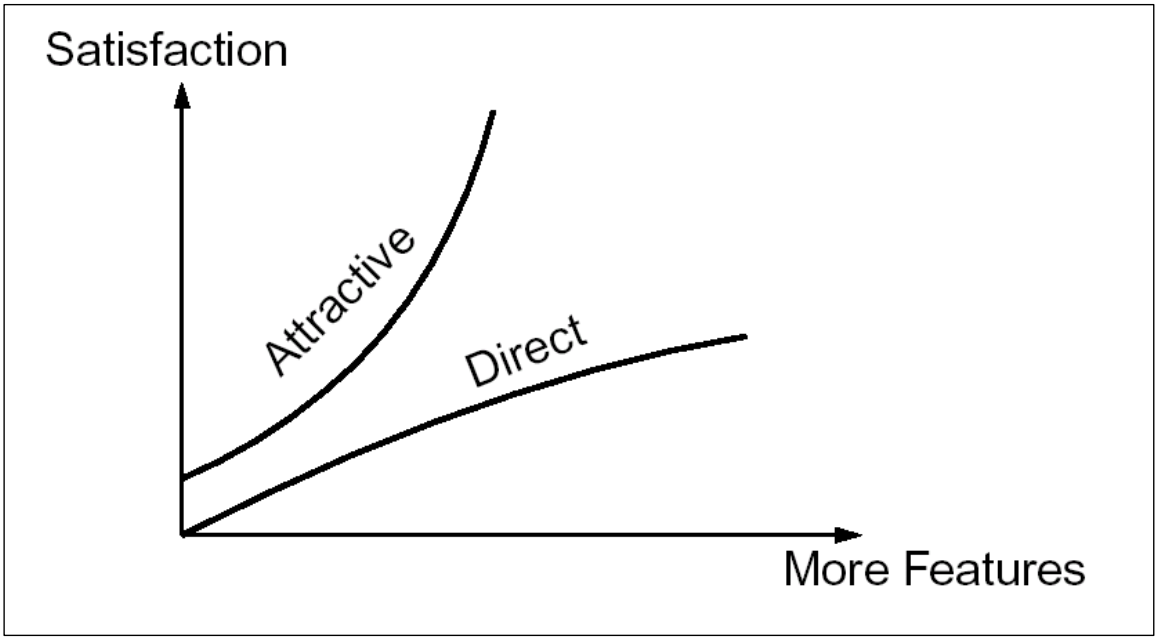








# Customer Satisfaction



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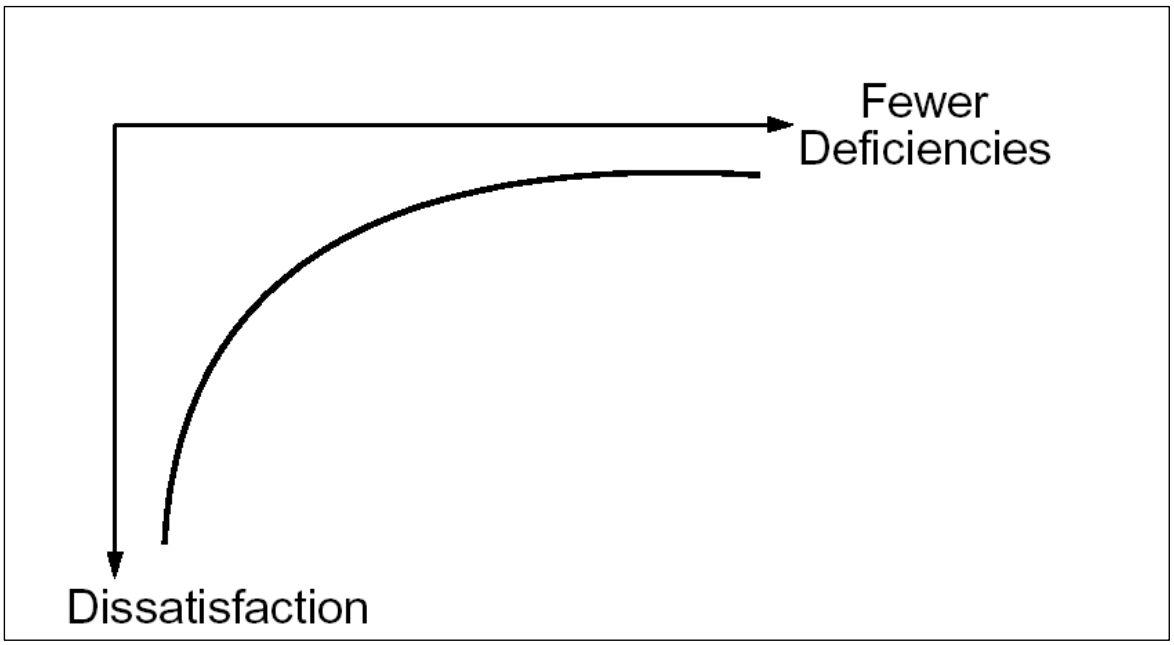
# Customer Dissatisfaction







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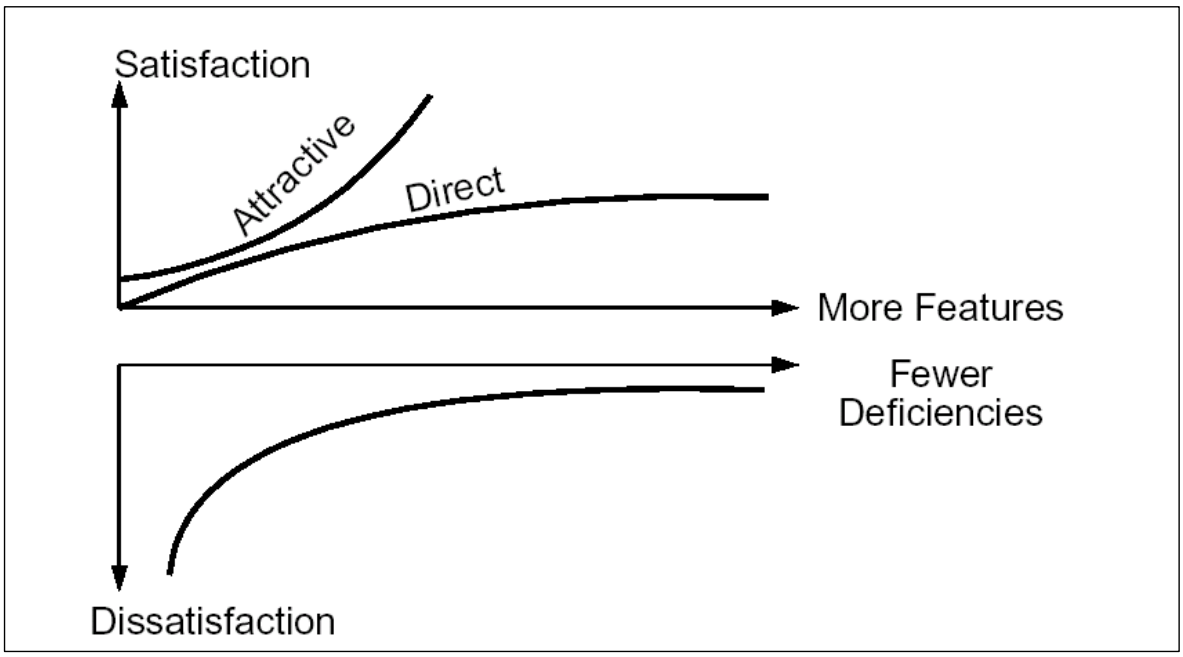
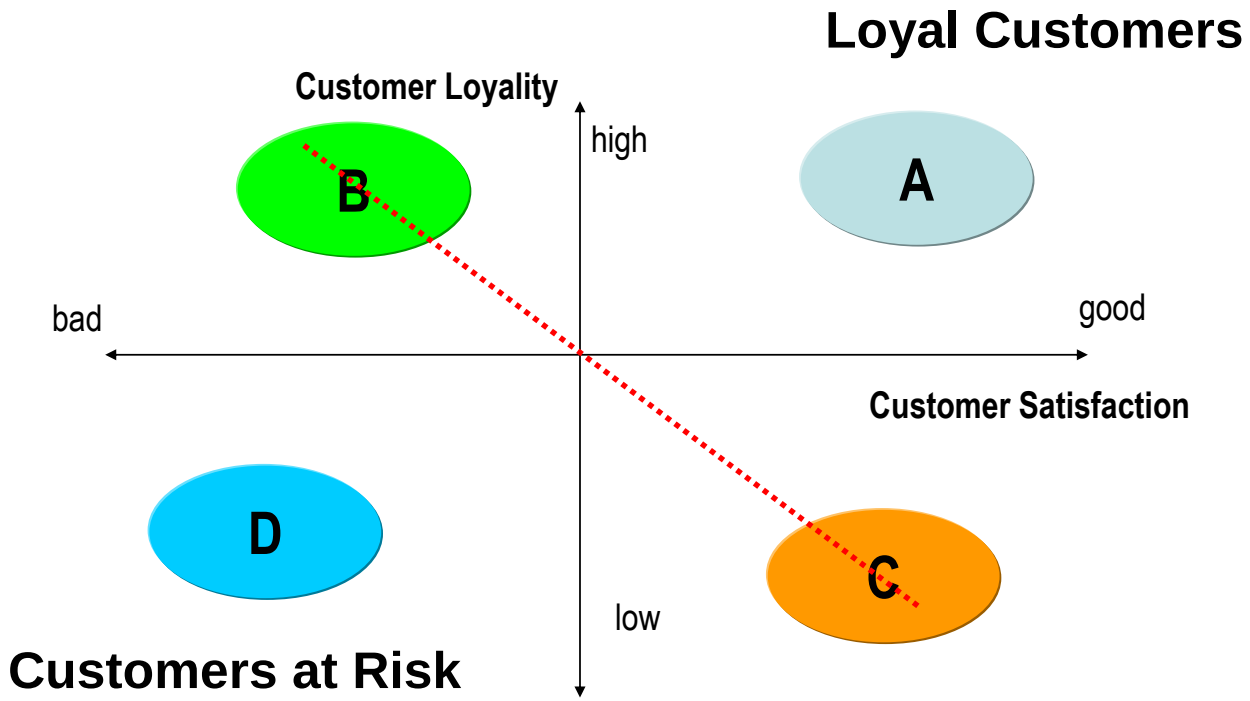
# Customer Satisfaction and Customer Dissatisfaction



# Today

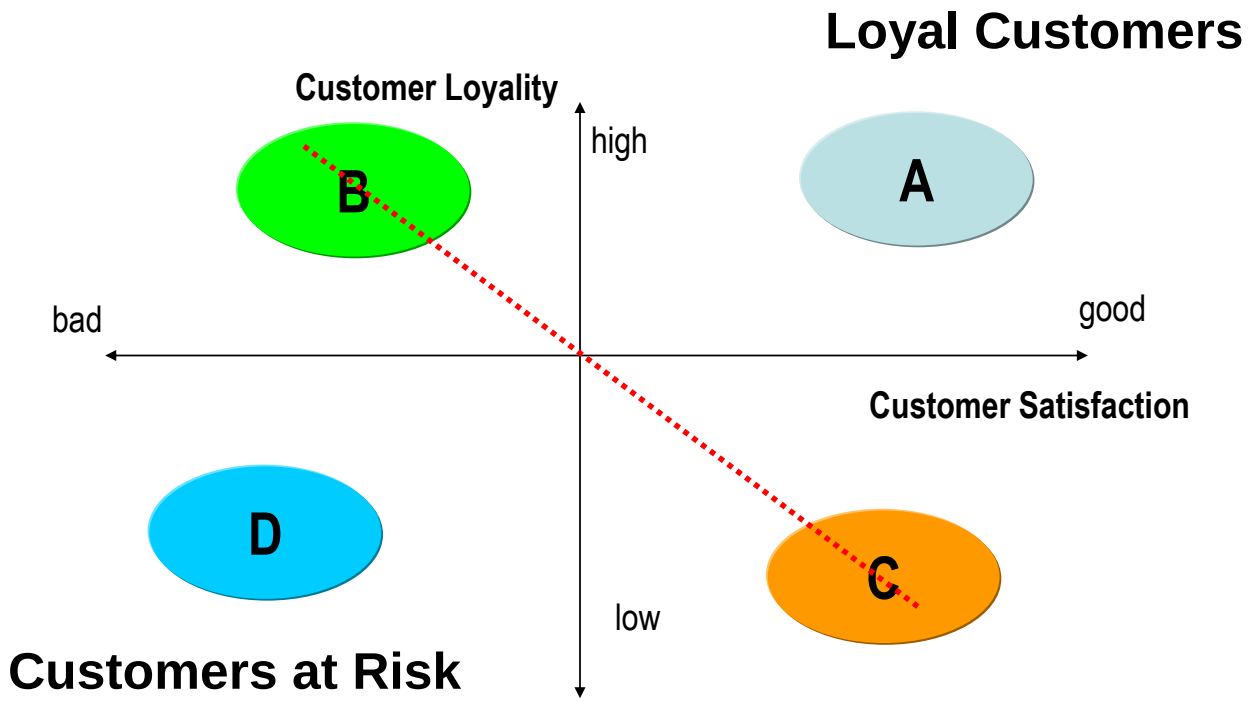




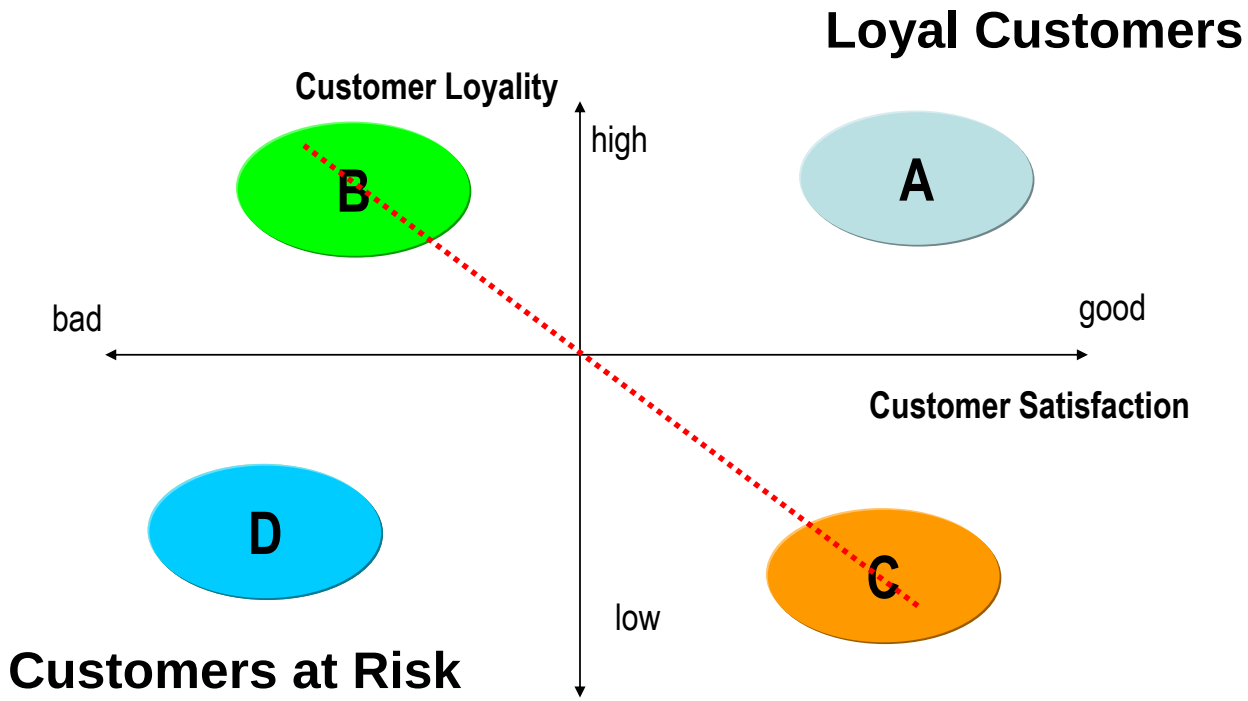




# Tomorrow without action



# Tomorrow with action

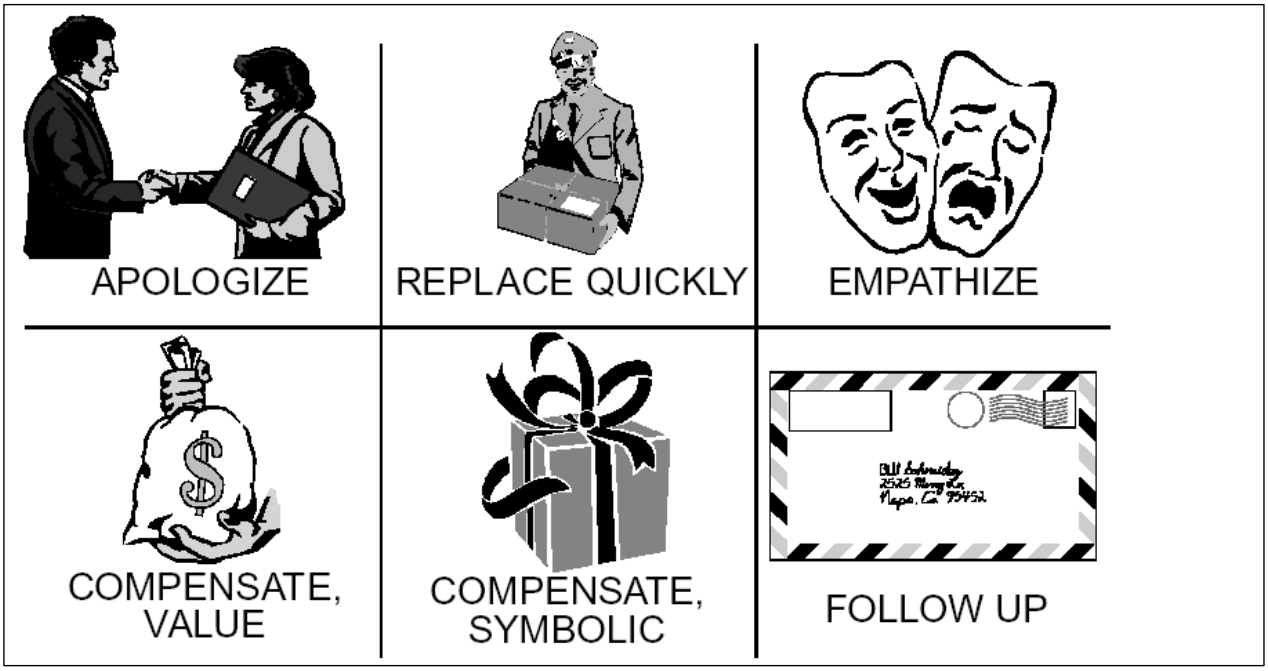




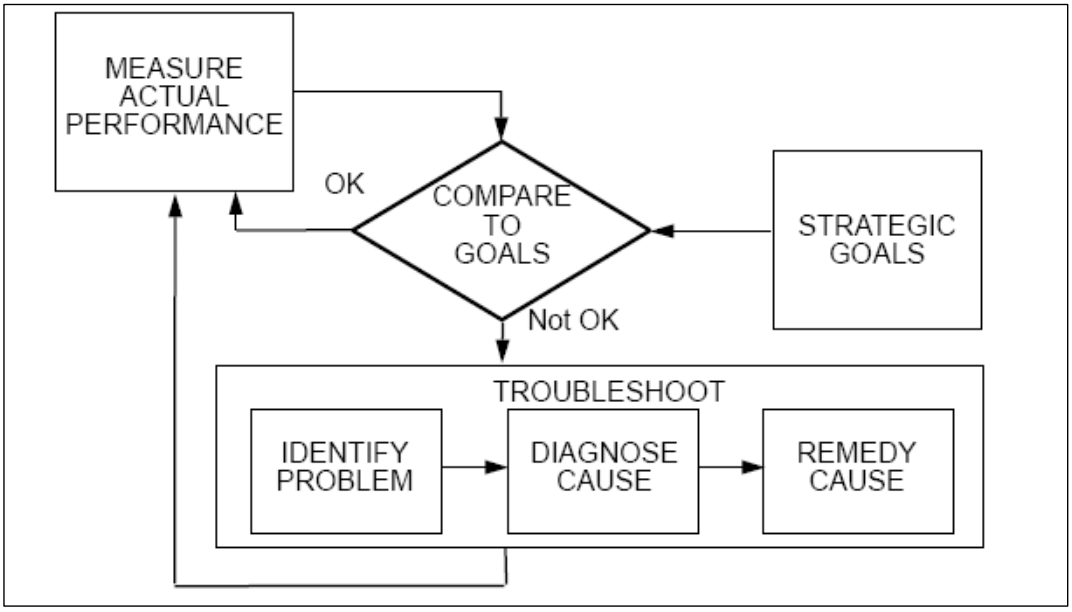





# Recovery Strategies



# Control mechanisms

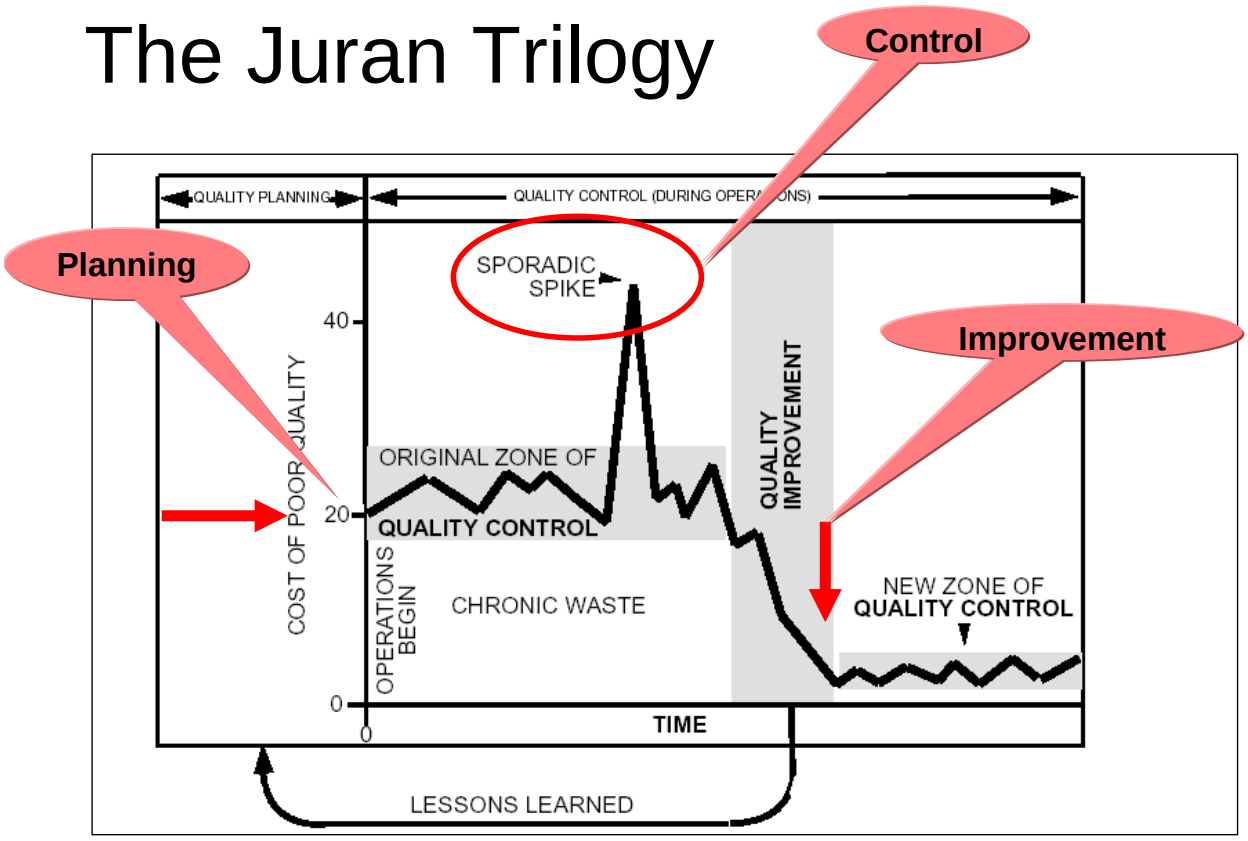




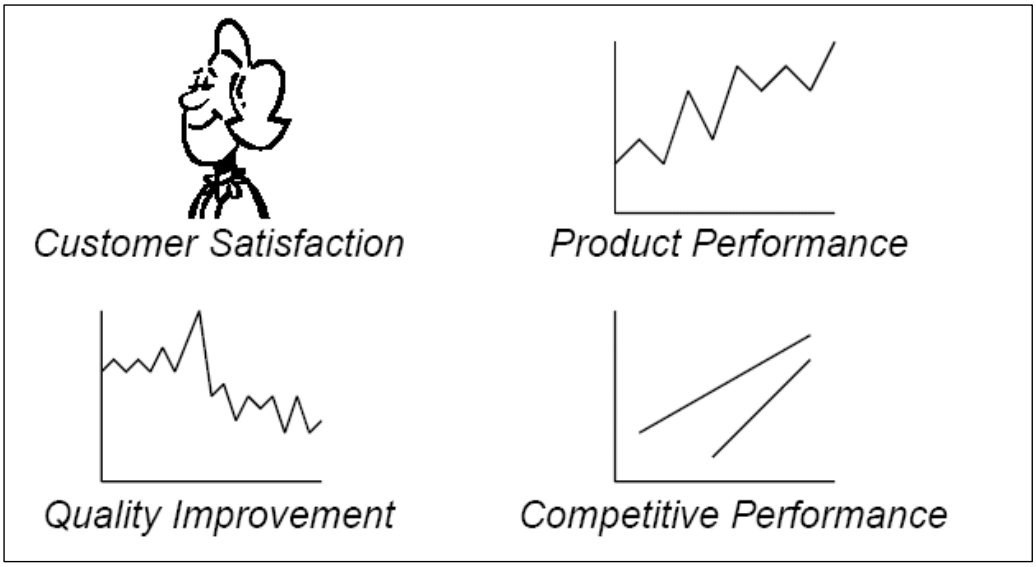





# The Juran Trilogy



# Strategic goals

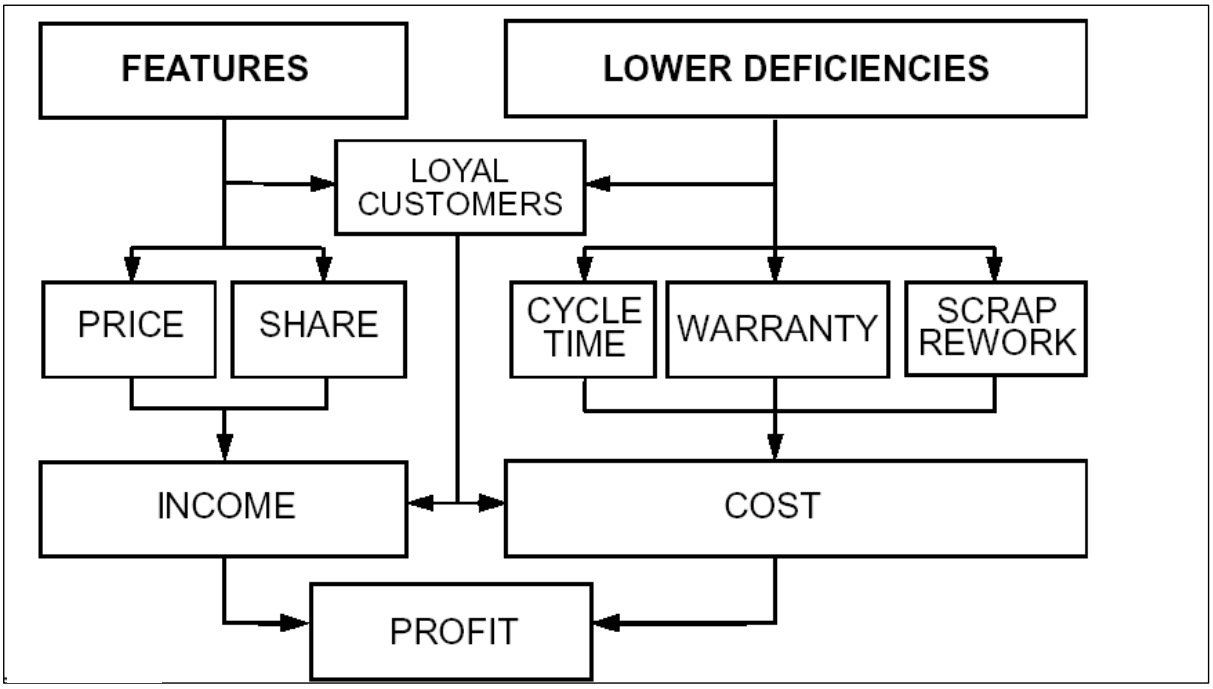




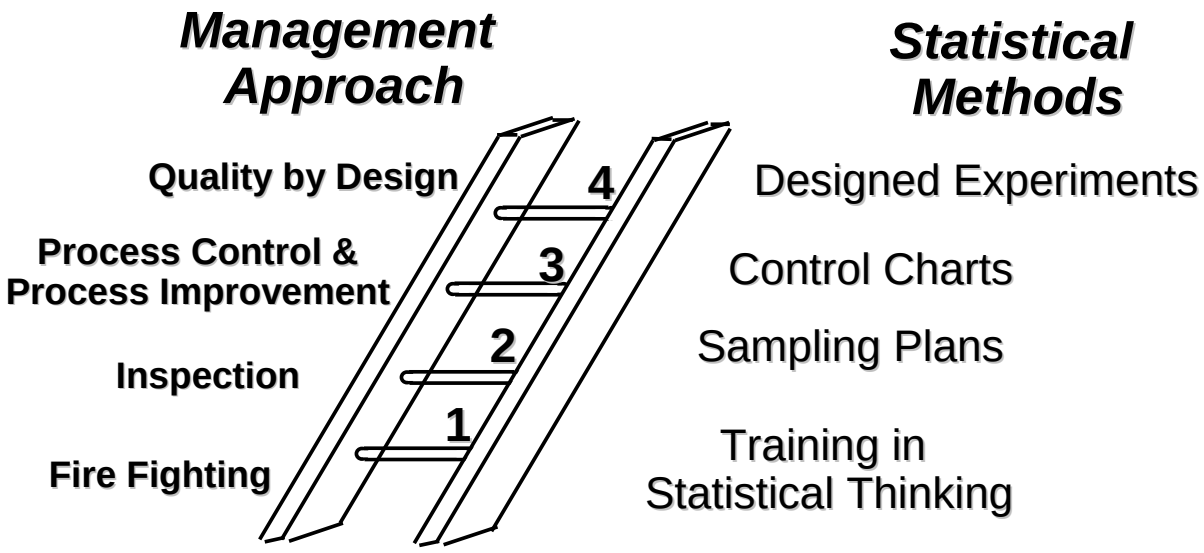




# ROI, Quality and Market Share



# The Quality Ladder*



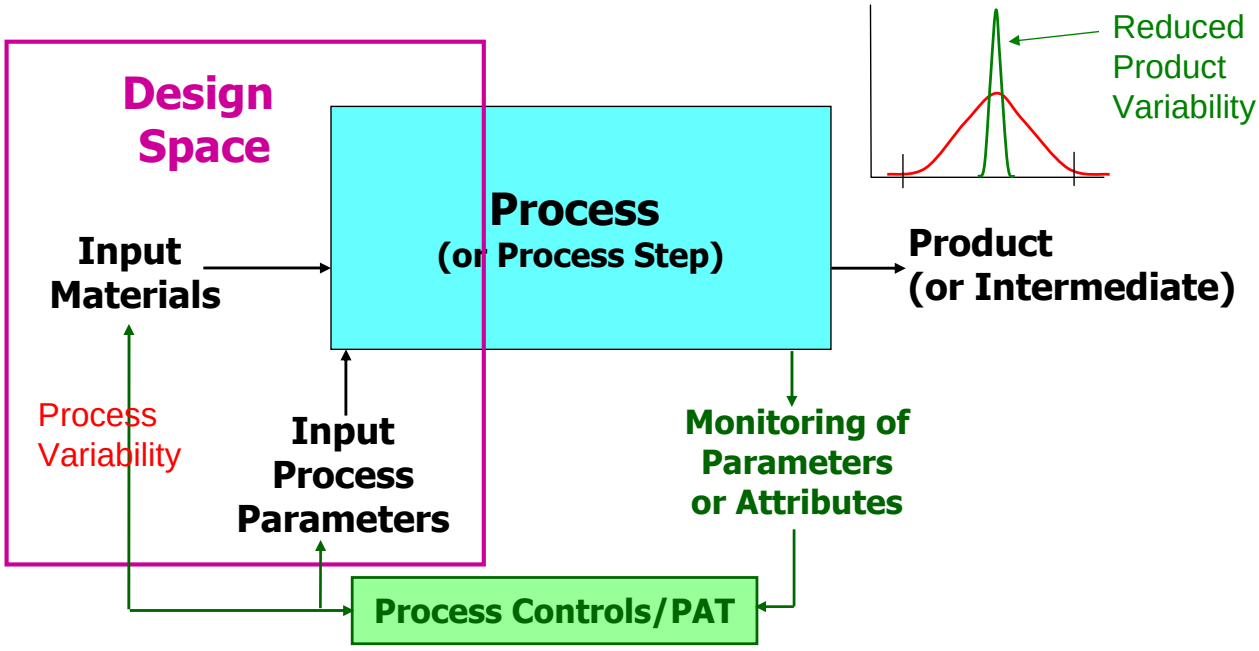

*How do you handle the inconvenience of customer complaints ?*



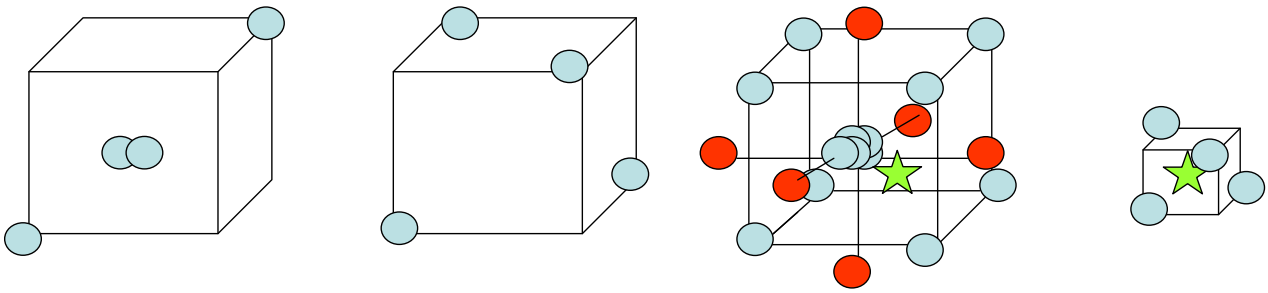
*MODERN INDUSTRIAL STATISTICS by Kenett and Zacks, Duxbury, 1998



# What is QbD?



# The Design of Experiments Strategy



**Scoping**
Initial assessment

**Screening**
Fractional designs

**Optimizing**
Response surfaces

**Robustness**
Robust designs

**Process knowledge**

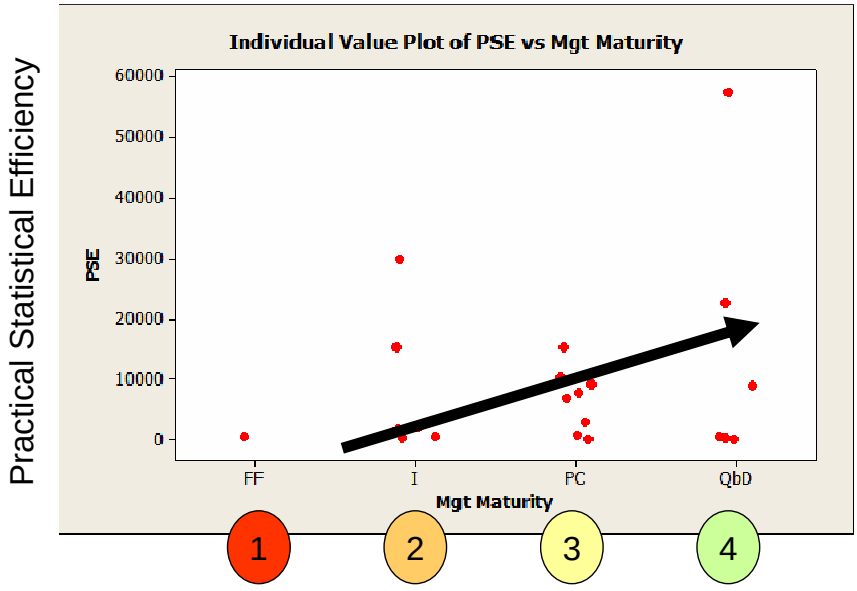
**Process Confidence**





# *The Statistical Efficiency Conjecture**:

**higher maturity ==> higher efficiency**




*Kenett, R., De Frenne, A., Tort-Martorell, X and McCollin, C., "The Statistical Efficiency Conjecture", *Applying Statistical Methods in Business and Industry – the state of the art*, Coleman S., Greenfield, T., Stewardson, D. and Montgomery, D. (editors), Wiley, 2008.

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# An exercise in inspection

**"federal fuses are the results of years of scientific study combined with the experience of years"**





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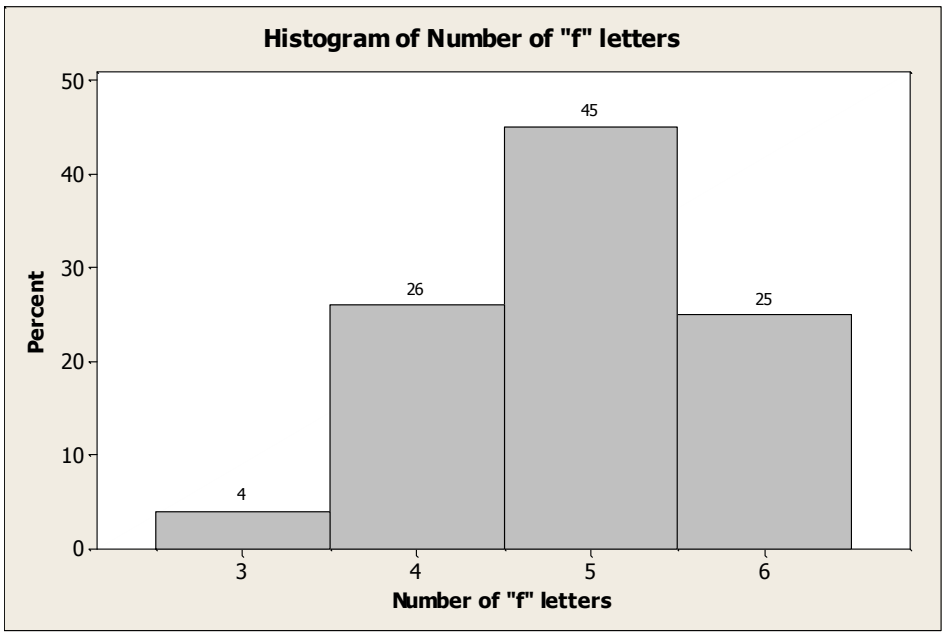
# An exercise in inspection








# Six Sigma Basics

"Show me the data"

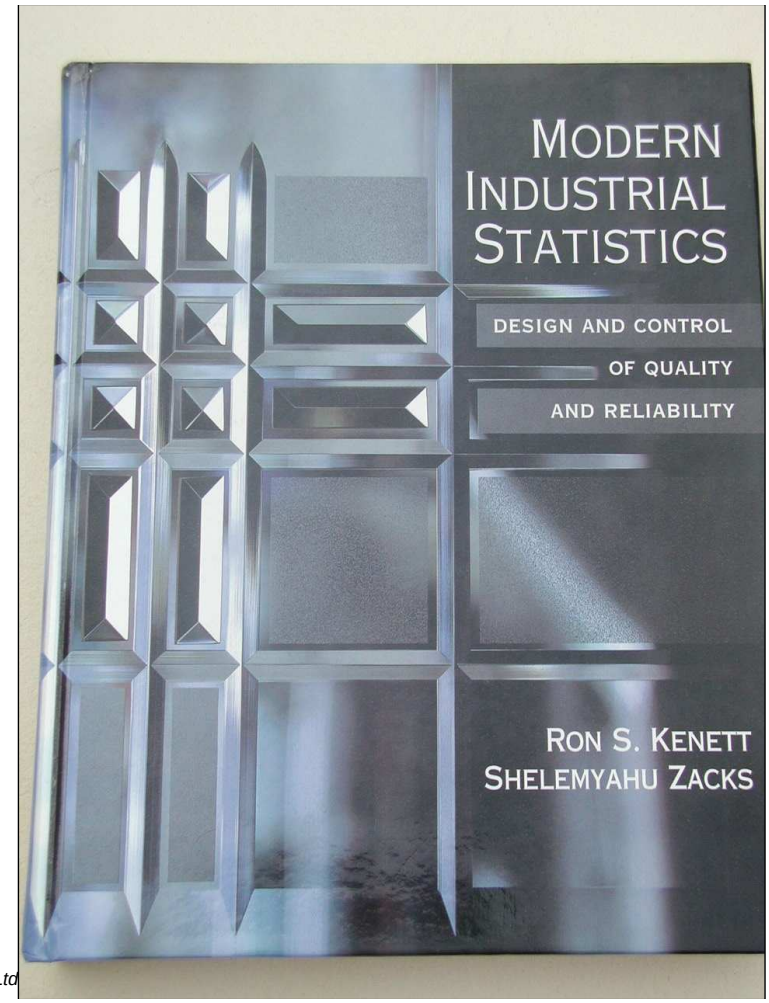
Scientific:

- Structured approach.
- Assuming quantitative data.

"Show me the money"

Practical:

- Emphasis on financial result.
- Start with the voice of the customer.




**MODERN INDUSTRIAL STATISTICS, Kenett and Zacks, Duxbury, 1998**
**2nd edition, 2003**
**Chinese edition, 2004**





# MOTOROLA

**"At Motorola we use statistical methods daily throughout all of our disciplines to synthesize an abundance of data to derive concrete actions…. How has the use of statistical methods within Motorola Six Sigma initiative, across disciplines, contributed to our growth? Over the past decade we have reduced in-process defects by over 300 fold, which has resulted in a cumulative manufacturing cost savings of over 11 billion dollars"*.**

**Robert W. Galvin**
**Chairman of the Executive Committee**
**Motorola, Inc.**

***From the forward to MODERN INDUSTRIAL STATISTICS by Kenett and Zacks, Duxbury, 1998**

# General Electric

- In 1995 mandated each GE employee to work towards achieving 6 sigma
- The average process at GE was 3 sigma in 1995
- In 1997 the average reached 3.5 sigma
- GE's goal is to reach 6 sigma by 2001
- Investments in 6 sigma training and projects reached 45MUS$ in 1998, profits increased by 1.2BUS$

**"the most important initiative GE has ever undertaken".**

**Jack Welch**
**Chief Executive Officer**
**General Electric**







**Alcoa**
**Ford**
**Lear Corporation**
**American Express**
**ABB**
**Dow**
**DuPont**
**Nokia**
**3M**
**Verbatim**

Caterpillar Inc
Texas Instruments
American Express
LG
Air Products
Xerox
Avery
JP Morgan-Chase
Invensys
Seagate
Cummins
Navistar
GKN
Nokia

A.B. Dick Company, Abbott Labs, Adolph Coors, Advanced Micro Devices, Aerospace Corp, Airborne, Alcoa, Allen Bradley, Allied Signal, Ampex, Apple Computers, Applied Magnetics, ASQC, Atmel, Baxter Pharmaseal, Beatrice Foods, Bell Helicopter, Boeing, Bombardier, Borden, Bristol Meyers - Squibb, Bryn Mawr Hospital, Campbell Soup, Cellular 1, Chevron, Citicorp, City of Austin, TX, City of Dallas, TX, Clorox, Cooper Ind, Dannon, Defense Mapping Agency, Delnosa ( Delco Electronics in Mexico), Digital Equipment Corp, DTM Corp, Eastman Kodak, Electronic Systems Center, Empak, Florida Dept. of Corrections, Ford Motor Company, GEC Marconi, General Dynamics, General Electric, Hazeltine Corp, Hewlett packard, Holly Sugar, Honeywell, Intel, Junior Achievement, Kaiser Aluminum, Kraft General Foods, Larson & Darby, Inc, Laser Magnetic Storage, Lear Astronics, Lenox China, Littton Data Systems, Lockhed Martin, Loral, Los Alamos National labs, Martin Marietta, McDonnell Douglas, Merix, Microsoft, Morton Int'l, Motorola, NASA, Nat'l Institute of Corrections, Nat'l Institute of Standards, Nat'l Semiconductor, Natural Gas Pipeline Company of America, Northrop Corp, PACE, Parkview Hospital, Pentagon, Pharmacia, PRC, Inc, Qualified Specialists, Ramtron Corp, Rockwell Int'l, Rohm & Haas, Seagate, Society of Plastics Egineers, Solar Optical, Sony, Star Quality, Storgae Tek, Symbios Logic, Synthes, Technicomp, Tessco, Texaco, Texas Commerce Bank, Texas Dept. of Transportation, Texas Instruments, Titleist, Trane, TRW, Ultratech Stepper, United States Air Force, United States Army, United technologies, UPS, USAA, Verbatim, Walbro Automotive, Walker parking, Woodward Governor, Xerox



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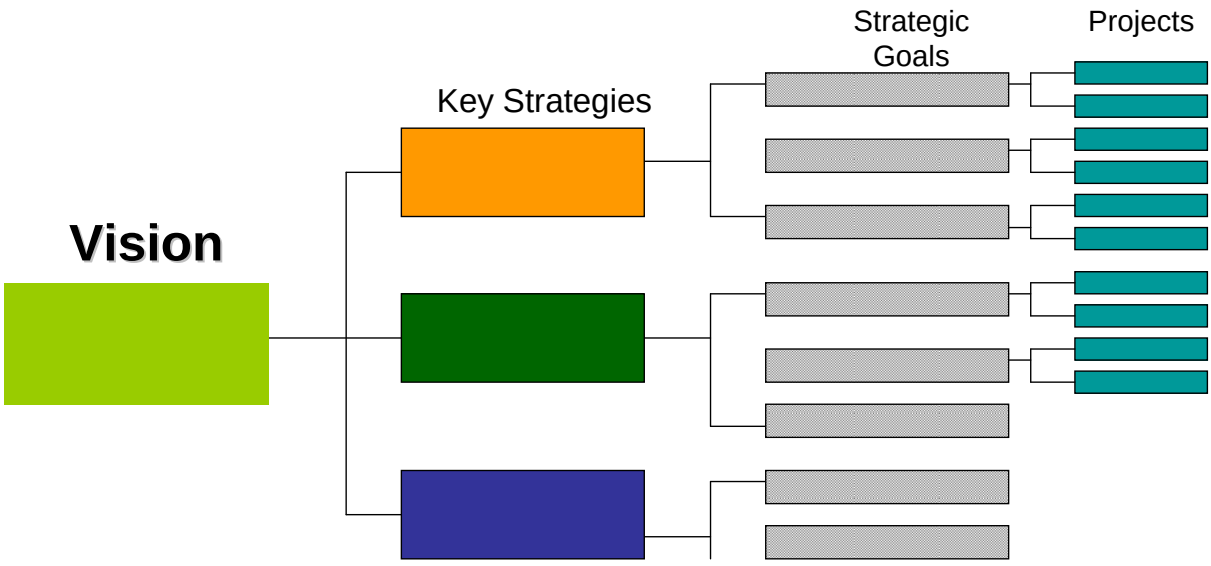
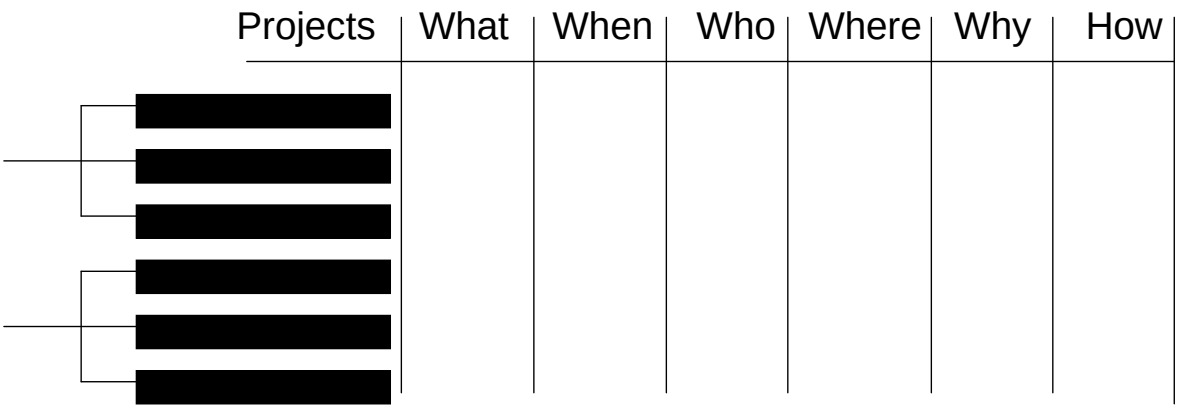
# Deploying the vision



# Deploying the vision










# Choosing Six Sigma Projects

**Eastman Chemical Company**

**Be the Best International Chemical Company...**

# Choosing Six Sigma Projects

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## Strategic Objectives

1. **Achieve higher customer satisfaction**
2. **Create shareholder value**
3. **Be a trusted member of the community**
4. **Join alliances to gain competitive advantage**





# Choosing Six Sigma Projects

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## Achieve higher customer satisfaction

- **Improve reliability of supply by 50%**
- Improve responsiveness to product changes to 70% of the time
- Demonstrate concern for the customer by doubling customer follow-ups
- Improve feedstock on-time delivery by 80%
- Improve billing accuracy 95%

Topics drawn from Pareto analysis of customer survey responses indicating first choices for improvements.

# Choosing Six Sigma Projects

**Improve reliability of supply by 50%**

1. Improve tanker supply
2. Decrease equipment downtime
3. Revise scheduling process

Topics drawn from Pareto analysis of reasons for unreliable supply from customer complaints and investigations.







# Choosing Six Sigma Projects

**Achieve higher customer satisfaction**

# SSM Health Care — Leading the Way

**Founded more than 130 years ago by Mother Mary Odilia Berger and sponsored today by the Franciscan Sisters of Mary**

**SSM Health Care is a private, not-for-profit health care system based in St. Louis, Mo, that provides primary, secondary, and tertiary health care services.**

**The system owns, manages, and is affiliated with 21 acute care hospitals and three nursing homes in four states: Illinois, Missouri, Oklahoma, and Wisconsin.**




SSM HEALTH · CARE "Through our exceptional health care services, we reveal the healing presence of God."
5

## Mission

Through our exceptional health care services, we reveal the healing presence of God.

## Values

Compassion
**We reach out with openness, kindness, and concern.**

Respect
**We honor the wonder of the human spirit.**

Excellence
**We expect the best of ourselves and one another.**

Stewardship
**We use our resources responsibly.**

Community
**We cultivate relationships that inspire us to serve.**


**SSM Health Care — Main Achievements**

**• In 1999, SSMHC started a clinical collaborative program with 4 teams to improve patient outcomes. By 2002, 85 teams have been involved in six clinical collaboratives.**
**• Physicians connected to an automated information system have increased steadily from 3,200 in 1999 to 7,288 in 2002.**
**• For four consecutive years, SSMHC has maintained an investment "AA Credit Rating"—a rating attained by fewer than 1 percent of U.S. hospitals.**
**• SSMHC's share of the St. Louis market increased over each of the past three years to 18 percent, while three of its five competitors lost market share.**




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## SSM Health Care — Improvement Projects

• Safely Reducing Cesarean Sections
• Improving Outcomes and Reducing Costs in Adult intensive Care
• Improving Outcomes and Reducing Costs for Adult Cardiac Surgery
• Reducing Medication Errors
• Reducing Wait Times and Delays
• Idealized Design of Clinical Office Practices
• Care at the End of Life
• Improving Secondary Prevention of Ischemic Heart Disease
• Using Patient Information to Improve Care and Ensure Success
• Improving Treatment and Decreasing Readmissions for Patients with Congestive Heart Failure
• Achieving Exceptional Safety in Health Care

# Quality Management also applies to a School of Management

*The experience of the*

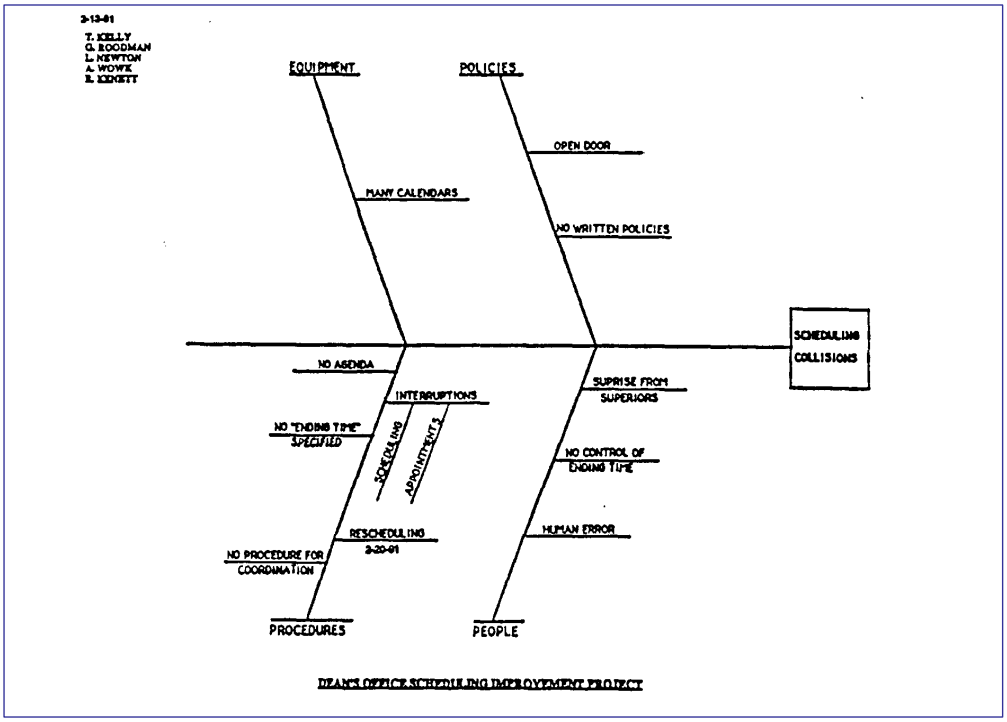
*State University of New York - Binghamton*

Project team leader: Tom Kelly - Dean
Team member: Garry Roodman - Associate Dean
Team member: Angie Wounk - Secretary
Team member: Liz Newton - Secretary
Facilitator: Ron Kenett - Professor





# Fishbone diagram



# Force Field Analysis - before

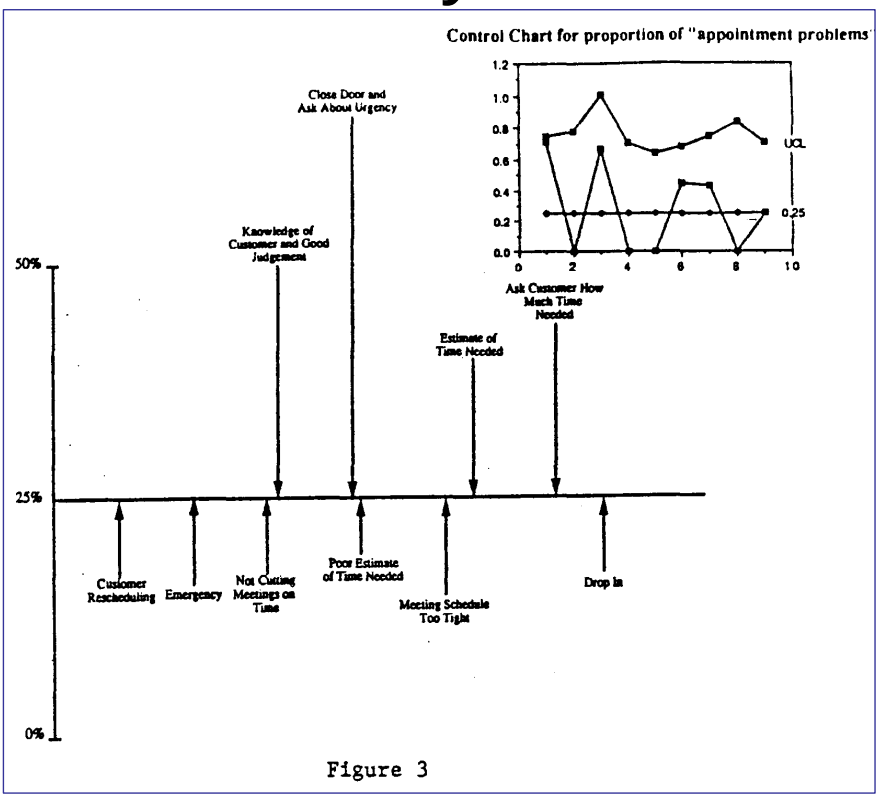



Figure 3







# Force Field Analysis - after

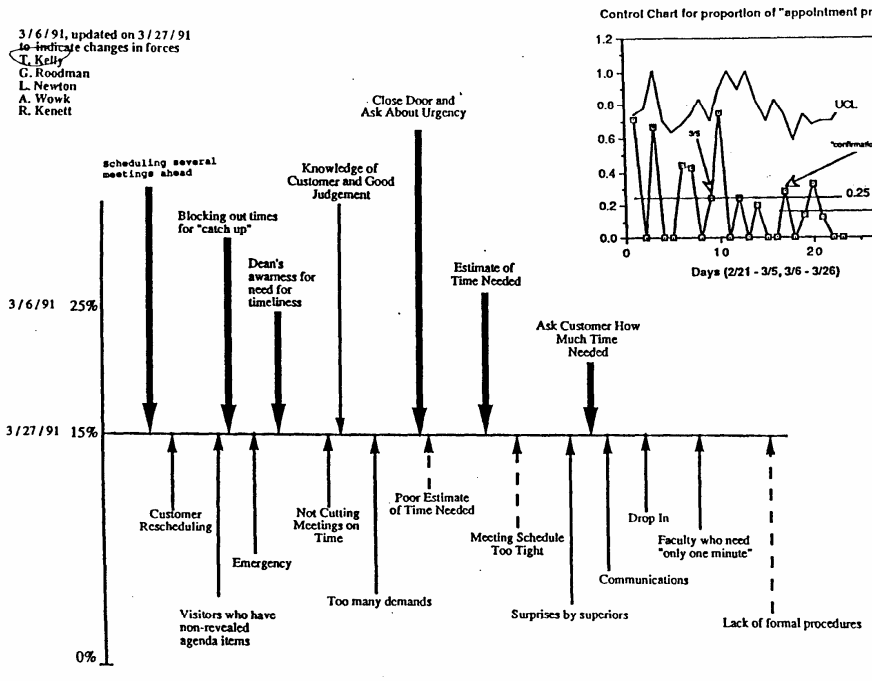



Figure 4

# Control Chart for ongoing control

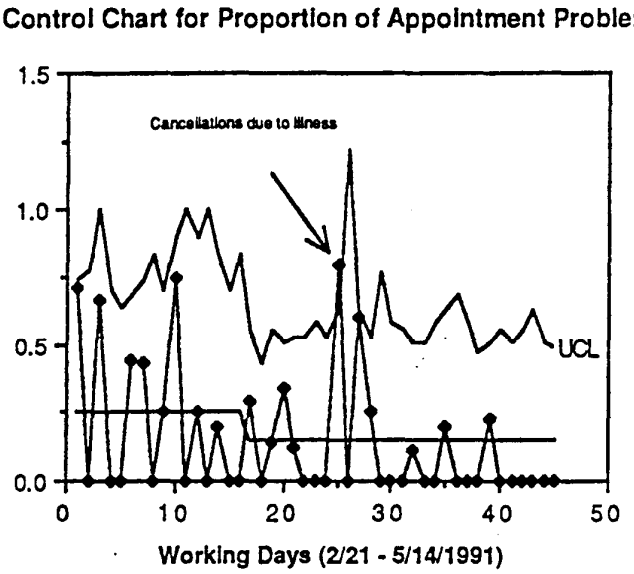



Figure 5







# Six Sigma Projects

| | |
|---|---|
| **Define** | Select a project |
| **Measure** | Map out the current situation |
| **Analyze** | Characterize the current situation |
| **Improve** | Optimize the process |
| **Control** | Hold the gains |

**DMAIC**

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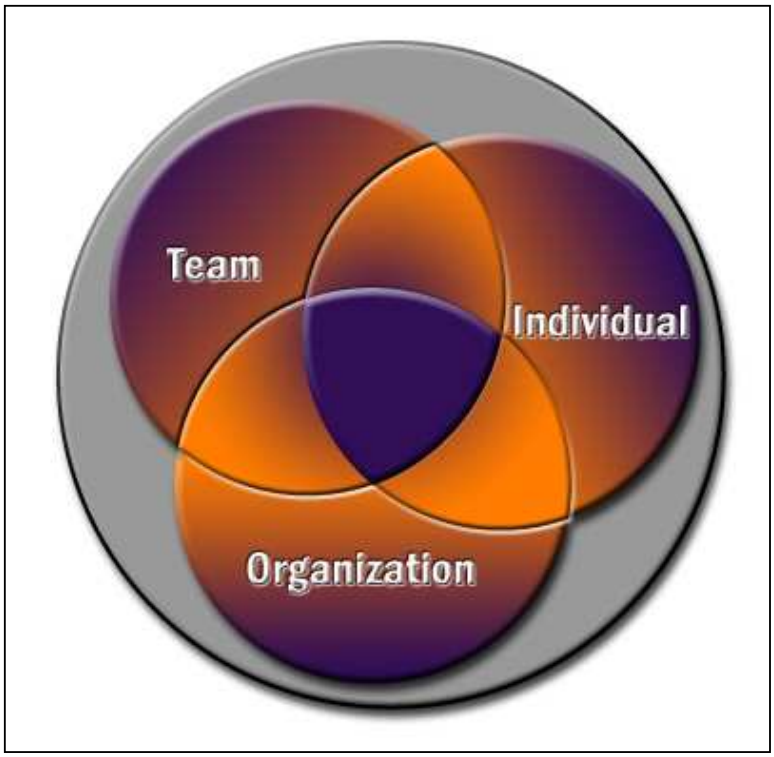
# Three Levels of Competence





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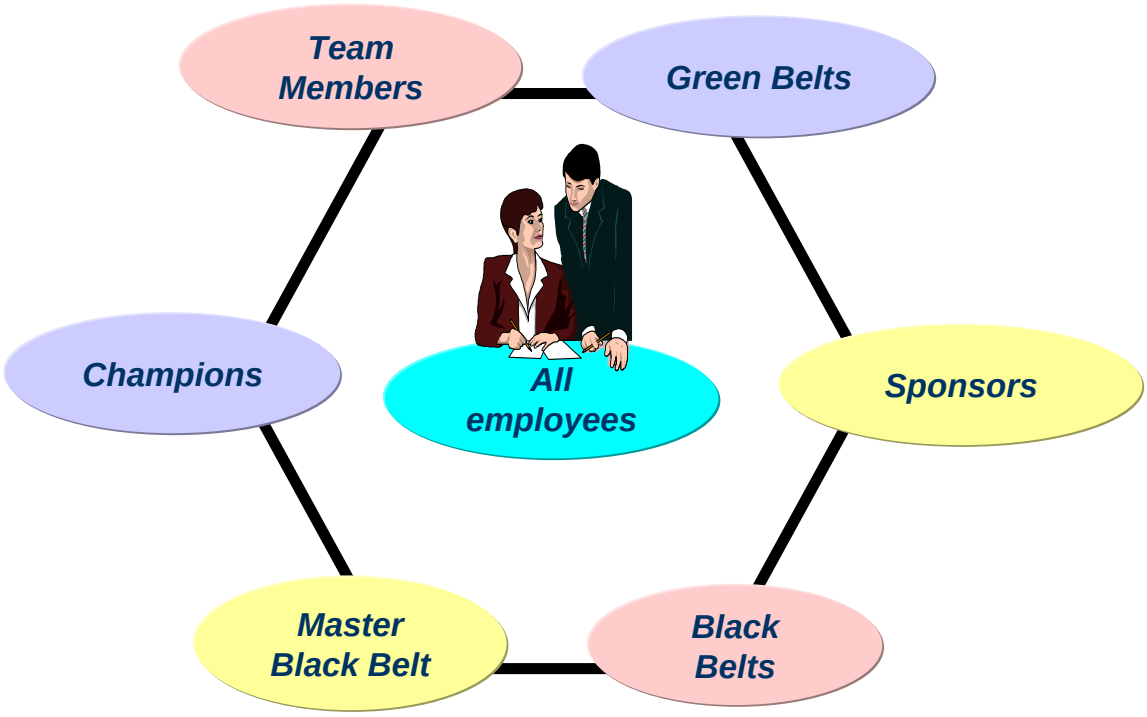
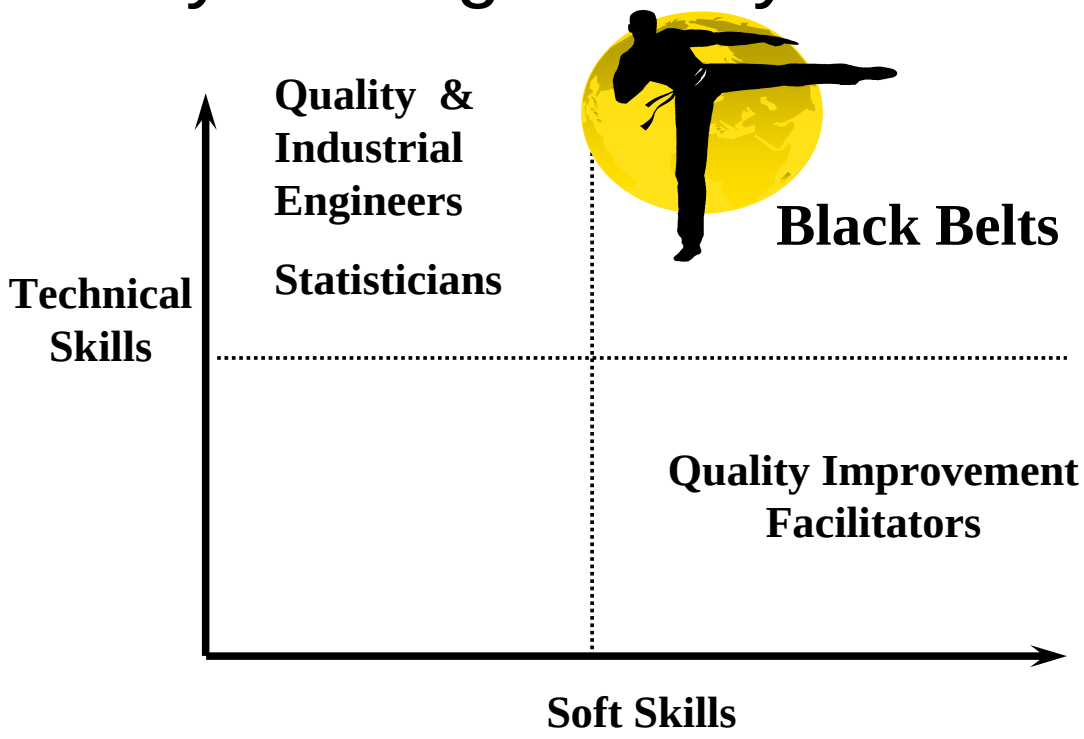
# Key Six Sigma Players



# Key Six Sigma Players







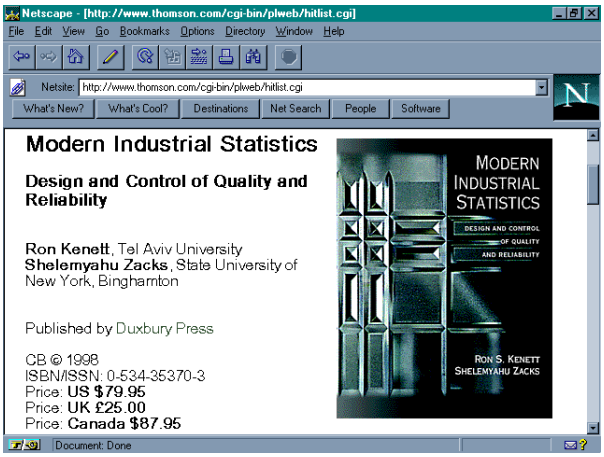



## Black Belt training program

- 6 sigma principles
- Quality Improvement
- Quality by Design
- Quality Control
- Teamwork
- Effective presentations
- QFD/VOC
- Statistical thinking
- Process mapping
- Barriers to breakthroughs
- JMP, MINITAB…..
- Gage R&R
- SPC
- SPC Strategy
- Risk Management
- FMEA
- Statistical Inference
- Design Of Experiments
- DOE Strategy
- Bootstrapping
- Robust Designs
- System Thinking

# Black Belt certification process

**MODERN INDUSTRIAL STATISTICS: Design and Control of Quality and Reliability, Kenett and Zacks, Duxbury Press, 1998**




**Participants must show:**
- **Active participation in training**
- **Project completion**
- **Demonstrated skills, soft and hard**
- **Problem handling skills using simulators**

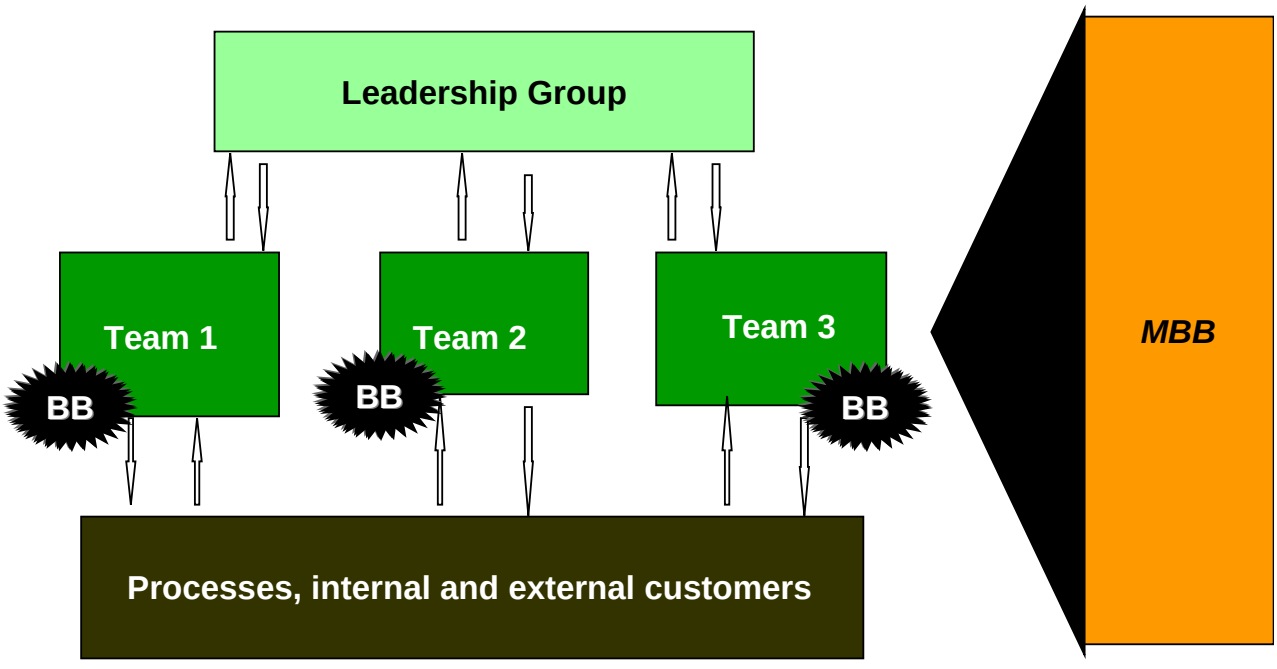
**Management's role:**
- **Management sponsorship**
- **Management reviews**
- **Monthly status report**
- **Project final report**



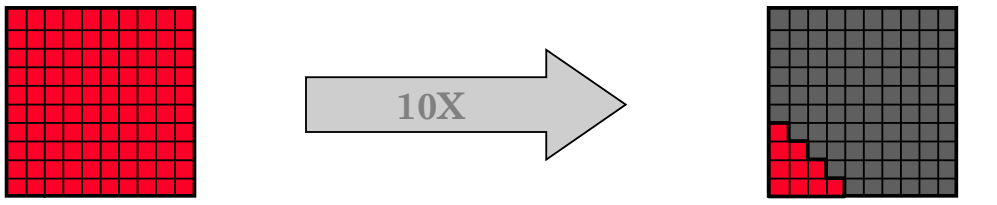




# The organizational structure supporting Six Sigma implementation

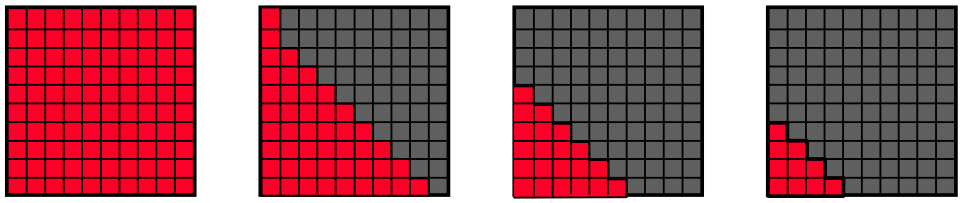


# 10X Improvement




End of Year 3
10 Errors in Process

**Constant improvement each of the next 3 years, requires 54% improvement per year**



Start of Year 1
100 Errors
in Process

End of Year 1
46 Errors
in Process

End of Year 2
21 Errors
in Process

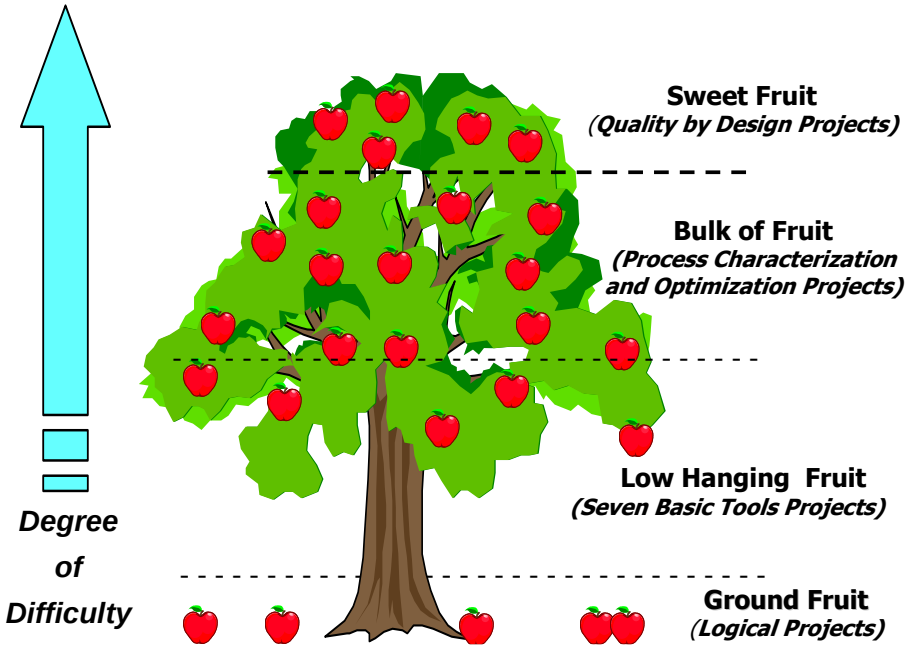
End of Year 3
10 Errors
in Process



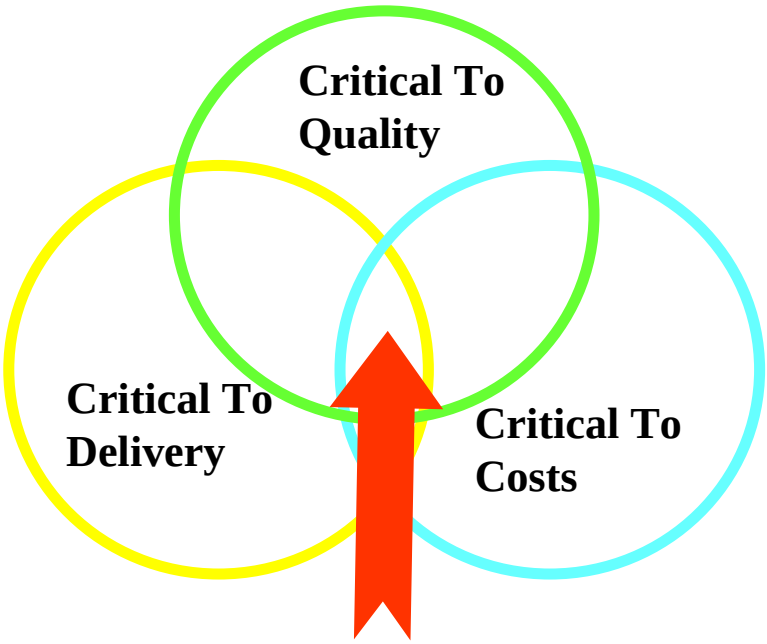




# Choosing Improvement Projects



# Choosing Six Sigma Projects




***Maximum Leverage***







# Six Sigma Projects

Six Sigma Project Review Form

| Black Belt Candidate: | Date: | 1 | | 3 | | 4 | 5 |
|---|---|---|---|---|---|---|---|
| Project Name: | Reviewer: | | | | | | |
| Six Sigma Black Belt Methodology Phases | | Completed | Incomplete | Not started | N/A | Action Items/Comments | |
| **A. MEASUREMENT** | | | | | | | |
| A1 | Problem identification. Key product/process selected, based on business impact (DPU, Yield, COPQ, etc) | 3 | 2 | 1 | | | |
| A2 | Project Customer, Mission, goals, metrics, client, measures of success established. | 3 | 2 | 1 | | | |
| A3 | Team members identified. | 3 | 2 | 1 | | | |
| A4 | Cashable return for Kodak identified (Return on investment) | 3 | 2 | 1 | | | |
| A5 | Potential barriers identified and listed. | 3 | 2 | 1 | | | |
| Items above (A1-A5) should be complete by Week 1 review | | | | | | | |
| A6 | Team formed and fully functional | 3 | 2 | 1 | | | |
| A7 | Project Baseline elements completed including scope, scale, analysis of defects, cycle time, and costs | 3 | 2 | 1 | | | |
| A8 | VOC collected, refined, and documented. | 3 | 2 | 1 | | | |
| A9 | Internal and external gaps identified through benchmarking | 3 | 2 | 1 | | | |
| A10 | Detailed process map documented (inputs, outputs, product/ process parameters, parameters classified, measurement points). | 3 | 2 | 1 | | | |
| A11 | Performance (key) parameters measured using basic Quality tools, basic statistics, and Six Sigma measures | 3 | 2 | 1 | | | |
| A12 | Project Management plan established including milestone dates and critical path | 3 | 2 | 1 | | | |
| Items above (A1-A12) should be complete by Week 3 review | | | | | | | |
| **B. ANALYSIS** | | | | | | | |
| B1 | Process/product data analyzed using control charts and other tools to determine stability, capability, variability and process limits | 3 | 2 | 1 | | | |
| B2 | Failure Modes and Effects Analysis performed using identified steps from product/process map. | 3 | 2 | 1 | N/A | | |
| B3 | Function Anaylsis Based Process Verification performed. | 3 | 2 | 1 | N/A | | |
| B4 | Systems Thinking tools applied (Reality Trees, Causal Loop Diagrams, etc.). | 3 | 2 | 1 | N/A | | |
| B5 | Key parameters prioritized based on capability analysis, defect pareto, cost analysis, FMEA, FAB-PV, Value Analysis, etc. | 3 | 2 | 1 | | | |
| B6 | Measurement System Analysis performed on key measurement processes (key parameters) | 3 | 2 | 1 | | | |
| B7 | "Measurement" phase elements updated (contract, baseline, metrics, flow maps, etc.). | 3 | 2 | 1 | | | |
| B8 | Project Management plan updated with proposed improvement strategy including milestone dates and critical path | 3 | 2 | 1 | | | |
| Items above (A and B) should be complete by Week 4 review | | | | | | | |
| **C. IMPROVEMENT** | | | | | | | |
| C1 | Key parameters selected for improvement. Response variables documented. | 3 | 2 | 1 | | | |
| C2 | Diagnostic studies completed (modeling, nested designs) | 3 | 2 | 1 | | | |
| C3 | Causal factor identification completed. Generate potential solutions. | 3 | 2 | 1 | | | |
| C4 | Factor levels established, design selected and factors loaded, DOE plan established | 3 | 2 | 1 | N/A | | |
| C5 | Experiment(s) conducted and data collected. | 3 | 2 | 1 | N/A | | |
| C6 | DOE analysis. | 3 | 2 | 1 | N/A | | |
| C7 | Select and test solution(s). Decision and risk analysis assessed. | 3 | 2 | 1 | | | |
| C8 | Implement solution(s). | 3 | 2 | 1 | | | |
| C9 | "Measurement" phase elements updated (contract, baseline, metrics, flow maps, etc.). | 3 | 2 | 1 | | | |

**DEFINE**

**MEASURE**

**ANALYZE**

**IMPROVE**

**CONTROL**

"Through our exceptional health care services, we reveal the healing presence of God."

# SSM Health Care Management Medical Report

## Radiology Retakes

***SSM HealthCare St. Louis***
***Clinical Performance Improvement Center***
***Medical Management Report DRAFT***

| | July-03 | | YTD 2003 | | Year 2002 | Year 2001 |
|---|---|---|---|---|---|---|
| Hospital A | Actual | Budget | Actual | Budget | Actual | Actual |
| Medicare (traditional and managed) | | | | | | |
| ALOS - traditional - acute *** | 5.2 | 5.0 | 5.1 | 5.0 | 5.3 | 5.8 |
| ALOS - managed care - acute*** | 5.2 | 5.1 | 4.9 | 5.1 | 5.1 | 5.1 |
| Care 1* | 5.2 | | 4.9 | | 5.9 | 5.9 |
| Care 2* | 6.3 | | 6.4 | | 6.1 | 5.5 |
| Care 3* | 4.9 | | 4.7 | | 4.8 | 4.8 |
| Total Medicare Patient Days (acute and SNF) * | 2,705 | | 12,467 | | 38,218 | 34,804 |
| Catastrophic Acute Trad Medicare Cases, excluding Behavioral Health, as % of all cases* | 9.5% | | 10.0% | | 10% | 11% |
| Total All Patient Days (acute and SNF)*** | 15,223 | 16,521 | 62,224 | 63,843 | 92,259 | 93,859 |
| Top DRGs (ICD9s) */** | | | | | | |
| DRG 79 & 89 Respiratory Infection/Pneumonia | | Goal | | Goal | | |
| Traditional Medicare ALOS (acute) | 5.1 | 5.2 | 5.6 | 5.2 | 6.0 | 6.4 |
| Total ALOS (acute) | 5.2 | 5.2 | 5.1 | 5.2 | 5.6 | 5.7 |
| Antibiotic time, arrival to administer-median in min (Core Measure) | 144 | <160 | 144 | <160 | | |
| 31 days readm rate for related condition - Quarterly | 6.6% | 2.0% | 6.6% | 2.0% | 5.4% | 6.0% |
| DRGs 106, 107,109 & other DRGs with CABG, not Valve Sx | | | | | | |
| Traditional Medicare ALOS (acute) | 9.8 | 8.0 | 10.5 | 8.0 | 8.4 | 9.4 |
| Total ALOS (acute) | 9.1 | 8.0 | 9.2 | 8.0 | 8.4 | 8.2 |
| Patient Satisfaction | 90% | 95% | 83% | 95% | 89% | 92% |
| In-hospital mortality (not risk adjusted) | 0.0% | 3.0% | 0.0% | 3.0% | 2.1% | 4.0% |
| APR-DRG 174 & 175 Cardiac Stent | | | | | | |
| Traditional Medicare ALOS (acute) | 2.1 | 3.0 | 3.2 | 3.0 | 3.5 | 3.5 |
| Total ALOS (acute) | 3.3 | 3.0 | 2.8 | 3.0 | 3.1 | 3.1 |
| Inhospital Mortality | 0.00% | 1.50% | 1.49% | 1.50% | 1.5% | 2.0% |
| % patients with EF<40% on ACE Inhibitor (Core Measure) | 97% | 95% | 97% | 95% | 96% | |
| DRG 209 Hip/Knee Surgery | | | | | | |
| Traditional Medicare ALOS (acute) | 5.2 | 5.0 | 4.2 | 5.0 | 4.7 | 4.6 |
| Total ALOS (acute) | 4.1 | 4.5 | 3.9 | 4.5 | 4.3 | 4.3 |
| Complication rate: Total Knee Replacement - Quarterly | 7% | 3% | 7% | 3% | 8% | |
| Complication rate: Total Hip Replacement - Quarterly | 3% | 4% | 3% | 4% | 9% | |
| Patient Satisfaction | 90% | 95% | 89% | 95% | 89% | 87% |
| ICD9 Code 410 Acute Myocardial Infarction | | | | | | |
| Traditional Medicare ALOS (acute) DRG 121,122, 123 | 7.5 | 6.0 | 5.7 | 6.0 | 5.9 | 7.8 |
| Total ALOS (acute) DRG 121, 122, 123 | 6.6 | 6.0 | 5.2 | 6.0 | 5.7 | 7.0 |
| % charged for Beta Blocker | 73% | 85% | 76% | 85% | 77% | 69% |
| % of pts with Beta Blocker prescribed at discharge (Core Measure) | 100% | 95% | 94% | 95% | 95% | |
| DRG 127 Heart Failure | | | | | | |
| Traditional Medicare ALOS (acute) | 3.4 | 4.0 | 5.6 | 4.0 | 5.3 | 5.6 |
| Total ALOS (acute) | 2.1 | 4.0 | 5.2 | 4.0 | 4.9 | 5.2 |
| % charged for ACE Inhibitor or ARB | 68% | 75% | 70% | 75% | 72% | 75% |
| % patients with EF<40% on ACE Inhibitor (Core Measure) | 97% | 95% | 97% | 95% | 96% | |
| 31 days readm rate for related condition - Quarterly | 9.6% | 8.0% | 9.6% | 8.0% | 11.2% | 9.8% |
| Achieving Exceptional Patient Safety (AES) Collaborative** | | | | | | |
| Near Miss (reports per month) | 63 | | 63 | | 18 | |
| % Compliance with Surgical Site Marking | 100% | 100% | 100% | 100% | 100% | |
| % Compliance with Dangerous Abbreviation Policy | 95% | 100% | 95% | 100% | 92% | |
| Quality (System Measures)*** | | | | | | |
| Patient Loyalty | 82.4% | 82.0% | 81.6% | 82.0% | 43.9% | 44.1% |
| 31-Day Acute Readmission Rate | 11.0% | 10.0% | 10.0% | 10.0% | | |
| Unscheduled Returns to ER | 0.92% | 1.5% | 1.05% | 1.5% | 1.3% | 1.9% |
| Unscheduled Returns to OR | 0.38% | 0.75% | 0.74% | 0.75% | 1.1% | 1.7% |

Medicare patients' section looks at patients' ALOS and other utilization data.

Six groups of patients have been designated for performance improvement efforts based on volume of cases and opportunities for positive change when compared to selected benchmarks. Primary outcomes for these patients are tracked on monthly reports.

Patient Safety Indicators

SSMHC System-wide Indicators

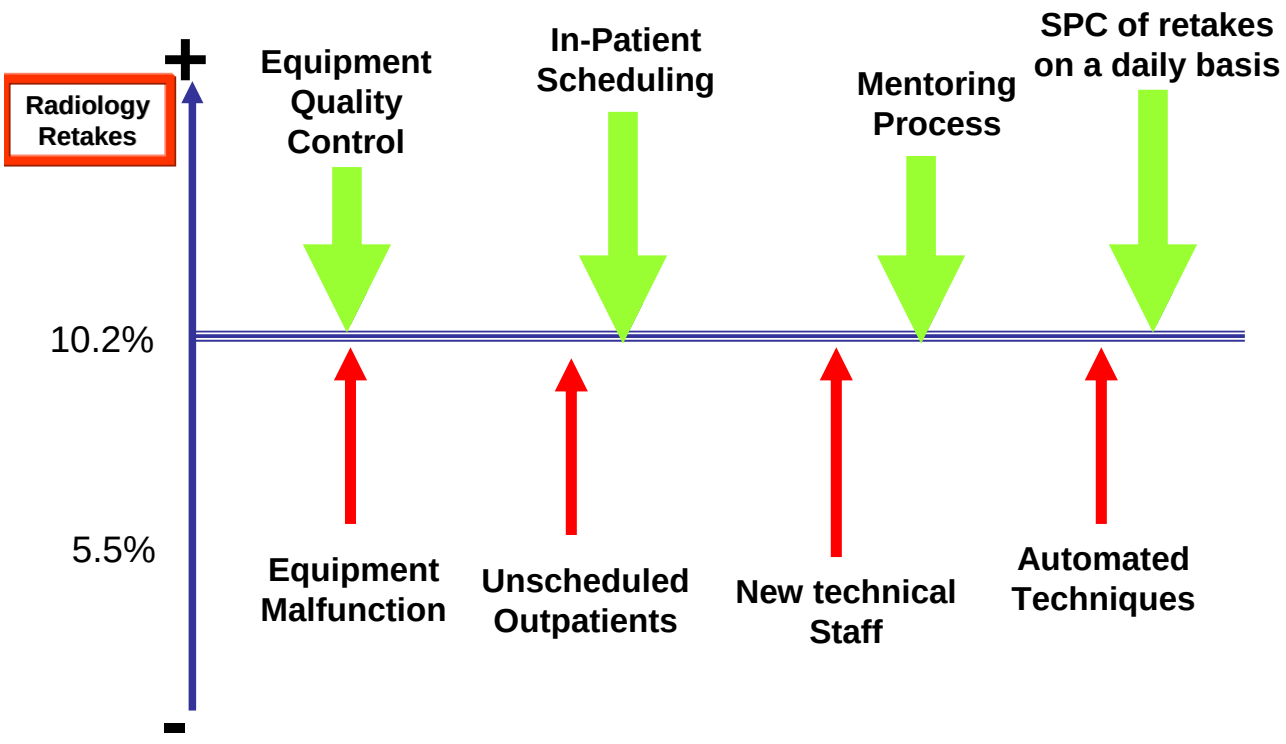
* Two dollar data
** Submitted by hospitals
*** Hospital Operations Performance Indicator Report





5

"Through our exceptional health care services, we reveal the healing presence of God."

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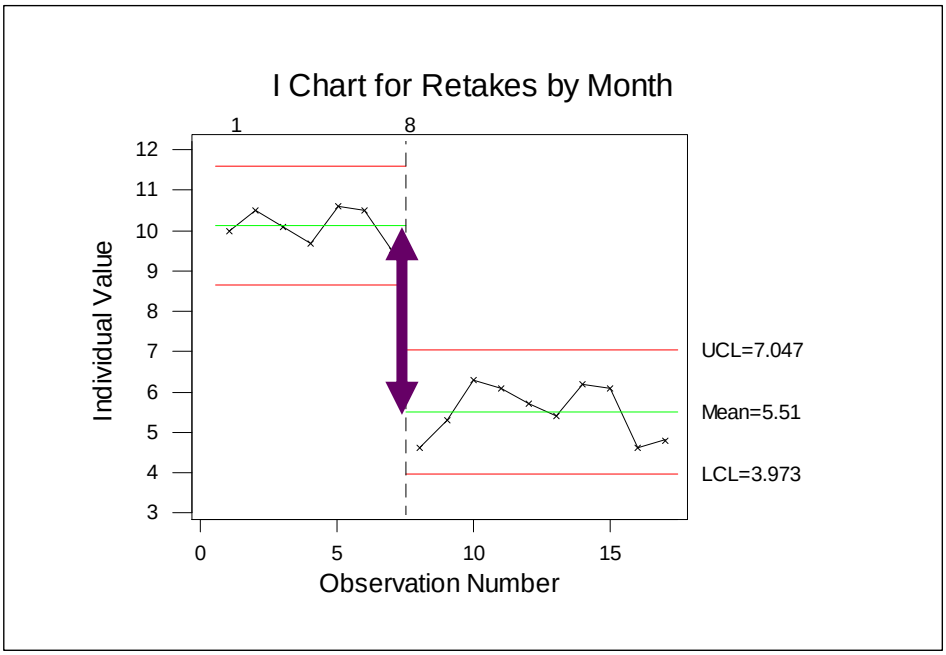
"Through our exceptional health care services, we reveal the healing presence of God."

# Radiology Retakes

10.2%

5.5%










# Sample projects

| | Black Belt | Project Sponsor | Sub Unit | Project Name |
|---|---|---|---|---|
| 1. | Boaz Parpar | Avi Bental | TC | Cost reduction in LABORATORY TEST |
| 2. | Shimon Azani | Andre Sillam | SM | Cost reduction in CHLORINE production |
| 3. | Meir Adler | Yitzhak Feier | IC | Reaching 6-Sigma target in AMMONIUM BROMIDE |
| 4. | Victor Malka | Ofer Lifshitz | IC | 6-Sigma target in HBr manufacturing |
| 5. | Gregory Shapiro | Alon Tavor | FR/RD | Improving flowability of TBBA |

# Sample Black Belt Projects

**Example 1**

**Repacking is currently estimated at 1.5M$**
**Reduce these costs by at least 500K$**

**Example 2**

**Plastic Injection moulding customers complain of residues blocking the mould injection orifices**
**Increase MTTF from 800 to 3000 injections**

**Example 3**

**Bromine raw material is delivered at 1-2.6 sigma levels using best in class specifications**
**Improve production capability to 6 sigma levels**

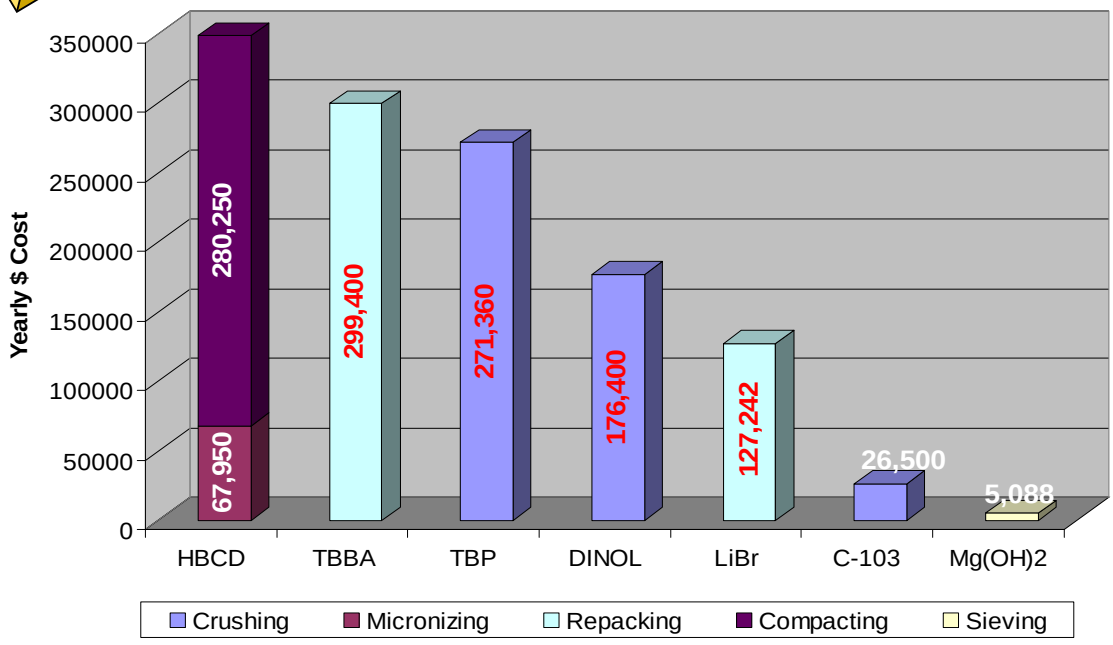






**Example 1**

# he Repacking Project



Example 2

# ne Residues Project

| | Parameter | Units | Level 1 | Level 2 |
|---|---|---|---|---|
| 1 | Screw Speed | RPM | 110 | 170 |
| 2 | Feed Rate | kg/hr | 500 | 700 |
| 3 | Temp (10) | C | 210 | 250 |

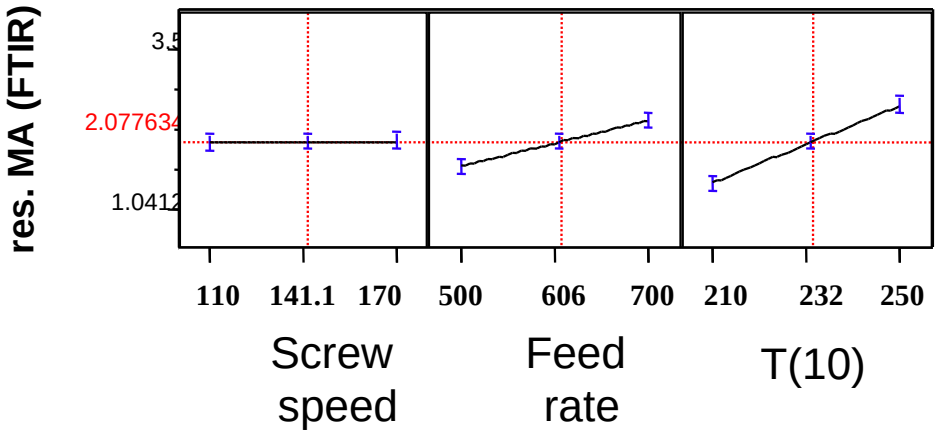
| N | | Screw Speed | Feed Rate | T(10) |
|---|---|---|---|---|
| 1 | - | 110 | 500 | 210 |
| 2 | a | 170 | 500 | 210 |
| 3 | b | 110 | 700 | 210 |
| 4 | ab | 170 | 700 | 210 |
| 5 | c | 110 | 500 | 250 |
| 6 | ac | 170 | 500 | 250 |
| 7 | bc | 110 | 700 | 250 |
| 8 | abc | 170 | 700 | 250 |







Example 2

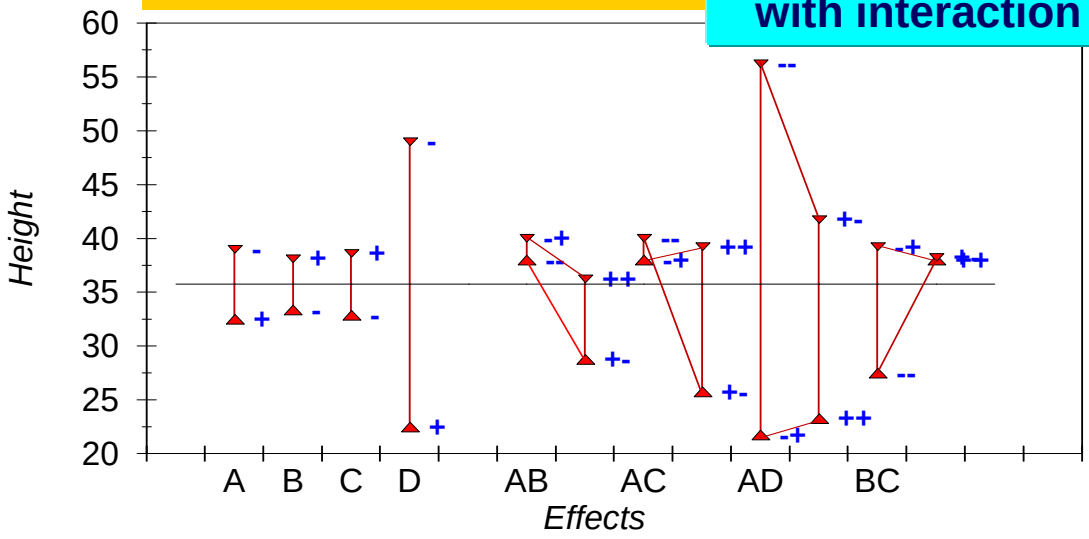


Example 2

"Going Beyond Main-Effect Plots" (with B. Vogel), *Quality Progress*, pp. 71-73, February 1991.

| | | | |
|---|---|---|---|
| Response Variable: | Height of the moulded part (Measured in mm.) | | |
| Factors | | - | Levels + |
| *A* - Injection Speed (in./sec) | | 1.0 | 3.0 |
| *B* - Injection Pressure (psi) | | 825 | 925 |
| *C* - Injection Time (sec) | | 2.0 | 3.5 |
| *D* - Pressure Hold Time (sec) | | 5.5 | 7.5 |
| Design | Full factorial - $2^4$ | | |
| | Replications per run - 20. | | |

## Combining main effects with interaction plots







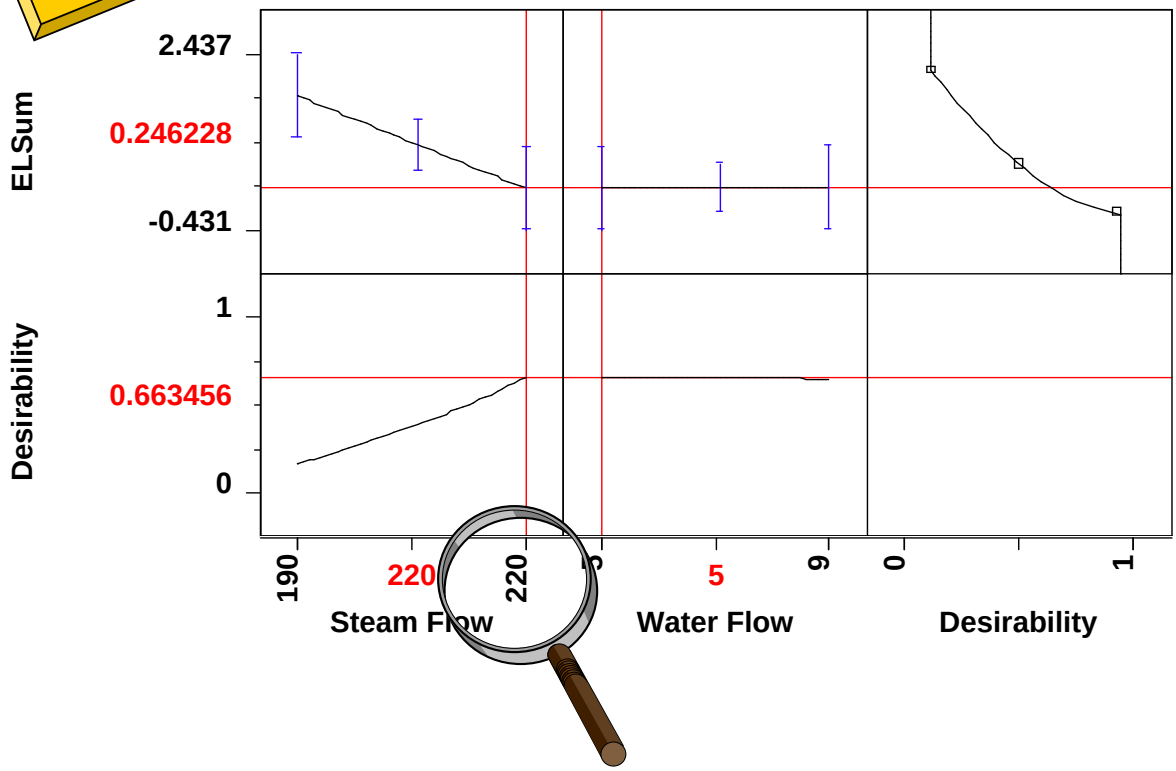



# The Bromine Project

Example 3

| Steam Flow | Water Flow | Chlorine | Moisture | Expected Loss Sum |
|---|---|---|---|---|
| 190 | 6 | 63 | 9 | 1.1925 |
| 200 | 5 | 54 | 20 | 1.2544 |
| 210 | 6 | 72 | 14 | 1.6578 |
| 210 | 8 | 63 | 10 | 1.2136 |
| 220 | 8 | 10 | 12 | 0.1878 |
| 210 | 9 | 41 | 13 | 0.6547 |
| 2[illegible] | 6 | 5 | 7 | 0.0614 |
| [illegible] | 7 | 8 | 8 | 0.0889 |
| [illegible] | 9 | 38 | 9 | 0.4911 |
| [illegible]0 | 9 | 2 | 9 | 0.0911 |
| 190 | 5 | 73 | 18 | 1.8403 |
| 200 | 7 | 43 | 8 | 0.5847 |
| 190 | 7 | 57 | 9 | 0.9925 |
| 190 | 8 | 80 | 19 | 2.1789 |
| 190 | 9 | 57 | 12 | 1.0625 |
| 210 | 7 | 42 | 7 | 0.5444 |
| 220 | 5 | 4 | 8 | 0.0756 |
| 200 | 6 | 68 | 20 | 1.7289 |
| 200 | 8 | 60 | 26 | 1.7511 |
| 210 | 5 | 35 | 10 | 0.4514 |

Example 3

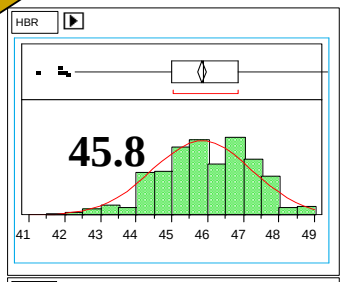
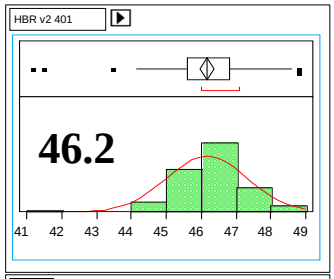
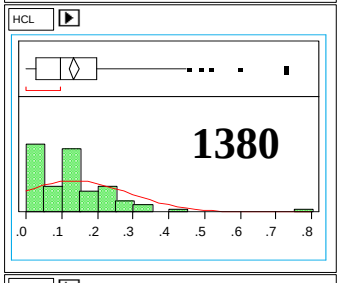
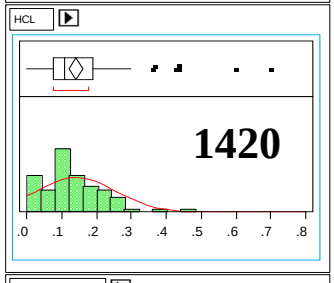
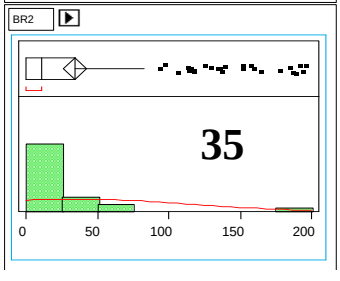
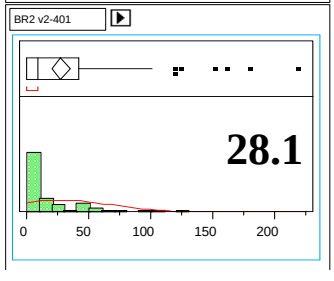






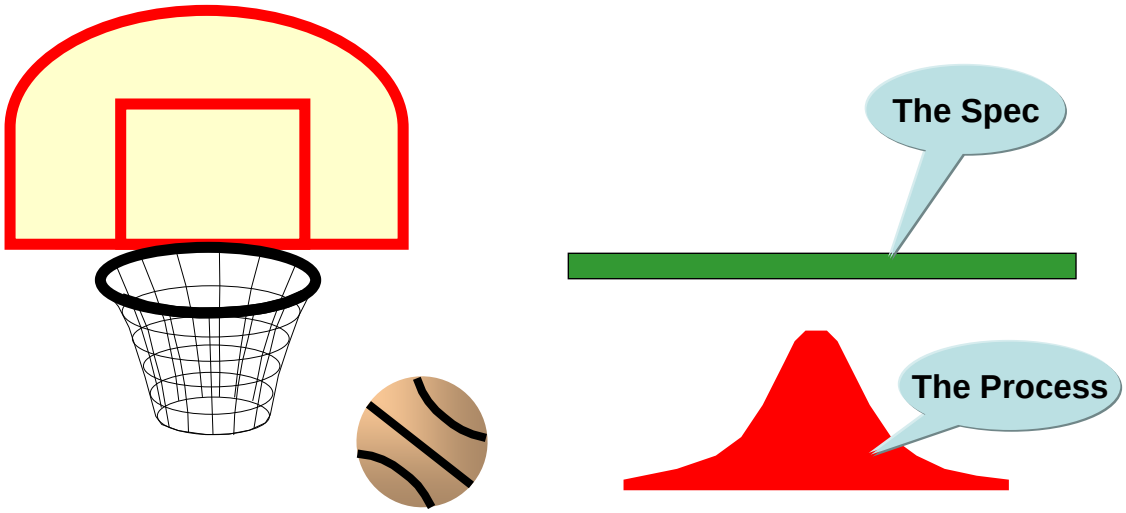



Example 3

| Baseline | Improved | Variance Improvement |
|---|---|---|
|  |  | $\frac{\sigma_b^2}{\sigma_i^2} = 1.45$ |
|  |  | $\frac{\sigma_b^2}{\sigma_i^2} = 1.8$ |
|  |  | $\frac{\sigma_b^2}{\sigma_i^2} = 3.0$ |

5

# Measuring Capability





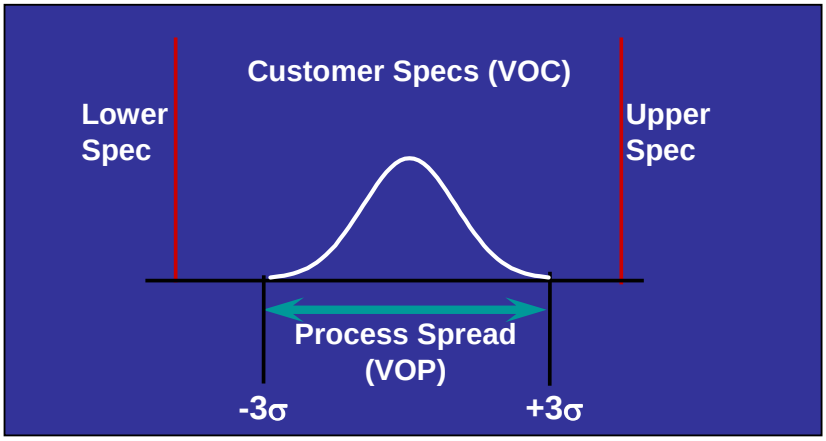



5

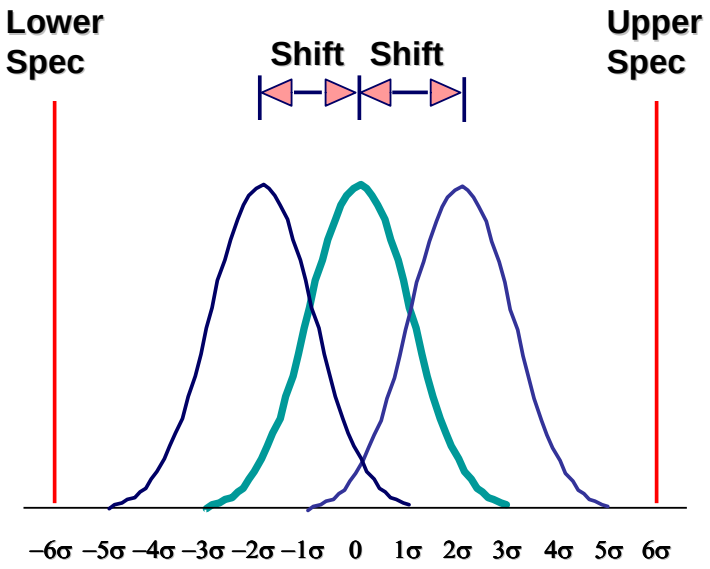
# Measuring Capability

$$\frac{\text{Customer Specifications (VOC)}}{\text{Process Spread (VOP)}}$$

$$C_p = \frac{\text{Upper Spec} - \text{Lower Spec}}{6\sigma}$$



# Measuring Capability

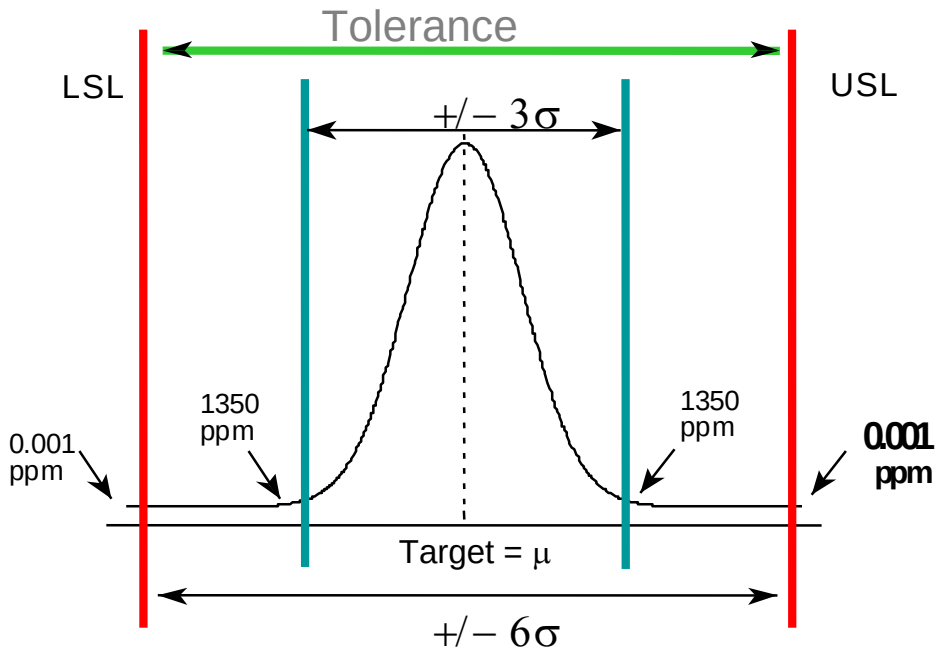




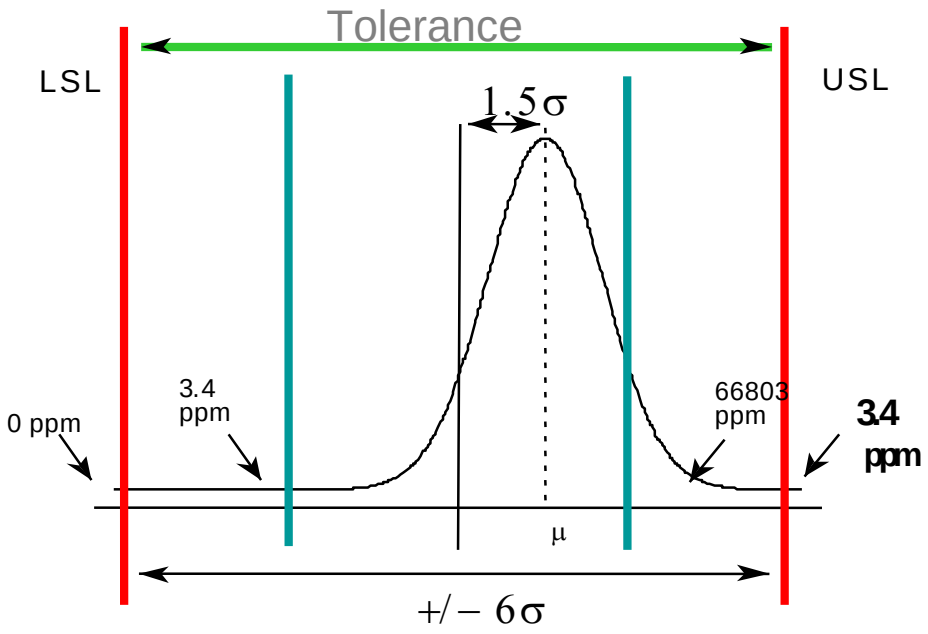





# Measuring Capability



# Measuring Capability










$$K = \left| \frac{\bar{X} - T}{\frac{USL - LSL}{2}} \right|$$

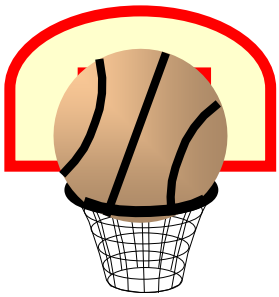
**On-target index**

**Actual capability**

**Potential capability**

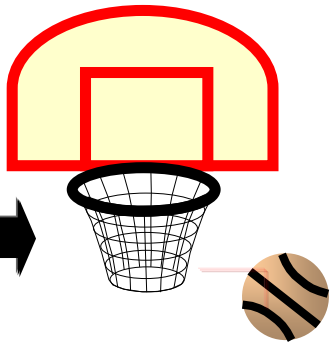
$$Cpk = Cp\ (1-K)$$

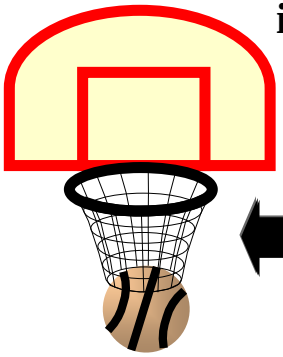
# Actual and Potential Capability



**There is no Potential Capability**

**There is Potential Capability However there is no Actual Capability**





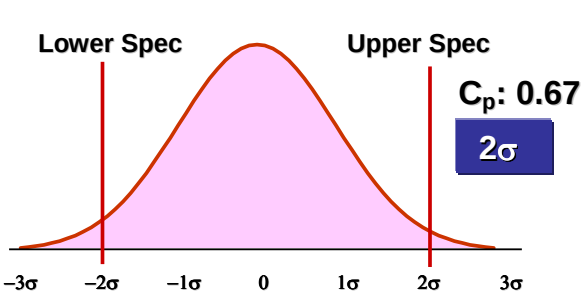
**There is Actual Capability**

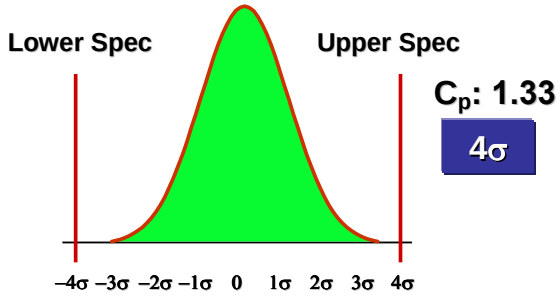


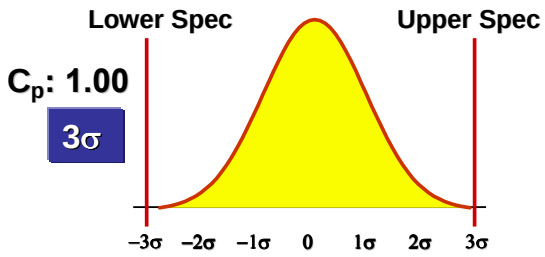


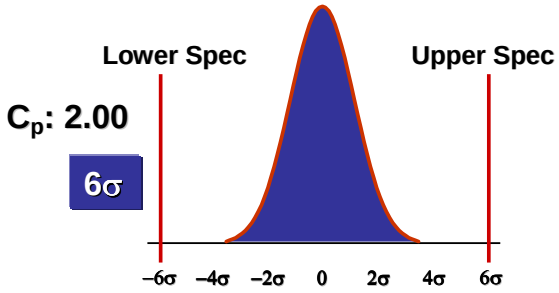


# Measuring Capability



# $C_p$, $C_{pk}$, Defects, and Sigma

| $C_p$ | DPMO * | $C_{pk}$** | DPMO** | Sigma Level |
|---|---|---|---|---|
| 0.67 | 50,000 | 0.17 | 308,770 | 2 |
| 1.00 | 2,700 | 0.50 | 66,811 | 3 |
| 1.33 | 63 | 0.83 | 6,210 | 4 |
| 2.00 | 0.002 | 1.50 | 3.4 | 6 |

* Assumes processed centered between specs
**Assumes a mean shift of 1.5 standard deviations






# Converting Defect Levels to Sigma Level

**175 defects are identified while producing 5000 controllers**

**DPU = 175 / 5000 = 0.035**

**There are 1367 defect opportunities per controller.**

**DPO = 0.035 / 1367= 0.0000256**

**DPMO = 25.6**

# Converting Defect Levels to Sigma Level

**Sigma -- DPMOp Conversion Table**

| Sigma* | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5.30 | 72.3 | 69.5 | 66.7 | 64.1 | 61.5 | 59.1 | 56.7 | 54.4 | 52.2 | 50.1 |
| 5.40 | 48.1 | 46.1 | 44.3 | 42.5 | 40.7 | 39.1 | 37.5 | 35.9 | 34.5 | 33.0 |
| 5.50 | 31.7 | 30.4 | 29.1 | 27.9 | 26.7 | 25.6 | 24.5 | 23.5 | 22.5 | 21.6 |
| 5.60 | 20.7 | 19.8 | 18.9 | 18.1 | 17.4 | 16.6 | 15.9 | 15.2 | 14.6 | 13.9 |
| 5.70 | 13.3 | 12.8 | 12.2 | 11.7 | 11.2 | 10.7 | 10.2 | 9.77 | 9.34 | 8.93 |
| 5.80 | 8.54 | 8.16 | 7.80 | 7.46 | 7.12 | 6.81 | 6.50 | 6.2 | 5.93 | 5.67 |
| 5.90 | 5.41 | 5.17 | 4.94 | 4.71 | 4.50 | 4.29 | 4.10 | 3.91 | 3.73 | 3.56 |
| 6.00 | 3.40 | 3.24 | 3.09 | 2.95 | 2.81 | 2.68 | 2.56 | 2.44 | 2.32 | 2.22 |
| 6.10 | 2.11 | 2.01 | 1.92 | 1.83 | 1.74 | 1.66 | 1.58 | 1.51 | 1.43 | 1.37 |
| 6.20 | 1.30 | 1.24 | 1.18 | 1.12 | 1.07 | 1.02 | 0.97 | 0.92 | 0.88 | 0.83 |

MOTOROLA

*Shifted 1.5 sigma

## An Example :

**175 defects are identified while producing 5000 controllers**

**DPU = 175 / 5000 = 0.035**

**There are 1367 defect opportunities per controller.**

**DPO = 0.035 / 1367= 0.0000256**

**DPMO = 25.6**

**"Sigma" level : 5.55**

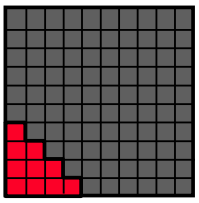






# Benchmarking for Quality Costs

| σ-level | Defect rate (ppm) | Costs of poor quality | Status of the company |
|---|---|---|---|
| 6 | 3.4 | < 10% of turnover | World class |
| 5 | 233 | 10-15% of turnover | |
| 4 | 6210 | 15-20% of turnover | Industry Average |
| 3 | 66807 | 20-30% of turnover | |
| 2 | 308537 | 30-40% of turnover | Noncompetitive |



# Reported Impact

| Table 2: Six Sigma Cost And Savings By Company | | | | | |
|---|---|---|---|---|---|
| Year | Revenue ($B) | Invested ($B) | % Revenue Invested | Savings ($B) | % Revenue Savings |
| Motorola | | | | | |
| 1986-2001 | 356.9(e) | ND | - | 16 1 | 4.5 |
| Allied Signal | | | | | |
| 1998 | 15.1 | ND | - | 0.5 2 | 9.9 |
| GE | | | | | |
| 1996 | 79.2 | 0.2 | 0.3 | 0.2 | 0.2 |
| 1997 | 90.8 | 0.4 | 0.4 | 1 | 1.1 |
| 1998 | 100.5 | 0.5 | 0.4 | 1.3 | 1.2 |
| 1999 | 111.6 | 0.6 | 0.5 | 2 | 1.8 |
| 1996-1999 | 382.1 | 1.6 | 0.4 | 4.4 3 | 1.2 |
| Honeywell | | | | | |
| 1998 | 23.6 | ND | - | 0.5 | 2.2 |
| 1999 | 23.7 | ND | - | 0.6 | 2.5 |
| 2000 | 25.0 | ND | - | 0.7 | 2.6 |
| 1998-2000 | 72.3 | ND | - | 1.8 4 | 2.4 |
| Ford | | | | | |
| 2000-2002 | 43.9 | ND | - | 1 6 | 2.3 |







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