

# Successful Implementation of Six Sigma

## *A Champion Overview*

### Section 6

#### *Early Wins: Case studies*

Ljubljana, Slovenia

April 6, 2004

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6.1

## Table of Content

1. Introduction: What is Six Sigma?
2. Assessment of readiness for Six Sigma
3. Organization for Six Sigma
4. Change management
5. Project management: Monitoring the effectiveness of your Six Sigma program
6. Early Wins: Case studies
7. Transition to Process Management
8. Alignment of Six Sigma with Strategy — Sustaining Success

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## Overview

- Introduction
- Case 1: Large integrated chemical company
- Case 2: Madison City Garage (service)
- Case 3: Healthcare (Red Cross Hospital in the Netherlands)

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*“All quality improvement takes place project by project and in no other way!”*

*J. M. Juran*

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## Six Sigma: Project Based!

- Six Sigma is project based because:
  - Aim directly at quickly accomplishing measurable gains
  - Introduce improvements incrementally in support of specific goals
  - People learn by doing
  - The psychology of quick successes: success creates encouragement and optimism that it is possible to change
  - **Use empirical evidence:** Learn from facts and measurements, what works and discard what doesn't!

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## Case 1: Large Integrated Chemical Manufacturing Company

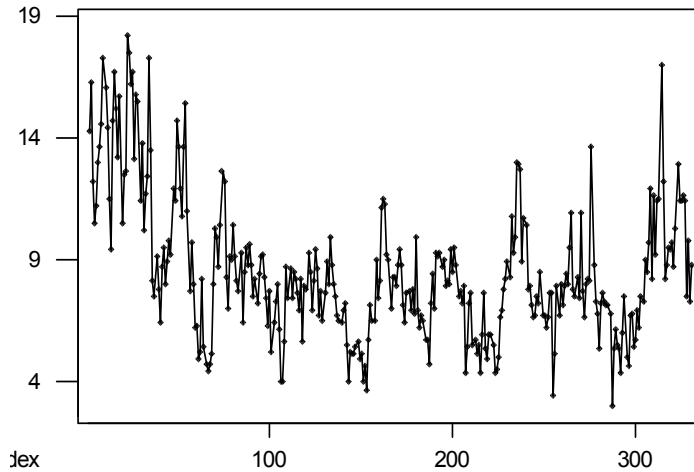
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### Data on Defect Type X Line 1: September 1, XXX1 to July 28, XXX2



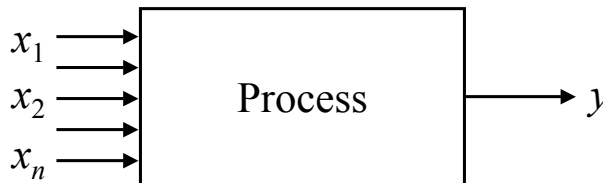
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## Six Sigma



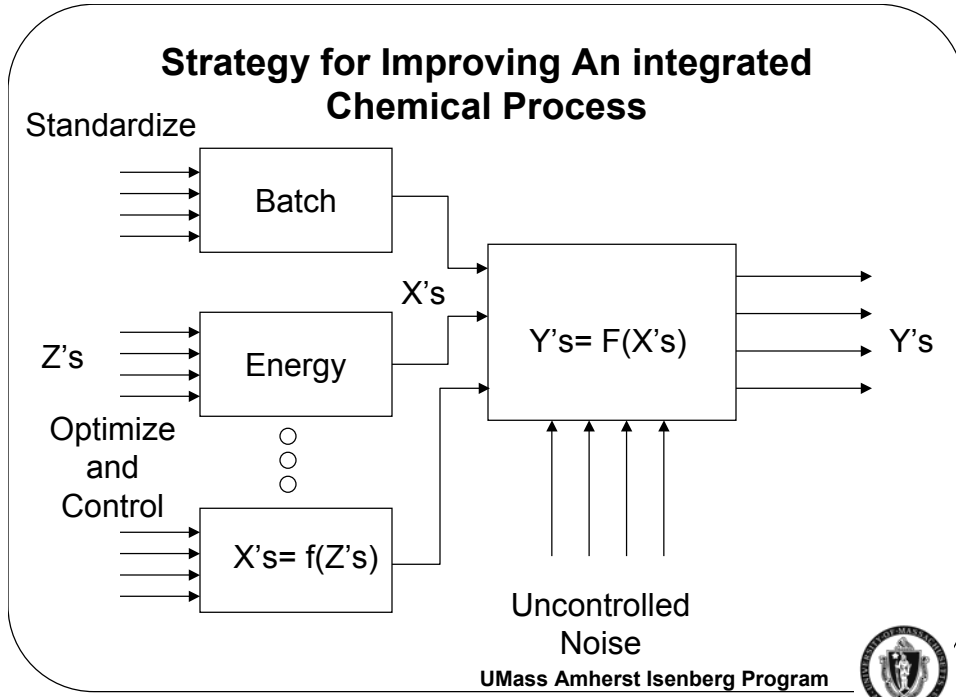
$$y = f(x_1, x_2, \dots, x_n)$$

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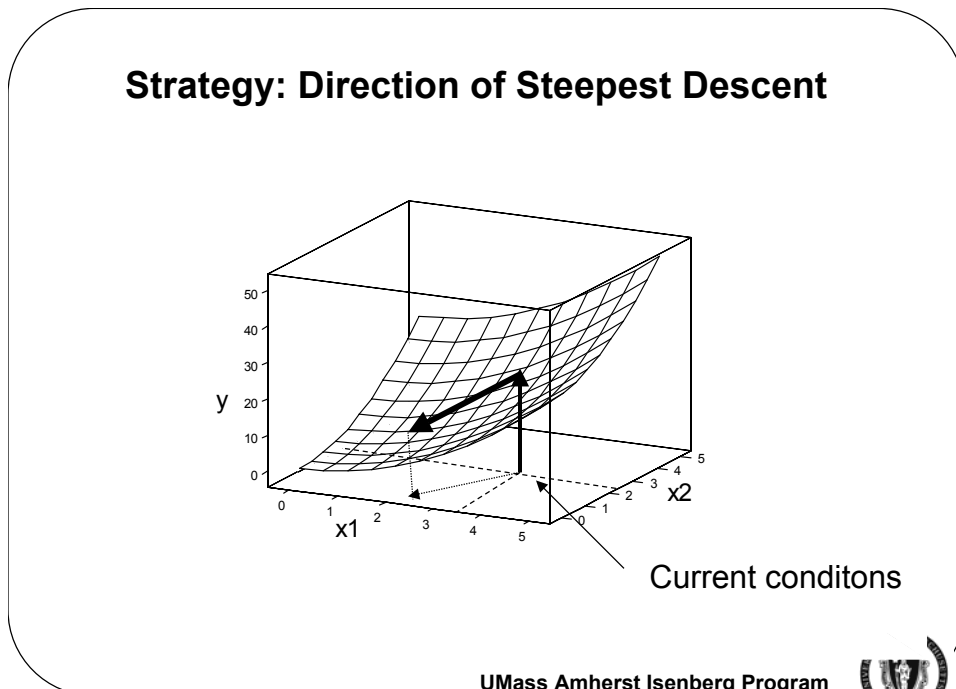
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## Regression- Multivari Study

The regression equation is

$$Y = 1077 - 0.0491 \text{ C/OF} - 0.162 \text{ 34R} - 0.372 \text{ 7L} - 0.104 \text{ RBSL} - 0.375 \text{ MC2} + 0.245 \text{ 3L} - 0.192 \text{ RB} - 0.225 \text{ RCA1} + 0.223 \text{ MC4} - 0.142 \text{ gas6}$$

112 cases used 68 cases contain missing values

Predictor	Coef	SE Coef	T	P	VIF
Constant	1077.1	146.1	7.37	0.000	
C/OF	-0.04909	0.01468	-3.35	0.001	2.1
34R	-0.16239	0.05207	-3.12	0.002	4.9
7L	-0.37169	0.05180	-7.18	0.000	2.4
RBSL	-0.10357	0.03491	-2.97	0.004	3.1
MC2	-0.37514	0.06678	-5.62	0.000	2.7
3L	0.24501	0.04068	6.02	0.000	2.3
RB	-0.19246	0.07007	-2.75	0.007	2.4
RCA1	-0.22460	0.06815	-3.30	0.001	3.1
MC4	0.22344	0.06955	3.21	0.002	6.8
gas6	-0.14171	0.02627	-5.39	0.000	3.7

S = 1.109      R-Sq = 68.1%      R-Sq(adj) = 64.9%

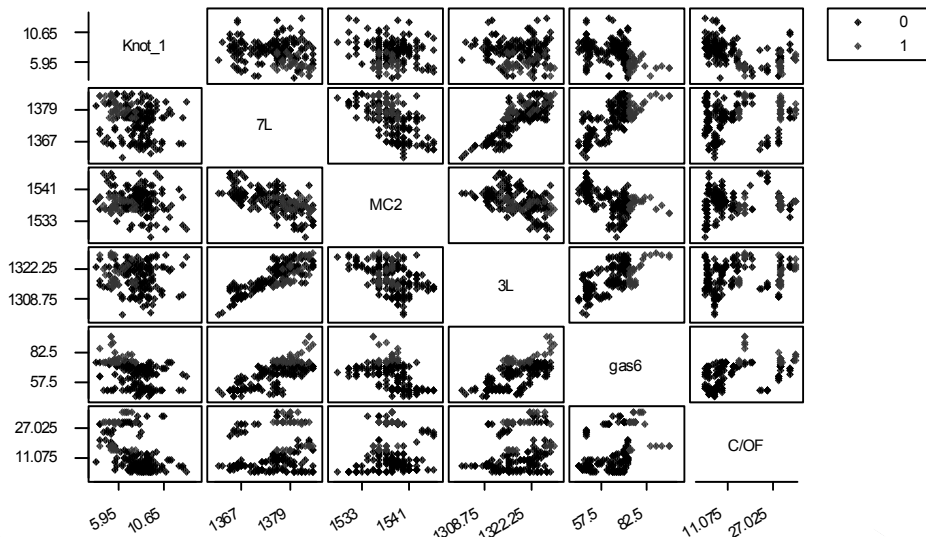
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## Defects Line 1 versus Key Variables (X's)



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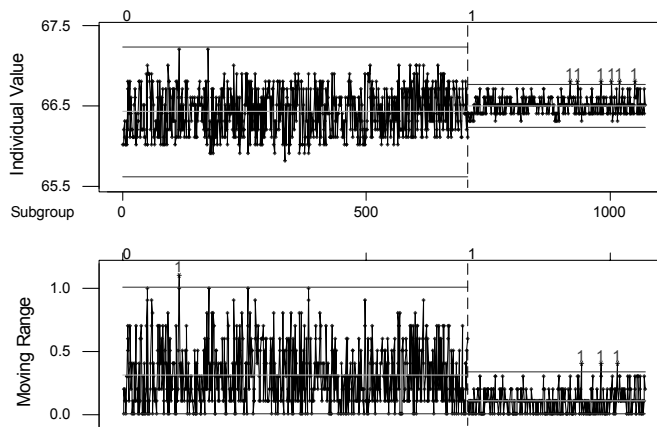


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## Typical Effect of Six Sigma Project: Reducing variability in the input to a Chemical Process

I and MR Chart for POTASH by Before/After



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## *To Make a Long Story Short ...*

- Within 12 month the corporate wide defect rate has been reduced from around 30% to about 15%:  
--Major \$\$\$ savings!
- Q: What was the magic?
- A: (1) Teaching them to use data better so they can better learn about their process. (2) Reduction of process variability
- Major problem: shortage of scrap as feedstock
- Still working on reducing the defect rate and to retain better process control
  - Multivariate control methods
  - Design of Experiments

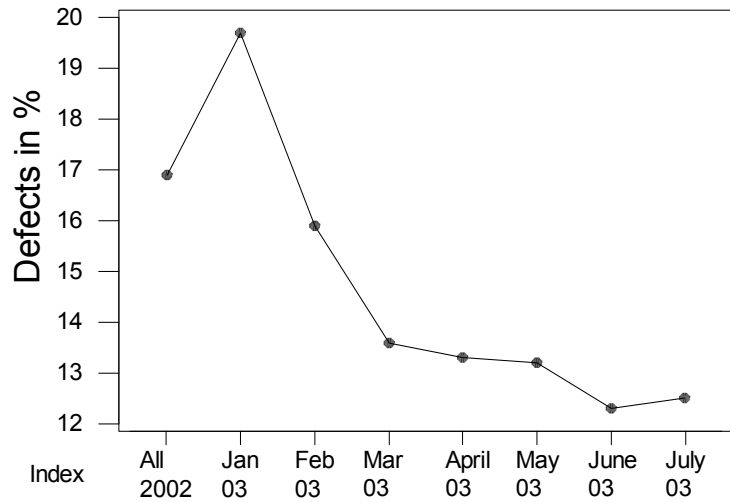
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## Is Six Sigma A Fad?



*Not to the CEO of this company!!!*

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## Case 2: City of Madison's Garage

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## Service Example

### *City of Madison's Garage*

#### Background

Findings from Audit:

- Poor productivity
- Poor management – labor relations

Recommendation:

- Use quality improvement

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## Initial Meeting

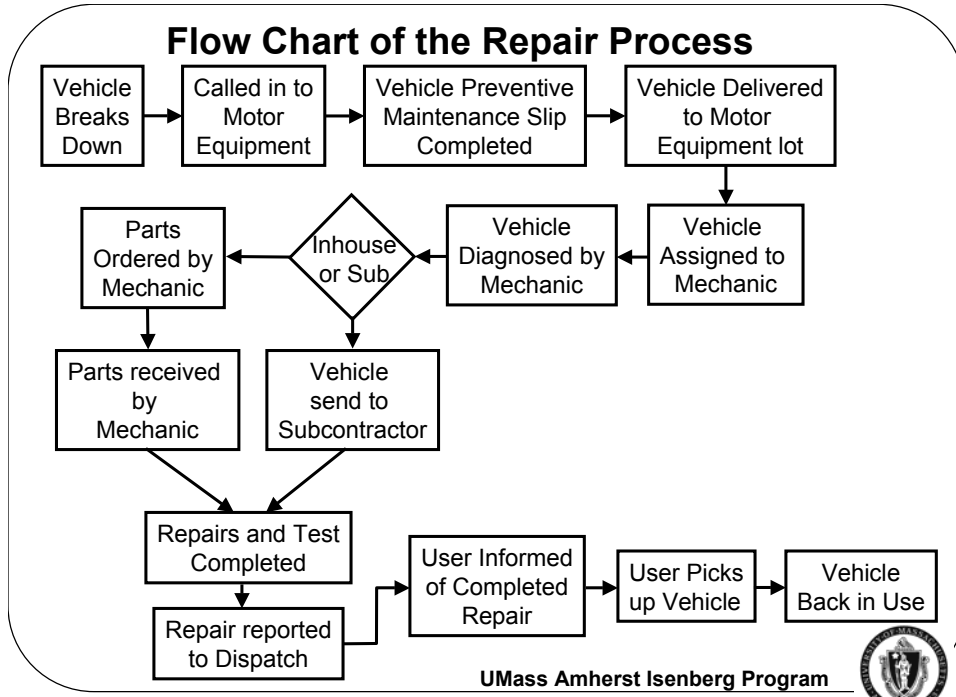
- Mechanics identified “morale” as the biggest problem
- Consultant suggested working on more tangible problems — “morale would then likely take care of itself”
- Training in the fundamental tools of Six Sigma: *Pareto diagram, cause-and-effect diagrams, histograms, check sheets, flow chart, etc.*
- Project: Study down-time

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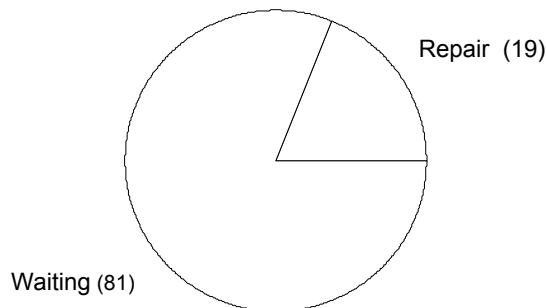
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## Result of Down-time Study

### Pie Chart of Down-Time



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## Conclusions: Down Time Project

- 81% of the time was spent in the parking lot or waiting for parts
- 19% of the time was spent on actual repairs
- Buying cars at lowest bid result in too many different types of cars requiring too many different types of spare parts
- The fleet was aging
- Minor problems became major because of a “if it ain’t broke, don’t fix it” policy

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## Presentation To The Mayor

- With carefully *documented facts* the mechanics persuaded the Mayor to:
  - Streamline the parts inventory:
    - » Reorganize shelf space
    - » Keep statistics on used parts
    - » Don't buy vehicles on lowest bid –look at the total cost
  - Develop a preventative maintenance program

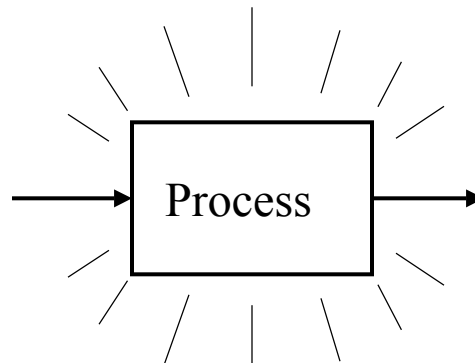
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***Every Process Produces  
Information  
That Can Be Used  
For Improvement***



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**Case 3: Six Sigma in  
Healthcare**

This case is based on the paper:  
***Dutch Experiences Implementing  
Six Sigma In Healthcare***

By

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<sup>2</sup>Institute for Business and Industrial Statistics, University of Amsterdam,  
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Amherst, Amherst, Massachusetts, USA

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## Background Information

- The Red Cross Hospital in Beverwijk is a 384-beds medium size general hospital in the Netherlands employing a staff of 930 with a current budget of \$76 millions.
- In addition to being a general healthcare provider, the Red Cross Hospital also host a national Burn Care Center with 25 beds providing services to all of the Netherlands.
- In 2002 the Red Cross Hospital made 11,632 admissions, performed 8,269 outpatient treatments, and received 190,218 visits to its ambulatories of which 72,500 were first contacts.

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## Previous Quality Efforts

- During the past four years, management and employees have invested significant resources in quality management.
- A quality system has been designed and implemented to support quality assurance.
- At the end of 2000 an external audit resulted in an ISO 9002 certification.
- From that time on we started with quality improvement projects on a regular basis.
- However, in this early phase we proceed without the benefit Six Sigma as a project management system.

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## Pre-Six Sigma Problems

- Initially the hospital's pre- Six Sigma quality improvement approach seemed to work reasonably well.
- But management control was ineffective. Some Problems:
  - Project goals and the hospitals strategic goals were poorly aligned.
  - Lacked a systematic way to determine projects relevance& contribution to long-term strategy
  - Lacked a standardized procedure for evaluating in advance the cost-effectiveness of a project.
  - It was difficult to make project go/no go decisions.
  - Most of the time we started projects because we “felt” they would contribute to the quality of care
  - Were not able to access potential savings of alternative projects.

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## Project Management Issues

- Lacked reliable information about project's status
- Each project had different milestones -- progress could not be evaluated and compared to other projects
- Management navigated in the dark!
- The employees also felt it was a problem that there was no standardised project management approach
- Time was frequently wasted; each time the approach, the project documents, the planning etc. had to be developed from scratch
- Couldn't properly train employees in project management

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***“Ironically we were mostly unaware of this unfortunate situation because of our poor management controls!”***

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## **Introducing Six Sigma**

- The implementation of Six Sigma was initiated with a one-day training session by Professor Ronald Does (IBIS, U of Amsterdam) for our upper management team at the end of 2001.
- The team consists of two directors and the managers of four divisions
- The quality manager completed her BB course, sixteen employees enrolled in in-house Green Belt (GB) training started in September 2002.
- After completing the first wave, a second group of 15 GB's started in February, 2003 and a third group of 13 GB's in September 200

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## Six Sigma Training

- The first group of GB's consisted of 16 employees involved with seven projects.
- One project was terminated during the course because it didn't run well.
- In the "pre Six Sigma" period such a project would have dragged on forever.
- The other six projects were successfully completed in February 2003.
- They are briefly described below

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## A SAMPLE OF RESULTS

- **Shortening the length of stay of COPD patients**
  - Patients with Chronic Obstructive Pulmonary Disease (COPD) were admitted to either the pulmonary or the internal medicine departments due to capacity problems in the former.
  - A statistical analysis showed that the average stay in the pulmonary depart was 2 day shorter than the internal medicine department. This difference was not due to patient characteristics or physicians.
  - Presumably, the pulmonary department was better at treating pulmonary patients!
  - Remedy: rebalanced the bed capacity so all COPD patients were admitted by the pulmonary department.
  - Result: admission days were saved and more admissions were possible. The annual savings was estimated to be \$40,000.

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## Improved checks on invoices from temp agencies

- Problem: A considerable number of invoices from temp agencies were incorrect.
- The errors were consistently in the temp agencies favor and cost us a lot of money to fix
- Remedy: Designed and implemented an improved declaration form required by all agencies that contracted with us.
- Results: The annual savings was estimated to \$75,000. Further we experienced a one-time saving of \$35,000 due to a refund.

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## Revision of the terms of payment

- Problem: An analysis revealed that there were a large number of different terms of payment for our suppliers.
- The root cause was that we lacked a uniform payment policy.
- Remedy: Established a standard policy and implemented a number of improvements
- Results: The total savings so far is \$35,000 and continues to increase

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## Reducing the number of mistakes in invoices

- Problem: The Red Cross hospital issues 250,000 invoices per year to our patients and their insurance companies. It appeared that 9% of our invoices are refused and sent back due to our mistakes.
- Given the large number of invoices (and mistakes) the true lovers of statistics had their finest hours during this project. More than a hundred percentage point of improvement could be identified! A large number of them are still in process.
- Results: We estimate that the savings so far exceeds \$140,000.

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## Rooming-in in the children's department

- Observation: When parents are permitted to stay with their admitted children during the night, the length of the stay decreased.
- Measures were implemented to facilitate the presence of parents.
- The insurance company agreed to pay 80% of the total cost.
- The significant decrease in the number of admission days, allowed us to admit more children and boost our budget.
- The total annual savings is estimated to \$30,000.

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## Reducing the number of patients with intravenous antibiotics

- Intravenous antibiotics are more expensive than oral medication.
- Observation: A number of patients using intravenous antibiotics could be transferred earlier to oral medication.
- An analysis showed that the internal medicine department, using a protocol (standard operating procedure, SOP) for switching was much better than the surgical department in managing this process.
- Remedy: The internal medicine department SOP was adopted throughout the hospital.
- The total annual savings were estimated to be \$25,000.

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## The Hospital Administrator's Conclusion

*“Six Sigma is not just an idea, or another trick to organise improvement projects. It is a set of managerial instruments, well defined and well tuned to enhance the results of improvement projects with the ultimate goal of maximising the performance of the entire organisation.”*

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## Again: Why Transformation Efforts Fail!

Research\* show that eight common errors in managing change, two of which are:

1. Not establishing a sense of urgency
2. Not systematically planning for and creating **short term wins**

\*Kotter, J. P. (1995), "Leading Change,"  
*Harvard Business Review*, March-April

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## Again: An Effective Strategy\*

1. Map out how the organization should look after a major change
2. Use a series of rapid cycle projects that provide the employees opportunities to develop their skills in managing change
3. As they learn to change, mount increasingly larger scale, more strategic efforts and move upstream
4. Periodically review and modify the overall strategic plan

***Benefit: The projects pay for the program***

\*Schaffer, R. H. and Thomson, H. A. (1992), "Successful Change Programs Begin with Results", *Harvard Business*

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## The Focus of Six Sigma

- Accelerating fast breakthrough performance
- Significant financial results in 4-8 months
- The program pays for itself
- Corrective feedback: Guided by empirical evidence -- Learn from facts and measurements, what works and discard what doesn't!
- People learn by doing
- The psychology of quick successes: success creates encouragement and optimism
- Ensuring Six Sigma is an extension of the Corporate culture, not the program of the month
- Results first, culture change will follow!

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## Again: The Reasons for Success

- The Success of Six Sigma critically hinges on:
  - Strong leadership
  - Initial focus on operations
  - Aggressive project selection
  - Training the right people
  - Firm project management

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Kotter, J. P. (1995), "Leading Change," *Harvard Business Review*, March-April

Schaffer, R. H. and Thomson, H. A. (1992), "Successful Change Programs Begin with Results", *Harvard Business Review*, January-February.

Snee, R. D. and Hoerl, R. W. (2002), *Leading Six Sigma*, Prentice Hall

Jaap van den Heuvel, Ronald J.M.M. Does and Søren Bisgaard (2004), "Dutch Experiences Implementing Six Sigma In Healthcare", Unpublished manuscript.

