

Successful Implementation of Six Sigma

A Champion Overview

Section 7

Transition to Process Management & DFSS

Ljubljana, Slovenia

April 6, 2004

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Why we need Six Sigma: Entropy and the Second Law of Thermodynamics

“As entropy increases, the universe, and all closed systems in the universe, tend naturally to deteriorate and lose their distinctiveness, to move from the least to the most probably state, from a state of organization and differentiation in which distinction and forms exist, to a state of chaos and sameness”

N. Wiener (1950, p. 12)

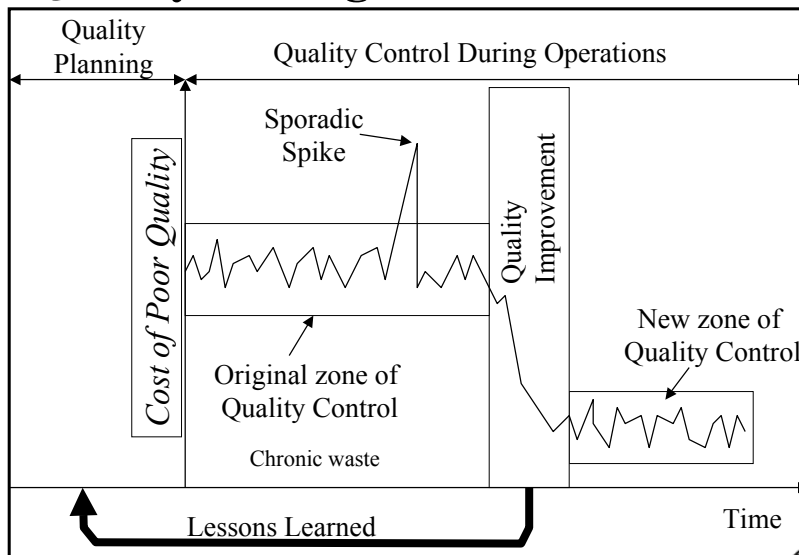
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Quality Management in a Nutshell



Adapted from Juran

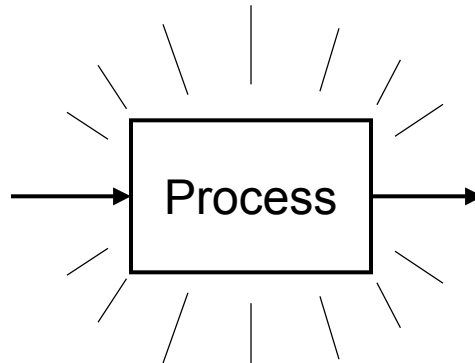
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**Every Process Produces
Information
That Can Be Used
For Improvement**



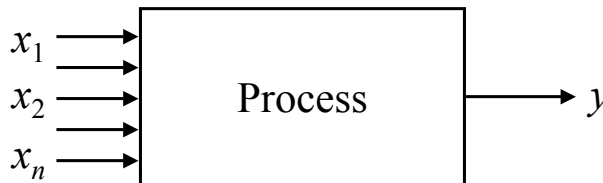
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Six Sigma



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

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Universal Applicability

- Methods and ideas are universally applicable:
 - Manufacturing
 - Service and hospitality industry
 - Banking and financial services
 - Business support processes
 - Software and hardware
 - Etc.

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Typical Applications: GE Examples

- Approving credit card application process
- Lending money to corporate customers
- Installation of turbines
- Servicing aircraft engines
- Overhauling locomotives
- Answering service call for appliances
- Underwrite insurance policies
- Developing software for a new CAT product

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Business Processes*

Business Processes = All non-manufacturing operations and services

Examples:

- Billing
- Invoicing
- Production scheduling
- Forecasting and inventory control
- Purchasing
- Sales
- After sales service
- Web site development
- Finance

*In Six Sigma terminology “Business Processes” is the preferred term for what may otherwise be called “service processes”

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Examples of Services

- Restaurants, hotels, travel agents, airlines, busses, rental cars
- Healthcare, hospitals, clinics, pharmacies, nursing homes, day care
- Banks, insurance companies, stock brokers, mortgage providers, accounting services
- Sales, wholesale, retail, after sales services, catalog operations, home shopping networks, internet sales organizations (Amazon.com)
- Communication, telephone, mail, package delivery, internet providers
- Power, electricity, oil, gas, gasoline
- Education, government, private, consulting
- News services, radio, print, TV, internet news services
- Cleaning, house cleaning, dry cleaning,

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A Few Characteristics of Business Processes

- High volume of transactions
- Labor intensive and costly
- Transactions not well defined
- Processes usually not planned or designed and have frequently never been subjected to rigorous study
- Pivotal to the entire organization
- A large number of ways to make mistakes and high frequency of errors and rework
- *Errors and delays have serious downstream costs consequences*

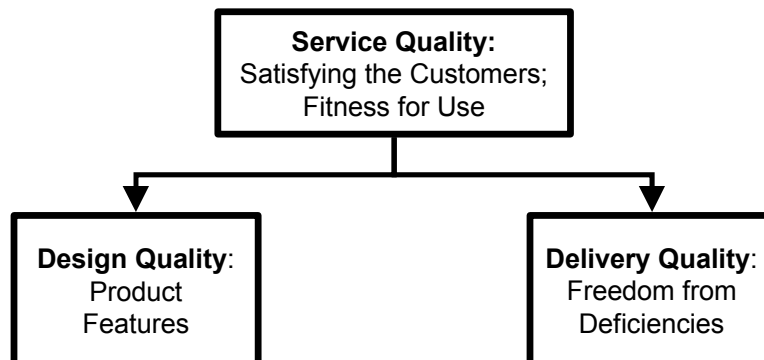
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Service Quality Defined



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Service Quality

- Fitness for use: A service is satisfactory only if it responds to the needs of the client in price, delivery time, and suitable for the client's purpose
 - Quality features:
 - timeliness
 - courtesy
 - consistency
 - accuracy
- Sub-features:
- psychological (beauty, comfort, ...)
 - time oriented
 - Ethical (honesty, principled, ...)

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Service Is A Process!

- Who are the customers: Make a list and categorize into vital few and useful many
- What constitutes quality to the customers (Quality, cost, delivery)
- Study the current situation; collect data on customers perception of the current level of quality
- Flow chart the process
- Collect data on the process; make Pareto analysis and control charts
- Propose solutions, develop new systems, standard operating procedures, forms, etc.
- Implement solution, educate the workforce
- Monitor the performance, check and analyze the data
- Propose further improvements

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Elements of A Service Quality Program

- Design and specification of services
- Establish control points in the process
- Process control: Monitoring and adjustments
- Identification and correction of sporadic errors
- Collection of statistical data
- Correction process
- Feedback
- Training in what the job is
- Quality improvement: Training, tools, and organizational arrangements for identifying chronic problems, finding their cause and eliminate them

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Components of Successful Service Quality Programs

- 1 Service performance standards
- 2 A system to measure conformance to those standards
- 3 Analytical procedures to determine causes of deviations from standards
- 4 A corrective action program to eliminate the causes for non-conformance
- 5 A program for making improvements
- 6 A control function to ensure that the program for service quality improvement is ongoing (new product development)
- 7 Training is what the service process is

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Process Cycle Time

- Cycle time is highly (negatively) correlated with service quality and customer satisfaction
- Long cycle time is an indication of quality problems
- Service processes should be flowcharted and cycle time and individual elements of the cycle time should be studied

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Product or Process Dissection

- Many products are produced by a process that has a series of operations
- If a product has a defect it is not always known at which step the defect originated
- In those cases it might be possible to make measurements and inspections at intermediate points to see where the defects occur
- Use flowchart and the principle of successive divisions in 1/2's

Source: Juran and Gryna (1994)

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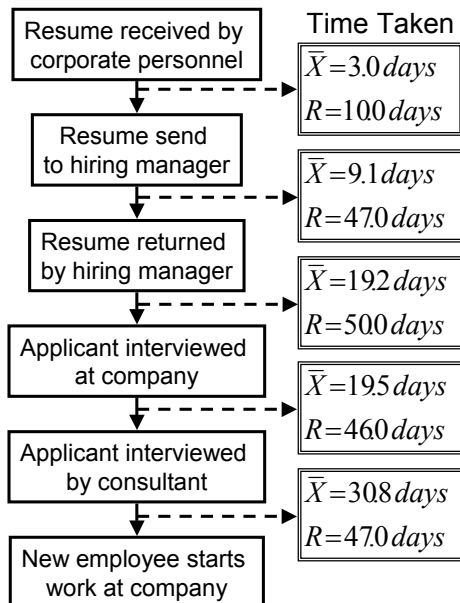
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A Champion Overview

Ljubljana, April 6, 2004

Example: Dissection of a hiring process*



Sample: 24 salaried employees hired from February 24 through April 2.

Management	3
Engineering	6
Administrave	6
Marketing	3
Sales	6
Total	24

Allsteps
 $\bar{X} = 79.6$ days (2.6 months)
 $R = 1320$ days

*Adapted from Jurgen A. Camp, *Lean Six Sigma*, 2011, p. 211

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Improving Bank Services

- A mortgage bank found after studying the data from the past year that to obtain a home owner's loan took on average 24 days
- The process was flow charted and data for a two month period were collected.
- The time it took to process the loans for each process step was plotted and the major sources of delay identified
- Through several meeting with all people involved new systems were developed to reduce the flow time
- After the redesign of the process, new standard operating procedures, etc. the average time was reduced to 4 days

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Service and IT

- Service organizations increasingly use computers in the service providing process
- This provides data that can be used to study and improve the service delivery process
 - Arrival time (when, patterns, staffing schedule)
 - Waiting time
 - Duration of service
 - Types of service rendered (Pareto analysis)
 - Customer loyalty
- Computer can guide the service provider through standard operating procedures

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Summary

- Service is a growing proportion of our economy; if inefficient the service industry is a burden for us all
- Service is no longer only local, but frequently an export “product” (banking, insurance,...)
- Service quality is a very important competitive parameter, often more important than price
- Standard operating procedures and training are essential to improving service
- IT provides many new opportunities for providing new and better services

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DFSS: Design for Six Sigma

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Motivation for Design for Six Sigma (DFSS)

- Traditional Six Sigma (DMAIC) projects aim at improving existing products, processes and services
- Working only on existing products processes and services is a dangerous strategy:
 - **Problem 1:** In a competitive economy product lifecycles are short and continue to become shorter– new technologies, products, processes and services are threatening our current offerings => innovation and renewal is an imperative
 - **Problem 2:** If the product development department continues to develop new products and processes with problems baked into the design and with insufficient regard for the customers, we will need to continue to weed out problems as they are being created

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Quality and Innovation

- *Quality is not just about quality!*
- It's about innovation!
 - Product innovation, process innovation, radical and incremental innovation!
- Radical innovations: entirely new products, processes and services
 - Example: the light bulb, wireless communication
- Incremental innovations: the adaptation, refinement and enhancement of existing products, processes and services
 - Example: next generation of a micro processes, next years automobile model,...
- Modern society needs innovation to stay competitive, growth and prosper!

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Innovation

- Joseph Schumpeter:
 - The fundamental impulse that sets and keeps the economic engine in motion comes from the innovation of new products, new methods of production or transportation, new markets, new forms of industrial organization
 - The primary reason for profits is as a premium for the risk of innovation

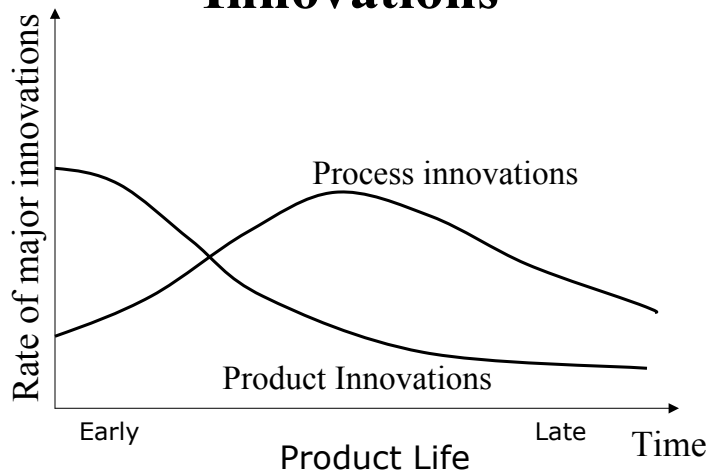
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Changing Character of Innovations



Adapted from Abernathy and Utterback (1978)

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What is Design for Six Sigma (DFSS)?

- The design of new processes, products and services from scratch:
 - Where a process, product or service does not previously exist
 - Where the existing process, product or service is not capable of being improved
- Focuses on systematically gathering the voice of the customer, prioritizing requirements, and building those requirements into new, processes, products or service
 - Identifies targeted customer requirements
- Focuses on *growth of the business*
- Not just for engineering – for all business areas

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Coordination of 6 σ Activities

- **Quality Control:** Coordination for *control* of operations delegated to line and staff functions through formal procedures. Feedback loop to upper management through audits of execution
- **Six Sigma Quality Improvement (DMAIC):** Coordination of creating change through use of project teams and other organizational forms
- **Design for Six Sigma (DFSS):** Planning and developing new products and services (features) to serve the future needs of customers

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The DFSS Process

1. Define and establish the project
2. Identify the customers
3. Discover the customers' needs and expectations
4. Develop the product, process or service
5. Verify that the product, process or service in fact meet or exceed the customers' needs and expectations
6. Develop a process for the delivery of the product or service
7. Develop the controls and transfer to operations

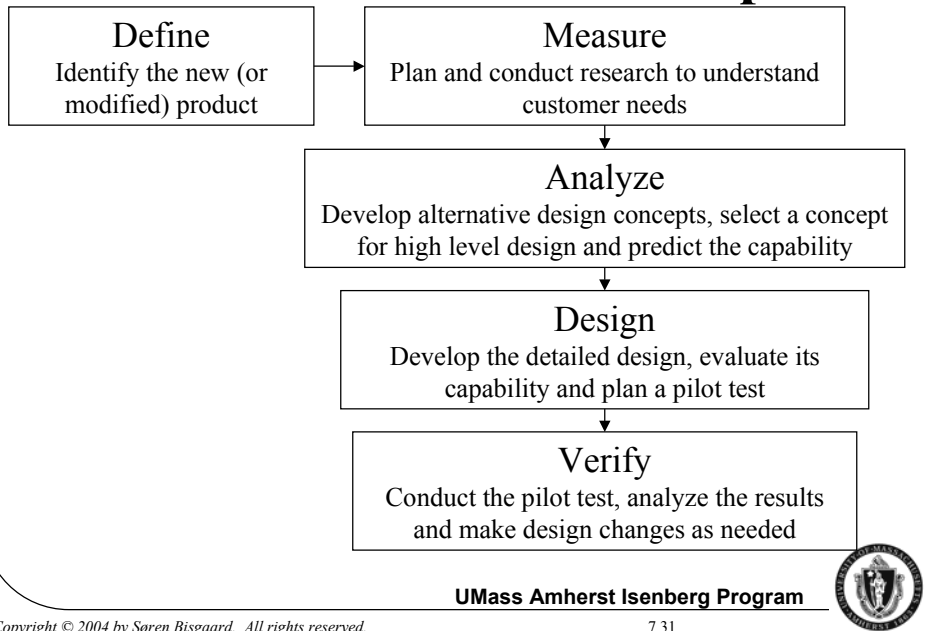
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The DMADV Road Map



DFSS

- DFSS is a structured process for determining customers' needs and expectations and developing products, processes and services that meet or exceed those needs and expectations
- Like Six Sigma DMAIC, DFSS is project based
- DFSS projects follow road maps
- DFSS is not just for engineering and product development but for the innovation in general and for the development of any process, service or product
- DFSS is a tool for achieving the overall strategic goals

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Symptoms of Lack of DFSS

- Lack of competitiveness of products, processes and services
- Outdated products, processes and services lacking competitive features
- High level of deficiencies
- Reduced sales income
- Large cost-of-poor-quality due to chronic quality problems (rework, scrap, waste,...)

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Management of DFSS

- Getting DFSS off to a successful start will require new organization structures
- It is particularly important that organizational structures are developed for managing
 - Alignment with the overall strategy
 - Selecting projects
 - Allocate resources
 - Reviewing customer needs and expectations
 - Monitor progress
 - Audit the projects

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Design for Six Sigma (DFSS): Organizational Structures for Evolving New Products

- New products (and processes) committee that maintains a business surveillance over new developments
- A structured procedure for shepherding the new developments through the various functional departments
- Product and process development departments (R&D) that carry out the technological work

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Comments

- The established organizational structure favors continued quality improvement
- Clear responsibility to technological improvements; part of the business plan
- Resources are provided (labs, research personnel,...)
- This, however, does not necessarily mean that new products are developed at a sufficiently high rate to satisfy the customers, meet the challenges of the market place and prevent loss of market and technological leadership

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Summary

- If the product development department develop new products and processes with problems baked into the design and with disregard for the customers, we will need to continue to weed out problems as they are being created
- In a competitive economy, product lifecycles are short –innovation and renewal is an imperative
- Modern society needs innovation to stay competitive, growth and prosper!
- DFSS offers a process for the development of new products and services within the Six Sigma framework

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