Lean and Six Sigma:

Partners for Quality and Productivity

Roots and Development, Comparison of characteristics

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Faith stimulated productivity …

Many contributors: *TQM → Lean-Thinking (Lean-Management, -Production, -Administration, …)*
Integrate the company's environment into a comprehensive quality management concept with general recommendations, tailored methods and specific tools

Feigenbaum, Imai, Smith: *TQC, Kaizen, Six Sigma*
Customer requirements determine the quality, waste and problems are levers for improvement, employees are responsible for their contribution

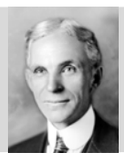


Deming, Ishikawa: *Quality Management (QM), Quality Circle, CWQC*
Recommendations for the Management to improve the Quality; Confidence, that employees are experts of their work and should be involved in improvements



Shewhart: *Statistical Process Control (SPC)*
Variation of the output results from variation of the process; control the process to improve the output quality

Taylor, Ford: *Quality by Control (QC)*
Analyze and synthesize processes to improve efficiency and productivity, at the expense of the output quality

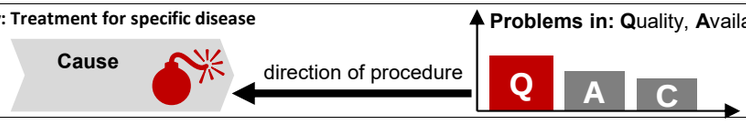
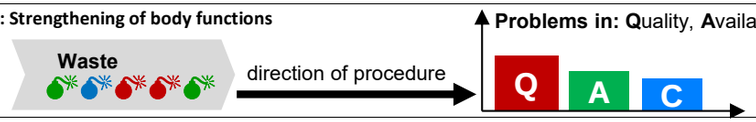



Calvin: *Waste of time and luxury is sinful (Calvinism)*
People were diligent, became more efficient and invested profits in new technologies, machines and methods

picture credits: see last slide

… and increased productivity required a management of quality

Comparison of Six Sigma with Lean-Thinking

	Six Sigma	Lean-Thinking (Lean-Management, Lean-Production, Lean-Administration; ...)
Assumption	Unwanted variation of properties of the input (xi) and process (xP) leads to variation of properties of the output (Y) Reduce unwanted variation of input/ process to improve the output	Maximal plant utilization, push-principle and waste lead to a discontinuous value-stream Problems are opportunities and employees are the experts to solve problems in their processes
Objective & Potentials	**For selected products/ services:** **Reduce costs by:** Increase **Q**uality and **A**vailability, decrease **C**onsumption **Increase customer satisfaction by:** Identification and fulfillment of customer requirements **Potential:** Costs of unfulfilled customer requirements and cost drivers	**For the entire company:** **Reduce costs:** Efficient (waste-free), stable, harmonized and standardized processes **Increase customer satisfaction by:** Achieve promised **Q**uality & **A**vailability of products/ services **Potential:** Costs of unfulfilled requirements, costs of cycle times, stocks, inventories and waste
Focus	**Entire organisation:** program to improve important (semi-finished) products/services **Project-team:** solve the identified problems of products/ services	**Entire organisation:** optimization of value-stream of processes in administration, production, service and support (...) **Work-unit:** continuous improvement in regular meeting employee teams (CIP-teams)
Approach	**Employees, Management & Customer:** identify problems in products/ services (continuous) **Management:** prioritize and select problems for Six Sigma projects (periodically) **Green/ Black Belt & Project-Team:** solve selected problem (temporary)	**Management:** identify appropriate methods for the company (once) **Experts:** implement and adapt methods (periodically) **Employees/ CIP-Teams:** eliminate waste, standardize process (continuously)
Principles	- identify, collect, prioritize and select suitable problems for projects - qualify Green-/ Black-Belts, members of project-team and a sponsor for selected project - implement the project - calculate financial benefit of project	- identify and prioritize customer requirements (:= value) - identify and optimize value-stream (chain of value-adding process-steps) - implement pull-principle and act order-related (JIT) - implement continuous-improvement-process (CIP, KAIZEN)
Methods & Tools	**Generic problem solving approach (DMAIC) with e.g.:** **Rational analyses of:** customer requirements, problem-cause relationships, root-causes **Statistical analyses of:** hypothesis on relationships (x-Y) and differences (Y1-Y2) **Optimization of specific parameters:** Design of Experiments (DoE) **Planning of processes:** process-simulation, DFSS	**Set of specific methods and recommended actions for a wide range of application:** **For Lean-Management:** Key-Performance-Indicator-System, Policy Deployment, Visible Management, Simultaneous Engineering, Decentral End-to-End Process Responsibility, Improvement-Teams, Incentives and Salary System **For Lean-Production, Service & Administration:** Value-Stream-Analysis and -Design, One-Piece-Flow, Kanban, Overall Equipment Effectiveness (OEE), Single Minute Exchange of Die (SMED), Total Productive Maintenance (TPM), 5S, Elimination of Waste and Standardization
Character	**Medical Therapy: Treatment for specific disease** 	**Fitness Program: Strengthening of body functions** 
Advantages & Disadvantages	+ financial benefits of projects calculable + identification of root causes for even complex problems - optimization of sub-processes without considering the overall context - the majority of employees are not involved in improvements	+ involvement of a large part of the employees - cultural change of company necessary + integrated optimization of all company divisions - decisions often based on perception and not on data

Six Sigma goes deep, and Lean goes wide to reduce costs and increase customer satisfaction

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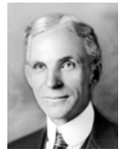

Henry Ford

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