Introduction to Quality Management

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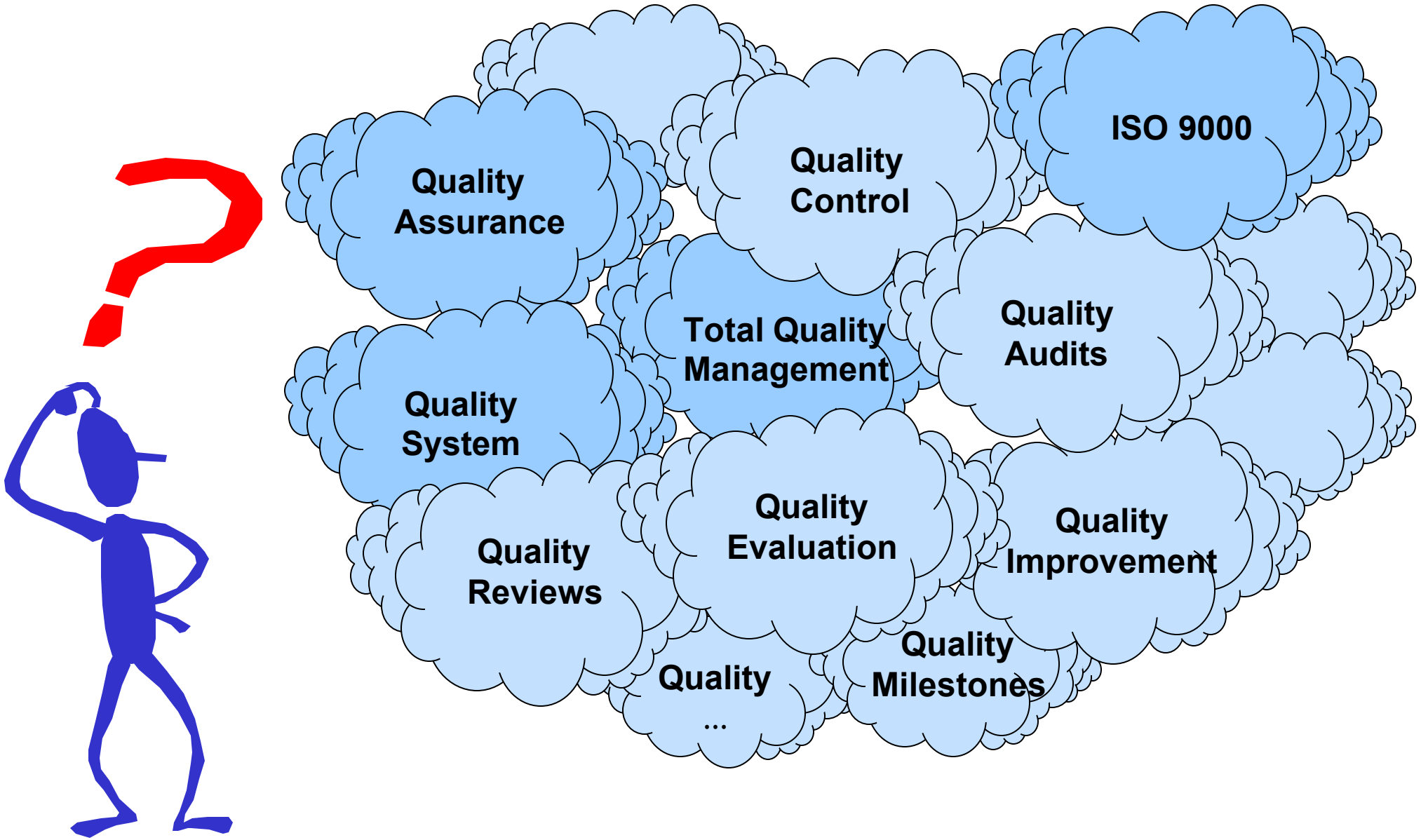
Curriculum Vitae

- Born 1955, married, two children.
- University education in Mechanical Engineering with emphasis on Production Management.
- Graduated from the University of Dortmund in 1980 with a masters degree in Mechanical Engineering (Dipl.-Ing.).
- Received a PhD (Dr.-Ing.) in 1985 based on the work at the Institute for Industrial Engineering in Dortmund.
- The following 11 years head of the departments of Industrial Engineering and Quality within two german locations of the Philips Company.
- Since 1997 back to applied research as the vice director of the Chair of Quality (Prof. Dr.-Ing. H.-A. Crostack) at the University of Dortmund.

Chair of Quality

- Located at the University of Dortmund, Faculty of Mechanical Engineering.
- Headed by Prof. Dr.-Ing. H.-A. Crostack.
- More than 15 years of research and education in all aspects of Quality Engineering and Management.
- Scope of activities:
  - destructive and non-destructive testing
  - quality management
  - information systems related to quality engineering/management
- Colaboration with the RIF e.V. in education and research (regulated by a co-operation agreement).

(RIF e.V. is a registered non-profit society, founded in 1990 with the aim of enforcing applied research and future development in the field of Computer Integration and Automation at the various stages of a product's life cycle)



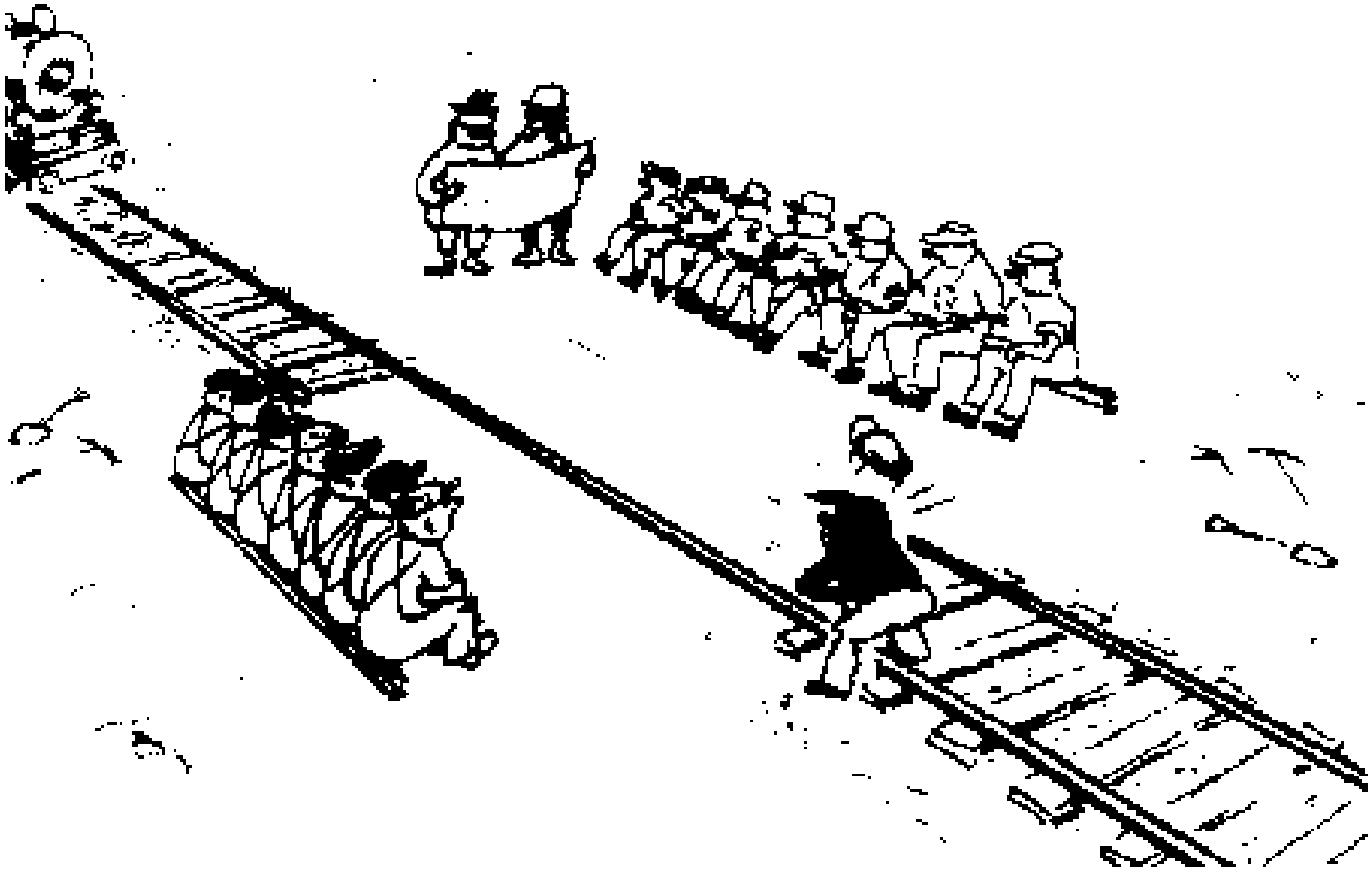
Quality - What?!?

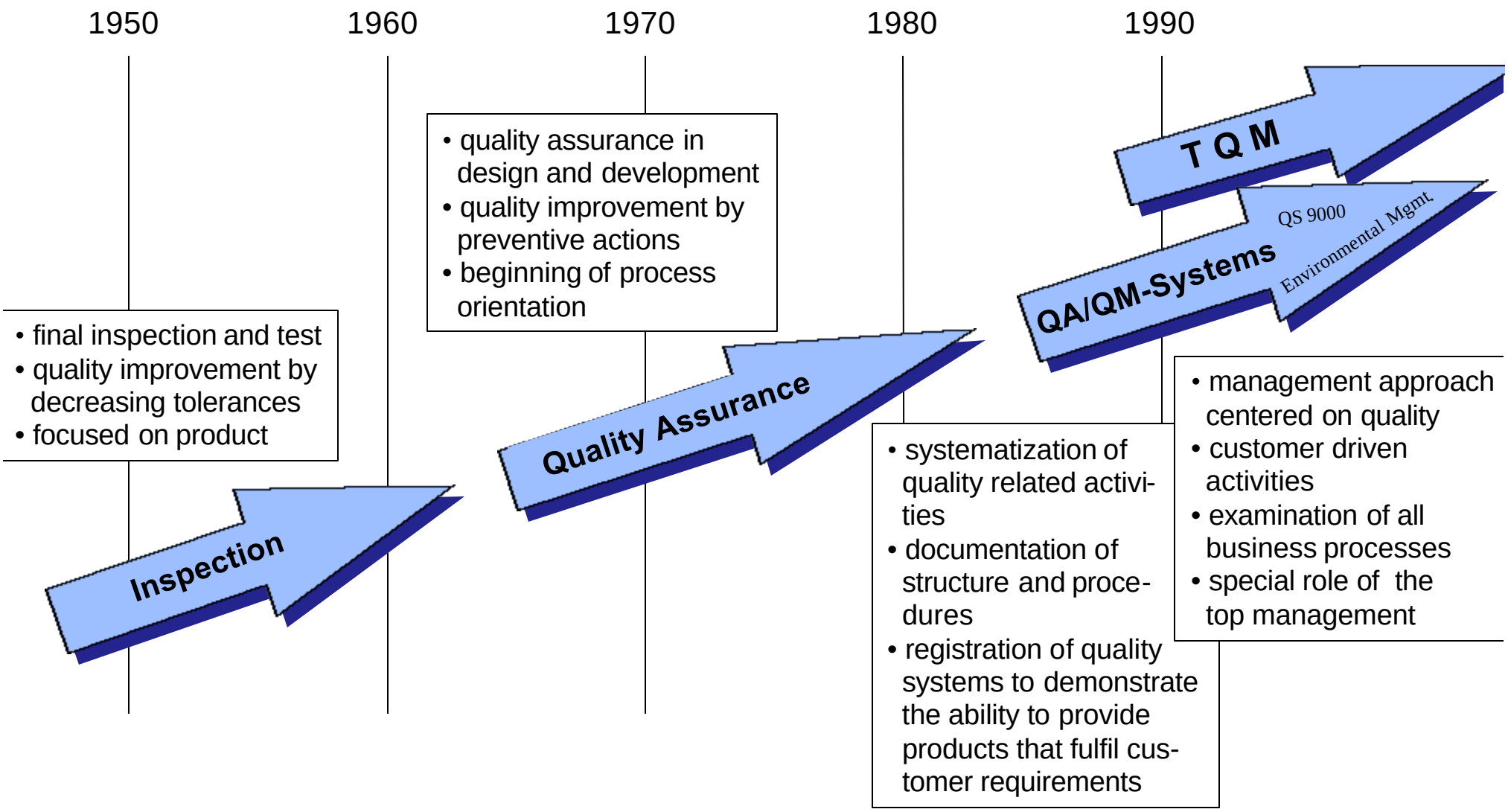
This presentation will show you

- a brief survey of the history of Quality Management
- the backgrounds of „modern“ Quality Management
- some of Quality Management Terminology
- the contents of different Quality Functions
- the correlations between Product Life Cycle Models and Quality Management
- examples of Quality Methods and Tools and where to apply
- how to plan complex Development Projects by means of Project Management and Milestone Planning

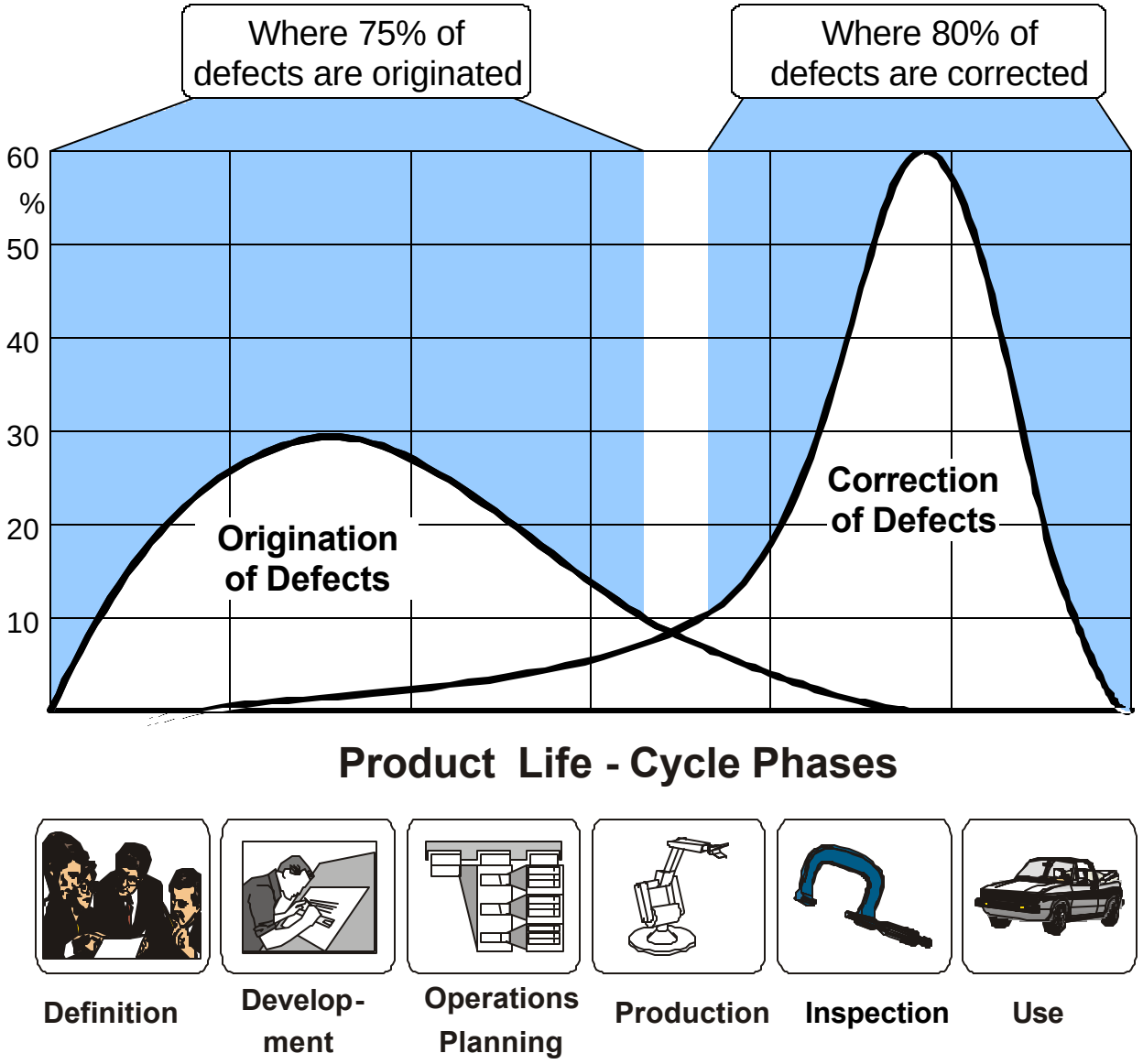
Quality Management is ....

... to prevent you from things happening like this ☺





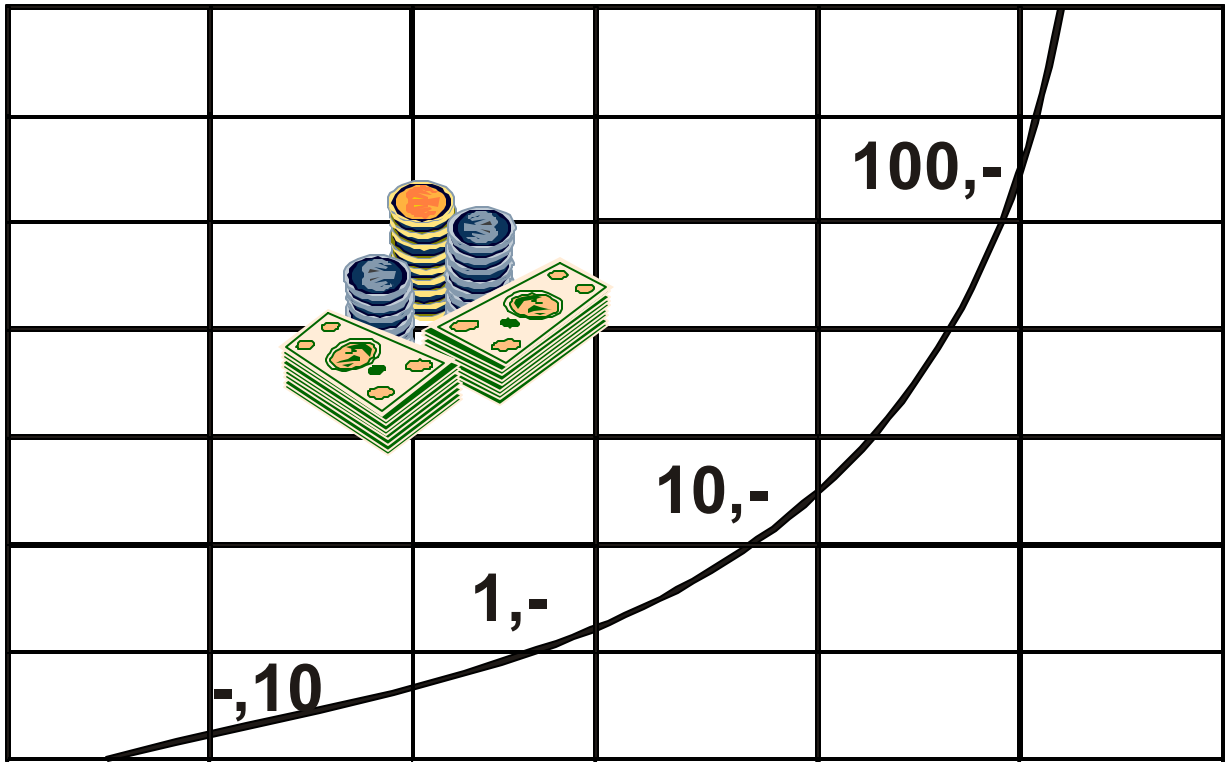
History of Quality Mangement



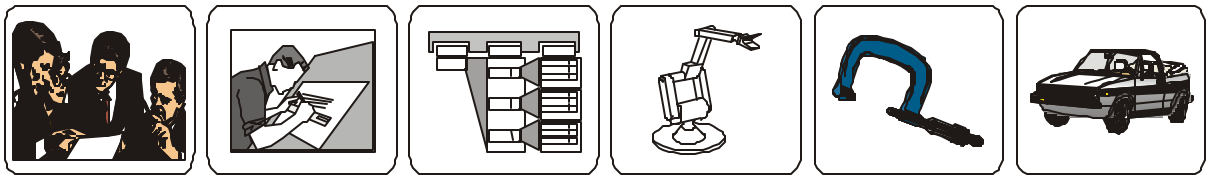
[Source: Jahn]

„Jahn Graph“

Costs per Failure



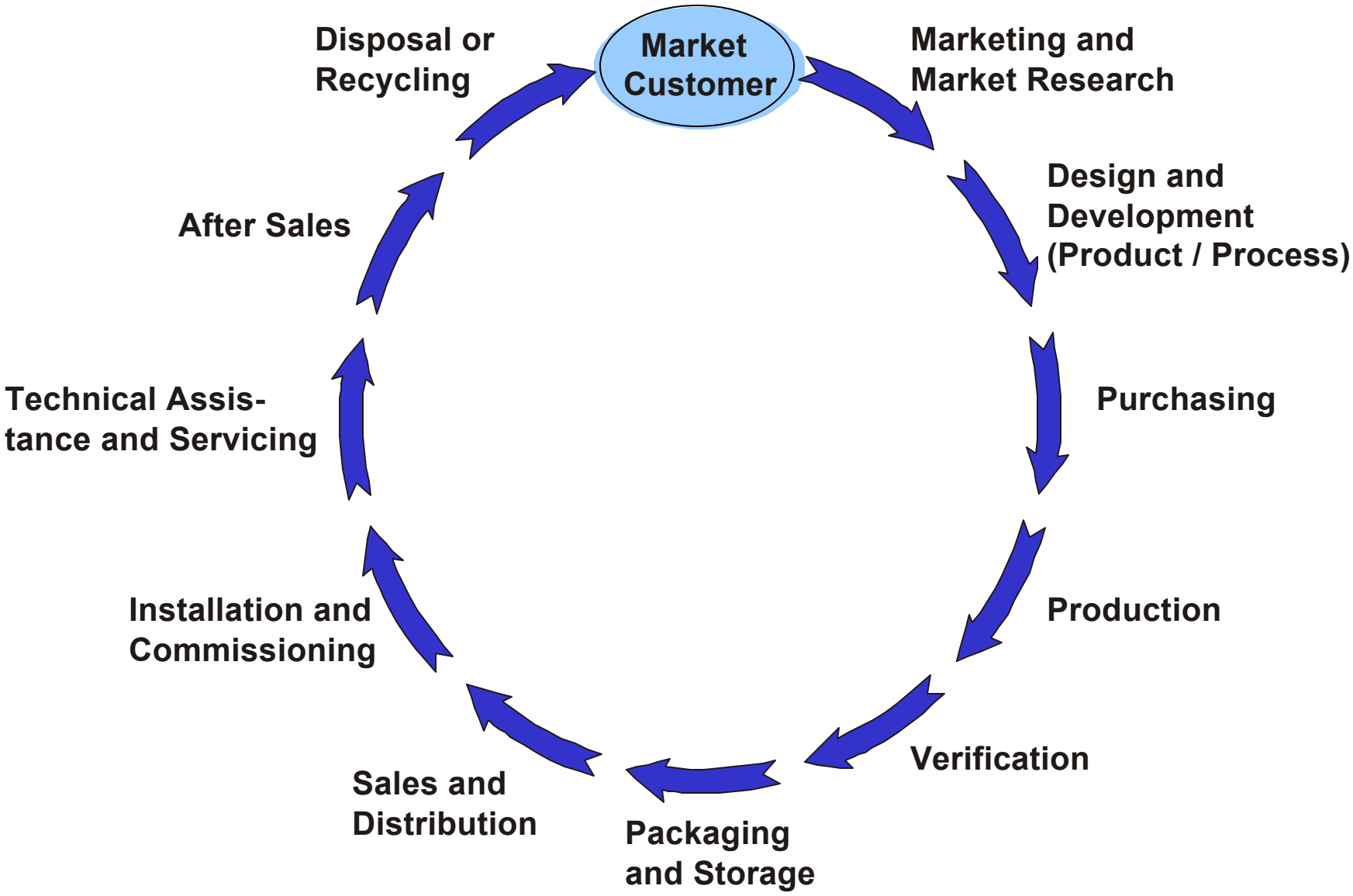
Product Life - Cycle Phases



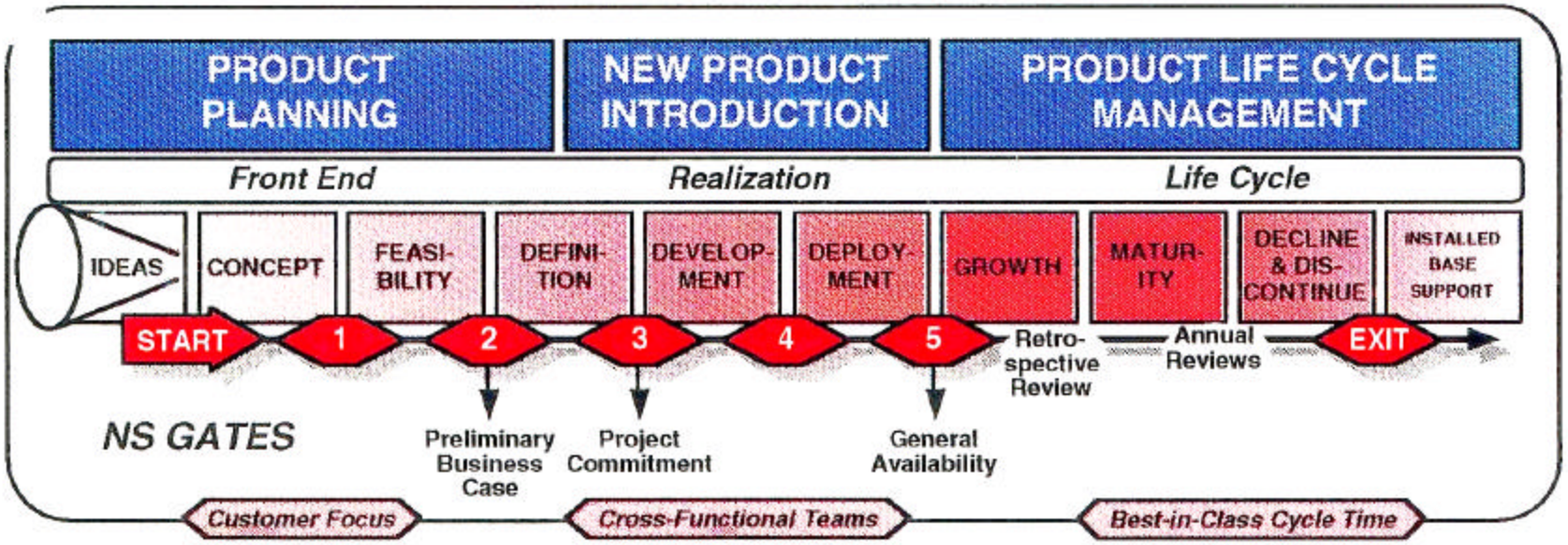
Definition | Develop-ment | Operations Planning | Production | Inspection | Use

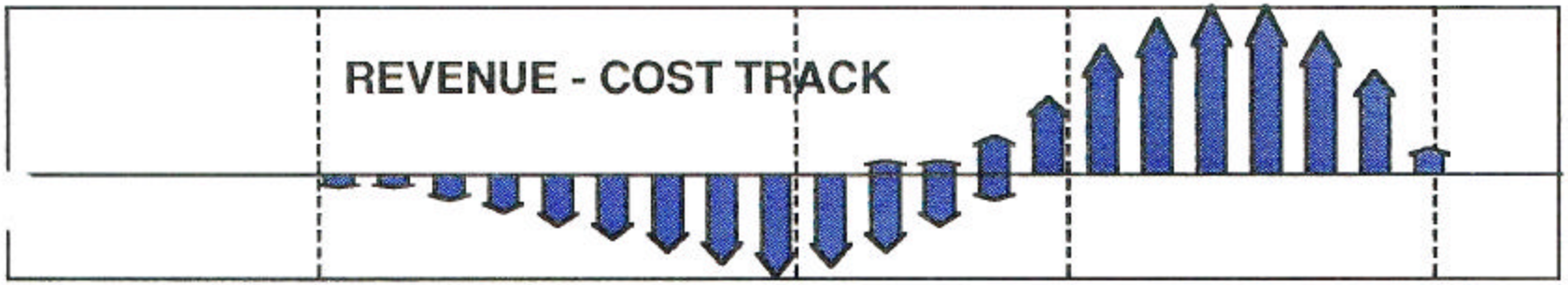
[Source: Daimler Benz]

Rule of Ten



Quality Loop Model (ISO 9004:1994)

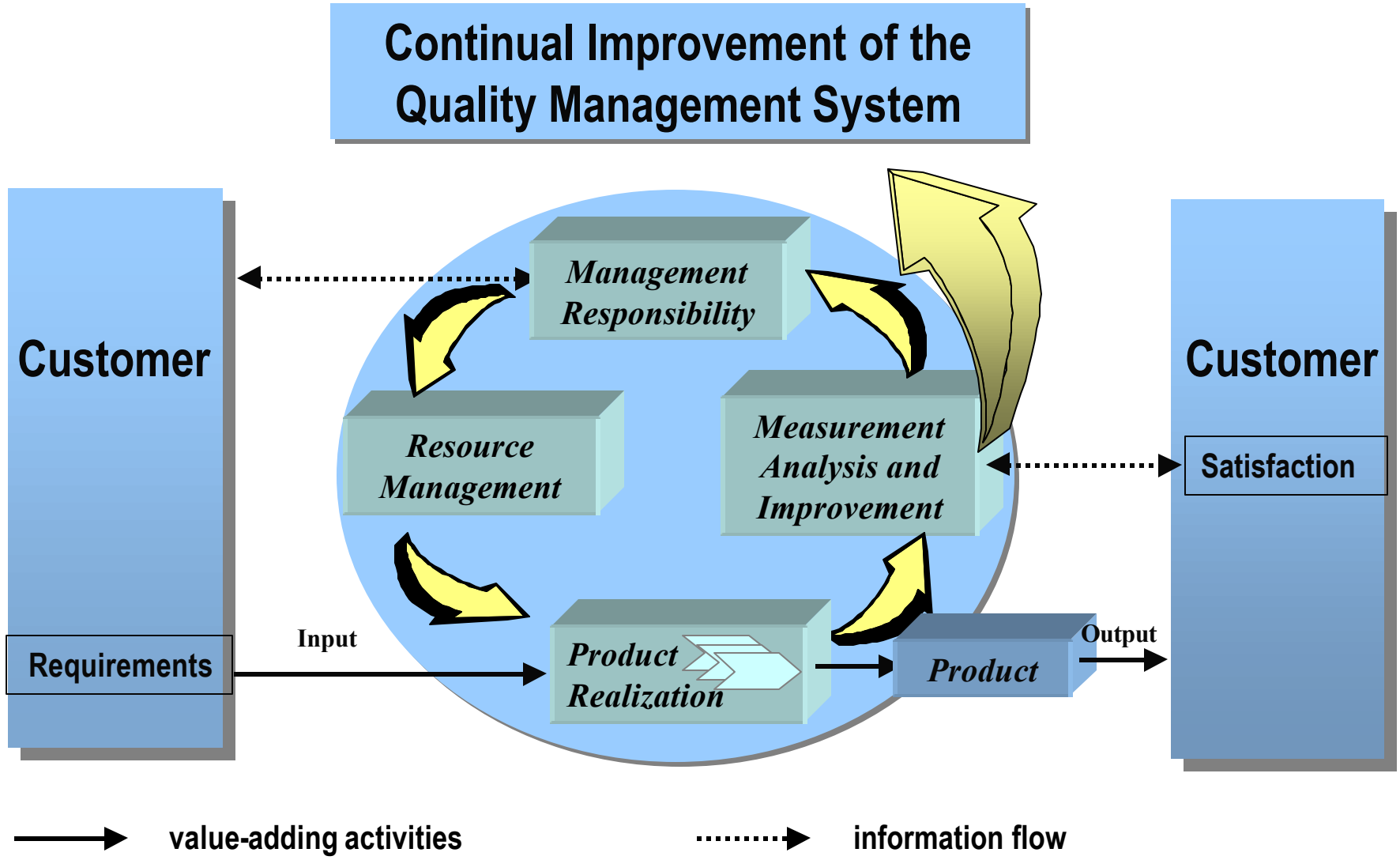




"Product" means any of the following:
Products, Services, Offers, Platforms

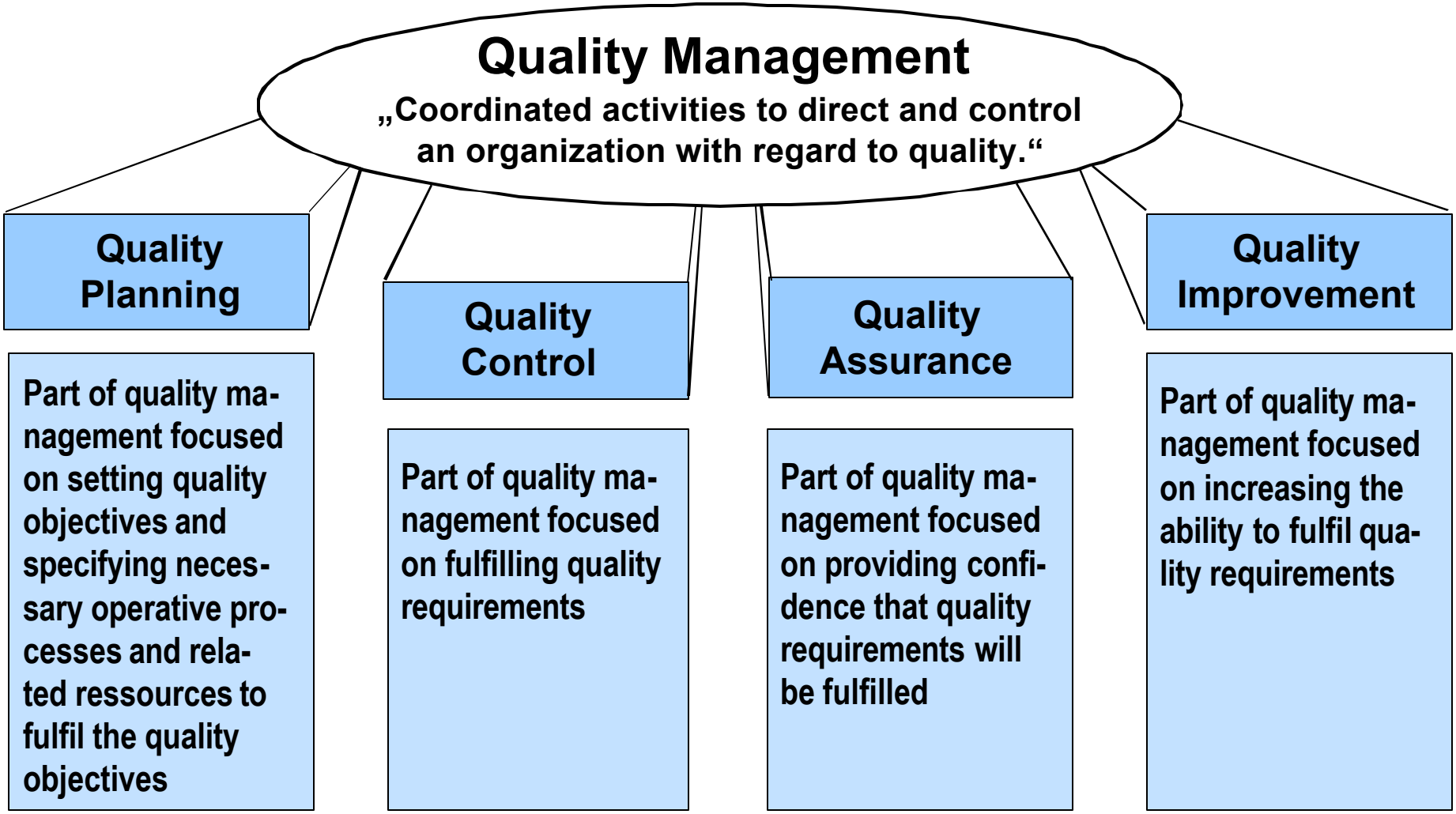
[Source: AT&T, 1996]

Example: Product Management Model (AT&T)

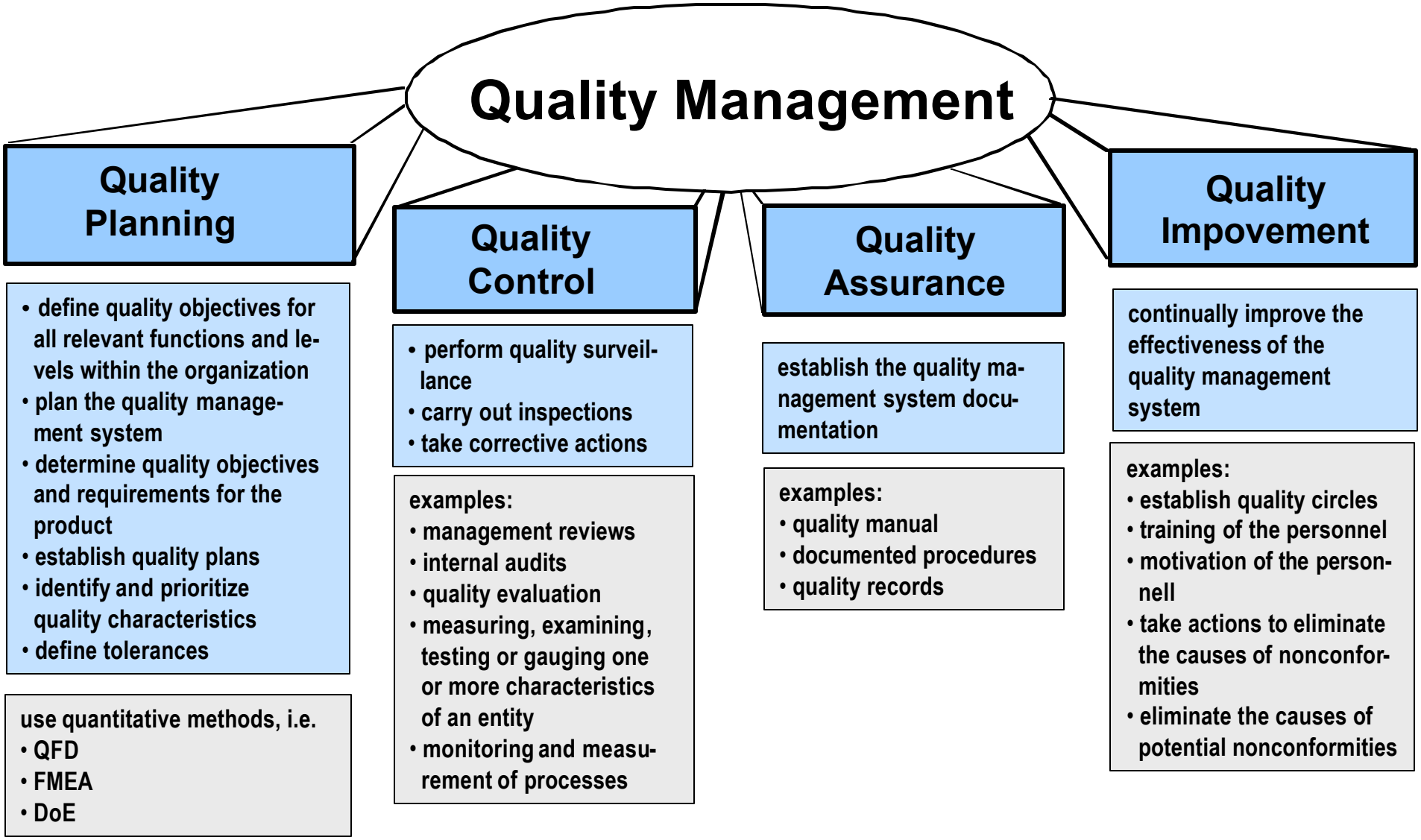


[Source: ISO 9000:2000]

Model of a process-based Quality Management System

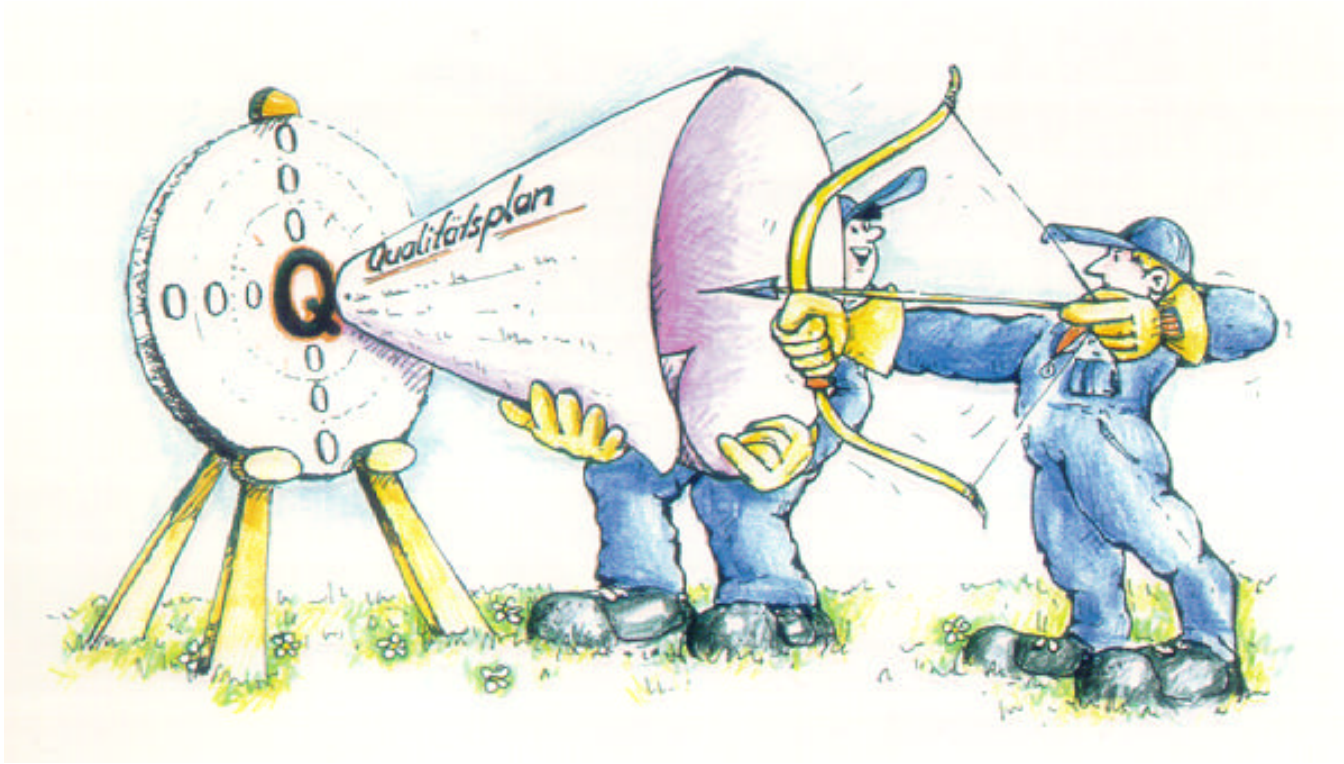


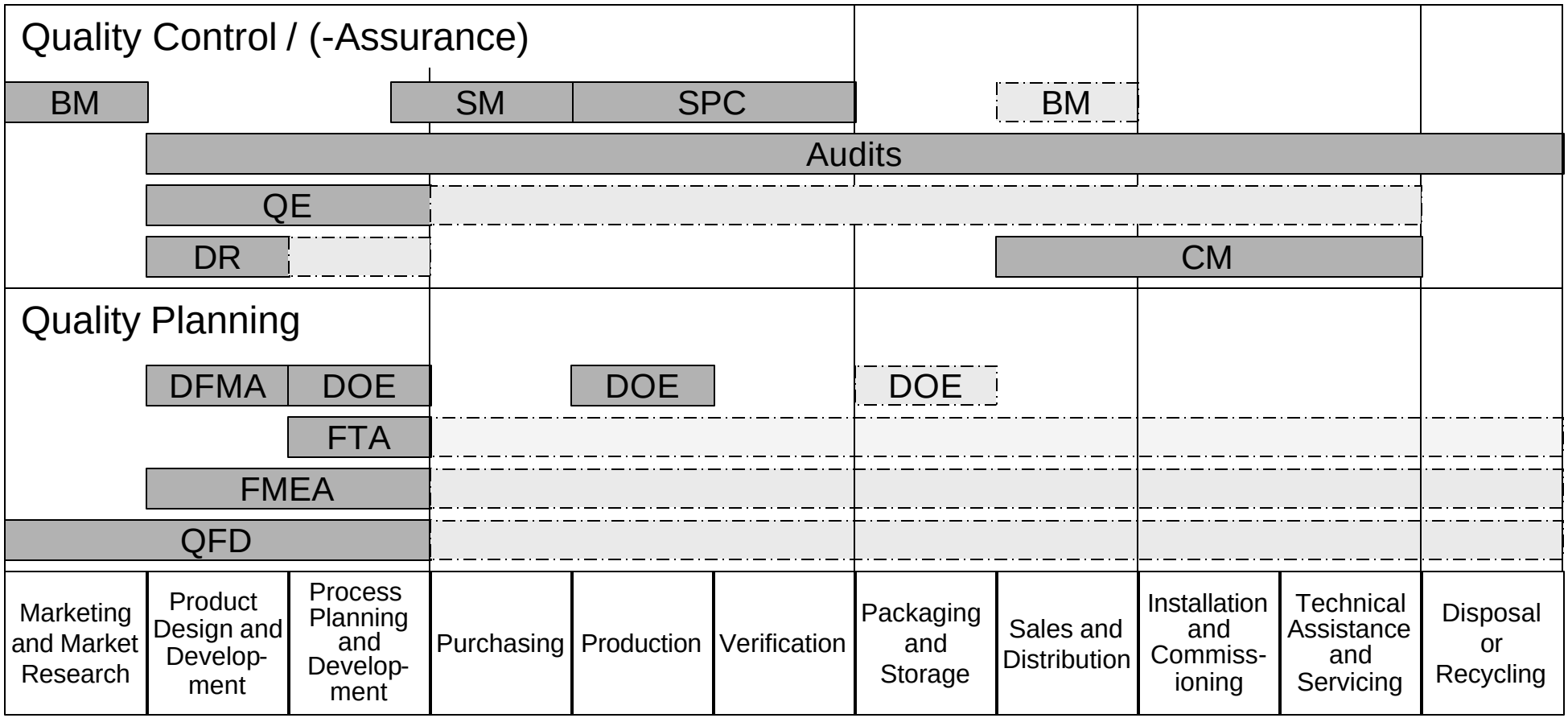
Actual Quality Management Terms (ISO 9000:2000)



Quality Management Functions

Document specifying which procedures and associated ressources shall be applied by whom and when to a specific process, product, project or contract.





Use of Quality Management Methods

DFMA: Design for Manuf. and Assembly

DOE: Design of Experiments

FMEA: Failure Mode and Effects Analysis

QFD: Quality Function Deployment

QE: Quality Evaluation

DR: Design Review

FTA: Fault Tree Analysis

SPC: Statistical Process Control

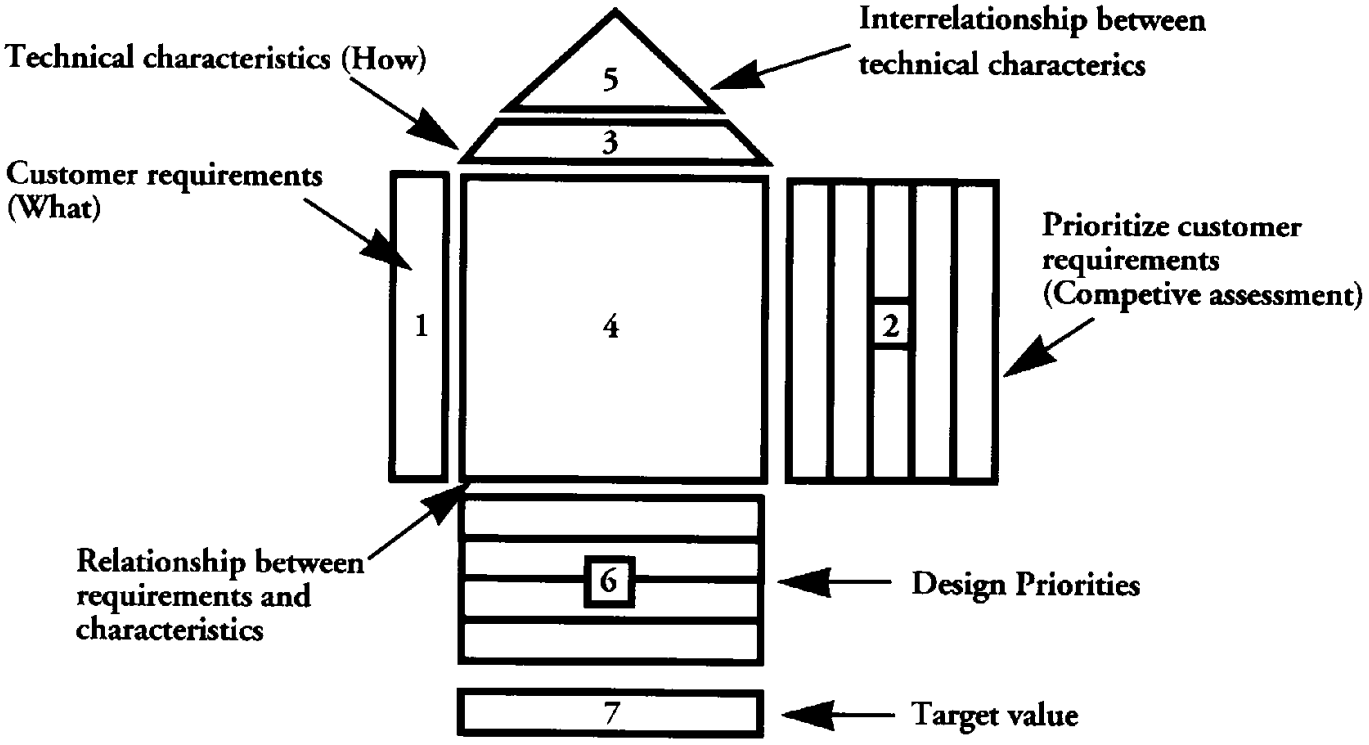
SM: Supplier Management

BM: Benchmarking

CM: Complaint Management

Acronyms and Abbreviations

Quality Function Deployment (QFD) is a customer-oriented approach to product innovation.



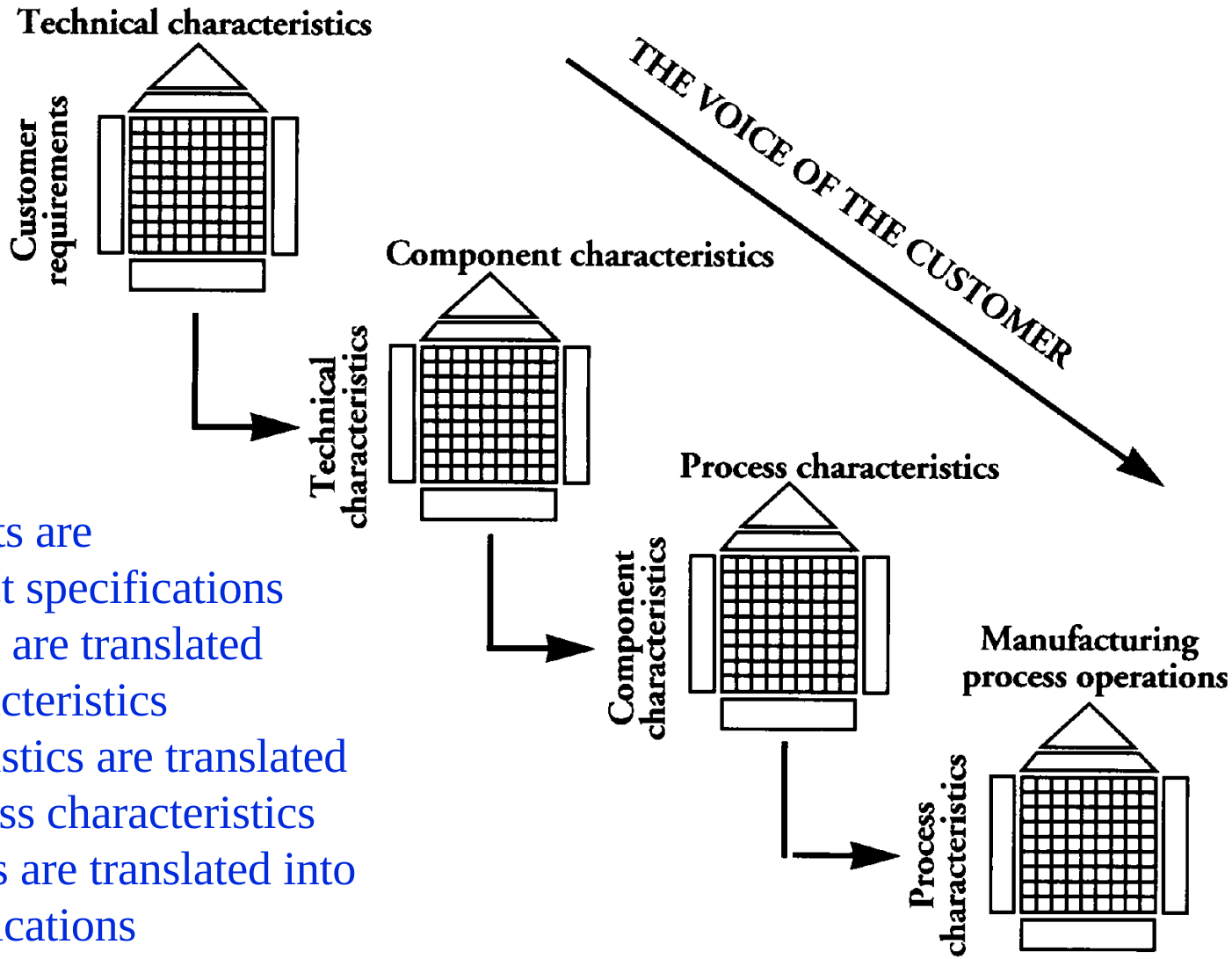
House of Quality

Quality Function Deployment ....

- puts the focus on the customer
- helps to manage the process of product creation
- reduces the time-to-market
- leads to lower costs
- promotes cooperation and communication between functions
- supports organizational learning

The translation of customer needs into manufacturing requirements is supported by a sequence of four „Houses of Quality“:

❶ Customer requirements are translated into product specifications
❷ Product specifications are translated into component characteristics
❸ Component characteristics are translated into production process characteristics
❹ Process characteristics are translated into manufacturing specifications



QFD-Sequence according to ASI

Use Project Management Principles taking into account following Fundamentals:

❶ Define the Scope
- customer requirements
- technical solution (or proposal)
- time line
- costs
- constraints

❷ Select and Organize the Team
- invite all disciplines involved
- select the team leader
- define roles and responsibilities
- describe ways of communication and documentatiom method to be used
- identify customers and suppliers involved (external / internal)

❸ Train the Team Members
- common understanding of require-ments
- skills needed in project

❹ Use Simultaneous Engineering
- avoid sequential phases
- early involve different disciplines

❺ Define Milestones
- number and timing of milestones
- contents of milestone reviews
- members of milestone reviews
- how to resolve concerns

ID	Activity	Document	Marketing	Product Management	Documentation	Development	System Group	Controlling	Operations	Purchasing	Sales	Sales Support	Service	NSOs	Order Desk	Repair Center	Logistics	Project Manager	AT	PLM	MTO
	Prepare *E-Kontrakt* for Definition Phase	*E-Kontrakt* for Definition Phase		V		M					M										
	Prepare Product Feasibility Paper:	Product Feasibility Paper		V		M			M	M	M										
	Approve Product Feasibility Paper	Product Feasibility Paper																	M	M	V
Definition Phase																					
	Approve Project Manager (only for new products)																		M	M	V
	Prepare System Function Specification	see SDP				V															
	per department: Prepare draft activity plan of release	detailed plans of departments		M		M			M	M	M							V			
	Consolidate department specific time schedules			M		M			M	M	M							V			
	Prepare macro plan containing key milestones	Integral Release Plan IRP		M		M			M	M	M							V			
	incorporate Business Case into Business Plan of AT	Business Plan		V		M		M		I	M										
	Define position of new product within MTN Product Platform	MTN Product Platform		V		M					M										
	Describe consequences of market introduction for existing products			V						I	M										
	Adapt concerned Business Plans	Business Plan		V																	
	Prepare final *E-Kontrakt*	final *E-Kontract*		V		M				M	M										
	Prepare Budget Approval Paper	Budget Approval Paper				M				M	M							V			
	Approve Budget Approval Paper	Budget Approval Paper																I	M	V	
	inform respective departments in case of yes			V		I		I	I	I	I										
	Prepare Advance Product Information	API Announcement	M	V	M	M					M										
	Approve API	API Announcement																I	M	V	

(V: responsible; M: collaboration; I: information)

[Source: Philips, 1995]

Examle: Responsibility Matrix

Gate 4: „From Development to Deployment“

Project Name: *Review Date:*

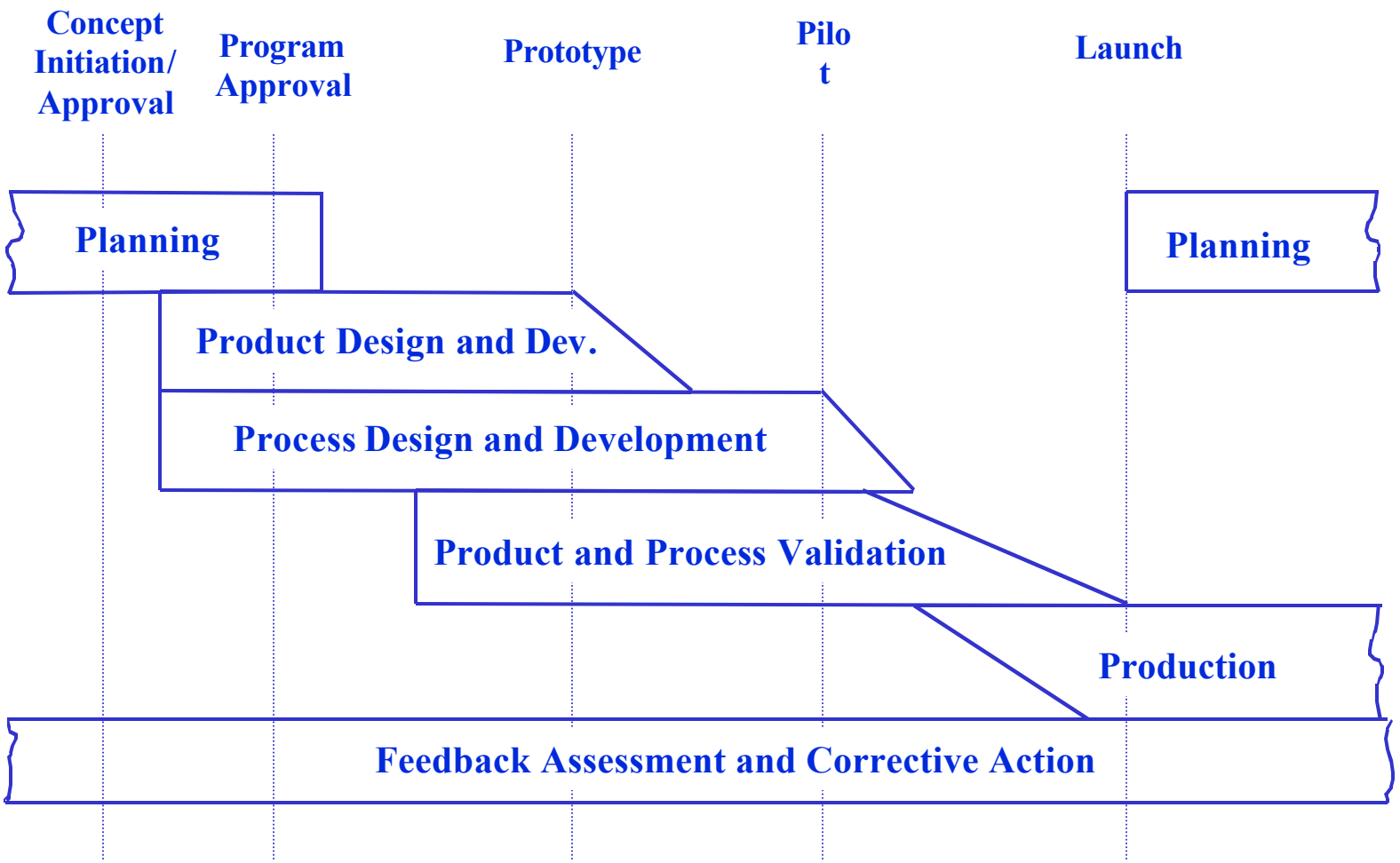
Project Leader: *Project Type:*

Required Gate Review Inputs		*YES*	*NO*
4.1	Updated Business Case and comparison to Gates 2 & 3 Business Cases	☐	☐
4.2	Updated Project Support Plans	☐	☐
4.3	FOA Completion Notice or Applicable Field Test Results	☐	☐
4.4	Statement of project costs to reach Gate 5	☐	☐

Gate Review Decision Criteria		*YES*	*EXCEPTION*
4.5	Is the project still aligned with the objectives of the original Business Case?	☐	☐
4.6	Can the product be manufactured within target cost?	☐	☐
4.7	Is there a plan for asset management?	☐	☐
4.8	Is implementation of the project support plans on schedule?	☐	☐
4.9	Is the customer documentation complete?	☐	☐
4.10	Is customer training available?	☐	☐
4.11	Are the documentation, tools, and training to support Sales, Engineering, Ordering, Technical Support, Installation, and Training staff available?	☐	☐
4.12	Is the manufacturing ramp-up schedule and inventory plan baselined?	☐	☐
4.13	Has a design review shown the Project to be supportable?	☐	☐
4.14	Has a design review shown the Project to be manufacturable, serviceable, and maintainable?	☐	☐
4.15	Are relevant BCPs being planned for the next phase?	☐	☐
4.16	Does the Project meet customer requirements? (This must be shown in an integrated system test or other appropriate setting.)	☐	☐

[Source: AT&T, 1996]

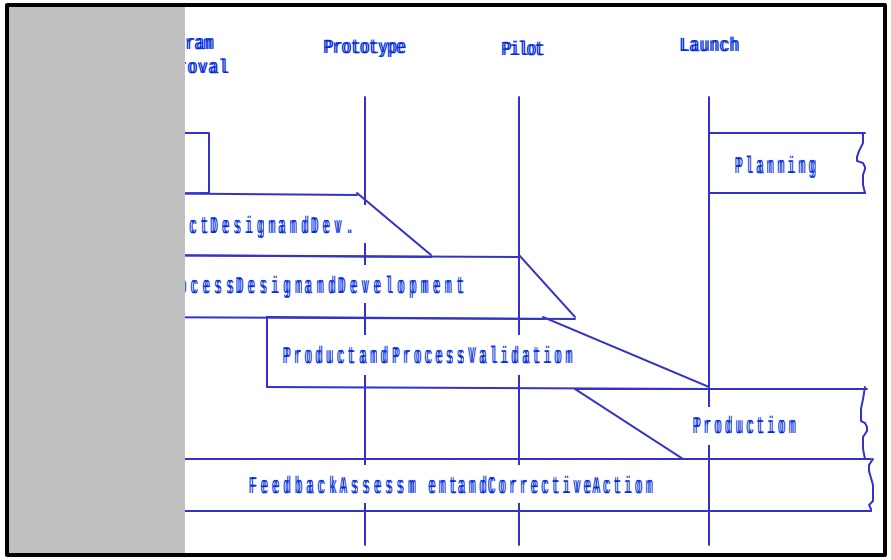
Example: Milestone Checklist



[Source: QS 9000, APQP]

Product Quality Planning Timing Chart

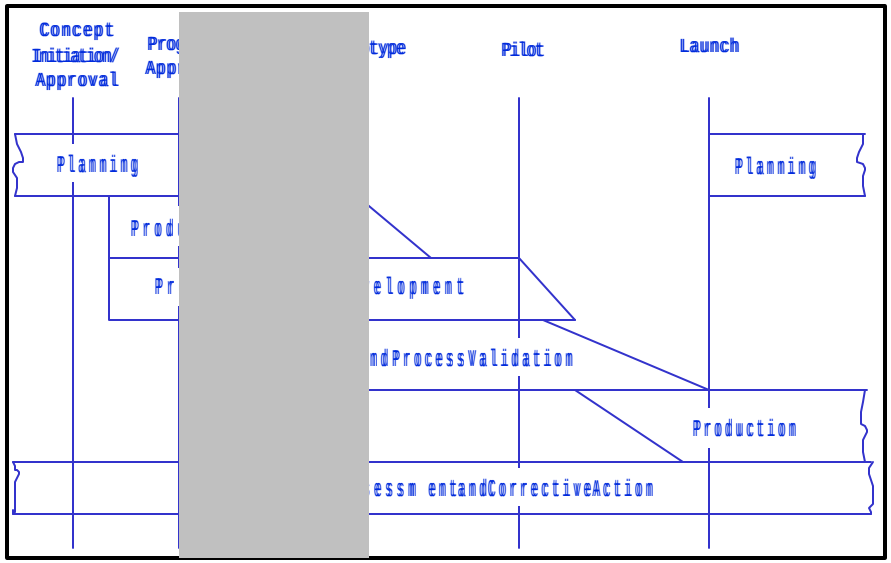
Phase 1:
Plan and Define Program



Outputs:

- Design Goals
- Reliability and Quality Goals
- Preliminary Bill of Material
- Preliminary Process Flow Chart
- Product Assurance Plan
- Management Support

Phase 2: Product Design and Development



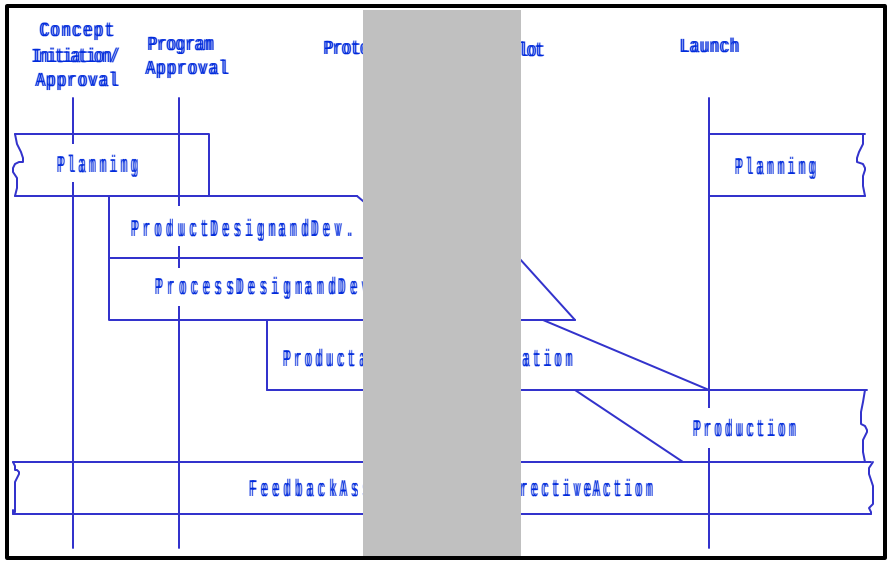
Outputs by Design Responsible:

- Design FMEA
- Design for Manufacturing and Assembly
- Design Verification
- Design Reviews
- Prototype Build
- Engineering Drawings
- Engineering Specifications
- Material Specifications
- Drawing and Specification Changes

Outputs by Q-Planning Team:

- New Equipment, Tooling and Facility Requirements
- Special Product and Process Characteristics
- Prototype Control Plan
- Gages/Testing Equipment Requirements
- Team Feasibility Committment & Management Support

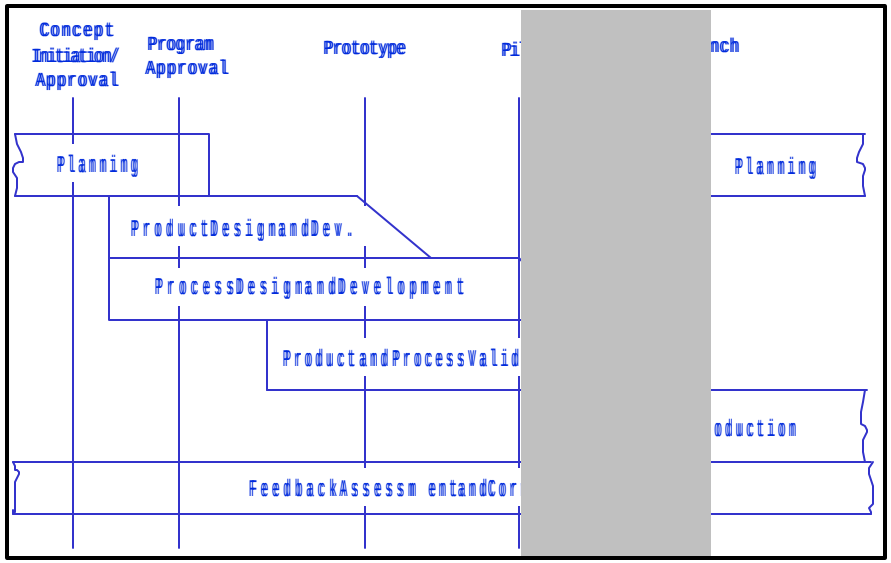
Phase 3: Process Design and Development



Outputs:

- Packaging Standards
- Product / Process Quality System Review
- Process Flow Chart
- Floor Plan Layout
- Characteristics Matrix
- Process FMEA
- Pre-Launch Control Plan
- Process Instructions
- Measurement Systems Analysis Plan
- Preliminary Process Capability Study Plan
- Packaging Specifications
- Management Support

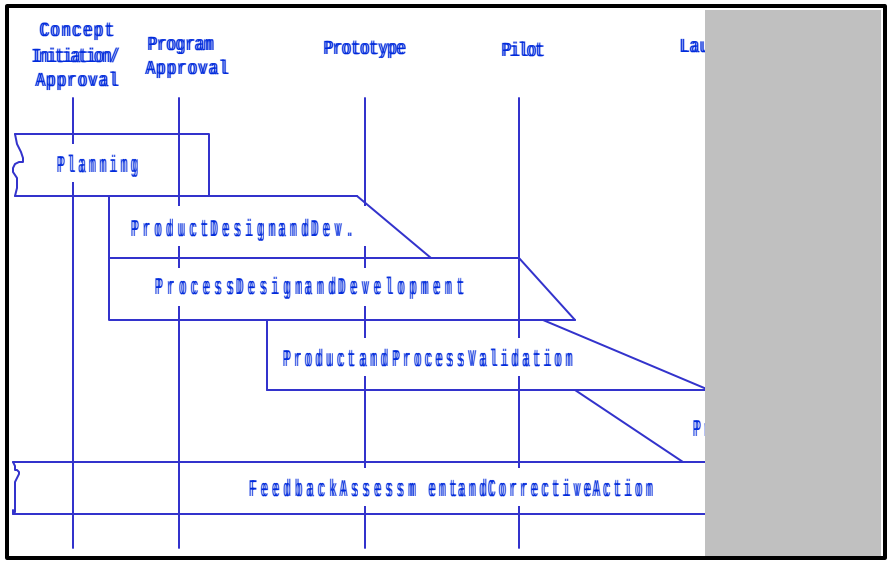
Phase 4: Product and Process Validation



Outputs:

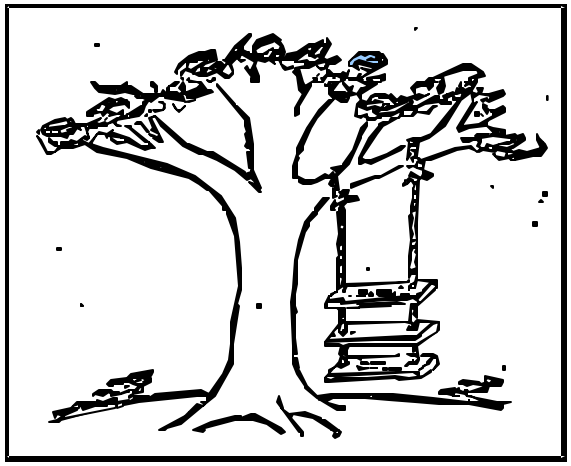
- Production Trial Run
- Measurement Systems Evaluation
- Preliminary Process Capability Study
- Production Part Approval
- Production Validation Testing
- Packaging Evaluation
- Production Control Plan
- Quality Planning Sign-Off and Management Support

Phase 5: Feedback, Assessment and Corrective Action

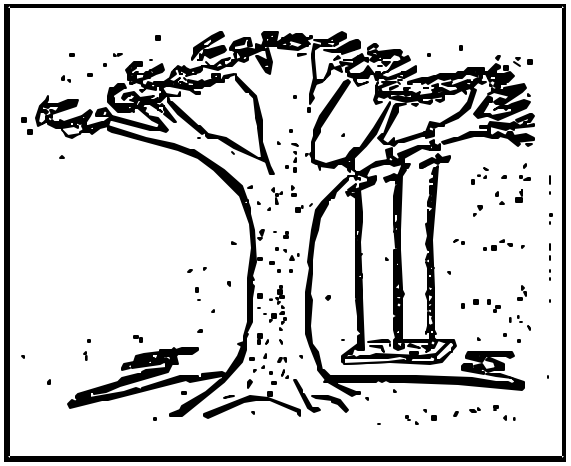


Outputs:

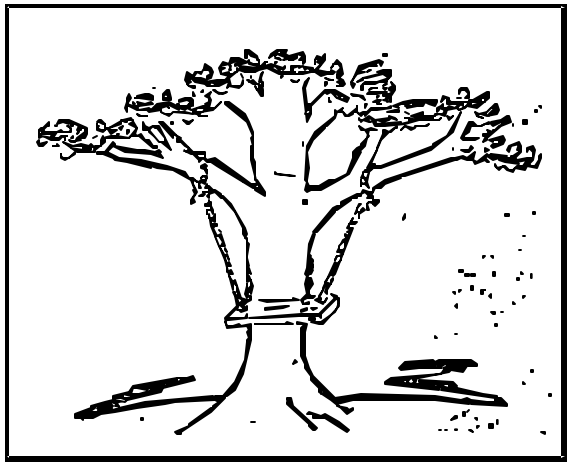
- Reduced Variation
- Customer Satisfaction
- Delivery and Service



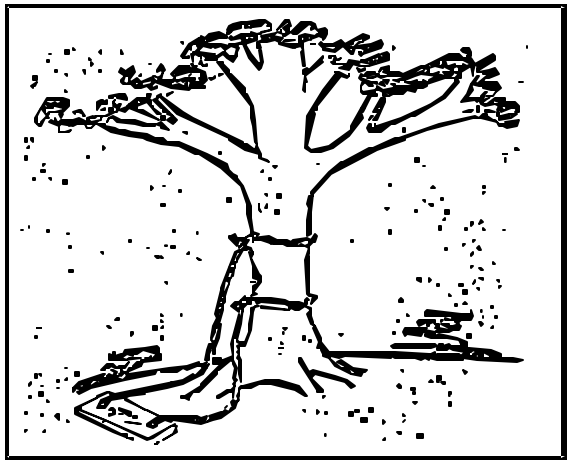
how it was required by sales



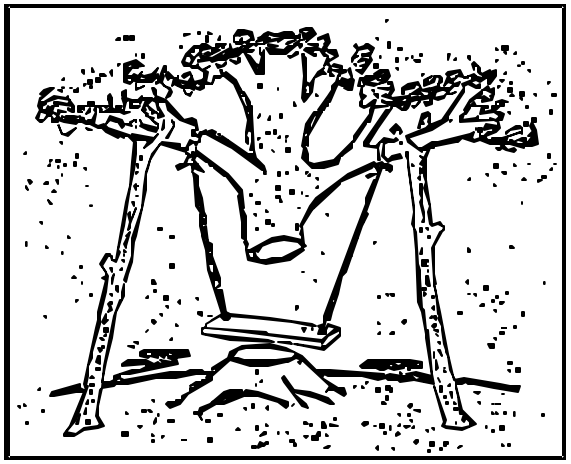
how purchasing ordered



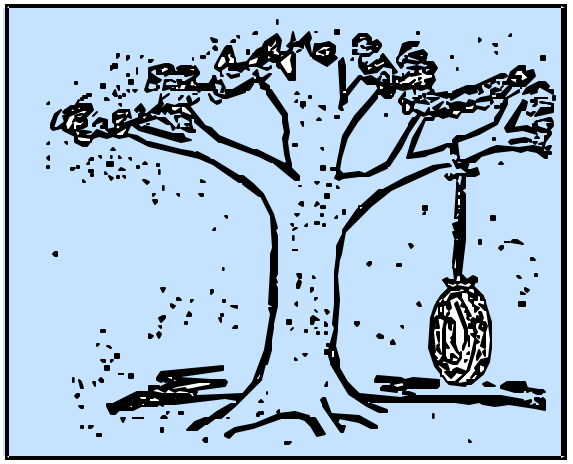
how it was designed



how it was produced



how it was assembled



what the customer expected

„Voice of the Customer“