IT QM Part2 Lecture 7

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Dr. Withalm Mar 3, 2009

IT QM Bratislava

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Lectures at the University of Bratislava/Spring 2008

21.02.2008	**Lecture 1 Impact of Quality-From Quality Control to Quality Assurance**
28.02.2008	**Lecture 2 Organization Theories-Customer satisfaction-Quality Costs**
06.03.2008	**Lecture 3 Leadership-Quality Awards**
13.03.2008	**Lecture 4 Creativity-The long Way to CMMI level 4**
03.04.2008	**Lecture 5 System Engineering Method-Quality Related Procedures**
10.04.2008	**Lecture 6 Quality of SW products**
17.04.2008	**Lecture 7 Quality of SW organization**

Vorlesungen am Technikum - Wien Winter 2008

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30.09.2008	**Vorlesung 1 Der weite Weg zu CMMII-Level 4**
07.10.2008	**Vorlesung 2 System Entwicklungsprozess + Planung**
14.10.2008	**Vorlesung 3 Verfahren 1 (CM, Reviews, Aufwandsabschätzung (Function Point))**
16.10.2008	**Vorlesung 4 Verfahren 2 (Wiederverwendung, Dokumentation, Case- Tools)**
13.11.2008	**Vorlesung 5 Qualität von SW 1 (Testen, Q-Bewertung, Quality in Use,)**
27.11.2008	**Vorlesung 6 Qualität von SW 2 (Quality Function Deployment, Zertifizierung von Hypermedia-Links bei InternetApplikationen, Technology Management Process)**
11.12.2008	**Vorlesung 7 Qualität einer SW-Organisation (ISO 9001, CMMI, BSC)**
	CMMI: Capability Maturity Model
	BSC: Balanced Scorecard

Today's Agenda

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- ISO-9000
  - Motivation
  - Definition
  - Introduction Strategy
  - Certification Expenditure
  - The Way to Certification
  - Background of Certification
  - Benefits & Drawbacks
- CMMI
  - Motivation
  - Definition
  - Characteristics of Mature/ Immature Processes
  - Process Areas
  - How a CMMI works
  - Structure of the Siemens modified Process
  - Presentation of Results
- Balanced Score Cards
  - Motivation
  - Definition
  - Elements
  - Proceeding
  - Example
  - Presentation

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- **Agenda : 10.3.08**
- **The long Way to CMMI level 4**
  - **Overview about the most essential QM measures**
- **System Development Method**
  - **Project Planning**
- **Agenda : 31.3.08**
- **Quality of SW organization**
  - **ISO 9000**
  - **CMMI**
  - **BSC**
  - **IHE: Integrating the Healthcare Enterprise**
  - **Movie: ProvenO and Sienet**
  - **Test**

Conclusion of Part 1/1

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- SEM
  - Overview
  - Tailoring
  - Phase Organization
  - Areas of Responsibility
  - Examples
- PM
  - Overview
  - Planning (Component, Organization, Volume, Course of Project, Risk)
  - Processing Tenders and Commissions
  - Project Checks and Project Control (Progress, Effort; Cost)
  - Coordination, Organization, Administration
  - PROWEB

Conclusion of Part 1/2

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- CM
  - Configuration Identification
  - Configuration Control
  - Configuration Status Account
  - Configuration Auditing
- Reviews
  - Review Techniques
  - Quality of Reviews
  - Intensive Inspection (Size, Roles, Expenditures)
  - Classification of Errors
- Expenditure Estimation
  - Estimation Methods
  - Function Point
  - Effort Estimation Meeting
  - Other Methods/Tools

Conclusion of Part 1/3

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- Testing
  - Definition
  - Structuring
  - V-Model
  - Test Levels
  - Types of Tests
    - White Box (C0, C1, C2)
    - Black Box
  - Test Cases
  - End of test Criteria
  - Conducting Tests
  - Test Evaluation
  - Verification vs. Validation

Conclusion of Part 1/4

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- SW Quality Evaluation
  - Motivation
  - Quality Characteristics
    - Sub Characteristics
    - List of Criteria
    - Evaluation Procedures
- Quality in Use
  - Needs
  - Needs and Requirements
  - Relationship between different Quality Characteristics

Conclusion of Part 1/3

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- Testing
  - Definition
  - Structuring
  - V-Model
  - Test Levels
  - Types of Tests
    - White Box (C0, C1, C2)
    - Black Box
  - Test Cases
  - End of test Criteria
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  - Verification vs. Validation

Overview

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Part1 ISO-9000-Certification

Part2 Capability Maturity Model

Part3 Balanced Score Cards

ISO-9000/1
For what certifying?

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- Improvement of quality and productivity
- Competition advantage
  - e.g. Ordering party prefers certified ranges when placing orders
- Demanded by the market
  - e.g. German TELECOM

ISO-9000/2
Reasons for a certification according to DIN ISO 9001

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- A precondition for public call for tenders in the European Union-internal market since 1993
  - e.g. water and energy suppliers
  - for all orders with an order value of 50.000 € or more
- Marketing argument (also the others do it)
- Less audits by customers required
- More or less irrevocable confession to the quality
- Reason for the examination of the QA system

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DIN ISO 9001.

Hardened, which we went through for you.
And we passed.

ISO-9000/4
Competition (Office Communication)/1

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You have the right to be objectively informed
which enterprise within the range
of the office communication in Germany has
a **quality assurance system**
examined by independent committees.

ISO-9000/5
Competition (Office Communication)/2

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DIN ISO 9001 requires:
Quality concerning marketing
quality concerning the coworkers
quality during the product development
quality concerning the production
quality during the product examination
quality concerning the service
quality concerning the customer service

ISO-9000/6
Definition of Quality management systems

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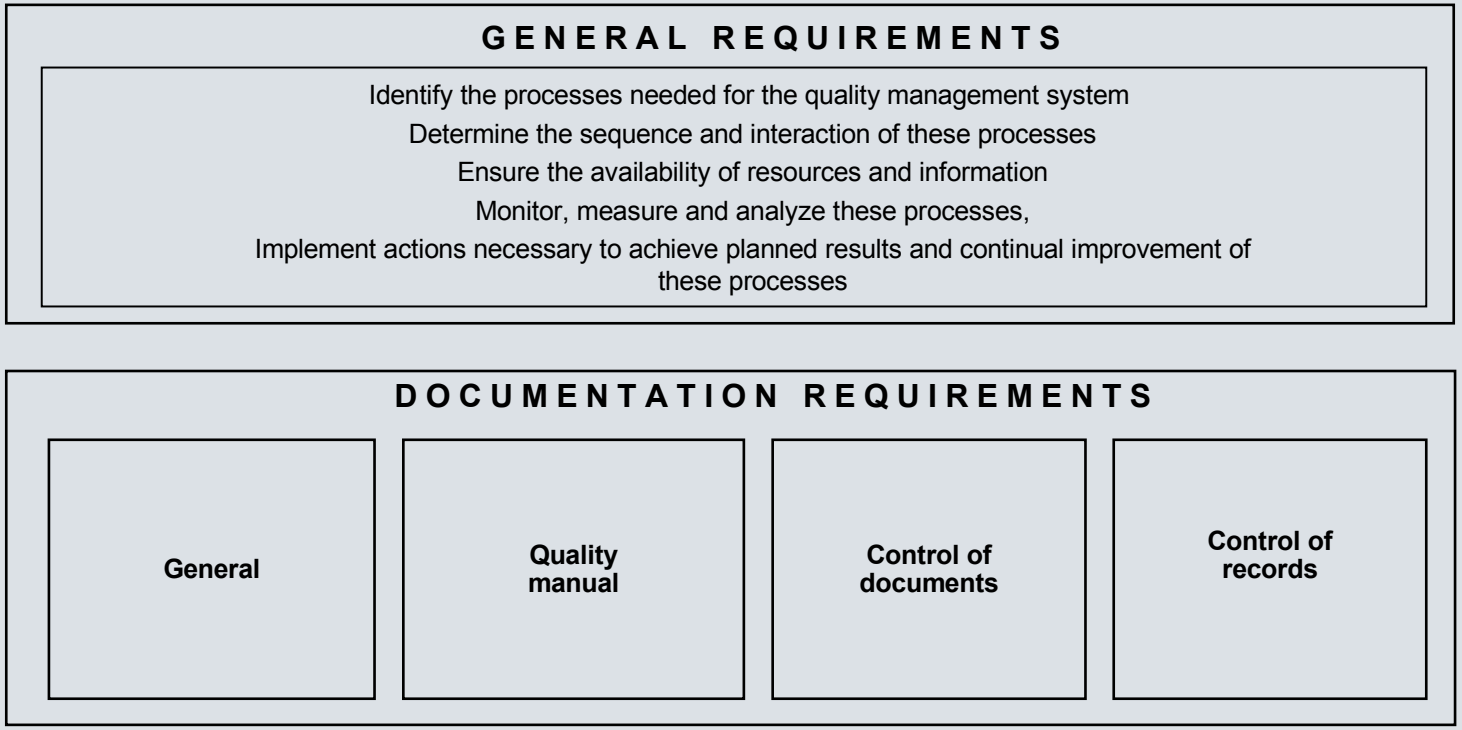
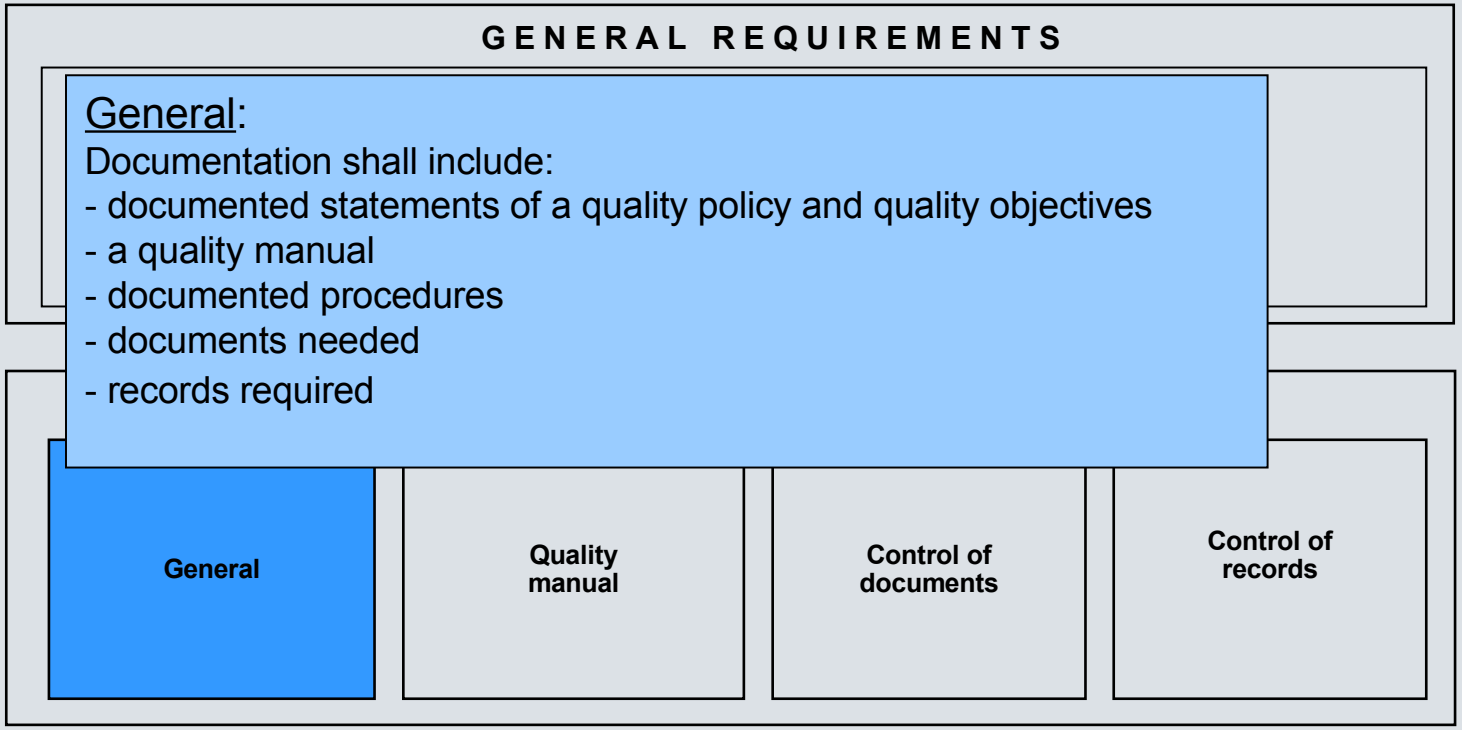
- Requirements stated in ISO 9001 (2000)



ISO-9000/7
Definition of Quality management systems/2

SIEMENS

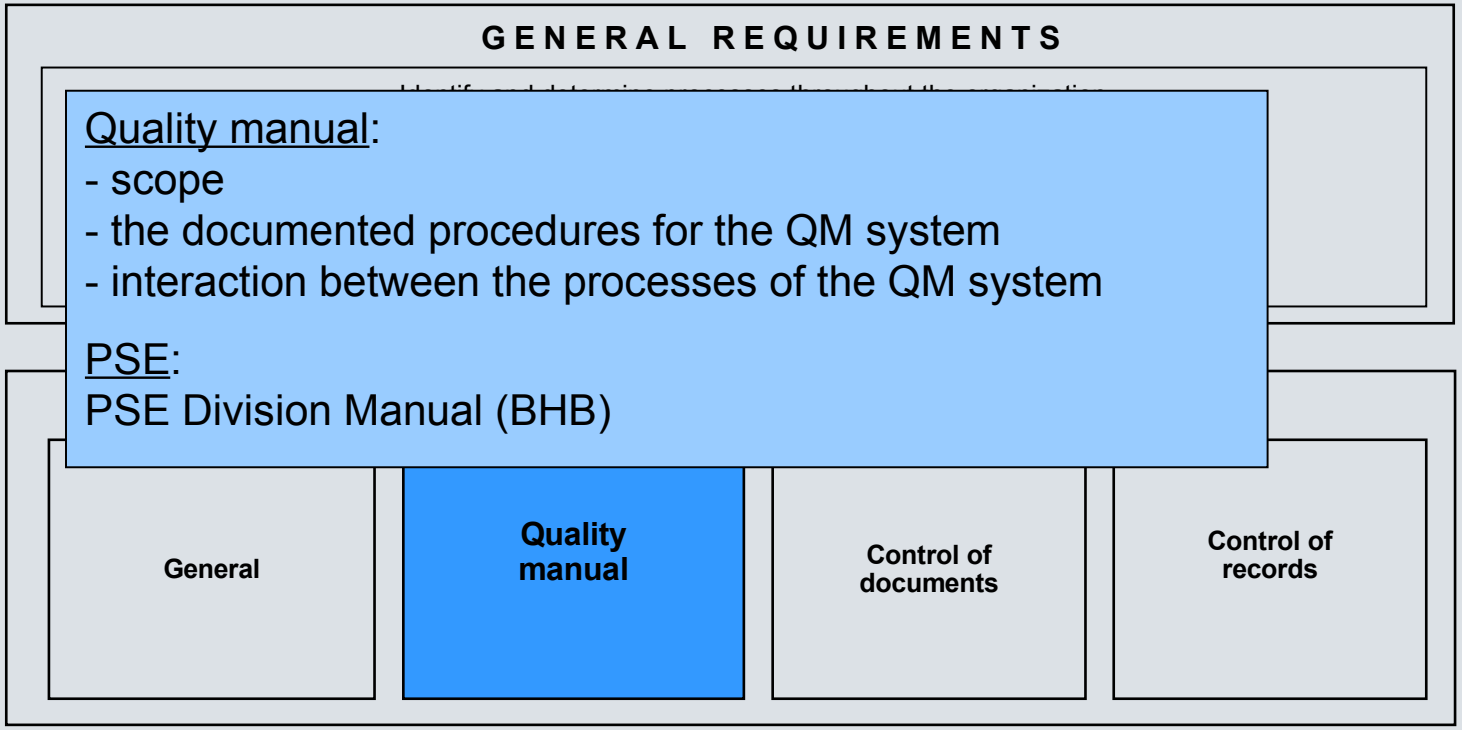
- Requirements stated in ISO 9001 (2000)



ISO-9000/8
Definition of Quality management systems/3

SIEMENS

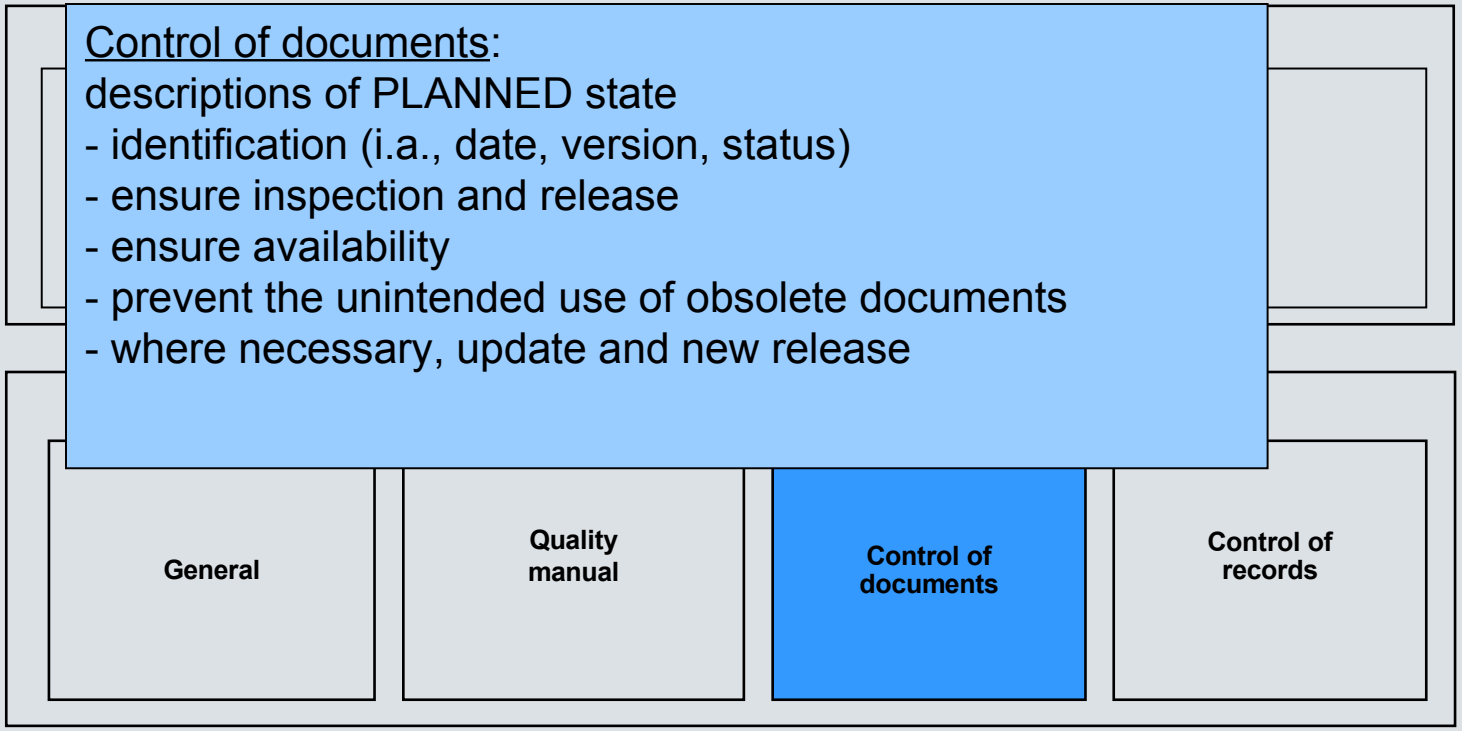
- Requirements stated in ISO 9001 (2000)



ISO-9000/9
Definition of Quality management systems/4

SIEMENS

- Requirements stated in ISO 9001 (2000)



ISO-9000/10
Definition of Quality management systems/5

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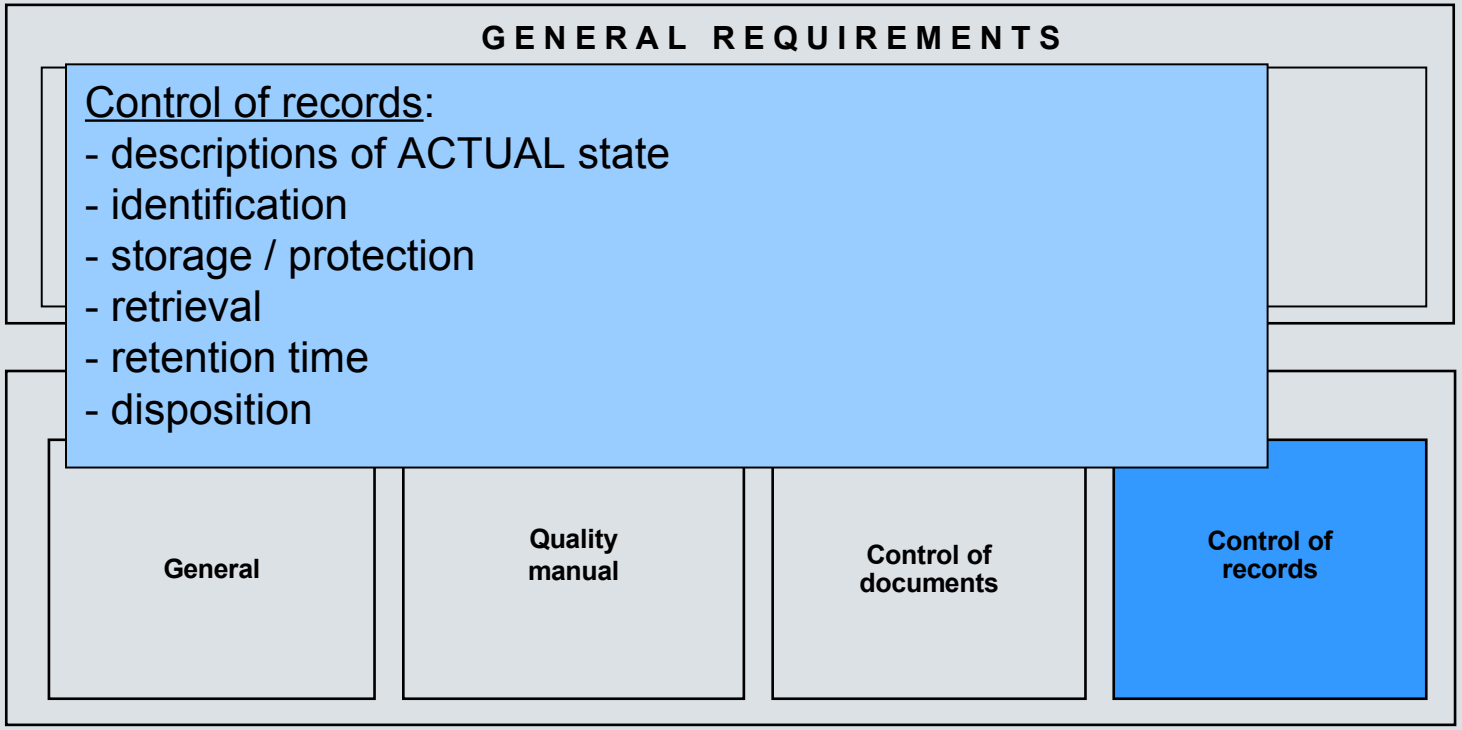
- Requirements stated in ISO 9001 (2000)



ISO-9000/11
Definition of Quality management systems/6

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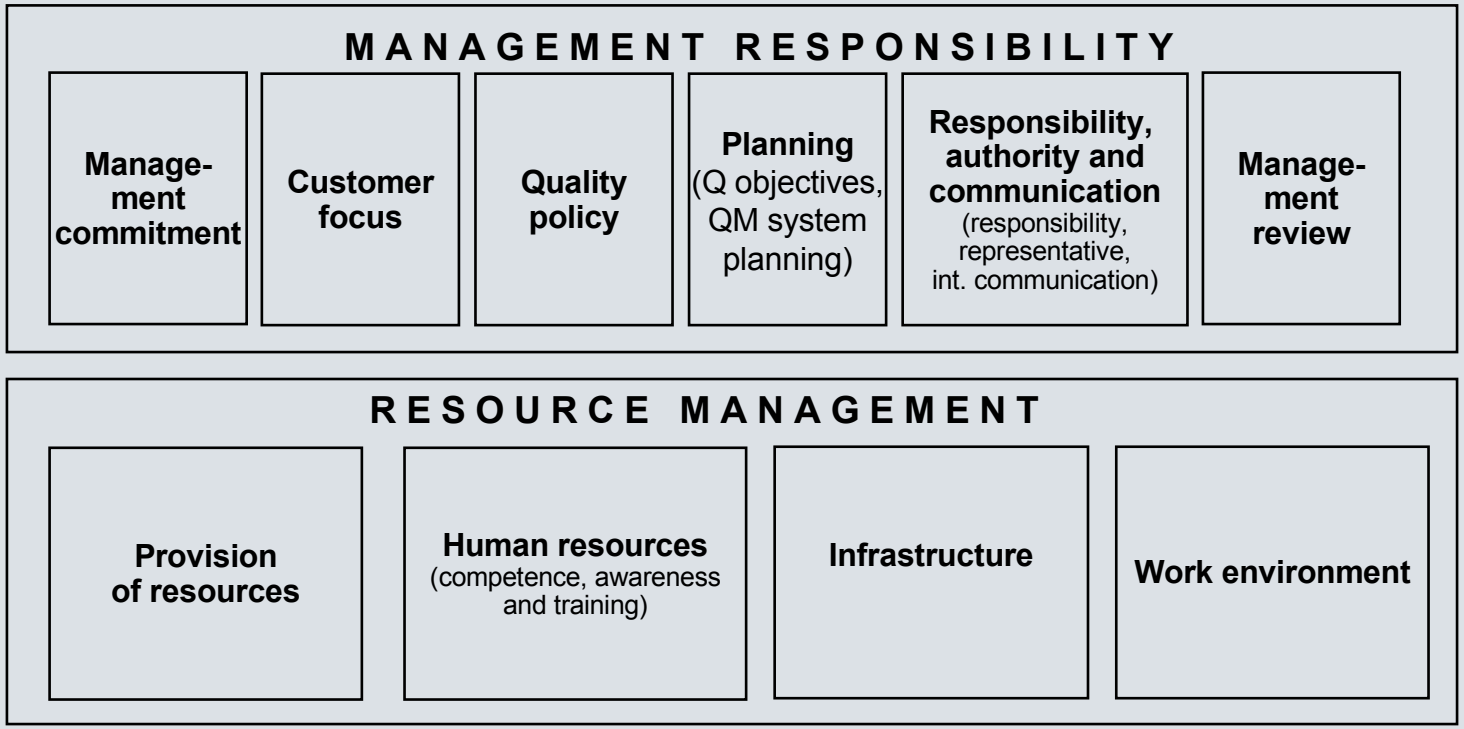
- Requirements stated in ISO 9001 (2000)



ISO-9000/12
Definition of Quality management systems/7

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- Requirements stated in ISO 9001 (2000)

ISO-9000/13
Definition of Quality management systems/8

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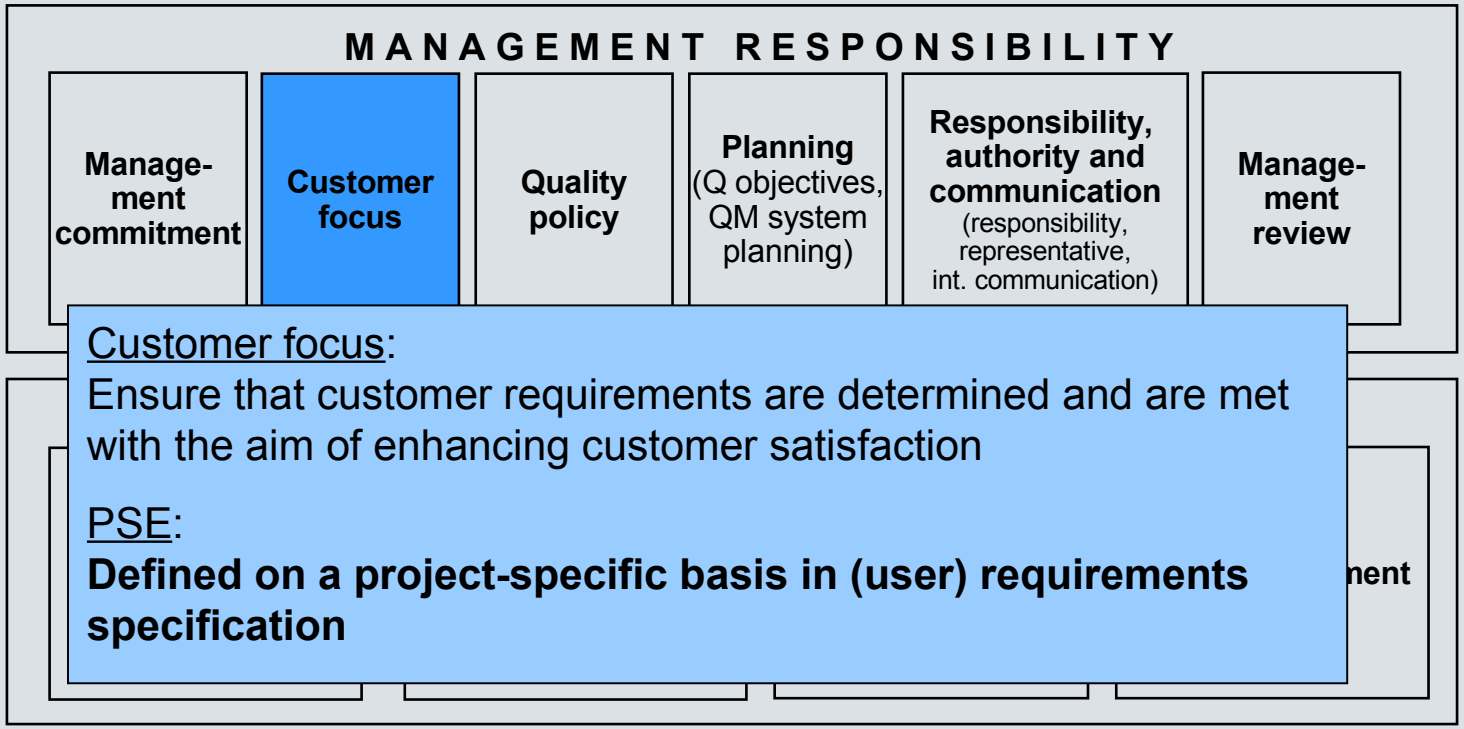
- Requirements stated in ISO 9001 (2000)



ISO-9000/14
Definition of Quality management systems/9

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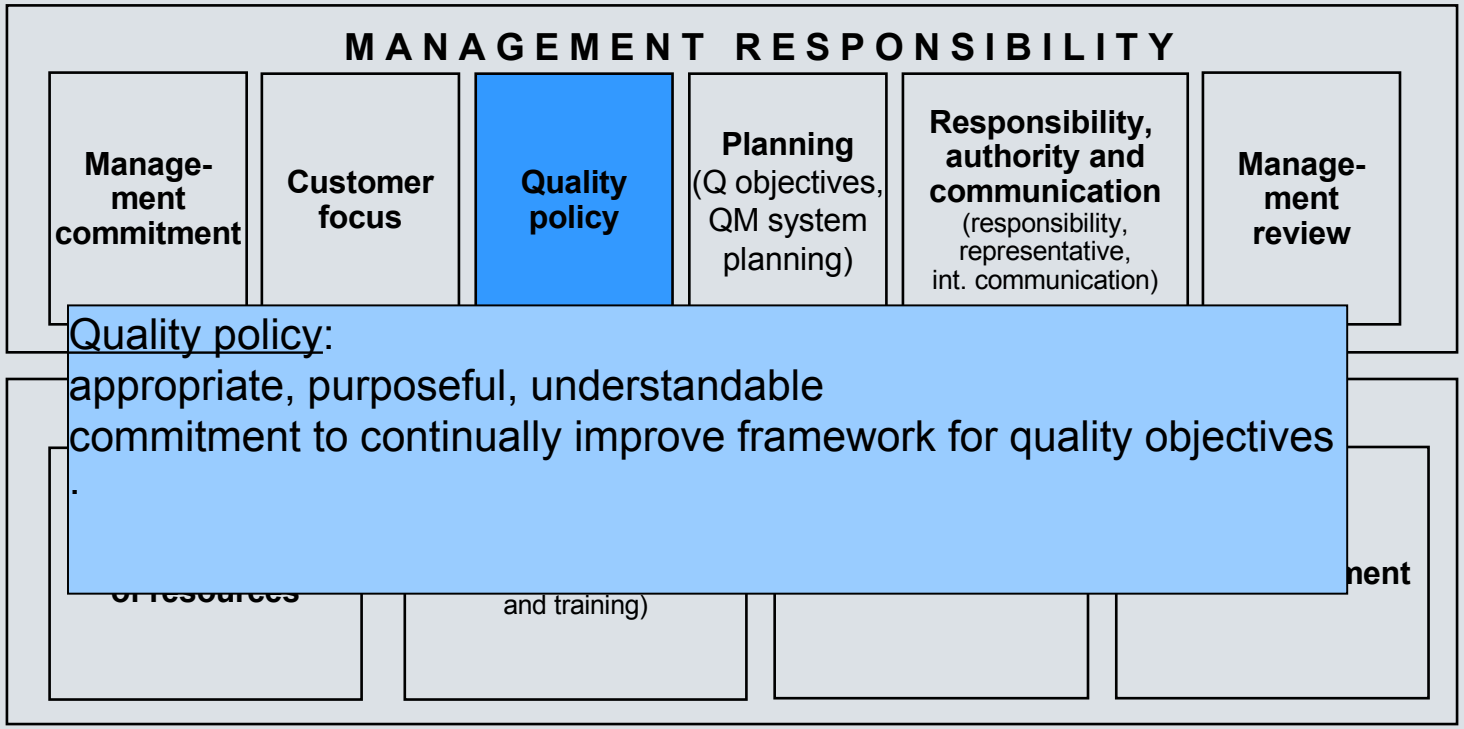
- Requirements stated in ISO 9001 (2000)



ISO-9000/15
Definition of Quality management systems/10

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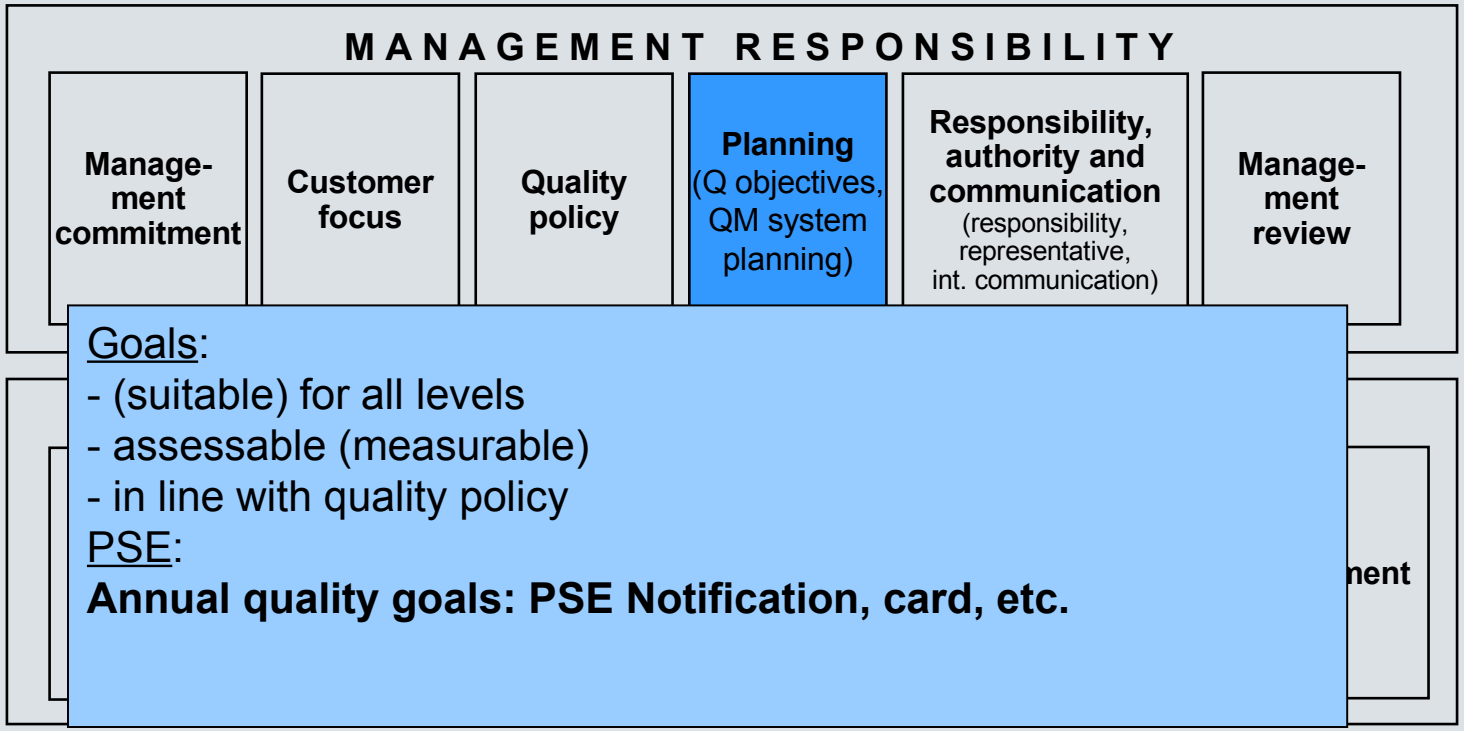
- Requirements stated in ISO 9001 (2000)



ISO-9000/16
Definition of Quality management systems/11

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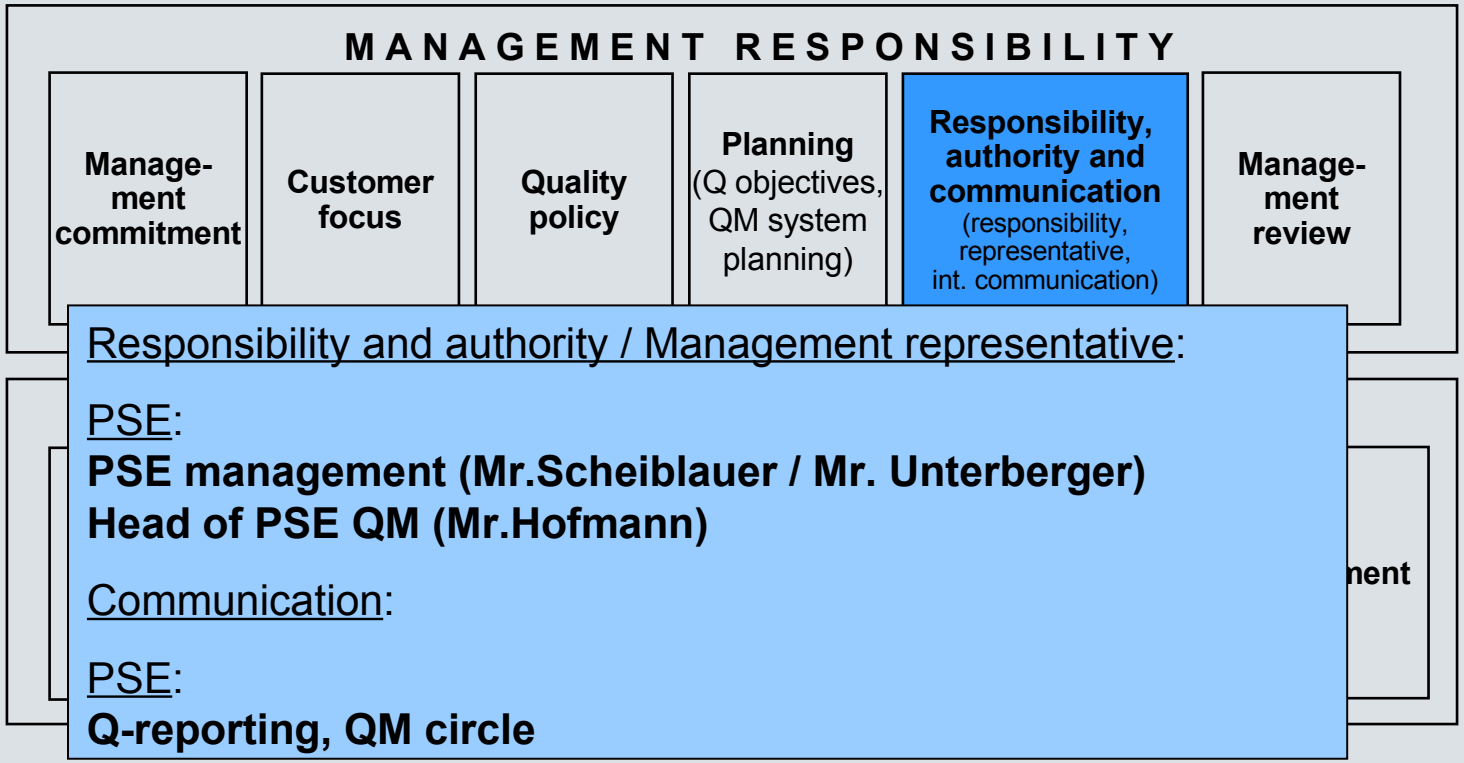
- Requirements stated in ISO 9001 (2000)



ISO-9000/17
Definition of Quality management systems/12

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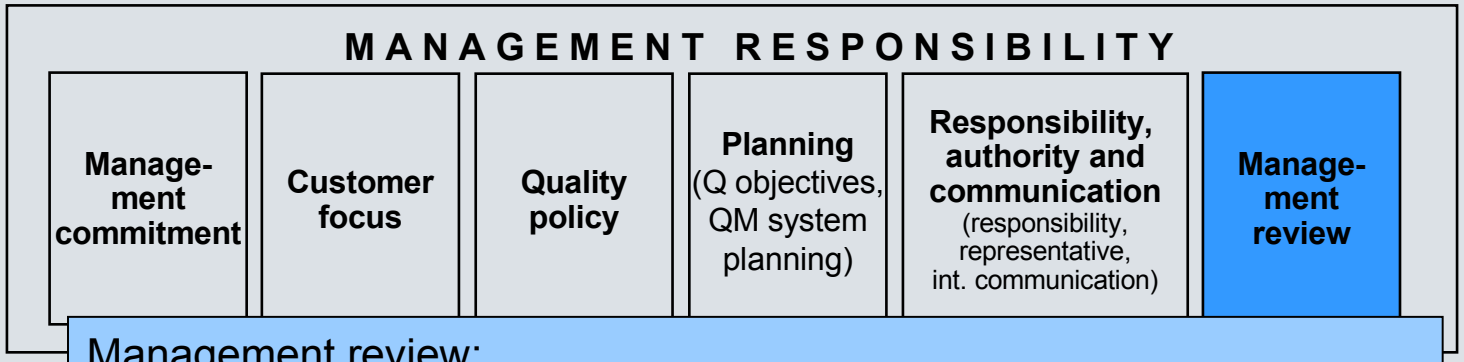
- Requirements stated in ISO 9001 (2000)



Management review:
regular review of the management system
Input: audits, customer feedback, corrective and preventive action, follow-up action from previous management reviews, planned changes that could affect the QM system, recommendations for improvements, ...
Output: improvement of the effectiveness of the QM system, improvement of product related to customer requirements, resource needs

PSE:
Annual management reviews at the PSE-/GG level

ISO-9000/18
Definition of Quality management systems/13

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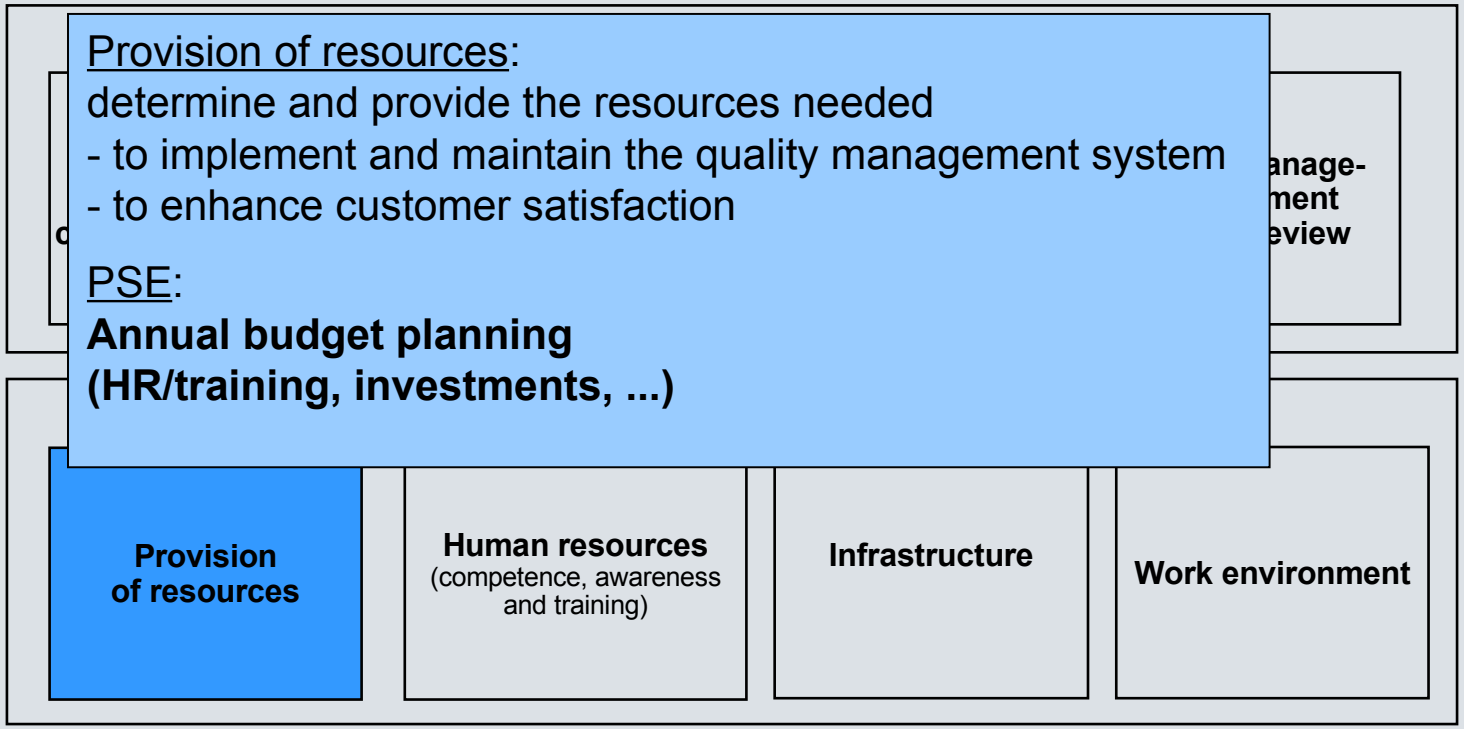
- Requirements stated in ISO 9001 (2000)



ISO-9000/19
Definition of Q

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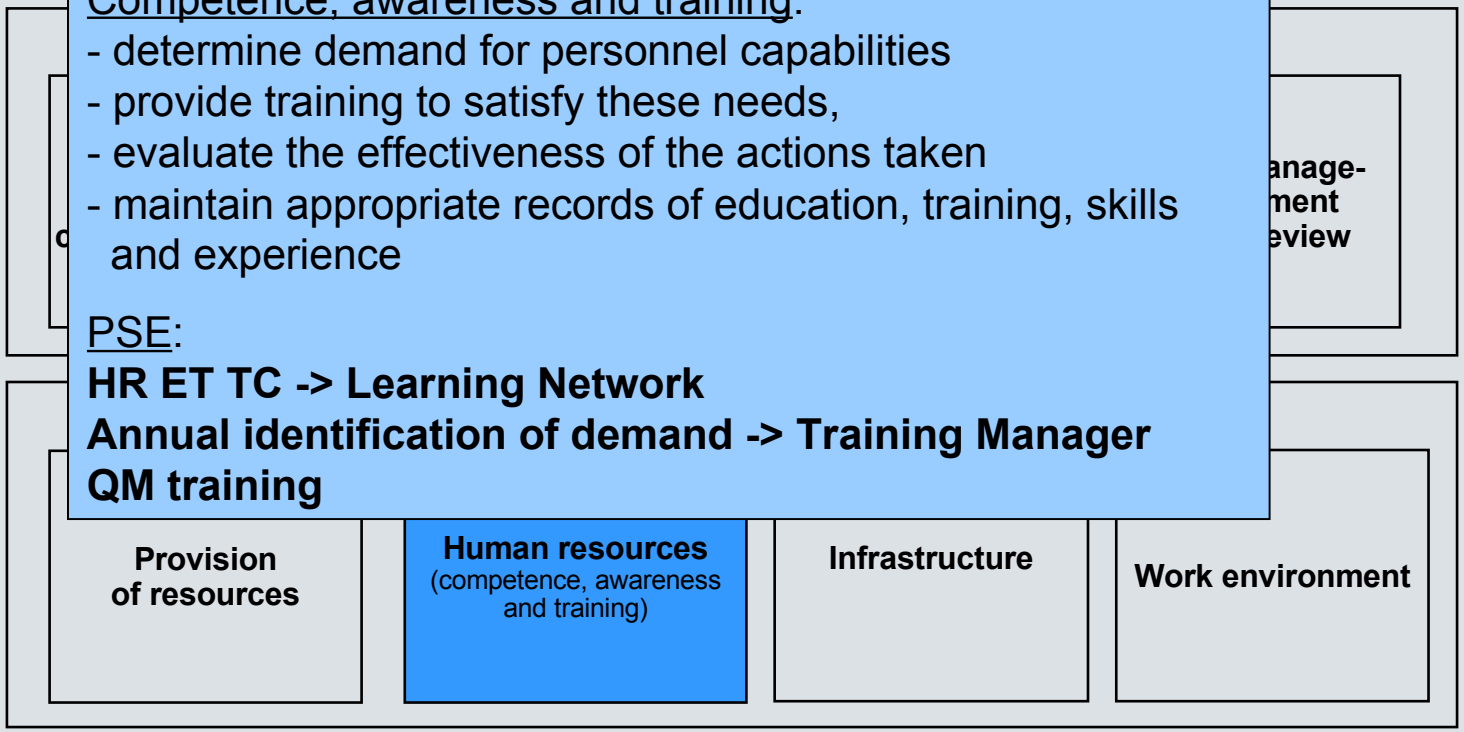
- Requirement

Assignment:
deployment of resources in accordance with education, training, skills, experience

PSE:
Mainly university graduates (techn. study programs)
Personnel development (various development programs)

Competence, awareness and training:
- determine demand for personnel capabilities
- provide training to satisfy these needs,
- evaluate the effectiveness of the actions taken
- maintain appropriate records of education, training, skills and experience

PSE:
HR ET TC -> Learning Network
Annual identification of demand -> Training Manager
QM training



ISO-9000/20
Definition of Quality management systems/15

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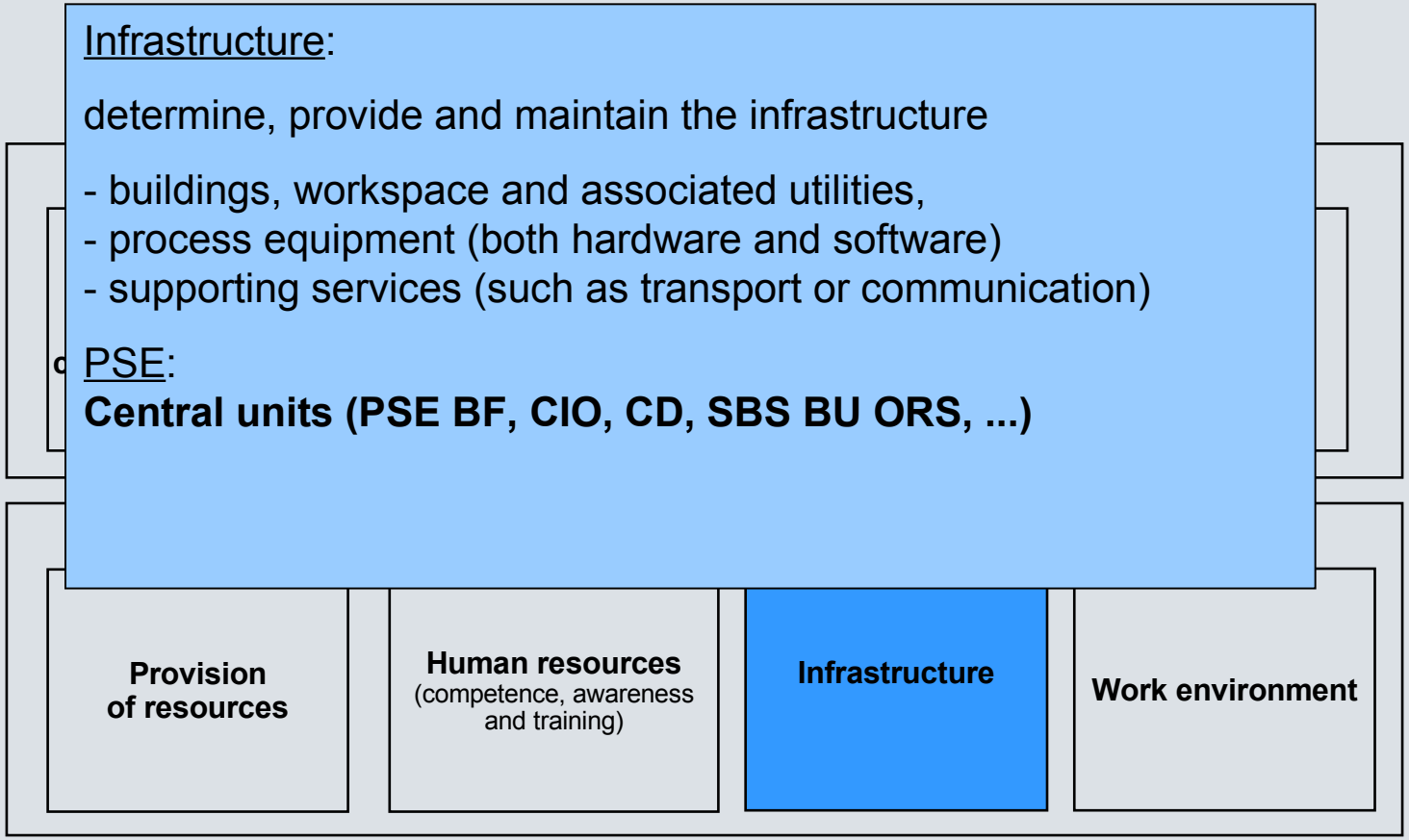
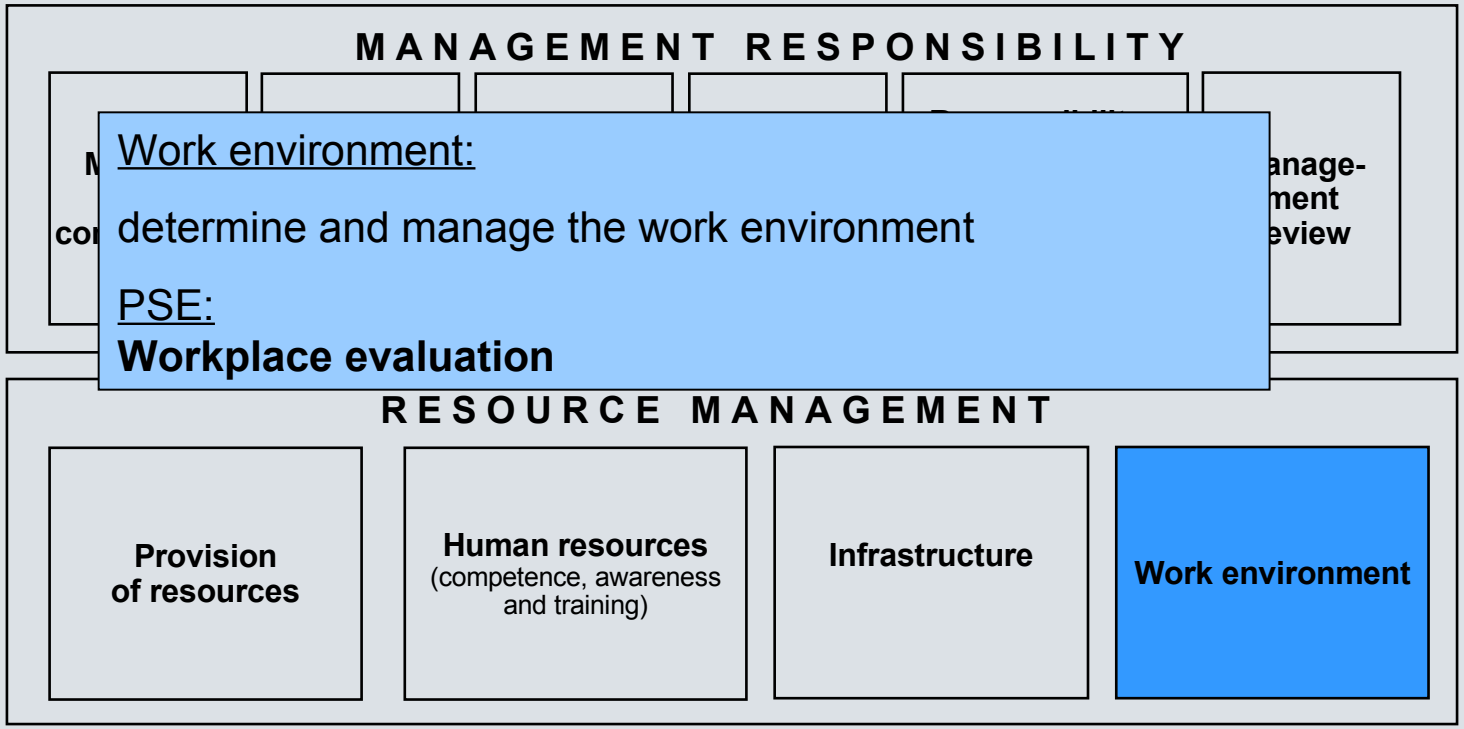
- Requirements stated in ISO 9001 (2000)



ISO-9000/21
Definition of Quality management systems/16

SIEMENS

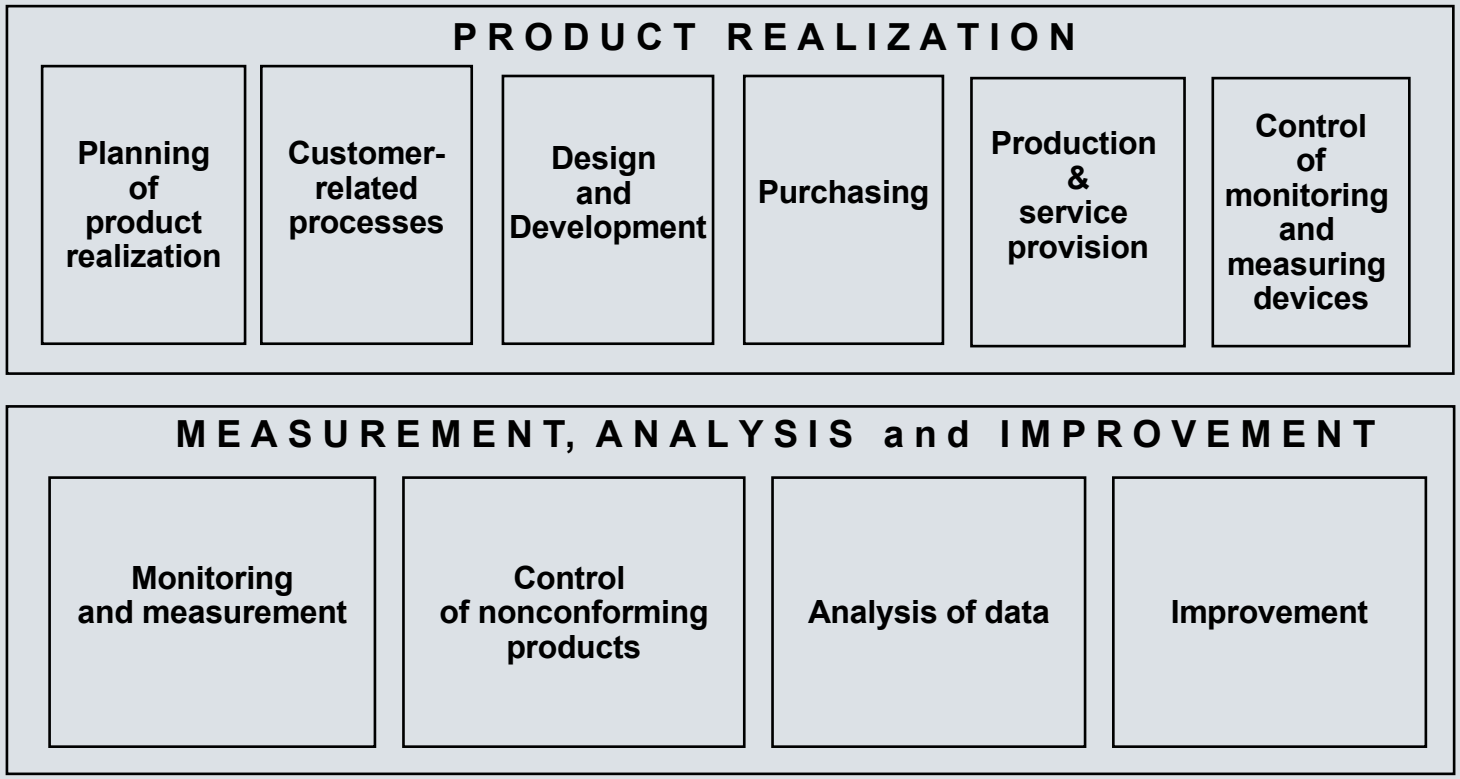
- Requirements stated in ISO 9001 (2000)



ISO-9000/22
Definition of Quality management systems/17

SIEMENS

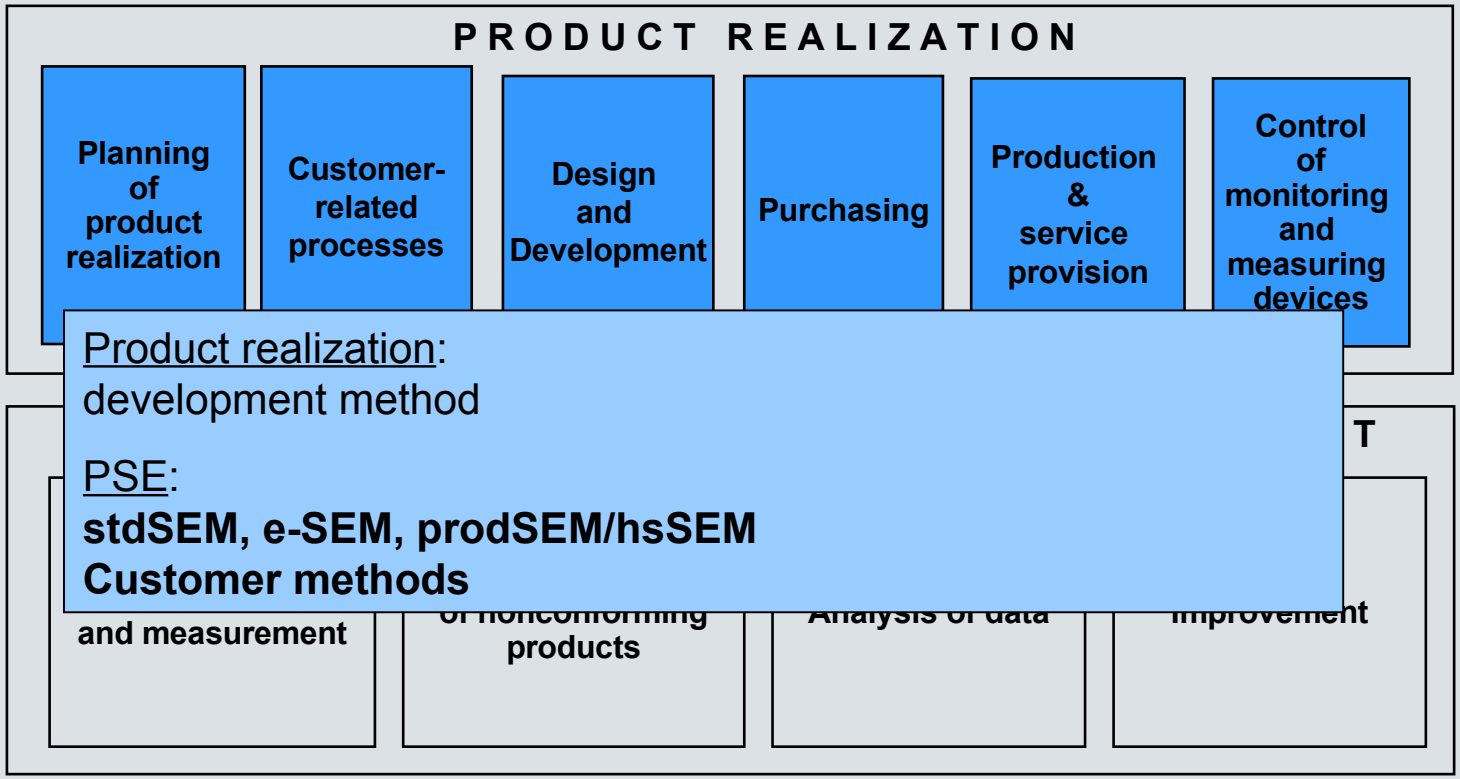
- Requirements stated in ISO 9001 (2000)



ISO-9000/23
Definition of Quality management systems/18

SIEMENS

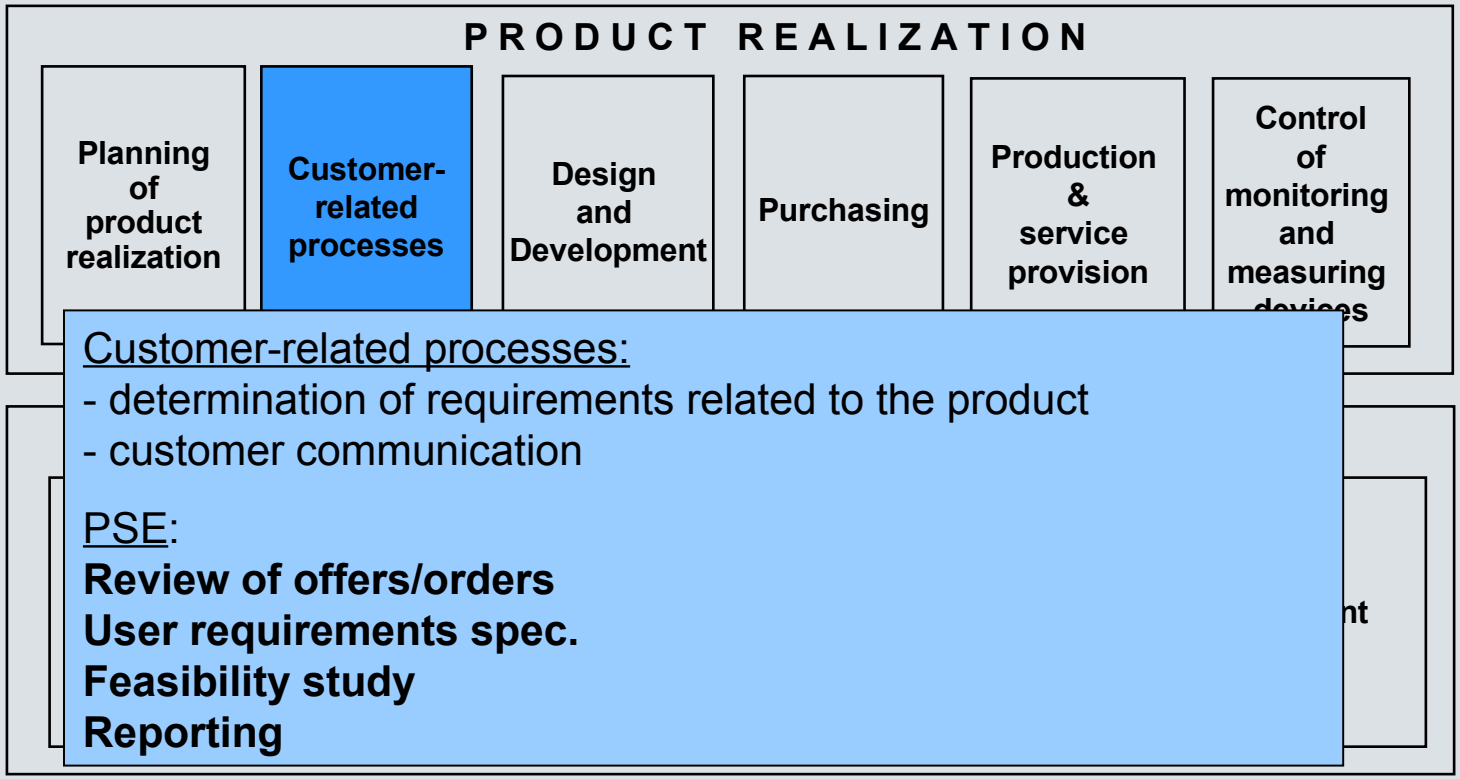
- Requirements stated in ISO 9001 (2000)



ISO-9000/24
Definition of Quality management systems/19

SIEMENS

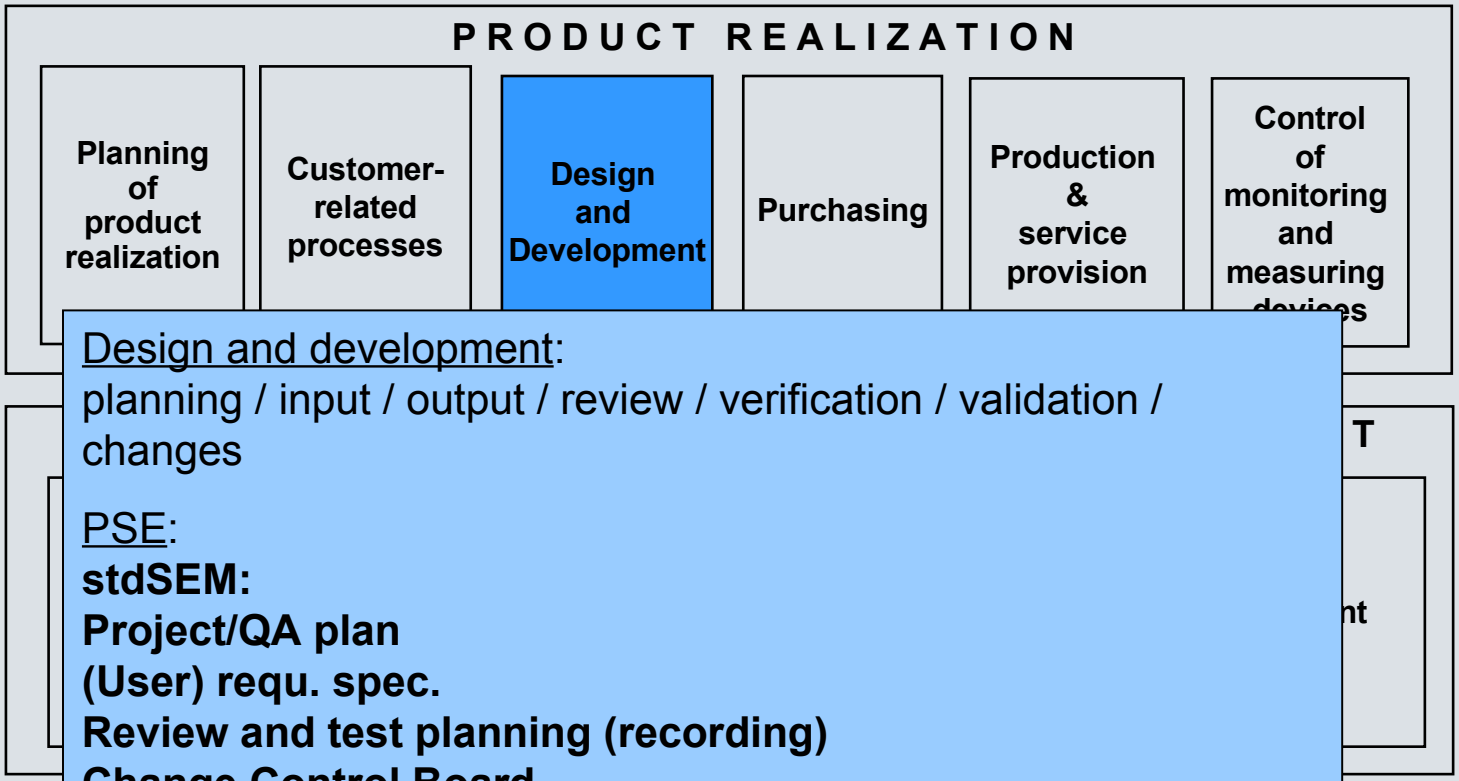
- Requirements stated in ISO 9001 (2000)



ISO-9000/25
Definition of Quality management systems/20

SIEMENS

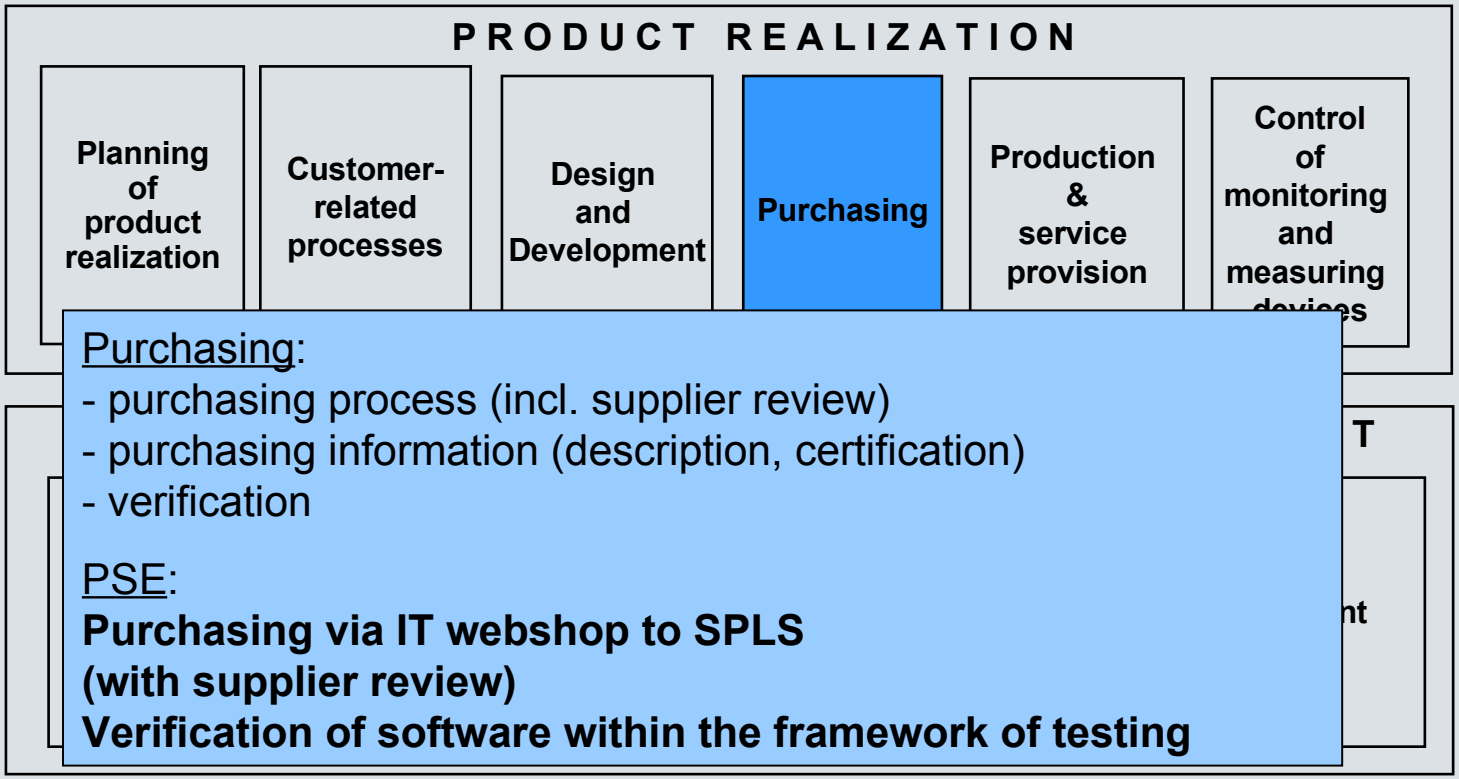
- Requirements stated in ISO 9001 (2000)



ISO-9000/26
Definition of Quality management systems/21

SIEMENS

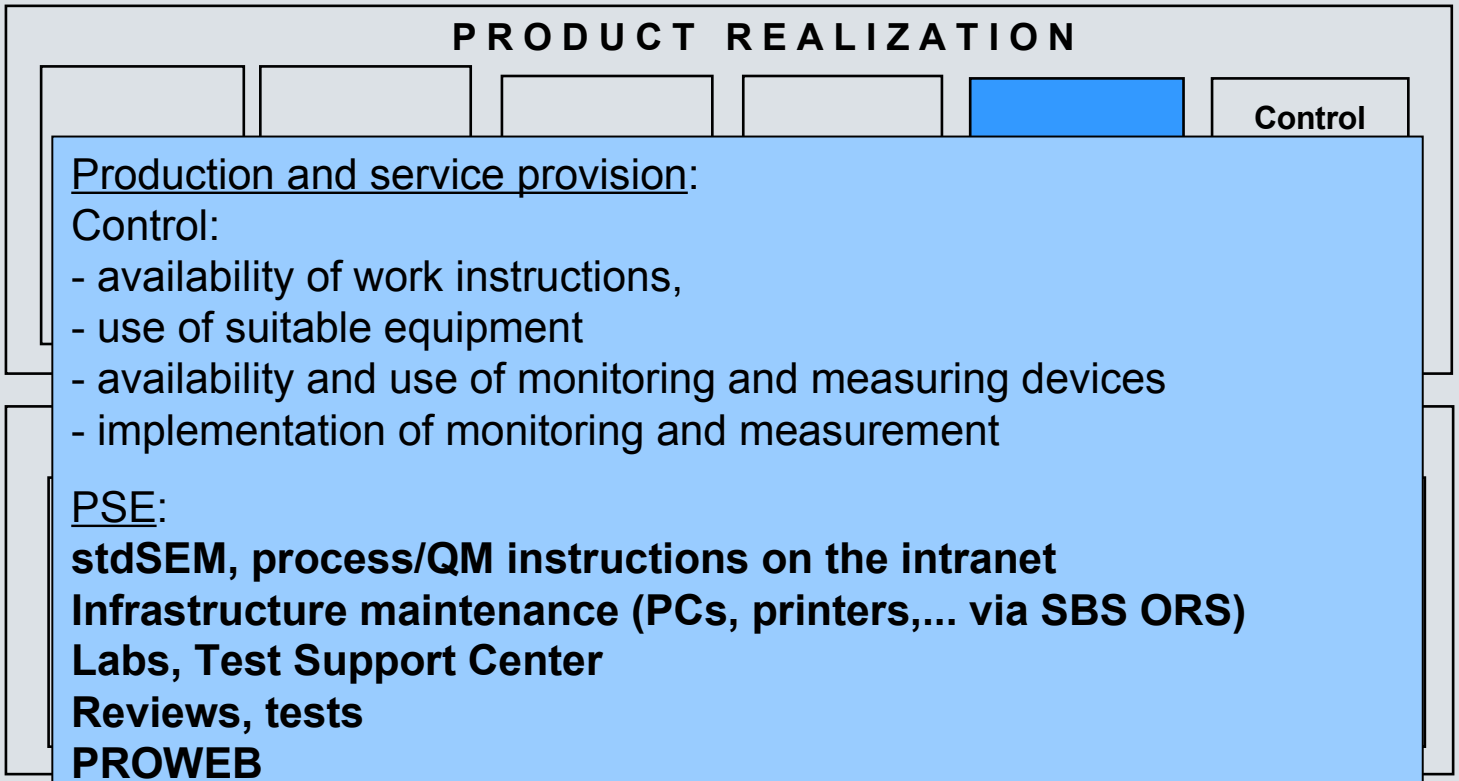
- Requirements stated in ISO 9001 (2000)



ISO-9000/27
Definition of Quality management systems/22

SIEMENS

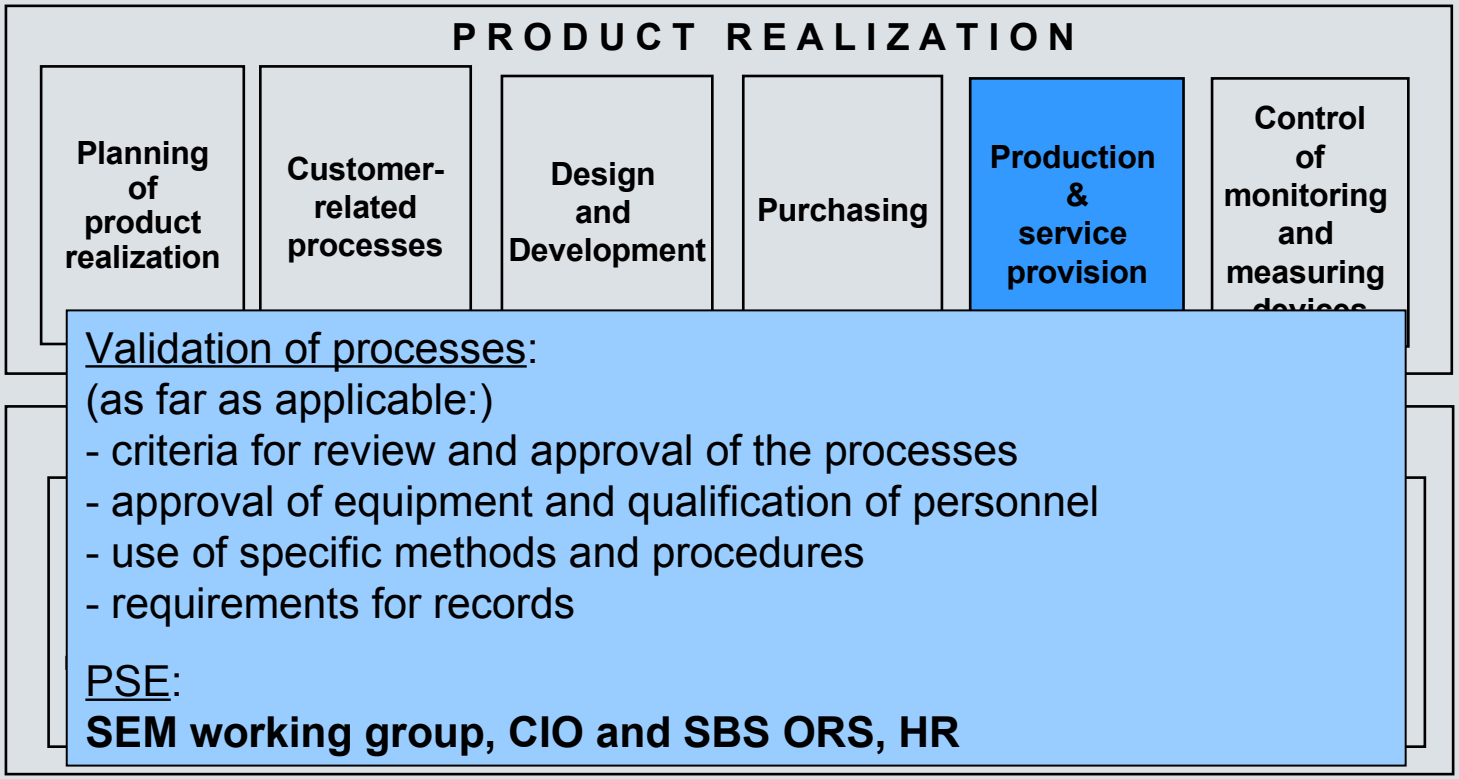
- Requirements stated in ISO 9001 (2000)



ISO-9000/28
Definition of Quality management systems/23

SIEMENS

- Requirements stated in ISO 9001 (2000)



ISO-9000/29
Definition of Quality management systems/24

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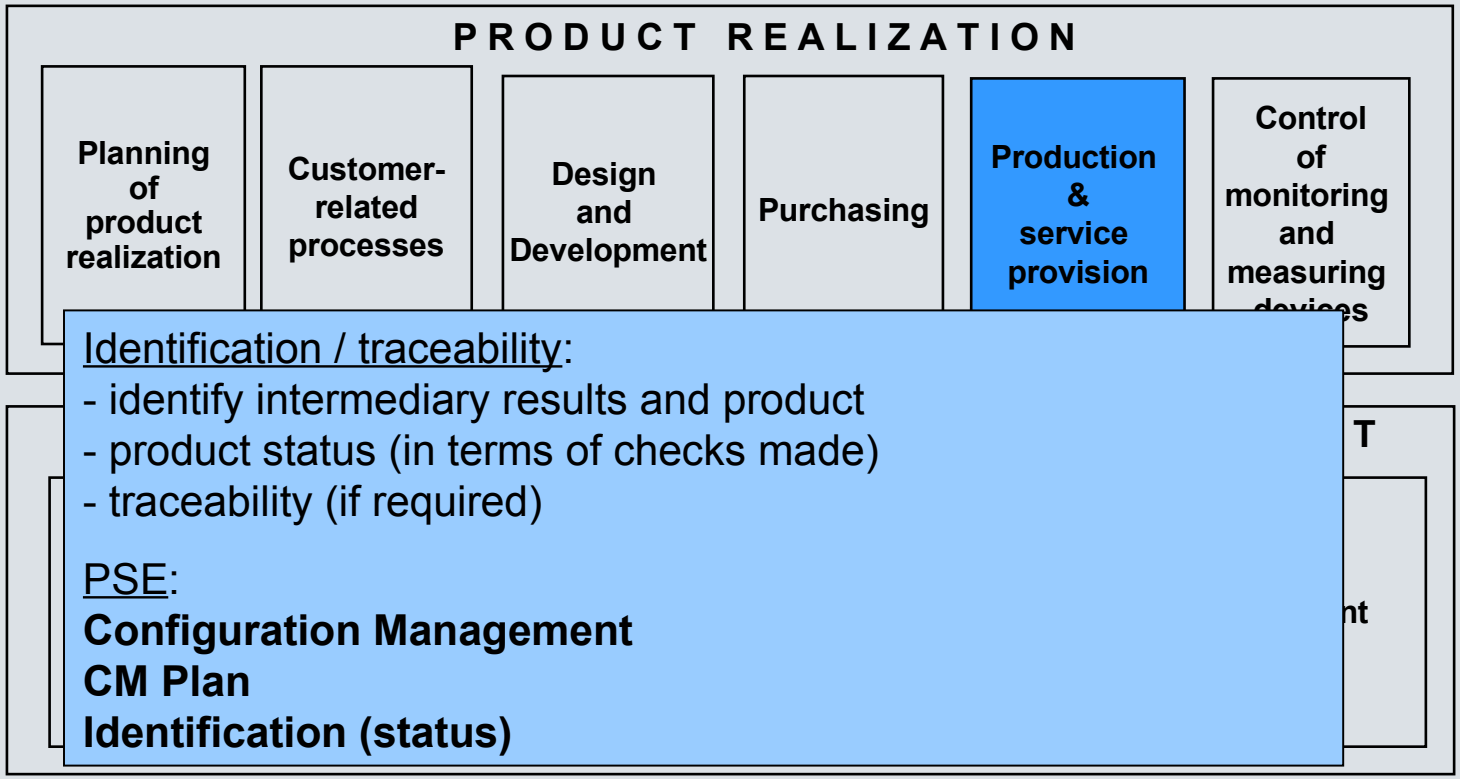
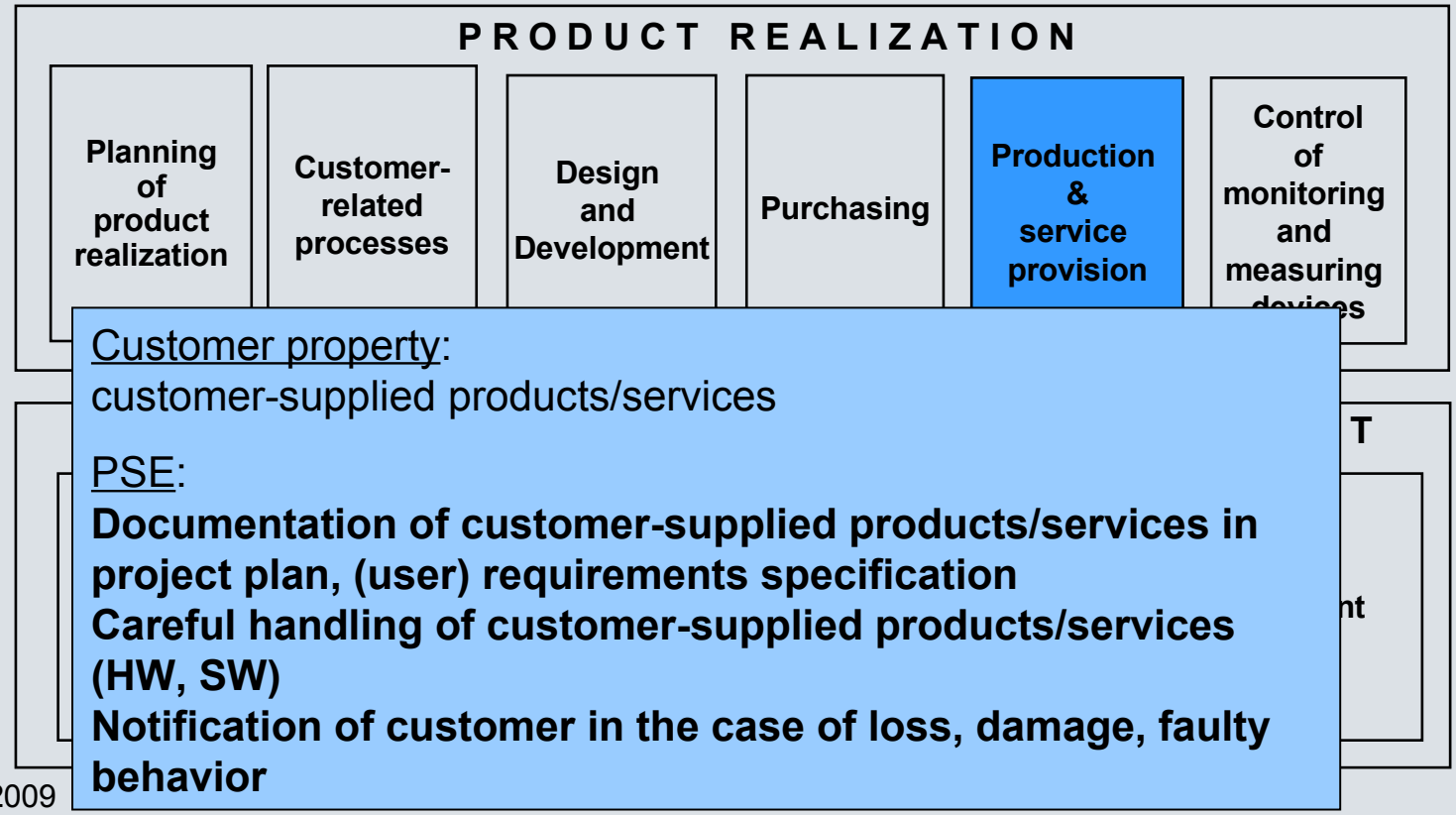
- Requirements stated in ISO 9001 (2000)



ISO-9000/30
Definition of Quality management systems/25

SIEMENS

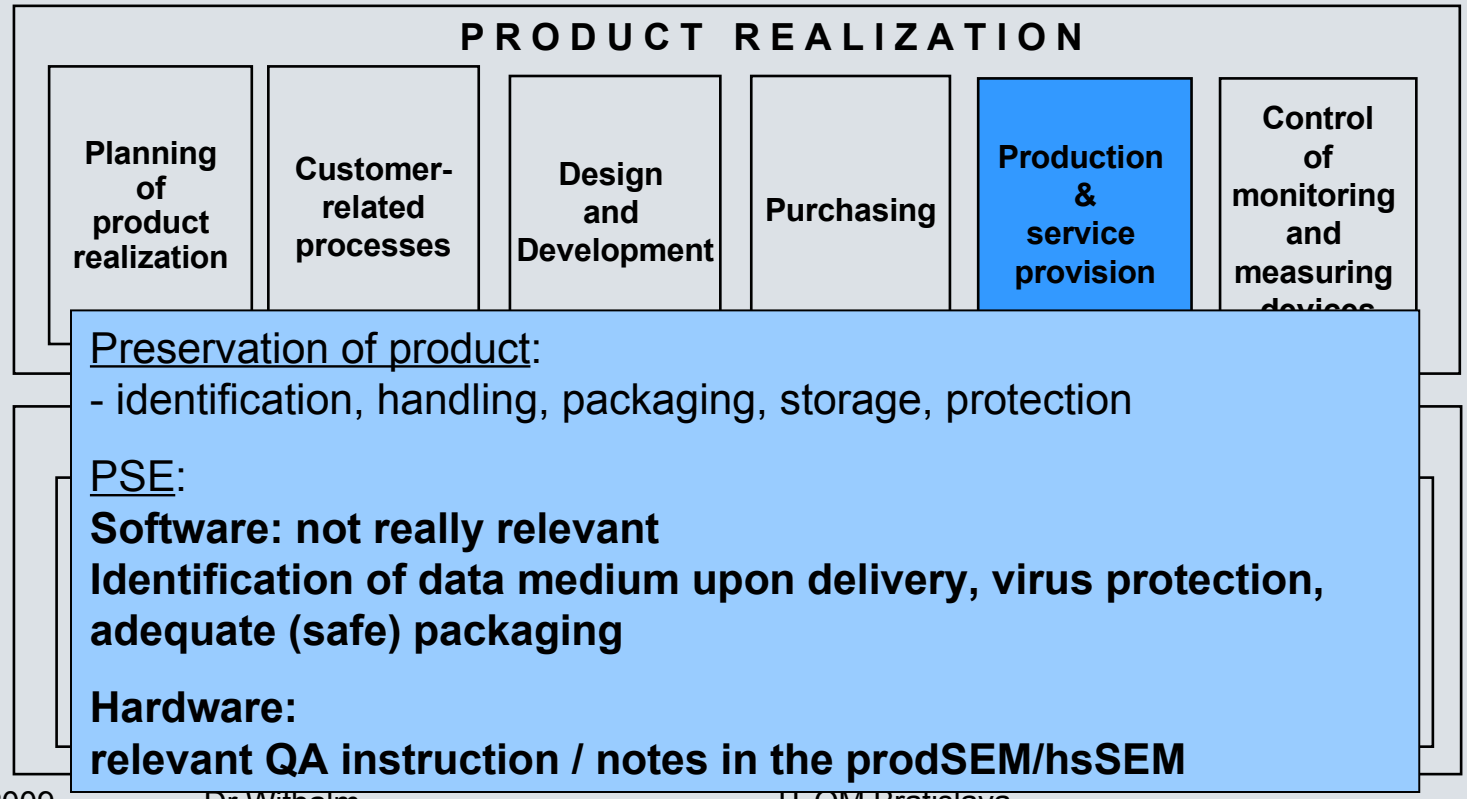
- Requirements stated in ISO 9001 (2000)



ISO-9000/31
Definition of Quality management systems/26

SIEMENS

- Requirements stated in ISO 9001 (2000)



ISO-9000/32
Definition of Quality management systems/27

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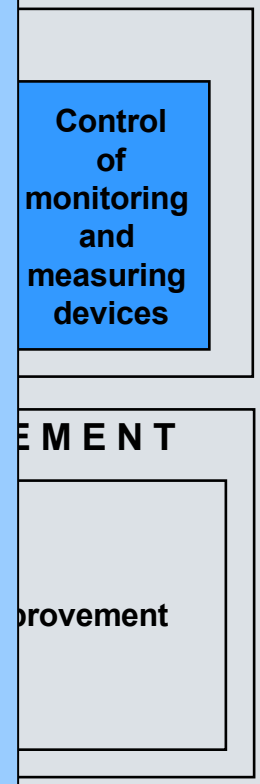
- Requirements stated in ISO 9001 (2000)

Control of monitoring and measuring devices:
- calibration / adjustment
- identification (calibration status)
- protection from invalidating adjustments
- protection from damage and deterioration during handling, maintenance and storage
- record results of calibration
- procedure to follow when monitoring and measuring devices are found faulty

PSE:
QA process instruction

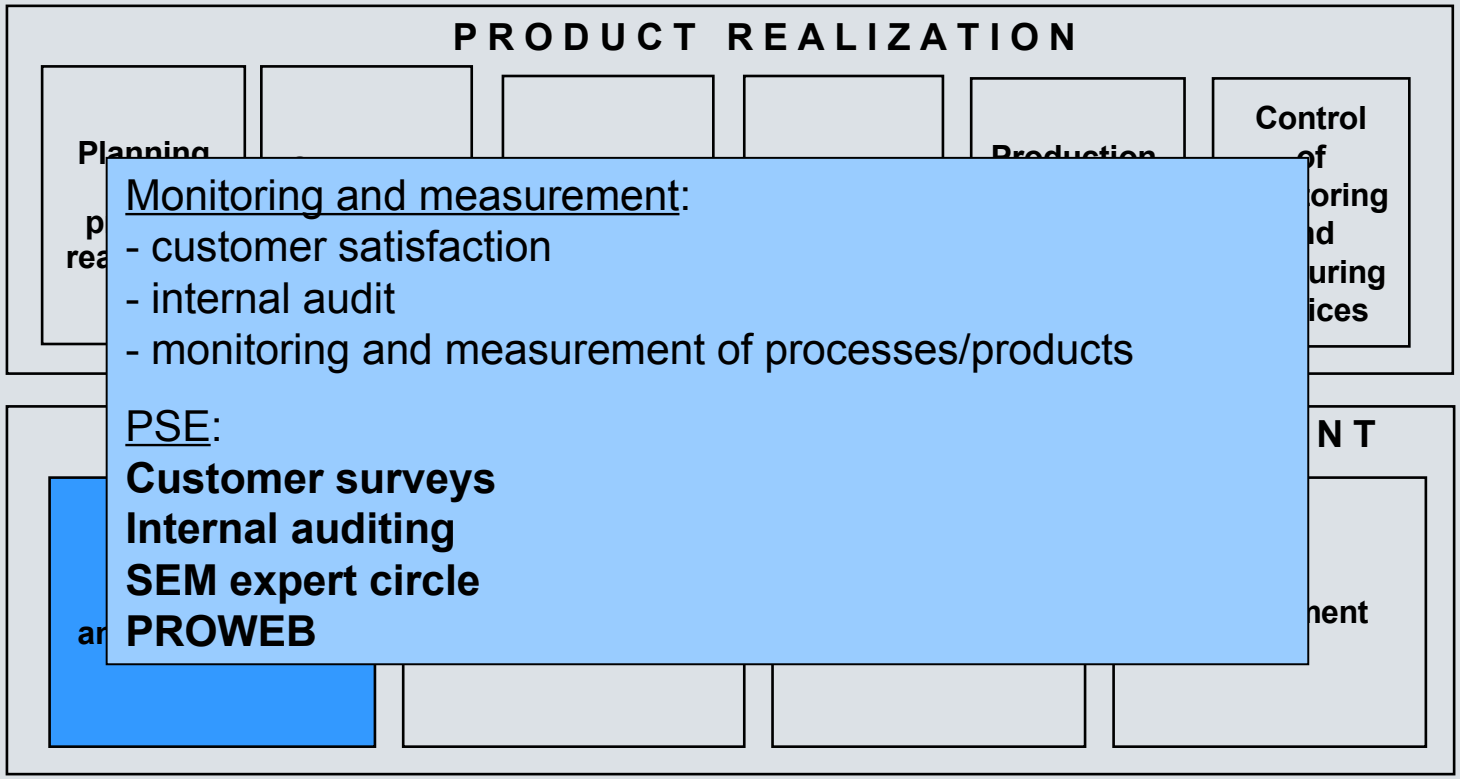
Relevant QA instructions in organization units that use monitoring and measuring devices
Problem: Are there any devices for monitoring and measuring devices?



ISO-9000/33
Definition of Quality management systems/28

SIEMENS

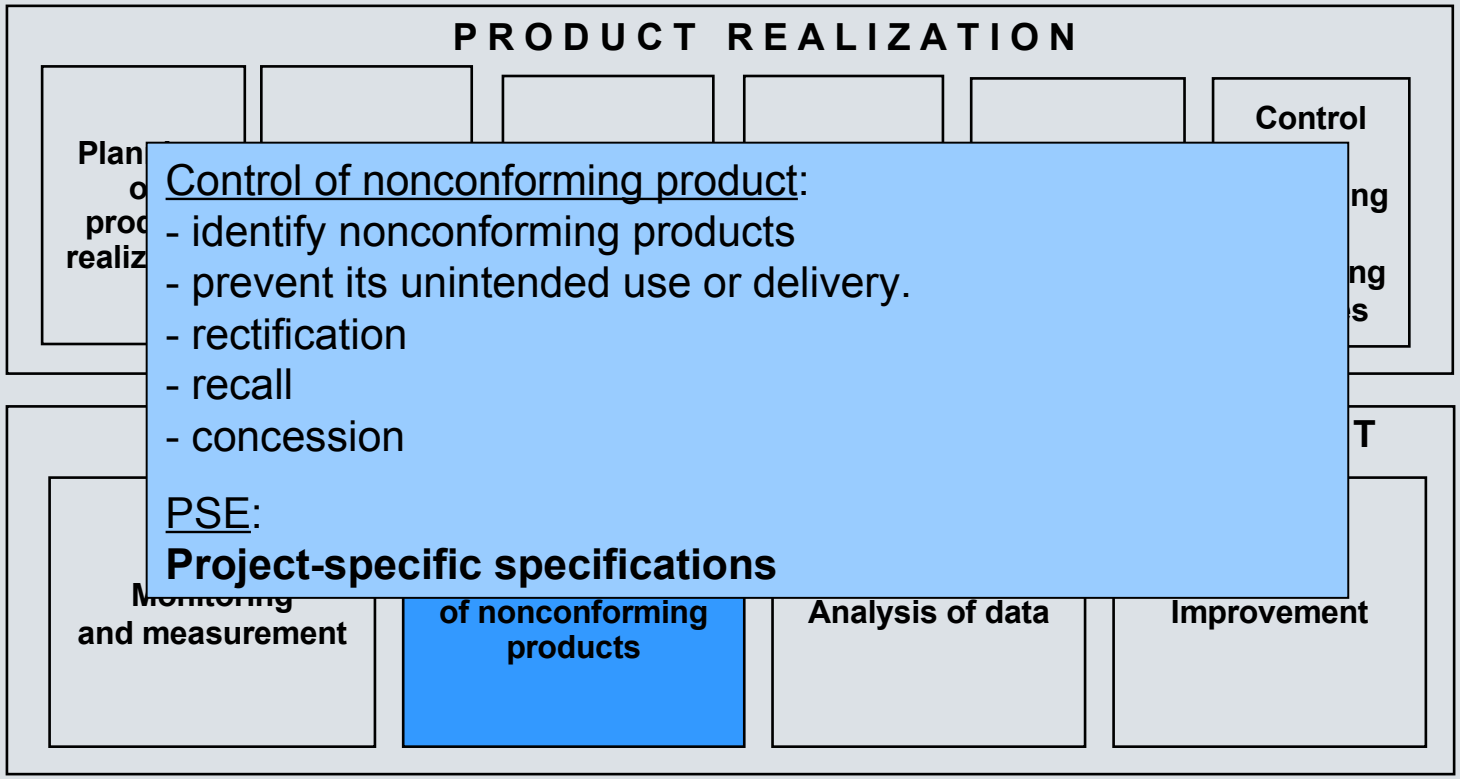
- Requirements stated in ISO 9001 (2000)



ISO-9000/34
Definition of Quality management systems/29

SIEMENS

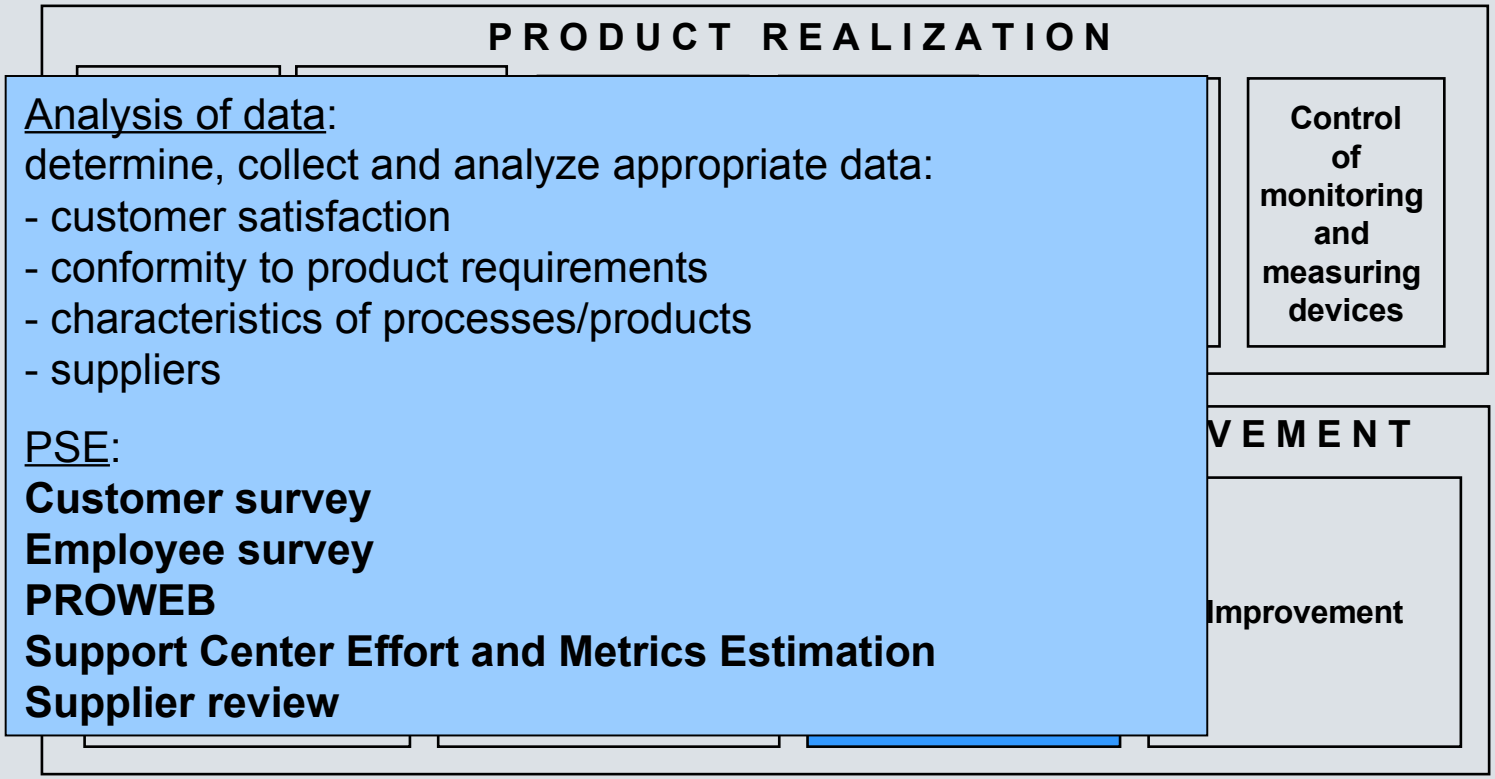
- Requirements stated in ISO 9001 (2000)



ISO-9000/35
Definition of Quality management systems/30

SIEMENS

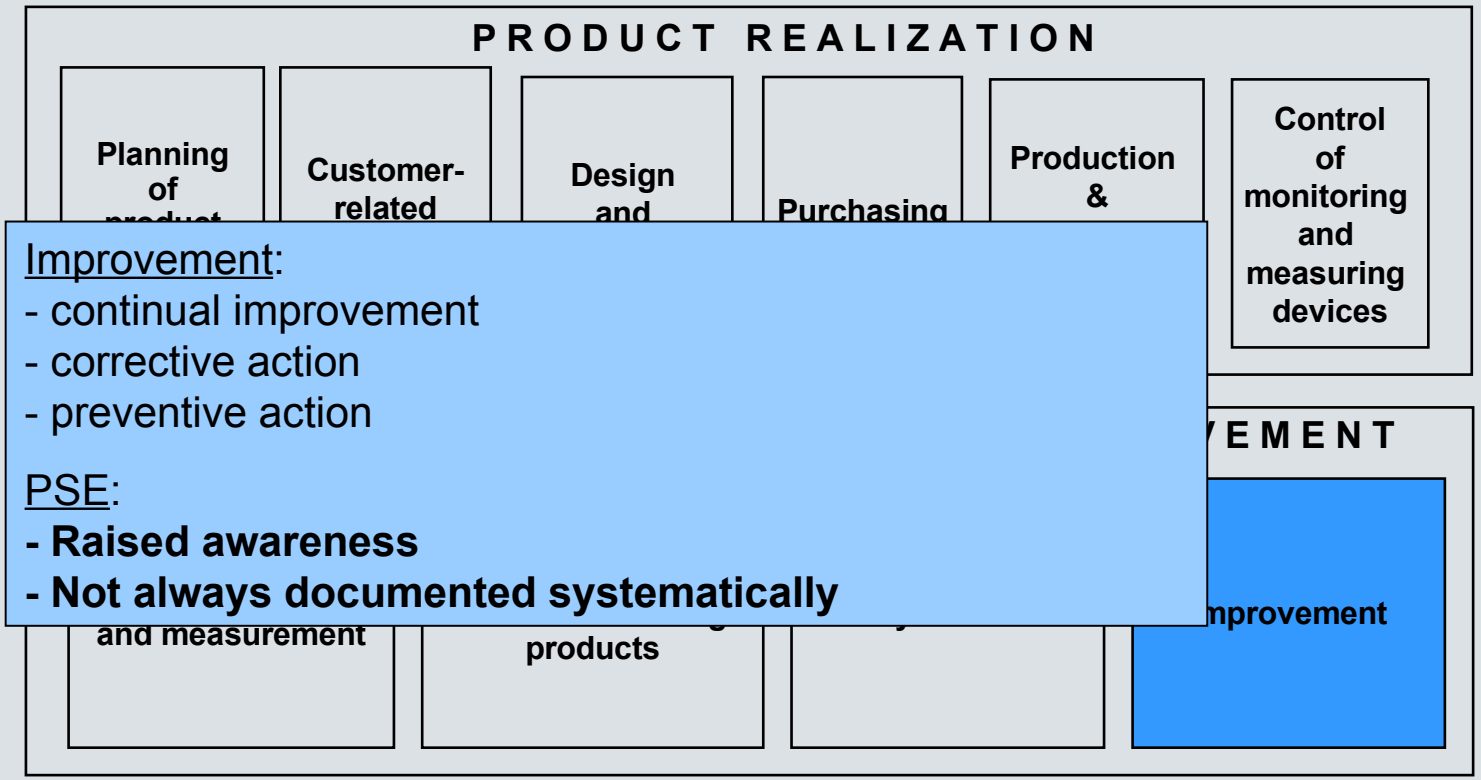
- Requirements stated in ISO 9001 (2000)



ISO-9000/36
Definition of Quality management systems/31

SIEMENS

- Requirements stated in ISO 9001 (2000)



ISO-9000/37
A standardize-fair QM-System

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- Support by the leadership
- Quality Assurance Manual
- Understandable and (written) fixed operational process descriptions
- Conversion of the minimum standard, which is defined in the standard
- Daily practice corresponds to the documentation

ISO-9000/38
Introduction strategies

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Bottom-up

- **Survey of the current situation**
- **Collection of information**
  - **and determination of gaps**
- **Close gaps**
  - **procedures and/or Documentation**

Top-down

- **Manual for contents of documents**
- **Adjustment of the description**
  - **to documented practice**

with practice agreeing documentation

Advantage:
- central standard knowledge
- crucially for cost estimation

Disadvantage:
- expensively and time consuming

Advantage:
- Know-how carrier shows
  - what is still missing

Disadvantage:
- Standard knowledge scattered
- hierarchical method

ISO-9000/39
Certification expenditure for primary acquisition

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- **Preparation**
  - Investigation of the existing material
  - Determination of gaps
- **Introduction**
  - Closing of gaps
  - Training of all coworkers
  - Training of the internal Q-Auditors
  - Internal preparation audits
- **Certification**
  - Preparation
  - Accompanying of the external auditors
  - If necessary subsequent audit

Depending on range and size the expenditure can amount from 2 to 100 man-years

- **Coworker**
  - QM-System
  - Standard
- **Internal Q-Auditors**
  - Siemens Auditor-Seminar
  - DGQ-Seminar

ISO-9000/41
Certification costs (ongoing)

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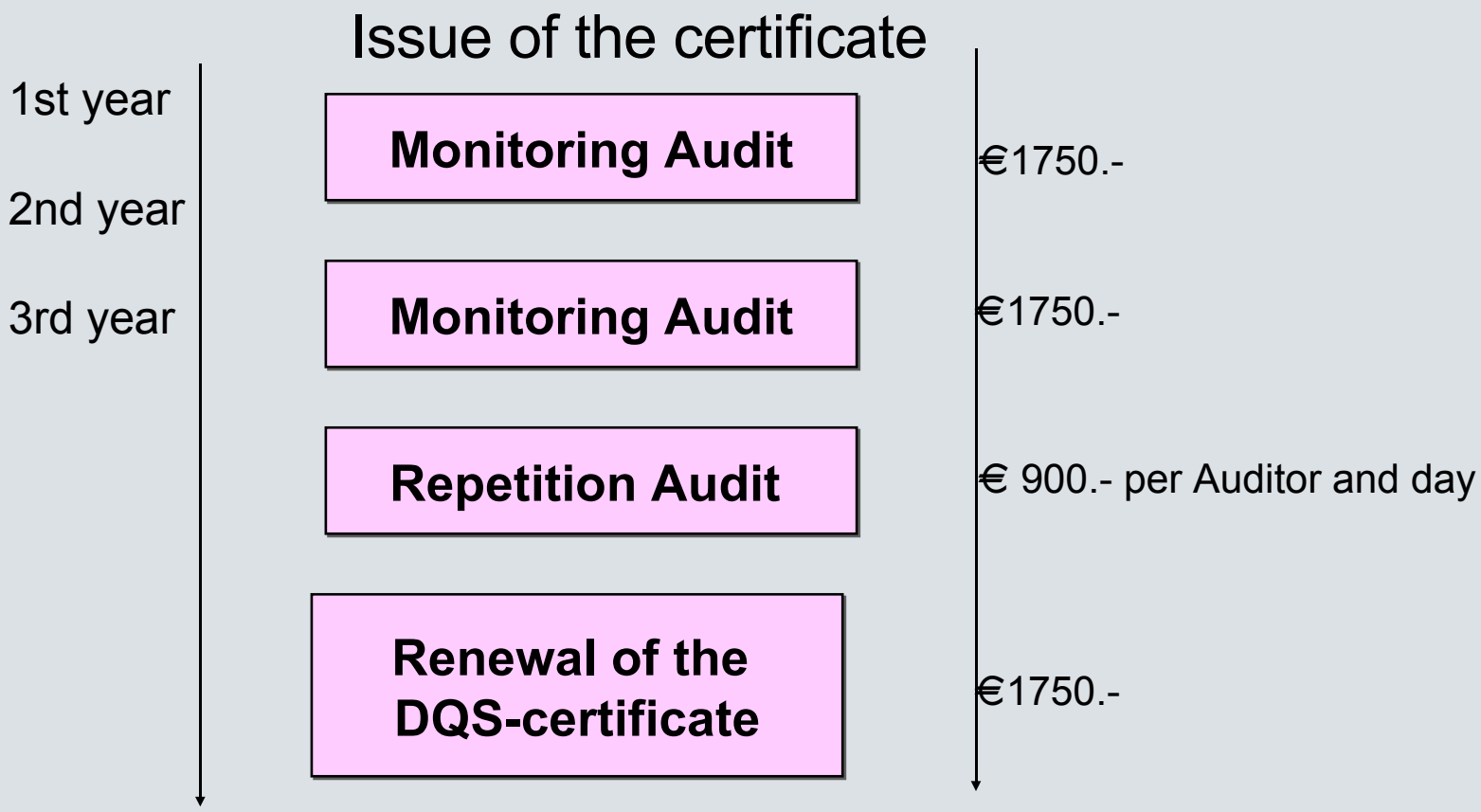
- Internal Q-Audits
- Management-Reviews
- Monitoring and repetition audit
- Training course measures

ISO-9000/41
Certification costs for renewal (DQS)



ISO-9000/42
The way to the certificate/1

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previous measures:

- revision of SEM regarding norm conformity
- internal audits (current since May 92)
- coordination with parent firm (in Germany)
- lecture series about ISO 9000 ff in all departments
- auditor training
- audit procedure manual
- audit check list

ISO-9000/43
The way to the certificate/2

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- PSE module in the QA manual adapted
- PSE QA Division Manual established
- Contractor audit 12/92
- Mandatory Q-training for all PSE coworkers from 1/93 to 3/93
- First contact with ÖQS on 31.3.1993
- Internal procedures concerning quality assurance (4-10/93)
    - Project organization for larger projects
    - Project controlling stage 1
    - Quality goals - tasks of the quality assurance
    - Definition of quality assurance within the PSE

ISO-9000/44
The way to the certificate/3

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- Suggestion for certification audit
  - for each of the 20 elements a responsible person within the PSE was nominated
- Tuning of the audit program with ÖQS (17.8.93)
- All PSE coworkers received a "blue QA map"
  - front: Quality goals
  - back: where are quality-referred documents to find
- Reporting over Q-goals in the PSE steering committee

ISO-9000/45
The way to the certificate/4
Q-Training

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- Mandatory participation of all coworkers (written confirmation)
- Duration approximately 3 hours
- Contents:
  - QM concept, ISO 9000
  - Q-strategy:
    - Explanation by management
    - Q-principles of Siemens Austria
    - Q-manual of Siemens Austria (with reference to SEM)
    - Structure of the Q-Organization of Siemens Austria
  - Definitions
  - Audit procedures
  - Notes for audit execution

ISO-9000/46
Certification - history in general

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back up

- after 2 nd world war QA was set up by Deming & Juran in Japan
- in USA, Europe still classical quality validation
- by HW development QA did not get acceptance till present times
- so-called QA in software in the beginning was only
  - restricted to tests and error count
- in USA above all military (DoD) starts with QA, which is also checked by audits (AQAP)
- Siemens starts in 1980 with QA system (CSA) to get through audits

quality validation
sample audits on the finished product

quality assurance
current checks during the development process

ISO-9000/47
Certification - history SW in general

SIEMENS

back up

- begin of 1980 quality label for SW should be introduced
  - pure quality validation
- discussion about certification since the middle eighties
- in Germany "Made in Germany" syndrome delays certification
- cooperation since 1990 with standards institute on ISO 9000 ff
- since 1992 pressure upon Siemens regarding certification

ISO-9000/48
Certification - connection SW-engineering - QA

SIEMENS

- SW engineering has 3 dimensions:
  - organization - method - technology

- organization means:
  - application of a method (e.g. SEM, SEPP,....)
  - verification of this application
  - organization of QA
  - record of primary data (metrics)

- method means e.g.:
  - functional development method
  - object oriented development method

- technology means:
  - with which tools the method is set up
    - informatics institutes of universities were originally mostly interested
    - in the beginning SW-engineers were only interested in technology

ISO-9000/49
Benefits & Drawbacks of certification/1

SIEMENS

- **Benefits**
  - quality assurance => quality system
  - procedures for project environment
  - major efforts for certification
  - regular internal audits
- **Drawbacks**
  - ISO 9001 - seduces to formalism
  - motivation

Peopleware

ISO-9000/50
Benefits & Drawbacks of certification/2

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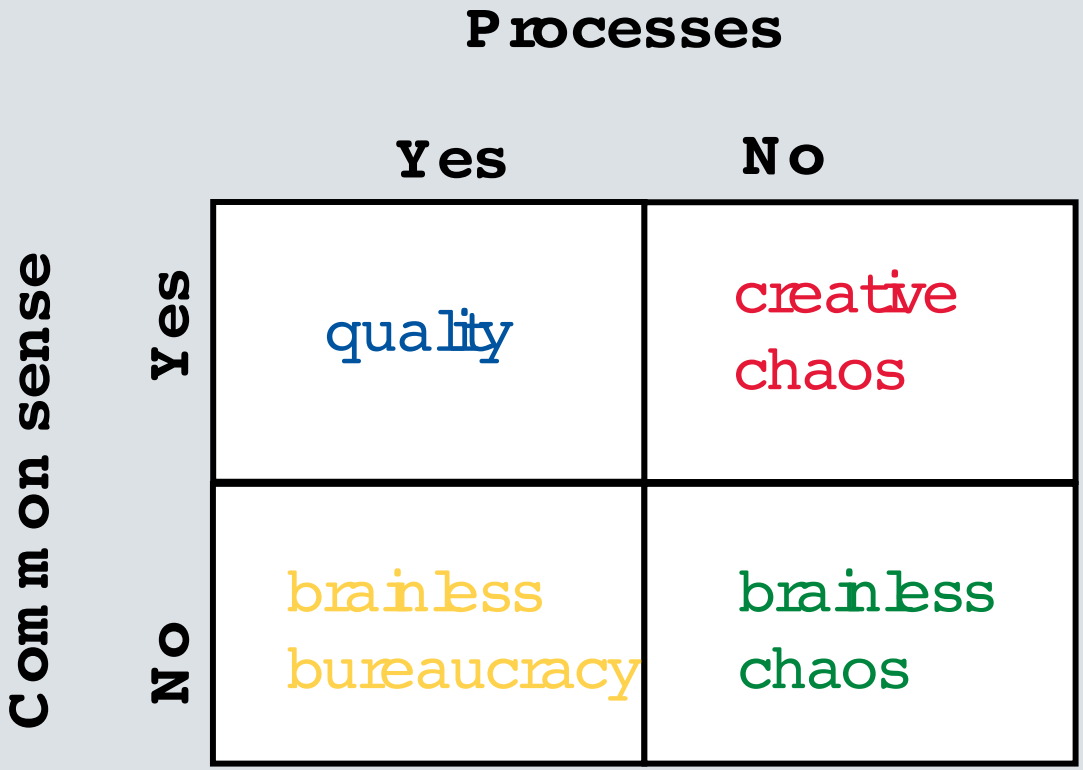

Quelle: Telelogic/Ivar Jacobs;SEI

Metrics and Assessments

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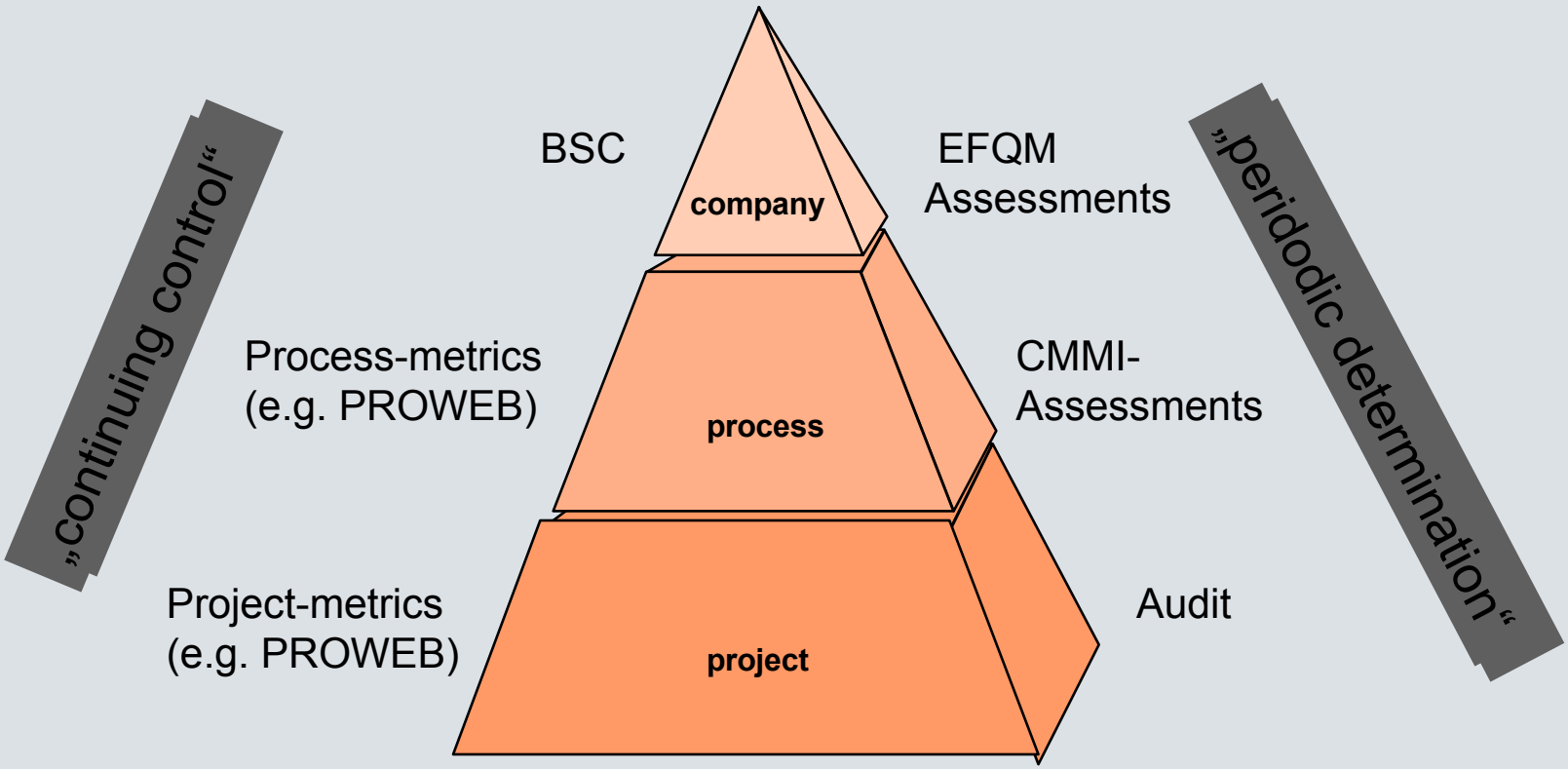


CMMI Assessments at PSE

SIEMENS

- **First Assessments 1993/1994**
  (3 Assessments for SEM, SEPP, SNI-PHB
  PSE-wide)
- **Second run 1997/1998**
  (7 Assessments on BU (Business Unit)-level)
- **Third run 2000/2001** (PSE-wide Process-Assessment
  and 10 Assessments on BU level)
- **Fourth run 2004/2005** (PSE-wide Process-Assessment
  and 2 Assessments on GG level)
- **Fifth run planned in 2006/2007** (6 Assessments on BU level)
- goal: **all** BU at **Level 3** or higher
- respectively **realization** of findings by BU´s and
  Q-organisation

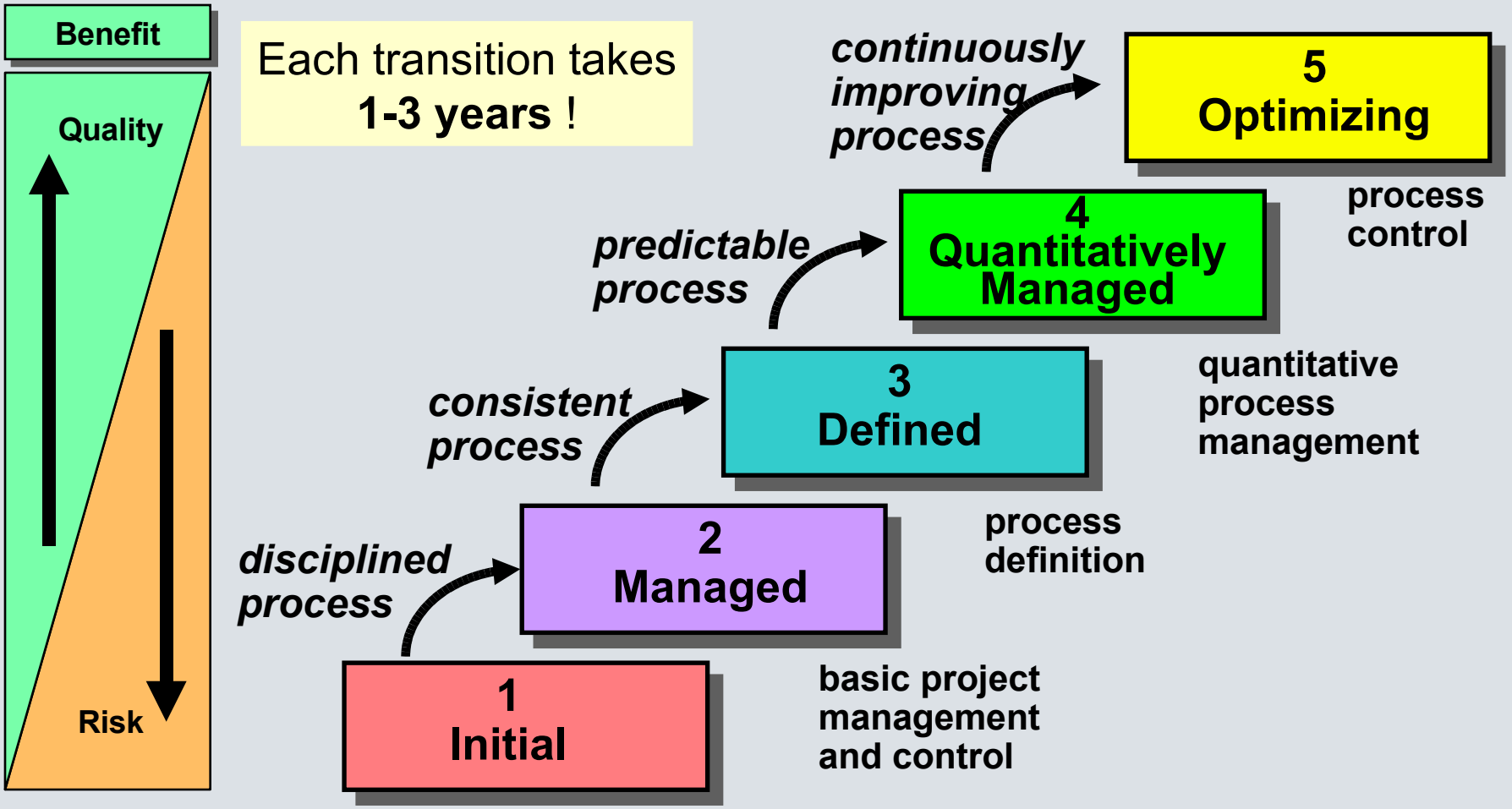
CMMI - Capability Maturity Model Integration

SIEMENS

- Model for evaluating software/hardware/systems engineering organizations
- Developed by the Software Engineering Institute (SEI)
  - Initiated by DoD
  - Headed by Watts Humphrey
- Reference model also for derived methods such as Bootstrap and Siemens Process Assessments

CMMI Maturity Levels (staged)

SIEMENS



Characteristics of an immature process

SIEMENS

- The process is ad hoc and generally based on improvisation (by developers and managers).
- Procedures, if existing at all, are not being adhered to.
- Strong dependency on individuals (“heroes”).
- Product quality and performance very difficult to predict.
- Product quality and functionality downgrading to meet deadlines, but deadlines are still exceeded.
- The use of new technologies involves major risks.
- During a crisis, guidelines/rules are often abandoned as unnecessarily complicating.

Characteristics of a mature process

SIEMENS

- Standardized process, defined and documented
  - has been understood and accepted
  - is being applied
  - is “alive”
- Visible support through management
- Clear definition and understanding of roles and responsibilities
- Well-established control – process compliance is being monitored and enforced
- Consistent with the staff’s current way of working
- Measurable and being measured
- Supported by means of suitable technologies and tools

CMMI Process Areas

SIEMENS

Optimizing (5)
- Organizational Innovation and Deployment
- Causal Analysis & Resolution

Quantitatively Managed (4)
- Quantitative Process Management
- Software Quality Management

Defined (3)
- Requirement Development
- Technical Solution
- Product Integration
- Verification
- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Integrated Project Management
- Risk Management
- Decision Analysis and Resolution

Managed (2)
- Requirements Management
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Measurement and Analysis
- Process and Product Quality Assurance
- Configuration Management

CMMI Definitions

SIEMENS

- **CMMI** Capability Maturity Model Integration
- **Staged** representation (analog SW-CMM) has Maturity Levels
- **Continuous** representation (analog SPICE) has Capability Levels
- **Process Areas**

- **Difference between**
  - **CMMI-wording (Process Areas, Maturity Level ML (1-5))**
  - **Siemens Process Assessment -wording**
    (OPAL Level 0.25,..5.00)
    Categories (e.g. Engineering)
    ->Siemens Process Areas (e.g. Supplier Management)
    ->Themes (e.g. Risk Management, Estimation Method)
    ->Questions

CMMI Key terms

SIEMENS

A **standard process**
- is a basic process guiding the establishment of a common process across the organization
- describes fundamental elements in a process used by a project
- exists at organizational level

A **managed process**
- is a performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled and reviewed for adherence to its process description

A **defined process**
- is a managed process that is tailored from the organization's set of processes according to the organization's tailoring guidelines
- has a maintained process description
- contributes work products, measures and other process improvement information to the organizational process assets
- exists at the project level

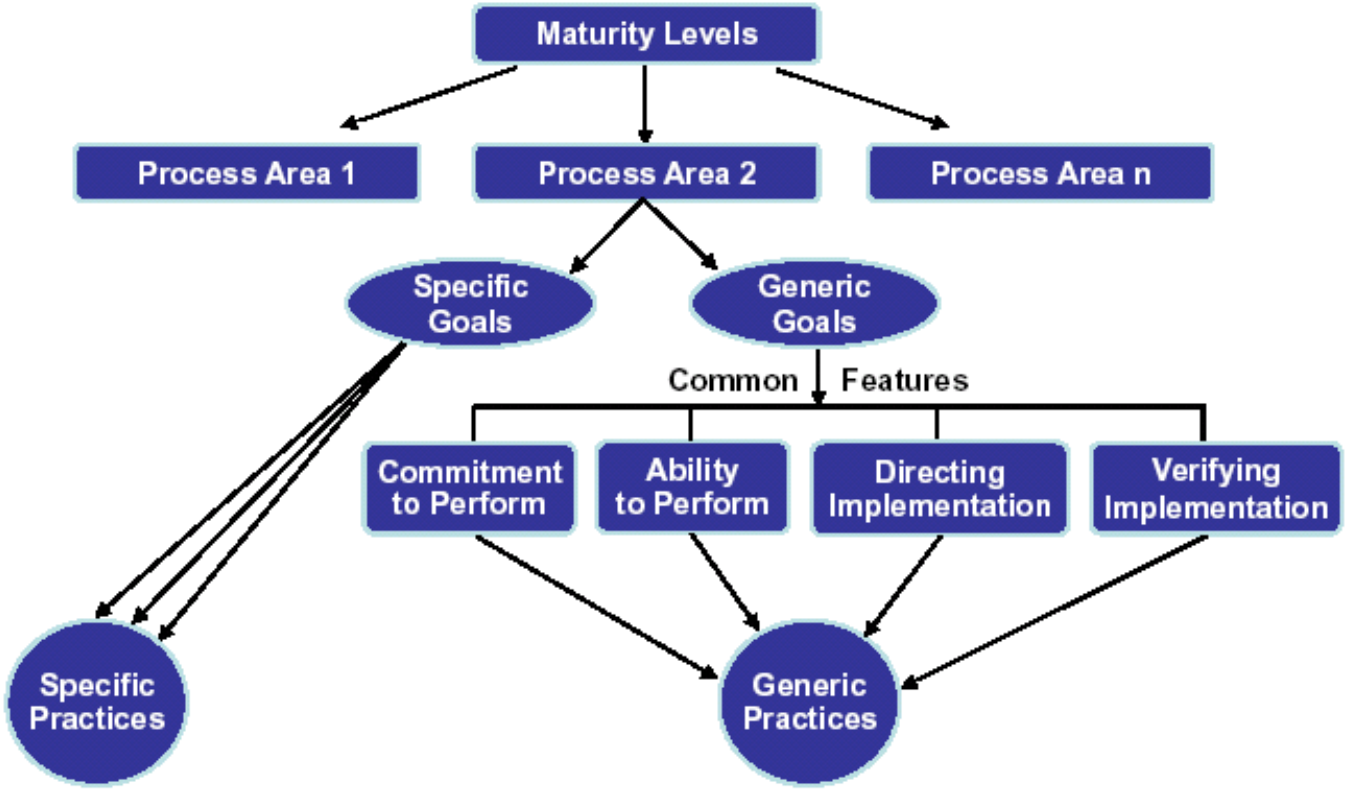
CMMI Model options

SIEMENS

- Model options
  - software engineering
  - systems + software engineering
  - systems + software engineering + integrated product and process development (IPPD)
  - systems + software engineering + integrated product and process development + supplier sourcing (SS)
- Representation options
  - staged
  - continuous

All models can be downloaded free from the SEI homepage!

CMMI Model Components in the Staged Representation



CMMI Generic Goals (1)

SIEMENS

CMMI®

Maturity Level 2 Generic Goal

- The generic goal for all maturity level 2 process areas is

GG 2: *The process is institutionalized as a managed process.*

- A managed process is a performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.

CMMI Generic Goals (2)

SIEMENS

Maturity Levels 3-5 Generic Goal

- The generic goal for all maturity level 3-5 process areas is

GG 3: *The process is institutionalized as a defined process.*

- *(GG 3 subsumes GG 2.)*

- A defined process is a managed process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines; has a maintained process description; and contributes work products, measures, and other process-improvement information to the organizational process assets.

Characteristics of ML 1

SIEMENS

- Processes are performed but often in an ad hoc and occasionally chaotic manner.
- Performance is dependent on the competence and heroics of the people.
- High quality and exceptional performance is possible, as long as the best people can be assigned to the task.
- Performance is difficult to predict.
- Management practices may not be effective.
- A product is (sometimes) produced by some amorphous process.

Characteristics of ML 2

SIEMENS

- Project management is more disciplined.
- Organizational polices are established and followed.
- Project plans and process descriptions are documented and followed.
- Resources are adequate.
- Responsibility and authority are assigned over the life cycle.
- Past successes can be expected on similar projects.
- Discipline helps ensure that existing practices are retained during times of stress.
- Status of activities and work packages is visible to management at defined points.
- Activities are performed in accordance with plans.
- Measures and reviews occur at defined points.

Process Areas and Specific Goals of ML 2 (1)

SIEMENS

Requirements Management

- Manage the requirements of the project's products and product components and identify inconsistencies between those requirements and the project plans and work products.
  - Manage Requirements.

Project Planning

- Establish and maintain plans that define project activities.
  - Establish Estimates
  - Develop a Project Plan
  - Obtain Commitment to the Plan

Project Monitoring and Control

- Provide understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan
  - Monitor Project against plan
  - Manage corrective actions to closure

Process Areas and Specific Goals of ML 2 (2)

SIEMENS

Supplier Agreement Management

- Manage the acquisition of products from suppliers for which there exists a formal agreement.
  - Establish supplier agreement
  - Satisfy supplier agreement

Measurement and Analysis

- Develop and sustain a measurement capability that is used to support management information needs.
  - Align measurement and analysis activities
  - Provide measurement results

Process and Product Quality Assurance

- Provide staff and management with objective insight into processes and associated work products.
  - Objectively evaluate processes and work products
  - Provide objective insight

Process Areas and Specific Goals of ML 2 (3)

SIEMENS

Configuration Management

- Establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting and configuration audits.
  - Establish baselines
  - Track and control changes
  - Establish integrity

Characteristics of ML 3

SIEMENS

- This level builds on the foundation of project management in the maturity level 2.
  - The engineering processes are more effectively implemented.
  - The organization is more proactive.
  - Organizational training needs are identified and provided.
- The organization has a set of standard processes, which individual projects tailor to their needs.
- Commonality among projects allows more uniform estimation of performance.

Process Areas and Specific Goals of ML 3 (1)

SIEMENS

Requirement Development

- Produce and analyze customer, product and product component requirements.
  - Develop customer requirements
  - Develop product requirements
  - Analyze and validate requirements

Technical Solution

- Design, develop and implement solutions to requirements. Solutions, designs and implementations encompass either singly or in combinations as appropriate.
  - Select product component solutions
  - Develop the design
  - Implement product design

Process Areas and Specific Goals of ML 3 (2)

SIEMENS

Product Integration

- Assemble the product from the product components, ensure that the product - as integrated – works properly (whole functionality) and deliver the product.
  - Prepare for product integration
  - Ensure interface compatibility
  - Assemble product components and deliver the product

Verification

- Ensure that the selected work products meet their specified requirements.
  - Prepare for verification
  - Perform peer reviews
  - Verify selected work products

Process Areas and Specific Goals of ML 3 (3)

SIEMENS

Validation

- Demonstrate that the product or product components fulfills its intended use when placed in its intended environment
  - Prepare for validation
  - Validate product or product components (must be suitable for use in their intended operating environment)

Organizational Process Focus

- Plan and implement organizational process improvement based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets.
  - Determine process improvement opportunities
  - Plan and implement process improvement activities

Process Areas and Specific Goals of ML 3 (4)

SIEMENS

Organizational Process Definition

- Establish and maintain a usable set of organizational process assets.
  - Establish organizational process assets

Organizational Training

- Develop the skills and knowledge of people so they can perform their roles effectively and efficiently..
  - Establish an organizational training capability
  - Provide necessary training

Integrated Project Management

- Establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes.
  - Use the project's defined process
  - Coordinate and collaborate with relevant stakeholders

Process Areas and Specific Goals of ML 3 (5)

SIEMENS

Risk Management

- Identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product of project to mitigate adverse impacts on achieving objectives.
  - Prepare for risk management
  - Identify and analyze risks
  - Mitigate risks

Decision Analysis and Resolution

- Analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria.
  - Evaluate alternatives

Characteristics of ML 4

SIEMENS

- Statistical and other quantitative methods are used – at the organizational and project level – to
  - understand past process performance, past product quality and past service quality
  - predict future process performance, future product quality and future service quality
- The behavior of the process is predictable and quantitatively understood.
- A quantitative basis exists for decisions to achieve established product quality, service quality and process- performance goals.
- Projects use measurable objectives to meet the needs of the customers, end-users and the organization.
- Managers end engineers use the data with statistical and other quantitative techniques in managing the processes and results.

Process Areas and Specific Goals of ML 4

SIEMENS

Organizational Process Performance

- Establish and maintain a quantitative understanding of the performance of the organization's set of standard processes in support of quality and process-performance objectives and to provide the process-performance data, baselines and models to quantitatively manage the organization's projects.
  - Establish performance baselines and models

Quantitative Project Management

- Quantitatively manage the project's defined process to achieve the project's established quality and process-performance objectives.
  - Quantitatively manage the project
  - Statistically manage sub-process performance

Characteristics of ML 5

SIEMENS

- Quantitative process improvement objectives for the organization are established and continually revised to reflect changing business objectives.
- Incremental and innovative improvements that measurably increase process capabilities are identified, evaluated and deployed.
- Once a process area has been successfully managed at a quantitative level, an optimizing process approach builds on this quantitative control and seeks to continually improve the process performance through both incremental and innovative process and technical improvements.
- Optimizing processes are concerned with finding the common causes of process variation that can be used to improve the organization's set of standard processes to improve process performance while maintaining statistical predictability.

Process Areas and Specific Goals of ML 5

SIEMENS

Organizational Innovation and Deployment

- Select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvement supports the organization's quality and process-performance objectives as derived form the organization's business objectives.
  - Select improvements
  - Deploy improvements

Causal Analysis and Resolution

- Identify causes of defects and other problems and take action to prevent them from occurring in the future.
  - Determine causes of defects
  - Address causes of defects

CMMI-Check

SIEMENS

- Capability Maturity Model Integration (CMMI) and Siemens Process Assessment (SPA V3.0) method as a basis for **self-assessment**.
- Target-oriented identification of **potential for improvement** with a view to increasing the quality and efficiency of the SW engineering process.
- The CMMI-check is supposed to provide starting points for **measures** that are to be implemented jointly by staff and management.
- The CMMI-check is not supposed to provide a SIEMENS-wide or internationally comparable assessment of processes, but is a good way to prepare for assessments.

How a CMMI Assessment works

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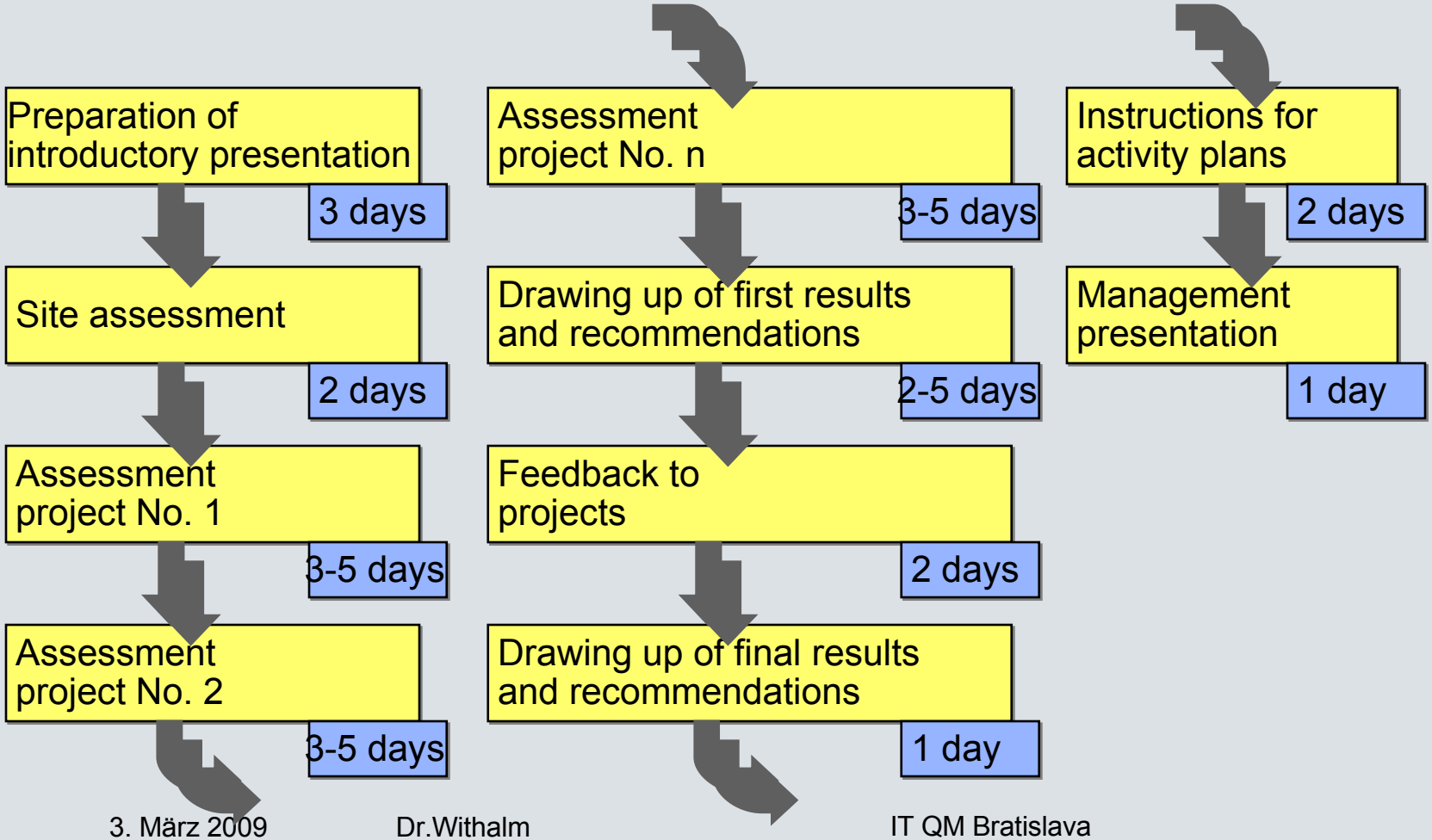

How a CMMI Check works

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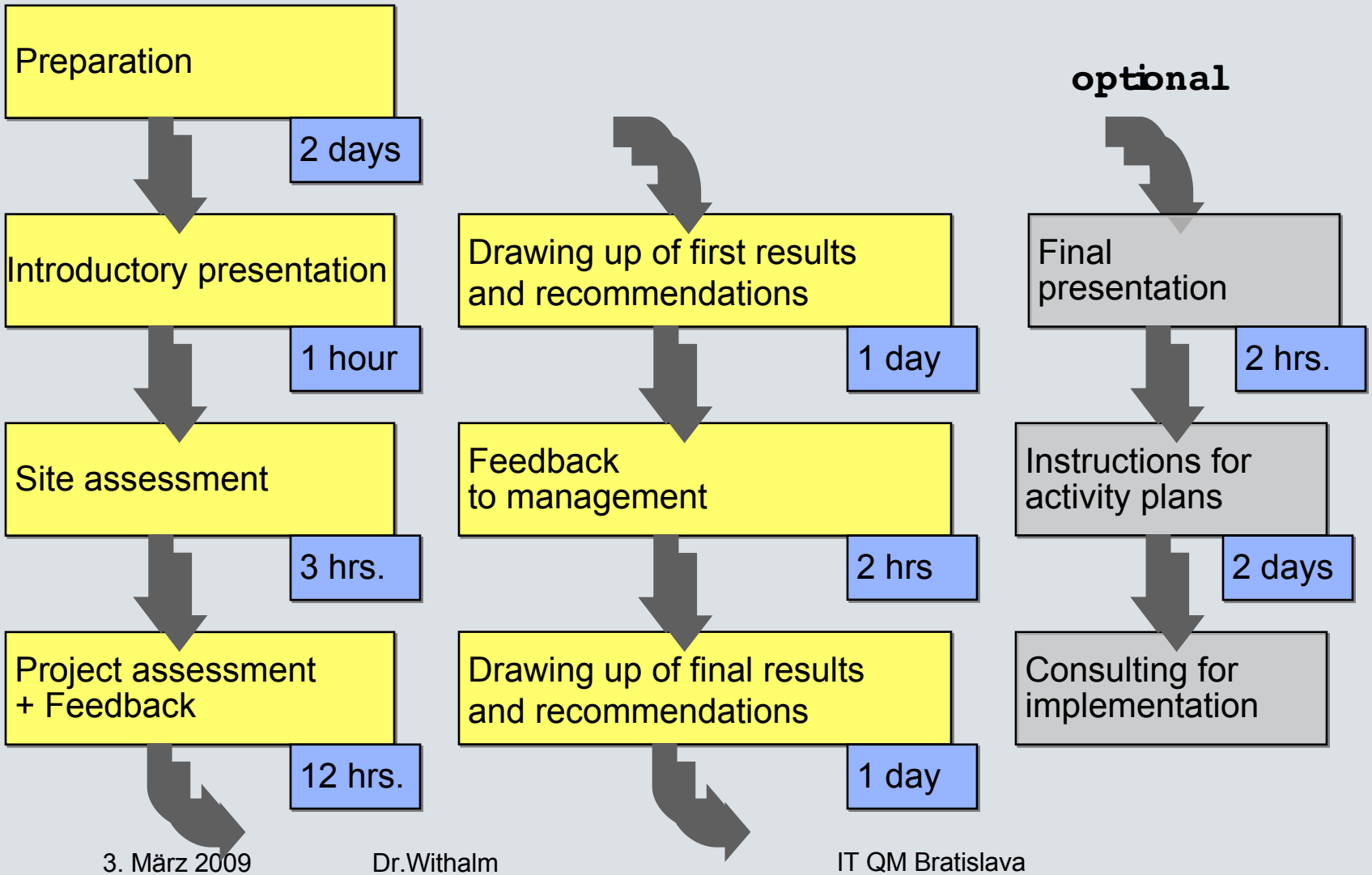

Structure of SPA: Categories and Process Areas

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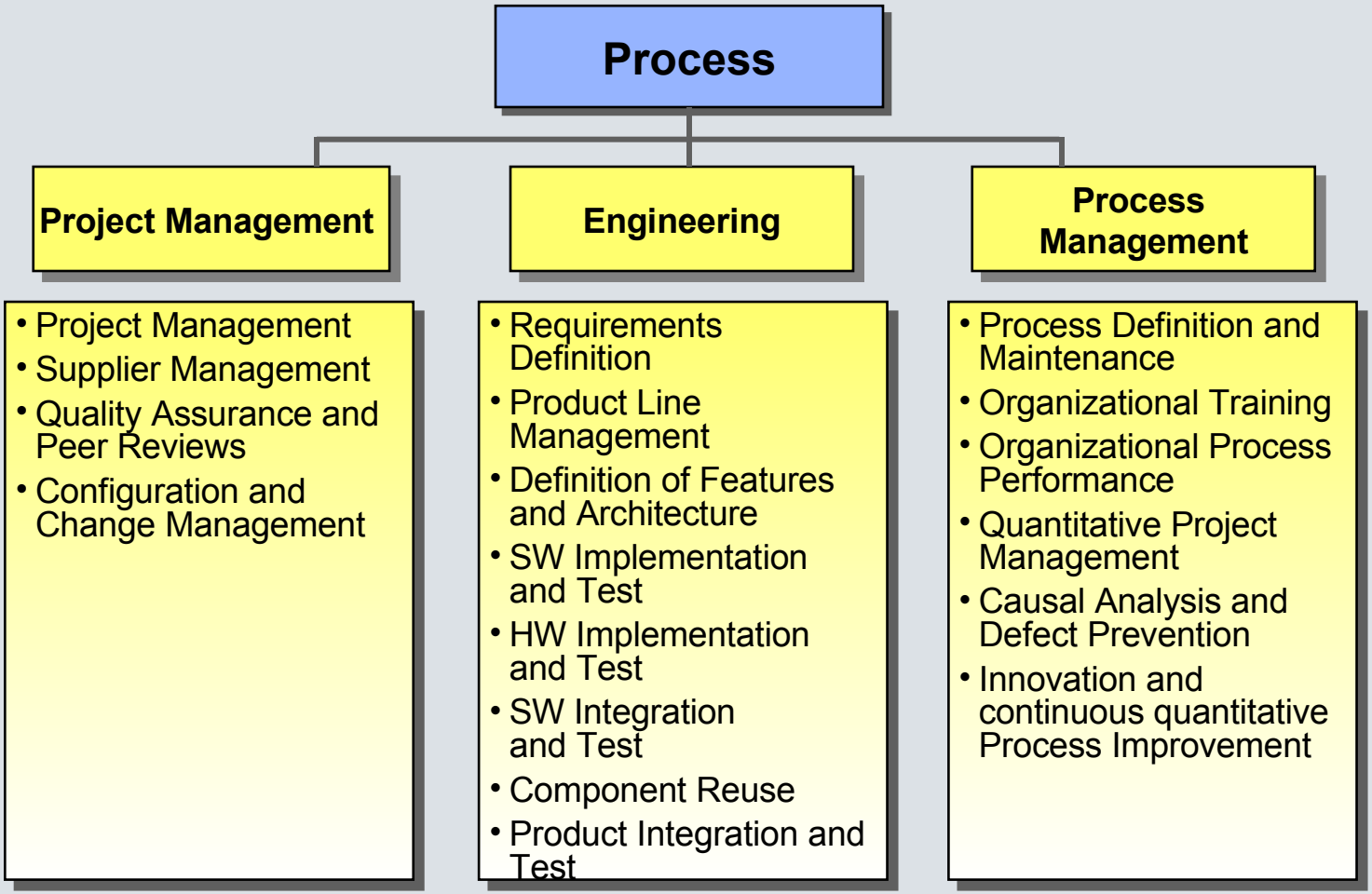

CMMI Capability Maturity Model Integrated/4 Site-Assessment

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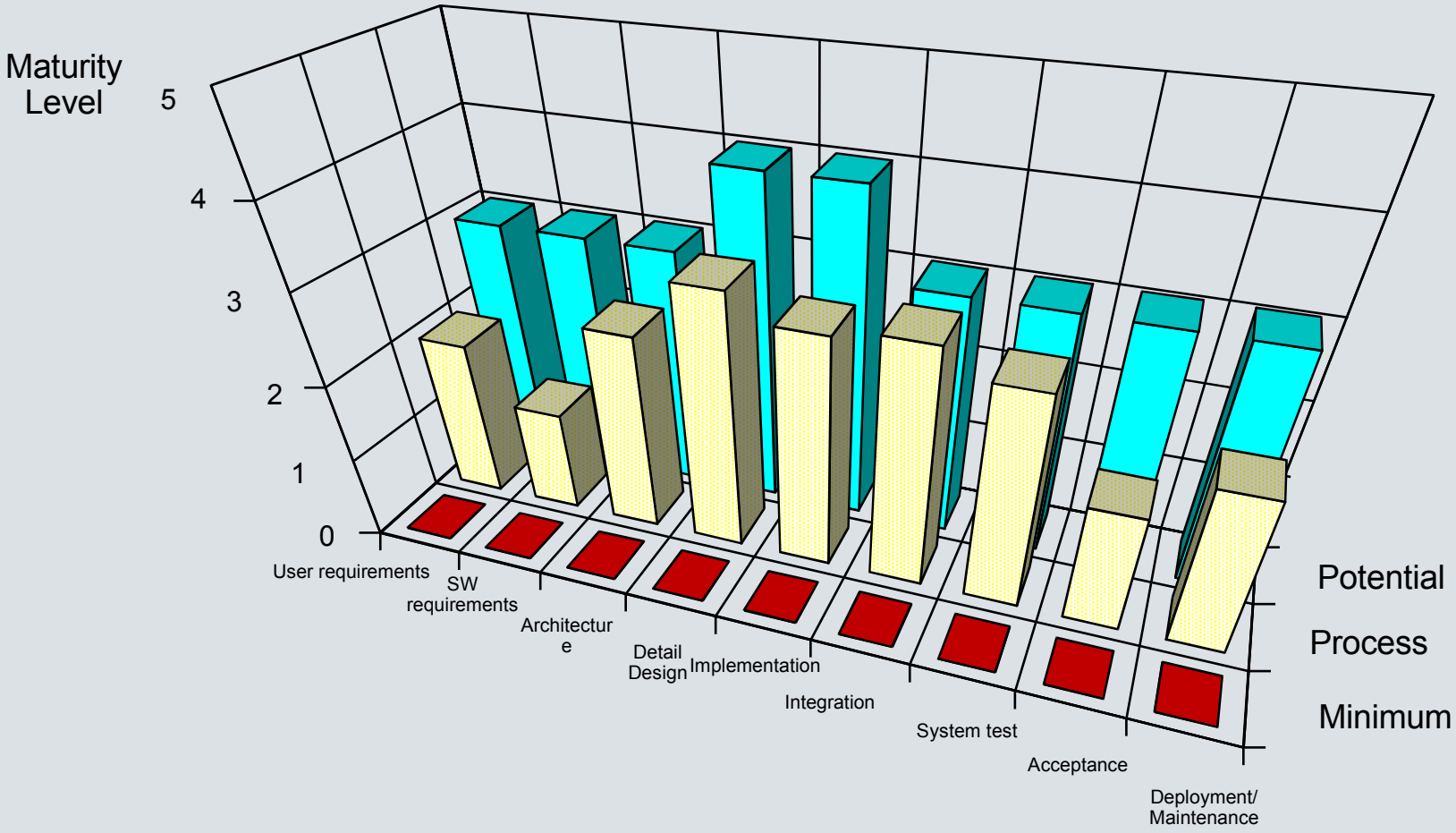

CMMI Capability Maturity Model Integrated/5
Development process Overview Site (I)

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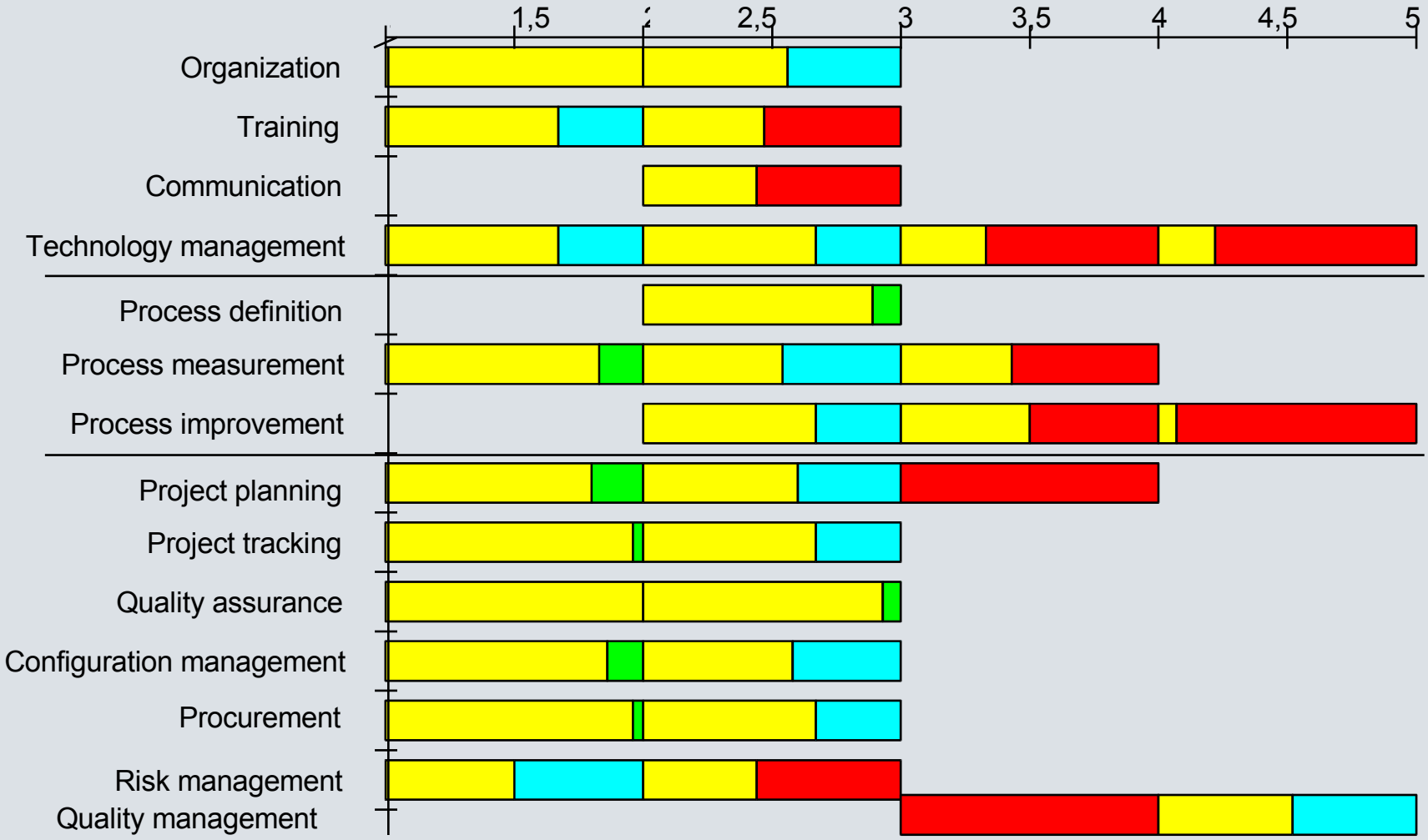

CMMI Capability Maturity Model Integrated/6
Life Cycle Functions: Implementation and Module Test

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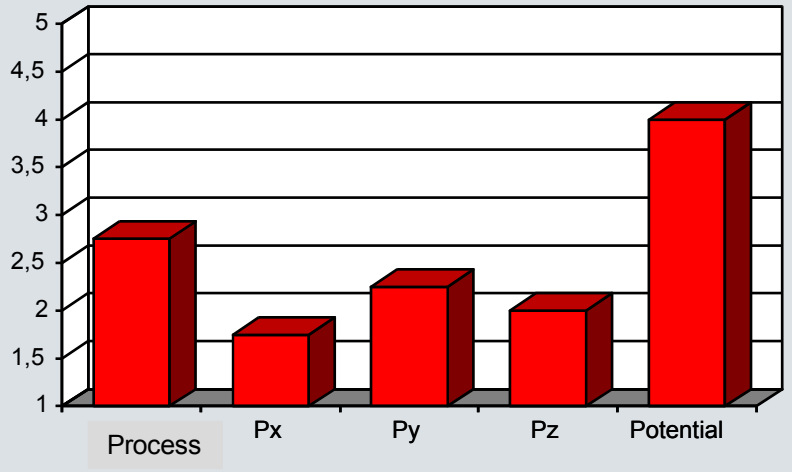

- Main Assessment Criterion according to the CMMI :
  - Programming Guidelines (Taking into consideration Quality, Complexity, and Readability)
  - Reuse of design or code
  - Development from reusable components
  - Application of code generators
  - Test methods and end criterion

- Test criteria and Methods for the test case design (e.g., Boundary testing, Cause-Consequences Graph, ...) was not used in the project
  - Translation problems exist in the reuse of software concerning process definitions. Hint:: Reuse must be applied in the earlier phases.
  - Introduce Test end-criterion, methods, and standards for Module Testing on the Project
  - Perform statistical analysis of the errors found during Module Testing, based on simple procedures such as checklists
  - Force the application of methods and tools to the analysis of code and test quality (e.g. Test coverage measurement, static and dynamic code analysis)
  - Use code generators in case corresponding tools are applied in the earlier phases

Success Factors

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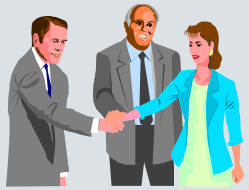
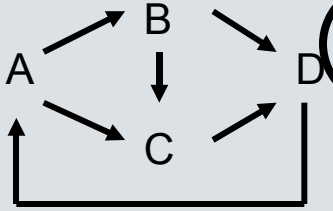


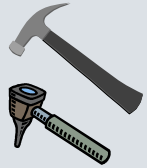
People
- Skill
- Training
- Motivation
- Management

... govern software costs, deadlines, and quality

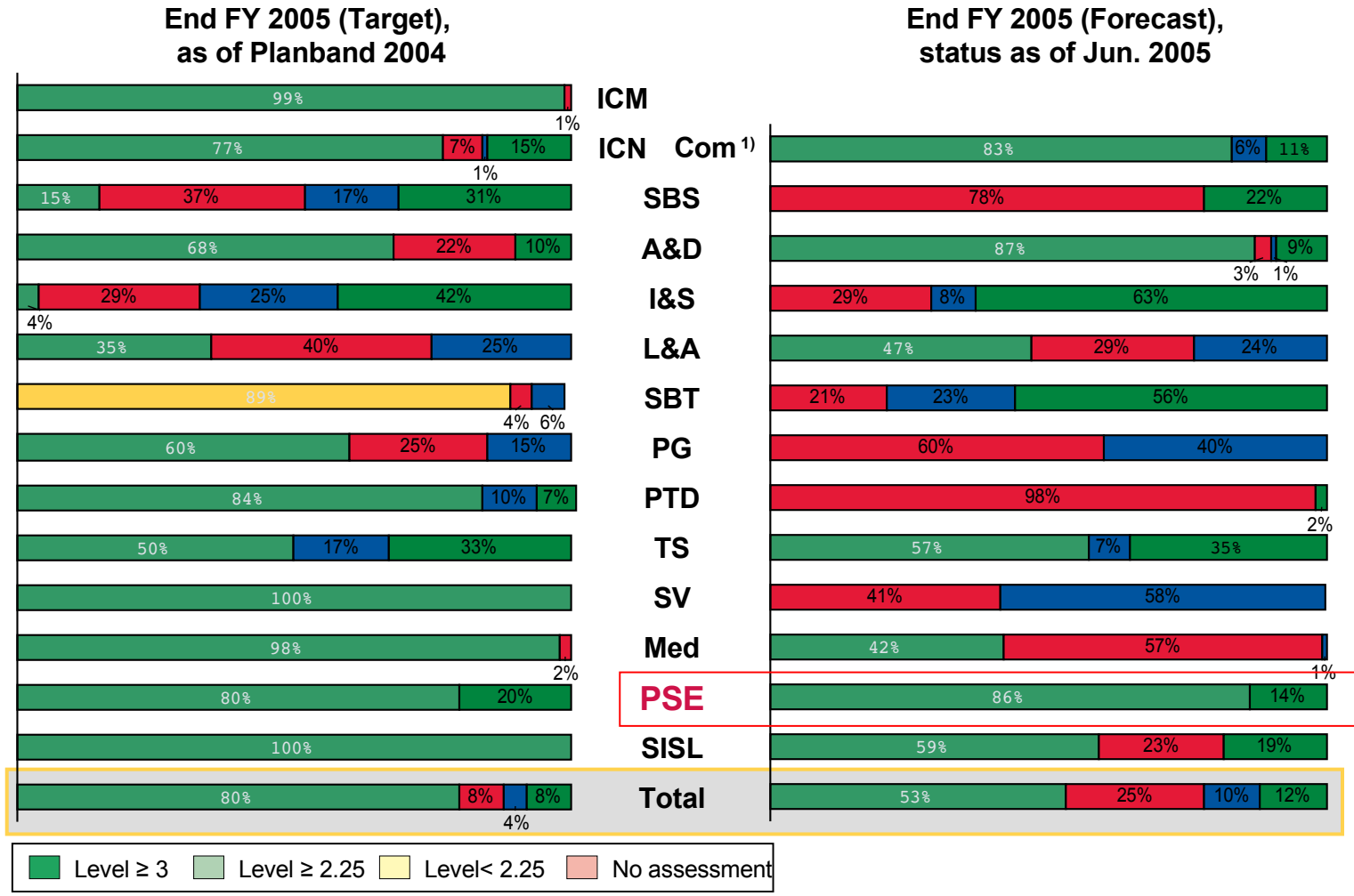
Processes
- Interplay of all required tasks



Technologies
- Tools
- Methods



Assessment coverage and maturity level (CMMI) distribution



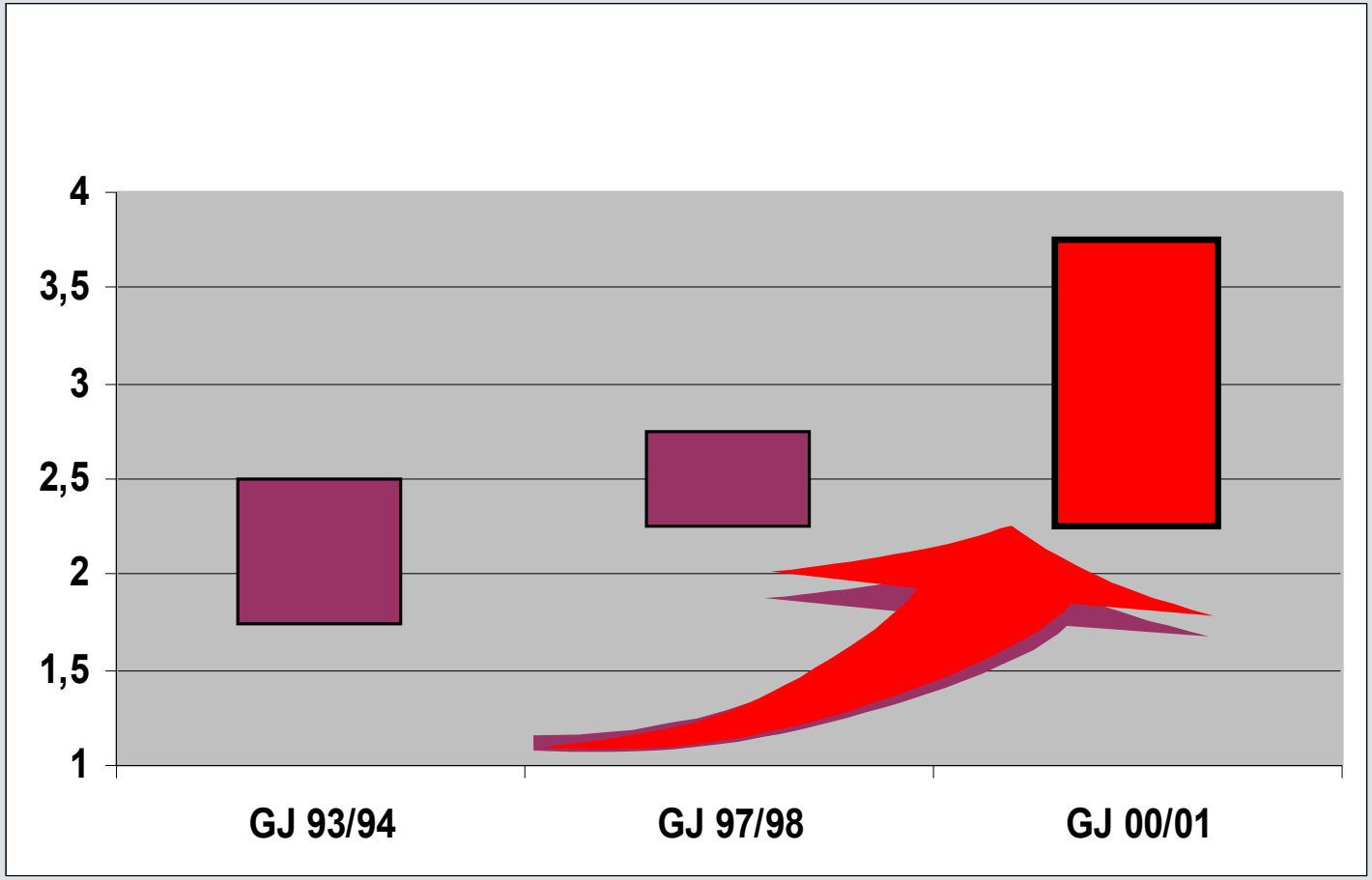
CMMI: Capability Maturity Model Integration
1) Com w/o Com Mobile Devices

Source: *top*+ Software Initiative, Status as of June 21st 2005

PSE: CMMI Level 4 in CT-Assessment Feb.05

CMMI- Level of PSE- Projects

SIEMENS



CMM/CMMI-results of the PSE-BA'S

SIEMENS

PSE

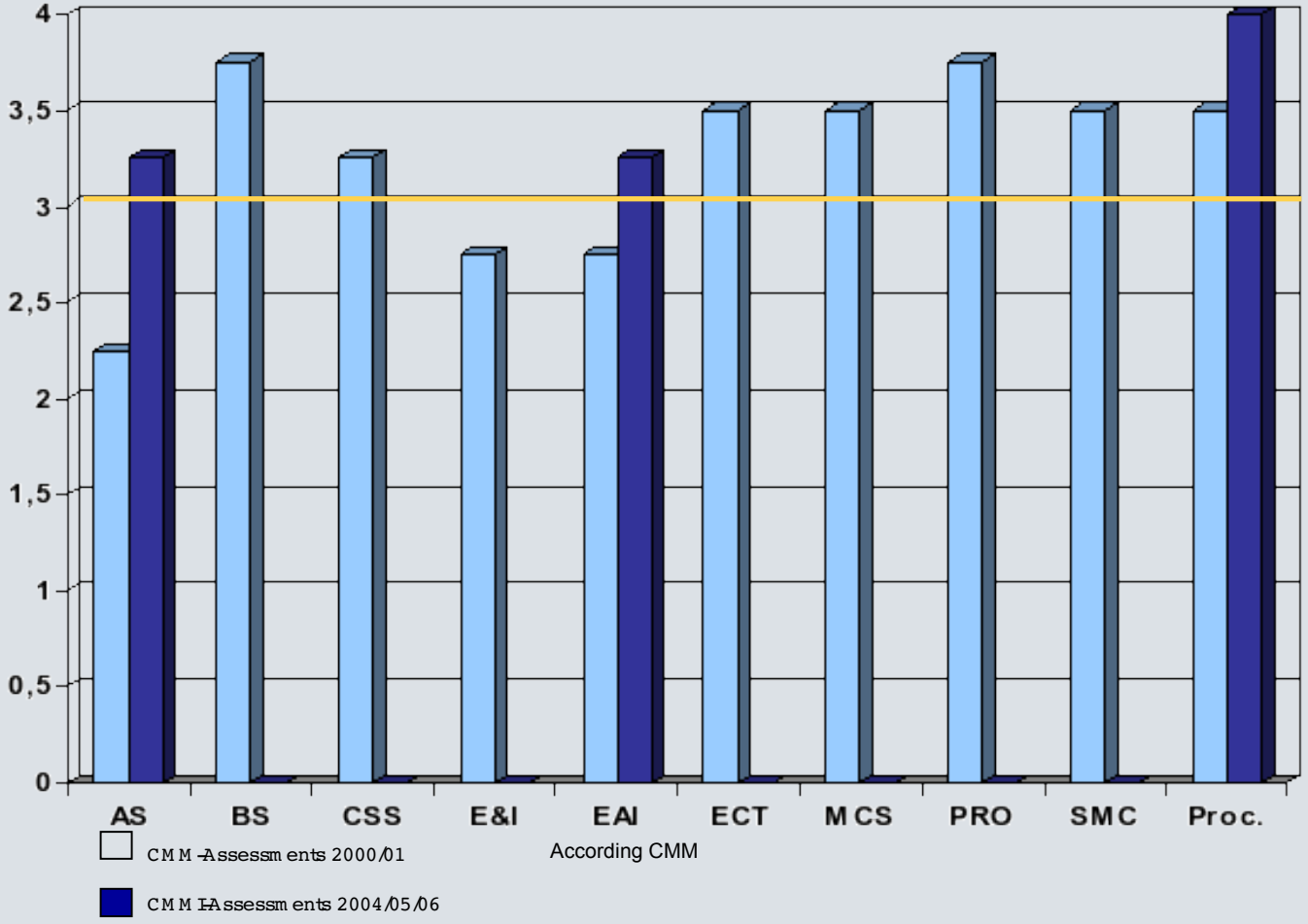
QM-Organization and Targets

Development Method SEM

Controlling und Assessments

Knowledge-Management

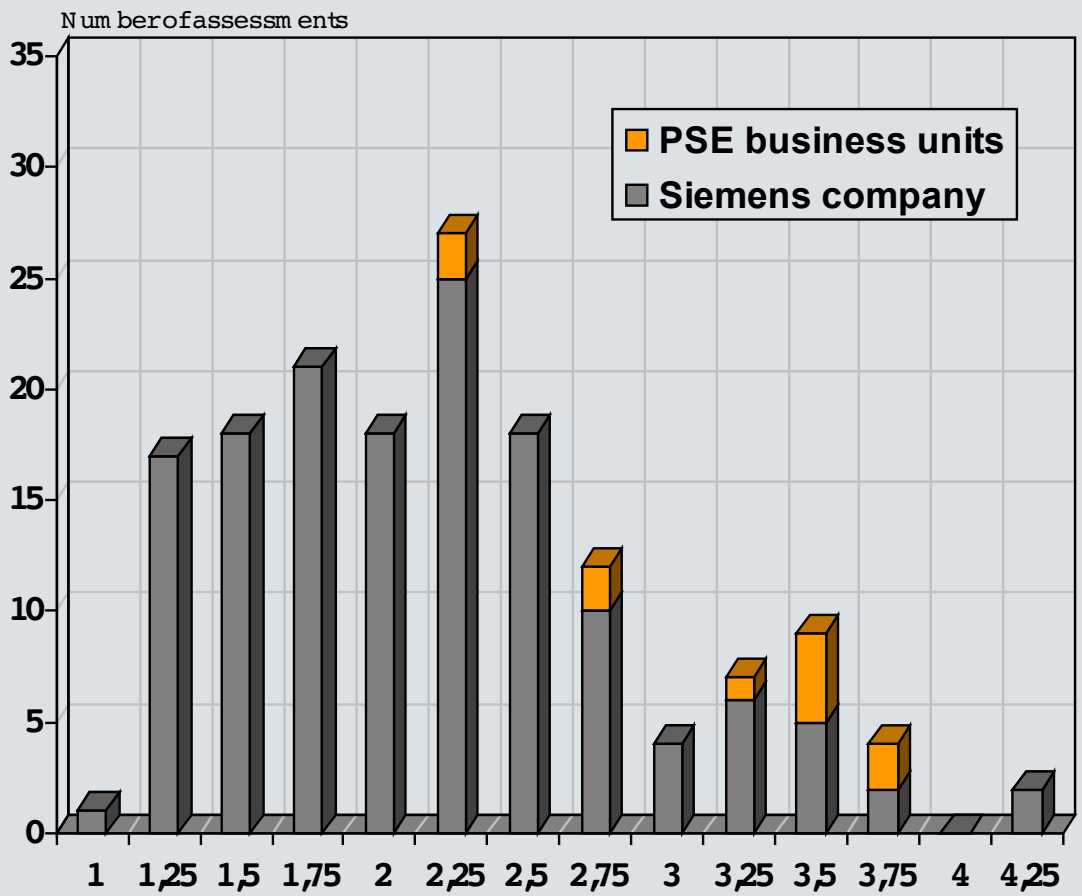
Improvements



CMMI -Maturity Level within Siemens

SIEMENS

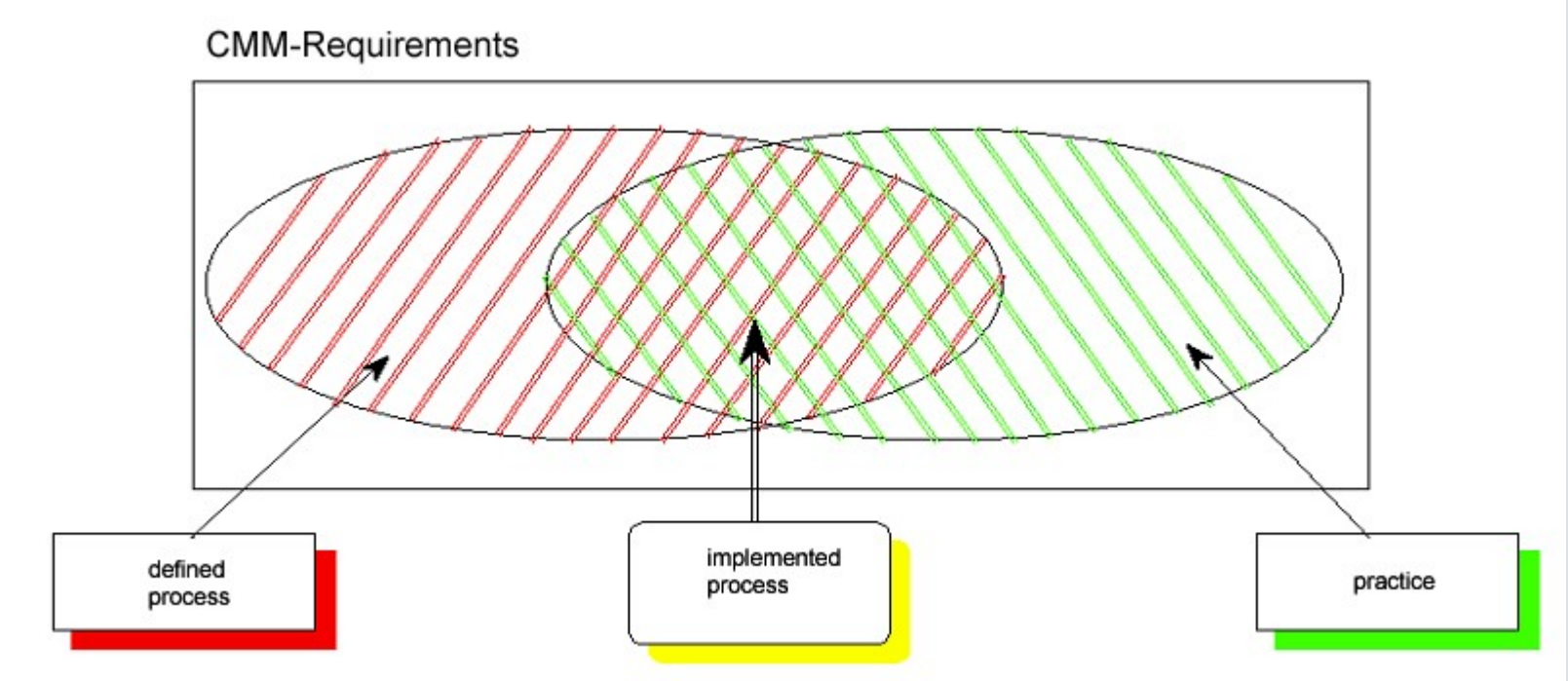
- PSE
- QM-Organization and targets
- Development Method SEM
- Controlling und Assessments
- Knowledge-management
- Improvements



Results of 170 Assessments performed by CT, München

Only the implemented process is of importance

SIEMENS



History of the Balanced Scorecard

SIEMENS

1990: **Study "performance Measurement in enterprises of the future" (e.g. General Electric, Hewlett-Packard, Shell, Canada, Apple computer, Bell South)**

1992: **"Balanced Scorecard" by Kaplan and Norton in Harvard developed and in the mean time introduced by many considerable enterprises world-wide very successfully**

Balanced scorecard (BSC)

SIEMENS

Kaplan and Norton, Harvard Business School, 1992:

- Managing based on balance sheets (i.e. outcomes, post facto) is too inert
- It is necessary to address the factors that lead to
- outcomes:
  - Identify impacting factors (drivers)
  - Strategically define objectives
  - Monitor achievement (metrics)
- Not just keep an eye on finances, but also on
  - Customers/market
  - People / innovation
  - Internal processes
- The focus is on business strategy

Balanced Scorecard (BSC) at PSE

SIEMENS

- ***Joint definition*** of strategic goals, related
- objectives and their interrelations
- (strategy map) by the management
  - Overall BSC at the PSE level
  - Business-specific BSCs in the subdivisions and business units
- ***Ongoing monitoring*** of a limited number of
- quantities at all levels
  - "BSC cockpit" with traffic light representation, early warning indicators, need for action

What is Balanced Scorecard (BSC)?

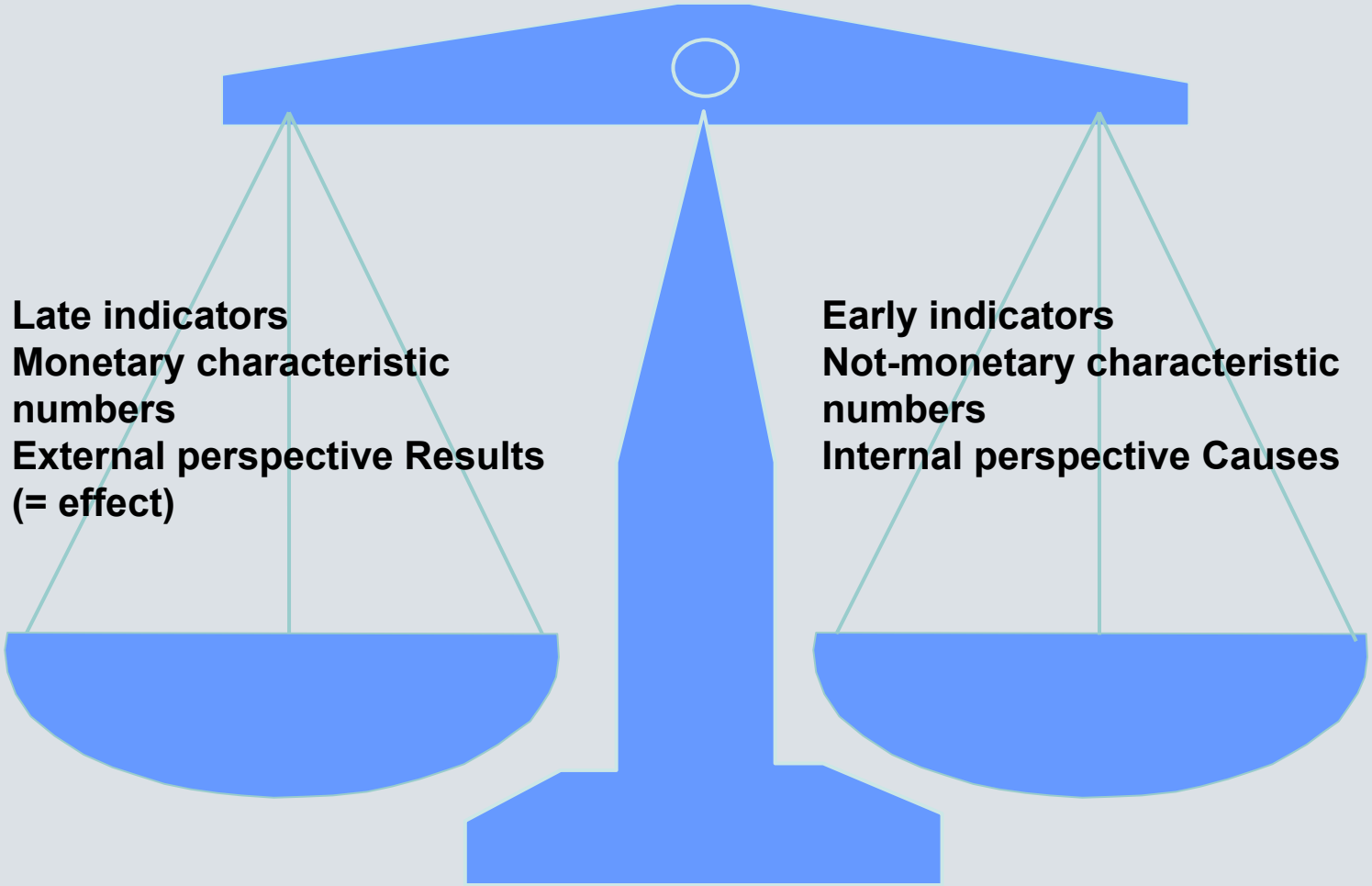
SIEMENS

- Comprehensive strategic control instrument
- Holistic, interlaced view on the enterprise
- Integrates modern management beginnings
  - Customer orientation
  - Process orientation
  - Coworker orientation
  - Innovation and learning
- Common systematic development of
  - Business drivers
  - Goals and measures

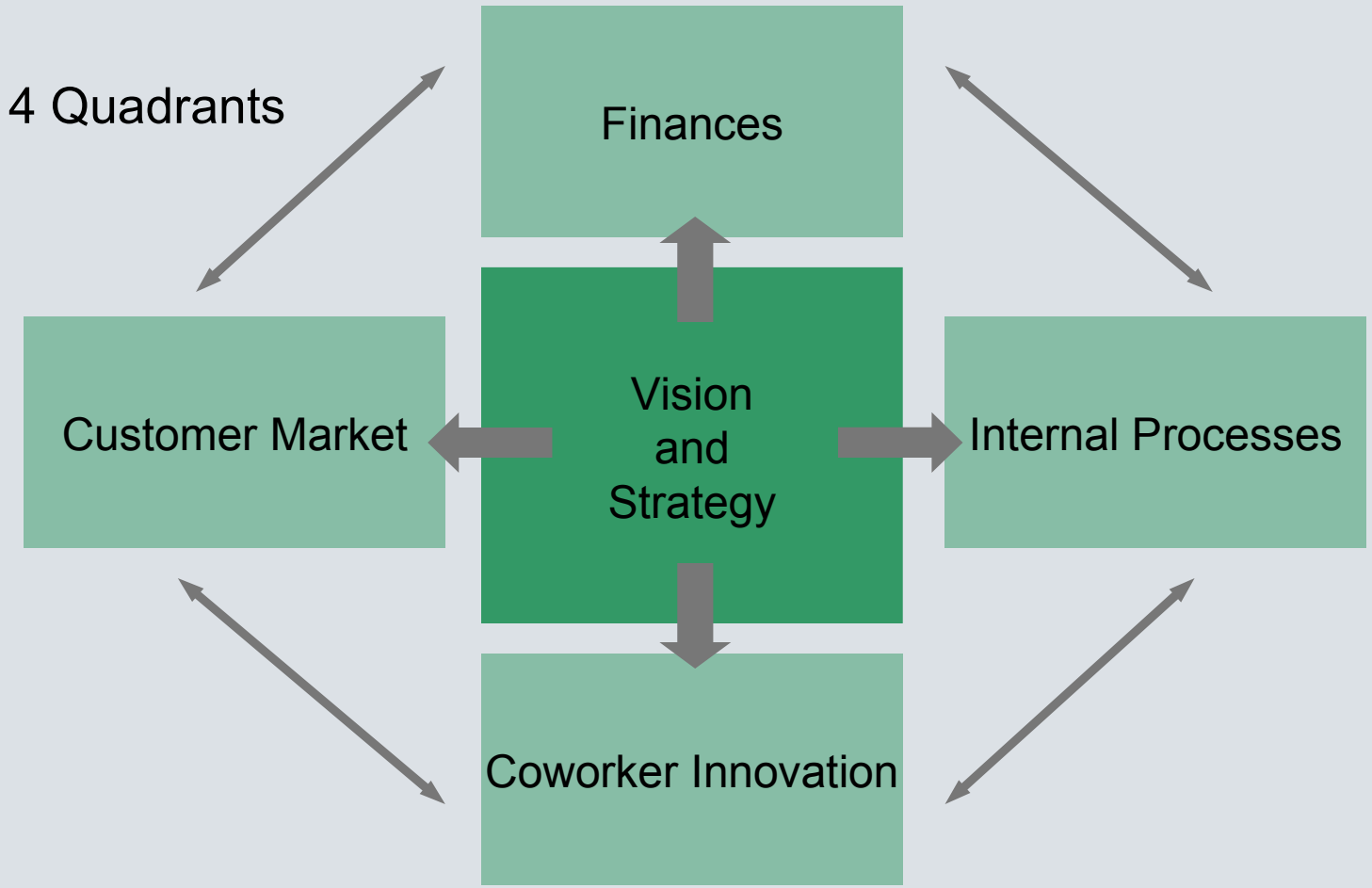
Basis is a clear, well prepared strategy!

Why "balanced"?

SIEMENS



Elements of the Balanced Scorecard



Proceeding for the development of a BSC

SIEMENS

- **Determine the substantial success factors for the successful conversion of the strategy**
  - business drivers
- **Development of the effect connections**
  - **driver tree**
- **Formulation of goals**
  - **quantifiable, scheduling**
- **Determination of metrics**
- **Resolution of measures**

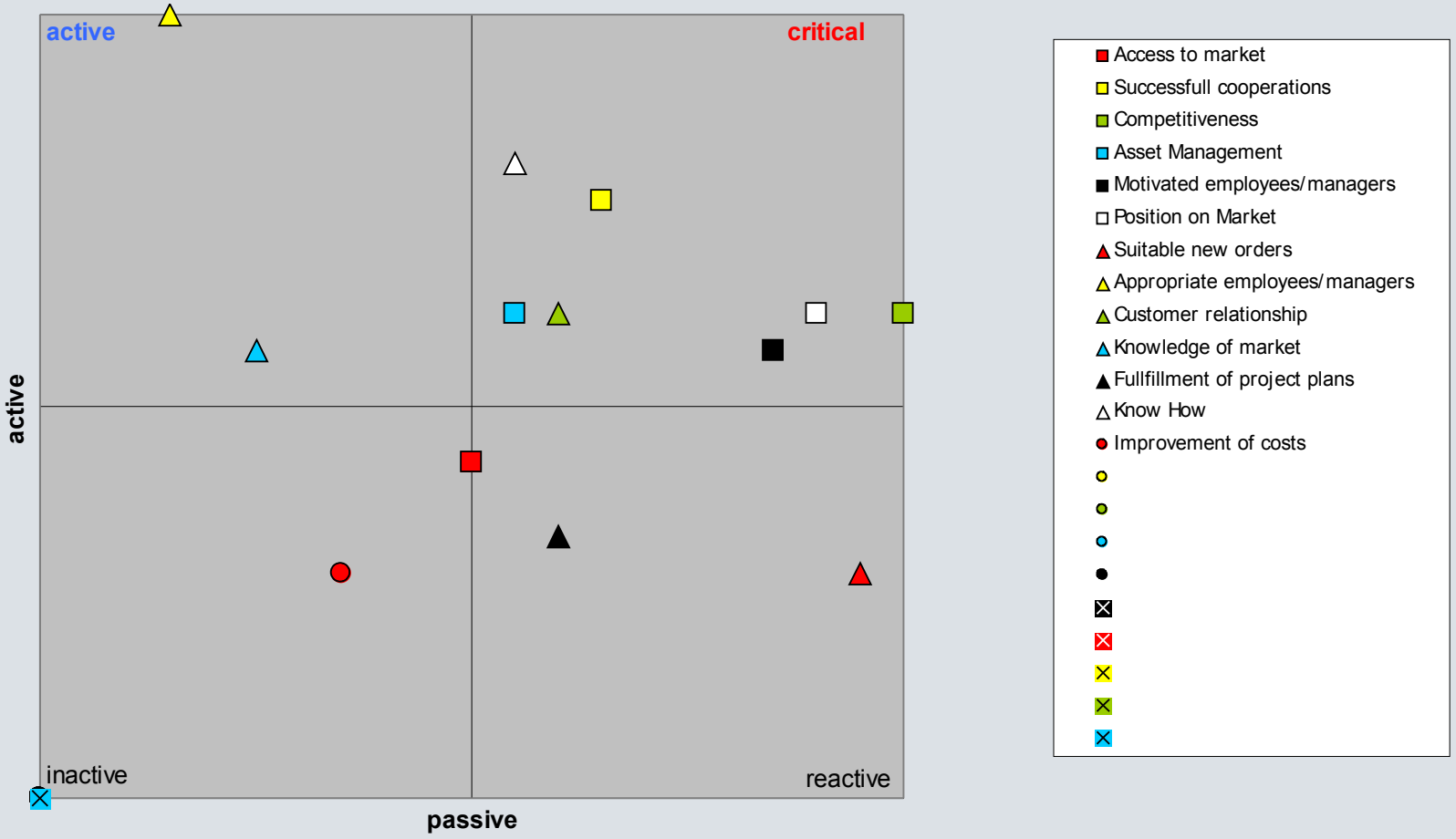
Success factors - example

SIEMENS

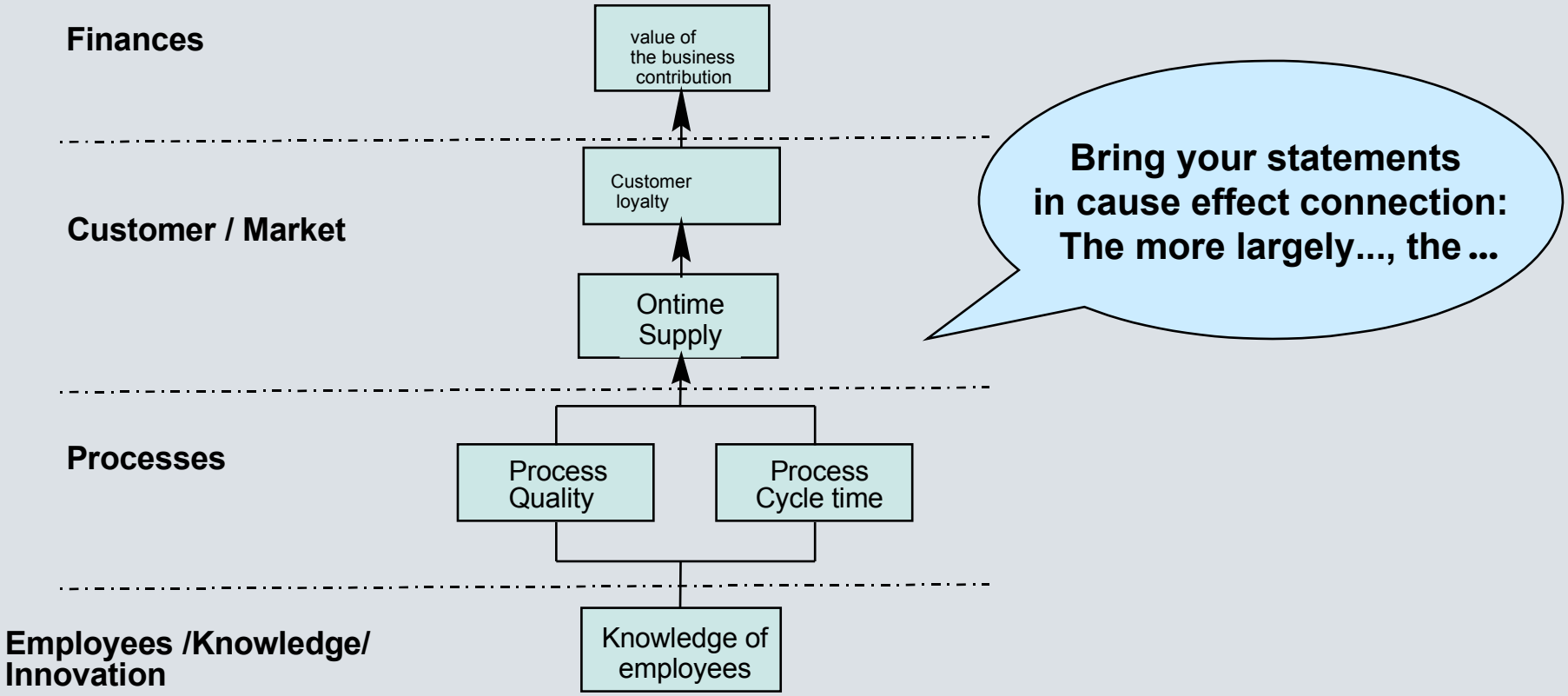
Domain competence	Technical Competence (ICT)	Motivation of employees	Customer satisfaction	Care & increase Of market
Domain Know How	Training of employees Focused on new products	Identifikation of employees	Customer satisfaction	Acquisition of projects
Allround- and broad Know-How	Knowledge of new SW-technologies	Motivation of employees	Adherence of accomplishment	Many main pillars
	technical authority in technology, products and industry	Motivation of employees e.g.. by setting-up of new main pillars	Adherence of expenditures	New acquisitions
	Know-how with the integration of adjacent systems		Adherence of delivery	Increase of market
	Training of new technologies		Fast reaction to inquiries	Acquisition

Success factors<>Business driver

Portfolioanalysis of the success factors



Cause-and-Effect chain Example



PSE's strategy map

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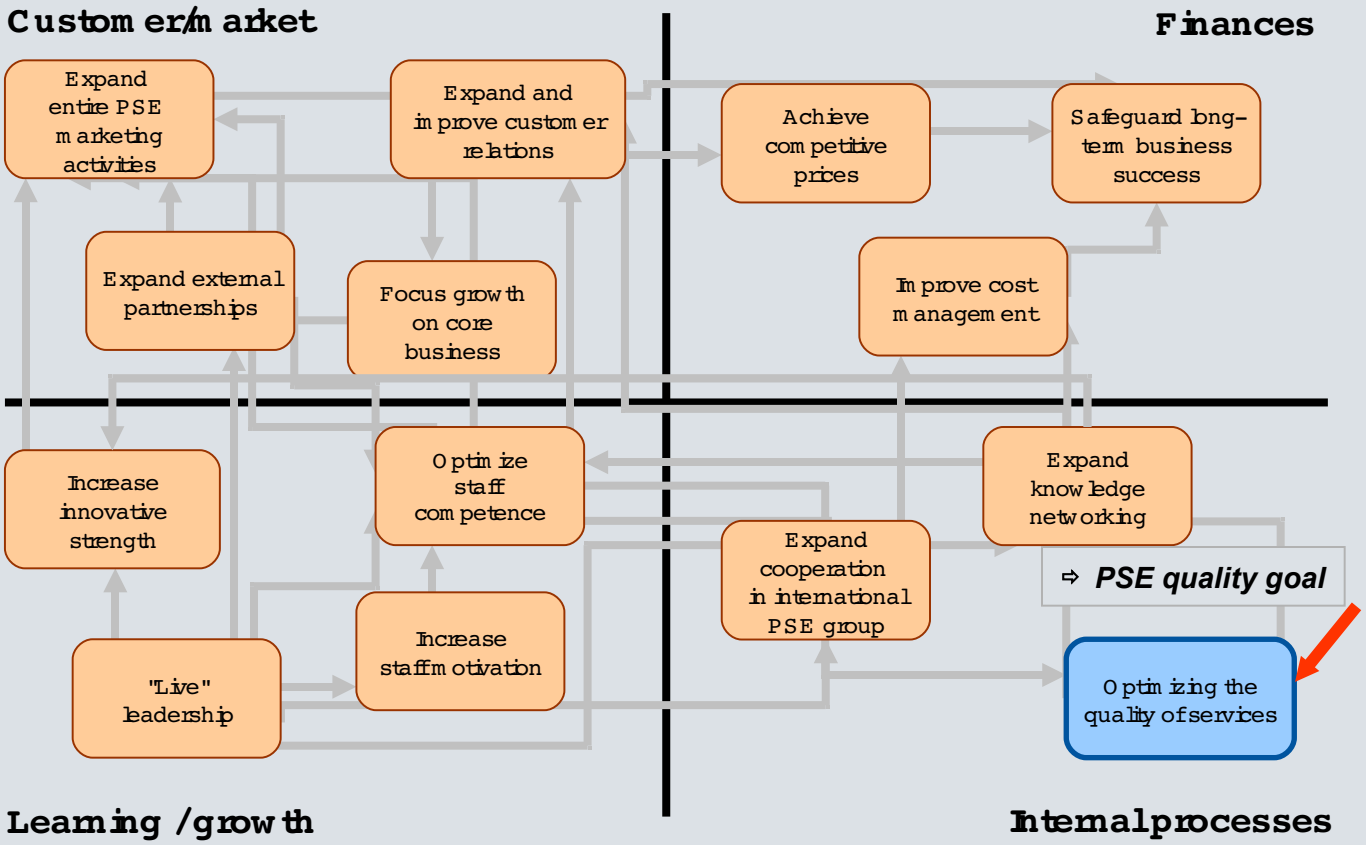
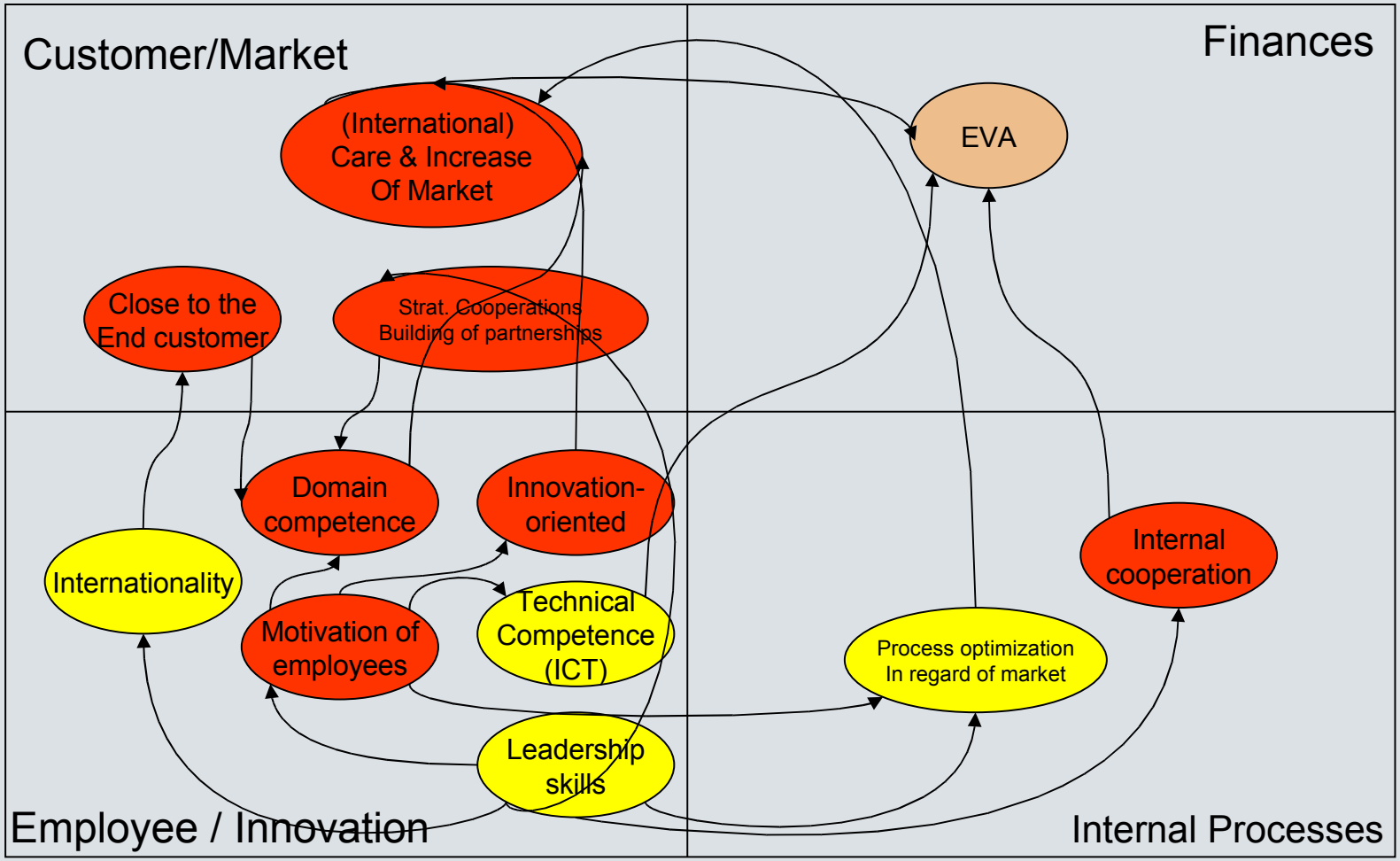


Driver Tree - Example



Balanced Scorecard - Example

Market/Customer

Driver	Measurement/entity	Actual 05/06	Target 05/06	Responsibility
Upgrading systems/ services	Turnover in Mio €	*374*	*374*	**GZ**
Market share in new focus markets	% in USA % in China	- -	*21.3* *6.2*	**BD**
Keep #1 Position/RWS	RWS	-	*150*	**BD**
Customer satisfaction	% internal RG/BG % external customer	*23* -	*30* -	**BD**

Finances

Driver	Measurement/entity	Actual 05/06	Target 05/06	Responsibility
EVA(Economic Value Added)	Mio. €	*30.2*	*-30.5*	**CC**
Account balance	Mio. €	*28.0*	*-13.5*	**CC**
EBIT(Earnings before interest And taxes)	% from turnover	*1.7*	*1.3*	**CC**
EBIT-Assets EBIT Asset turn	Mio. DEM #Turns	*408* *2,7*	*466* *2.4*	**CC**

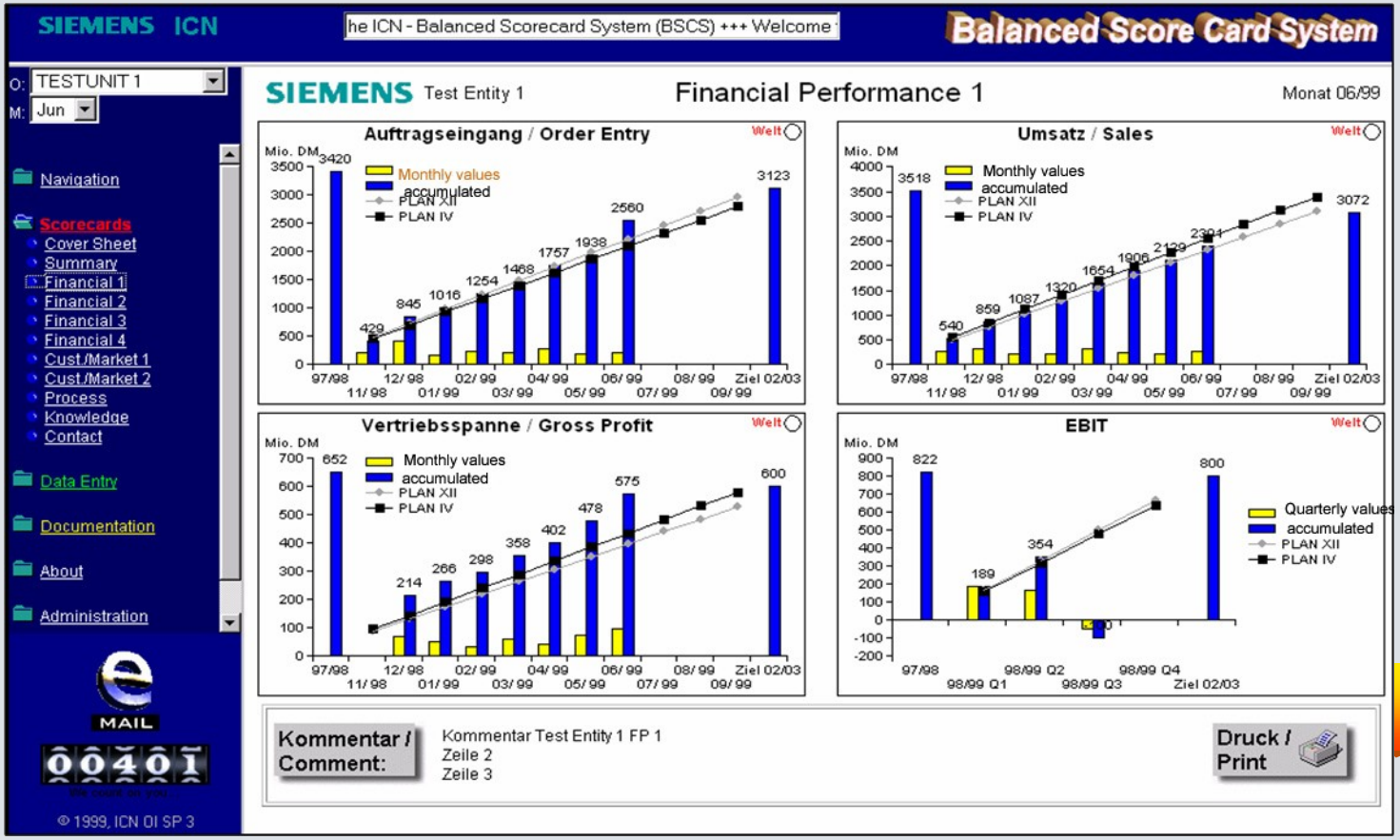
Employeer / Innovations

Driver	Measurement/entity	Actual 05/06	Target 05/06	Responsibility
Old/new products	% turnover of new Products(< 5 years))	*43*	*43*	**GZ-MS**
A-Projects acc. R&D Plan	% Status green„To Plan“	*86*	*80*	**CC**
Skills & Competences	% building of team proces finalized	*0*	*0*	**HR**
Corporate Identity/Culture	Barometer:% Commitment % rate of return	*62* *29*	*66* *50*	**BD**

Processes

Driver	Measurement/entity	Actual 05/06	Target 05/06	Responsibility
Savings from BIP	Mio. € cumulative	*60.9*	*78.8*	**CC**
Benchmarking	% gap of cost closed	*0*	*0*	**BMT**
Aherence of delivery (2 days tolerance)	% deliveries „on time“	*62*	*75*	**LO**
SW Process Improvement	% gap to CMMI level 3 closed	*0*	*0*	**BD**

BSC –Tool representation



Scorecard Layout

Benefit of Balanced Scorecard?

- Broad consent and common understanding of the strategy
- Clear adjustment on the substantial common goals
- Balance of the relevant success factors of the business
  - business driver
- Clarify the effect connections of the business
- Strategy well communicatable
- Simple position-fixing

Important: Take time !

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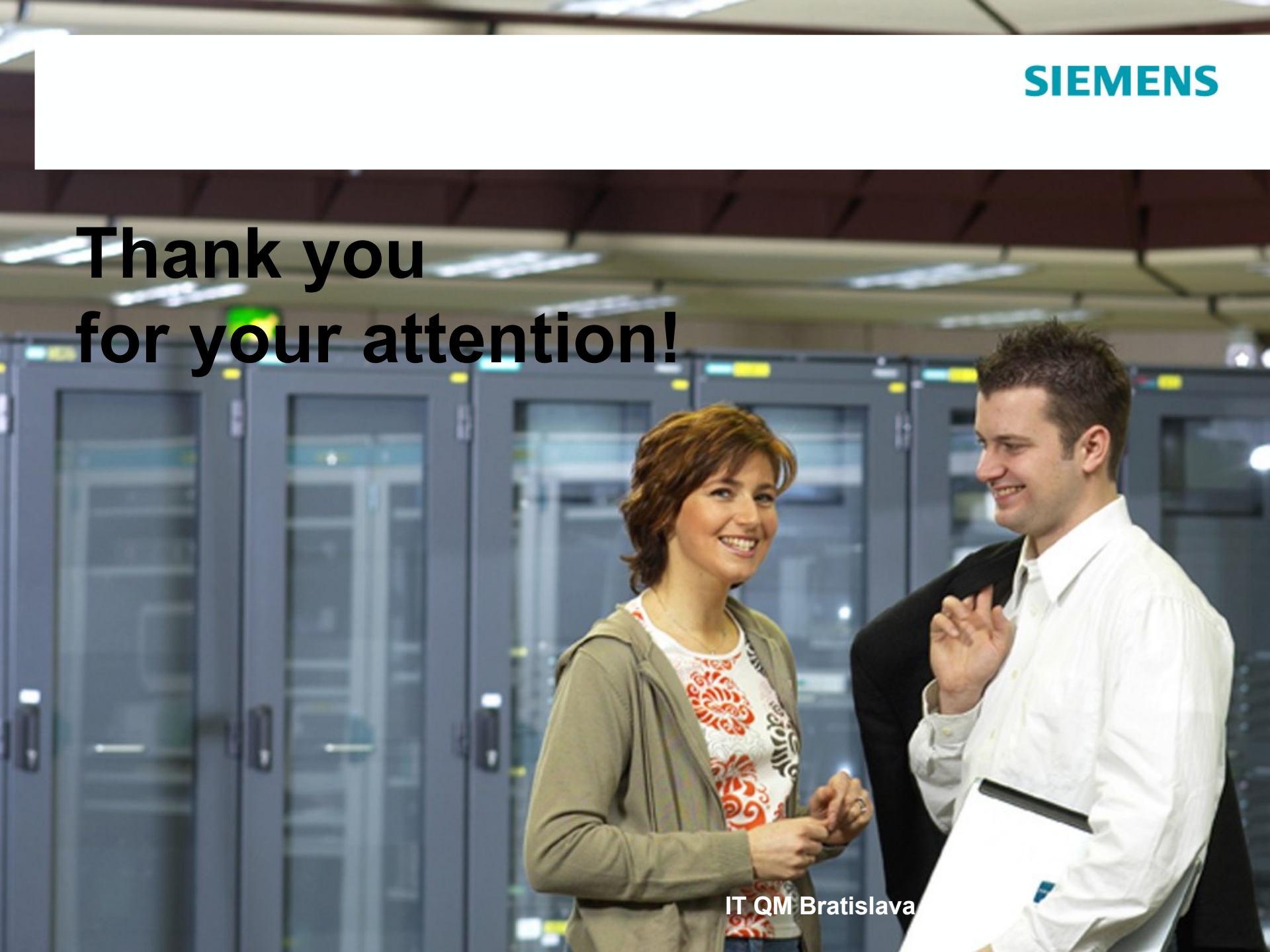
Thank you for your attention!



Farbpalette mit Farbcodes

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Primäre Flächenfarbe:

R 255 G 255 B 255

Sekundäre Flächenfarben:

R 215 G 225 B 225	R 170 G 190 B 195	R 130 G 160 B 165
R 220 G 225 B 230	R 185 G 195 B 205	R 145 G 155 B 165

Akzentfarben:

R 255 G 210 B 078	R 245 G 128 B 039	R 229 G 025 B 055	R 000 G 133 B 062	R 000 G 084 B 159	R 000 G 000 B 000
R 255 G 221 B 122	R 248 G 160 B 093	R 236 G 083 B 105	R 064 G 164 B 110	R 064 G 127 B 183	R 064 G 064 B 064
R 255 G 232 B 166	R 250 G 191 B 147	R 242 G 140 B 155	R 127 G 194 B 158	R 127 G 169 B 207	R 127 G 127 B 127
R 255 G 244 B 211	R 252 G 223 B 201	R 248 G 197 B 205	R 191 G 224 B 207	R 191 G 212 B 231	R 191 G 191 B 191
R 255 G 250 B 237	R 254 G 242 B 233	R 252 G 232 B 235	R 229 G 243 B 235	R 229 G 238 B 245	R 229 G 229 B 229