



Q.A.

Осигуряване на качество на софтуера (2015/2016, редовно)

based on:

Software Quality Management Models: Intro to Process Improvement (PI)

[SEMP Program course, in collaboration with Carnegie Mellon University]

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Организация

Лекции:упражнения = 1:1 (10 седмици, 20+20 часа)

Четвъртък

08:15 - 10:00 Аула 2 лекции
10:00 - 11:45 група 26 – 533 к.з.
група 16 – 532 к.з.
11:45 - 13:30 група 2а - 547 к.з.
група 1а - 532 к.з.

Групи, екипи (проекти) + отговорници
Координация

Students quarter – 15 minutes

Информация, източници:

www.esicenter.bg >> general info and in "Resources"

links to CMMI models

<http://cmmiinstitute.com/cmmi-solutions/>

<http://www.sei.cmu.edu/cmmi/tools/index.cfm>

CMMI –DEV v 1.3 model (CMMI Institute, and SEI, Carnegie Mellon University)

<http://cmmiinstitute.com/resource/cmmi-for-development-version-1-3/>

www.sei.cmu.edu/reports/10tr033.pdf

General

www.sei.cmu.edu

www.cmmiinstitute.com



About

SEMP: SOFTWARE ENGINEERING MANAGEMENT PROGRAM

The course is developed (and compiled) jointly by ESI Center (Eastern Europe) and CMU from the main lines and materials for SEMP, in partnership with SEI/CMU.

It introduces students to process improvement as a main factor for the quality of products and services.

Based on process-oriented models - CMMI, the "industrial" standard developed by SEI/CMU, project management (PMI/PM BOK), personal/team management (PSP/TSP BOK), strategic planning (Balanced ScoreCards), information security.

Augmented by modern methods and techniques – Agile CMMI, Six Sigma, etc. Mapping between main industrial models and standards. Implementation. Models for quality improvement in small settings and SMEs. Business aspects – cost of quality, what is "the right model for my company", why invest in PI, what is the return, who can help.

Съдържание (модули)

1	Увод в управление на качеството. Компоненти и цена на качеството. Процеси. Преглед на моделите за управление на качеството и подобряване на процесите. Методи за оценка на зрелостта на ИТ-интензивни и софтуерни организации. Стратегически карти/Балансирана система от показатели (balanced ScoreCards).
2	Модел CMMI (ver 1.3). История, внедряващи организации. Обща структура. Процесни области. Генерични и специфични цели и практики. Презентации – Maturity/Capability нива на Continuous и Staged representations. Категории процесни области: Process Management, Project Management, Engineering, Support.
3	Процесни области от ниво 2 на CMMI. Детайлно представяне на: REQM – Requirements Management PP – Project Planning MA – Measurement and Analysis PPQA – Process and Product Quality Assurance CM – Configuration Management PMC – Project Monitoring and Control Преглед на: SAM-Supplier Agreement Management
4	Процесни области от ниво 3 на CMMI. Детайлно представяне на: RD – Requirements Development VAL - Validation VER - Verification RSKM - Risk Management TS - Technical Solution Преглед на: DAR - Decision Analysis and Resolution , IPM - Integrated Project Management , OPD - Organizational Process Definition , OPF - Organizational Process Focus, OT - Organizational Training , PI - Product Integration Преглед на Maturity Level 4 и 5. Обобщение на връзките между процесните области: Tying all together
5	Внедряване на програма за подобряване на процесите на база CMMI. Адаптирани подходи – Agile CMMI, CMMI/ISO. Нови модели CMMI – CMMI for Services, CMMI for Acquisition. Оценка (SCAMPI), роли.
6	Подобряване на процесите в малки фирми – IT Mark. Компоненти на зрелостта – бизнес, организация/процеси, информационна сигурност. Оценка на нивото и план за подобрения.

Practical Exercises

Objective 1: remember-understand-apply

1. SW project/product lifecycle
2. Cost of Quality
3. Process policy and definitions (samples – REQM, PP, CM)
4. Project Planning, Estimates, PMC
5. (optional) VER/VAL – Peer Review

Objective 2:analyze-evaluate

1. Presentations (team work exercise)
2. (optional) Kanban team/project game workshop
3. Case study (+ presentation)
4. Real project (team work) – RD, TS, PP (?)

Objective 3: create

1. Elevator Pitch (perform)
2. Students quarter (15 minutes “free mind”)

Why are you here?

Part 1: Introduction

Увод в управление на качеството.

Компоненти и цена на качеството.

Процеси. Преглед на моделите за управление на качеството и

подобряване на процесите. Методи за оценка на зрелостта на ИТ-интензивни и софтуерни организации. Стратегически карти/Балансирана система от показатели (balanced ScoreCards).

Since 1993

European Software Institute



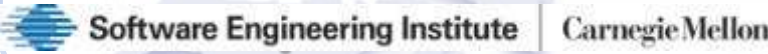
- Non-profit member-based Foundation
- Founded in 1993 by the European Commission and the Basque Government
- Established in Zamudio, near Bilbao, Spain

Who are we?



Since 1993

partner of:



Since 2003

ESI Center Eastern Europe

PPP: SW Industry(BASSCOM), ESI & State ICT agency, supported by: USAID, UNDP



Helping companies and organizations compete by **QUALITY** and **EXCELLENCE** since 2003

Affordable "BIG" standards for "small" companies



ESICenters

• ESI@net Partners





Software Engineering Institute (SEI)

- Federally funded research and development center based at Carnegie Mellon University
- Basic and applied research in partnership with government and private organizations
- Helps organizations improve development, operation, and management of software-intensive and networked systems

CERT – Anticipating and solving our nation’s cybersecurity challenges

- Largest technical program at SEI
- Focused on internet security, digital investigation, secure systems, insider threat, operational resilience, vulnerability analysis, network situational awareness, and coordinated response

**Carnegie
Mellon
University**



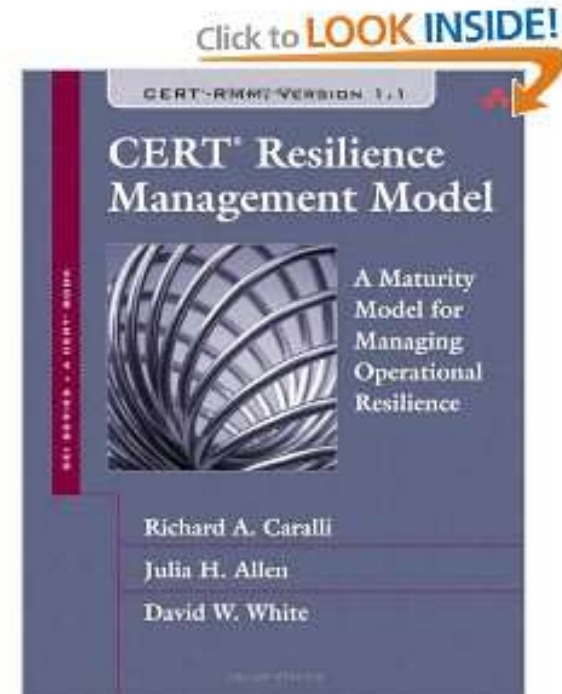
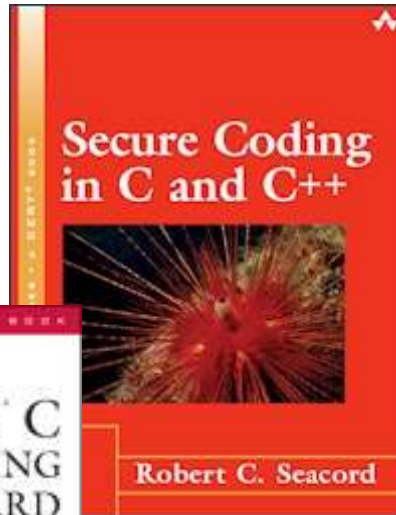
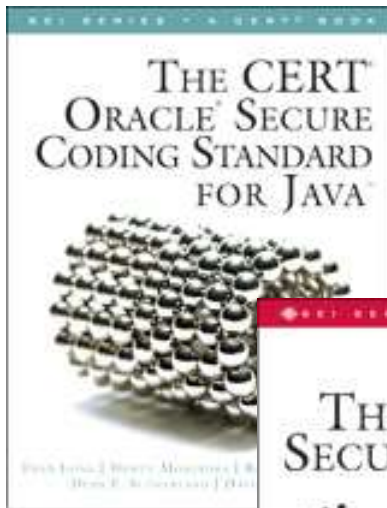
Also from SEI: Computer Emergency Response Team



Software Engineering Institute | Carnegie Mellon

**Closing gaps & develop good code:
Secure Coding Standards**
[languages + compilers]

**Generic Model to
Manage and Assess
the Operational Resilience**
[Information Security, Security
Business Continuity]



Soft

ROBERT C. SEACORD

Carnegie Mellon

small or **BIG**

business depends on **excellence**

What is excellence?

Corporate Excellence is a feature of an organizational entity that manifests how incomparably excellent it is when assessed adhering to success criteria (ISO, CMMI, 6 Sigma etc.); excellence refers always to excellent performance concerning the best methodologies in the world and it manifests in official certification according to them.

Corporate excellence perspectives

Corporate excellence is a **balanced model**

Kaplan and Norton structured it in four perspectives:

- Financial perspective
- Customers perspective
- Processes perspective
- Learning perspective

Excellence is in:

repeating the success

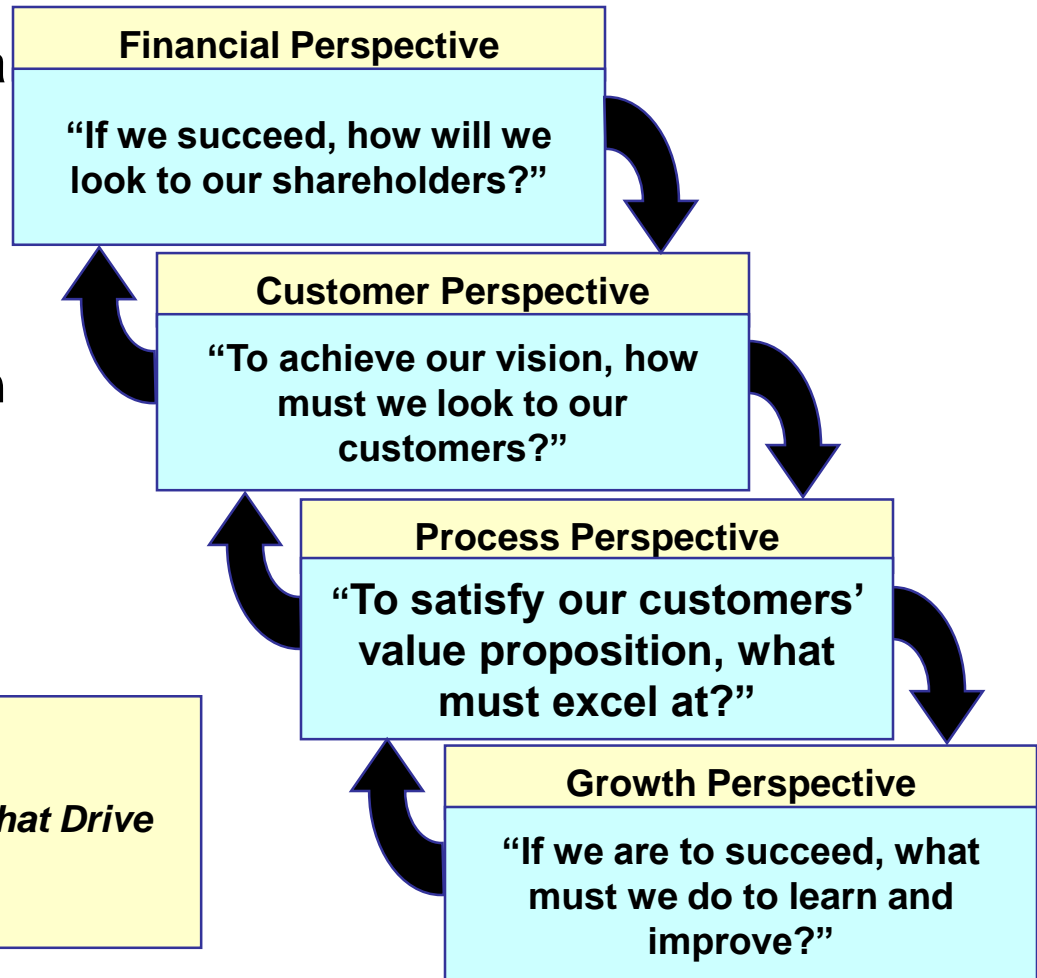
turn it to sustainable growth

make the best with your people

for higher profit

So what is the Balanced Scorecard?

The Balanced Scorecard is a framework for translating a vision into a strategy by focusing on shareholder, customer, internal and learning requirements which collectively describe the strategy of an organisation and how that strategy can be achieved.



*Kaplan & Norton
Harvard Business Review ,1992
“The Balanced Scorecard - Measures that Drive Performance”*

Financial Perspective

Results-oriented perspective that covers goals and performance measures related to the financial performance of the company.

Typical indicators: Return on Investment (ROI), Shareholder Value, Increase of Revenue, Increase of Turnover, Cash Flow, etc.

Customer Perspective

Related to the market and customer segments and it directly supports the implementation of financial objective.

Typical indicators are: market segments, customer satisfaction, percentage of new customers, life cycle, quality, service, price - quality, delivery times, reputation, commitment to delivery times

Process Perspective

Defines and measures the processes, in which the company should invest and improve so that it can attain the goals in the customer and finance related perspectives.

Typical indicators: Processing time, % milestones met , process frequency, process costs, process quality, time to market, innovation cycle etc.

Learning and Growth Perspective

Structuring goals and performance measures related to the knowledge necessary for maintenance and further development of all perspectives.

Typical indicators: market innovation, intellectual competences, staff satisfaction, fluctuation, staff productivity, number of improvement proposals, quality of improvement proposals, training days, etc.

Corporate excellence – FINANCIAL

The RESULT produced by the corporate excellence is high profitability

- The major goal of the companies is to produce profit for their shareholders rather than have the “ideal company”
- Corporate excellence is a tool for sustainable financial results
- The key social impacts of corporate excellence are higher employment and increased fiscal stability

Corporate excellence – CUSTOMERS

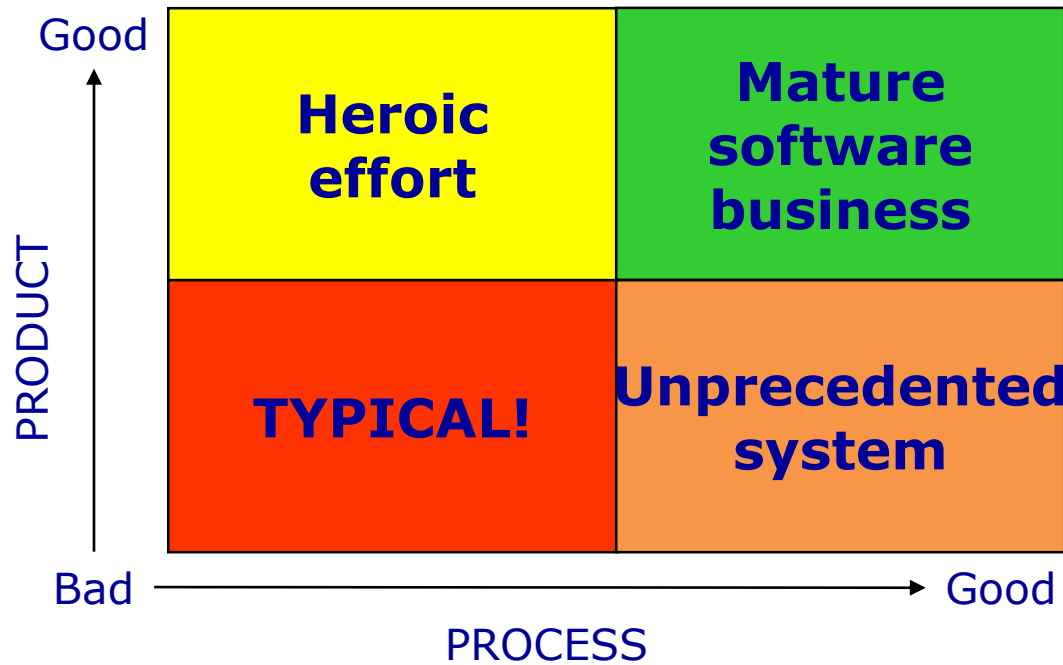
The corporate excellence is **CERTIFIED** by the customers

Understanding, predicting and managing the customers expectations are critical:

low cost	<->	creativity and efficiency
coding	<->	complex solution
outsourcing	<->	partnership with the clients
competition	<->	“coopetition”

Corporate excellence – INTERNAL

**The corporate excellence is BASED on
good internal processes**



"The quality of a product is largely determined by the quality of the process that is used to develop and maintain it."

Based on TQM principles as taught by Shewhart, Juran, Deming and Humphrey.

Corporate excellence – LEARNING

The corporate excellence is **EMPOWERED** by learning and innovations

- Motivated and qualified human resources
- Knowledge management
- Organizational learning

Focus on the processes

The company inside: Why should a manager care about the software process?

“It’s very difficult to consistently deliver quality products to your customers, while also making a profit, if your development process is poor.”

The sad truth

25% of all software projects are killed.

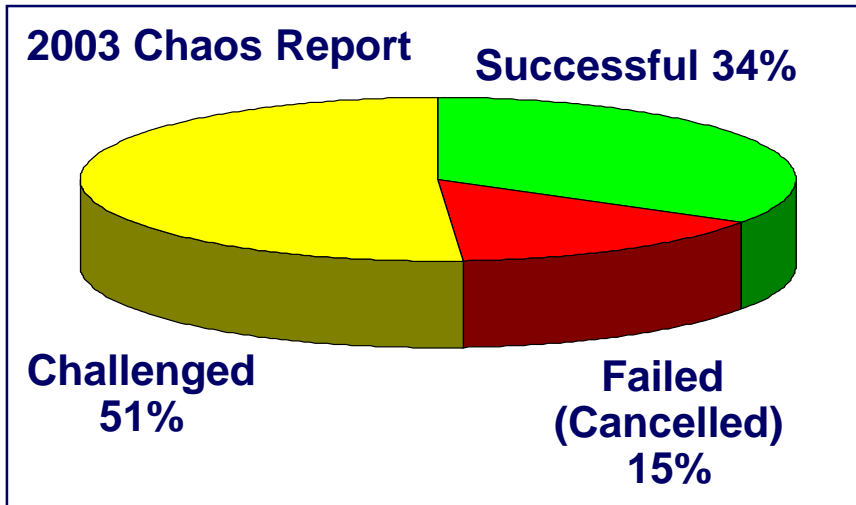
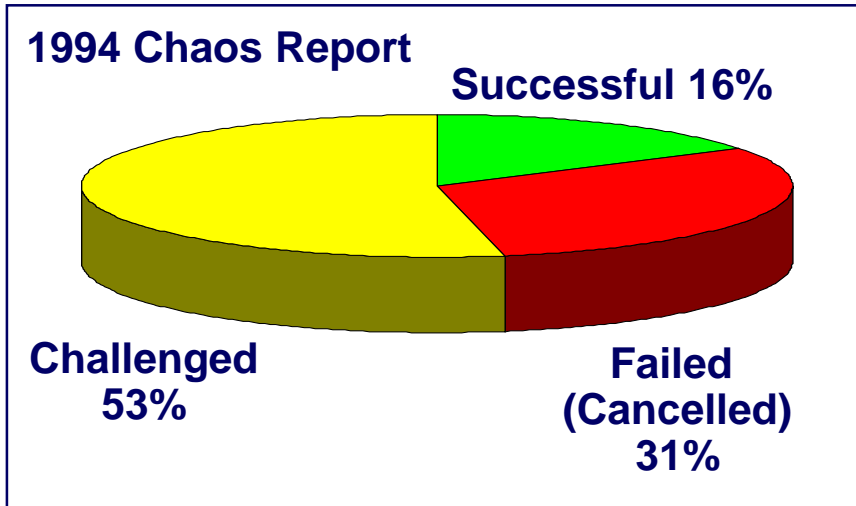
Companies are releasing products to their customers with 15% of the defects remaining in the product.

Many companies are spending 30-44% of their time and money on reworking software they have already written.

Companies meet their schedules only 50% of the time.

Sources: Capers Jones and Bill Curtis

We're getting better, but ...



- ⊕ Project waste has dropped from 32% to 21.5% of project spending
- ⊕ Cost overruns have dropped from 180% to 43%
- ⊕ Project waste of \$55 billion against \$255 billion in project spending
- ⊕ For every 100 project starts, there are 94 restarts
- ⊕ 52% of required features and functions make it to the released product
- ⊕ Projects cost, on average, 143% of the original estimate and 82% have schedule overruns

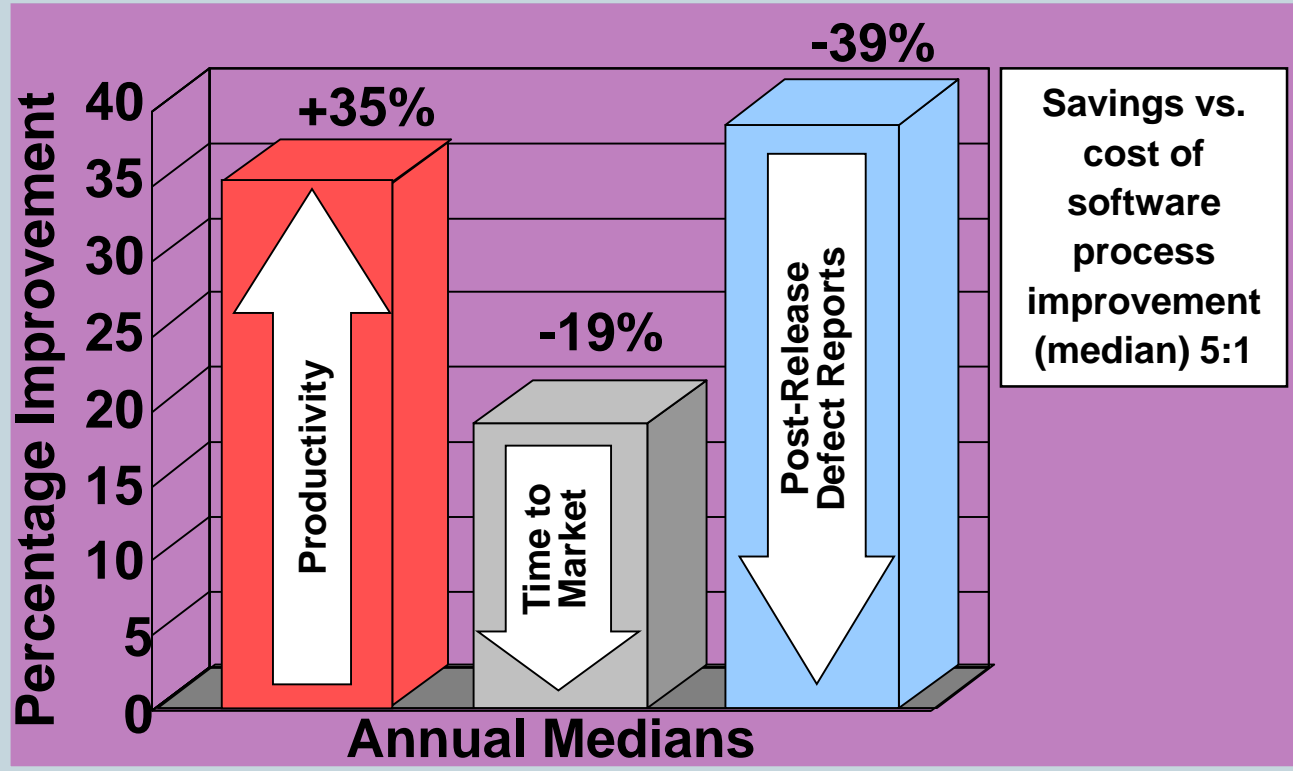
Definitions	
Successful	on time, on budget, promised functionality
Challenged	late, over budget and / or missing functionality
Failed	Severely impaired projects; cancelled projects

Source: Standish Group Chaos Report - 2003

Things are Looking Brighter

Improvements From Adopting SW-CMM (SEI, 1994)

Current ROI Value
to Programs
(DACS, 1999)



Development Costs	Reduced 73%
Rework Costs	Reduced 96%
Average Schedule Length	Reduced 37%
Post-Release Defects	Reduced 80%
Weighted Risk Likelihood	Reduced 92%
Return On Investment	21:1

Expect Even Higher ROI For CMMI

You can only do 3 things



Work harder

Hire better people

Invest in improving the processes that you use to do your job

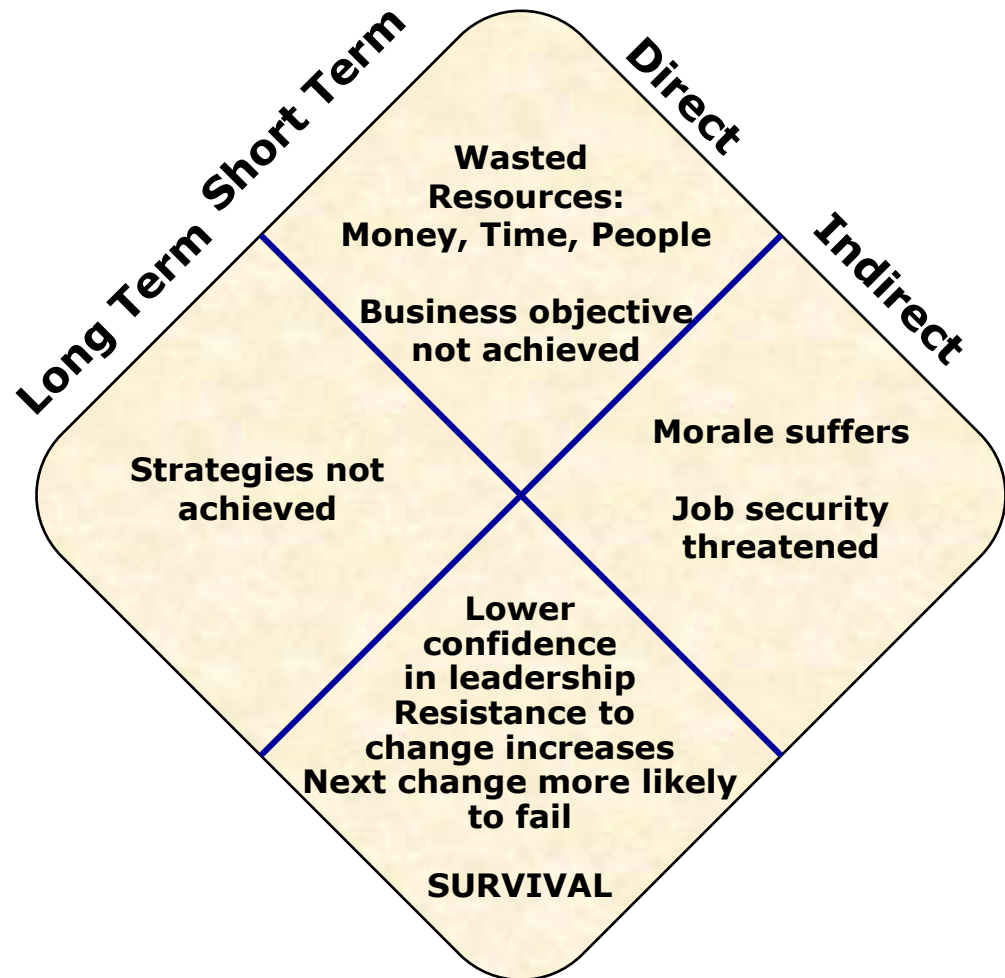
Cost of implementation failure

Quality is NOT Free...

- Cost of conformance

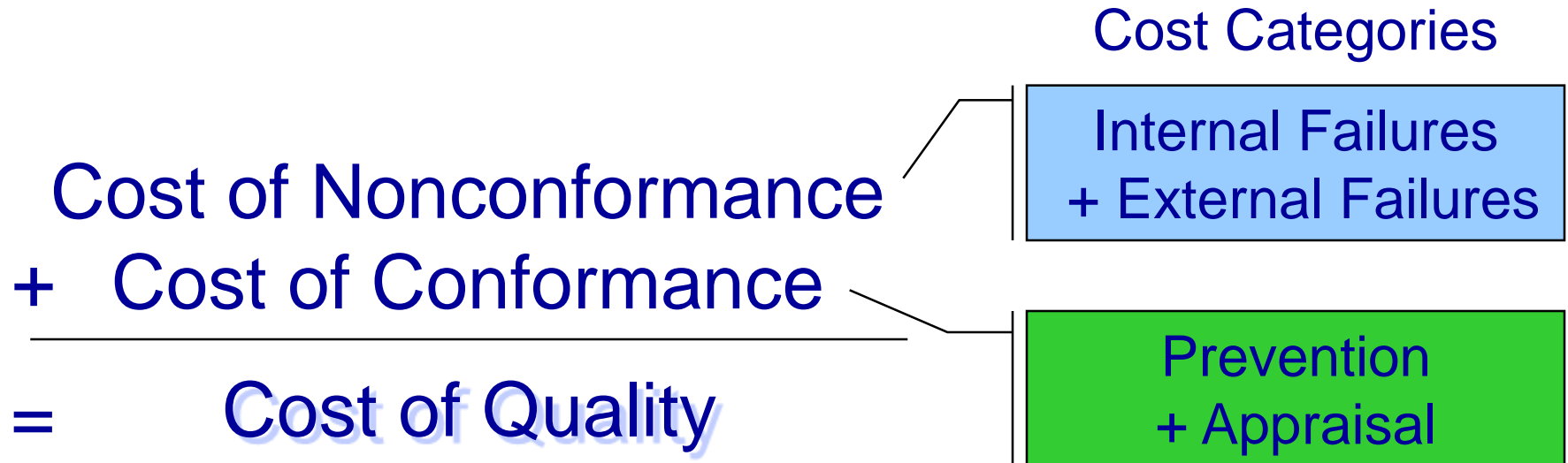
...but quality is cheaper than the alternatives

- Cost of nonconformance



Cost of Quality (CoQ)

Crosby describes Cost of Nonconformance as the extra cost incurred because a product or service wasn't done right the first time.



EXERCISE - Cost of Quality

Prevention	Appraisal	Internal Failure	External Failure
<i>Costs associated with preventing defects</i>	<i>Costs associated with "looking" for defects</i>	<i>Costs associated with defects found prior to implementation / release</i>	<i>Costs associated with defects found after the product is implemented / released</i>

CoQ Cost Categories (exercise)

Prevention	Appraisal	Internal Failure	External Failure
<p><i>Costs associated with preventing defects</i></p> <p>Planning Documentation Training Tools Policies and procedures Quality improvement projects Data gathering and analysis Fault and root cause analysis Quality reporting</p>	<p><i>Costs associated with “looking” for defects</i></p> <p>Reviews</p> <ul style="list-style-type: none"> • System • Requirements • Design • Test Plan • Test Script <p>Walkthroughs and code inspections</p> <ul style="list-style-type: none"> • Testing (First-time) <p>Audits CMM Assessments</p> <ul style="list-style-type: none"> • Class A,, B, C 	<p><i>Costs associated with defects found prior to implementation / release</i></p> <p>Rework</p> <ul style="list-style-type: none"> • Requirements • Design • Code • Documentation <p>Defect re-testing Process losses (testing downtime, changing deliverables, schedule slips, cost overruns, etc.)</p>	<p><i>Costs associated with defects found after the product is implemented / released</i></p> <p>Warranties Complaint adjustments Lost projects Tech support Subsequent releases, patches, “Service Packs” (MS terminology)</p>

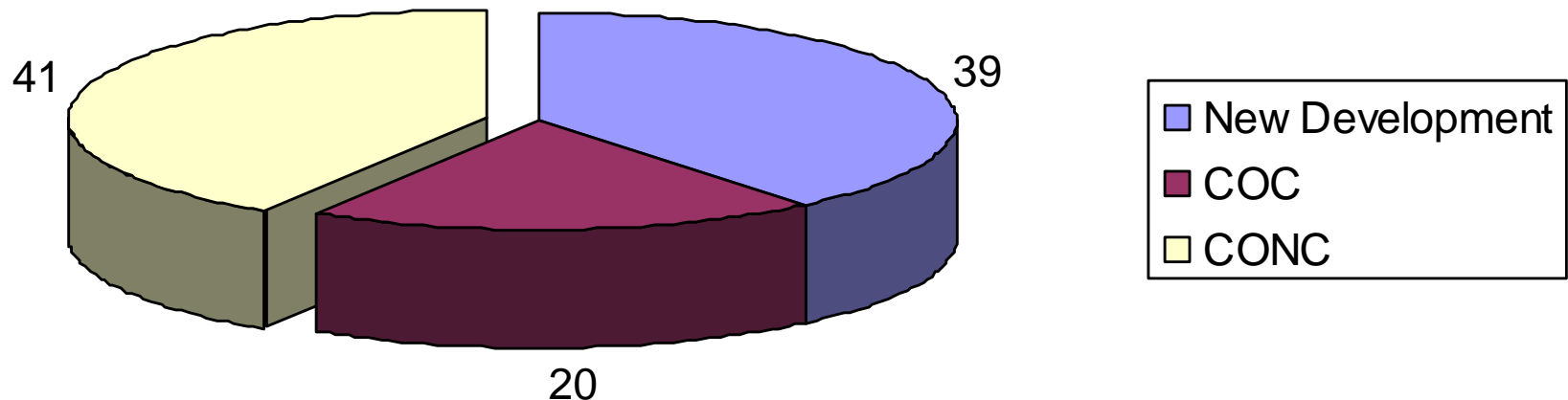
An Early CoSQ Experience

Raytheon

Where are software engineers spending their time?

OR

Where are we spending our software engineering budget?



Source: Raytheon Electronic Systems Experience in Software Process Improvement, CMU/SEI-95-TR-017, November 1995

Successful software process improvement programs can

reduce the number of defects delivered to customers by 95%

reduce software development schedules by 71%

increase productivity (measured in lines-of-code or function points per day) by 222%

realized an average ROI of 5:1

Sources: Capers Jones and Software Engineering Institute

Why Focus on Process?

Process provides a constructive, high-leverage focus...

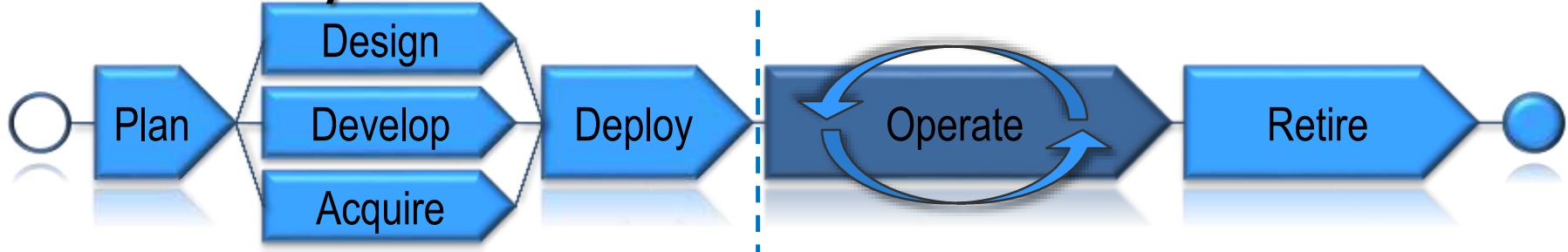
... as opposed to a focus on people

- Your work force, on the average, is as “good” as it is *trained* to be.
- Working harder is not the answer.
- Working smarter, through process, is the answer.

... as opposed to a focus on technology

- Technology applied without a suitable roadmap will not result in significant payoff.
- Technology provides the most benefit in the context of an appropriate process roadmap.

SW life cycle, software (quality) assurance standards/models



CERT-RMM

CMMI-DEV

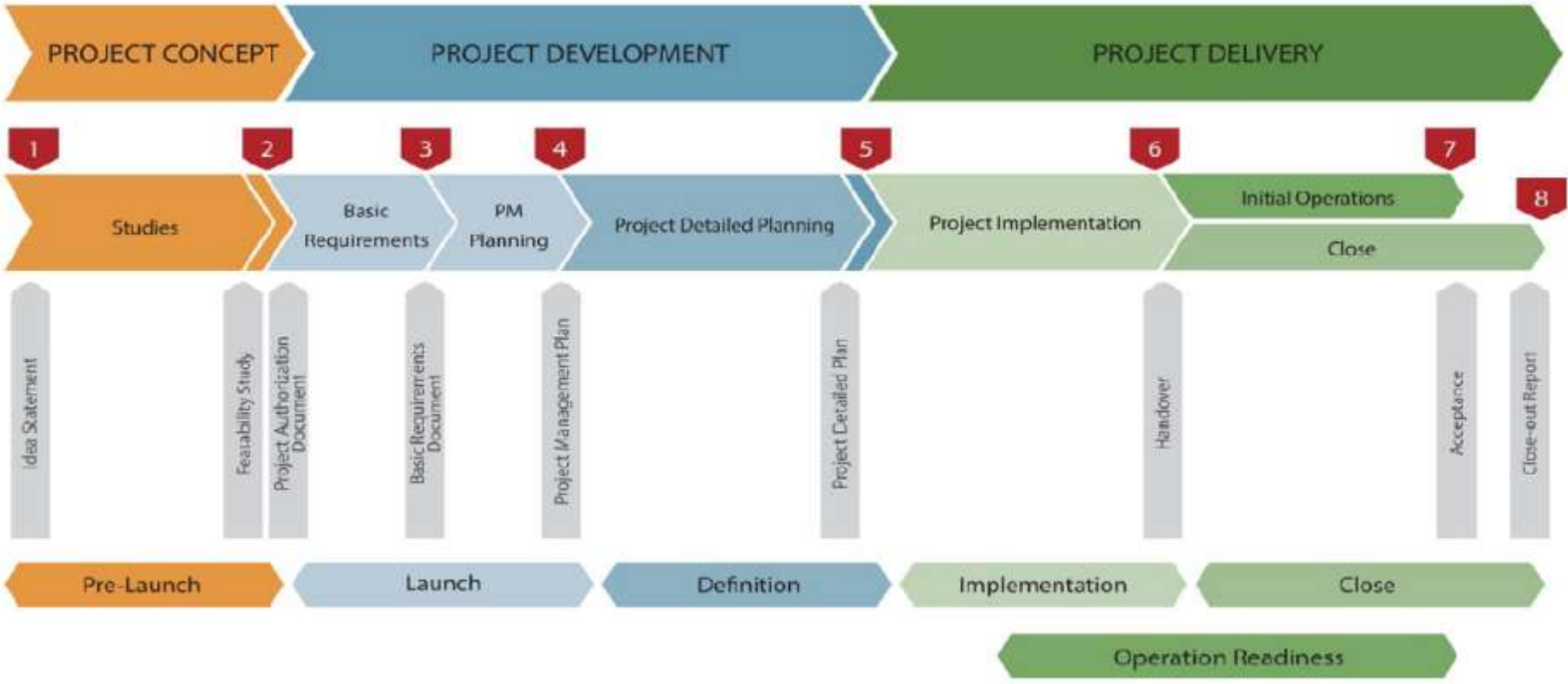
CMMI-ACQ

CMMI-SVC

DEVELOPMENT

OPERATION

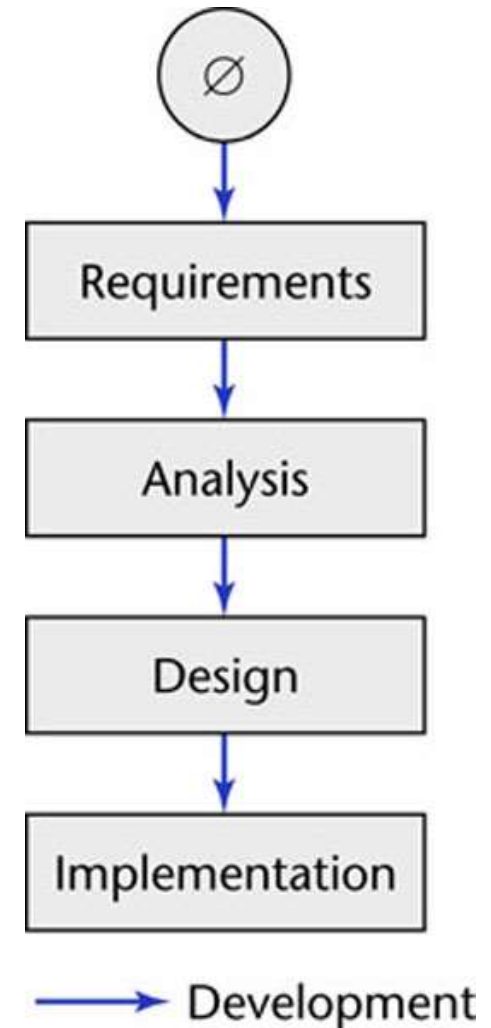
SW Project life cycle



Software Development in Theory

Ideally, software is developed:

- Linear
- Starting from scratch



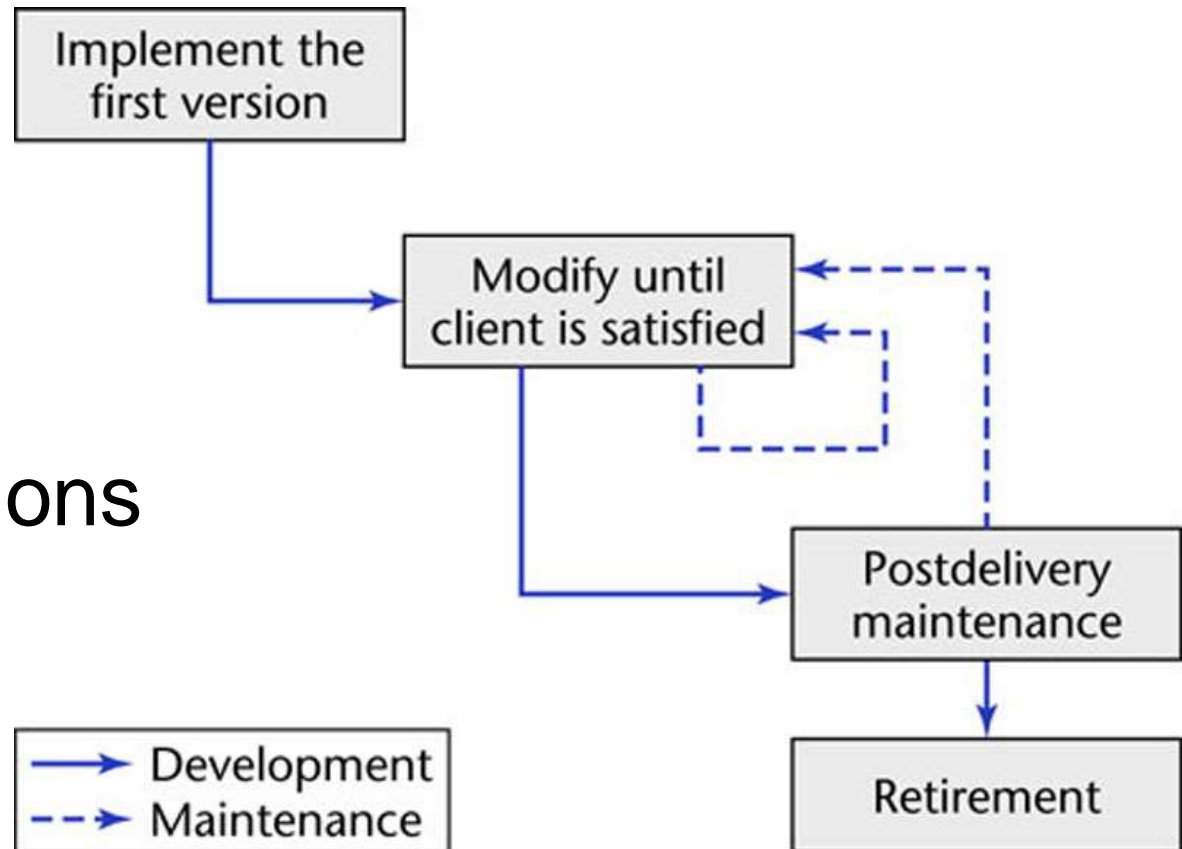
Software Development in Practice

In the real world, software development is totally different and is more chaotic

- Software professionals make mistakes
- The client's requirements change while the software product is being developed
- A software product is a model of the real world, and the real world is continually changing.

Code-and-Fix Life-Cycle Model

- No design
- No specifications



The easiest way to develop software
The most expensive way for maintenance
(i.e., maintenance nightmare)

Code-and-Fix Life-Cycle Model (Cont.)

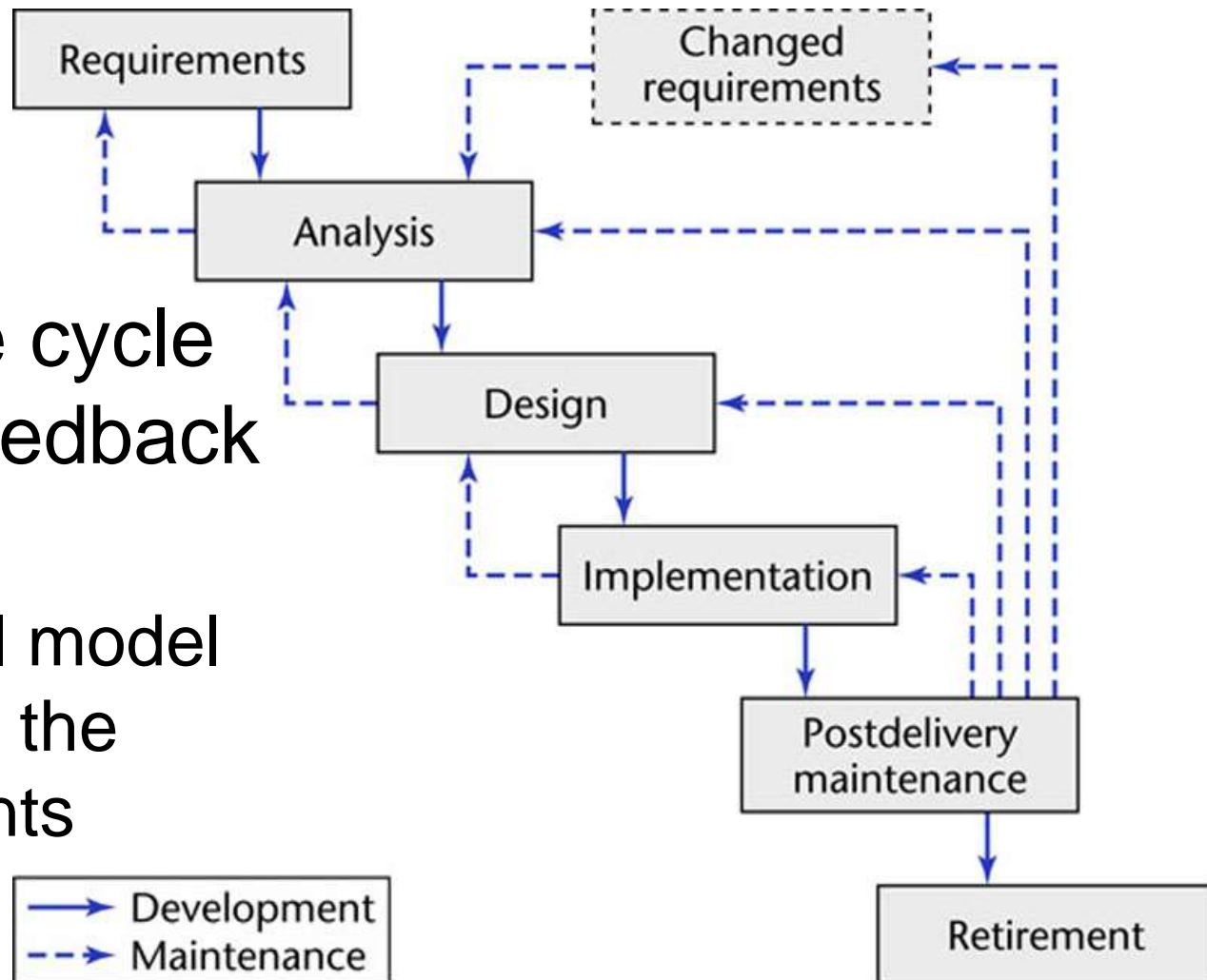
The product is implemented without requirements or specifications, or any attempt at design.

The developers simply throw code together and rework it as many times as necessary to satisfy the client.

It is used in small project and is totally unsatisfactory for products of any reasonable size.

Waterfall Life-Cycle Model

- The linear life cycle model with feedback loops
 - The waterfall model cannot show the order of events



Waterfall Life-Cycle Model (Cont.)

No phase is complete until the **documentation** for that phase has been completed and the products of that phase have been approved by the **software quality assurance** (SQA) group.

If the products of an earlier phase have to be changed as a consequence of following a **feedback loop**, that earlier phase is deemed to be complete only when the documentation for the phase has been modified and the modifications have been checked by the SQA group.

Waterfall Life-Cycle Model (Cont.)

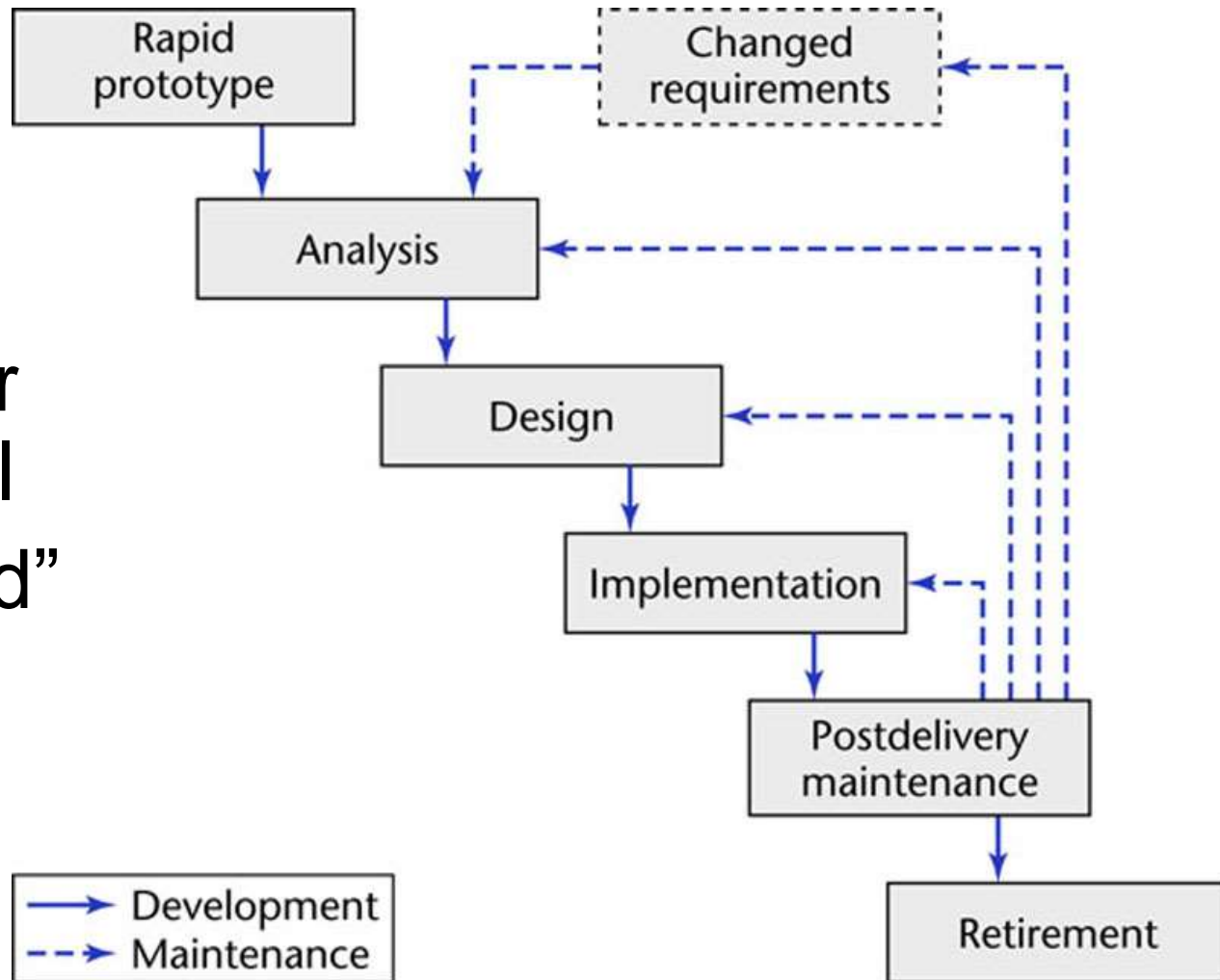
Advantages:

- Documentation is provided at each phase
- All the products of each phase (including the documentation) are meticulously checked by SQA. → Maintenance is easier

Disadvantages:

- Specification documents are long, detailed, and boring to read.

Rapid-Prototyping Life-Cycle Model



- Linear model
- “Rapid”

Rapid-Prototyping Life-Cycle Model (Cont.)

A rapid prototype is a working model that is functionally equivalent to a subset of the product.

The first step is to build a rapid prototype and let the client and future users interact and experiment with the rapid prototype.

Strength:

- The development of the product is essentially **linear**, proceeding from the rapid prototype to the delivered product.
- The feedback loops of the waterfall model are less likely to be needed in the rapid prototyping model.
- It is built rapidly and modified rapidly to reflect the client's needs. → **Speed** is of the essence.

Rapid-Prototyping Life-Cycle Model (Cont.)

Weakness:

- One the client's real needs have been determined, the rapid prototype implementation is discarded.

The lessons learned from the rapid prototype implementation are retained and used in subsequent development phases.

Mini Case Study

Episode 1: The first version is implemented

Episode 2: A fault is found

- The product is too slow because of an implementation fault
- Changes to the implementation are begun

Episode 3: The requirements change

- A faster algorithm is used

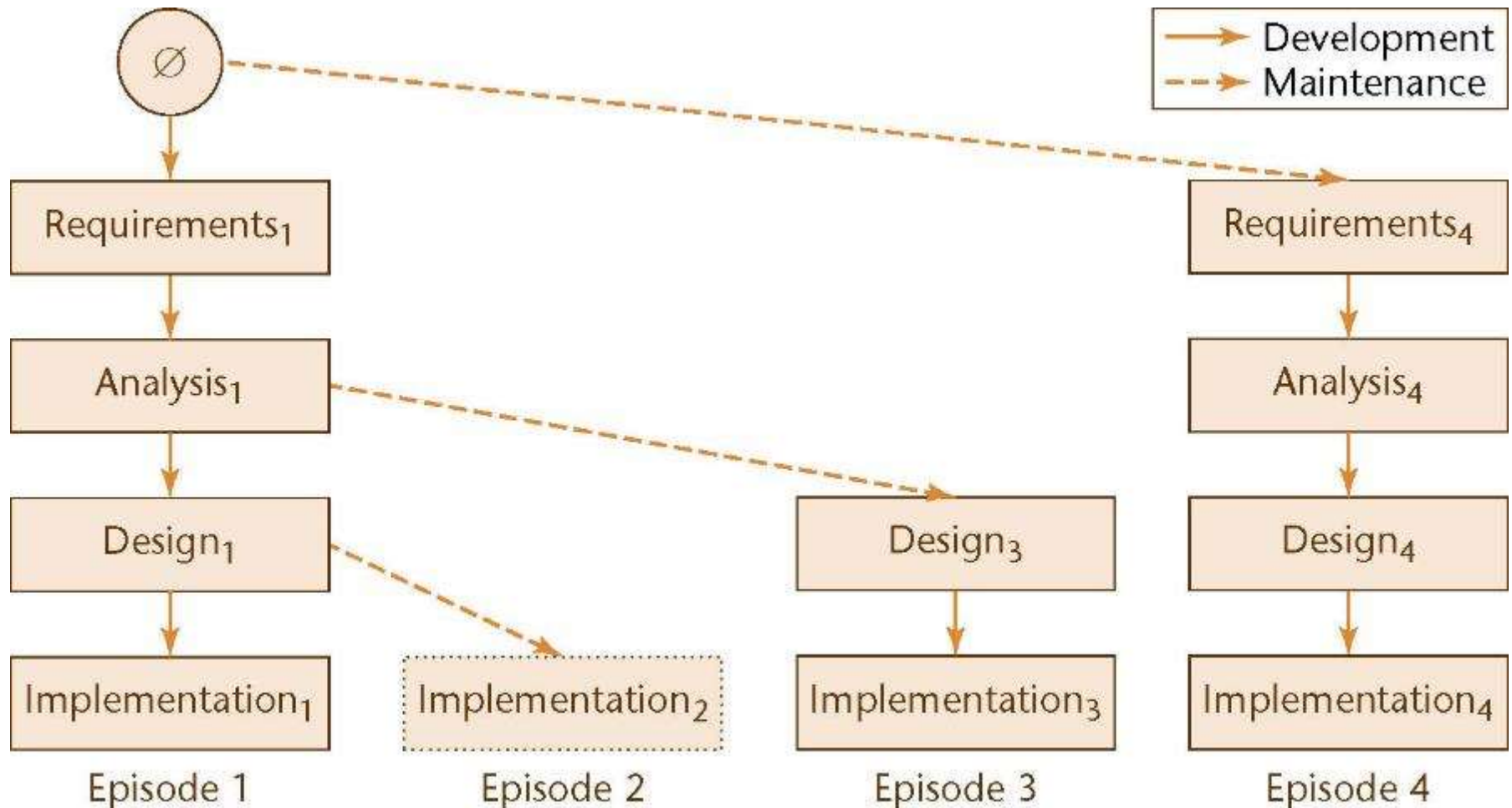
Episode 4: A new design is adopted

- Development is complete

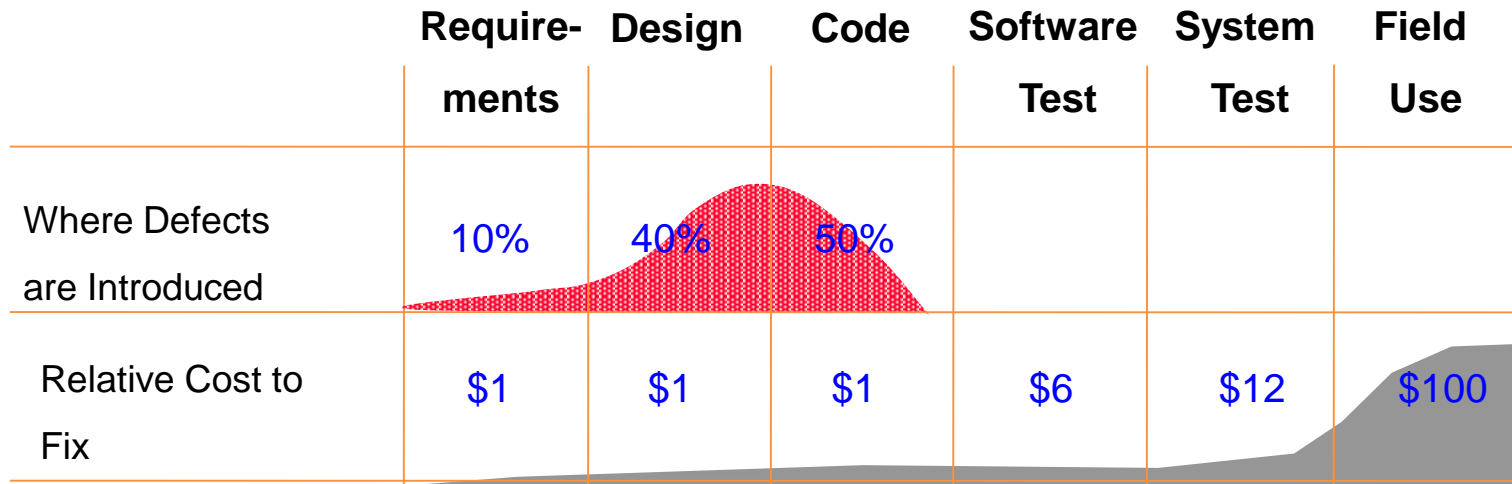
Epilogue: A few years later, these problems recur

Evolution-Tree Life-Cycle Model

The model for Winburg Mini Case Study

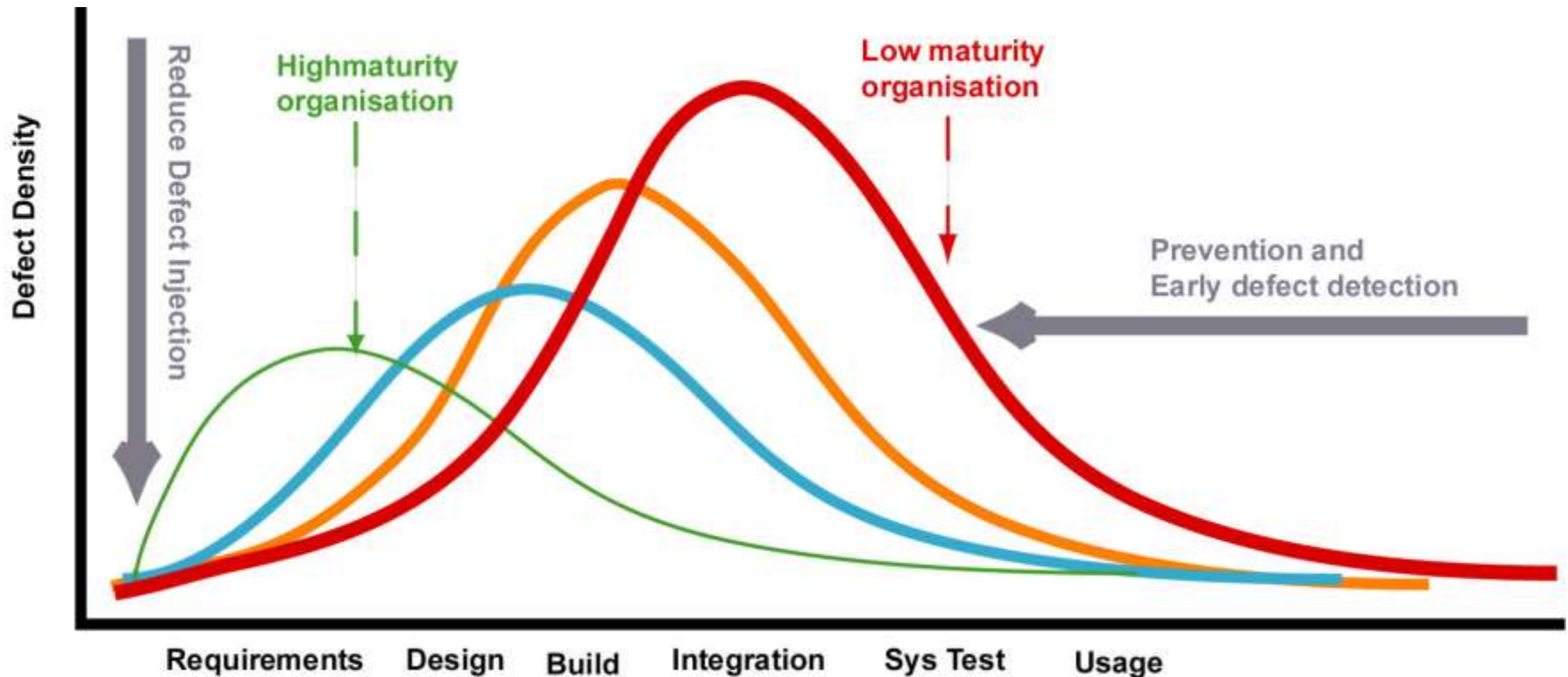


Defects : Insertion Pattern & Cost of Removal



Source: SEPG Asia Pacific 2009
presented by Ravindra Nath, KUGLER MAAG CIE GmbH

Defects-2: Injection & Prevention



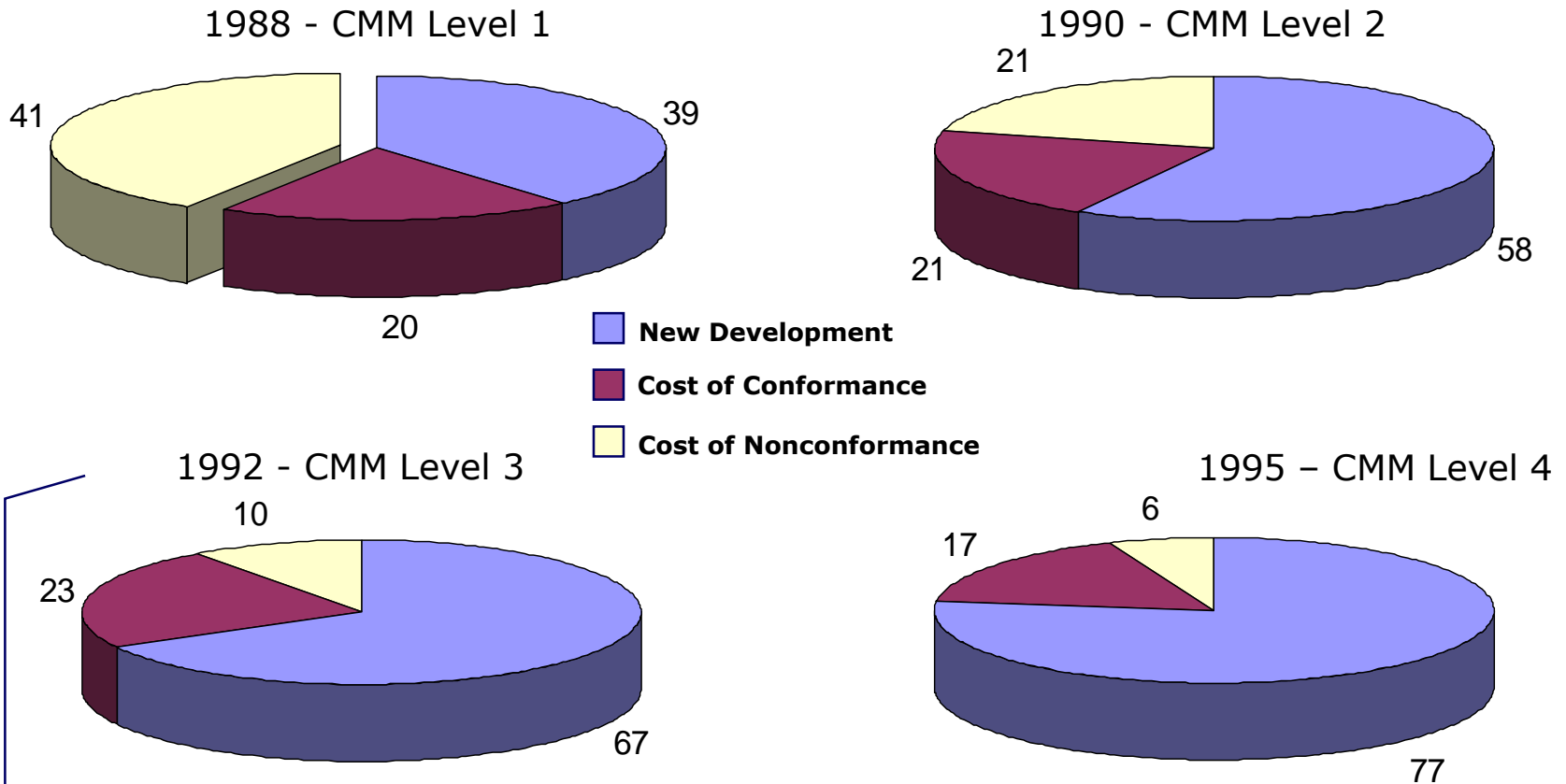
Source: Six Sigma and DFSS for IT and Software Engineering
Position Paper
Radouane Oudhiri, CTO, Systonomy Limited

This is also about SW Quality?



SELECT name FROM users WHERE name=" OR "=" AND passwd= " OR "="

The shift to increased profitability

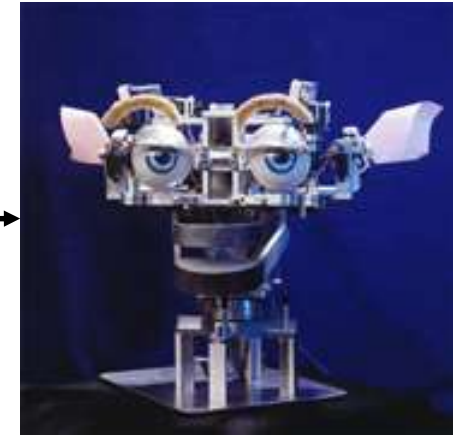
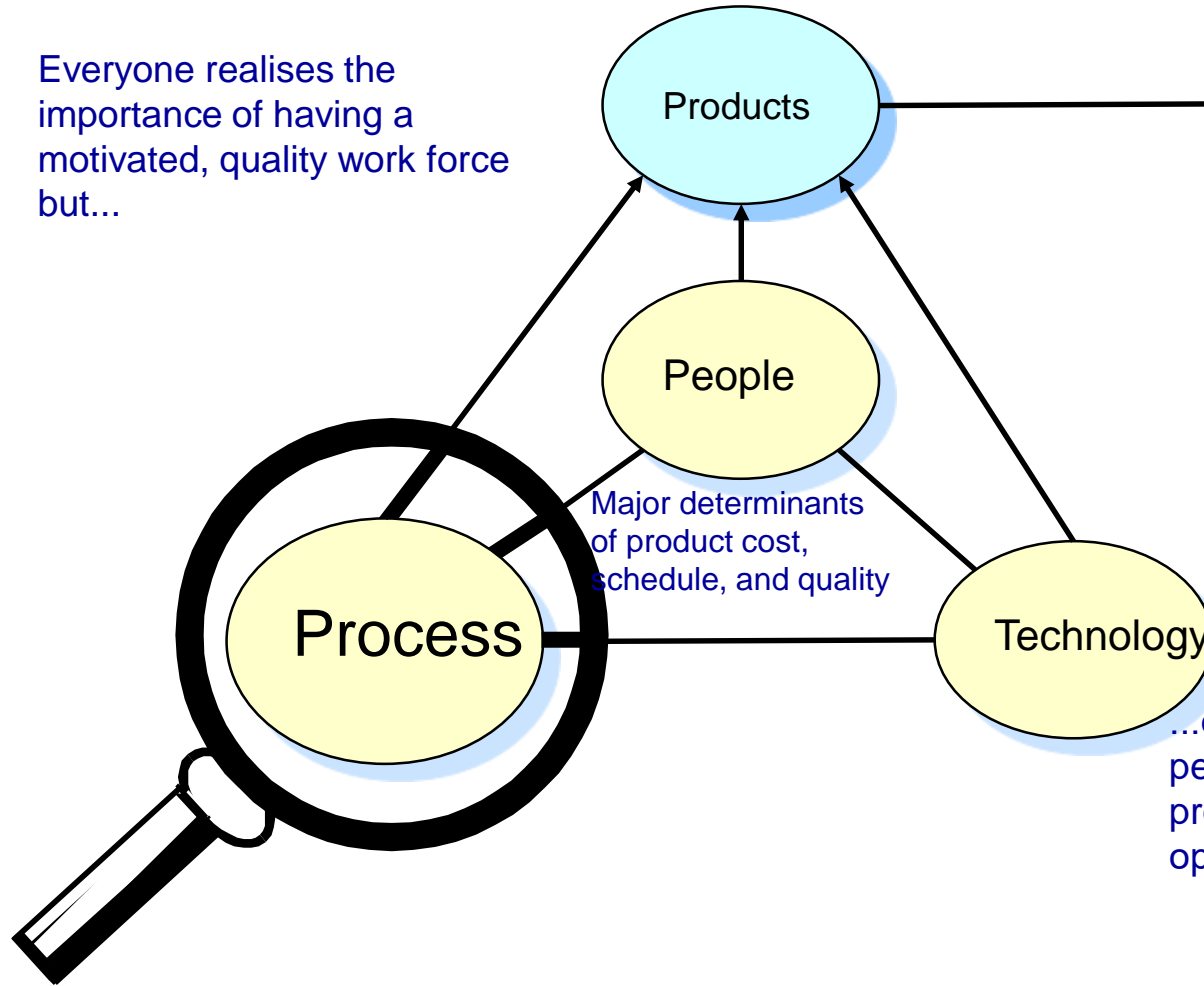


ROI 7.7:1, Productivity ↑140%, \$4.48M savings over 6 projects in 1 year

Source: Raytheon Electronic Systems Experience in Software Process Improvement, CMU/SEI-95-TR-017, November 1995

Quality Leverage Points

Everyone realises the importance of having a motivated, quality work force but...



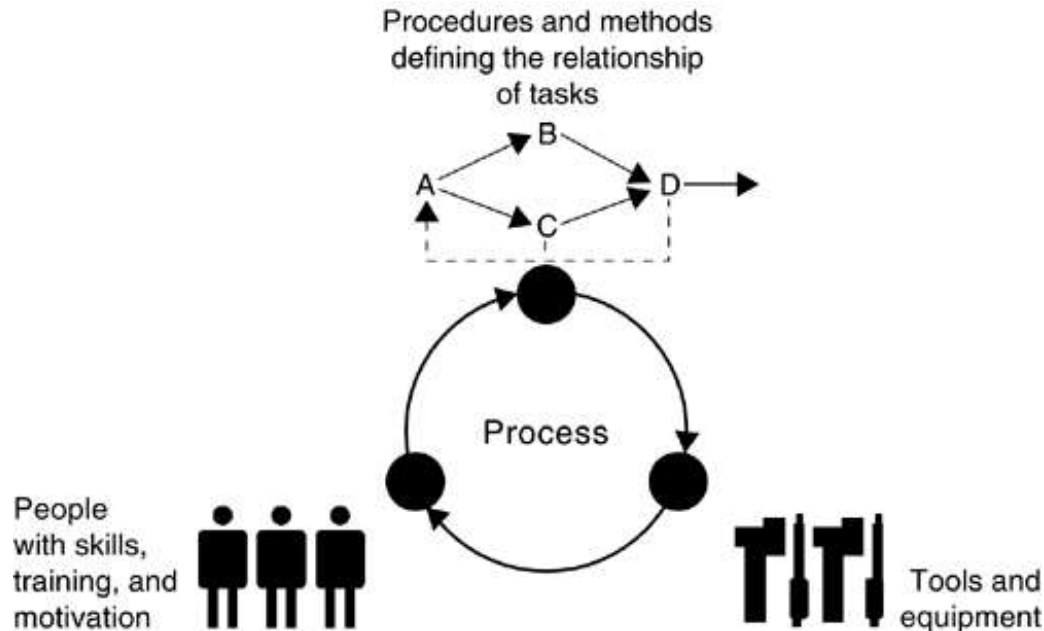
CUSTOMER SATISFACTION

...even our finest people can't perform at their best when the process is not understood or operating "at its best."

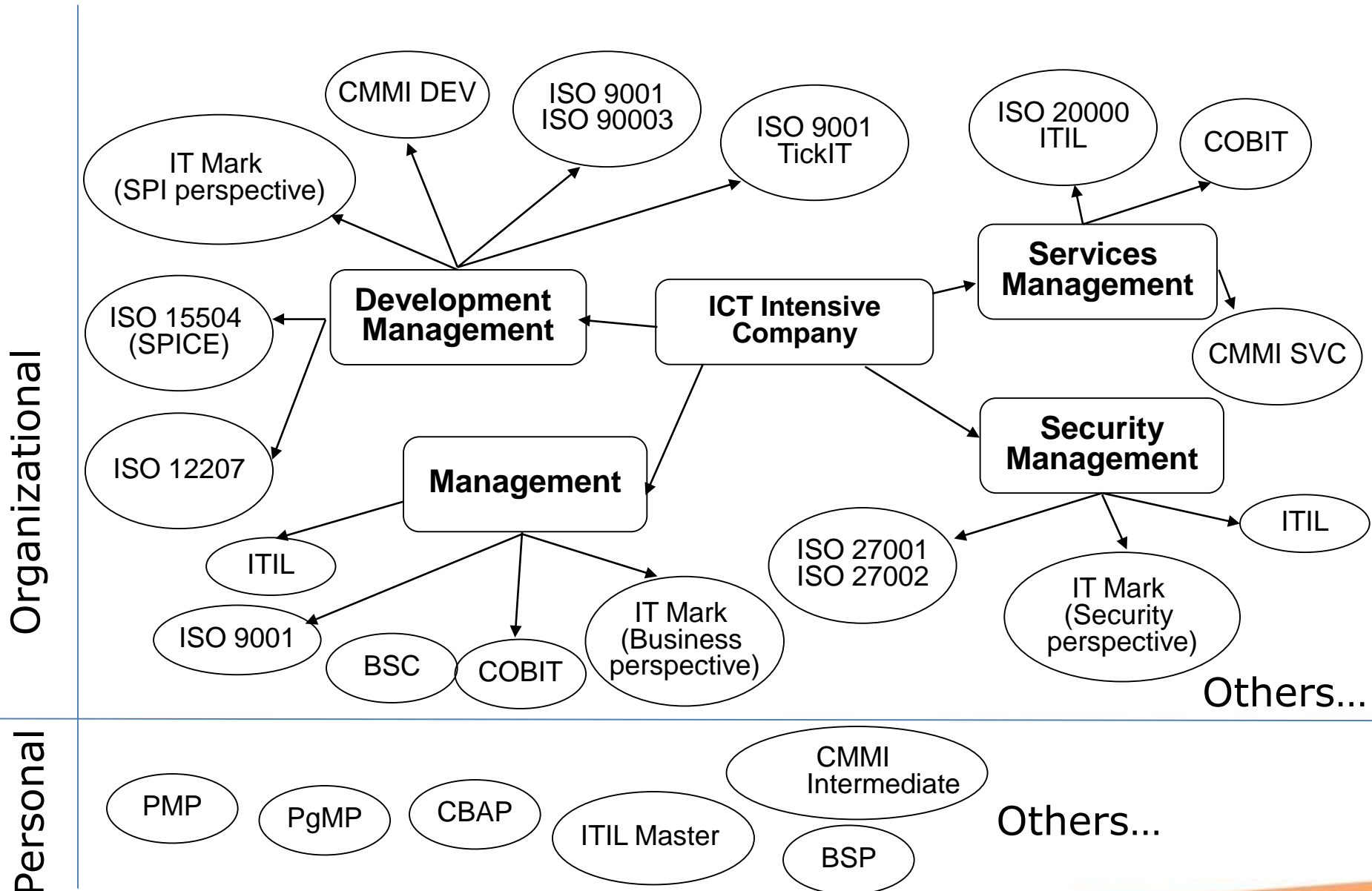
Why using models?

“All models are wrong,
but some are useful.”

George Box



So many models and standards...



Process \neq Bureaucracy

Process $=$ Work

Part 2: CMMI model

Модел CMMI (ver 1.3). История, внедряващи организации. Обща структура. Процесни области. Генерични и специфични цели и практики. Презентации – Maturity/Capability нива на Continuous и Staged representations. Категории процесни области: Process Management, Project Management, Engineering, Support.

CMMI = Capability Maturity Model Integration

links to all CMMI models (DEV, SVC, ACQ, PCMM)

<http://cmmiinstitute.com/cmml-solutions/>

<http://www.sei.cmu.edu/cmml/tools/index.cfm>

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www.sei.cmu.edu/reports/10tr033.pdf

What is a Capability Maturity Model?

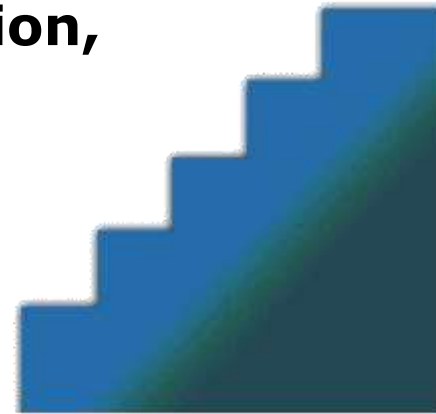
Capability Maturity Model:

A reference model of mature practices in a specified discipline, used to assess a group's capability to perform that discipline

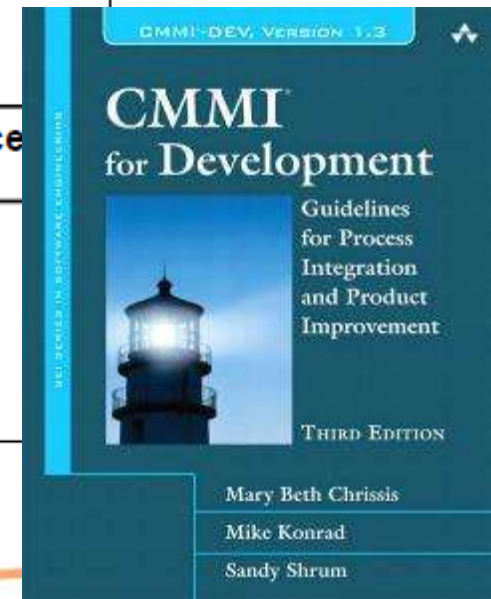
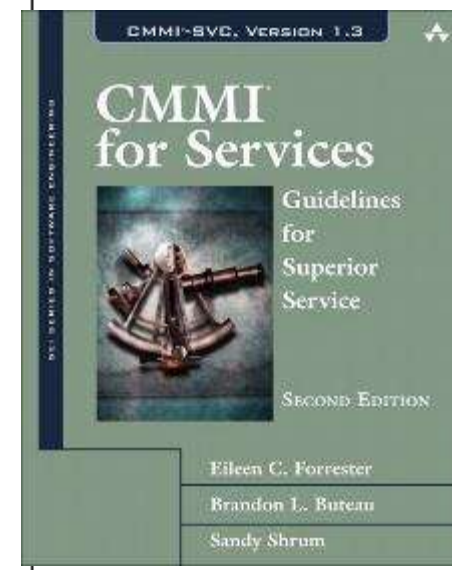
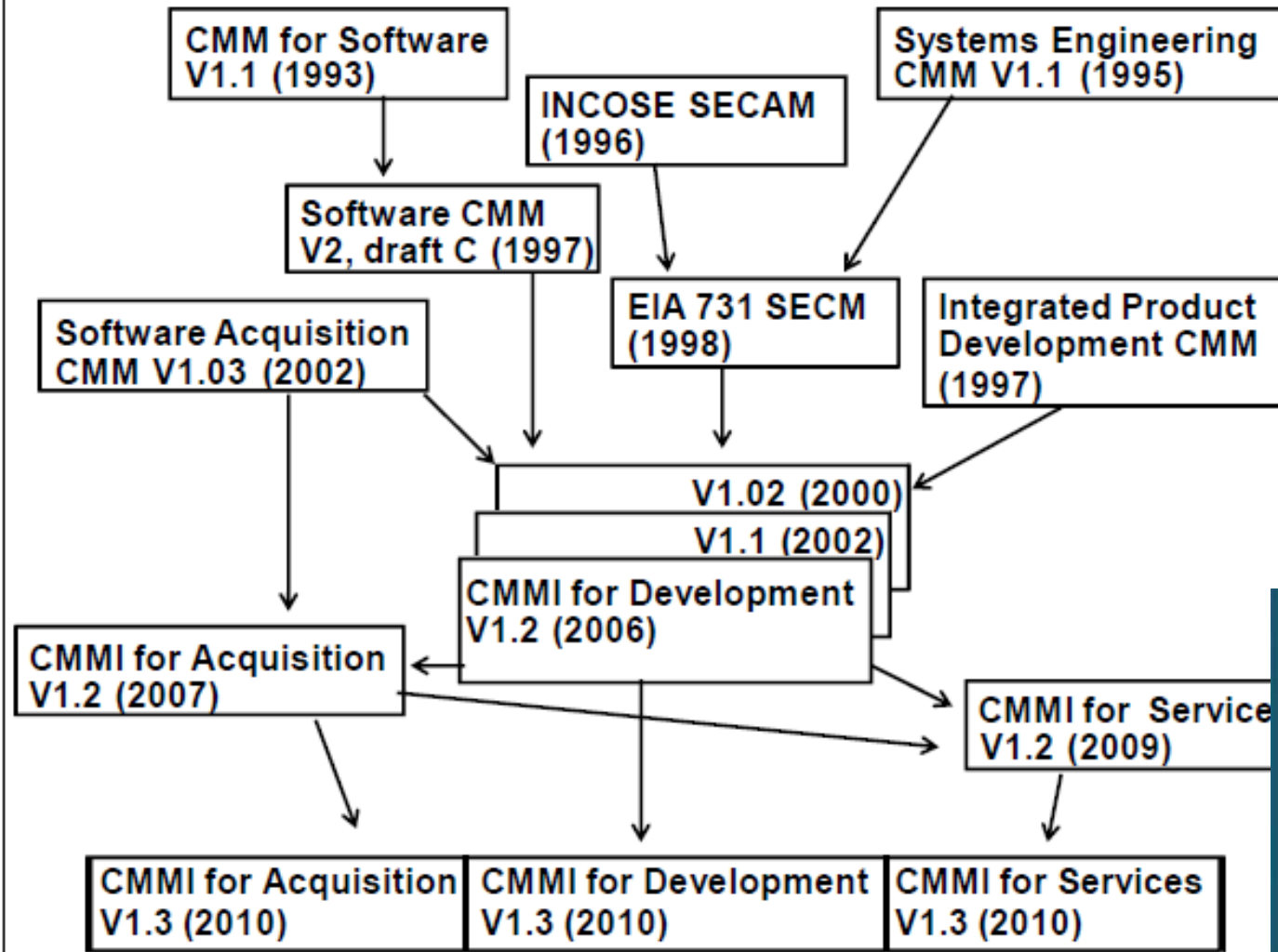
CMMs differ by

- **Discipline (software, systems, acquisition, etc.)**
- **Structure (staged versus continuous)**
- **How Maturity is Defined (process improvement path)**
- **How Capability is Defined (institutionalisation)**

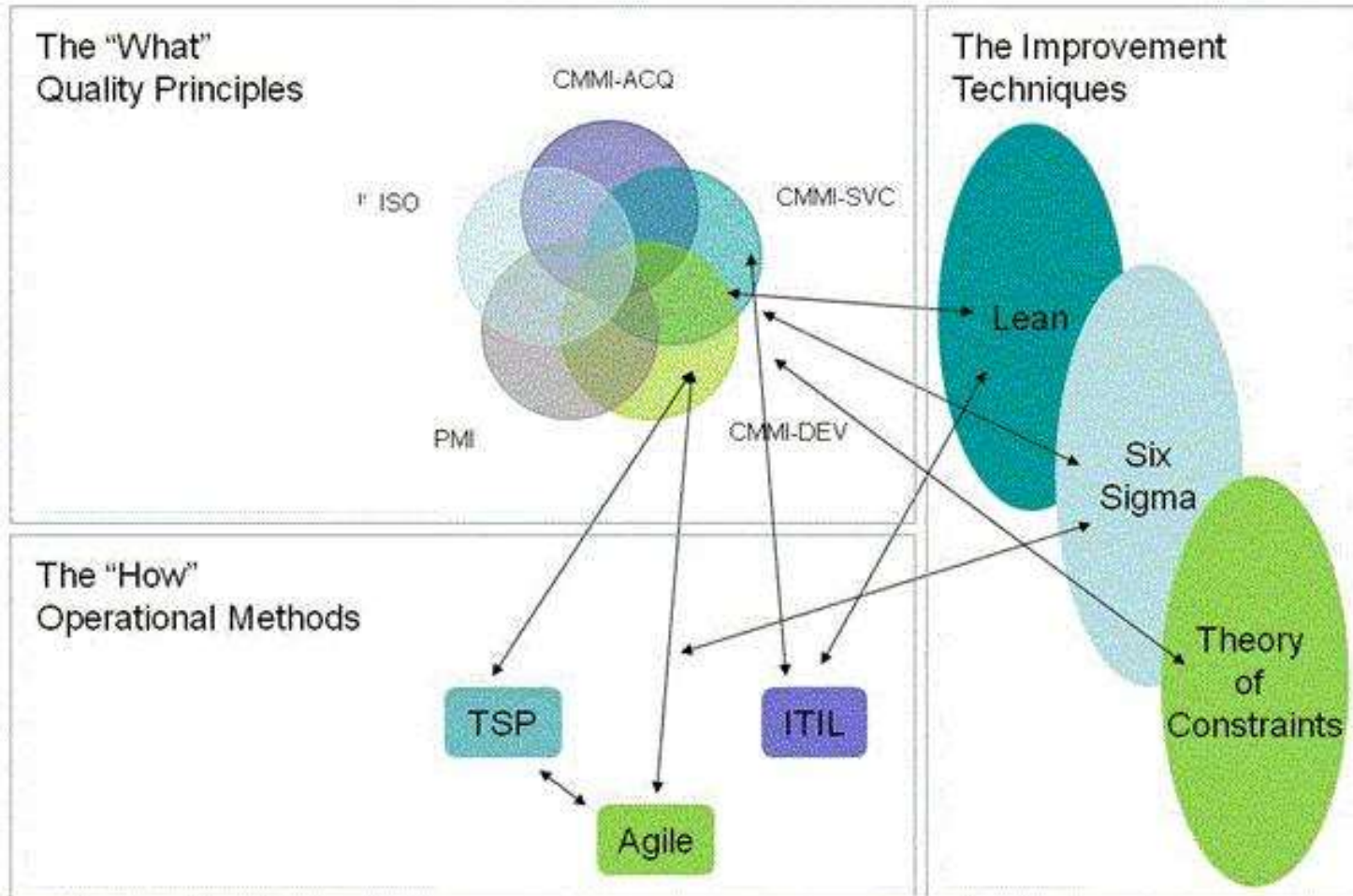
"Capability Maturity Model®" and CMM® are used by the Software Engineering Institute (SEI) to denote a particular class of maturity models



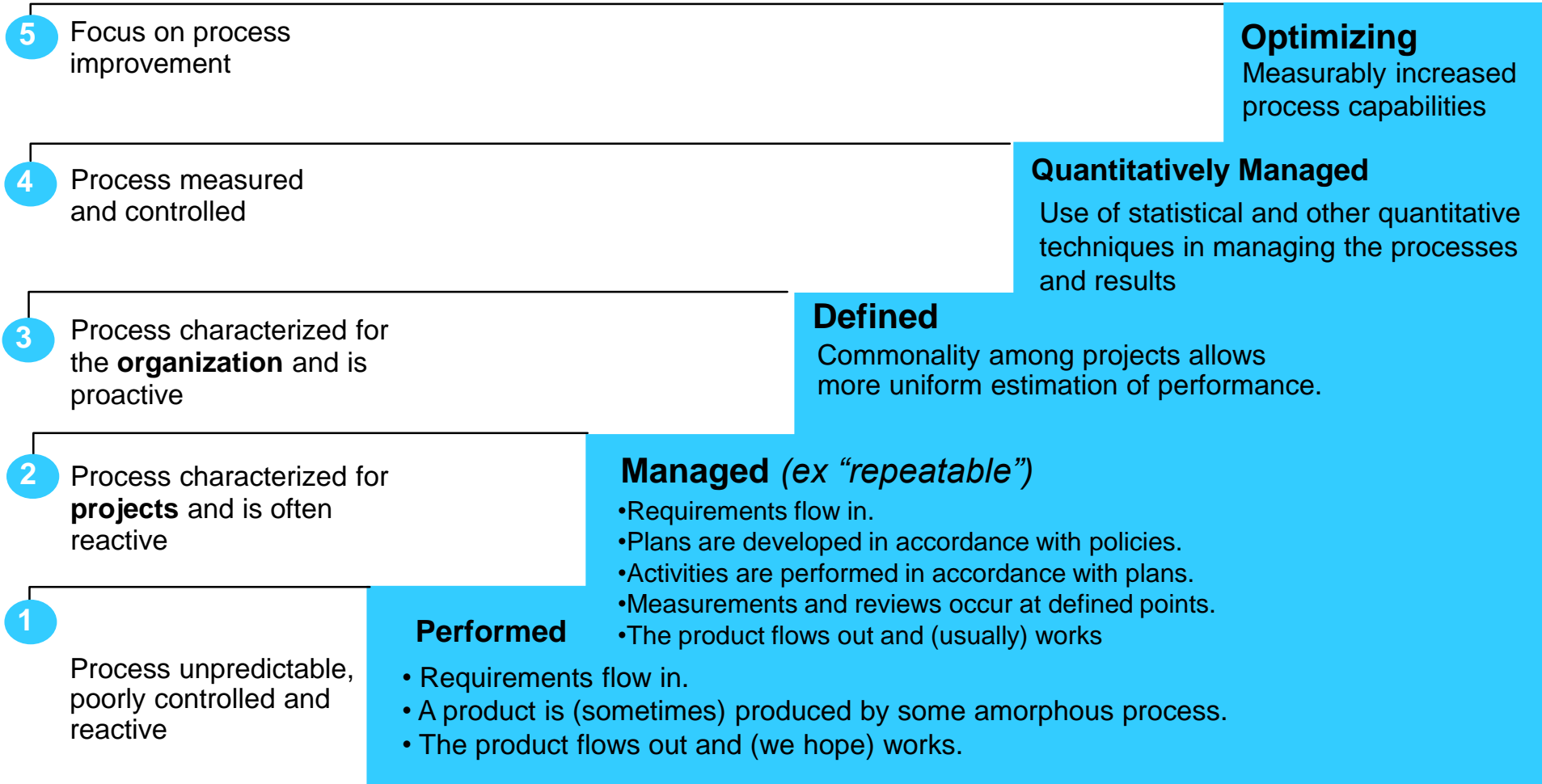
History of CMMs



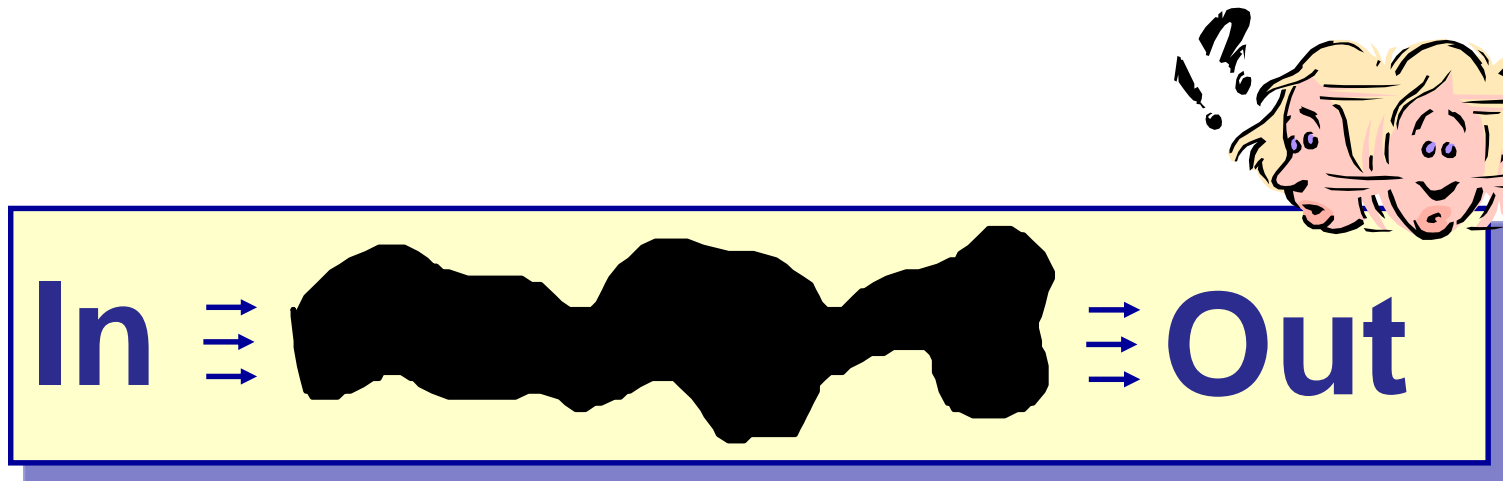
CMMI and other models



CMMI (SEI/CMU) – reference model de facto industrial standard CMMI DEV, CMMI ACQ, CMMI SVC



ML1: Performance Is Unpredictable



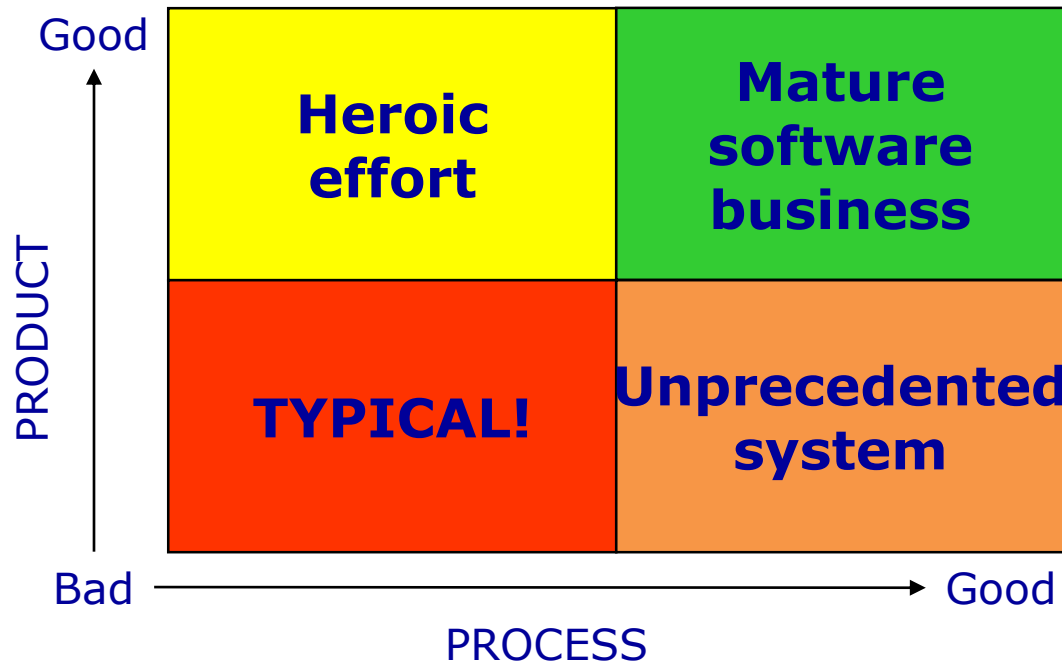
Requirements flow in.

A product is (sometimes) produced by some amorphous process.

The product flows out and (we hope) works.

REMEMBER? Corporate excellence – INTERNAL

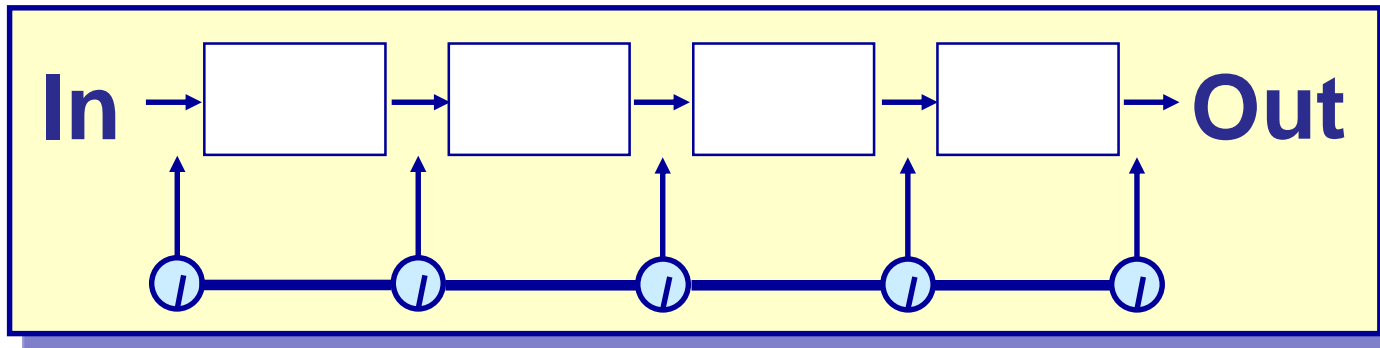
The corporate excellence is BASED on good internal processes



"The quality of a product is largely determined by the quality of the process that is used to develop and maintain it."

Based on TQM principles as taught by Shewhart, Juran, Deming and Humphrey.

ML2: Process Is "Managed"



Requirements flow in.

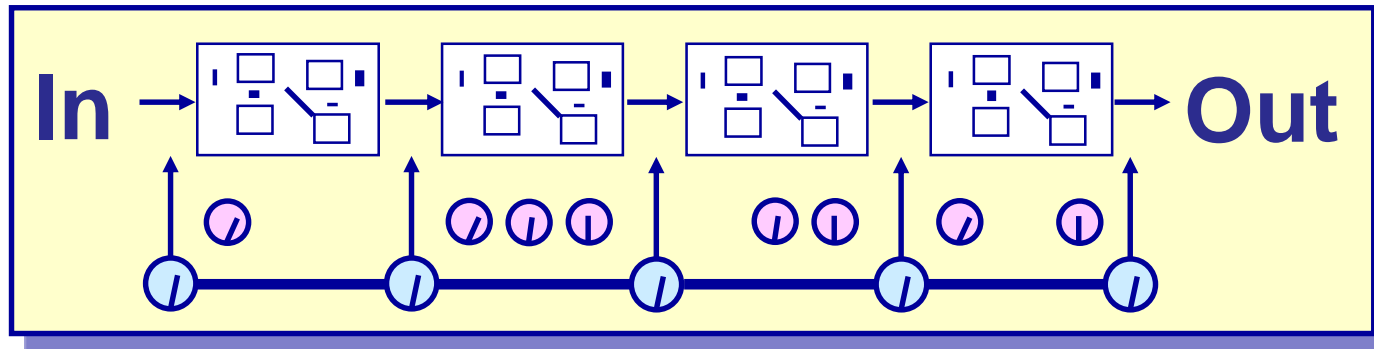
Plans are developed in accordance with policies.

Activities are performed in accordance with plans.

Measurements and reviews occur at defined points.

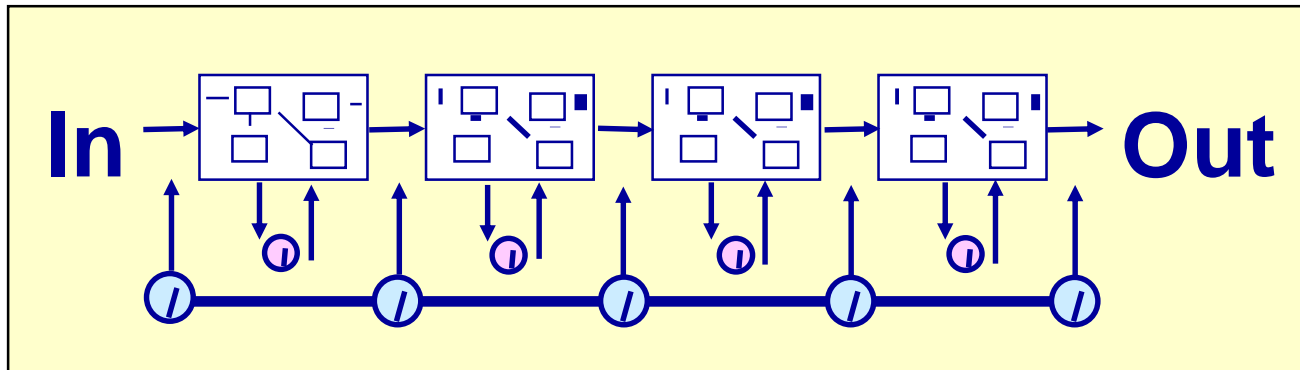
The product flows out and (usually) works.

ML3: Managed According to a Defined Process



Commonality among projects allows more uniform estimation of performance.

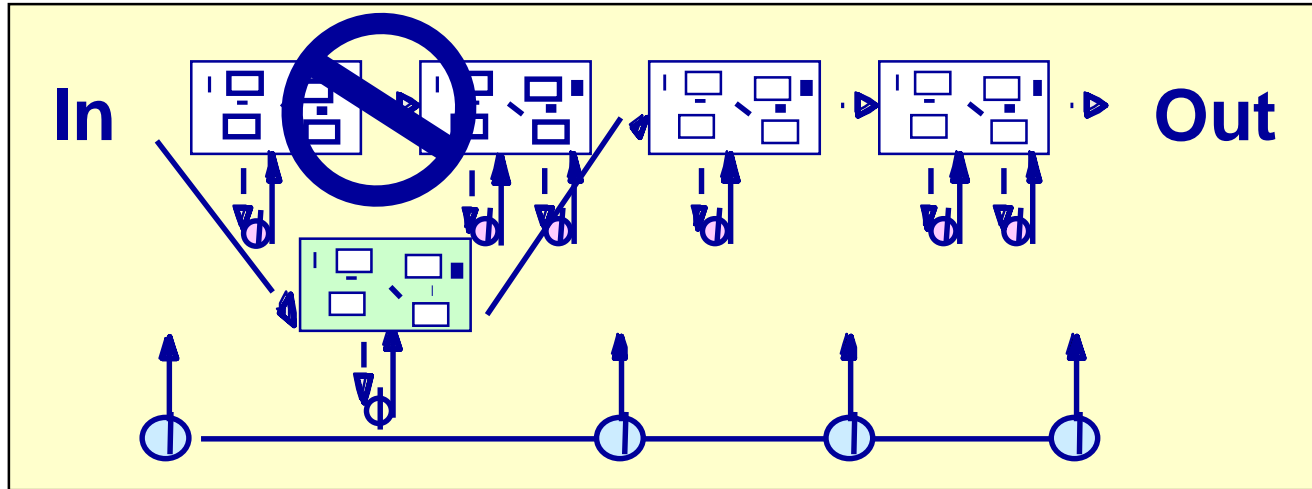
ML4: Quantitatively Managed Process



The process performance is predictable and quantitatively understood

There is a quantitative-based decision making that permits to achieve the established processes objectives, the quality of the product and the quality of the service.

ML5: Optimizing Processes



Measurable and continuous process improvement (while the process stability is managed) is integrated in the daily work

Measures are used to:

- Select improvements and innovations
- estimate the costs and benefits of the improvements and innovations
- Measure the current costs and benefits of the improvements and innovations.

Sample Level 1 Organization

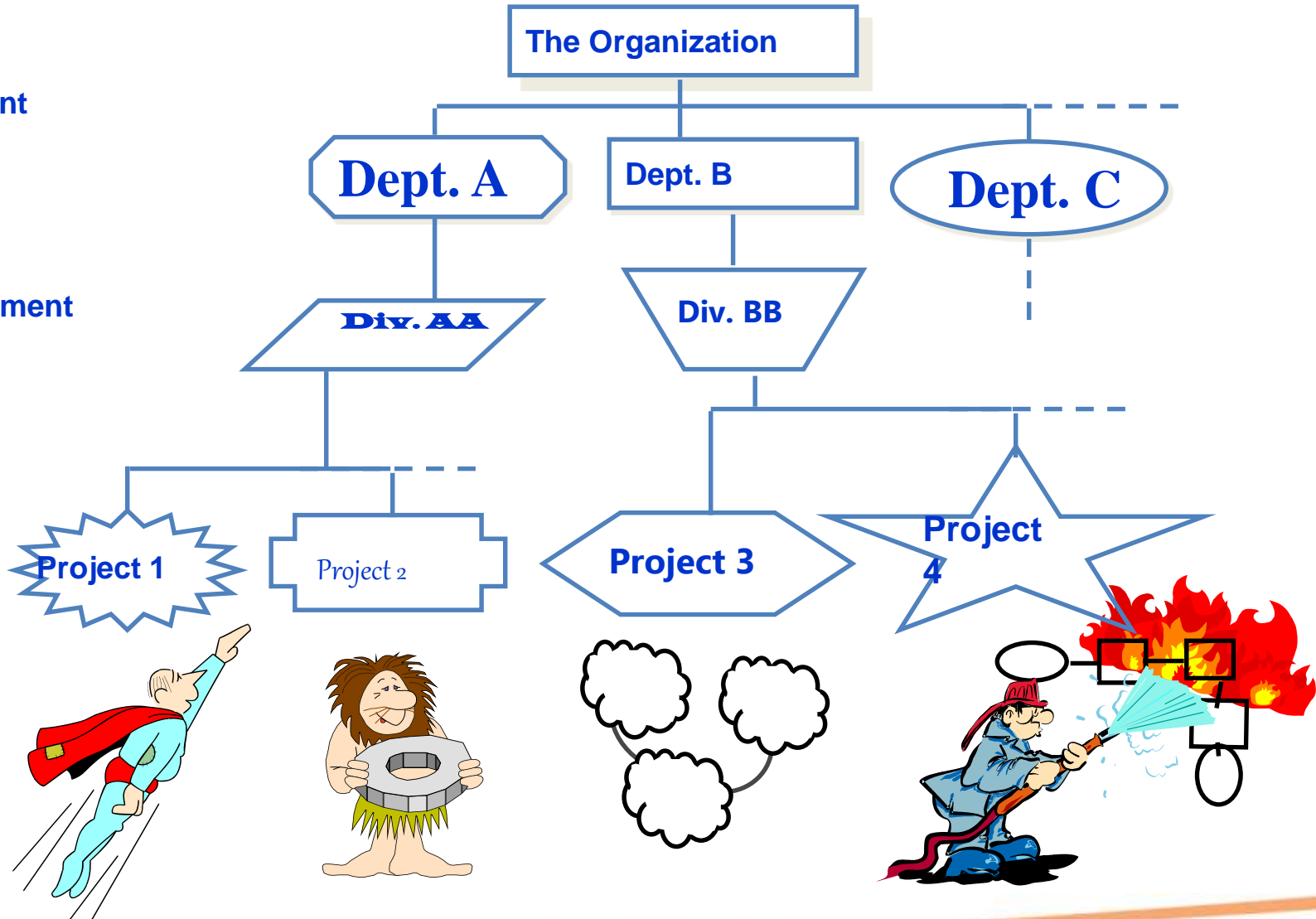
few processes in place

Top Management

Middle Management

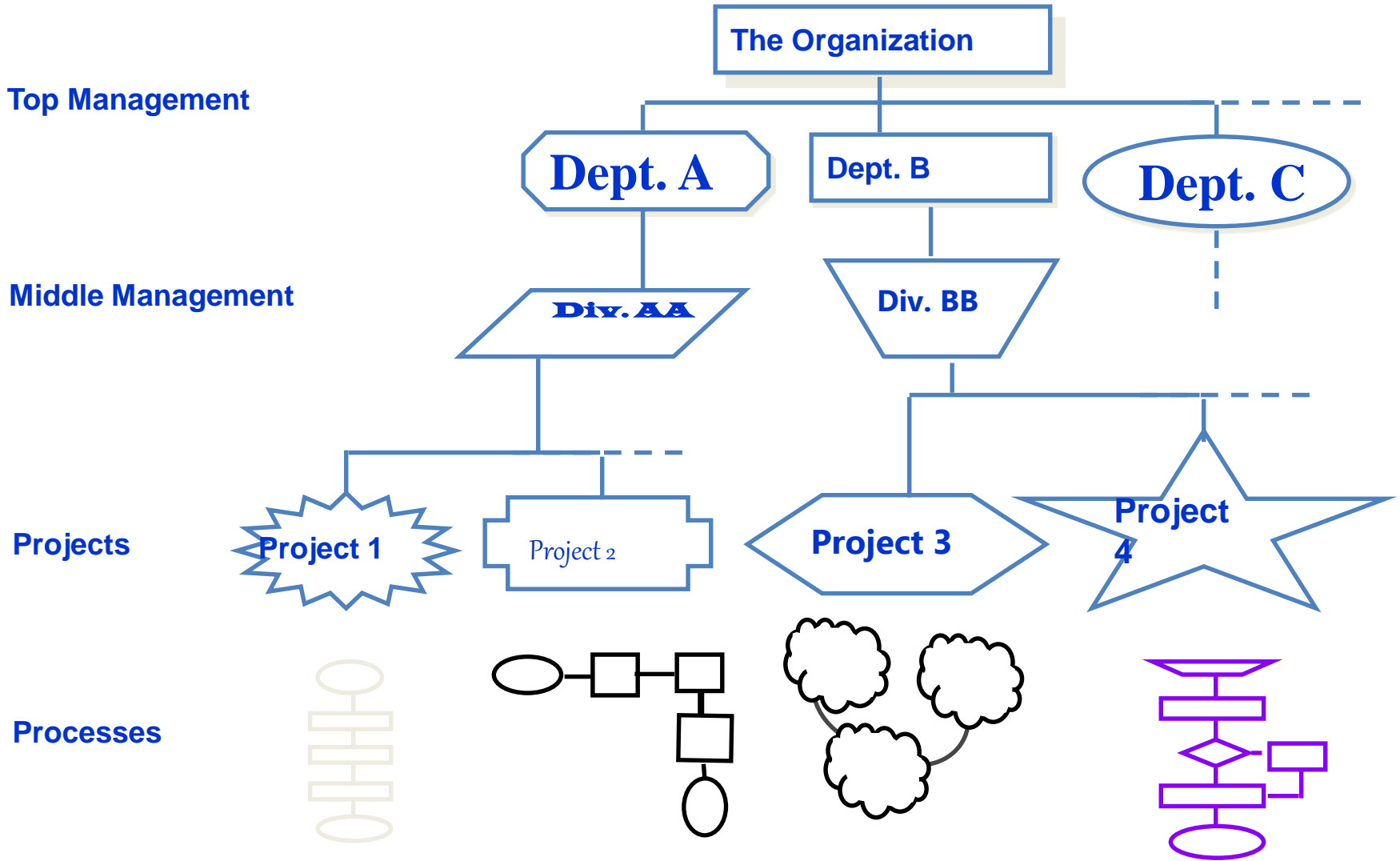
Projects

Processes



Sample Level 2 Organization

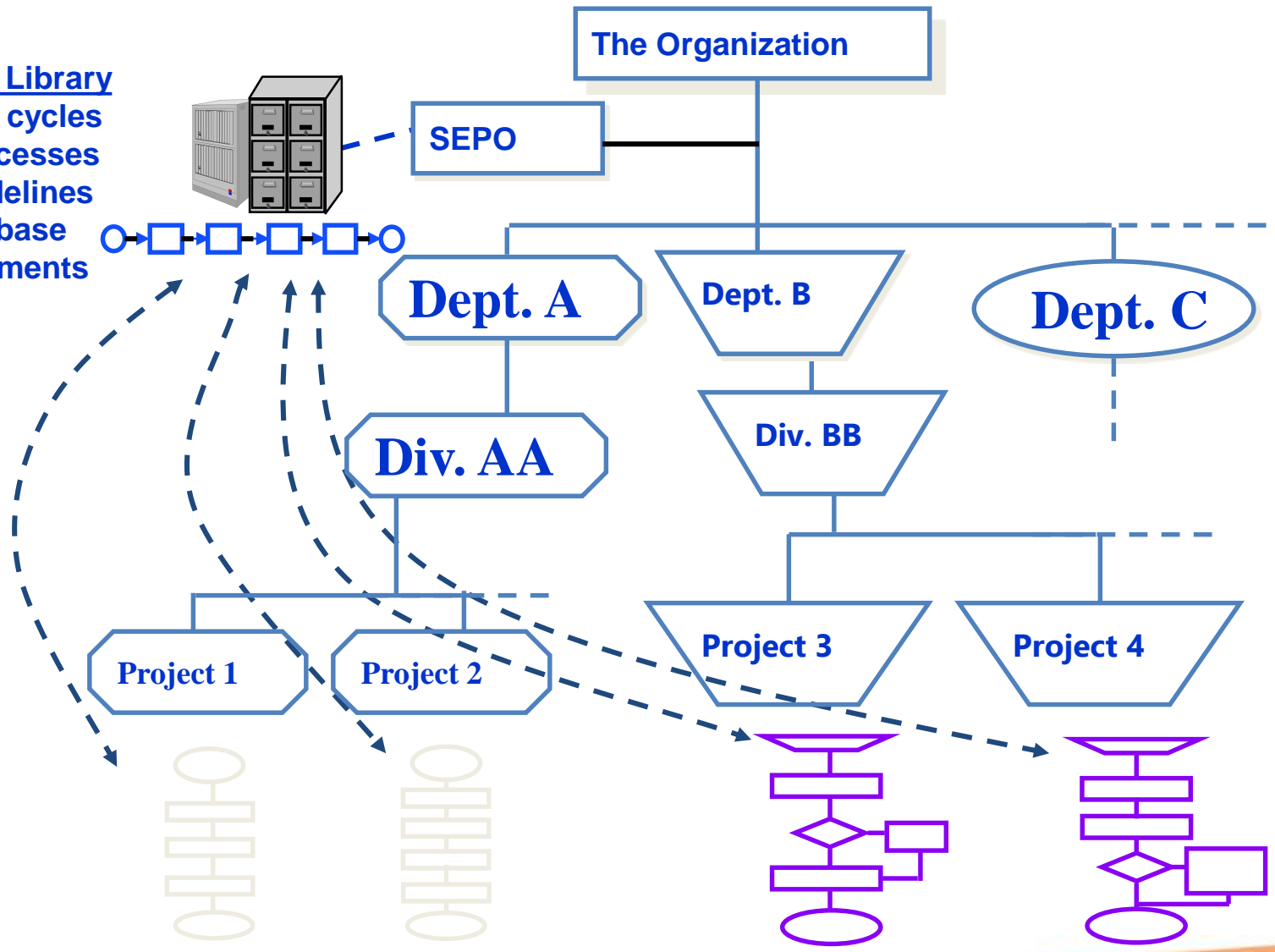
many processes in place; but they are project-specific



Sample Level 3 Organization

processes based on organization's Process Asset Library (PAL)

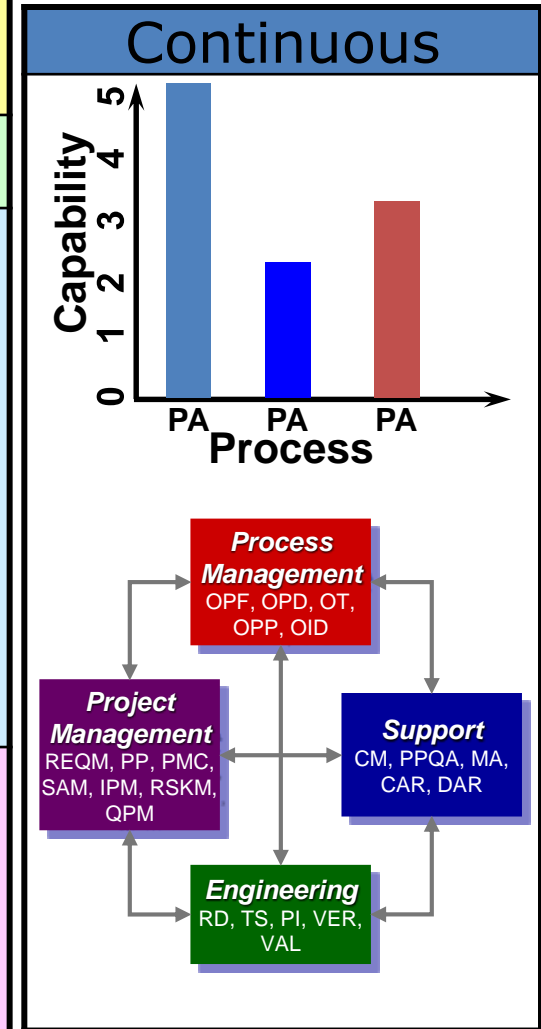
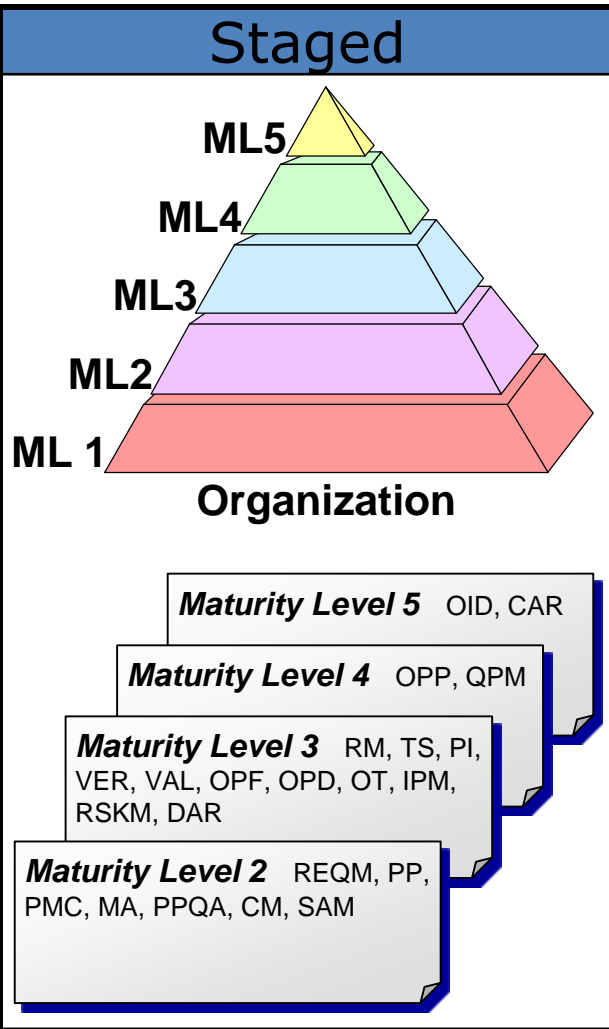
- Process Asset Library**
- Approved life cycles
- Standard processes
- Tailoring guidelines
- Process database
- Related documents



Projects

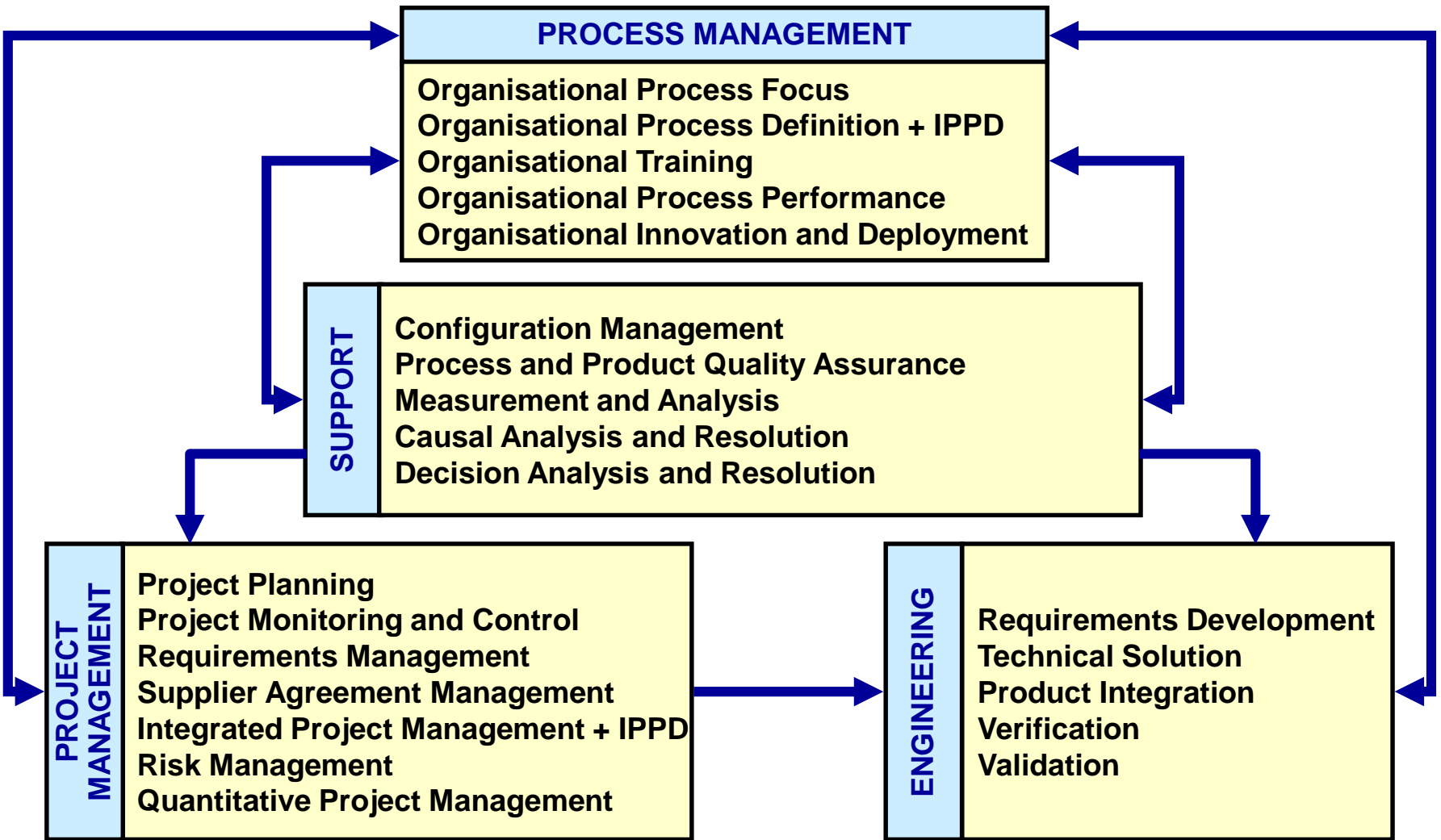
Processes

CMMI Representations

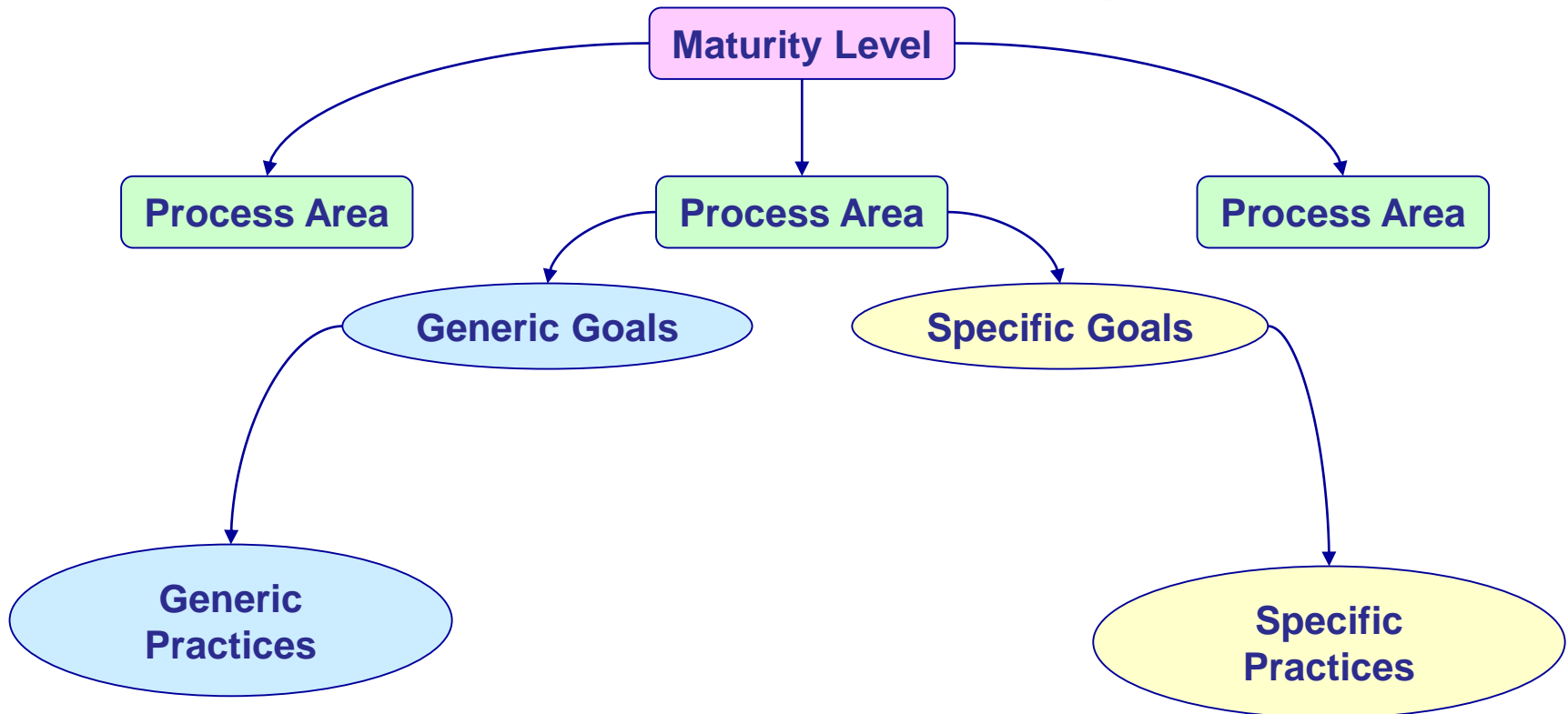


LEVEL	FOCUS	PROCESS AREAS	Quality Productivity
5 Optimising	Continuous Process Improvement	Organisational Innovation and Deployment Causal Analysis and Resolution	
4 Quantitatively Managed	Quantitative Management	Organisational Process Performance Quantitative Project Management	
3 Defined	Process Standardisation	Requirements Development Technical Solution Product Integration Verification Validation Organisational Process Focus Organisational Process Definition Organisational Training Integrated Project Management Risk Management Decision Analysis and Resolution	
2 Managed	Basic Project Management	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management	
1 Initial	No process areas – the work just gets done somehow!		

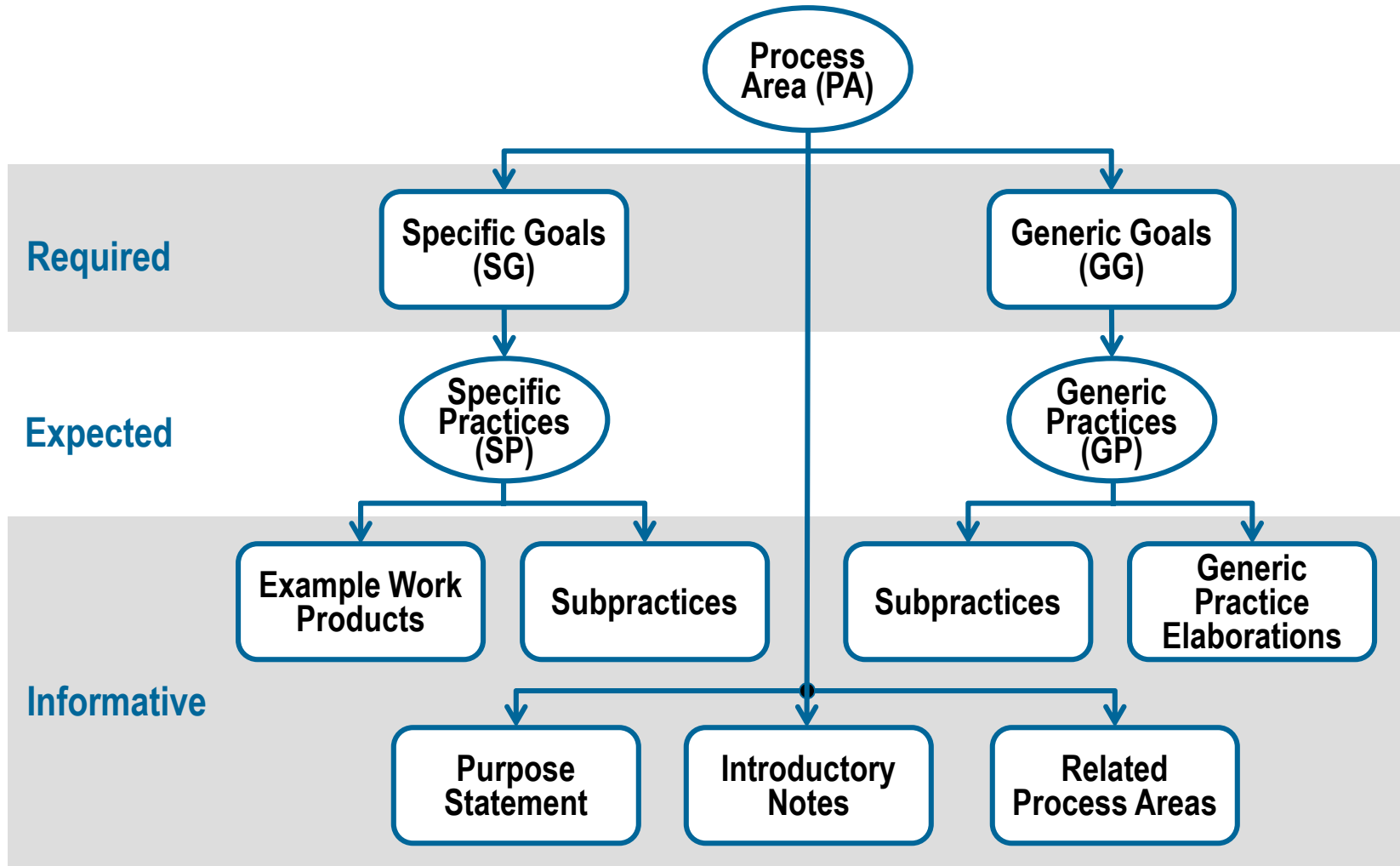
Process areas categories (v 1.3)



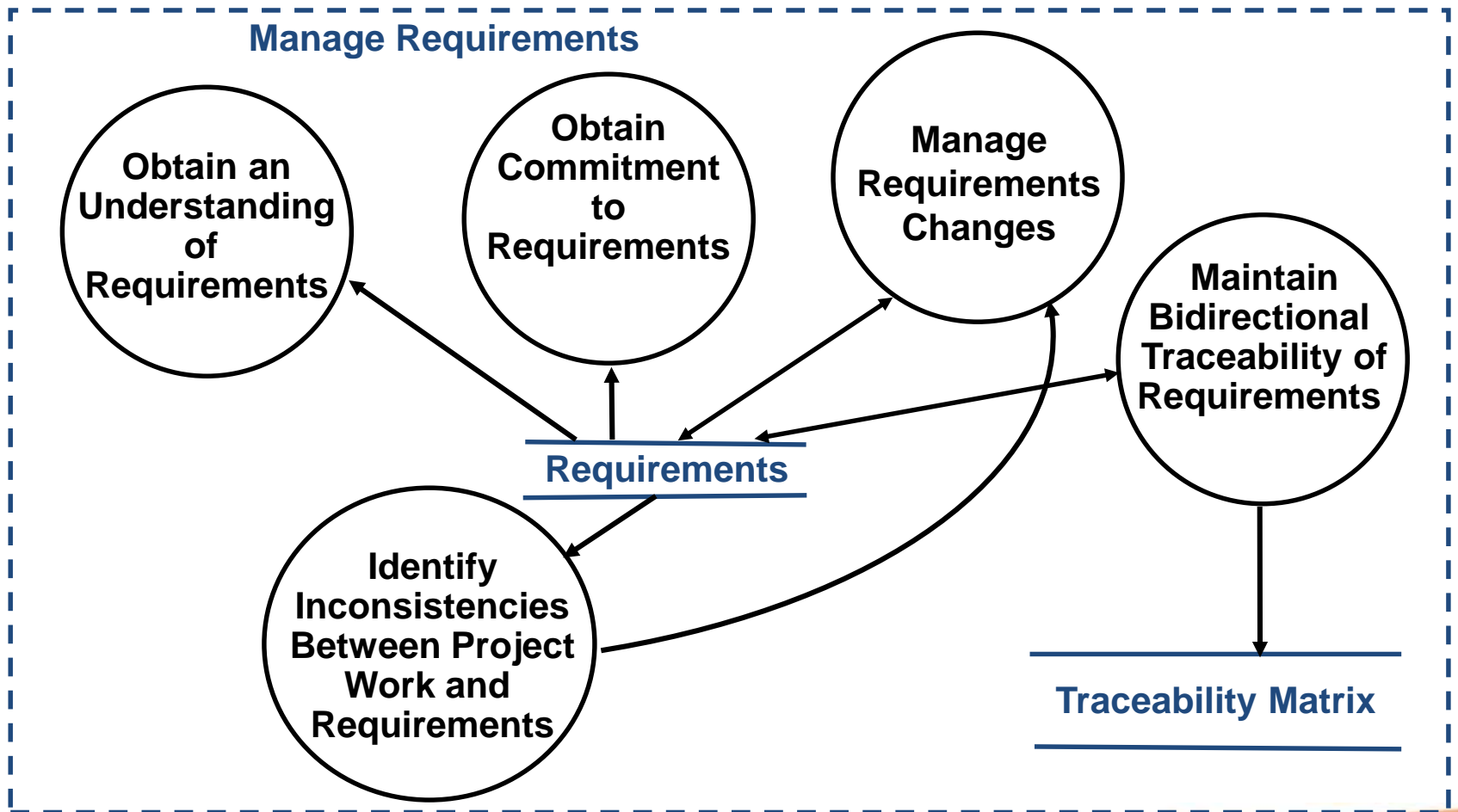
Structure of the CMMI Staged Representation



Process Area Components (or how to read the book)



Example: Requirements Management (REQM) Context



Example: Requirements Development (RD, ML3) Specific Practices

SG 1 Develop Customer Requirements

SP 1.1 Elicit Needs

SP 1.2 Develop the Customer Requirements

SG 2 Develop Product Requirements

SP 2.1 Establish Product and Product-Component Requirements

SP 2.2 Allocate Product-Component Requirements

SP 2.3 Identify Interface Requirements

SG 3 Analyze and Validate Requirements

SP 3.1 Establish Operational Concepts and Scenarios

SP 3.2 Establish a Definition of Required Functionality

SP 3.3 Analyze Requirements

SP 3.4 Analyze Requirements to Achieve Balance

SP 3.5 Validate Requirements with Comprehensive Methods

Maturity Levels Cannot Be Skipped

A level provides a necessary foundation for effective implementation of processes at the next level.

- Higher level processes are easily sacrificed without the discipline provided by lower levels.
- The effect of innovation is obscured in a noisy process.

Higher maturity level processes may be performed by organisations at lower maturity levels, with risk of not being consistently applied in a crisis.

GG (Generic goals) = Institutionalization

GG2 (ML2): Institutionalize a Managed Process

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.
- Management of the process is concerned with institutionalization and the achievement of specific objectives established for the process, such as cost, schedule, and quality objectives.

ML2 > GG2 > GPs

GP2.1: Establish an Organizational Policy

GP2.2: Plan the Process

GP2.3: Provide Resources

GP2.4: Assign Responsibility

GP2.5: Train People

GP2.6: Control Work Products

GP2.7: Identify and Involve Relevant Stakeholders

GP2.8: Monitor and Control the Process

GP2.9: Objectively Evaluate Adherence

GP2.10: Review Status with Higher Level Management

Maturity levels: generic and specific practices

Maturity Level 2

- Requirements management
- Project planning
- Project monitoring and control
- Supplier agreement management
- Measurement and analysis
- Process and product quality assurance
- Configuration management

- GP 2.1 Establish organizational policy
- GP 2.2 Plan the process
- GP 2.3 Provide resources
- GP 2.4 Assign responsibility
- GP 2.5 Train people
- GP 2.6 **Control Work Products** (Manage configuration)
- GP 2.7 Identify and involve relevant stakeholders
- GP 2.8 Monitor and control the process
- GP 2.9 Objectively evaluate adherence
- GP 2.10 Review status with higher level management

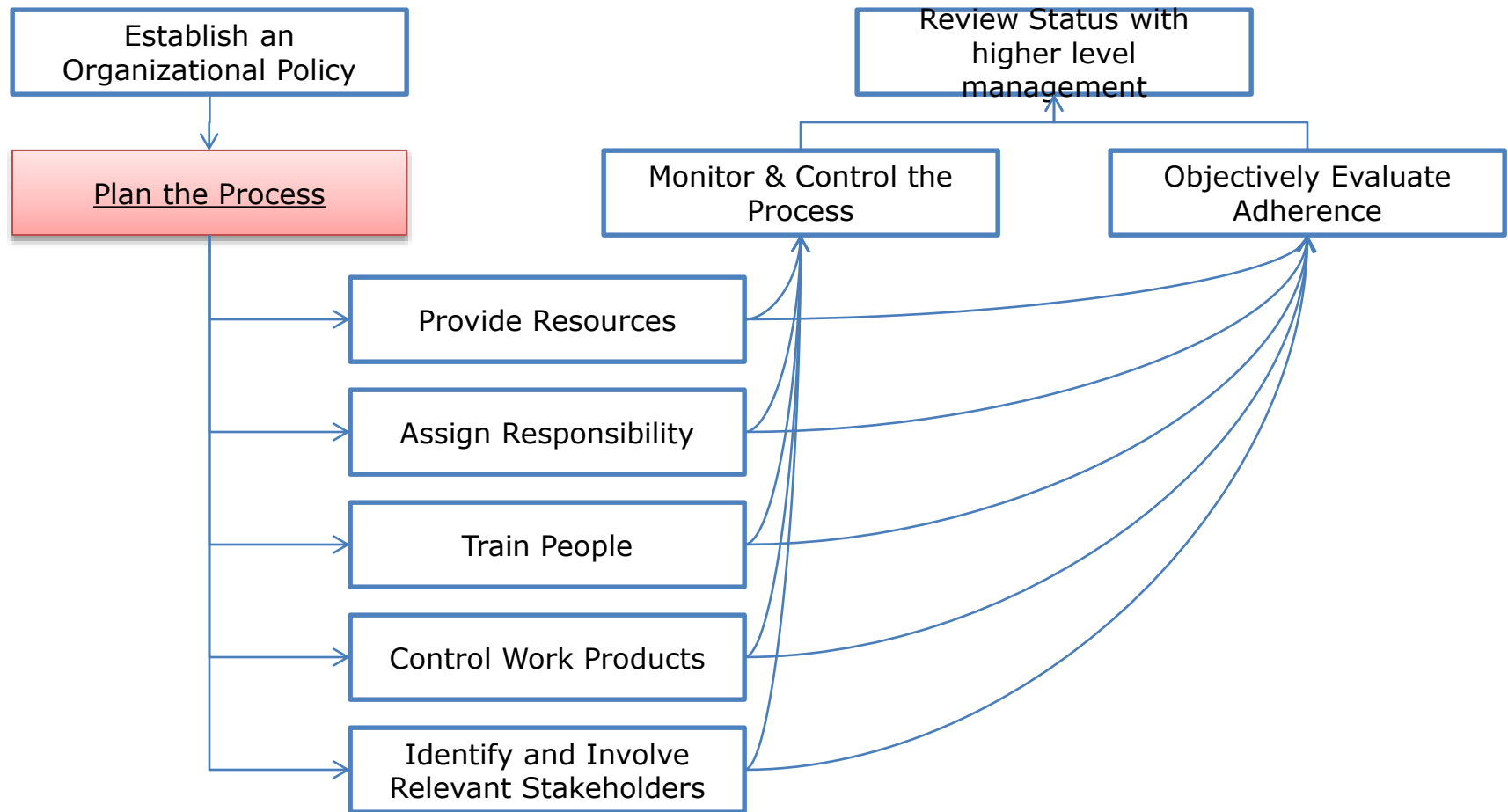
Maturity Level 3

- Requirements development
- Technical solution
- Product integration
- Verification
- Validation
- Organizational process focus
- Organizational process definition + IPPD
- Organizational training
- Integrated project management + IPPD
- Risk management
- Decision analysis and resolution

GP 3.1 Establish a defined process

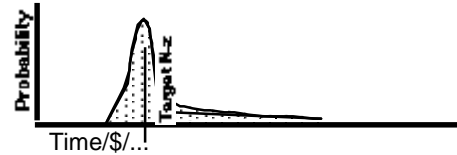
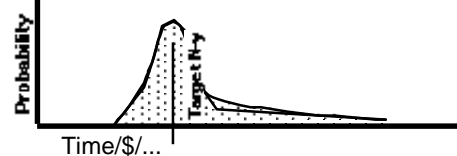
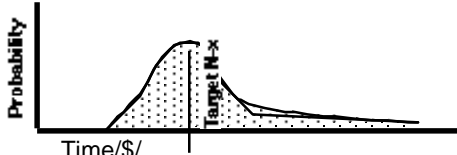
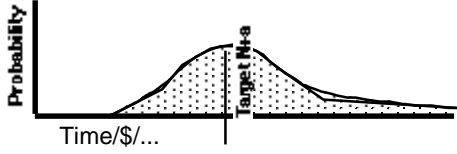
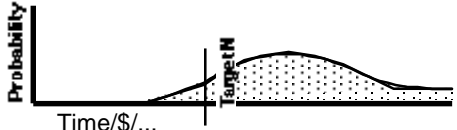
GP 3.2 Collect improvement information

How PAs relate to Generic Practices?

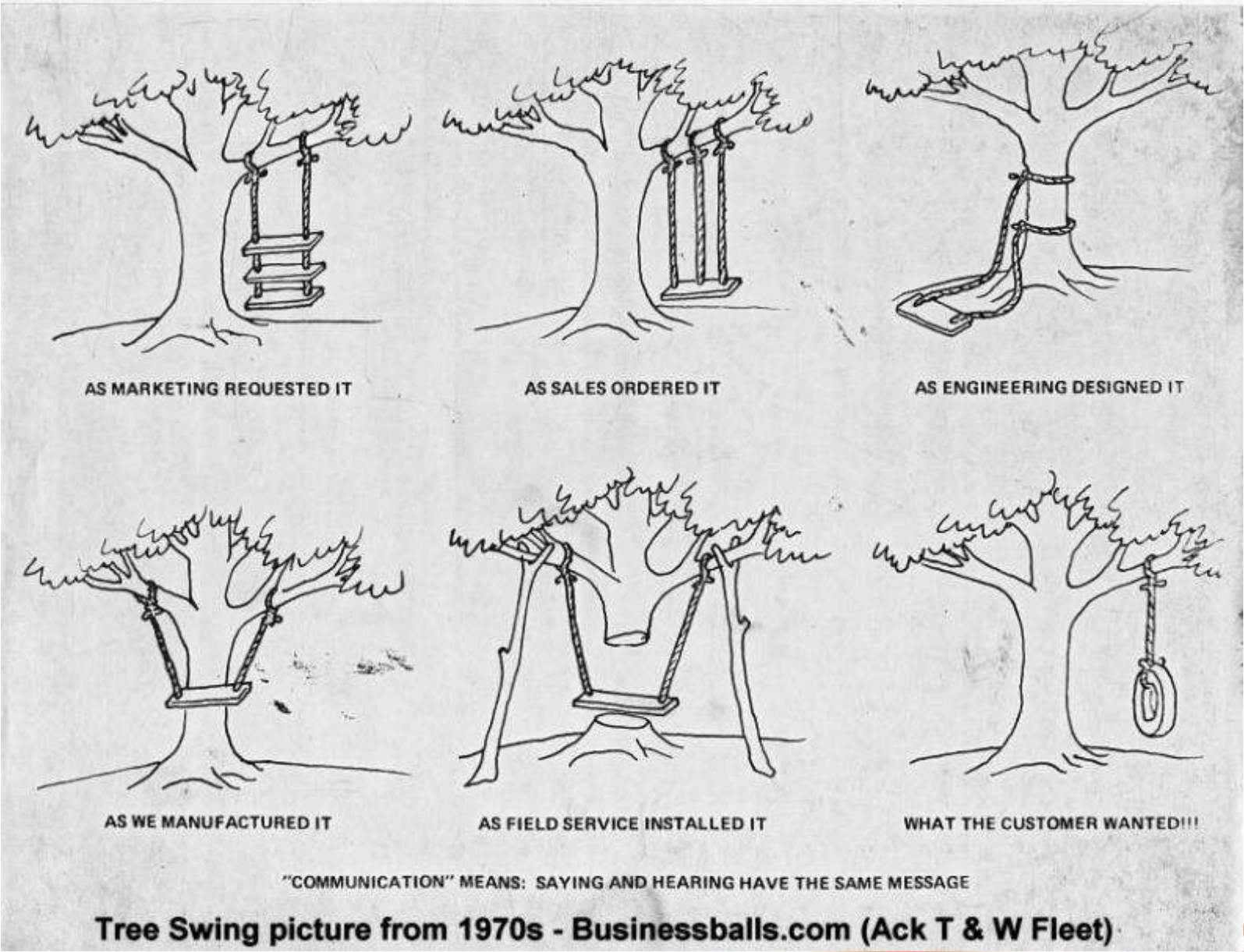


Source: Kiril Karaatanasov, ESI Center Bulgaria

Evolution of Process Capability

Level	Process Characteristics	Predicted Performance
5 Optimising	Process improvement is institutionalised	
4 Quantitatively Managed	Product and process are quantitatively controlled	
3 Defined	Software engineering and management processes are defined and integrated	
2 Managed	Project management system is in place; performance is repeatable	
1 Initial	Process is informal and unpredictable	

Remember: We want to avoid this!



Read pages 1- 66 from the model