



Q.A.

Осигуряване на качество на софтуера (2017/2018/2019/.../2024 редовно/задочно)

based on: Software Quality Management Models

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

Assoc. Prof. George Sharkov FMI/PU & ESI Center Eastern Europe/Bulgaria www.esicenter.bg

gesha@esicenter.bg

Dr. Maya Stoeva

FMI/PU

may_vast@yahoo.com

МАТЕРИАЛИ: <http://edesign-bg.com/courses.html>

<http://semp.esicenter.bg/>

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.

Информация, източници:

ESI Center Eastern Europe - Resources:

<https://esicenter.bg/resources>



Education > Resources > (Software) Quality Management - CMMI

(+ the links: - model in pdf ver 1.3)



Links to CMMI models (from the new source – CMMI Institute, spin-off of Carnegie Mellon/SEI):

<https://cmmiinstitute.com/resource-files/public/cmmi-v2-0-development-model> (paid!!!)

[free] ver 2.0 Practices mapping (to ver 1.3)

<https://cmmiinstitute.com/resource-files/public/v2-0-materials/cmmi-v2-0-to-v1-3-practice-mapping>



Software Engineering Institute | Carnegie Mellon

> Access V 1.3 to download CMMI –DEV v 1.3 model (*free, upon registration*)

old SEI repository – VALID for FREE DOWNLOAD:

https://resources.sei.cmu.edu/asset_files/TechnicalReport/2010_005_001_15287.pdf



https://en.wikipedia.org/wiki/Capability_Maturity_Model_Integration

General sources (Software Engineering, Quality)

www.sei.cmu.edu

<http://resources.sei.cmu.edu/library/>

www.cmmiinstitute.com

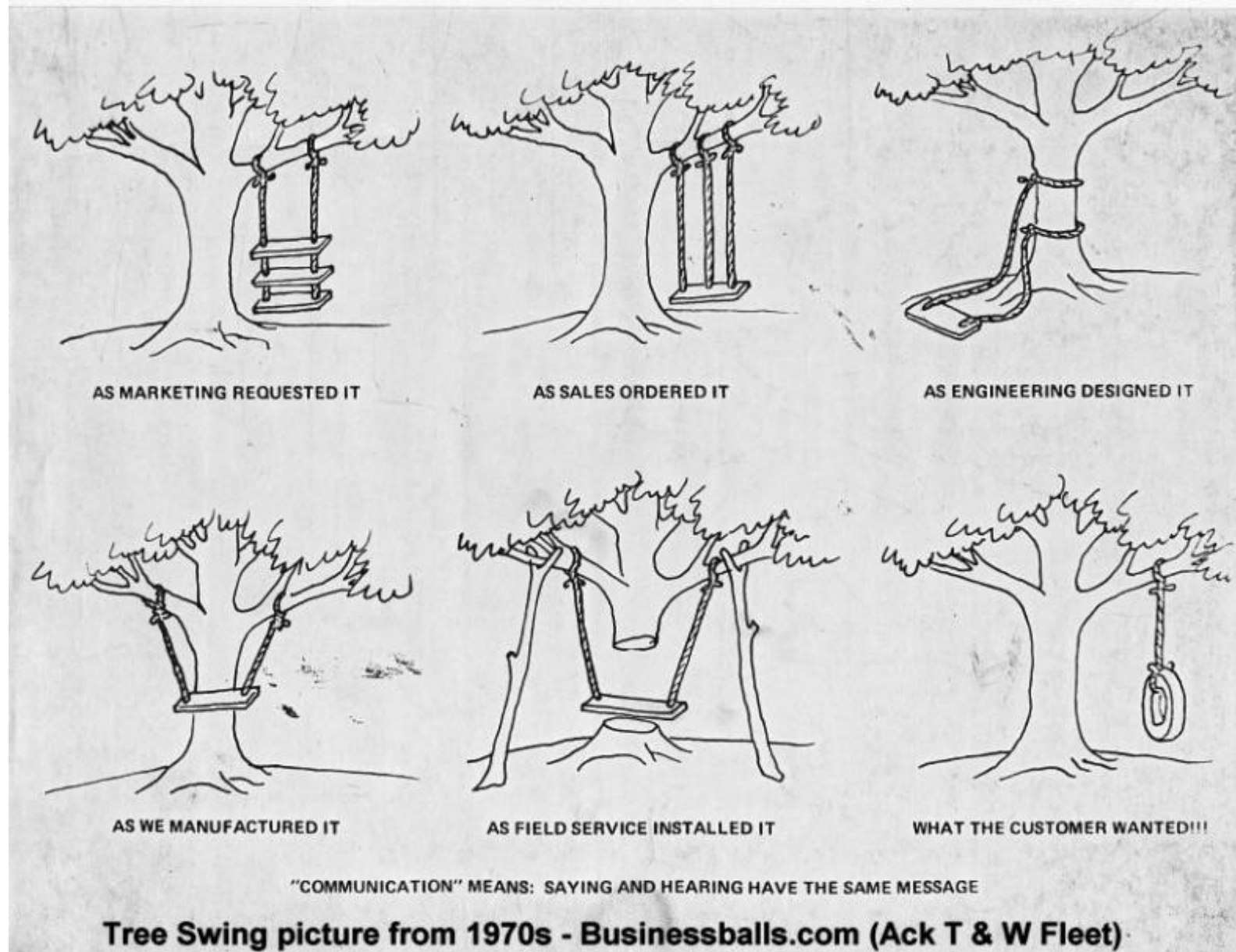
Съдържание (модули)

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, 2.0, 3.0). 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 Обобщение на връзките между процесните области: Tying all together Update for ver. 2.0, 3.0 (CMMI Institute)
5	Методи и средства за извършване на тестове на качеството на софтуер. Видове тестове. Автоматизирани тестове. Интегриране на CMMI с модел на зрялост за планиране и провеждане на тестове – TMMi.
6	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. DevOps, DevSecOps – Security Requirements (for SW), Security by Design, Resilience by Design (CERT RMM), TMM (Testing Maturity Model)
7	Подобряване на процесите в малки фирми – IT Mark. Компоненти на зрелостта – бизнес, организация/процеси, информационна сигурност. Оценка на нивото и план за подобрения.

Why are we here?

What is Software Quality and how we assure it?

Do we want this?



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).

Who are we?

ESI European Software Institute *tecnalia* Since 1993

partner of:

Software Engineering Institute | **Carnegie Mellon**

ESI European Software Institute Center Eastern Europe Since 2003

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

SEI Partner | Carnegie Mellon. CERT RMM it mark
CMMI Institute Partner CMMI



Affordable "BIG" standards for "small" companies



• ESI@net Partners

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



**Carnegie
Mellon
University**

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

ZDNet Q

CENTRAL EUROPE MIDDLE EAST SCANDINAVIA AFRICA UK ITALY SPAIN MORE NEWSLETTERS ALL

MUST READ: [Why JavaScript developers are choosing TypeScript](#)

The day computer security turned real: The Morris Worm turns 30

Three decades ago, the internet was hit by its first major security attack. The world has never been the same since.


By Steven J. Vaughan-Nichols for Networking | November 2, 2018 -- 19:26 GMT (19:26 GMT) | Topic: Security

Free Intelligent Writing Tool

Grammarly Makes Sure Everything You Type Is Effective And Mistake-Free. Try now!

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1 f in t e



MORE FROM STEVEN J. VAUGHAN-NICHOLS

- Networking**
Pg acquires NGINX: What to expect from the deal
- Google**
All Chromebooks will also be Linux laptops going forward
- Cloud**
OpenShift 4: Red Hat's on ramp for the hybrid cloud
- Virtualization**
Red Hat Universal Base Image: RHEL containers for everyone

SECURITY

Mozilla releases Firefox 66.0.4 with fix disabled add-ons issue

On Nov. 2, 1988, I was working at NASA's Goddard Space Flight Center in the data communications branch. Everything was fine. Then, our internet servers running SunOS and VAX/BSD Unix slowed to a stop. It was a bad day.

We didn't know it yet, but we were fighting the Worm. Before the patch was out, 24 hours later the internet was down, and the rest of the net

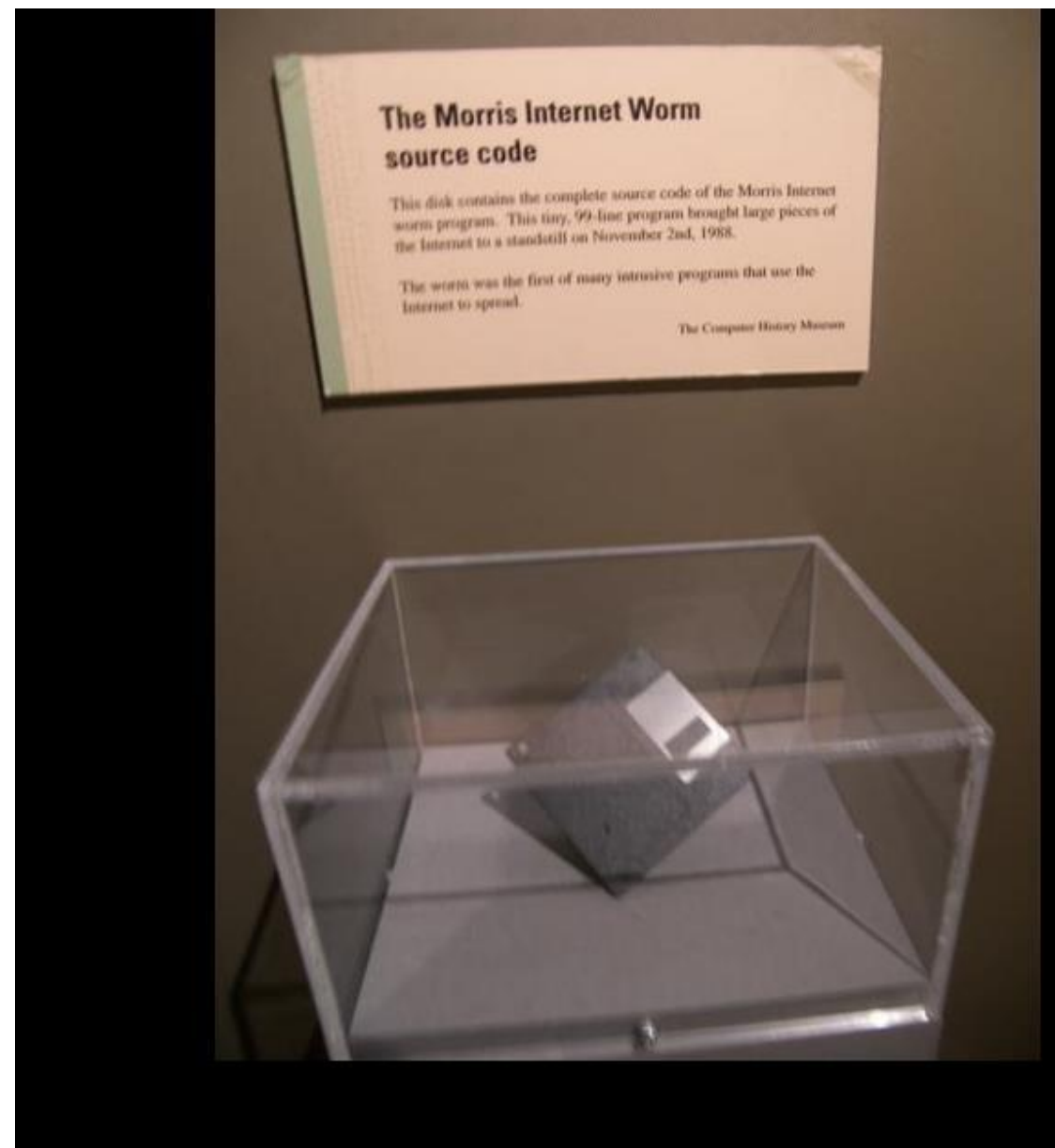
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Fill out this confidential survey and you could help make ZDNet better for users everywhere.

ZDNet Security

Your weekly update on security around the globe, featuring research, threats, and more

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Floppy Diskette containing the source code for the Morris Worm held at the Computer History Museum.



Go Card USA from Boston, USA - Museum of Science - Morris

Morris worm - WikipediaThe day computer security 1Scott Fahlman and the c

scihi.org/scott-fahlman-emoticons/

You are here: [Home](#) > [computer science](#) > Scott Fahlman and the Origin of the Emoticons :-)

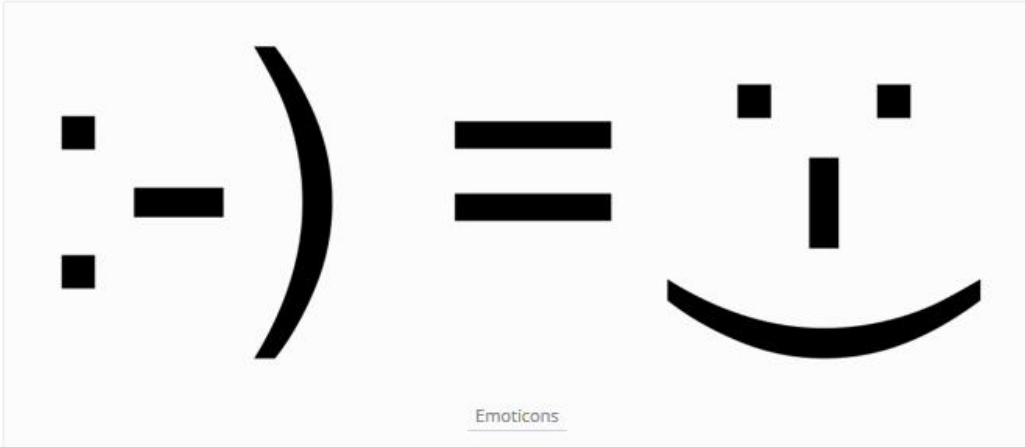
Scott Fahlman and the Origin of the Emoticons :-)

computer science

19. September 2018

0

Harald Sack



Emoticons

On September 19 , 1982 , **Scott Fahlman** posted the first documented emoticons 😊 and ☹ on the Carnegie Mellon University Bulletin Board System . As SMS and the Internet became widespread in the late 1990s , emoticons became increasingly popular and were commonly used on text messages , internet forums and e-mails . Emoticons have played a significant role in communication through technology .





“I often think there should exist a special typographical sign for a smile — some sort of concave mark, a supine round bracket.”

— Vladimir Nabokov. NYT interview in 1969


SEARCH

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Chess playing automata have a long tradition, as e.g. The famous Turk, by Wolfgang von Kempelenscihi.org/deepblue-vs-ga...





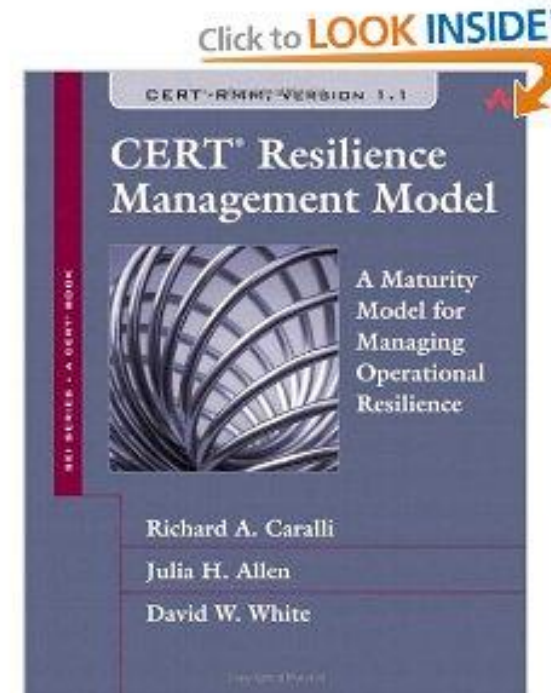
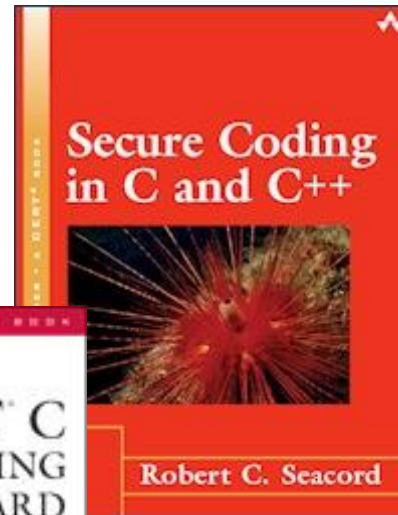
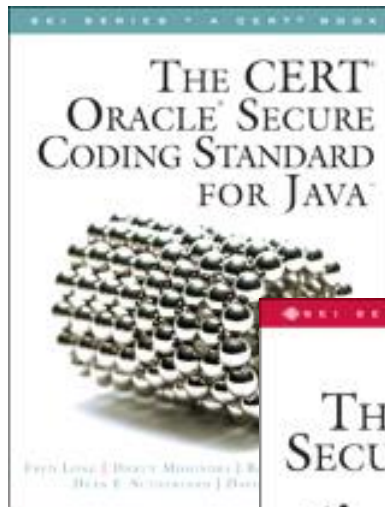
Also from SEI: Computer Emergency Response Team



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]



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: Balanced ScoreCards (BSC)



Corporate excellence is a balanced model

Kaplan and Norton structured it in four perspectives:

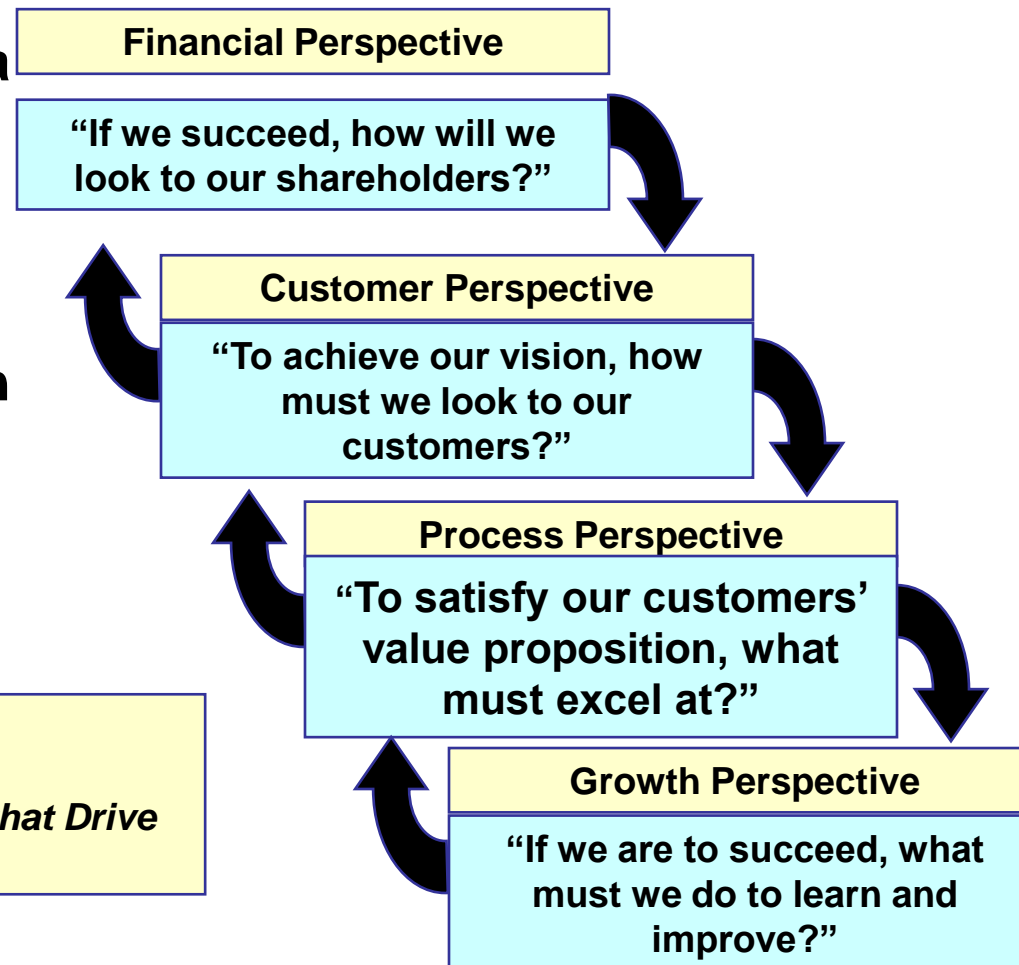
- Financial perspective
- Customers perspective
- Internal Processes perspective
- Learning & Growth perspective
(Organizational Capacity)

<https://balancedscorecard.org/bsc-basics-overview/>

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"*



Excellence is in:

repeating the success
turn it to sustainable growth
make the best with your people
for higher profit

= follow established processes
(repeatable, basis for continuous improvement)

Corporate excellence – FINANCIAL Perspective

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

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

Corporate excellence – CUSTOMERS Perspective

The corporate excellence is CERTIFIED by the customers

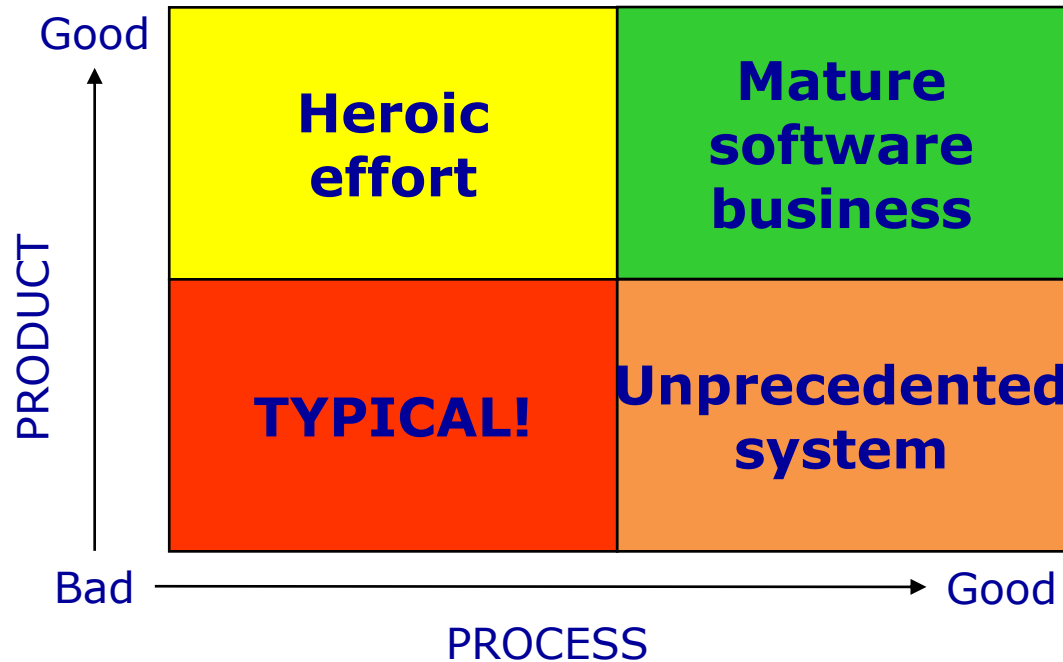
Understanding, predicting and managing the customers' expectations are critical:

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

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

Corporate excellence – INTERNAL Perspective

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.

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

Corporate excellence – LEARNING and GROWTH Perspective

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

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

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

Why focus on the processes?

Quality Is More Than Making a Good Product

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.

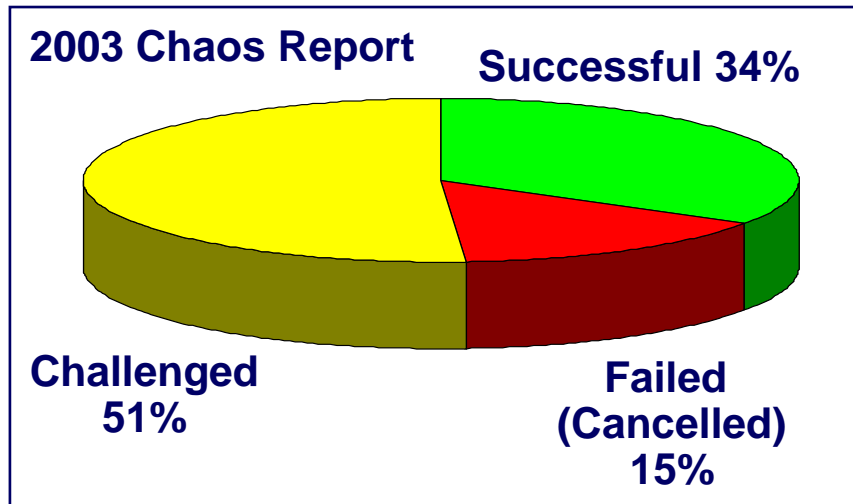
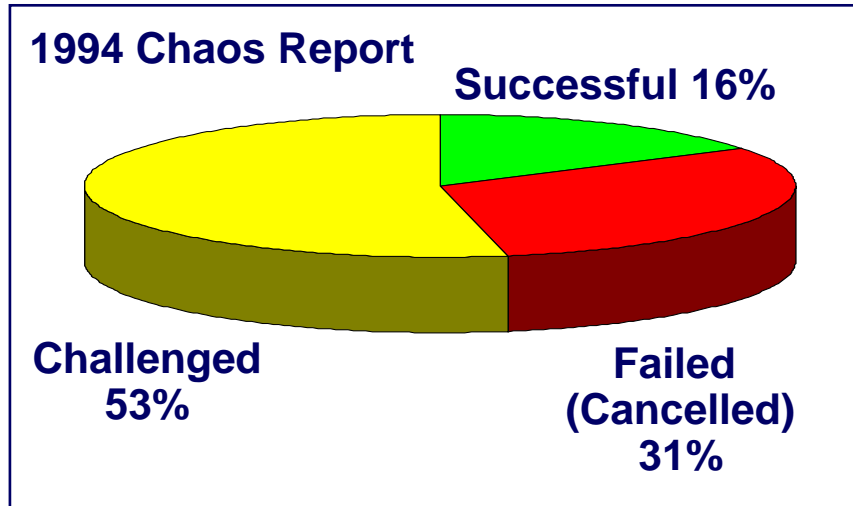
Companies are releasing products to their customers with 15% of the defects remaining in the product.

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 ...



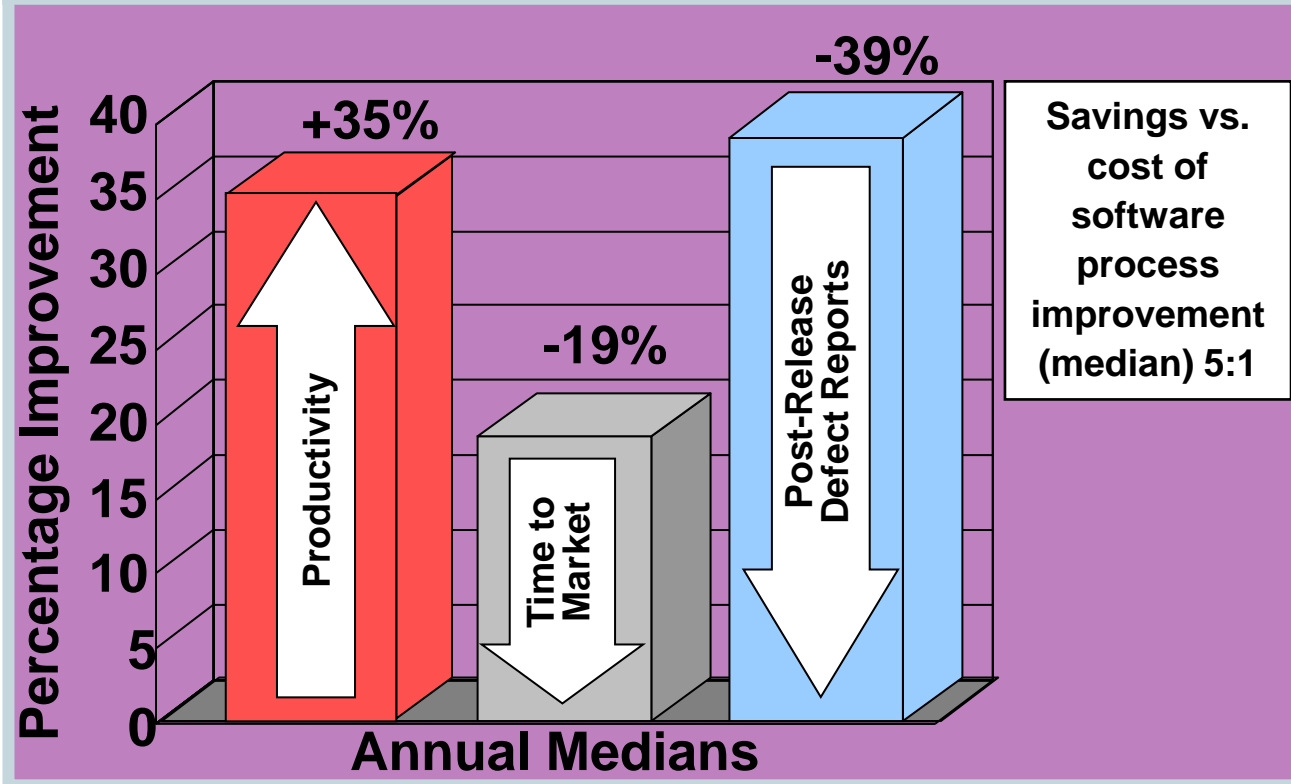
Source: Standish Group Chaos Report - 2003

- ⊕ 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

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 Quality (CoQ)



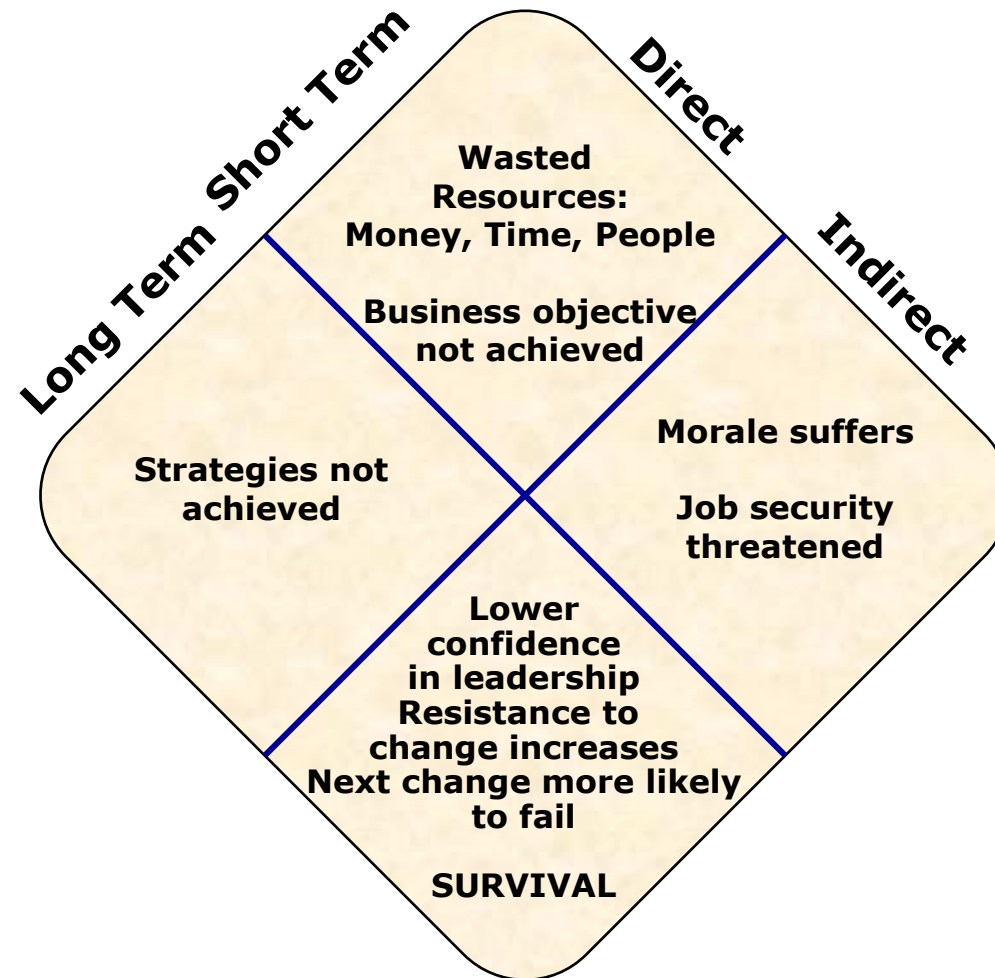
Cost of implementation failure

Quality is NOT Free...

- Cost of conformance

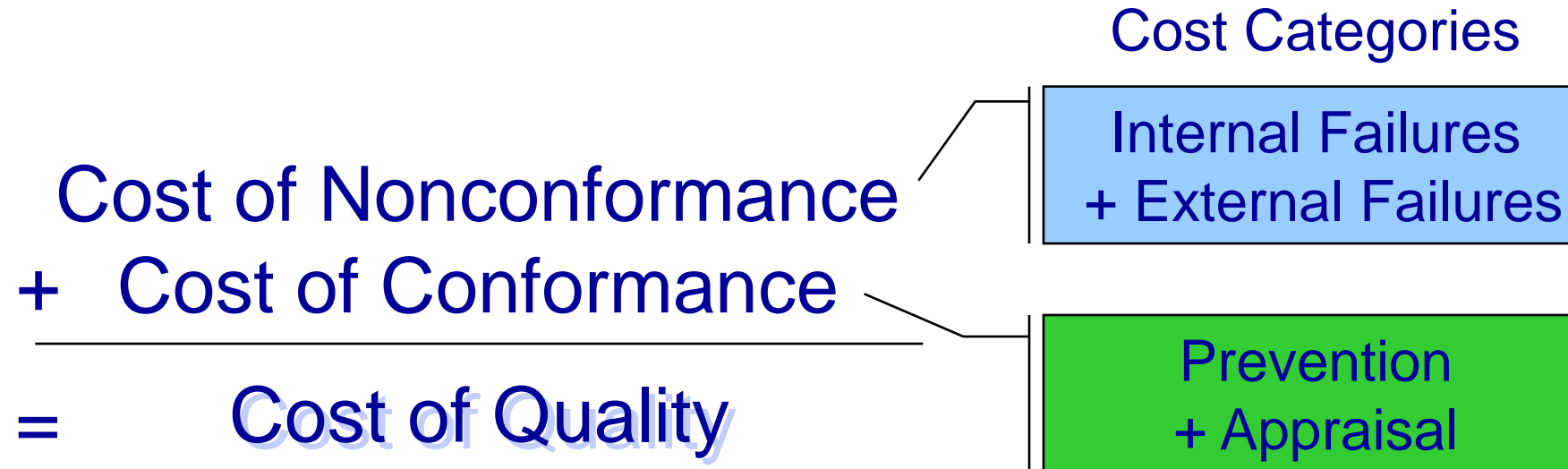
...but quality is cheaper than the alternatives

- 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 CoQ - Cost Categories

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>

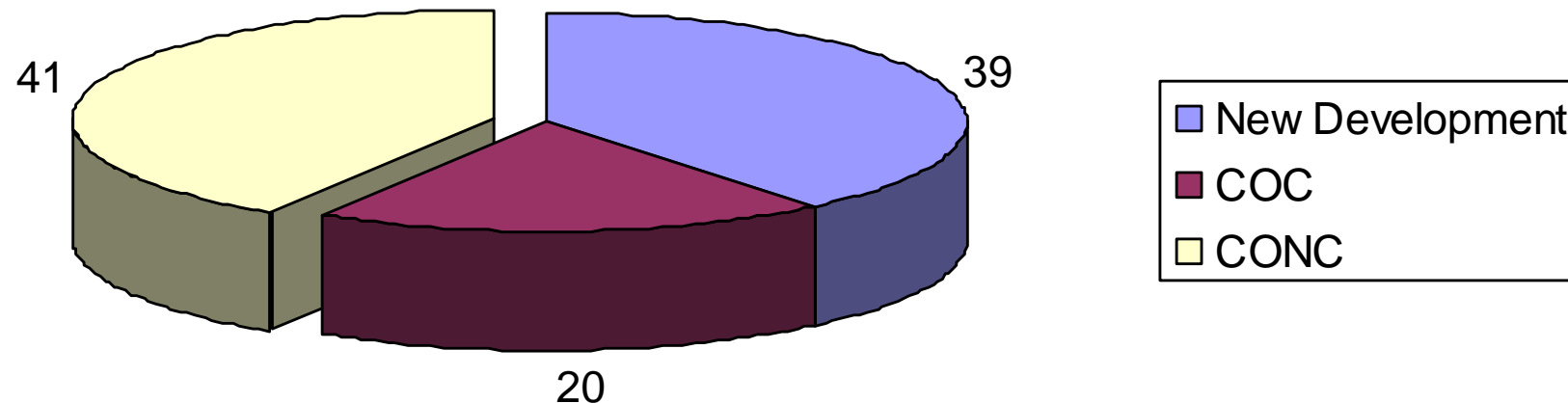
An Early CoSQ Experience

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...

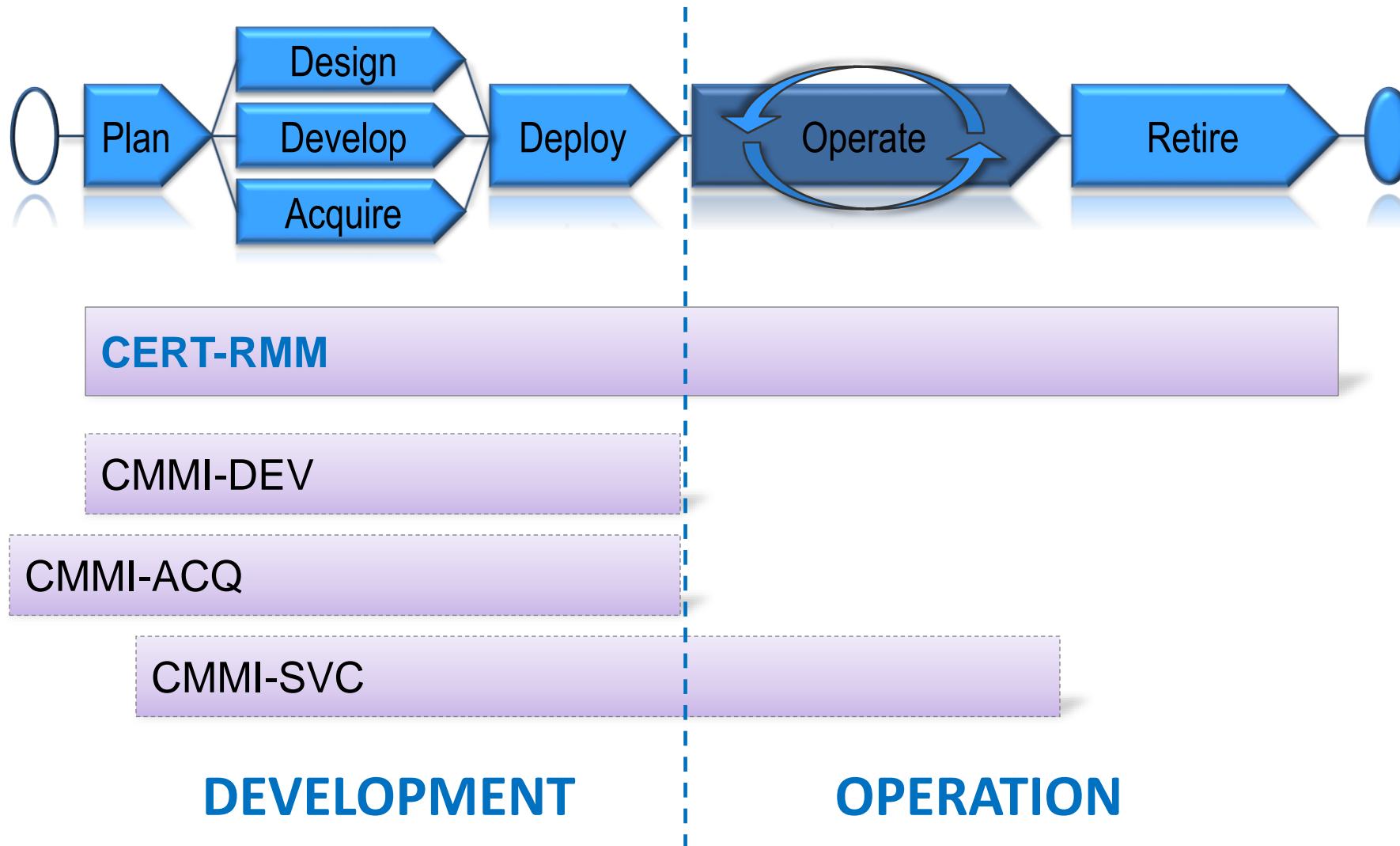
... as opposed to a focus on people

- 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.

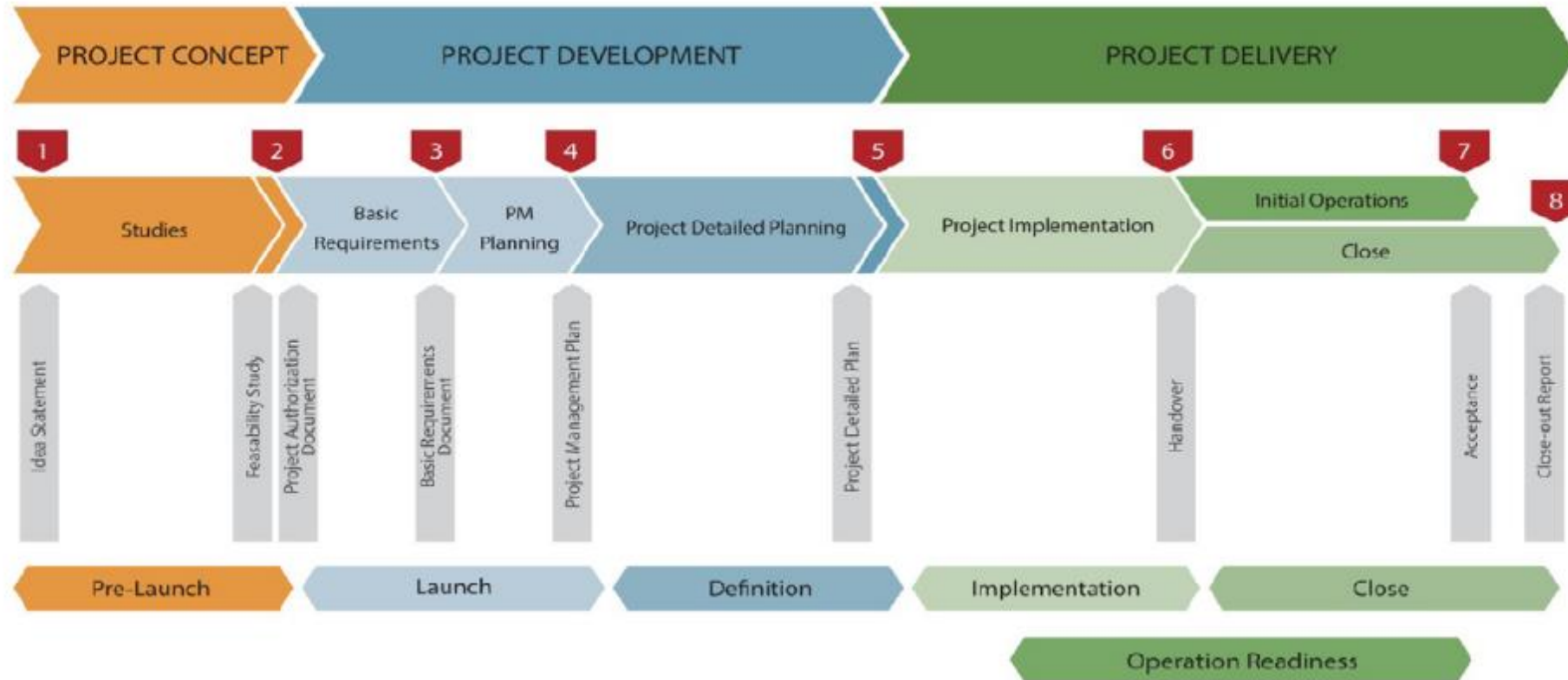
... as opposed to a focus on technology

- 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

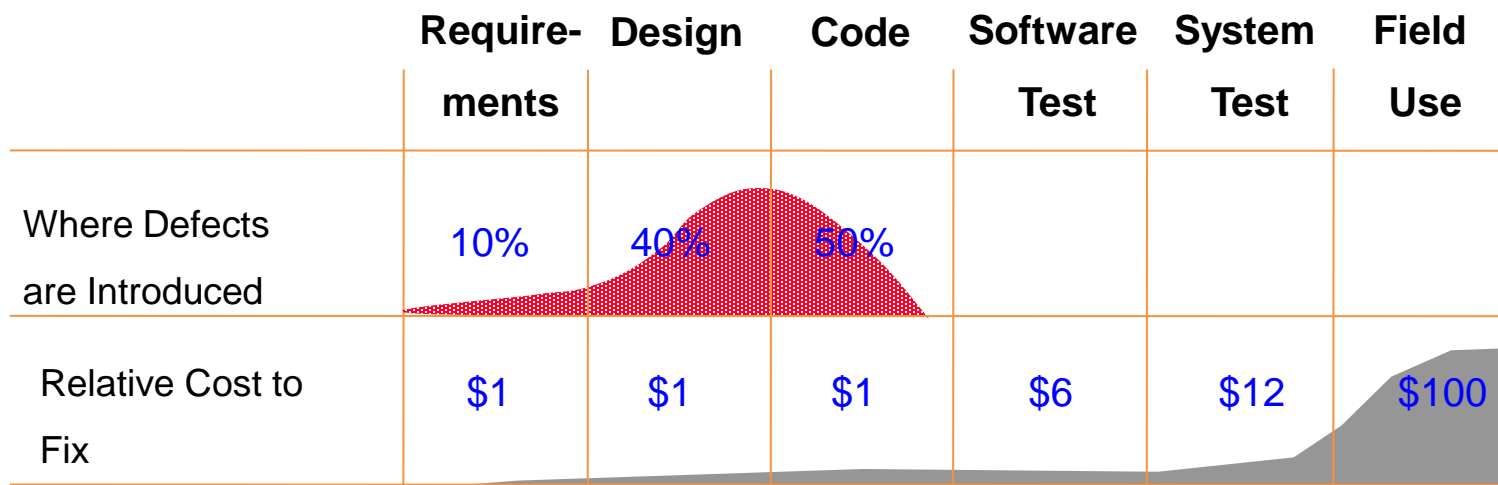


SW Project life cycle (detailed)



Defects : Insertion Pattern & Cost of Removal

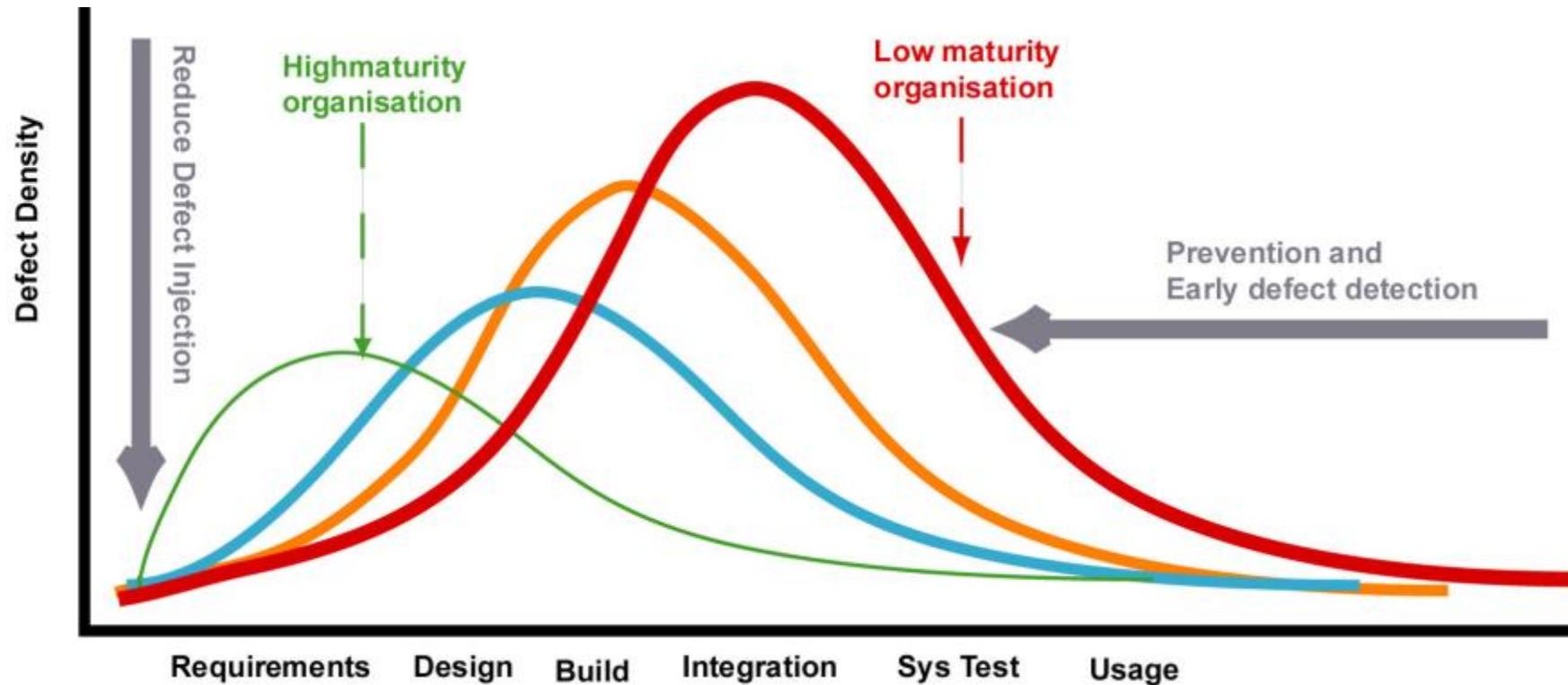
But...this is also about SW
Quality?



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

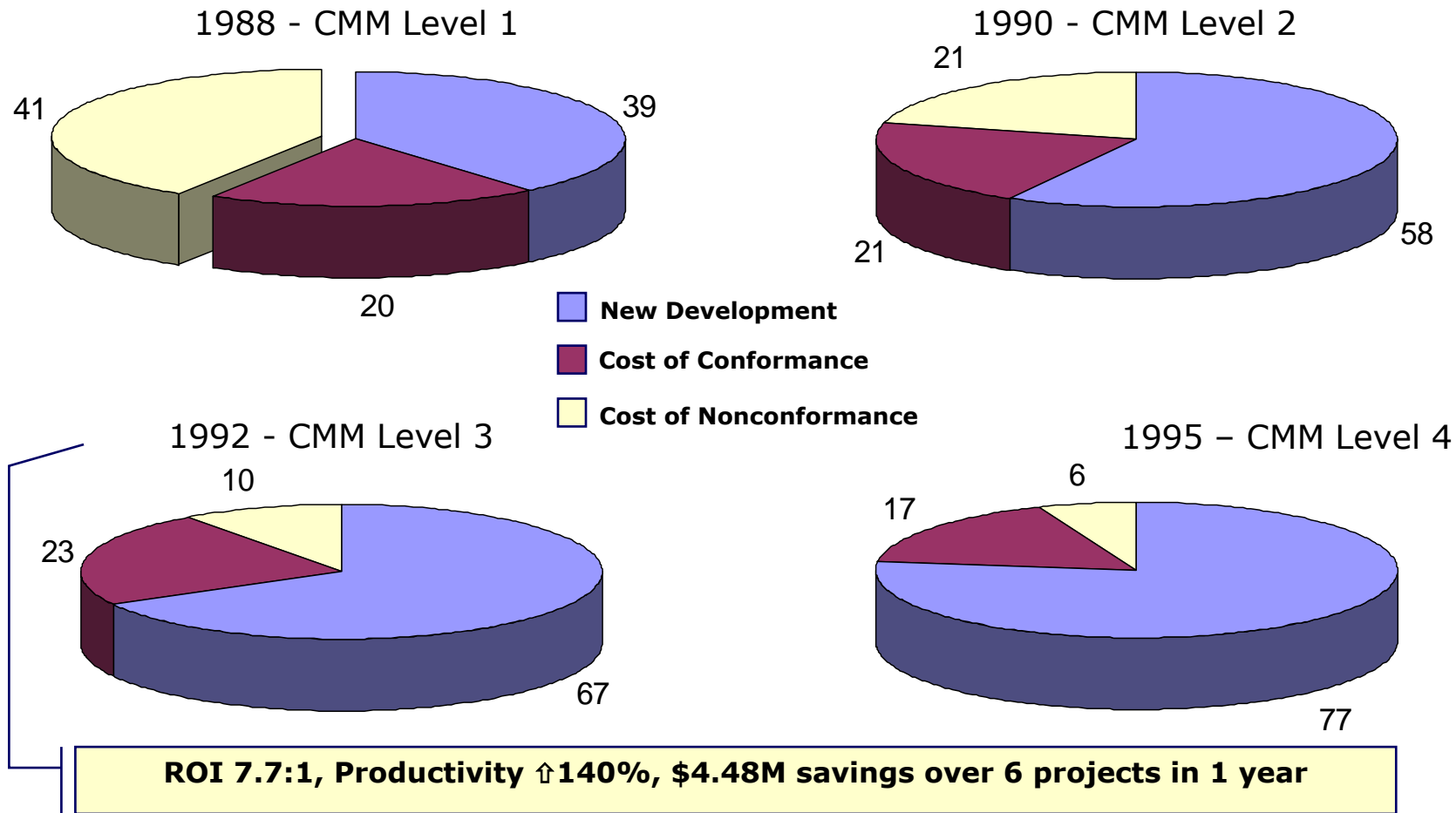
SELECT name FROM users WHERE name=" OR "="
AND passwd= " OR "="

Defects-2: Injection & Prevention



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

The shift to increased profitability

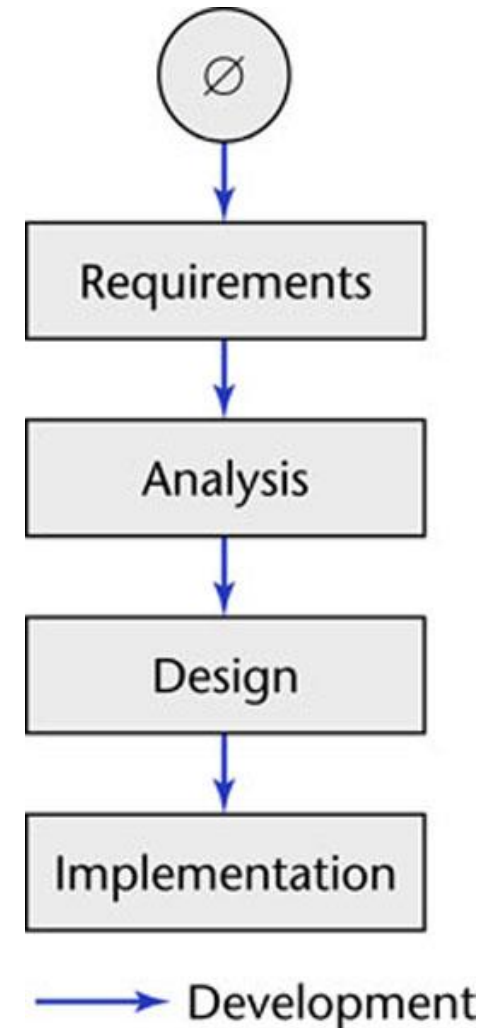


Source: Raytheon Electronic Systems Experience in Software Process Improvement, CMU/SEI-95-TR-017, November 1995

Software Development in Theory

Ideally, software is developed:

- Linear
- Starting from scratch



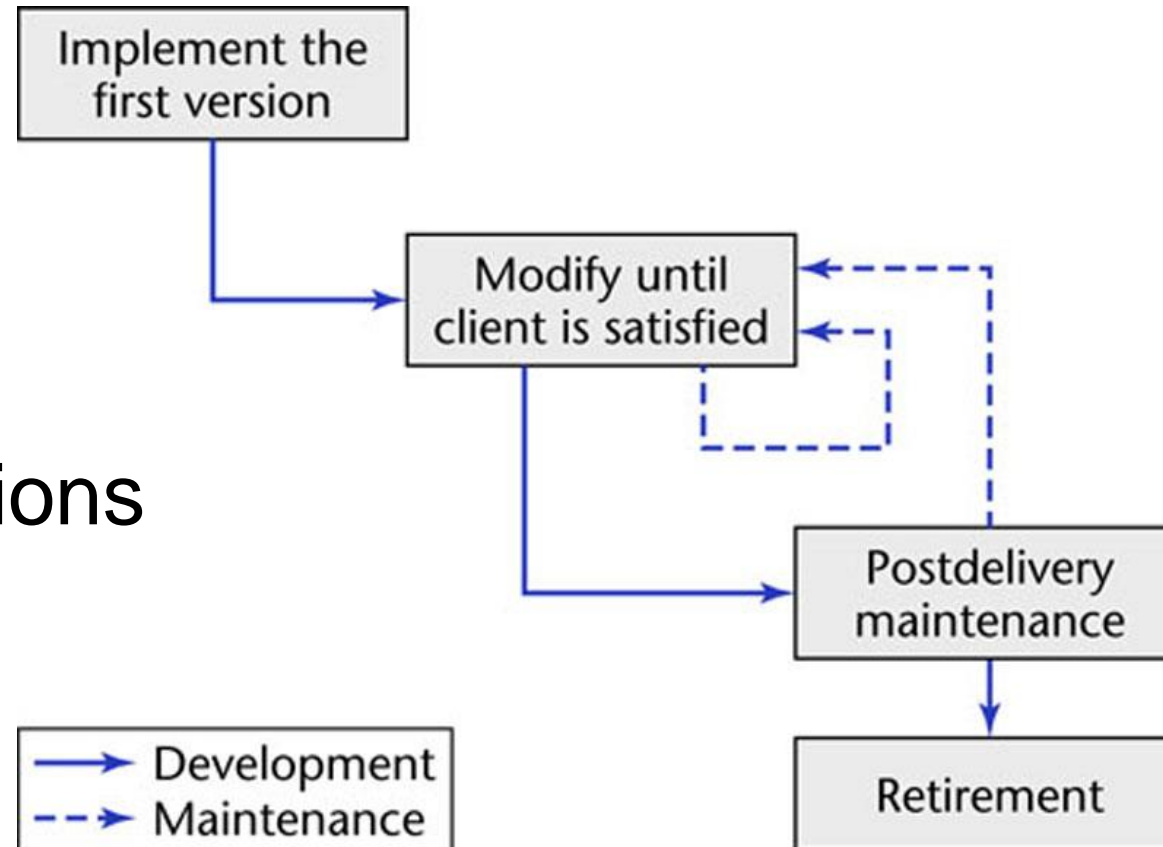
Software Development in Practice

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

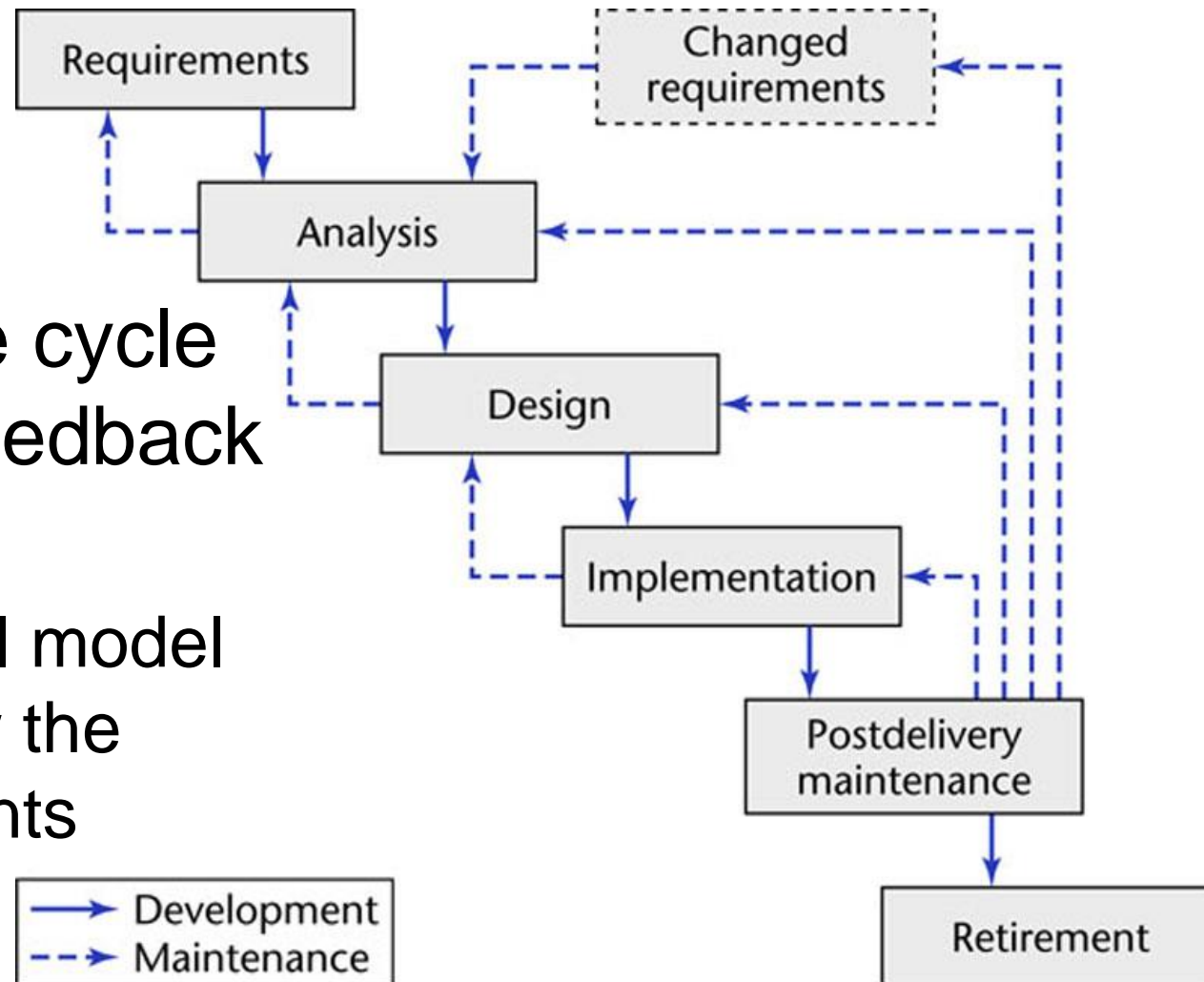
- No design
- No specifications



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

Waterfall Basic 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.)

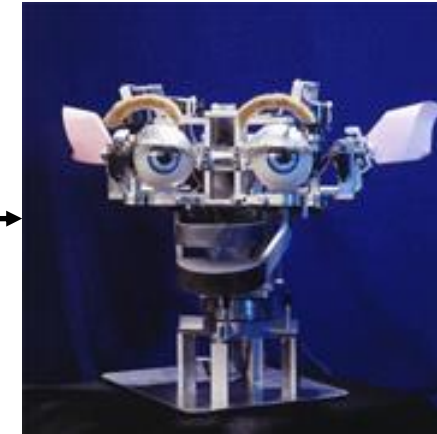
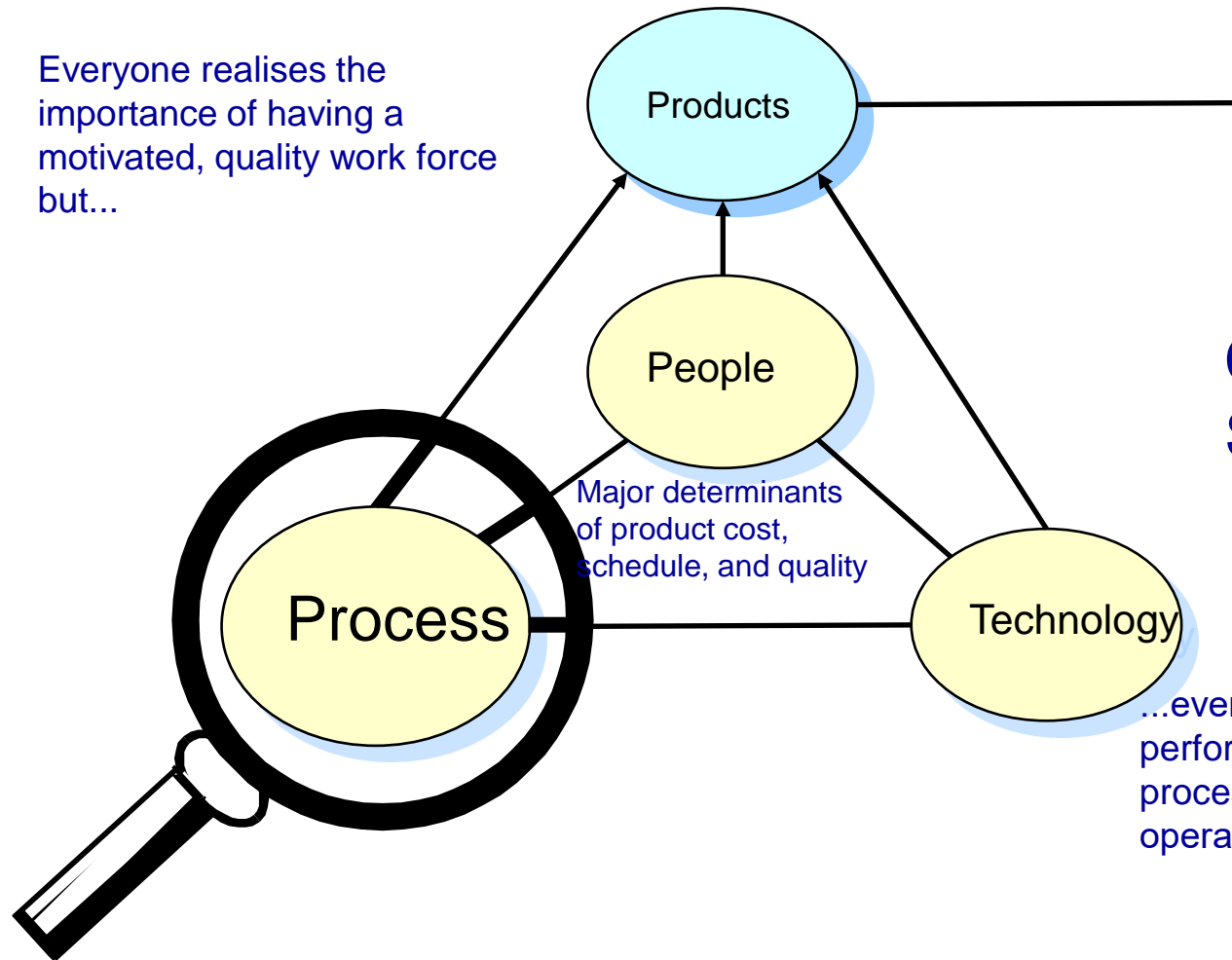
No phase is complete until the **documentation** for that phase has been completed and the products of that phase have been approved by the **software quality assurance** (SQA) group.

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.

Focus on the processes (2)

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."

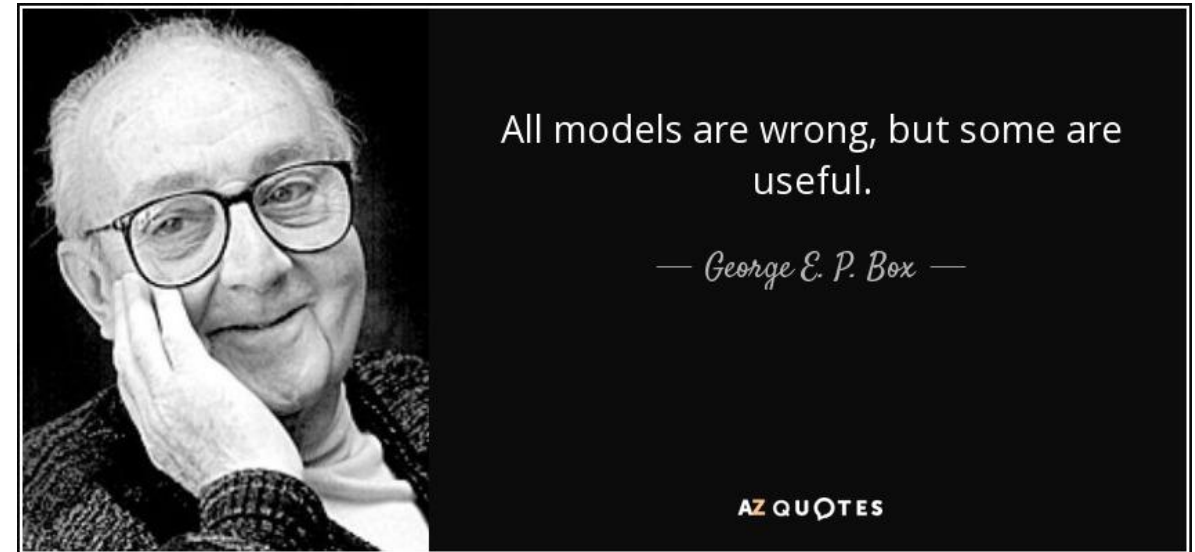
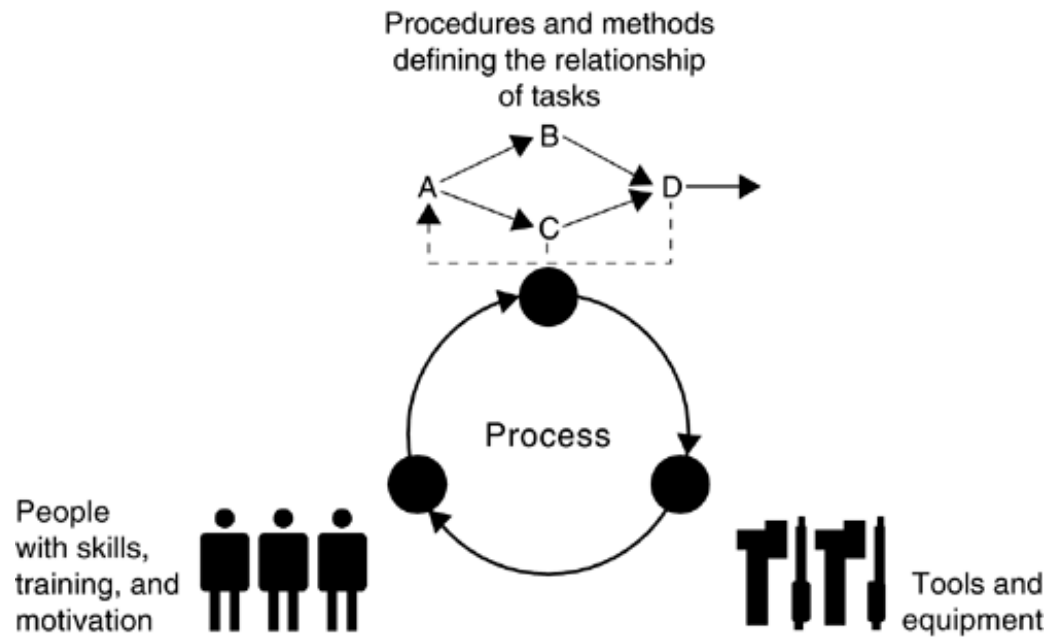
General Definition of Process

- How do you define process?

A **process** is a set of practices performed to achieve a given purpose; it may include tools, methods, materials, and/or people.

While process is often described as a leg of the process-people-technology triad, it may also be considered the “**glue**” that unifies the other aspects.

Why using models?



George E. P. Box. (n.d.). AZQuotes.com. Retrieved November 20, 2023, from AZQuotes.com Web site:

<https://www.azquotes.com/quote/534227>

Remember:

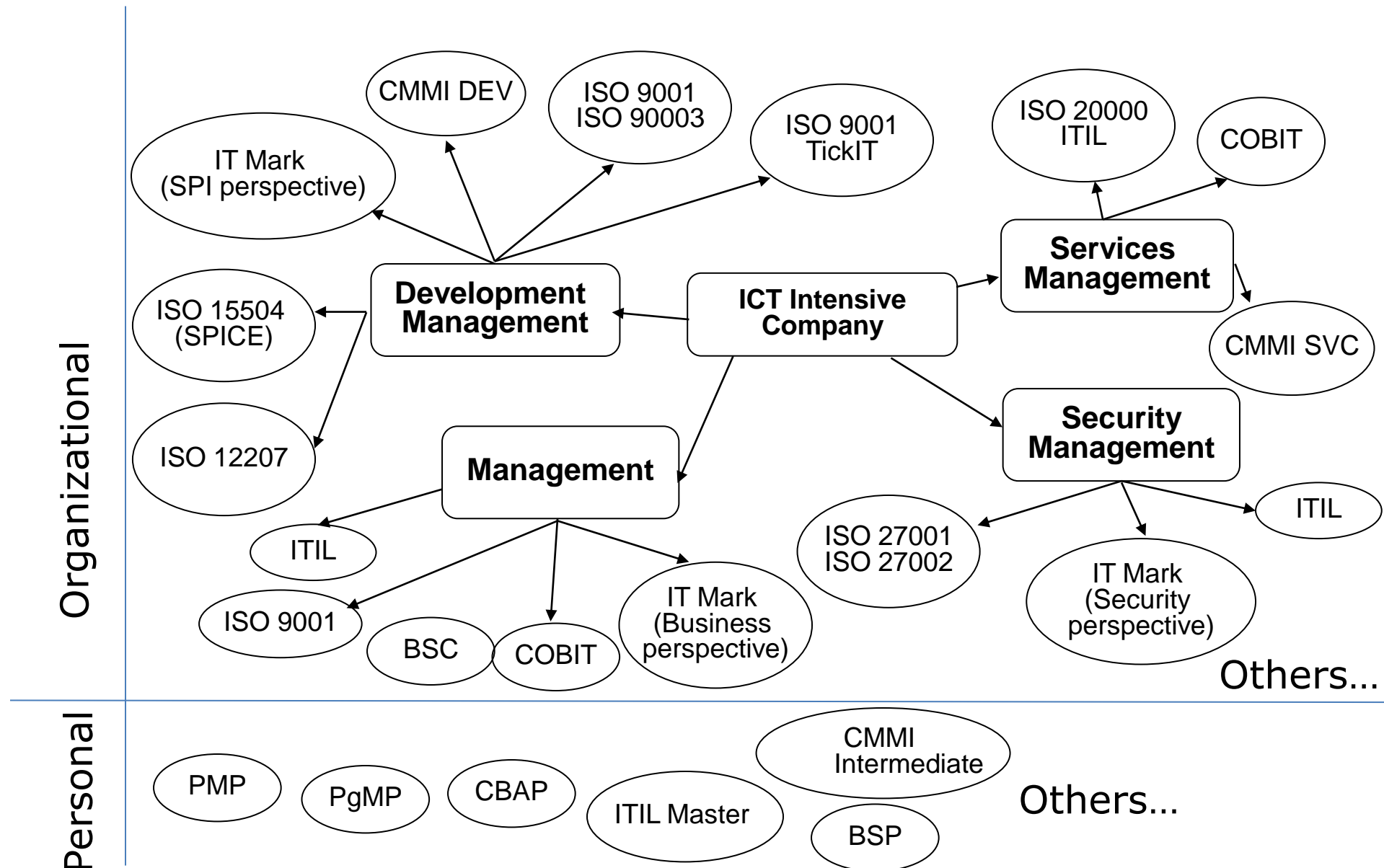
Process \neq Bureaucracy

Process $=$ Work

Part 2: CMMI model

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

So many models and standards...



What is a Capability Maturity Model?

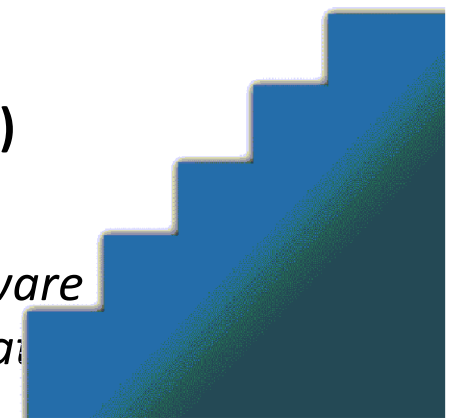
Capability Maturity Model:

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

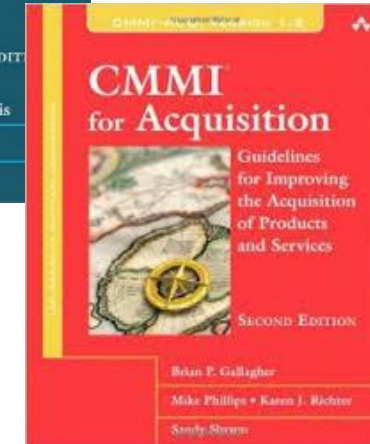
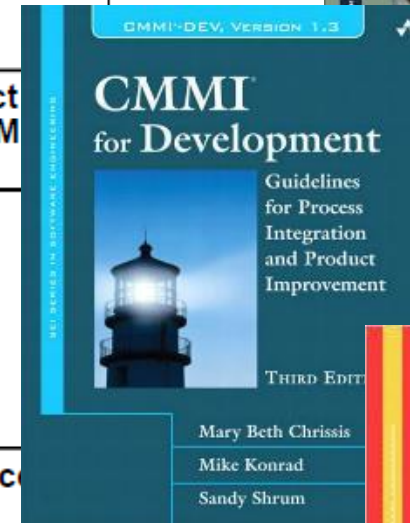
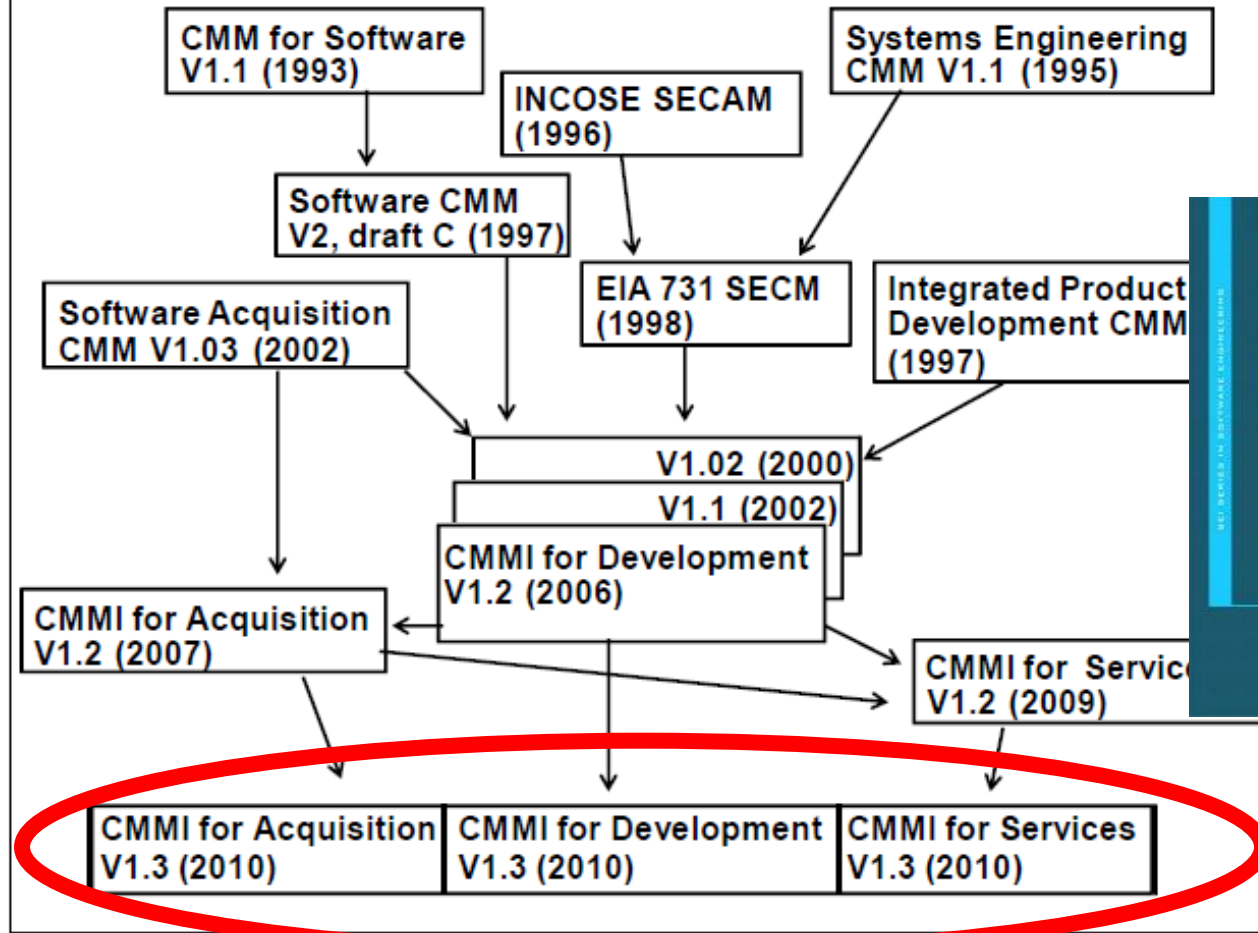
CMMs differ by

- **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



Software Engineering Institute | Carnegie Mellon

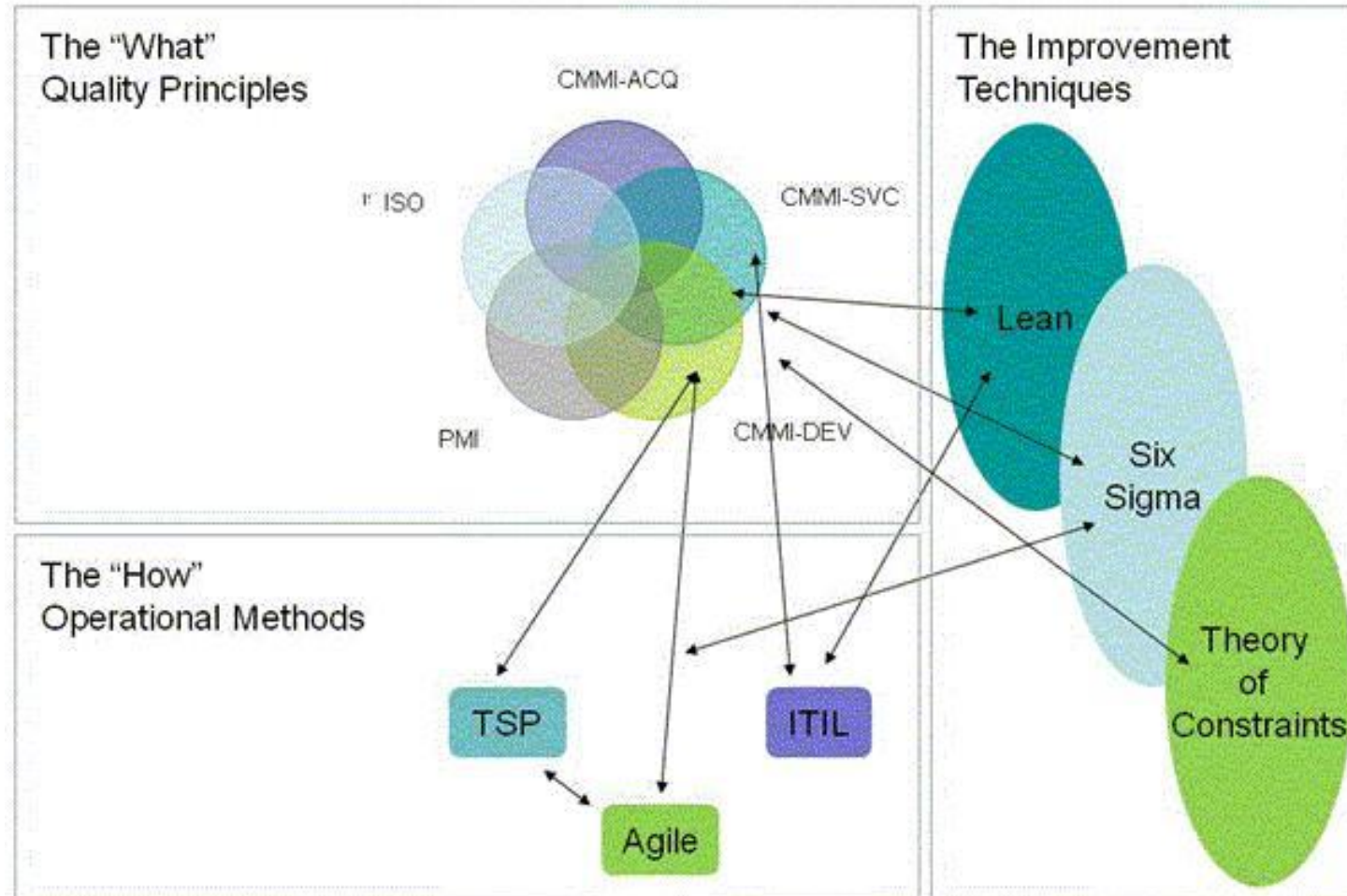


Founded 2012

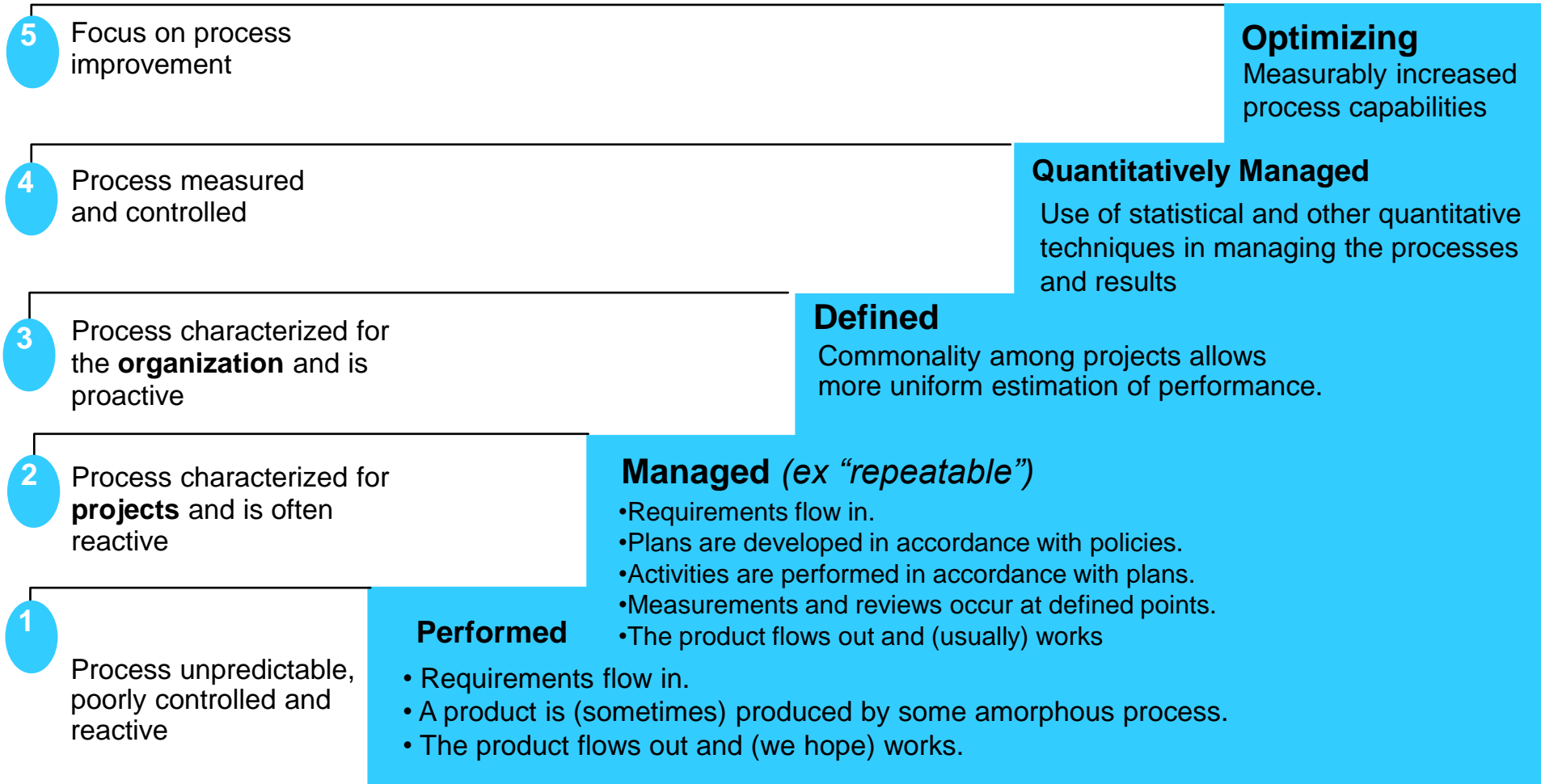
Acquired by ISACA
(March 2016)



CMMI and other models

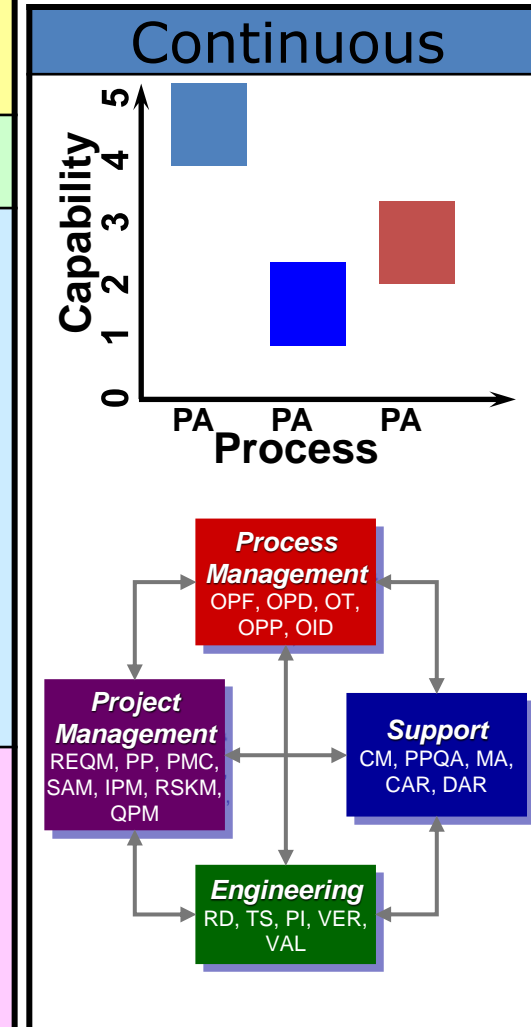
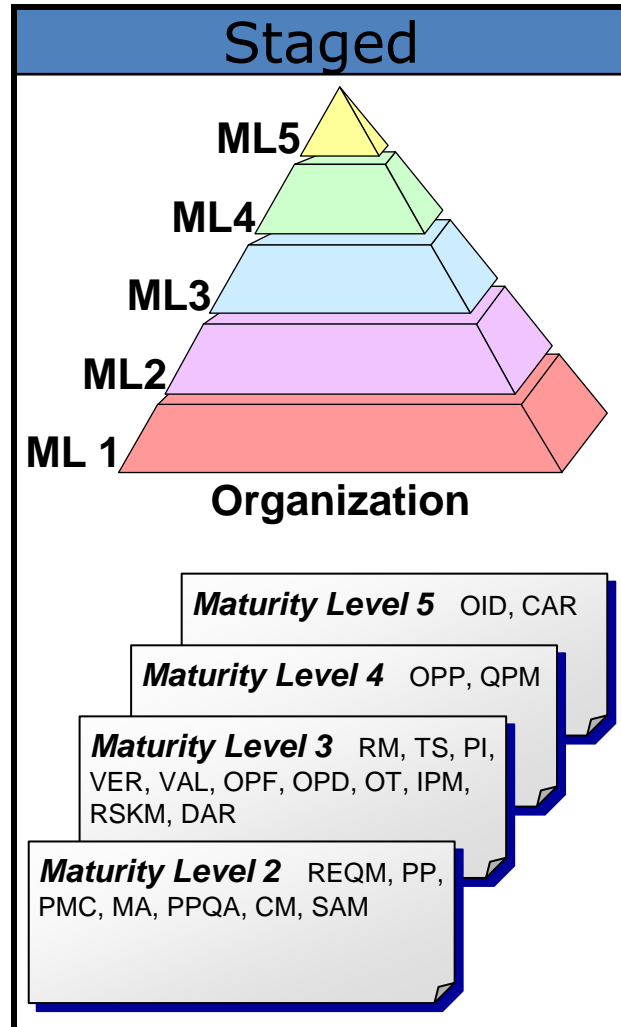


Maturity Levels (ML 1-5) - Staged Representation

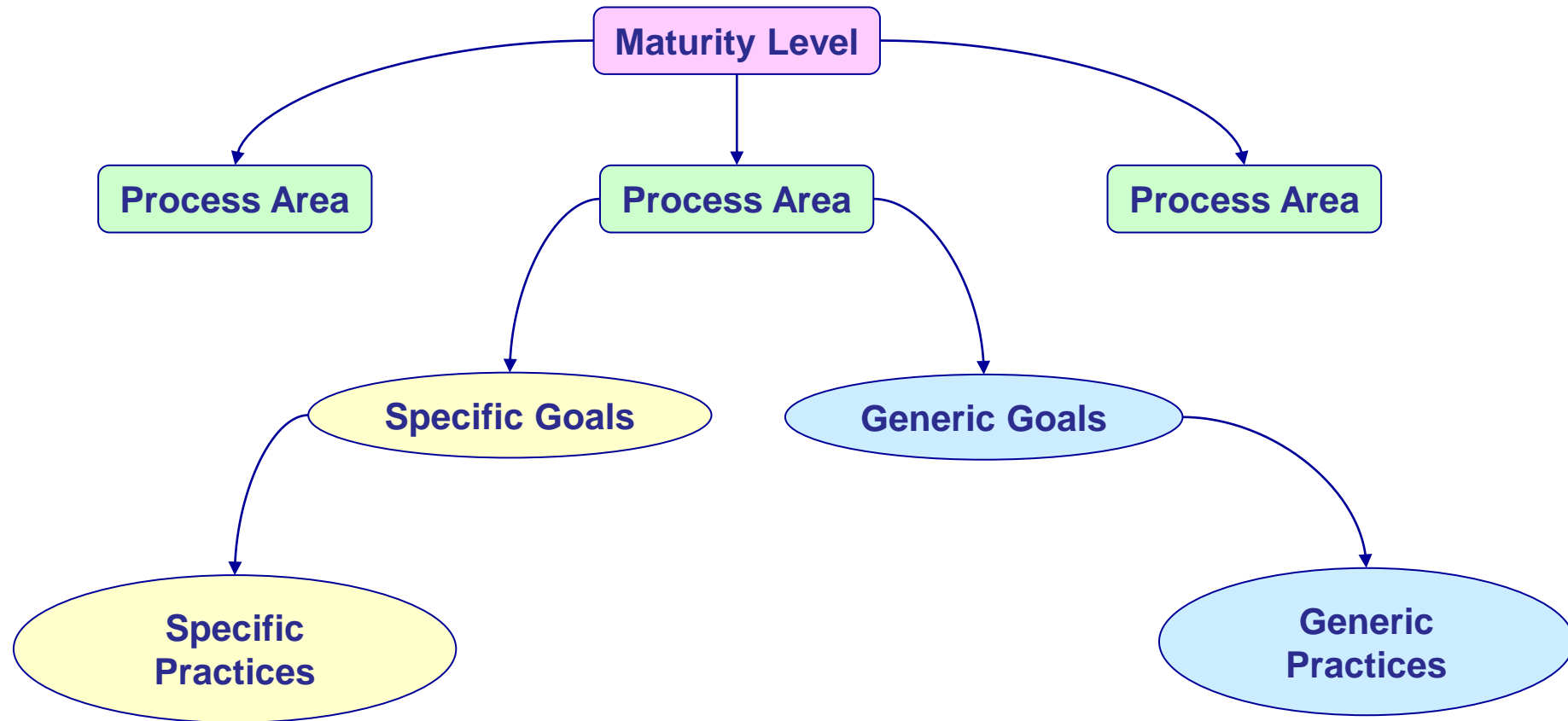


CMMI DEV, CMMI ACQ, CMMI SVC

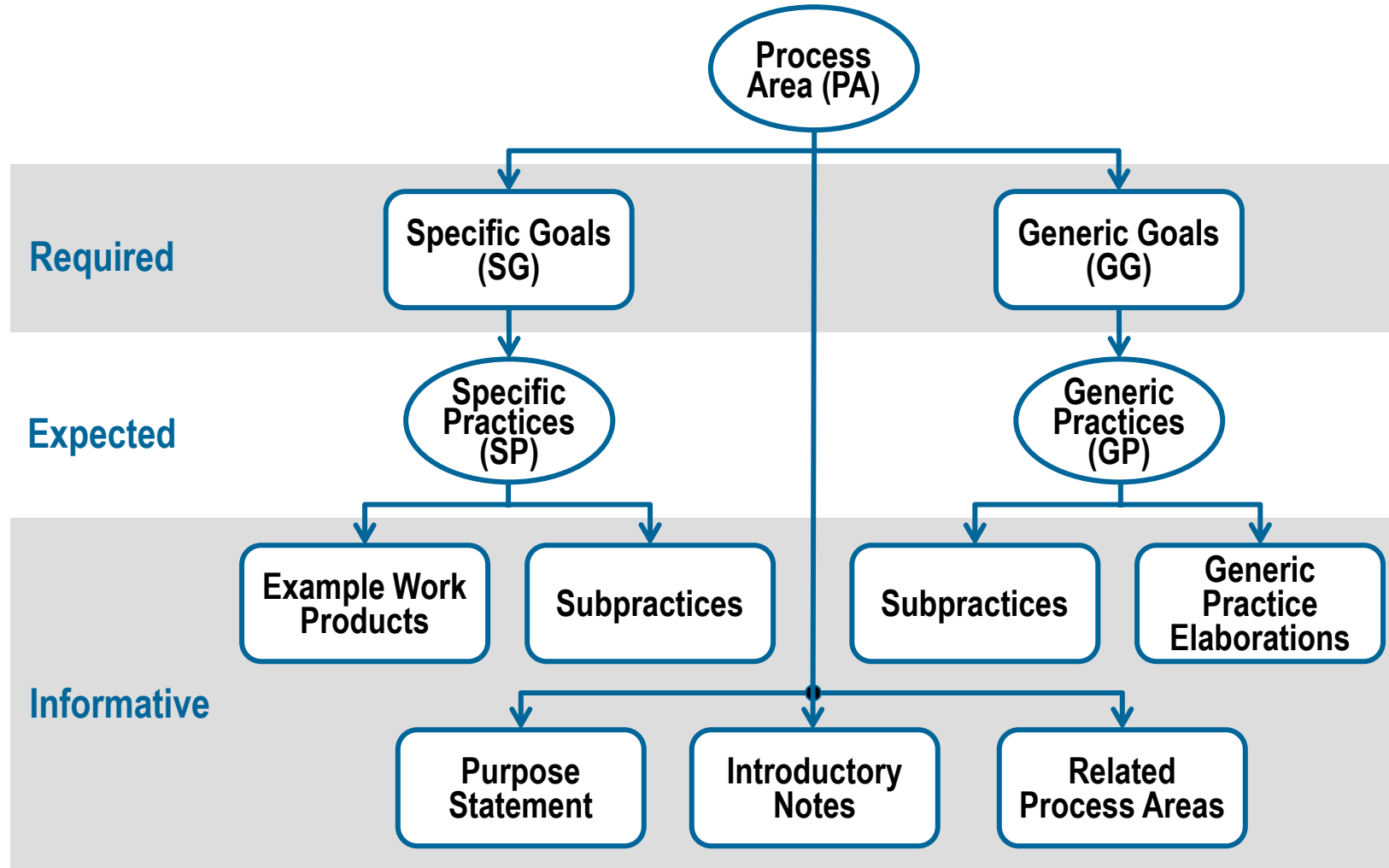
CMMI Representations



Structure of the CMMI Staged Representation



Process Area Components (or how to read the book)



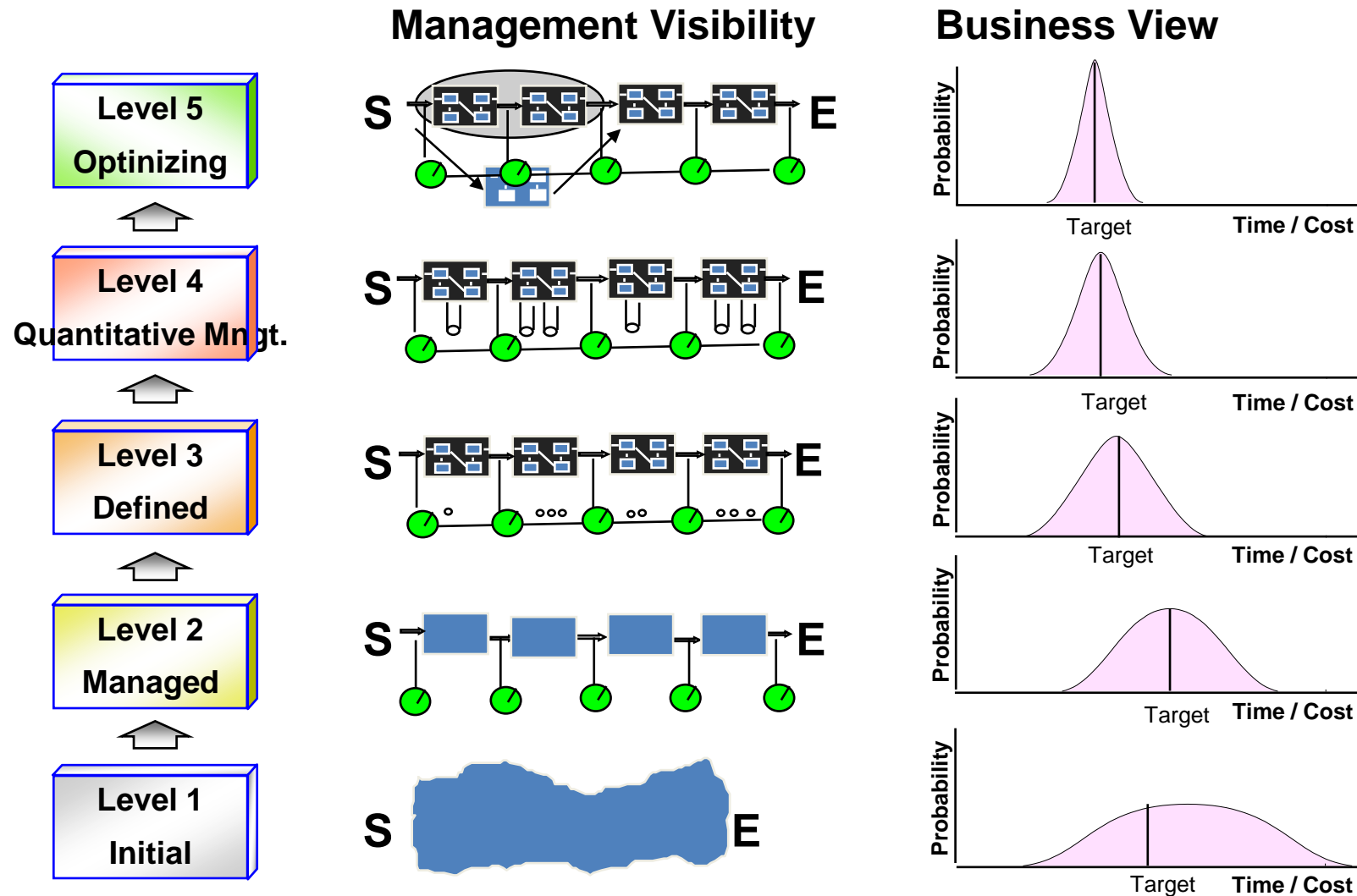
Maturity Levels Cannot Be Skipped

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.

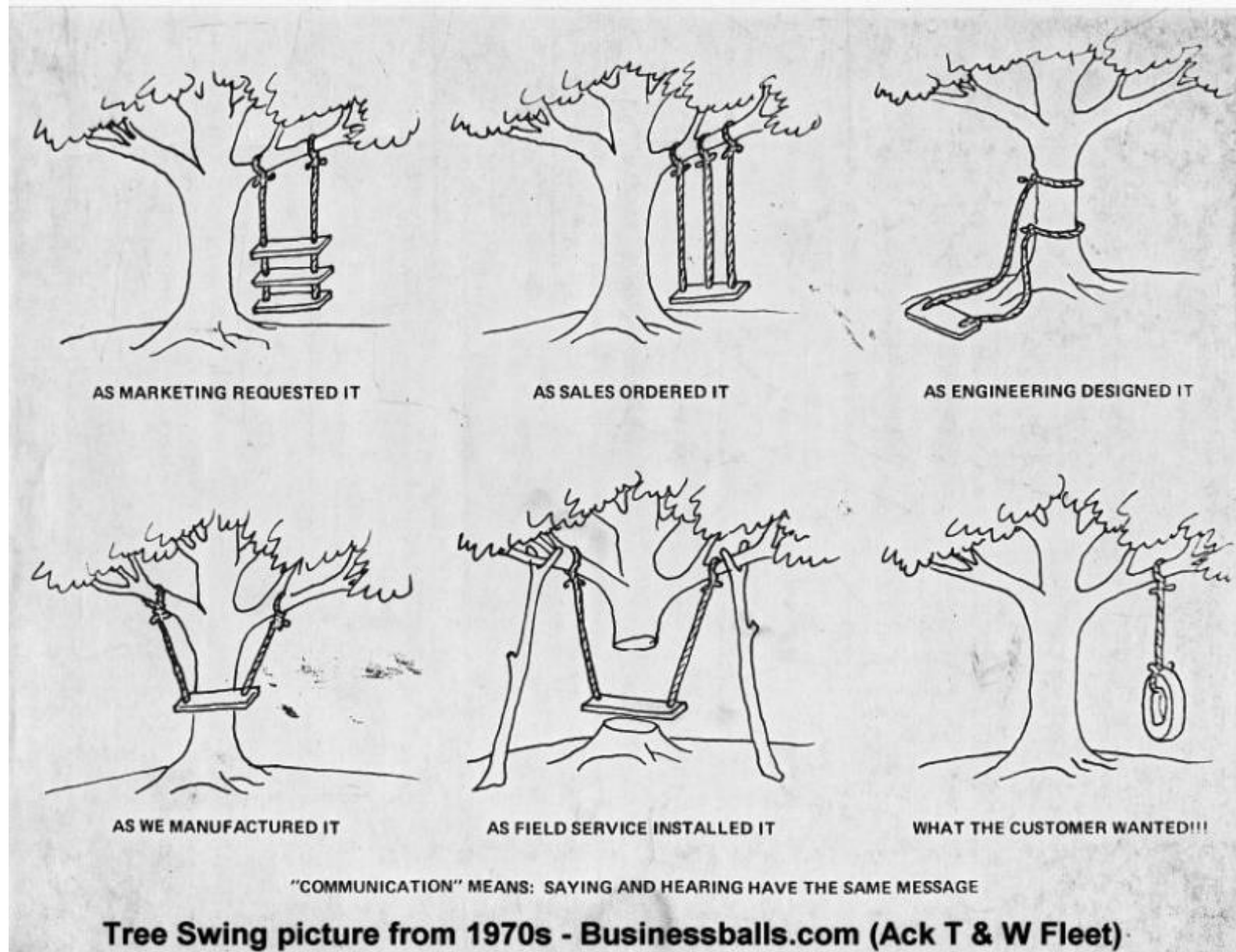
Higher maturity level processes may be performed by organisations at lower maturity levels, with risk of not being consistently applied in a crisis.

Visibility & Predictability



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

Remember: We want to avoid this!



DO NOT FORGET!!!

Process \neq Bureaucracy

Process $=$ Work

Life Cycle Relationships

