



SPICE & CMMI

제1차 S/W Management 연구회 (경영정보학회)

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정호원 교수 (고려대학교 경영학과)

- SPICE Research International Coordinator
- SEI Authorized CMMI Instructor
- IPRC Charter Research Member

hwjung@korea.ac.kr

<http://biz.korea.ac.kr/~misjung>

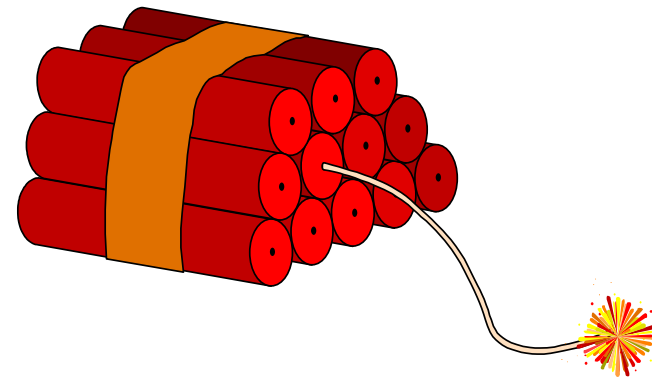
(T) 3290-1938



Part 1

왜 프로세스 개선이 필요한가?

- 경쟁력 향상
- 고객 만족





소프트웨어 관련 문제점-1

- 전 세계의 대형 프로젝트의 **1%**만이 목표 달성
 - 일정 → 계획에 비해 평균 **1년** 지연
 - 비용 → 계획에 비해 평균 **2배** 소용
 - 품질 → 수 많은 **error**
 - 고객 불만족

Möller, K.-H. and Paulish, D.J., 1993, *Software Metrics: A Practitioner's Guide to improve Product Development* (New York: Chapman & Hall Computing).

- 에러 한 개 수정 평균비용: \$7,000 at Ericsson
- Ohlsson, N. and Albert, H, 1996, Predicting fault-prone software modules in telephone switches. *IEEE Trans. on Software Engineering*, **22**, (12), 886-894.



소프트웨어 관련 문제점-2

- 미국의 business 부분의 소프트웨어 연간 투자
 - 2,500억 달러
- 소프트웨어 에러 연간 비용
 - 1250억 달러
 - Windows 95 defects: 10,000
- 1995년 조사 통계
 - 폐기된 프로젝트: 31.1%
 - 비용과다와 일정지연 프로젝트: 52.7% (189%의 비용 추가)
 - 성공 프로젝트: 16.2%

A 1996 study by the Standish Group



프로세스 관련 문제점 해결 방법

○ 문제 해결 방안

- 기술적인 해결 방안
 - New programming language, new methodology, etc.

● 프로세스 개선

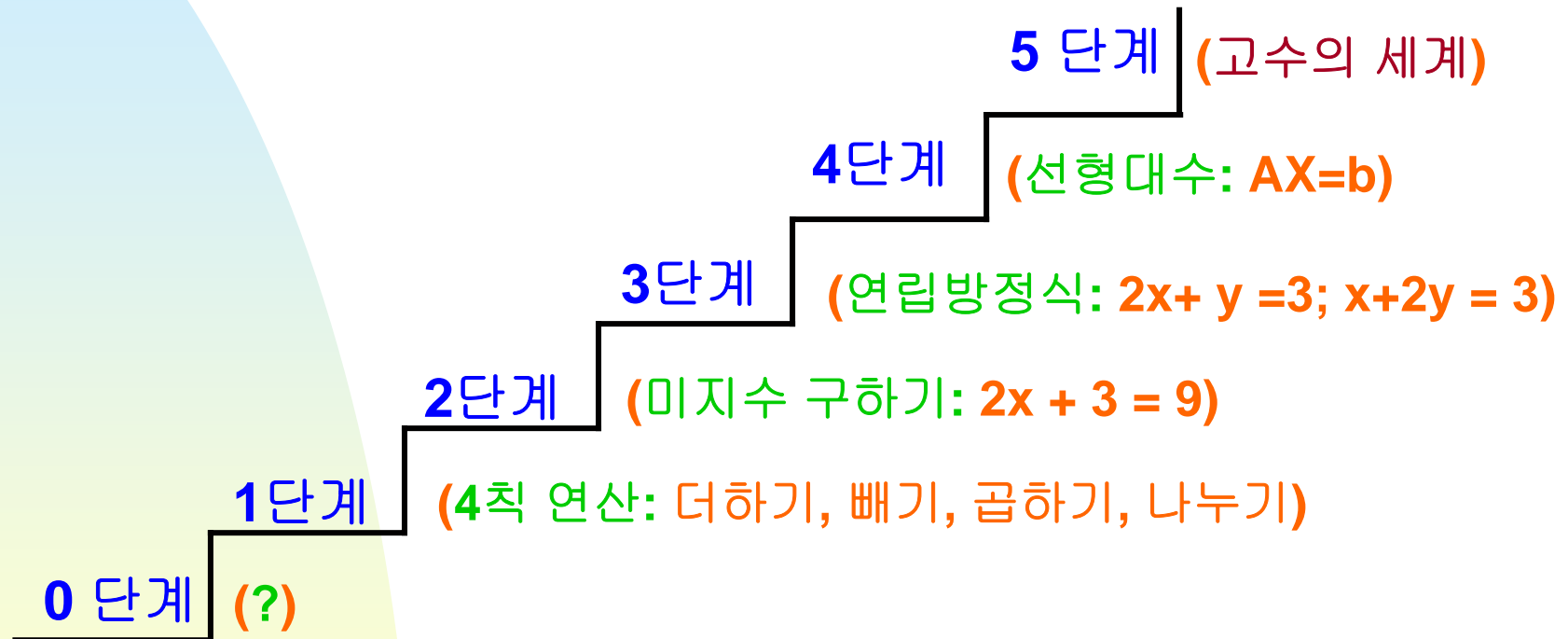
- 능력 향상 (capability improvement)

프로세스 표준의 역할





능력 (capability) 이란 ?



능력에는 단계가 있다. 즉, 사칙연산을 모르면 미지수 문제의 답을 구할 수 없다



심사와 능력의 관계

- 심사를 통하여 현재의 능력을 파악
 - 각 프로세스의 강점과 약점 파악
- 우선순위를 고려한 프로세스 개선
- 현재의 능력을 모르고는 개선(지도)은 불가능



Part 2

Process 개선 models

- ISO/IEC 15504(SPICE)
- CMMs



Model: ISO/IEC 15504 (프로세스 심사)

Member only: <http://wg10.intranets.com/>

Subscription: <http://www.isospice.com/>

Research: <http://www.cis.strath.ac.uk/research/SPICE/>

KSPICE: <http://www.kspice.co.kr/> (한국)

한국의 ISO/IEC 15504 심사원 시험 합격자: 약 600명

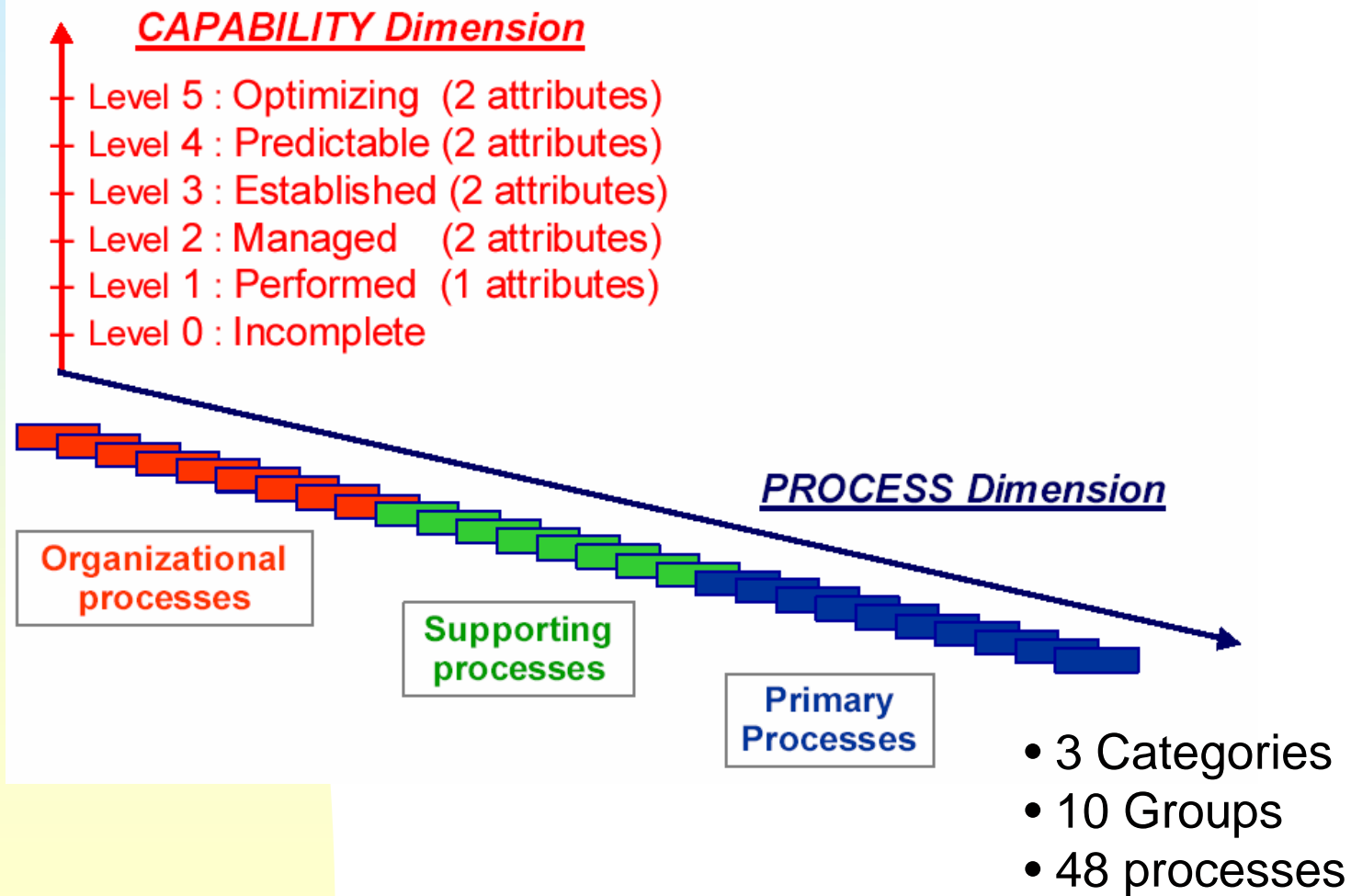


ISO/IEC 15504 현황

- **ISO/IEC FDIS 15504: Information Technology — Process Assessment**
 - Part 1: Concepts and Vocabulary (지침)
 - Part 2: Performing an Assessment (표준)
 - Part 3: Guidance on performing an assessment (지침)
 - Part 4: Guidance on use for process improvement and process capability determination (지침)
 - Part 5: An exemplar process assessment model (지침)



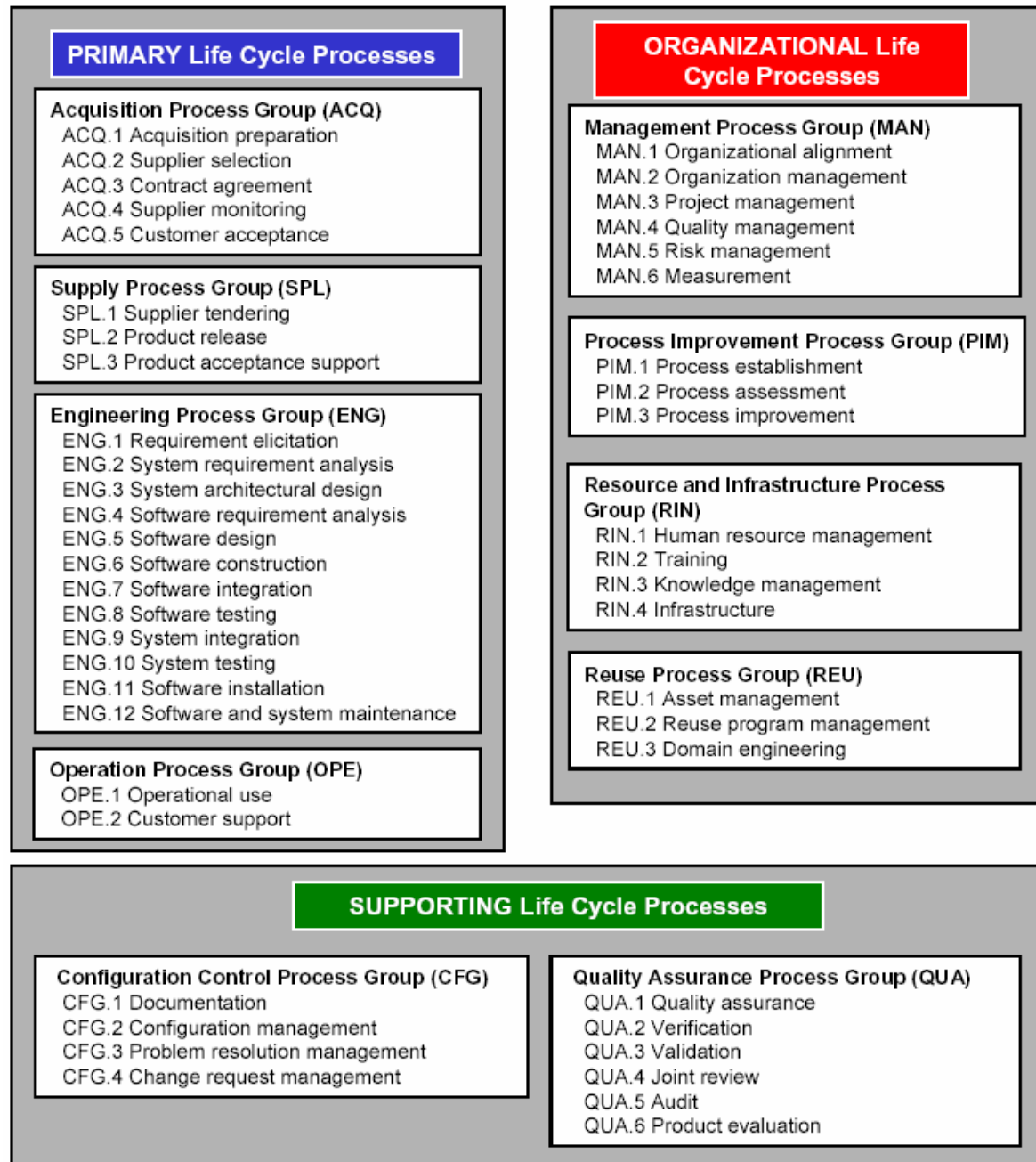
Two-dimensional architecture





Process dimension

- 3 Categories
- 10 Groups
- 48 processes





Capability level and process attributes

Capability level	Process attributes
Level 0 (Incomplete)	
Level 1 (Performed)	PA1.1: Process Performance
Level 2 (Established)	PA2.1: Performance Management
	PA2.2: Work Product Management
Level 3 (Managed)	PA3.1: Process Definition
	PA3.2: Process Deployment
Level 4 (Predictable)	PA4.1: Process Measurement
	PA4.2: Process Control
Level 5 (Optimizing)	PA5.1: Process Innovation
	PA5.2: Process Optimization



Model: CMMs



Capability and maturity Models

○ Reference (Assessment) Models

- **SW-CMM (Software CMM)**
 - *Capability Maturity Model for Software, Version 1.1* (CMU/SEI-93-TR-024)
 - *Key Practices of the Capability Maturity Model, Version 1.1* (CMU/SEI-93-TR-025)
- SA-CMM (Software Acquisition CMM)
- SE-CMM (Systems Engineering CMM)
- P-CMM (People Capability Maturity Model)
- IPD-CMM (Integrated Product Development CMM)
- **CMMI (CMM Integration)**
 - *CMMI for Systems Engineering/Software Engineering/Integrated Product and Process Development/Supplier Sourcing, Version 1.1, Continuous Representation* (CMMI-SE/SW/IPPD/SS, V1.1) (Continuous: CMU/SEI-2002-TR-011) and *Staged Representation* (CMU/SEI-2002-TR-012)

○ Appraisal (Assessment) Methods

- SPA (Software Process Assessment)
- Clarity Testing
- Interim Profile
- **CBA IPI (CMM-Based Appraisals for Internal Process Improvement)**
 - *CMM-Based Appraisal for Internal Process Improvement (CBA IPI) Lead Assessor's Guide, V1.1* (CMU/SEI-96-HB-003)
 - *CMM-Based Appraisal for Internal Process Improvement (CBA IPI): Method Description* (CMU/SEI-96-TR-007, ADA307934)
- SCE (Software Capability Evaluation)
- **CMMI SCAMPI (Standard CMMI Appraisal Method for Process Improvement)**
 - *Standard CMMI Appraisal Method for Process Improvement (SCAMPI), Version 1.1: Method Definition Document* (CMU/SEI-2001-HB-001)
- Others



SW-CMM의 폐기

- SEI는 SW-CMM은 2003년 말 폐기
 - 10년전에 만들어진 기준
 - 어떠한 기관도 SW-CMM을 SEI을 대신해 보급 불가
 - 더 이상 심사원 교육 없음
- 폐기 이유
 - SW-CMM의 내용이 잘못된 것이 아님
 - SW-CMM의 내용이 미 국방성의 목표와 다름
- CBA-IPI 선임 심사원 자격
 - 앞으로 2년간 유효 (SEI는 더 이상 계약을 않음)
 - 이후는 더 이상 선임심사원이란 용어를 사용 않음
- SEI는 CBA-IPI 심사 결과는 SEI의 PAIS DB에서는 수용
 - 연구 목적으로만 사용



Model: CMMI

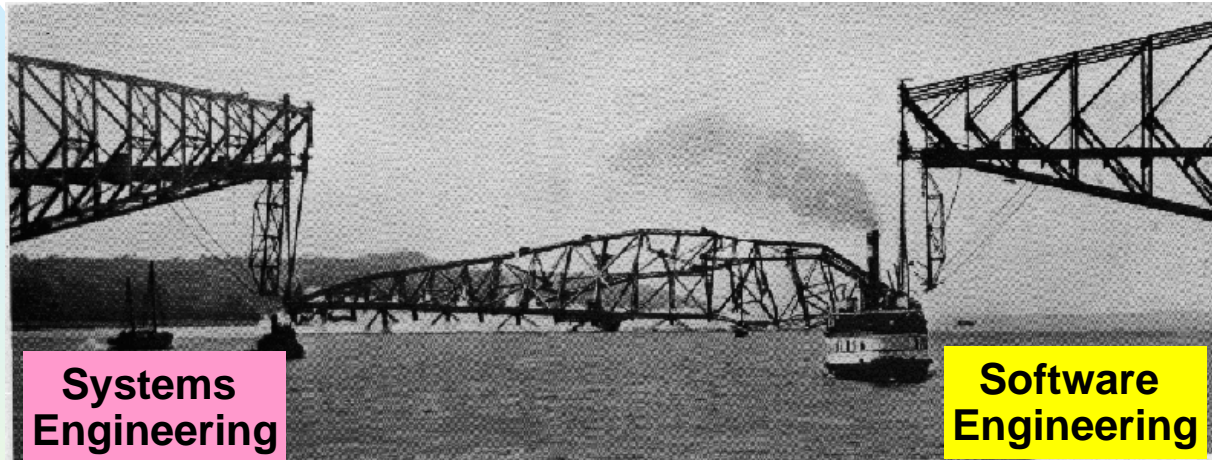
- Capability Maturity Model Integration -

SEI: <http://www.sei.cmu.edu/> (CMMI)

CMMI: <http://www.sei.cmu.edu/cmmi/> (CMMI)

- SEI는 CMMI가 ISO/IEC 15504의 compatible 하다고 선언
- 약 3년간 모형 변경 없음

Process 표준의 문제점



- 시스템 공학과 소프트웨어 공학은 전통적으로 다른 분야로 여겨져옴
- 시스템에서 소프트웨어의 중요성 증대
 - 예: 시스템에서 소프트웨어가 차지하는 비중 (%)
 - B-2 -- 65%
 - F-22 -- 80%
- 미 국방성은 시스템 공학과 소프트웨어 공학을 통합한 평가 모형을 개발



시스템 공학과 소프트웨어 공학 통합

**Systems
Engineering**

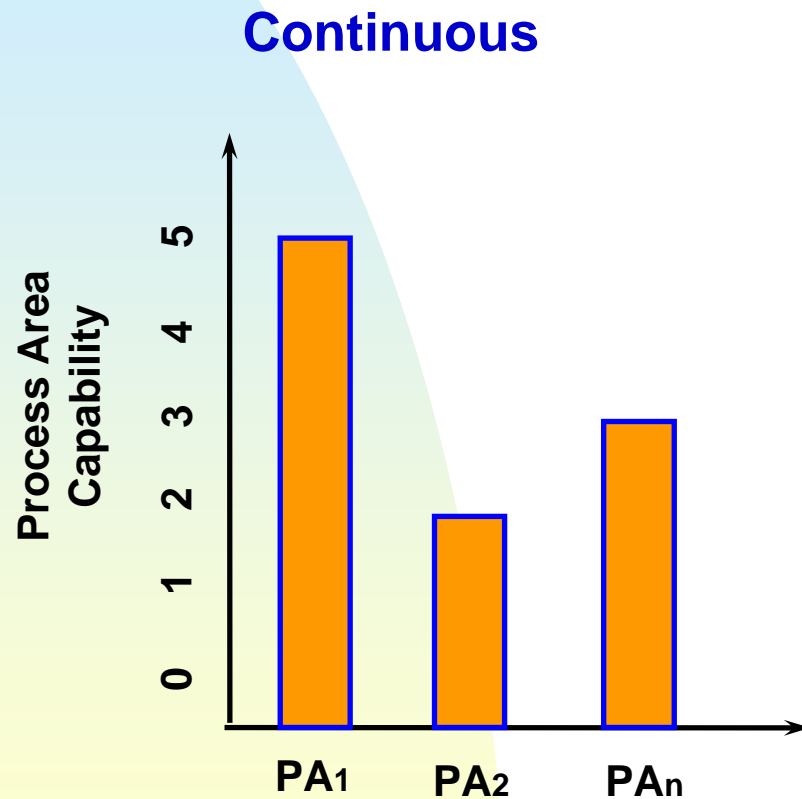


**Software
Engineering**

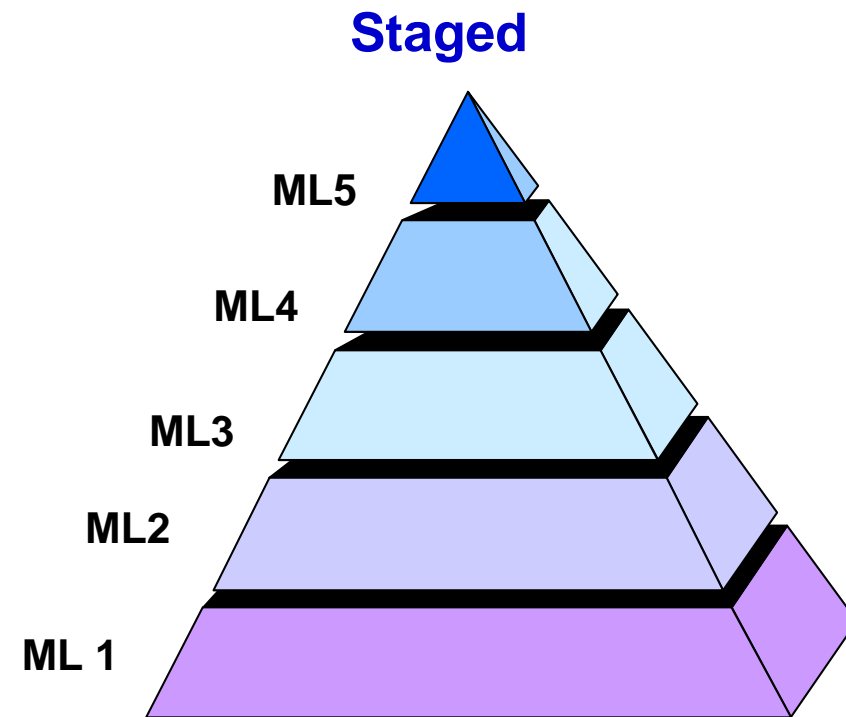
- 시스템 공학과 소프트웨어 공학 통합
- 두 공학 분의 개선을 동시에 추구



Two Representations



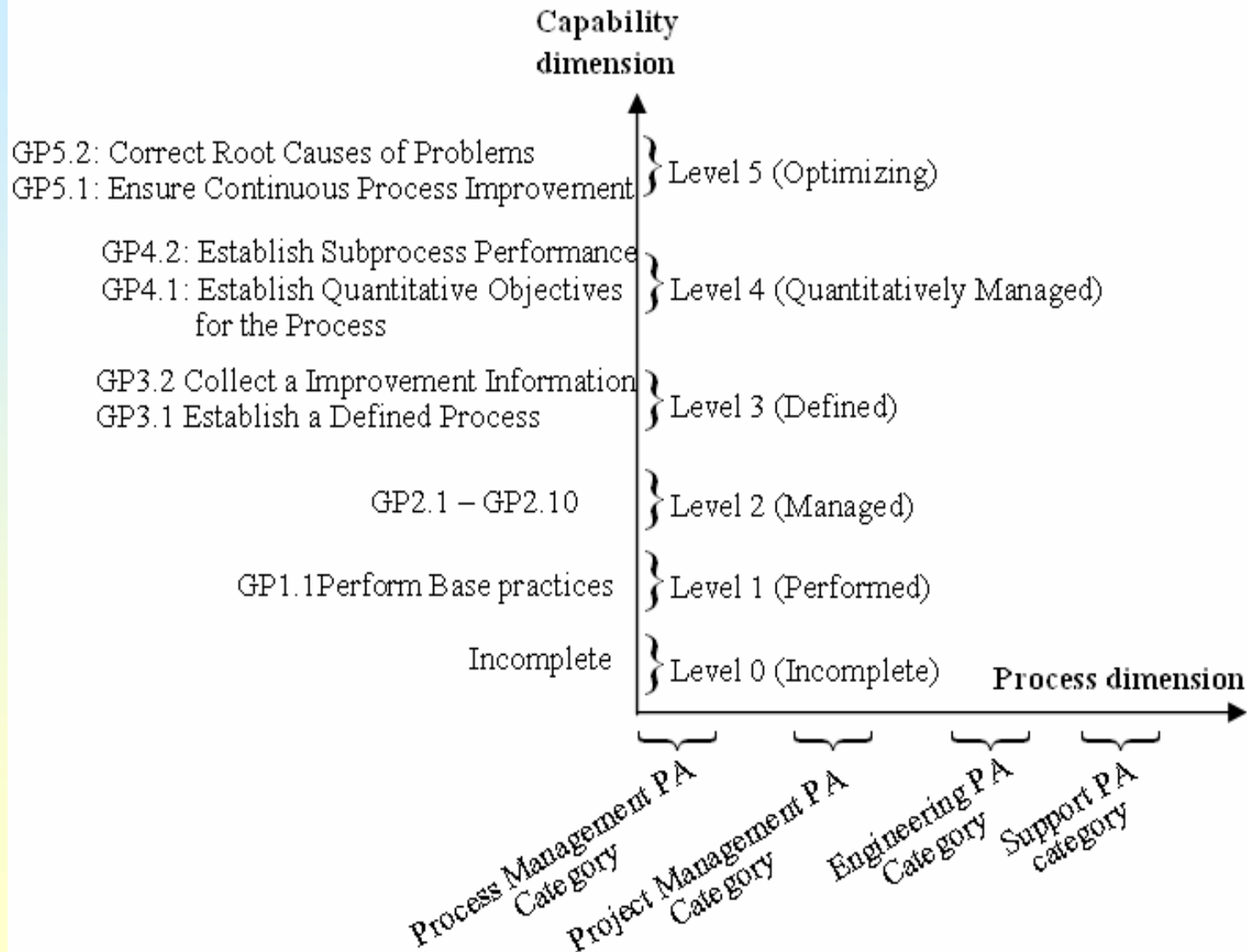
...for (1) a single process area
or (2) a set of process areas



...for (1) an established set of process areas across an organization



Process Area Capability Profile





Continuous representation – SE/SW/IPPD/SS, Version 1.1 (25 Process Areas)

Process management	1. Organizational Process Focus	OPF (3)
	2. Organizational Process Definition	OPD (3)
	3. Organizational Training	OT (3)
	4. Organizational Process Performance	OPP (4)
	5. Organizational Innovation and Deployment	OID (5)
Project management	1. Project Planning	PP (2)
	2. Project Monitoring and Control	PMC (2)
	3. Supplier Agreement Management	SAM (2)
	4. Integrated Project Management for IPPD	IPM for IPPD (3)
	5. Risk Management	RSKM (3)
	6. Integrated Teaming (IPPD)	IT (3)
	7. Integrated Supplier Management (SS)	ISM (3)
	8. Quantitative Project Management	QPM (4)
Engineering	1. Requirements Management	REQM (2)
	2. Requirements Development	RD (3)
	3. Technical Solution	TS (3)
	4. Product Integration	PI (3)
	5. Verification	VER (3)
	6. Validation	VAL (3)
Support	1. Configuration Management	CM (2)
	2. Process and Product Quality Assurance	PPQA (2)
	3. Measurement and Analysis	MA (2)
	4. Decision Analysis and Resolution	DAR (3)
	5. Organizational Environment for Integration (IPPD)	OEI (3)
	6. Causal Analysis and Resolution	CAR (5)



Staged representation – SE/SW/IPPD/SS, Version 1.1 (25 Process Areas)

Level	Focus	Process Areas
5 Optimizing	<i>Continuous process improvement</i>	<ul style="list-style-type: none"> 1. Organizational Innovation and Deployment (ORG5) 2. Causal Analysis and Resolution (SUP6)
4 Quantitatively Managed	<i>Quantitative management</i>	<ul style="list-style-type: none"> 1. Organizational Process Performance (ORG4) 2. Quantitative Project Management (PRJ8)
3 Defined	<i>Process standardization</i> <i>(IPPD)</i> <i>(IPPD)</i> <i>(SS)</i> <i>(IPPD)</i>	<ul style="list-style-type: none"> 1. Requirements Development (ENG2) 2. Technical Solution (ENG3) 3. Product Integration (ENG4) 4. Verification (ENG5) 5. Validation (ENG6) 6. Organizational Process Focus (ORG1) 7. Organizational Process Definition (ORG2) 8. Organizational Training (ORG3) 9. Integrated Project Management (PRJ4) 10. Risk Management (PRJ5) 11. Integrated Teaming (PRJ6) 12. Integrated Supplier Management (PRJ7) 13. Decision Analysis and Resolution (SUP4) 14. Organizational Environment for Integration (SUP5)
2 Managed	<i>Basic project management</i>	<ul style="list-style-type: none"> 1. Requirements Management (ENG1) 2. Project Planning (PRJ1) 3. Project Monitoring and Control (PRJ2) 4. Supplier Agreement Management (PRJ3) 5. Measurement and Analysis (SUP3) 6. Process and Product Quality Assurance (SUP2) 7. Configuration Management (SUP1)
1 Performed		



Part 3

어떤 표준이 가장 좋은가?



The Best ?

○ Product type

- Software systems
- Software + hardware
 - 통신기기
 - 컴퓨터 주변기기
 - 무기 system

• Application domain

- Finance (excluding banking)
- Insurance
- Banking
- Petroleum
- Automotive
- Public Utilities (Gas, Water, Electricity)
- Aerospace
- Telecommunications
- Public Administration
- Consumer Goods
- Retail
- Distribution/Logistics
- Defense
- Information Technology / Software
- Health and Pharmaceutical
- Leisure and Tourism
- Manufacturing
- Construction
- Travel
- Media (Television, Radio)
- Education



The Best ?

- 우리의 선택에서 고려해야 할 사항
 - Market requirements
 - 비용
 - Appraisal
 - Document purchase
 - Training
 - Maintainability of standards
 - 비교 가능한 사례들



Part 4

Continuous Model의 장점



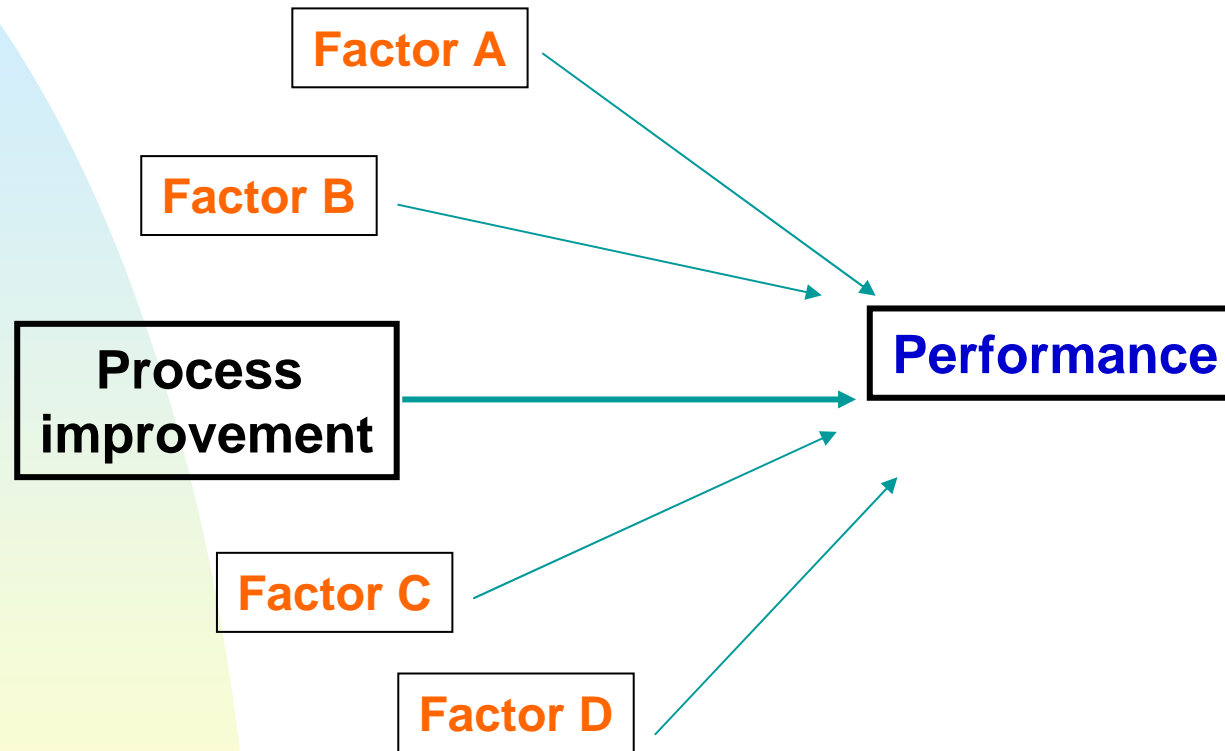
프로세스 개선의 목표

- Process improvement benefits fall into one or more general categories
 - Improved schedule and budget predictability
 - Improved cycle time
 - Improved quality (as measured by defects)
 - Increased productivity
 - Increased customer satisfaction
 - Improved employee morale
 - Increased return on investment
 - Decreased cost of quality

**called external attributes
(Performance criteria)**



이론적 배경

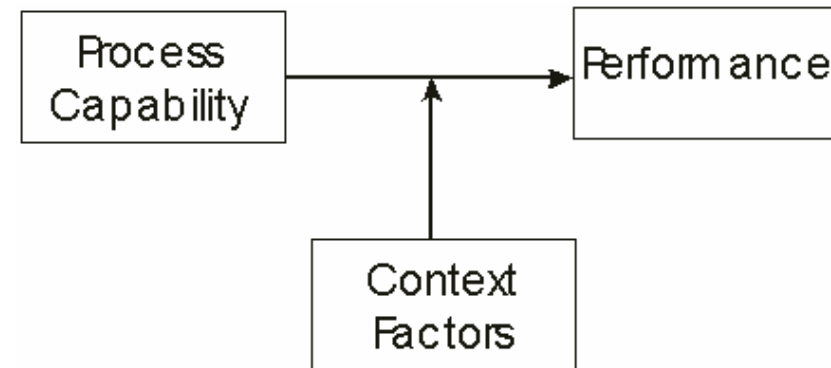


Is there an association between process improvement and performance ?



성과 변수의 측정 방법

- **Considering process context**
- **Examples of process context**
 - **Organization size**
 - **Application domains**
 - **ISO 9000 certification**





Continuous model vs. Staged model

- Continuous models
 - ISO/IEC 15504
 - CMMI Continuous Representation

- Staged models
 - SW-CMM
 - CMMI Staged Representation



Functional form

Continuous model: Correlation[CL(x), Performance]

Staged model: Correlation[CL($X_1 + L + X_k$), Performance]

Staged model에서는 어떤 process가 improve 되어 performance가 improve되었는지 알 수 없다.

따라서,

-SW-CMM의 CBI-IPA method, CMMI Staged representation을

사용해서는 level 향상이 성과와 관련이 있다는 것을 실증적으로 보여주기에는 많은 시간이 걸림



Part 5

결언



모델, 심사 보다 중요한 것

- 통용되는 상식
 - 어떠한 기술이나 model도
 - 70% 이상의 시장을 점유하지 어렵다.
 - 5년 이상 시장을 지배 하기 어렵다.
- 다른 기술이나 model을 사용하는 사람이나 기업도 적어 아니다.



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

George Box



지리의 영광



Assessor Training

- SPICE
 - Quality Academy
 - KSPICE and KASPA: Lead assessor

- CMMI
 - Introduction to CMMI
 - Intermediate (SEI)
 - SCAMPI (SEI)
 - Instructor (SEI)