A Taxonomy of SPI Frameworks

Efficient and Objective Comparison of SPI Frameworks

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Agenda

- General discussion of SPI
- Comparison of SPI frameworks
  - Why compare?
  - Four classes of comparison methods
- Our new taxonomy
  - General discussion of the taxonomy
  - Proposed classification of 6 frameworks using the taxonomy

Software Process Improvement (SPI)

- Usual assumption: Product quality depends on process quality

  Quality(Process) $\Rightarrow$ **Quality**(Product)

- Structured in various SPI frameworks, e.g. CMM, ISO 9000, SPICE
- Problem areas between technology and organization

Why Compare SPI Frameworks?

- Practical insight and guidance needed for SPI framework selection
  - Which SPI framework is appropriate for the organization?
- Organizational context:
  - No prior SPI strategy in place
  - Implementation of several SPI frameworks

Comparison Difficulties

- Costly and time-consuming
- No comparison method appropriate for all situations
- Knowledge-level of user
  - Appropriate level of detail
- Point of view
  - General or from a specific framework?

Classes of Comparison Methods

- Characteristics
- Framework mapping
- Bilateral comparison
- Needs mapping

Characteristics

- High-level/general overview
  - Starting-point for further investigations
- Characteristics should be objective, measurable and comparable
- Purpose: Point out areas of interest when investigating SPI frameworks

Framework Mapping

- Map from statements/ concepts of one framework to those of another
  - Beneficial when several SPI frameworks are used
- Purpose: Identify overlap/correlation between frameworks, i.e. which parts are equal?
- Ex.: Tingey's book

Bilateral Comparison

- Textual description
- Can describe one framework in terms of another
- Purpose: Summarize or explain findings from other comparison methods
- Ex.: Paulk's ISO 9001 vs. CMM

Needs Mapping

- Identification of requirements from organization or environment
  - May limit choice of SPI framework
- Purpose: Examine external requirements that influence SPI framework selection
- Ex.: Customer requiring ISO 9001 certification

Attributes of the Proposed Taxonomy

- Characteristics comparison method
  - 25 characteristics from misc. literature
  - Grouped into 5 categories
- Points out areas of interest
- Starting point for further investigation
- Proposed classification of TQM, CMM, ISO 9000, SPICE, EF/QIP/GQM, SPIQ

General Category

- Geographic origin/spread
- Scientific origin
- Development/stability
- Popularity
- Software specific
- Prescriptive/descriptive
- Adaptability

Process Category

- Assessment
- Assessor
- Process improvement method
- Improvement initiation
- Improvement focus
- Analysis techniques

Organization Category

- Actors/roles/ stakeholders
- Organization size
- Coherence

Quality Category

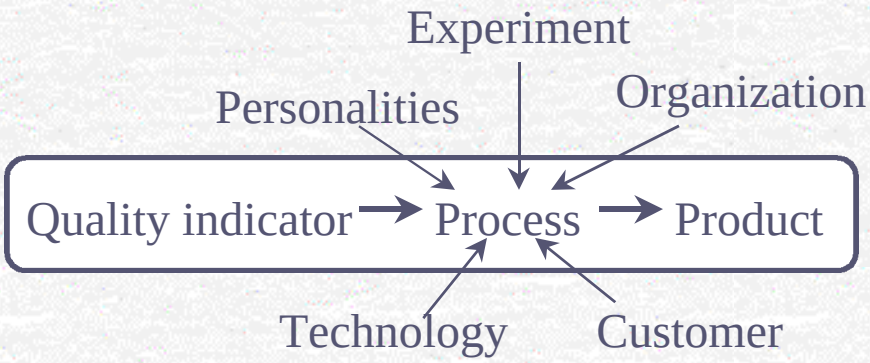
- Quality perspective
- Progression
- Causal relation
- Comparative

Result Category

- Goal
- Process artifacts
- Certification
- Cost of implementation
- Validation

Causal Relations in SPI Frameworks

- Process quality difficult to determine
  - Quality indicators
  - Multi-factor problem:



SPI Framework	Causal Relation
TQM	Not applicable
CMM	**F'**(*Key process areas*) ⇒ **F**(*Maturity level*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)
ISO 9001	**F'**(*Quality elements*) ⇒ **F**(*Certification*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)
ISO/IEC 15504 (SPICE)	**F'**(*Process attributes*) ⇒ **F**(*Capability level*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)
QIP/GQM/EF	**F**(*Experience reuse*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)
SPIQ	**F**(*Experience reuse*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)

- Comparison method influences quality:

F''(*Comparison method*) ⇒ **F'**(*SPI framework*) ⇒
F(*Quality indicator*) ⇒ **Quality**(*Process*) ⇒ **Quality**(*Product*)

Category	Characteristic	TQM	CMM v1.1	ISO 9000	ISO/IEC 15504	EF/QIP/GQM	SPIQ
General	**Geo. origin/spread**	Japan/World	U.S./World	Europe/World	World/World	U.S./World	Norway/Norway
	Scientific origin	Quality control	TQM, SPC	-[2]	CMM, Bootstrap, Trillium, SPQA.	Partly TQM	TQM, GQM, EF, QIP, ESSI
	Develop./stability	Entire post-war era	Since 1986	Since 1987	Under development	Since 1976	Under development
	Popularity	High (esp. in Japan)	Top (esp. in U.S.)	High (esp. in Europe)	Growing	Medium	Norway only
	Software specific	No	Yes	No	Yes	Yes	Yes
	Prescriptive/ descriptive	Descriptive	Both	Both	Both	Descriptive	Descriptive
	Adaptability	Yes	Limited	Limited	Yes	Yes	Yes
Process	**Assessment**	None	Org. maturity	Process	Process maturity	None	Customer satisfaction
	Assessor	NA[1]	Internal and external	External	Internal and external	NA[1]	Limited internal
	Process improve-ment method	PDCA	IDEAL	None	SPICE Doc. part 7	QIP	Two-level PDCA
	Improvement initiation	Top-down	Top-down	NA[1]	Process instance	Iterative bottom-up	Top-down and iterative, bottom-up
	Improvement Focus	Management processes	Management processes	Management processes	Management processes	Experience reuse	Experience reuse
	Analysis techniques	7QC, 7MP, SPC, QFD	Assessment questionnaires	ISO guidelines and checklists	Several (manual and automated). Required.	GQM	GQM, QFD, 7QC, 7MP
Organ-ization	**Actors/roles/stake-holders**	Customer, employees, management	Management	Customer, supplier	Management	Experience factory, project organization	Customer, experience factory, project org., sponsoring org.
	Organization size	Large	Large	Large	All	All	All
	Coherence	Internal and external	Internal	Internal and limited external	Internal	Internal	Internal and external
Quality	**Quality perspective**	Customer	Management	Customer	Management	All	Customer, all
	Progression	Continuous	Staged	Flat	Continuous (staged at process instance level)	Continuous	Continuous
	Causal relation	NA[1]	**F'**(*Key process areas*) ⇒ **F**(*Maturity level*) ⇒ **Q**(*Process*) ⇒ **Q**(*Product*)	**F'**(*Quality elements*) ⇒ **F**(*Certification*) ⇒ **Q**(*Process*) ⇒ **Q**(*Product*)	**F'**(*Process attributes*) ⇒ **F**(*Capability level*) ⇒ **Q**(*Process*) ⇒ **Q**(*Product*)	**F**(*Experience reuse*) ⇒ **Q**(*Process*) ⇒ **Q**(*Product*)	**F**(*Experience reuse*) ⇒ **Q**(*Process*) ⇒ **Q**(*Product*)
	Comparative	No	Yes, maturity level	Yes, certification	Yes, maturity profile	No	No
Result	**Goal**	Customer satisfaction	Process improvement, supplier capability determination	Establish core management processes	Process assessment	Organization specific	Increased competitiveness
	Process artifacts	Plans, diagrams	Process documentation, assessment result	Process documentation, certificate	Process profile, assessment record	Experience packages, GQM models	Experience packages, GQM models
	Certification	No	No	Yes	No	No	No
	Implementation cost	-[2]	-[2]	-[2]	-[2]	-[2]	-[2]
	Validation	None	Surveys and case studies	Survey	Document review, trials (case studies and surveys)	Experimental and case studies	Experimental and case studies

Table 1 - The Taxonomy Applied to Six SPI Frameworks

[1] Not applicable
[2] Yet to be determined

Category	Characteristic	CMM v1.1	EF/QIP/GQM
General	Geographic Origin/ Spread	U.S./World	U.S./World
	Scientific Origin	TQM, SPC	Partly TQM
	Development/ Stability	Since 1986	Since 1976
	Popularity	Top (esp. in U.S.)	Medium
	Software Specific	Yes	Yes
	Prescriptive/ Descriptive	Both	Descriptive
	Adaptability	Limited	Yes
Process	Assessment	Org. maturity	None
	Assessor	Internal and external	NA
	Process Improve-ment Method	IDEAL	QIP
	Improvement Initiation	Top-down	Iterative bottom-up
	Improvement Focus	Management processes	Experience reuse
	Analysis Techniques	Assessment questionnaires	GQM
Organ-ization	Actors/Roles/ Stakeholders	Management	Experience factory, project organization
	Organization Size	Large	All
	Coherence	Internal	Internal

Concluding Remarks

- Proposed taxonomy is not final
- Proposed classification in table is not final
- Empirical evaluation of the taxonomy is necessary
  - How should the taxonomy be used in the selection process?