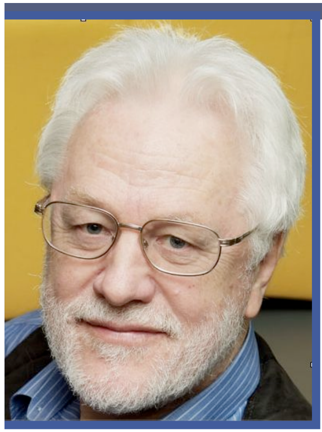


Tom Gilb

How Good is a Process? :

Evaluating Engineering Processes' Efficiency

10 Practical Principles: for determining your critical-few objectives for process improvement. How to measure, estimate, and evaluate the effects of a process improvement effort for critical stakeholders.

by Tom Gilb, www.Gilb.com, Tom@Gilb.com

Friday 31st August 2007

Euromicro, Lübeck, Germany, Keynote 1030-1130

Sources: Tom Gilb, "Competitive Engineering" (Book).

Introduction:

1. **You should not seriously tackle your process improvement unless you have stated and agreed your *long term improvement objectives* quantitatively.**
2. **Process improvement is the 'means'. To manage it meaningfully, to sell it to top management, you must develop and present a clear 'bottom line' verifiable trackable notion of the 'ends'**
3. **You not only need to realistically set your ambition levels, but you need to be able to estimate the projected impact on those objectives of your investments in process improvement.**
4. **You also need to measure quickly and continuously your progress towards those goals**
5. **Most process improvement programs (like CMMI) are not good at any of this. They are therefore doomed from the start to fail and be discredited.**
6. **This talk will show you how to quantify, measure and estimate PROCESS ATTRIBUTES – and will illustrate with real case studies and examples**

Keynote Learning Objectives:
(what I hope you pick up)

1. **Learn how to quantify any process improvement objective**
2. **Learn how to deal with the critical set of your process improvement objectives: many simultaneous objectives**
3. **See varied examples of process improvement quantification**
4. **Get the basic idea: a process improvement is only as good as *the measurable lasting effect* it has on your official objectives in practice.**

10 Principles for Evaluating Engineering Processes: A Summary

1. Processes are 'good' to the degree they in practice satisfy specific organizational objectives.
2. When organizational objectives change, or are satisfied by other means, the usefulness of a process may decline or disappear.
3. Processes that are equivalent in their performance effects can be distinguished by their 'efficiency' – their use of limited and budgeted resource costs.
4. We can estimate the efficiency (value to cost ratio) of a process based on experience with it, or similar processes; but we cannot be certain of the process impacts until we measure them in place in our organization.
5. Just because we have measured the process efficiency once does not mean that the efficiency will not change for better or for worse in time or in other circumstances.
6. If the process efficiency does not meet the estimated levels of efficiency, then one possible cause is malpractice of the process.
7. Processes should be implemented in small evolutionary steps, early, and measured for effects before scaling up and before combining with other processes.
8. Process impacts will always be on multiple critical organizational performance and cost characteristics; so we must not evaluate them in single dimensions alone.
9. The entire justification for any process should rationally be the efficient effects on our organizational objectives; so they should never be mandated as 'best practices', but should forever be monitored for their justification.
10. Before implementing any new process, the resources to implement and to maintain it should be created by conscious and specific removal of less efficient processes which they will replace. [Conner98]

• Detailed discussion of the process evaluation principles

Follows….

Principle 1. PRACTICAL RESULTS
Processes are 'good'
to the degree they in practice
satisfy specific organizational objectives.

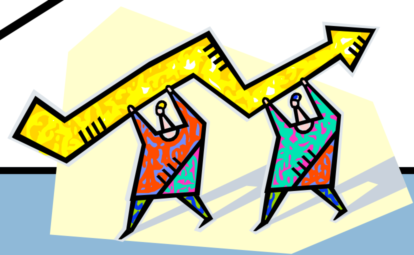
- **There is an implication here:**
  - ***all organizational performance objectives can be expressed quantitatively;***
  - **that means with**
    - **a defined scale of measure,**
      - ***Scale : Mean Time Between Failure.***
    - **a target level**
      - ***Goal: 30,000 hours.***
    - **and a deadline.**
      - ***Goal [Release 9.0] 20,000 hours***

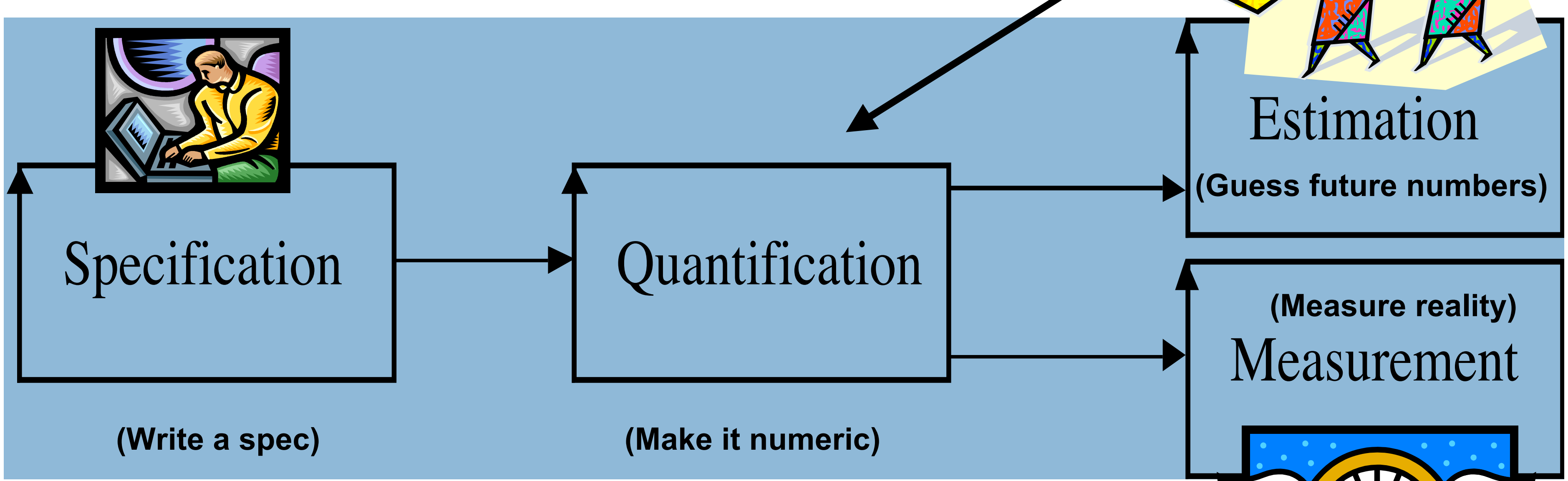
- Here are some interesting examples of potential organizational objectives:

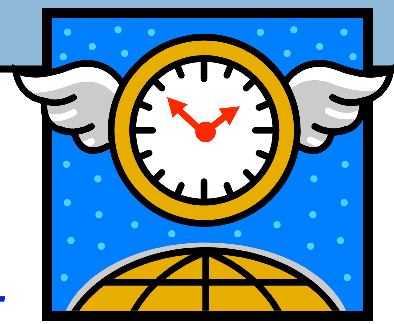
- **Time To Market**
- **Predictability of Time To Market**
- **Lead Time**
- **Productivity**
- **Quality Levels**
- **Transportability (Outsourceability)**
- **Competitiveness**
- **Risk Avoidability/Controllability**
- **Prioritization Ability**
- **Customer Satisfaction**

• Here are some examples of "defining a scale of measure" for these concepts:

Process Symbol (Planguage)







*‘**Quantification**’ is different from*
‘Measurement, Estimation and Specification’.
A ‘scale of measure’ DEFINES an attribute <u>quantitatively</u>.

Time To Market (template)

- **Scale:**
  - **Time**
  - **from [Product Concept Approval]**
  - **to availability on defined [Market].**

Predictability of Time To Market (Real Example)

Scale: % overrun of actual Project Time compared to planned Project Time

(this is specified in 'Planguage' as defined in the CE book)

TTMP: Predictability of Time To Market:

Ambition: From Ideas created to customers can use it. Our ability to meet agreed specified customer and self-determined targets.

Scale: % overrun of actual Project Time compared to planned tual Project Time

Project Time: Defined: time from the date of Toll-Gate 0 passed, or other Defined Start Event, to, the Planned- or Actually- delivered Date of All [Specified Requirements], and any set of agreed requirements.

Specified Requirements: Defined: written approved Quality requirements for products with respect to Planned levels and qualifiers [when, where, conditions].
And, other requirements such as function, constraints and costs.

Meter: Productivity Project or Process Owner will collect data from all projects, or make estimates and put them in the Productivity Database for reporting this number.

Past [1994, A-package] < 50% to 100%> <- Palli K. guess.
[1994, B-package] 80% ?? <- Urban Fagerstedt and Palli K. guess

Record [IBM Federal Systems Division, 1976-80] 0%
<- RDM 9.0 quoting Harlan Mills in IBM SJ 4-80
"all projects on time and under budget"
[Raytheon Defense Electronics, 1992-5] 0% <- RDE SEI Report 1995 Predictability.

Fail [All future projects, from 1999] 5% or less <- discussion level TG

Goal [All future projects, from 1999] 0% or less <- discussion level TG

Lead-Time: (another real example)

Lead-Time:

"Months for major Packages"

Ambition: decrease months duration between major Base Station package release.

Scale: Months from TG0, to successful first use for major work station package.

Note: let us make a better definition. TG

Past [C Package, 1996?] 20? Months?? <-guess tg

Goal [D-package] 18 months <- guess tg

Goal [E-package and later] 10.8 Months <- R PROJECT 96 1.1 a "40% > D"

Goal [Generally] ??? <- R PROJECT AS 3a

"10% Lead-Time reduction compared to any benchmark".

Productivity (template)

- **Scale:**
  - **Net Profit**
  - **per financial year**
  - **derived from defined new [Products or Services]**

Process Transportability (template)

- **Scale:**
  - **the cost,**
  - **in % of affected persons Gross Annual Cost,**
  - **for successfully learning to deploy a defined [Process]**
  - **to a defined [Capability Level].**

Competitiveness (template)

Scale:

- **Average % impact**
- **on a defined set of [Competitiveness Measures]**
- **within a year**
- **from First Deployment**
- **in a defined [Organization].**

Risk Controllability (template)

Scale:

- **the % probability that**
- **defined [Project or Product Requirements]**
- **can be delivered**
- **within defined [% of Target Levels]**
- **under conditions of defined [Risks].**

Prioritization Ability (template)

Scale:

- **the average speed in Days**
- **that a new [Priority Item]**
- **can be effectively acted upon.**

Product Attributes:

Product Attributes:

"Keeping Product Promises."

Ambition: Ability to meet or beat agreed targets, both cost, time and quality. (except TTMP itself, see above)

Scale: % +/- deviation from [defined agreed attributes with projects].

Past [1990 to 1997, OUR DIVISION] at least 100% ???

<- Guess. Not all clearly defined and differences not tracked. TSG

Goal [Year=2000, R PROJECT] near 0% negative deviation <- TsG for discussion.

Customer Satisfaction

Customer Satisfaction:

"Customer Opinion of Us"

Scale: average survey result on scale of 1 to 6 (best)

Meter: The Company Customer Satisfaction Survey

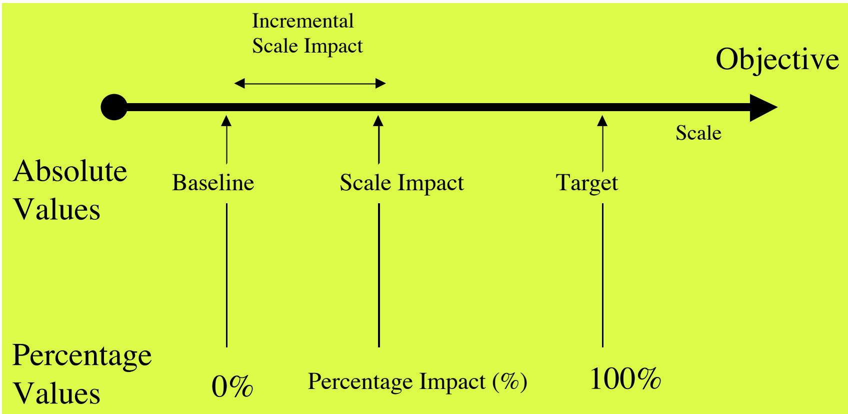
Past [1997] 4

Goal [1998-9?] 5 <- R PROJECT 96 1.1 b

Impact Estimation:

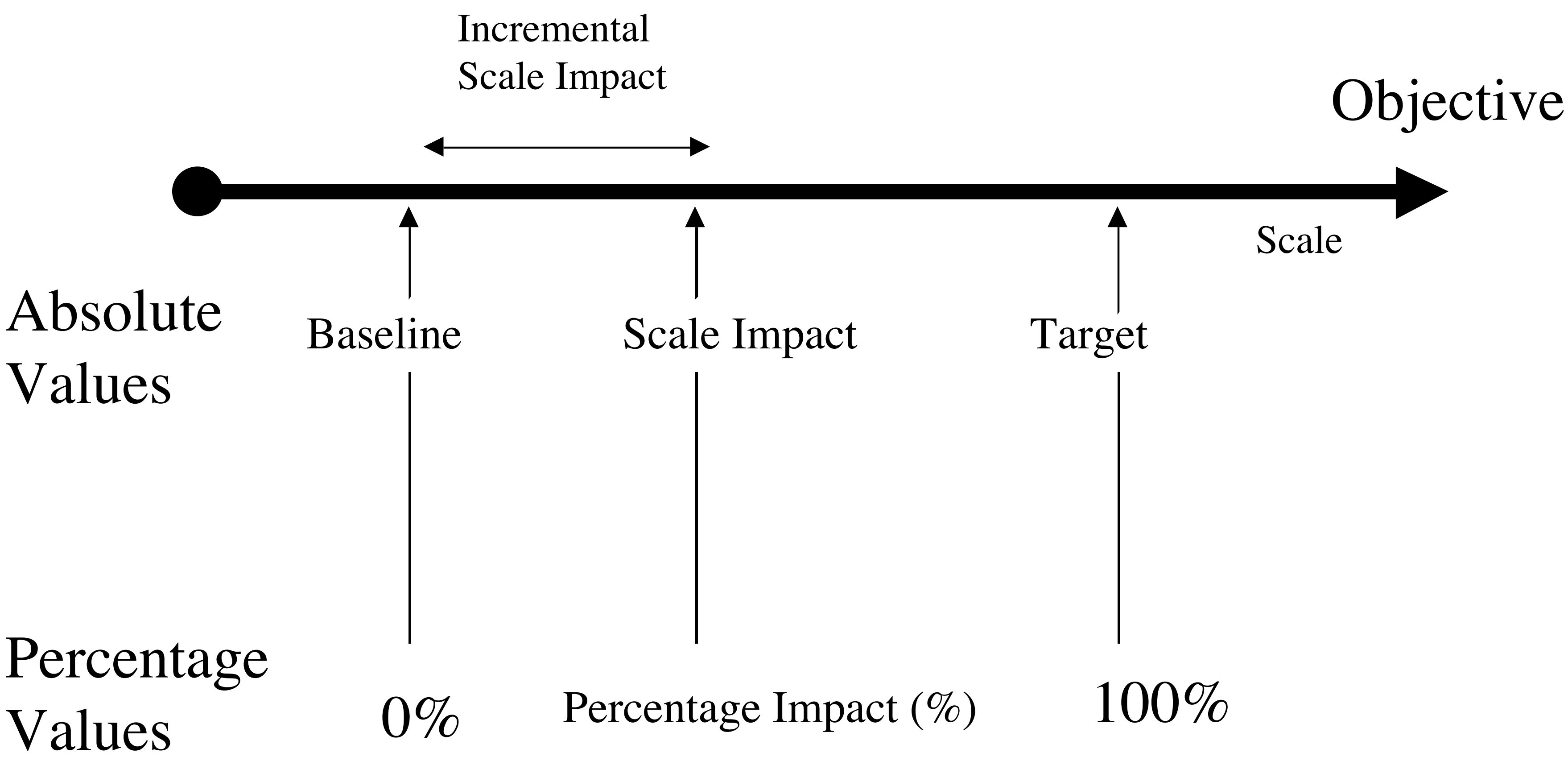
a **tool** for initial evaluation of *how good* a process *might be*

- **The *second* implication is that**
  - **we can evaluate initially using Impact Estimation (IE) Tables**
- **We can estimate the degree of <u>expected impact</u>**
  - **on *organizational performance characteristics,***
  - **and on *resource budgets*.**
- **'Impact Estimation' is an engineering process**
  - **that forces us to ask**
    - **"exactly how much will *your process* impact *my unfilled engineering objectives?"***
- **This assumes that we have taken the trouble to define, and approve, a set of engineering objectives, like the ones cited above.**



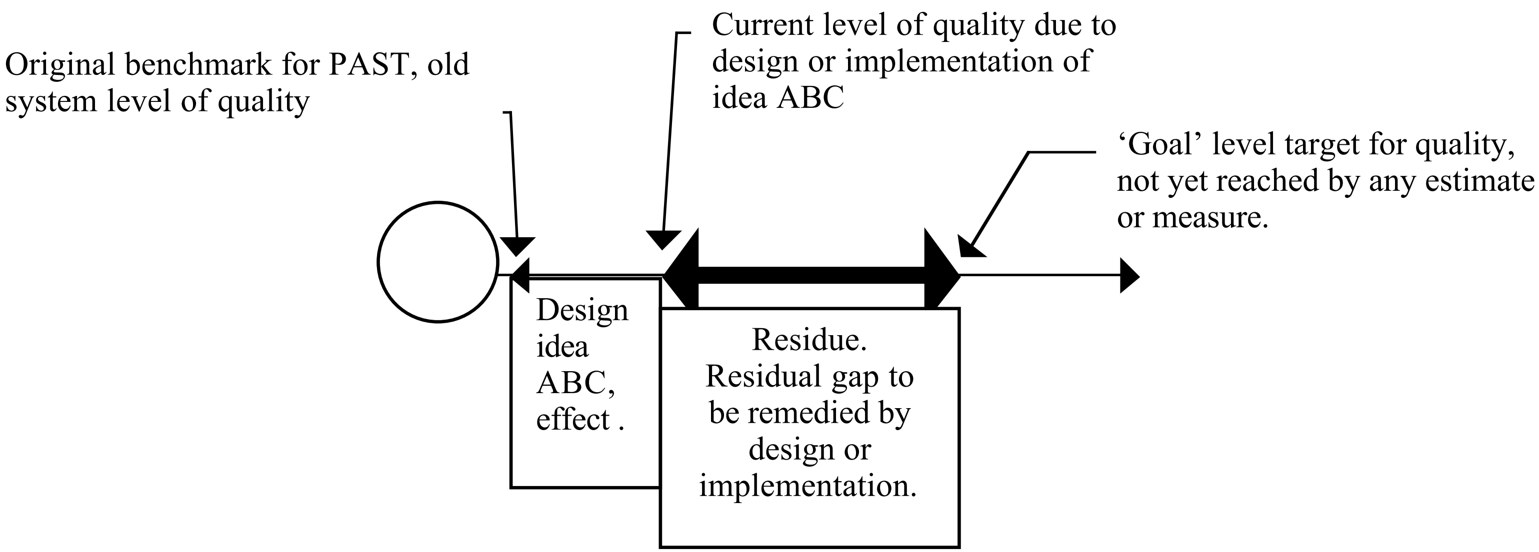
<--See next slide for detail

Impact Estimation Basic Concepts



Source: Competitive Engineering

How do we evaluate a single dimension of impact?



We must estimate, or measure, the numeric cumulative impact of the design

- on a defined Scale (a definition of the quantification concept, like mph, bits/sec),
- using a defined Meter, (a sketch of a test process, where are we along that scale?)
- with respect to target and constraint levels. (like 'Goal' and 'Fail')
- 'Cumulative' - the effect it has after other designs are in place.
  - Consider synergy effect of other designs (2+2 > 4)
  - Consider thrashing effect of other designs (2+2 < 4)

US Army Example: PERSINSCOM

STRATEGIES → OBJECTIVES	Technology Investment	Business Practices	People	Empow-erment	Principles of IMA Management	Business Process Re-engineering	SUM
Customer Service ?→0 Violation of agreement	50%	10%	5%	5%	5%	60%	185%
Availability 90% → 99.5% Up time	50%	5%	5-10%	0	0	200%	265%
Usability 200 → 60 Requests by Users	50%	5-10%	5-10%	50%	0	10%	130%
Responsiveness 70% → ECP's on time	50%	10%	90%	25%	5%	50%	180%
Productivity 3:1 Return on Investment	45%	60%	10%	35%	100%	53%	303%
Morale 72 → 60 per mo. Sick Leave	50%	5%	75%	45%	15%	61%	251%
Data Integrity 88% → 97% Data Error %	42%	10%	25%	5%	70%	25%	177%
Technology Adaptability 75% Adapt Technology	5%	30%	5%	60%	0	60%	160%
Requirement Adaptability ? → 2.6% Adapt to Change	80%	20%	60%	75%	20%	5%	260%
Resource Adaptability 2.1M → ? Resource Change	10%	80%	5%	50%	50%	75%	270%
Cost Reduction FADS → 30% Total Funding	50%	40%	10%	40%	50%	50%	240%
SUM IMPACT FOR EACH SOLUTION	***482%***	***280%***	***305%***	***390%***	***315%***	***649%***	
Money % of total budget	15%	4%	3%	4%	6%	4%	
Time % total work months/year	15%	15%	20%	10%	20%	18%	
SUM RESOURCES	***30***	***19***	***23***	***14***	***26***	***22***	
BENEFIT/RESOURCES RATIO	**16:1**	**14:7**	**13:3**	**27:9**	**12:1**	**29:5**	

QUANTIFIED ENGINEERING BUSINESS OBJECTIVES

Real (NON-CONFIDENTIAL version) example

of an initial draft of setting the objectives that engineering processes must meet.

Business objective	Measure	Goal (200X)	Stretch goal ('0X)	Volume	Value	Profit	Cash
Time to market	Normal project time from GT to GT5	<9 mo.	<6 mo.	X		X	X
Mid-range	Min BoM for The Corp phone	<$90	<$30	X		X	X
Platformisation Technology	# of Technology 66 Lic. shipping > 3M/yr	4	6	X		X	X
Interface	Interface units	>11M	>13M	X		X	X
Operator preference	Top-3 operators issue RFQ spec The Corp	1	2	X		X	X
Productivity						X	[illegible]
Get Torden	Lyn goes for Technology 66 in Sep-04	Yes		X		X	X
Fragmentation	Share of components modified	<10%	<5%		X	X	X
Commoditisation	Switching cost for a UI to another System	>1yr	>2yrs		X	X	X
Duplication	The Corp share of 'in scope' code in best-selling device	>90%	>95%		X	X	X
Competitiveness	Major feature comparison with MX	Same	Better	X		X	X
User experience	Key use cases superior vs. competition	5	10	X		X	X
Downstream cost saving	Project ROI for Licensees	>33%	>66%	X	X	X	X
Platformisation IFace	Number of shipping Lic.	33	55	X		X	X
Japan	Share of of XXXX sales	>50%	>60%	X		X	X
	Numbers are intentionally changed from real ones						

Engineering
<-- Business
Objectives
Quantified

Proposed PROCESS Impact Estimation:
for a £50,000,000 Organizational Improvement Investment

Technical PROCESSES

Objectives

Viking Deliverables

100% = meets Business Objective's Goal level, on time

Business Objective	hardware adaptation	Telephony	Reference designs	IFace	Modularity	Defend vs Technology 66	Tools	User Experce	GUI & Graphics	Security	Defend vs OCD	Enterprise
Time to market	20%	10%	30%	5%	10%	5%	15%	0%	0%	0%	5%	5%
Mid-range	15%	0%	15%	0%	30%	15%	5%	10%	5%	5%	0%	0%
Platformisation Technology	25%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0%	5%	0%	10%	0%	5%
Interface	5%	15%	15%	0%	5%	0%	5%	0%	0%	10%	0%	10%
Operator preference	0%	10%	0%	15%	5%	20%	5%	10%	10%	20%	5%	10%
Get Torden	25%	10%	[illegible]	[illegible]	[illegible]	[illegible]	0%	10%	-20%	10%	10%	5%
Commoditisation	20%	10%	20%	10%	-20%	25%	15%	0%	0%	5%	10%	5%
Duplication	15%	10%	10%	[illegible]	0%	40%	0%	0%	0%	5%	20%	5%
Competitiveness	10%	15%	20%	[illegible]	10%	20%	10%	10%	20%	10%	10%	10%
User experience	5%	[illegible]	0%	0%	20%	0%	0%	30%	10%	0%	0%	0%
Downstream cost saving	15%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10%	0%	0%	10%	5%
Platformisation IFace	10%	10%	20%	40%	0%	20%	5%	0%	0%	0%	0%	5%
Japan	10%	5%	20%	0%	10%	0%	0%	10%	5%	0%	0%	0%
Contribution to overall result	15%	9%	17%	4%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5%
Cost (£M)	£ 2.85	£ 0.49	£ 3.21	£ 2.54	£ 1.92	£ 2.31	£ 0.81	£ 1.21	£ 2.68	£ 0.79	£ 0.62	£ 0.60
ROI Index (100=average)	106	358	109	33	78	137	148	107	10	152	202	174

"Benefits"

PROCESS Impacts on Objectives

Cost

Benefit/Cost ratio

358 !

Principle 2. 'PROCESS ENTROPHY'
When organizational objectives change, or are satisfied by *other* means, the usefulness of a given process may decline or disappear.

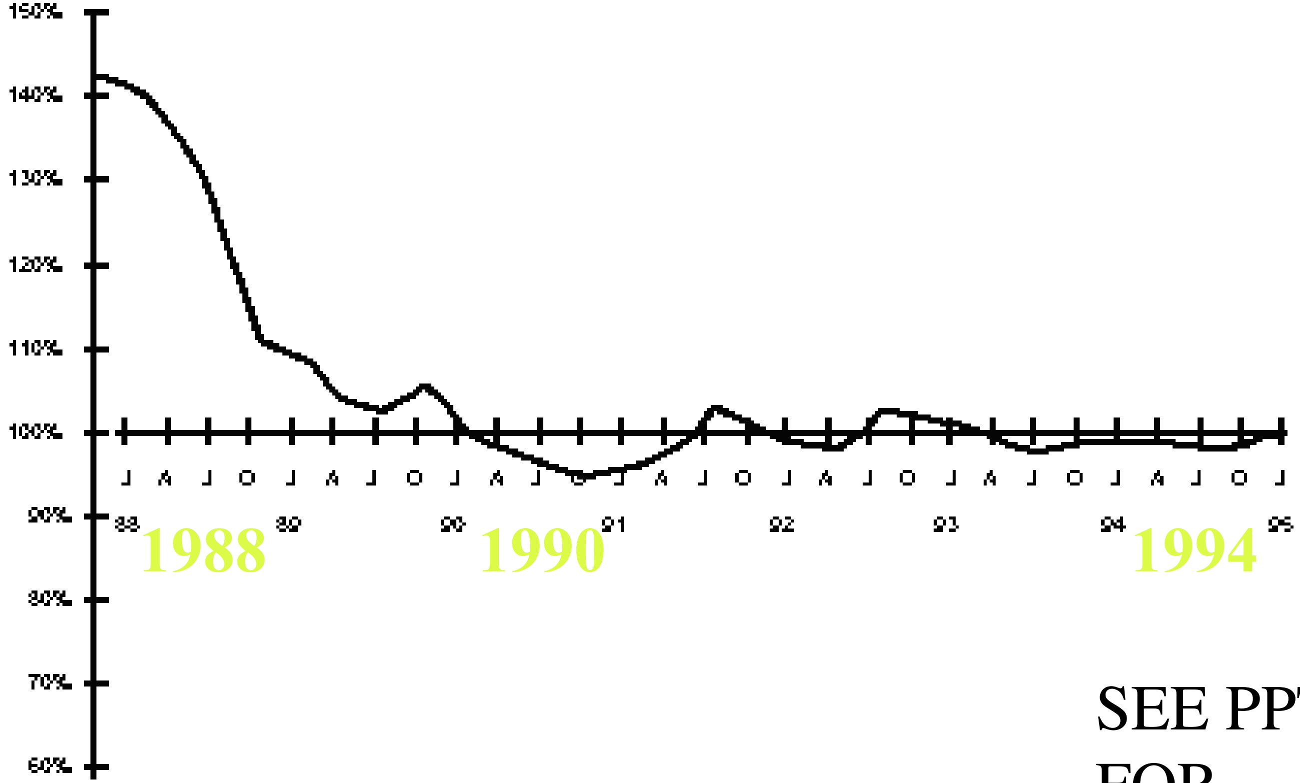
- *Organizational engineering objectives* are subject to pressures that demand constant tuning, updating and even radical change ASAP. (market, organization change, tech)
- It is simple enough to change target number and due dates in a set of objectives.
  - But stopping the process change ship, in mid Atlantic, is quite another problem.
  - Major investments in contracts and training may have been set in motion.
  - Maybe they have suddenly become obsolete!
- This argues for implementing processes with the following considerations:
  - Highest value-to-cost processes first
  - Highest risk-of-obsolescence processes last
- You would have to understand the volatility of an objective's target levels, to determine that risk.
- *Large and costly processes* need to be decomposed into *smaller, early implementations,*
- and *high value low volatility sub-processes* need to be prioritized.
  - This method is detailed as the Evo method [CE book , Chapter 10].

Achieving Project Predictability: Raytheon 95

Cost At Completion / Budget %

140%

100%



SEE PPT NOTE FOR DEFINITION.

Principle 3. 'PROCESS EFFICIENCY'
Processes that are equivalent in their performance effects, can be *distinguished* by their 'efficiency' – (their use of limited and budgeted resource costs).

- **The primary characteristic of en engineering process is**
  - **its ability to <u>help us reach</u> our engineering <u>target levels</u>**
- **If it does *not* do that,**
  - **it does not matter *how cheap* it is.**
- **The second consideration is**
  - **that the costs, all types of cost, are <u>within budgets</u>, or profitability limitations.**
- **In addition a single process cannot (should not)**
  - **<u>steal resources from</u> more-profitable processes.**
- **Decisions about what to <u>spend</u> on process implementation**
  - **cannot be made in isolation**
  - **from all other processes**
  - **that use concurrent resources.**
- **The Impact Estimation table helps us**
  - **get a view of all of these considerations.**

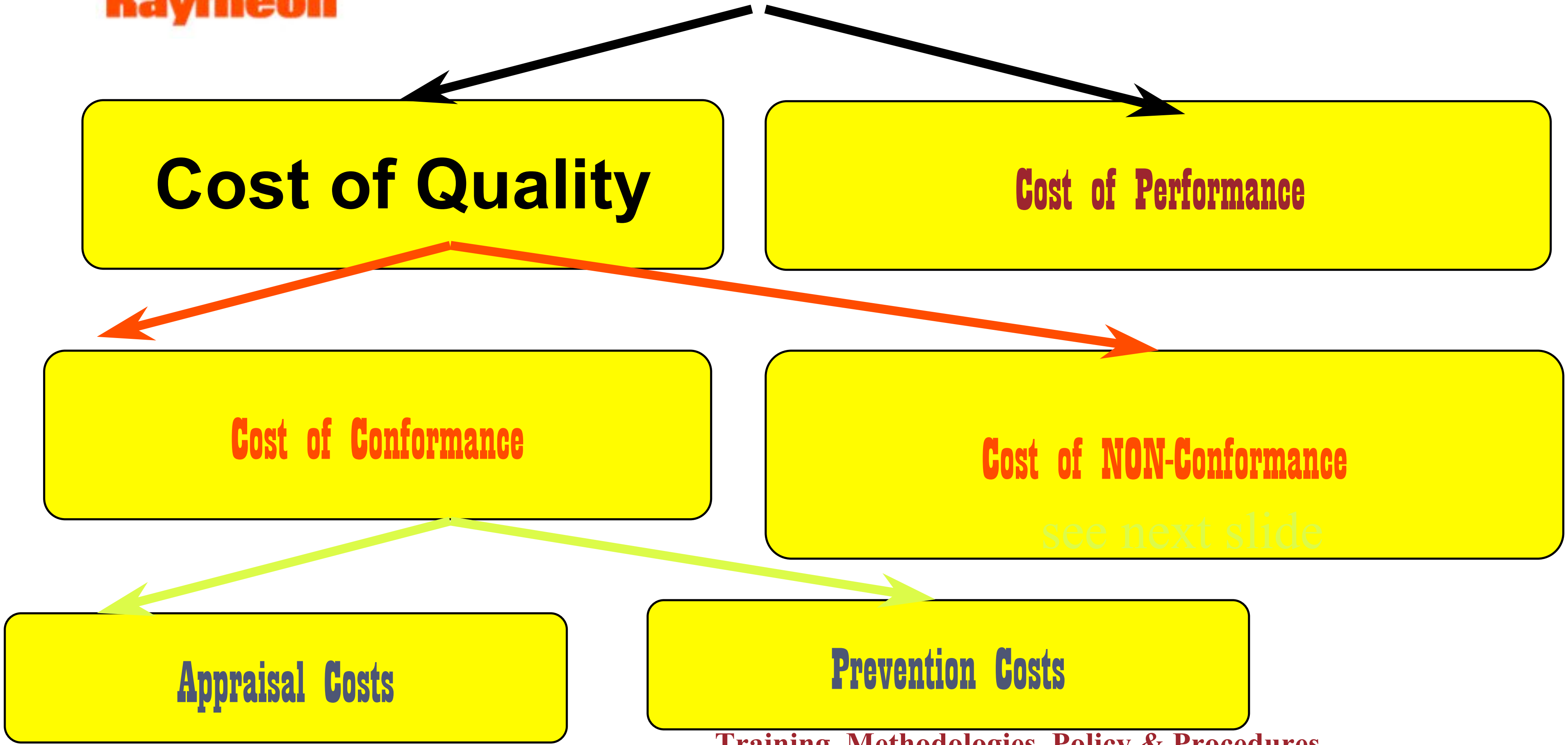
Process Return On Investment

Raytheon

- $7.70 per $1 invested at Raytheon
  - For 1,000 Programmers
  - Sell your improvement program to top management on this basis
  - Set a concrete target for it
  - Raytheon ‘cornered’ money going for improvements by convincingly demonstrating their ROI
  - PLAN [Our Division, 2 years hence] 8 to 1

Project Cost

Raytheon



Reviews, Inspections, Testing 1st time, IV&V (1st), Audits

Training, Methodologies, Policy & Procedures, Planning, Quality Improvement Projects, Data Gathering and Analysis, Fault Analysis, Root Cause Analysis, Quality Reporting.

Costs of Non-conformance Items

Raytheon

Re-reviews

Re-tests

Fixing Defects (code, documentation)

Reworking any document.

Engineering Changes

Lab Equipment Costs of Retests

Updating Source Code

Patches to Internal Code

Patches to Delivered Code

External Failures

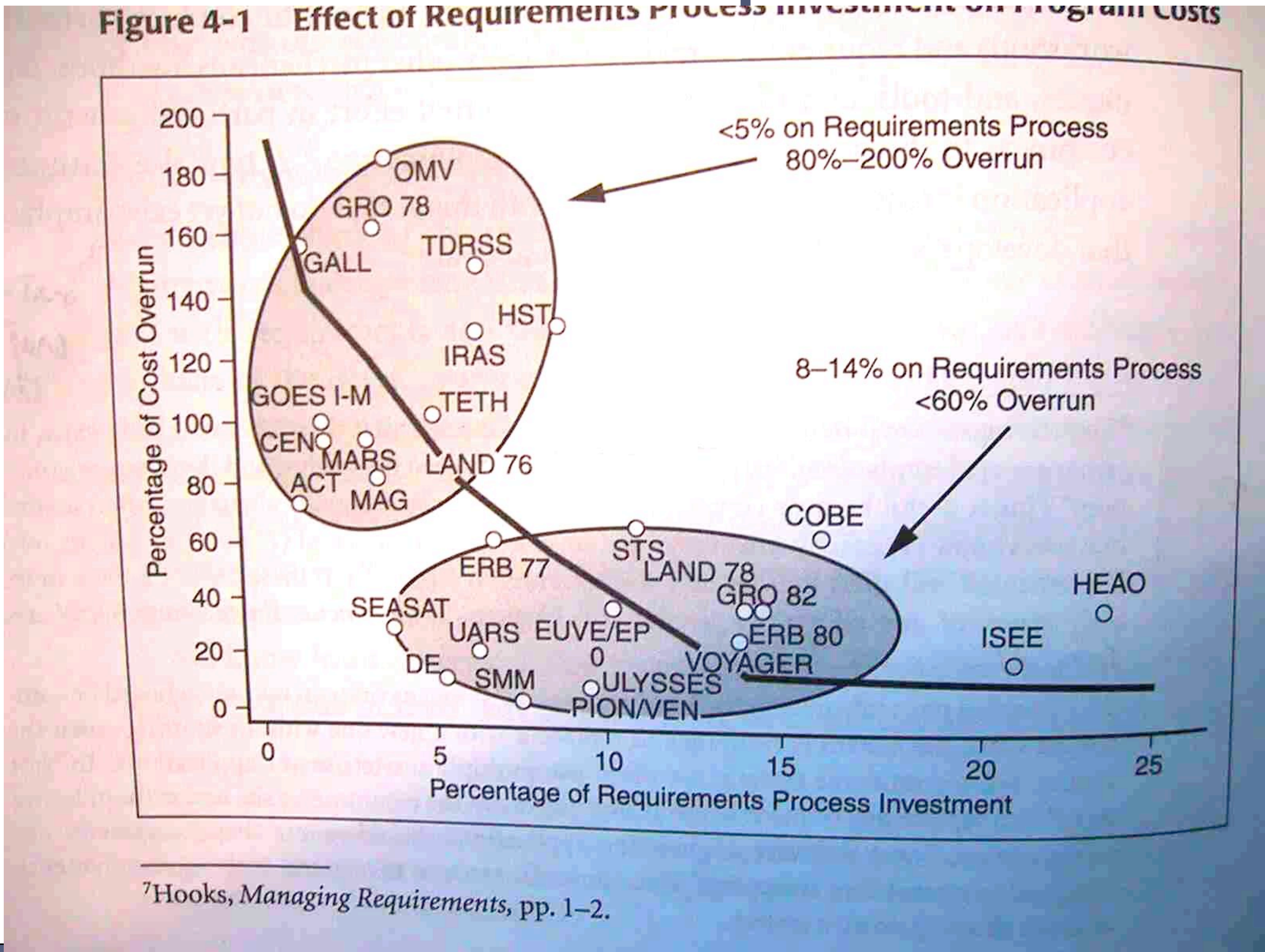
from Crosby's Model according to Raytheon95 Fig. 7

Principle 4. 'MEASURE PROCESS RESULTS'

We can *estimate* the *efficiency* (value-to-cost ratio) of a process, based on experience with it,
or with similar processes;
but we cannot be certain of the process impacts,
until we *measure* them, *in place* - in *our* organization.

- **Estimations are guesses,**
  - **and we all know they are not for sure.**
- **Consequently, we cannot bind ourselves**
  - (in contracts, and corporate plans)
  - **to *full* implementation of a** particular **process**
  - **until it is proven to *deliver to expectations,* in practice.**
- **This requires evolutionary implementation,**
  - **for example, on a *project-by-project* basis,**
  - **or even in small groups, within larger projects.**
- **If the estimates are validated by practical experience,**
  - **we can ramp up.**
  - **Otherwise we may have to**
    - **drop the new engineering process,**
    - **replace it with another**
    - **or tune it to work properly.**

Investment in Requirements



Principle 5. 'PROCESS VARIABILITY'

Just because we have measured the process efficiency once, does not mean that the efficiency will not change for better or for worse, in time, or in other circumstances.

- **We should have a commitment to *long- term measurement***
  - **that the processes are still working**
  - **with the impacts they *initially* were validated to have.**
- **Processes may well have to be reinforced**
  - **(training, motivation, management support),**
  - **and they may well have to be re-tuned**
    - **(taken seriously – done properly - instead of done for show).**
- **This does not have to be expensive or frequent.**
  - **For example, *sampling* should be sufficient.**
  - **And we can at least measure *new people* using the process**
    - **(new hires, new projects).** A 'CMMI Audit does not prove they do it right!
- **This *process measurement process* is the basic cost,**
  - **like financial auditing,**
  - **of making sure we get value for process money.**
- **This process measurement cost has to be planned and budgeted**
  - **as a part of understanding whether we should use the process at all.**

- If we can't afford to check that it works, then we can't afford to do it.

Cost of Quality over Time: Raytheon 95

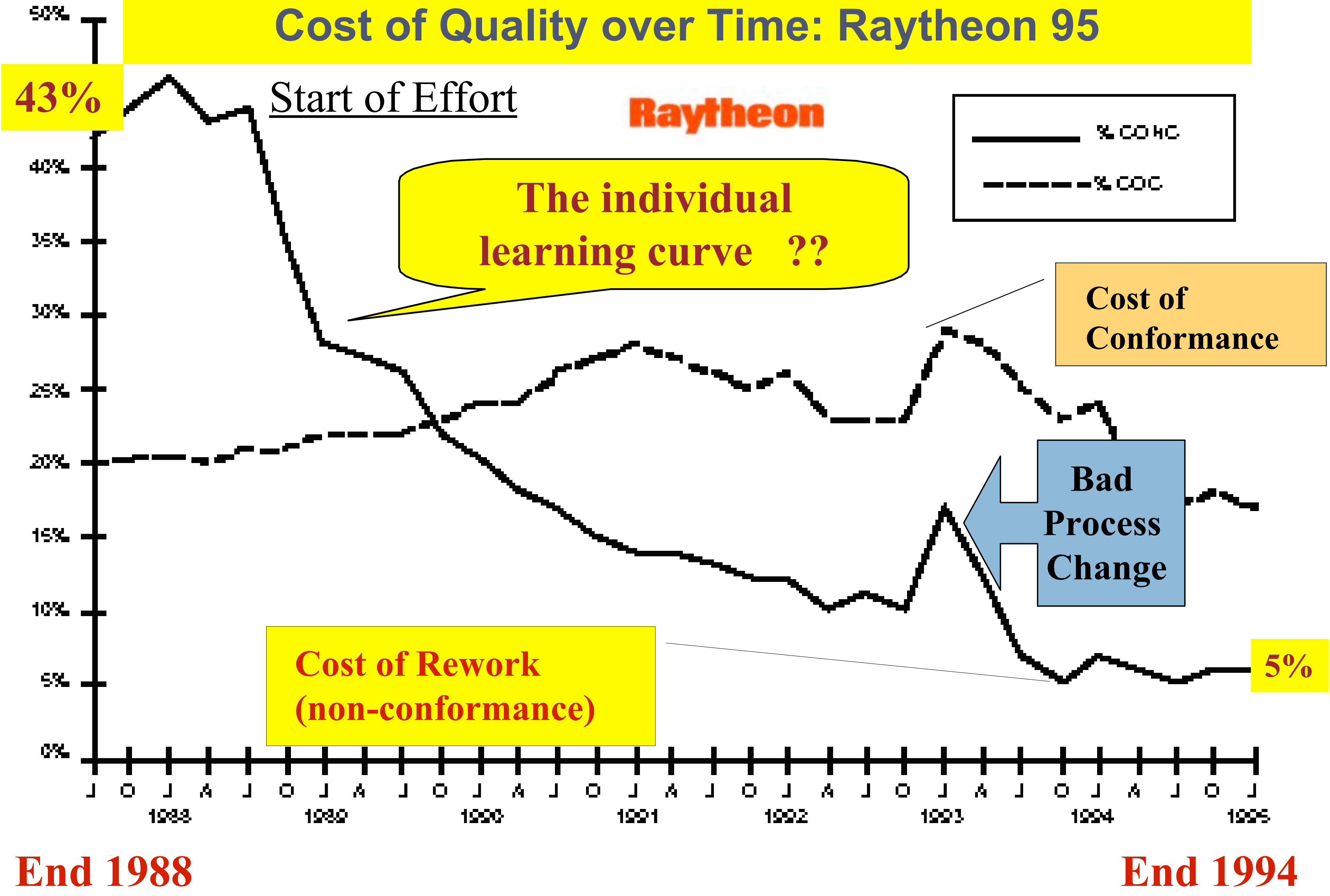


Figure 8: Cost of Quality Versus Time

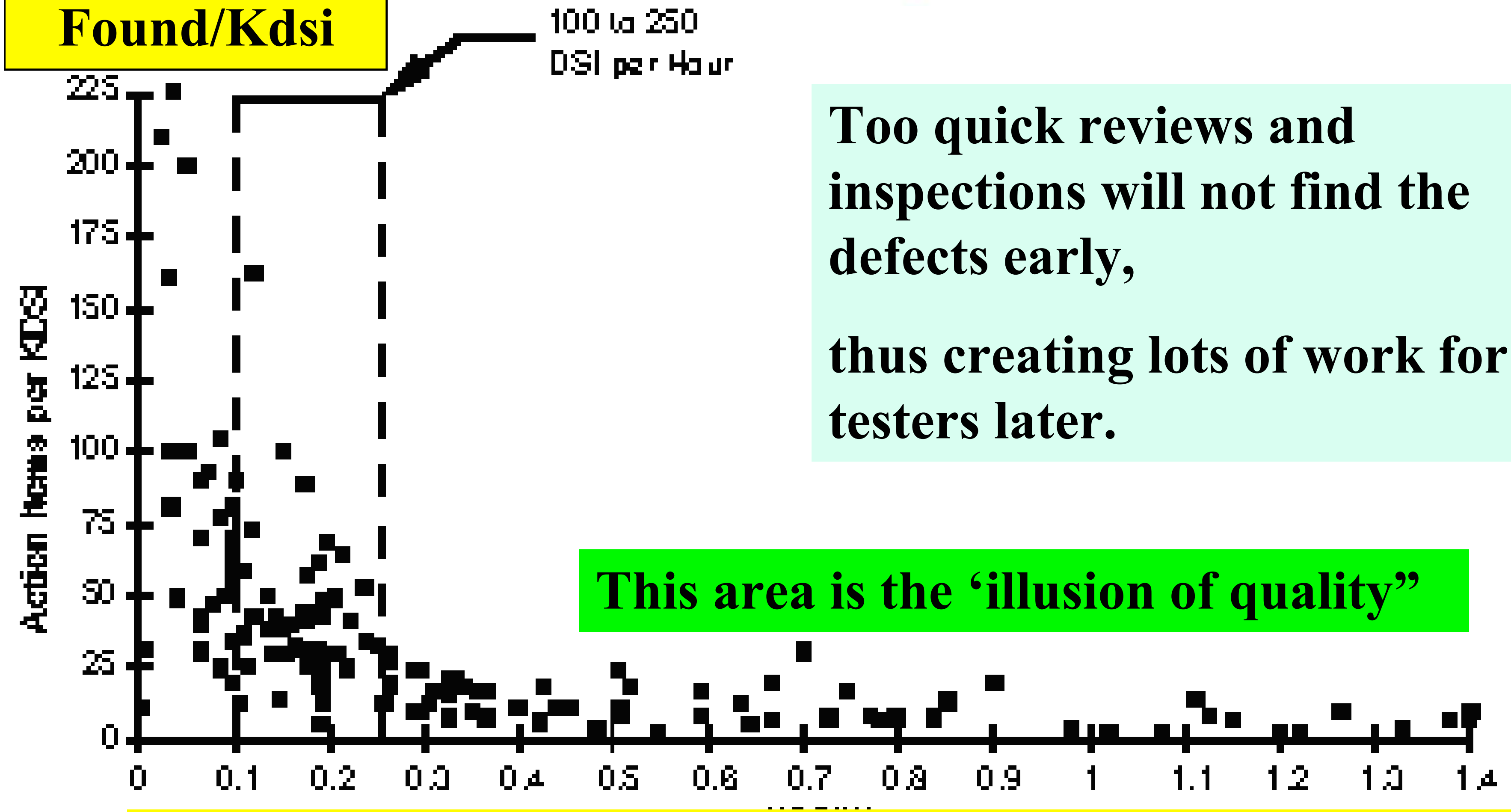
Principle 6. 'PROCESS MALPRACTICE'

If the *process efficiency* (Impact/Cost) does not meet the *estimated levels of efficiency,* then one possible cause is *malpractice* of the process.

- Many engineering processes are complicated, and malpractice of an apparently small detail, 'cutting corners', will be tempting for those who do not know the consequences, or do not care.
  - So, just because a highly estimated practice does not appear to give the results experienced elsewhere, does not mean it will not work for you.
  - You might have to bring in expertise on successful use of the method
    - (or read the process recipe more carefully).
- My favorite example is in 'Specification Quality Control' [CE, Chapter 8].
  - most people who claim they are using the method (also known as Document Inspections) do not practice 'checking at the optimum checking rate' (about one page per hour). See next slide.
  - They try to check 5 to 50 page documents in an hour or two,
    - with the inevitable consequence that
      - the defect detection rate can fall by at least an order of magnitude.
  - They then falsely conclude that the process is *'no good at finding defects!'*

Fault Density versus Checking Rate: Raytheon 95
AN EXAMPLE OF NOT FOLLOWING THE PROCESS WELL

Defects Found/Kdsi



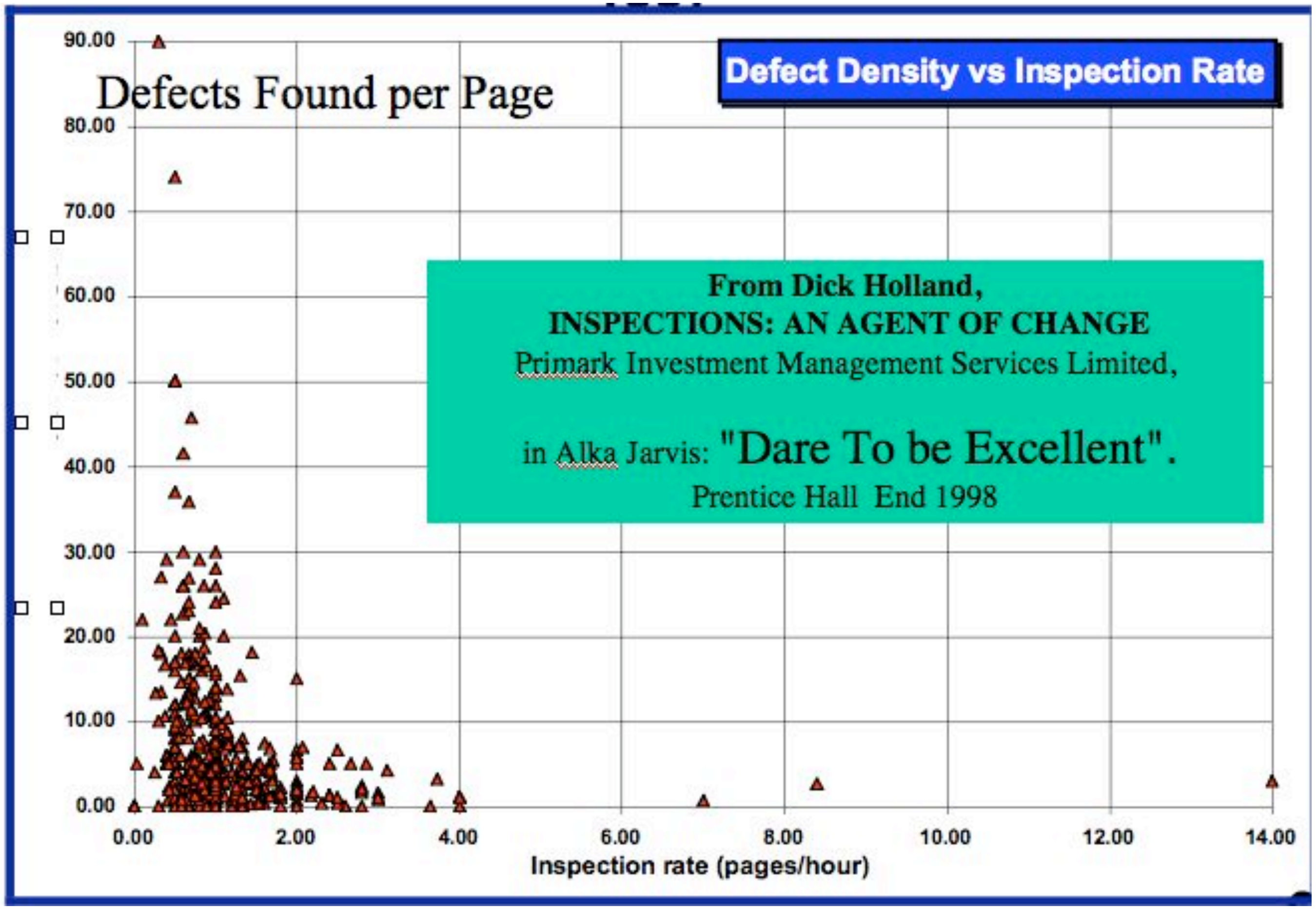
Too quick reviews and inspections will not find the defects early,

thus creating lots of work for testers later.

This area is the 'illusion of quality"

Thousands of Statements Checked per hour by a person

Counter example: Report from a client of ours who took engineering process control *seriously*.



A copy of the full case study Will be found at www.gilb.com

- **Most document inspections here are run at an appropriate rate (<1 page/ individual/hour) for discovering defects.**
- **The few that are *not* (like 14 pages per hour) prove the point of this detail of the process.**
- **There is a limit to the speed of the engineers mind for checking things!**

Principle 7. 'EVOLVE PROVEN PROCESSES'

Processes should be implemented in small evolutionary steps,
early, and measured for effects
before scaling up
and before combining with other processes.

- **There are always pressures and temptations to install exciting new engineering processes all at once in an organization.**
- **I have had clients trying to pressure us into training hundreds of engineers in a new process within a year, when there were no instances where the process was working as it should do.**
- **Our audit showed that after a year.**
  - **They had no truly successful model to follow!**
  - **Corners were being cut, pressured by managers who did not take the weeks training their engineers got from us.**
  - **Ultimately the client reported about $ 10 million from the use of our process teachings.**
  - **But I am convinced they could have done an order of magnitude better as HP did [Grady].**
  - **If they had followed out persistent advice to master the process locally and spread the correct process and its measurements.**
  - **They actually argued that massive training and bottom up process change was their corporate culture.**
  - **Maybe it was, but it felt to us like generals sending kids into battlefield slaughter unnecessarily, and then claim credit for the needlessly bloody victory.**
  - **Brute force can work, but I do not admire its efficiency!**

The One Page Summary (Real Case)
(an example of starting early, and evolved)

The Dominant Goal

Improve Software Productivity in R PROJECT by 2X by year 2000

Dominant (META) Strategies

Continual Improvement (PDCA Cycles)
.DPP: Defect Prevention Process
.EVO: Evolutionary Project Management

Long Term Goal [1997-2000+]

DPP/EVO, Master them and Spread them on priority basis.

Short Term Goal [Next Weeks]

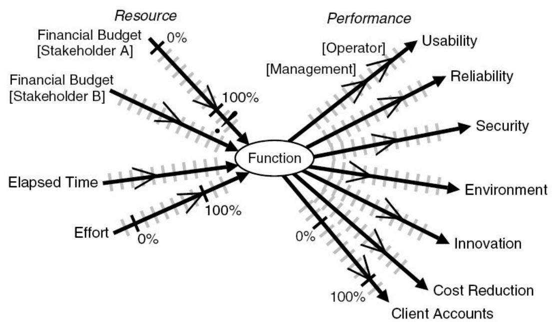
DPP [RS?]
EVO [Package C ?]

Decision: {Go, Fund, Support}

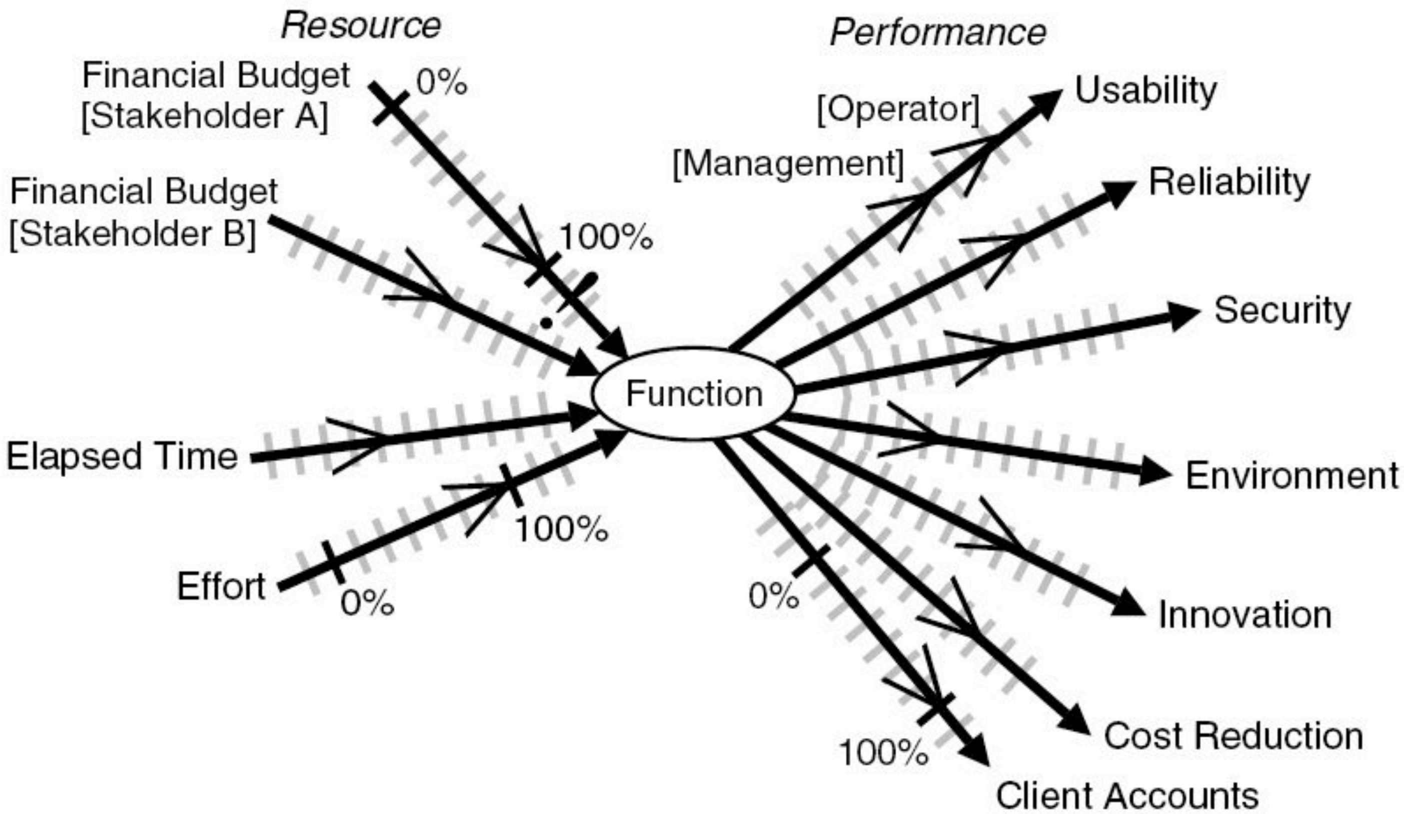
Principle 8. PROCESSES MULTIPLE IMPACTS

Process impacts will always be on multiple critical organizational performance and cost characteristics; so we must not evaluate them in single dimensions alone.

- ○ **It is a general characteristic of any design or architecture,**
  - **including any process design,**
  - **that when you install it in a system (organization)**
  - **it tends to have some impacts on**
    - ***many* critical performance**
    - **and cost attributes,**
    - **and significant impacts on more than one.**
    - ○
- **So, evaluation of any major engineering process based on**
  - **a single dimension (for example Productivity)**
  - **is doomed to incomplete and risky.**
- **The other effects can be**
  - **positive**
  - **and they can just as well be negative side effects.**
  - **They can be intolerable effects.**
  - ○
- **You therefore need to**
  - **both estimate all side effects,**
  - **and you need to measure them in your evolutionary pilot installations of the process.**
  - **Impact Estimation tables used for both estimates and feedback**
    - **are a good practical tool here to keep track.**



Multiple Attributes of a Process



A representation of multiple performance and resource attributes showing goal and budget levels respectively. The 'point' of the icon goal and budget symbols indicates the level (reference needs to be made to the Scale to interpret the numeric value). One constraint, a Fail level, is shown on the resource attribute for Financial Budget [Stakeholder A]. The lines of the arrows represent the scales of measure (divisions along the scales are also marked).

THE NAMES GIVEN ARE MERELY CHANCE ILLUSTRATIONS. The actually interesting attributes depend on your objectives.

Source: "Competitive Engineering" book, "Scales of Measure" chapter, page 163, Figure 5.5

Principle **9. PROCESS JUSTIFICATION**

The entire justification for any process should rationally be the efficient effects on our organizational objectives; so they should never be mandated as 'best practices', but should forever be monitored for their justification.

- **We need to stop the dogmatic culture of mandating processes**
  - **because they are 'known best practices'**
  - **or because they are in some set of key practices in some standard such as CMMI.**
  - **This is primitive and people who do it are not real engineers!**

•There needs to be a clear corporate policy like

– ***"All engineering practices***
  - ***must always prove themselves***
  - ***numerically***
  - ***in terms of***
    - ***our plans and needs"***

•Another approach to process choice is

- **to be clear that**
  - **engineering communities are**
  - **charged with well defined engineering <u>results</u>**
    - **(quality on time , for example)**
- **and they are**
  - **free to use any engineering process they want**
  - ***that gets them to results,***
- **and they are**
  - *(with some unfortunate political exceptions)*
  - **<u>free to avoid</u> using any engineering processes**
    - **which <u>prevent</u> them from reaching their objectives.**

•The best CEOs and CTO’s I have known, make this (processes for results) clear to their engineers.

- **For example John Young, CEO at HP in his ‘10X’ policy** (next slide for detail on 10X)
  - **which applied for a whole decade, that engineers would be supported in getting ‘ten times better quality’, with whatever methods worked!**
    - **They got 9.95 X better by the end of the decade. See next slides.**
    - **HP is a good example of <u>inspiring</u> the troops and <u>supporting</u> them in finding the right technical solutions.**
  - **None of this “you will get CMMI Level 3 this year” that I have seen some CEO’s guilty of.**
    - **At least one CEO client of mine realized his mistake and changed to giving his CTO a bonus based on the *measurable* engineering *productivity* that the “CMMI level 3” achievement was supposed to bring about.**

CEO JOHN YOUNG'S HP 10X Software Challenge

*Approaches to process improvement ...***10X**

"We need similar gains in the quality of our software products to achieve the same excellent reputation for quality that our hardware products have earned.

For this reason I am extending the commitment made for hardware to software.

"HP is to achieve a tenfold improvement in two key software quality mea

in the next five years.

The first measure is aimed at our design process;

The second at our ability to solve problems

once customers have our products in place. "

John Young

We will measure these improvements by...

- Post Release Defect Density -

The total number of defects (KPRs) reported from any source,during the first twelve months after first shipment, divided by the size (KNCSS) of the product.

This measure helps us to understand the effectiveness of our design and testing process and is in a format widely used in industry.

- Open and Serious KPRs -

The number of service requests classified as KPRs (Known Problem Reports) which have a severity of critical or serious which are not yet closed or signed off at the end of the month.

This measure helps us to focus on the support process involved in providing permanent solutions to severe customer problems."

John Young HP's CEO, 24 April 1986

http://www.osel.co.uk/presentations/SPI%20Approaches.pdf

Bill and Dave at the Garage

The HP Result of the 10X Policy

HP announced at the end of the ten years

That they had achieved 9.95 X on average.

(from an internal HP newsletter at end of 1980's) tsg

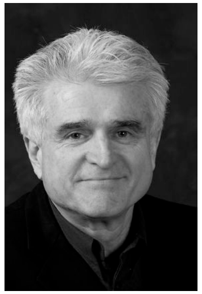

John Young

invent

Principle 10. **'PROCESS RESOURCE CREATION'**

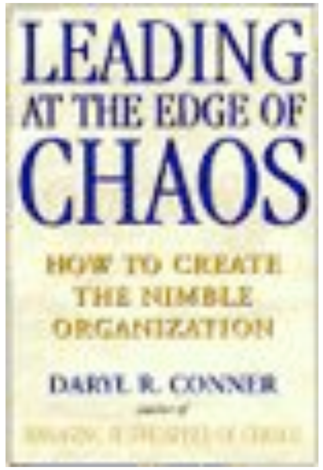
Before implementing any new process, the resources to implement, and to maintain it, should be created by conscious and specific removal of less efficient processes that they will replace. [Conner98]

- **Conner makes a major point**
  - **in his incredibly deep book**
  - **that we have to get pretty formal about reducing the load of process change (overload) on most engineer's shoulders.**
- **The world's greatest process for you will not be successfully implemented**
  - **unless top management clearly removes the burdens of past process failures.**
- **We need to create a human capacity for people to prioritize the best changes,**
  - **the ones that are needed now, and will really work.**
- **We are going to have to unceremoniously dump masses of process baggage**
  - **that cannot prove its necessity based on measured facts,**
  - **and with relation to current objectives.**
- **Give your engineers a fair chance to implement ideas,**
  - **give them the time and money necessary to do it.**



Daryl R. Conner

Chairman of Conner Partners,
http://www.connerpartners.com/



Leading at the Edge of Chaos
John Wiley & Sons, 1998)

ADVANCED REFACTORING: creating future resources by regular re-engineering

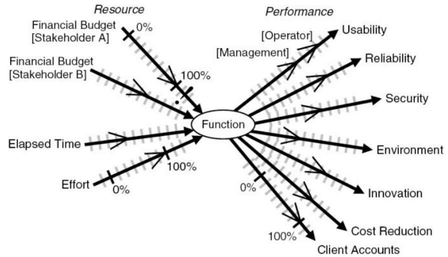
One 70 employee client of mine, building a successful Web Opinion Survey Product, (Future Information Research Management, product: Confirmit) successfully practices (on a small agile scale) just about everything we are talking about in this paper. [Gilb and Johansen], but they have one practice I

Current Status	Units	Improvement	Goals: Past	Goals: Tolerable	Goals: Goal	Step 6 (week 14): Estimated Impact	Step 6 (week 14): Actual Impact	Step 7 (week 15): Estimated Impact	Step 7 (week 15): Actual Impact
	100,0	100,0	0	80	100			100	100
Speed									
	100,0	100,0	0	80	100	100	100		
Maintainability.Doc.Code									
	100,0	100,0	0	80	100				
InterviewerConsole									
NUnitTests									
	0,0	0,0	0	90	100				
PeerTests									
	100,0	100,0	0	90	100			100	100
FxCop									
	0,0	10,0	10	0	0				
TestDirectorTests									
	100,0	100,0	0	90	100			100	100
Robustness.Correctness									
	2,0	2,0	0	1	2	2	2		
Robustness.BoundaryConditions									
	0,0	0,0	0	80	100				
Speed									
	0,0	0,0	0	80	100				
ResourceUsage.CPU									
	100,0	0,0	100	80	70	70			
Maintainability.Doc.Code									
	100,0	100,0	0	80	100	100	100		
SynchronizationStatus									
NUnitTests									

Green Week: Preventative Maintenance

- **They use one of every five 'weekly evolutionary result delivery steps', and shift their normal customer/user focus to measurable improvement (by *any* means they see fit) of the *internal* product qualities, as viewed by the internal stakeholders (developers, maintainers, testers).**
- **They are completely driven by 12 long-term product quality goals (regarding testability, maintainability for example). They can use any process or technology that in fact delivers the engineering goals. The grass roots people themselves can discover and try out the techniques. Management does not want to tell them what to do. They love it and have "empowered creativity".**

Conclusion



- **We can and should think about engineering processes in terms of their <u>multidimensional contribution</u>**
  - **to meeting our <u>defined engineering process objectives</u>**
  - **(aka Business Objectives).**
- **We need to be continuously aware of necessary changes in our objectives,**
  - **and the corresponding need to change engineering processes to satisfy them.**
- **We need to be <u>fact driven</u>**
  - **by what the engineering process changes <u>actually deliver</u>,**
  - **and we need to let the grass roots of engineers find out what works in practice –**
  - **to design their own workplace,**
    - **so they are satisfied with it,**
    - **and satisfied with their workplace's ability to satisfy necessary business objectives.**

10 Principles for Evaluating Engineering Processes: A Summary

1. Processes are 'good' to the degree they in practice satisfy specific organizational objectives.

2. When organizational objectives change, or are satisfied by other means, the usefulness of a process may decline or disappear.

3. Processes that are equivalent in their performance effects can be distinguished by their 'efficiency' – their use of limited and budgeted resource costs.

4. We can estimate the efficiency (value to cost ratio) of a process based on experience with it, or similar processes; but we cannot be certain of the process impacts until we measure them in place in our organization.

5. Just because we have measured the process efficiency once does not mean that the efficiency will not change for better or for worse in time or in other circumstances.
6. If the process efficiency does not meet the estimated levels of efficiency, then one possible cause is malpractice of the process.

7. Processes should be implemented in small evolutionary steps, early, and measured for effects before scaling up and before combining with other processes.

8. Process impacts will always be on multiple critical organizational performance and cost characteristics; so we must not evaluate them in single dimensions alone.

9. The entire justification for any process should rationally be the efficient effects on our organizational objectives; so they should never be mandated as 'best practices', but should forever be monitored for their justification.

10. Before implementing any new process, the resources to implement and to maintain it should be created by conscious and specific removal of less efficient processes which they will replace. [Conner98]

References:

CE: Gilb05: Gilb, Tom, Competitive Engineering, A Handbook For Systems Engineering, Requirements Engineering, and Software Engineering Using Planguage, ISBN 0750665076, 2005, Publisher: Elsevier Butterworth-Heinemann.

Conner98: Daryl R Conner "Leading at the Edge of Chaos, How to Create the Nimble Organization". Wiley, $29.95 0 471 29557 4,345 pages, http://www.connerpartners.com/

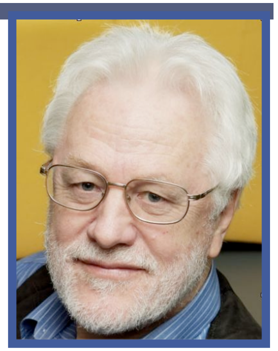
Gilb and Johansen: Tom Gilb and Trond Johansen, "From Waterfall to Evolutionary Development (Evo): How we rapidly created faster, more user-friendly, and more productive software products for a competitive multi-national market. ", Paper in INCOSE.org proceedings, INCOSE International Annual Conference , Rochester NY, 2005. The Green Week slide is from a corresponding presentation by Trond Johansen without paper, as ROOTS Conference, Bergen, Norway May 2005.

Grady: On page 253 of "Successful Software Process Improvement" by Robert B. Grady, HP's estimated annual savings was $31 million "per year" and "growing" (e.g., not a "one time savings"). The graph shows an estimating savings over more than a decade of more than $350 million.

Gorscheck05: Introduction and Application of a Lightweight Requirements Engineering Process Evaluation Method. Paper free at http://crinfo.univ-paris1.fr/REFSQ/03/papers/P09-Gorschek.pdf

- **Tony Gorschek *tony.gorschek@bth.se*. Mikael Svahnberg, Kaarina Tejle**
- ***Department of Software Engineering & Computer Science,***
- ***Blekinge Institute of Technology, PO Box 520, S-372 25 Ronneby, Sweden***
- ***Phone: +46 457 385000. This paper is notable for the explanation of the REPM (Requirements Engineering Process Model) as a tool for the requirements process evaluation. This is a different angle of evaluation from this paper, but is nevertheless an interesting angle. It evaluates 'what' you do in the process, but not what the process 'affects'. I argue in this paper that the effects or impacts of a process are the primary thing to evaluate, and that these are measurable in relation to a set of quantified technical process objectives.***

Biography
Tom Gilb



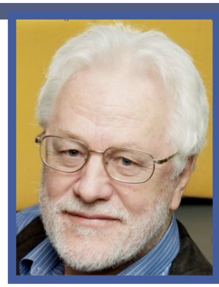
- **Tom Gilb is a freelance consultant, teacher and author serving clients in Europe, Asia, and the US.**
- **His newest textbook,**
  - **"Competitive Engineering: A Handbook For Systems Engineering, Requirements Engineering, and Software Engineering Using Planguage",**
  - **was published in the US August 2005 (now 2nd Printing).**
- **He has also written**
  - **"Principles of Software Engineering Management" (1988, in 20th printing)**
  - **and is Principal author of "Software Inspection" (1993, in 13th Printing).**
  - **He pioneered 'Software Metrics" (1976)**
- **He specializes in software quality design and management.**
- **He lives in Norway (and London), when he is not traveling.**

His methods are in use at

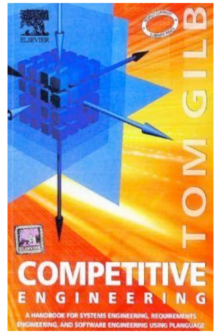
- **Hewlett Packard, Intel, IBM, Citigroup, Symbian, Philips Medical Systems, Microsoft, Ericsson, Nokia, Boeing, Confirmit (web survey products), Schlumberger, Citigroup, and many other companies.**

- **Current Clients Include**
  - **Qualcomm, United Health Group, Bosch, Credit Suisse, University of Trondheim IT, Viz Bergen (trading software), Symbian, tomtom (GPS), Tektronix (Berlin),**

Last Slide



1. Join my tutorial this afternoon!
   1400-1530 on Evo project management process.



2. Let me give you a copy of my new book, **"Competitive Engineering"**, free on pdf (7MB)
   - Ask me personally, give me your card marked 'CE', or ask by email (Tom@Gilb.com) for a free copy.
   - see the reviews on Amazon.com!
3. Let me give you a ppt copy of **<u>these</u>** slides, and a corresponding paper, on a memory stick.
4. Grab me at the conference and discuss with me or show me your 'problems'. I love to discuss things.
5. If you are shy or can't find me, email me now and ask questions. Tom@gilb.com