Samskaping og Innovasjon i tverrfaglige digitale prosjekter: ved hjelp av digitale ingeniørmetoder og verktøy

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Tekna Konferanse, Oslo
"Prosjektledelse i digitaliserings tid"

These slides are at http://concepts.gilb.com/file24

Teamwork and innovation in multidisciplinary digital projects

with the help of quantitative engineering methods and tools

Innovation
Useful, Practical, Purposeful

Order of magnitude, or better, improvement
in performance/cost efficiency,

of stakeholder-valued system attributes.

Innovation
How big?

- The 'order of magnitude (10:1)' concept is an arbitrary, but useful, concept in the definition.
- It is our way of being somewhat more precise about the concept of 'significant' (improvement).
- In given situations we can certainly argue that far less (25%, 250% improvement) would be considered 'innovation.
- So the degree of improvement needs to be argued in defined contexts.
- However, any '10 to 1' improvement in the ratio of performance and costs, will almost invariably be considered true innovation.
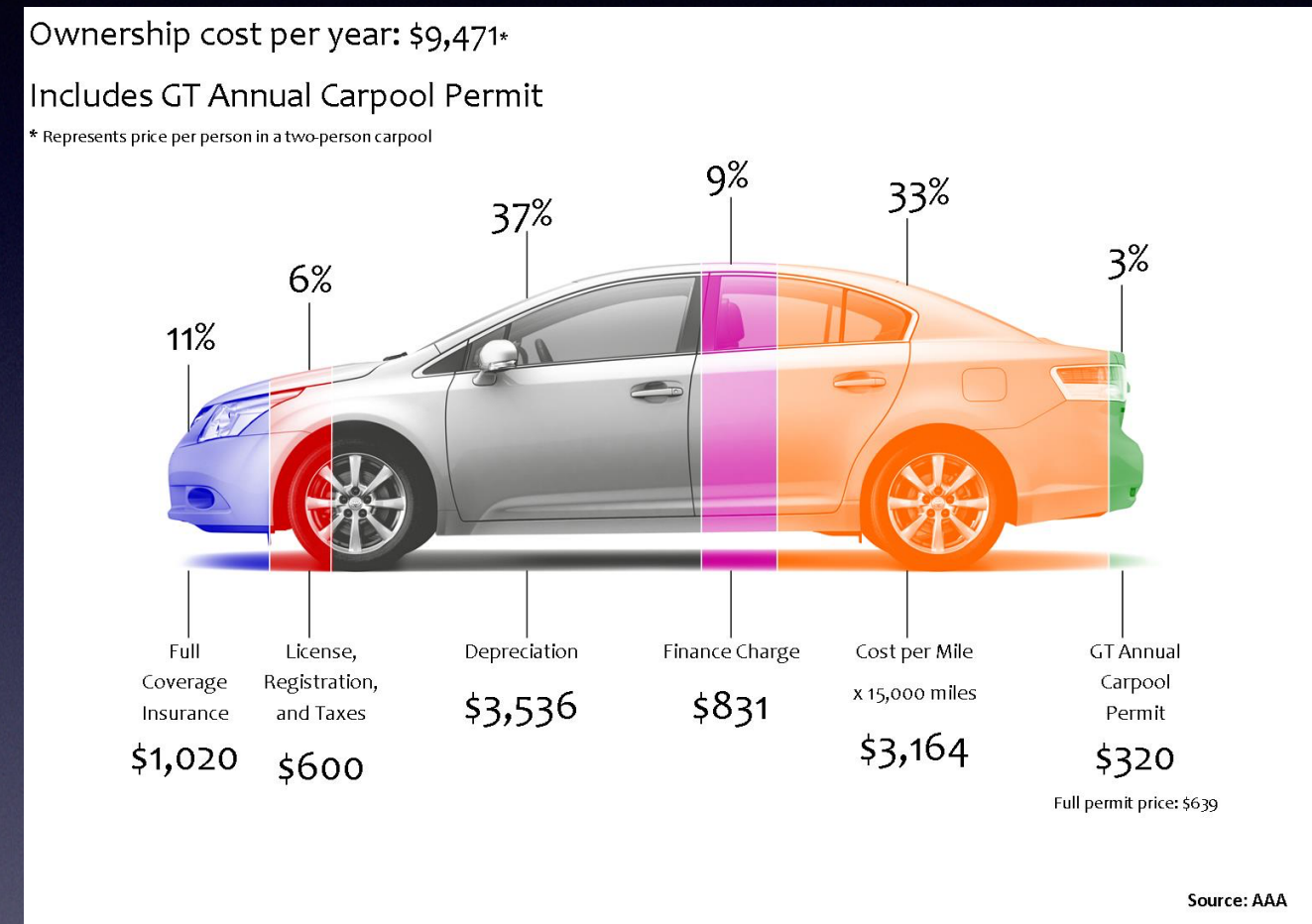- The less than this it is , the less 'innovation' degree.

Innovation
The COSTS aspect

1. **Notice that we consciously avoided the trap of only considering the performance increases (and it can be several *concurrent* performance dimensions) alone.**

2. **We believe that practical innovation will consider the *costs* (plural!) incurred, as an integral factor to be evaluated in considering the true degree of innovation.**

3. **I.e. big performance improvements are interesting innovation, but doing so at half the price, rather than infinitely costly is 'even more innovative' in the real world.**

Ownership cost per year: $9,471*

Includes GT Annual Carpool Permit

* Represents price per person in a two-person carpool

11% 6% 37% 9% 33% 3%

Full Coverage Insurance	License, Registration, and Taxes	Depreciation	Finance Charge	Cost per Mile x 15,000 miles	GT Annual Carpool Permit
$1,020	$600	$3,536	$831	$3,164	$320

Full permit price: $639

Source: AAA

Innovation
Multiple Attributes Thinking

1. **Note that we very consciously include the notion of simultaneous improvement in any *useful set* of performance characteristics**
   (for example Usability, and Security),

2. **together with any *useful set* of cost characteristics**
   (for example Capital Cost, and Installation time).

3. **The more attributes improved, the more 'innovation.**

4. **All improvements deserve evaluation and credit.**

Sorting by Multiple Attributes
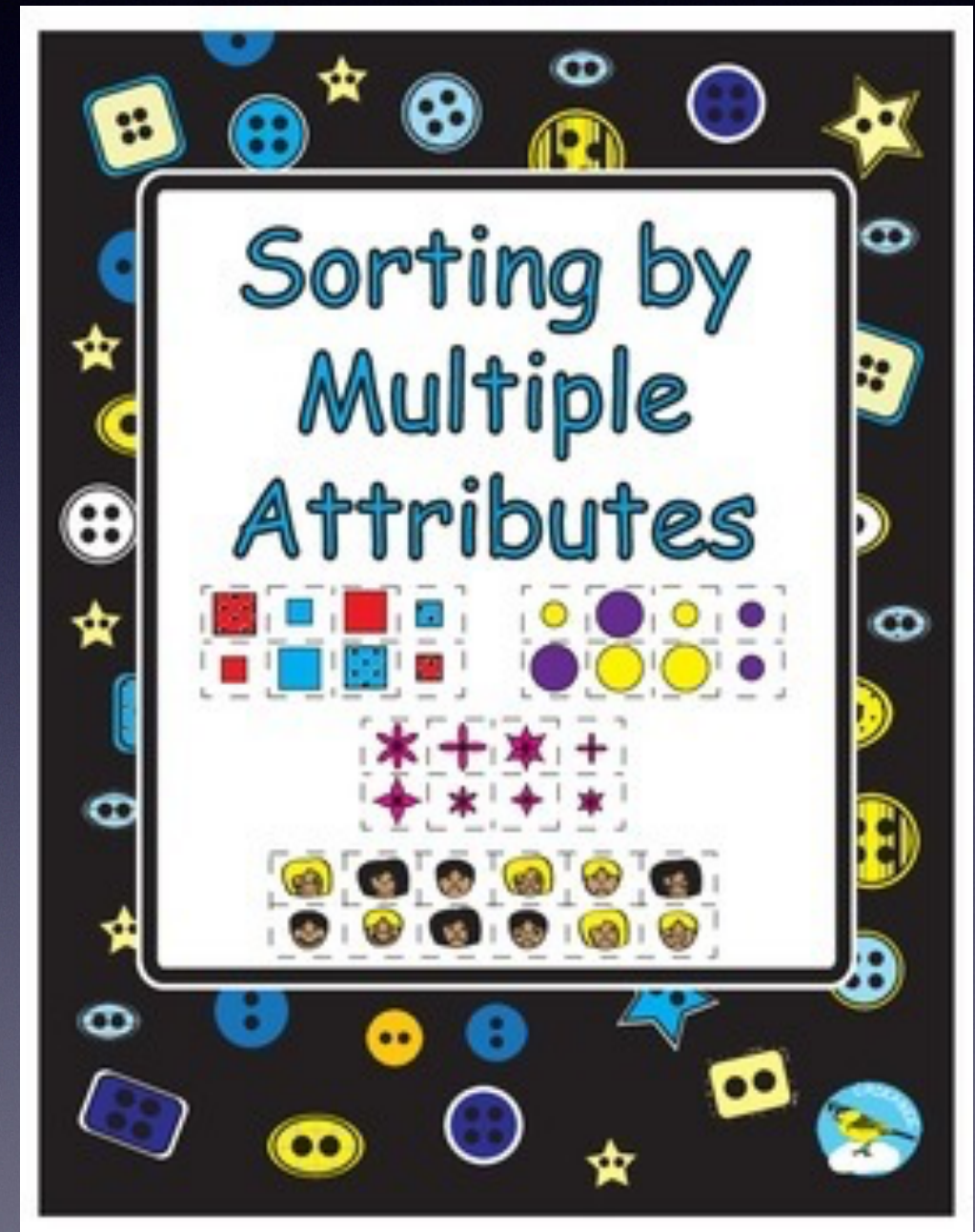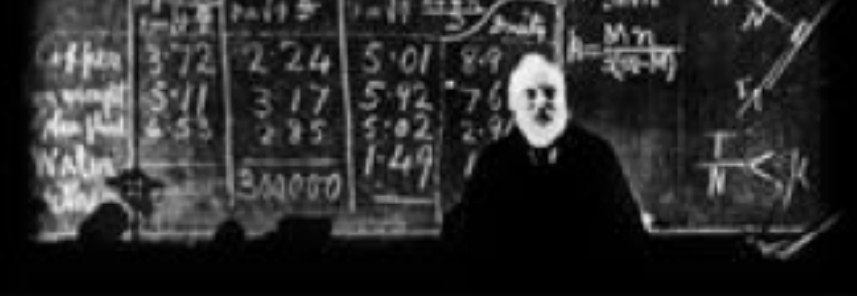
The Principle Of 'Innovation Quantification'
## The Words of a 'Lord'

"In physical science the first _essential step_ in the direction of _learning any subject_ is to find principles of numerical reckoning and _practicable methods for measuring_ some _quality_ connected with it.

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it;

but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind;

it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of Science, whatever the matter may be."

Lord Kelvin, 1893, _Lecture to the Institution of Civil Engineers, 3 May 1883_   From
http://zapatopi.net/kelvin/quotes.html
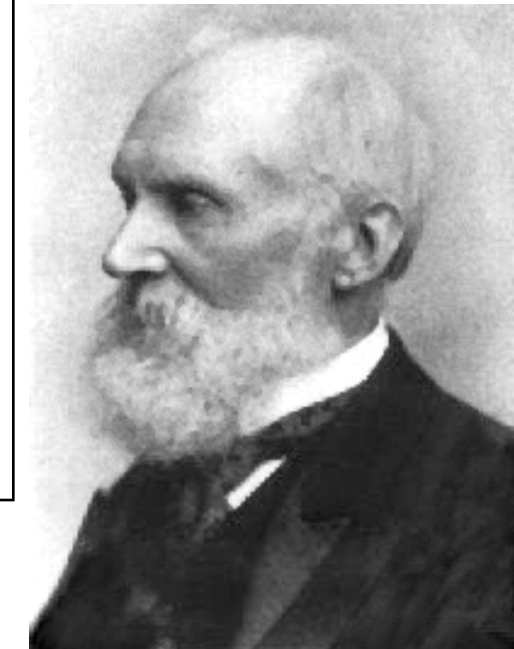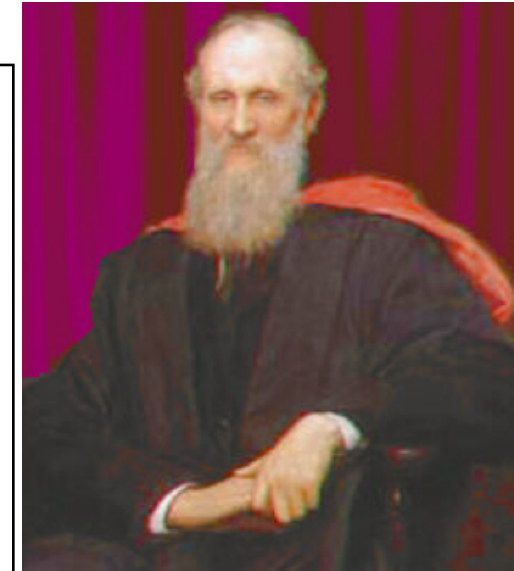
"All qualities can be expressed quantitatively,
'qualitative' does _not_ mean unmeasurable". (Gilb)

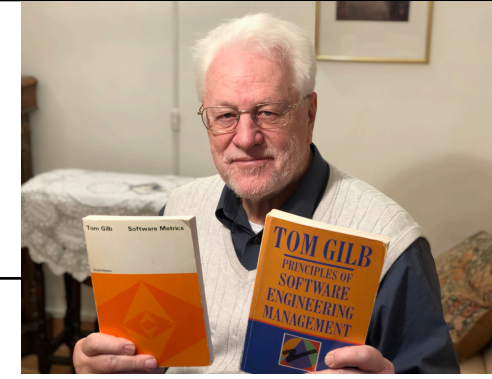http://tinyurl.com/**GilbTedx**   © Gilb.com

Born: 26 June 1824; Belfast, Ireland
Died 1907..

My Principles of Useful Innovation Resulting from
Practical Purposeful Creativity
and also
Some measurable attributes of Innovation. Tom Gilb

UNIVERSALITY: 1. Innovation is more useful when it applies to more circumstances

ETERNALITY: 2. Innovation is worth more if it can be applied for a long time after learning it

VALUE: 3. Innovation is more useful if there is a high value from applying it

SHARING: 4. Innovation is more useful if it can easily be shared with others

PROOF: 5. Innovation is useful when early feedback can prove its usefulness in practice

SYNCHRONOUS: 6. Innovation is more useful when it can be used together
with a larger body of Innovation

MEASURABIILITY: 7. Innovation is more useful when the results of its application can be measured

ACCEPTANCE: 8. Innovation is more useful when it is widely accepted in your culture.

COST: 9. Innovation is more useful when the cost of applying it is low.

GENERATION: 10. Innovation is more useful when is can be used to generate even more useful
Innovation.

Practical Purposeful Creativity paper
www.gilb.com/dl22

Security Value Quantification

National Security

Business Value *Label?*

Is Part Of: Stakeholder Values `Value`

Ambition Level: to reduce terrorist attacks, and identify potential terrorist attacks, and regulate cyber information

Scale: Number Negative [Effects] on [Stakeholders] from [Attack Types] under [Conditions] in [Places] per year for given [Area]

Stakeholders: Prime Minister, Casualties, Council Representatives, Police, Relatives Of Victims, Volunteers

Status: Level: **150** Number Bad Stuff [Effects = { Death }, Stakeholders = { <All> }, Attack Types = { Vehicle Attack,Knife Attack,Gun Attack }, Conditions = { Hig...

Wish: Level: **10** Number Bad Stuff [Effects = { Death }, Stakeholders = { <All> }, Attack Types = { Vehicle Attack,Knife Attack,Gun Attack }, Conditions = { High A...

Record: Level: **1** Number Bad Stuff [Effects = { Death }, Stakeholders = { <All> }, Attack Types = { Vehicle Attack,Knife Attack,Gun Attack }, Conditions = { High ...

> **All values and qualities can be expressed quantitatively**

> Bullshit level

> **This structure of requirements is in 'Planguage'. Which is specified in books 'Competitive Engineering' and 'Value Planning'**

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So, our concept is 'plural efficiency' improvement,

of significant dimensions (critical values)

(10:1 as a benchmark idea, but not only possibility).

Safari   File   Edit   View   History   Bookmarks   Window   Help   100%   12 Jun 14:15   Tom Gilb

app.needsandmeans.com

Tom Gilb & K...ents-Material   appleinsider.com   Google Docs   TOM'S NET Services ∨   Resources »   NORSKE STEDER ∨   Travel 4 TOM ∨   Social Sites ∨   NEWS ∨   ALLE ANDRE ∨

Requirements	Use Community Su... 💡	Defect Preventio... 💡	The BEST Design 💡	Design 💡	Sum
Reduce Bed Days 🎛 Decrease from **4** to **3 days** By end of November 2015 Average number of days per [Patient Type] per month [Patient Type = A...	📅 **0.3** days **30** % 📈 30 %	📅 **0.5** days **50** % 📈 80 %	📅 **0** days **0** % 📈 80 %	📅 **0** days **0** % 📈 80 %	**80 %**
Clinical Quality Decrease from 0.1 to **0.05 Infections** By end of June 2015 Average number of [Infections] per [Patient Type] per month [Infections = Bloodstream, Patient Type = HIV]	...5 Infections ...% 📈 50 %	📅 **.003** Infections **6** % 📈 56 %	📅 **0** Infections **0** % 📈 56 %	📅 **0** Infections **0** % 📈 56 %	**56 %**
Sum Of Performance:	📅 **80** % 📈 80 %	📅 **56** % 📈 136 %	📅 **0** % 📈 136 %	📅 **0** % 📈 136 %	
Skilled Effort in work Days 💲 Increase from **0** to **100** work days o... By end of all *No qualifiers*	📅 **10** work d... **10** % 📈 10 %	📅 **50** work d... **50** % 📈 60 %	... work d...	📅 **0** work d... **0** % 📈 60 %	📅 **60 %**
Sum Of Resources:	📅 **10** % 📈 10 %			📅 **0** % 📈 60 %	
Performance To Resource Ratio:	📅 **8.00**	📅 **1.12**	📅 **0.00**	📅 **0.00**	

Values

Value of the Innovation Ideas

Resources

Profitability Priority

— Confucius, *Sayings of Confucius*

"True wisdom is knowing what you don't know"

— Confucius, *Sayings of Confucius*

What intellectual tools do you have
that will help you
to be more conscious of
exactly what
you do NOT know enough about?

'Engineering' is researching risks and unknowns

Designs ->

Requirements	Incentivise	Tea Kiosk	Daily Danger Checks	Sum
⟨⟩ Project Timeliness Status: **10 ➔** Wish: **5 %** % time overrun necessary to deliver ... [Project Cost Size = { Medium ($10k -...] 🗓 30th June 2017	=: Δ%: ?%:	**8 ± 0** -2 % **40 ± 0 %** *32 % (x 0.8)* 40%	**5 ± 1** -5 % **100 ± 20 %** *50 % (x 0.5)* 100%	**15 ± 8** 5 % **-100 ± 160 %** *-80 % (x 0.8)* -100%	ΣΔ%: **40 ± 180 %**
⟨⟩ Building Security Status: **50 ➔** Wish: **10 % I...** % of [Emergency Types] which impact... [Emergency Types = { Earthquake }, 🗓 30th June 2018	=: Δ%: ?%:	**50 ± 0** 0 % Injury **0 ± 0 %** *0 % (x 0.0)* 0%	**50 ± 0** 0 % Injury **0 ± NaN %** *0 % (x 0.6)* 0%	**30 ± 10** -20 % Injury **50 ± 25 %** *15 % (x 0.3)* 50%	ΣΔ%: **50 ± 25 %**
⟨⟩ User Productivity Status: **15 ➔** Wish: **5 minutes** number of minutes for a [user] to co... [user = { adult }, task = { dri...] 🗓 30th June 2017	=: Δ%: ?%:	**10 ± 0** -5 minutes **50 ± 0 %** *0 % (x 0.0)* 50%	**8 ± 3** -7 minutes **70 ± 30 %** *56 % (x 0.8)* 70%	**15 ± 0** 0 minutes **0 ± 0 %** *0 % (x 0.0)* 0%	ΣΔ%: **120 ± 30 %**
Sum Of Values: Credibility - adjusted:	Σ%: Σ?%:	**90 ± 0 %** *32 %*	**170 ± 50 %** *106 %*	**-50 ± 185 %** *-65 %*	
⟩⟨ Method Implementation Cost Status: **0 ➔** Budget: **3m $** Total monetary cost in US Dollars fo... [Project Cost Size = { }] 🗓 30th June 2017	: %: ?%:	**500k ± 0** 500k $ **17 ± 0 %** *34 % (x 0.0)* 17%	**2m ± 0** 2m $ **67 ± 0 %** *134 % (x 0.0)* 67%	=:**1m ± 0** Δ: 1m $ Δ%: **33 ± 0 %** ?%: *66 % (x 0.0)* 33%	ΣΔ%: **117 ± 0 %**
Sum Of Development Resources: Credibility - adjusted:	Σ%: Σ?%:	**17 ± 0 %** *34 %*	**67 ± 0 %** *134 %*	**33 ± 0 %** *66 %*	
Value To Cost:		5.30	2.50	-1.50	

The numeric relation between ends and means: *Engineering Analysis*.

Basic Structure of an Impact Estimation Table

What items here help us to "know what we do not know"?

Learn

Stakeholders

**Solutions
(designs, architectures,
strategies)**

must be identified

Measure

Values

**and their total impacts on
critical objectives
and
constraints**

Requirements		☐ Incentivise	☐ Tea Kiosk	☐ Daily Danger Checks	Sum
⊢⊣ **Project Timeliness**	=:	**8 ± 0**	**5 ± 1**	**15 ± 8**	
Status: **10** → Wish: **5** %	Δ:	-2 %	-5 %	5 %	
% time overrun necessary to deliver …	Δ%:	**40 ± 0** %	**100 ± 20** %	**-100 ± 160** %	Σ△%: **40** ± 180 %
[Project Cost Size = { Medium ($10k -…]	?%:	32 % (x 0.8)	50 % (x 0.5)	-80 % (x 0.8)	
📅 30th June 2017		40%	100%	-100%	
⊢⊣ **Building Security**	=:	**50 ± 0**	**50 ± 0**	**30 ± 10**	
Status: **50** → Wish: **10** % I…	Δ:	0 % Injury	0 % Injury	-20 % Injury	
% of [Emergency Types] which in fact…	Δ%:	**0 ± 0** %	**0 ± NaN** %	**50 ± 25** %	Σ△%: **50** ± 25 %
[Emergency Types = { Earthquake },	?%:	0 % (x 0.0)	0 % (x 0.6)	15 % (x 0.3)	
30th June 2018		0%	0%	50%	
⊢⊣ **User Productivity**	=:	**10 ± 3**	**8 ± 3**	**15 ± 0**	
Status: **15** → Wish: **5** minutes	Δ:	-5 minutes	-7 minutes	0 minutes	
number of minutes for a [user] to co…	Δ%:	**50 ± 0** %	**70 ± 30** %	0 %	
[user = { adult },	?%:	0 % (x 0.0)	56 % (x 0.8)	0 % (x 0.0)	
task = { dri…]		50%	70%	0%	
30th June 2017					
Sum Of Values:	Σ%:	**90 ± 0** %	**170 ± 50** %	**-50 ± 185** %	
Credibility - adjusted:	Σ?%:	32 %	106 %	-65 %	
⊢⊣ **Method Implementation Cost**	=:	**500k ± 0**	**2m ± 0**	=:**1m ± 0**	
Status: **0** → Budget: **3m** $	Δ:	500k $	2m $	Δ: 1m $	
Total monetary cost in US Dollars fo…	Δ%:	**17 ± 0** %	**67 ± 0** %		**117** ± 0 %
[Project Cost Size = { }]	?%:	34 % (x 0.0)	134 % (x 0.0)	66 % (x 0.0)	
📅 30th June 2017		17%		33%	
Sum Of Development Resources:	Σ%:	**17 ± 0** %	**67 ± 0** %	**33 ± 0** %	
Credibility - adjusted:	Σ?%:	34 %	134 %	66 %	
Value To Cost:		5.30	2.50	-1.50	

**must be estimated
reasonably**

(order of magnitude)

Solutions

Deliver

**Impact Estimation Tables
(Planguage)
are a tool for doing estimates
of potential solutions
and 'how good' they *might* be**

Develop

Decompose

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Main ideas or Principles

- Numeric Requirements

    - can stimulate creativity and innovation

    - can protect creative ideas from being dismissed
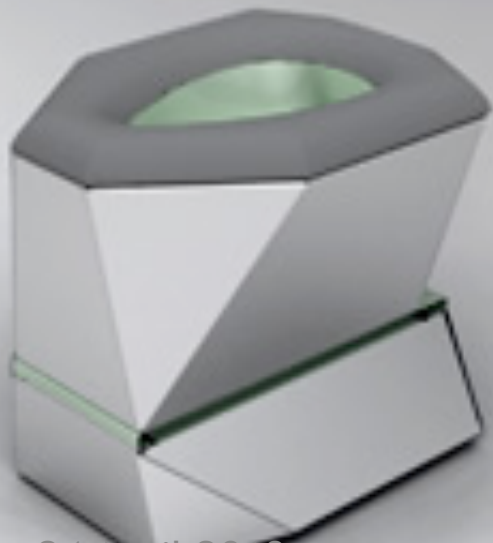
Loo Watt Case

Successful Innovation Using Planguage
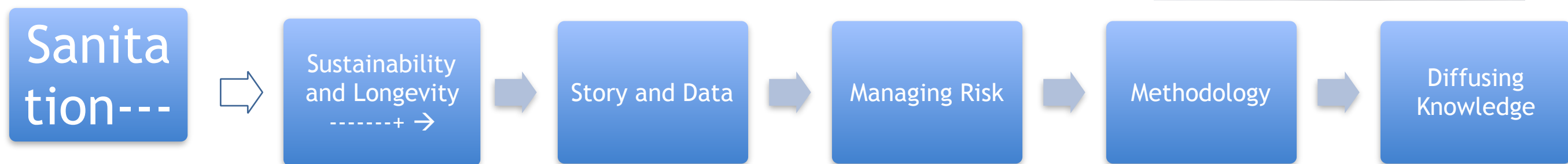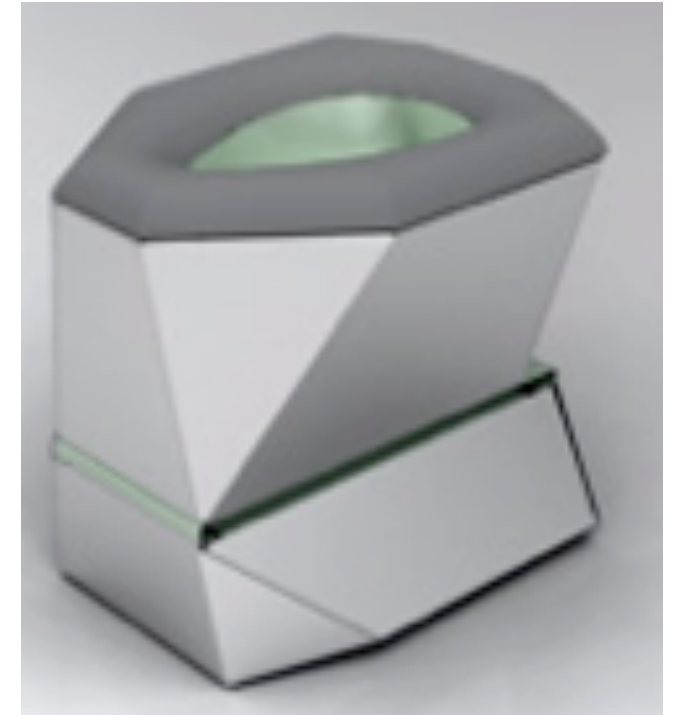
LOOWATT: A NEW PARADIGM IN SANITATION

15

Key Values: Quantified

Sanita tion---		Sustainability and Longevity -------+ →		Story and Data		Managing Risk		Methodology		Diffusing Knowledge

Planning Language

Name of Value definition

Definition of value as a quantity

Current or Past level (systems analysis)

Target level, Required level, Objective

- **Improve Sanitation**
  Target: 25% – 75%
  ...cted / waste produced by user group
  ...d **Longevity**
  ...le user per m...
- **Story and Data**
  Target: 0.4 - 0.8
  Unit: Average of factors rated 0...
- **Managing Risk**
  Target: 0.2 – 0.8
  Unit: Average of factors rated 0.0 – 1.0
- **Methodology**
  Target: 0.4 – 0.8
  Unit: Average of factors rated 0.0 – 1.0
- **Diffusing Knowledge**
  Target 0.15 – 0.8
  Unit: Average of factors rated 0.0 – 1.0
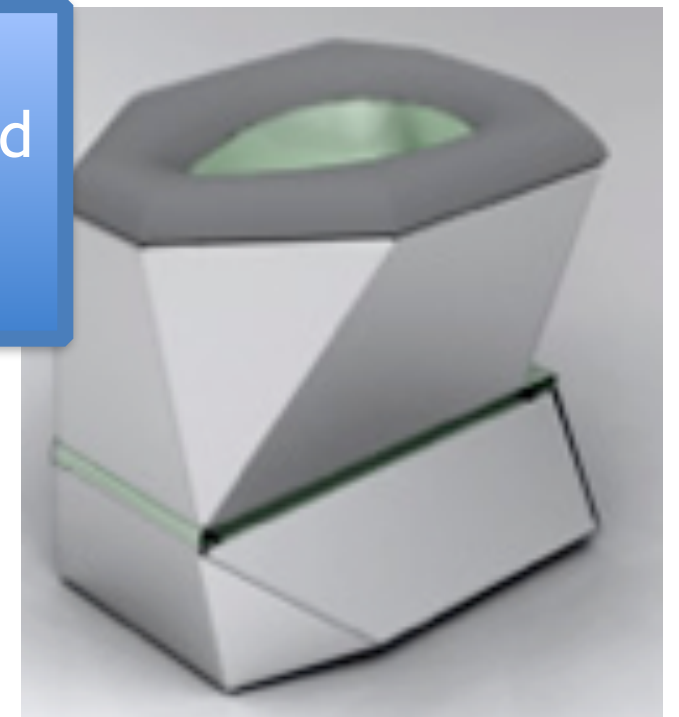
Nick Coutts
Imperial College Innovation Centre

© Gilb.com
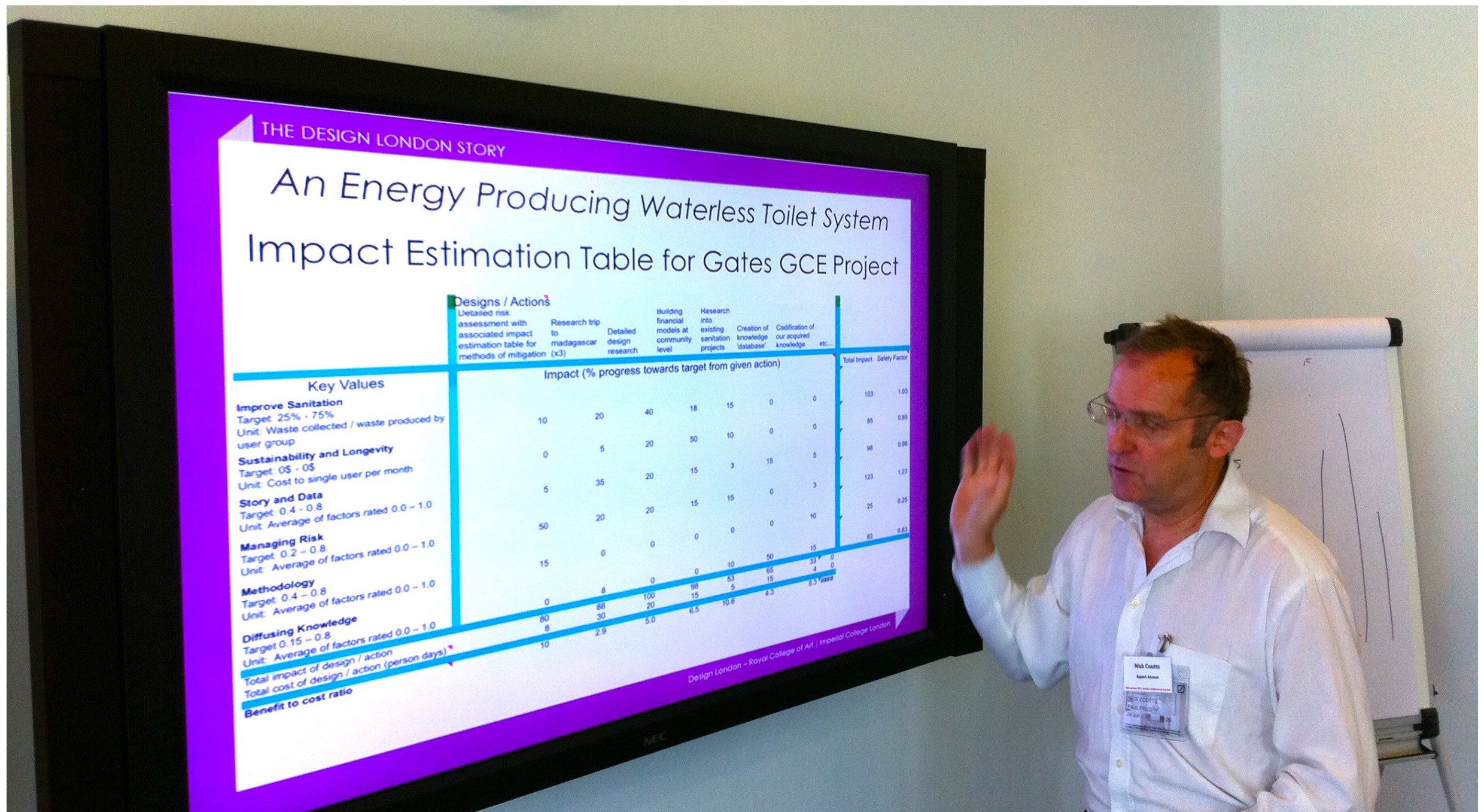
FEEDBACK FROM LOOWATT

- ## They continued to use the planning method throughout the 14 month project
  - Because it helped keep them on track to the real critical objectives
- ## They highly recommended to their 20 parallel incubator projects, that they should use these methods for planning their startups

Winners!

- The **Bill & Melinda Gates Foundation** has awarded Loowatt Ltd a $1 million grant to expand its pioneering waterless toilet systems in Madagascar and Sub-Saharan Africa.

- 13.09.2013

Creative Design Principles supported by Metrics

- **Estimating and measuring the effects of ideas, on your requirements**

  - **will stimulate people to find better ideas**

  - **will defend good enough ideas**

  - **will help teams to prioritise and agree on good or promising ideas**

  - **will make people responsible for the results of their ideas, and thus motivate them to**

    - **make sure they work**

    - **even if they need better definition to succeed**

My basic 'paper' on 'Creativity'

'Practical Purposeful Creativity'

paper

**Journal:
AI & SOCIETY ·
Volume 7 ... T. Gilb, 1993**

Practical Purposeful Creativity Constructs

by Tom Gilb,
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Kolbotn, Norway
Telephone: +47-66-801697, Tom@Gilb.com, +47 920 66 705
URL www.Gilb.com
Version Updated May 4 2006, Nov 6 2008 (address, Imagination definition at end)

Introduction

This paper is written as an invited contribution to a book "Creativity, Innovation and Cooperation" (Springer) and a special issue of "AI & Society: the Journal of Human-Centred Systems and machine Intelligence". The editor is Robert C. Muller (Fax +44-491-579750). Published around 1992.

Definitions.

Creativity: accessing ideas to improve some values.

Practical (INDUSTRIAL) Creativity: *Systematic Identification of ideas which serve useful human purposes*

Purposeful Creativity: *Identification and validation of ideas which meet specified objectives.*

Part One: A Theory of Practical Creativity.

Creativity is a result of the **creativity process structure** and its **particular agent**.

A creative process is more or less suitable (or "good") for its purposes as a result of:
• its <u>structure</u> (how the creative process is defined and managed)
• <u>who</u> does it (the individual, the team, the organization).
• its <u>resources</u> (time, money, knowledge base)

Sustainable Employee Creativity Model

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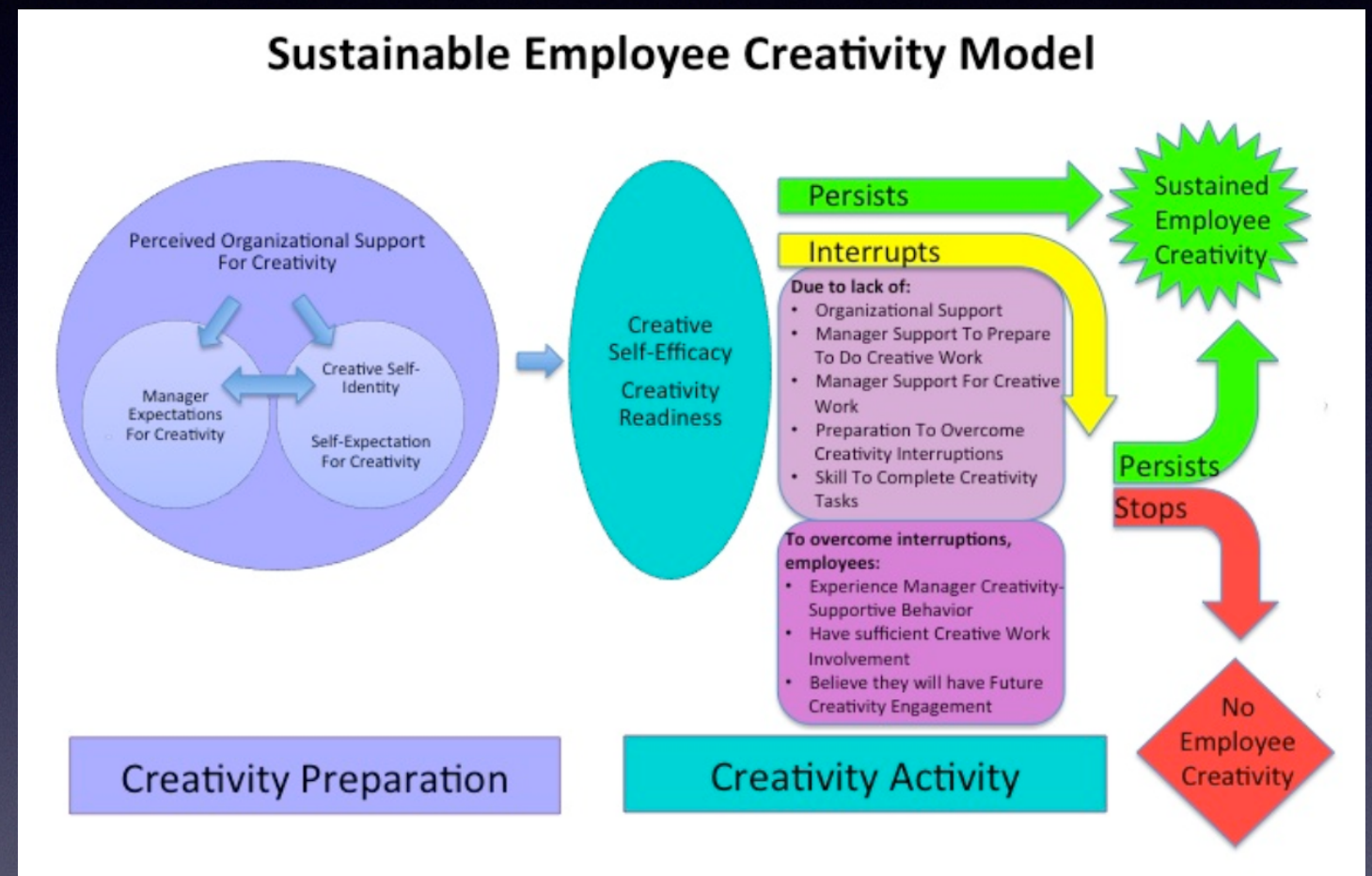
My Ten fundamental principles of Practical Creativity

(1993)

1. *Practical* creativity must have a defined purpose which is objectively measurable.
2. Practical creativity must operate in multiple purpose dimensions at the same time.
3. The result of practical creativity depends on the clarity of the stated objectives.
4. The result of practical creativity depends on the nature of the creativity process and the agents employed to do it.
5. Any creativity objectives initially defined, will tend to change as time goes on due to changed perceptions, changed external world and experience with delivering partial results.
6. The practical creative process follows the rules of any similar "design", "planning" or "engineering process": it is merely a higher level generalization of them.
7. The "net value" of an additional idea for solving a defined problem can be estimated in relation to remaining unsatisfied objectives. How far will the idea move us in the direction of our final objectives, from where we are at the moment?
8. The degree of yet unsatisfied objectives for a problem being solved, determines the priority needed for continued creative effort. This (degree of yet unsatisfied objectives) is a function of previously accepted or applied ideas and of any changed objectives since they were originally defined.
9. Seemingly "bureaucratic" idea management processes <u>can</u> stimulate, protect and justify creative effort. Total freedom of thought is not necessarily the best way to get useful creativity.
10. If a creative effort fails to satisfy even a <u>single</u> real, defined or not, critical success factor then it is, in practice, a total failure. It serves no useful purpose.

1. *Measurable* Purpose
2. *Multiple* Purposes
3. Goal *clarity* is critical
4. Process+ *Agents* = Result
5. *Change* happens
6. Creation = Engineering = Planning
7. Degrees of *Innovation Evolve*
8. Unsatisfied goals = *Priority Signal*
9. Constraints and Targets *stimulate* creativity
10. We must satisfy *ALL critical factors* (even unknown ones)

7 'da Vinci' Principles: Systems Engineering!

M. Gelb, *How to Think Like Leonardo Da Vinci* , p.9

- **Curiosità**
  - Insatiably **curious**, unrelenting quest for continuous learning
- **Dimostrazione**
  - Commitment **to test knowledge through exper**ience, willingness to learn from mistakes. Learning for ones self, through practical experience
- **Sensazione**
  - Continual **refinement** of senses. As means to enliven experience
- **Sfumato**
  - Willingness to **embrace ambiguity**, paradox, uncertainty
- **Arte/Scienza**
  - **Balance** science/art, logic & imagination, **whole brain thinking**
- **Corporalità**
  - Cultivation of grace, ambidexterity, **fitness**, poise
- **Connessione**
  - Recognition & appreciation for **interconnectednes**s of all things and phenomena, **Systems thinking**

Leonardo's persistence

- "Although generally recognized as the greatest genius of all time, Leonardo made many colossal mistakes and staggering blunders." <-Gelb

- "Despite mistakes, disasters, failures, and disappointments, Leonardo never stopped learning, exploring, and experimenting. He demonstrated Herculean persistence in his quest for **knowledge**." <- Gelb

Da Vinci's helicopter

- Leonardo wrote: <-Gelb p.79
  - "I do not depart from my furrow.
  - "Obstacles do not bend me"
  - "Every obstacle is destroyed through rigor"
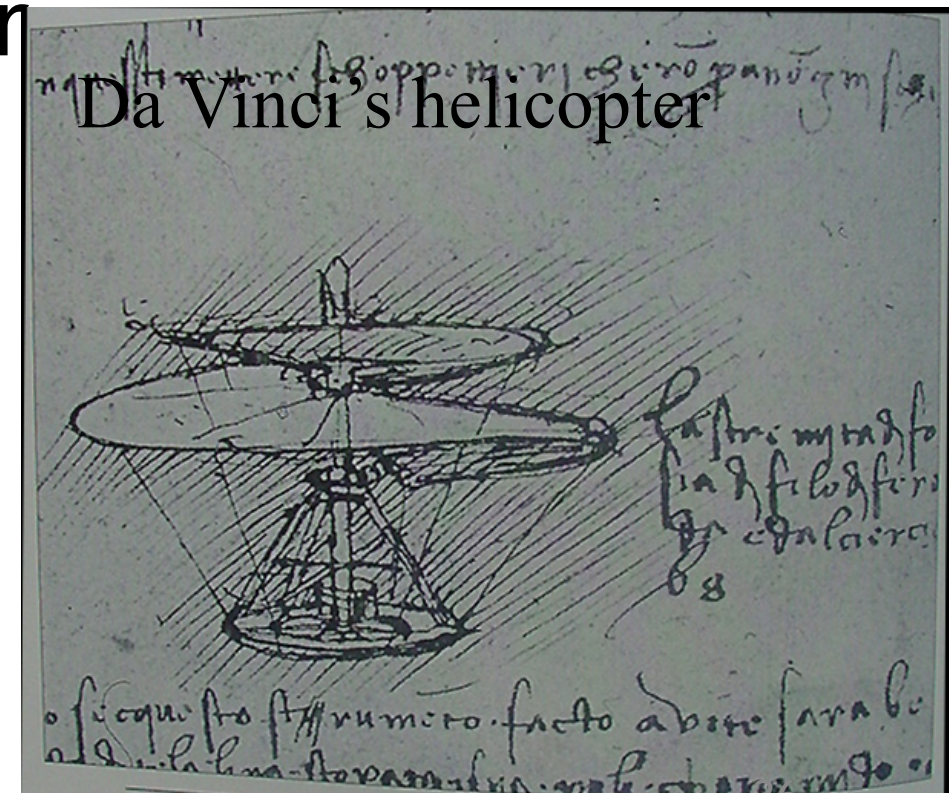
Agile Innovation
Numeric Feedback
and
Re-engineering between Sprints
(IBM Federal Systems Cleanroom)

MIlls and Quinnan Slides
http://concepts.gilb.com/dl896

Quinnan: IBM FSD Cleanroom
Dynamic Design to Cost
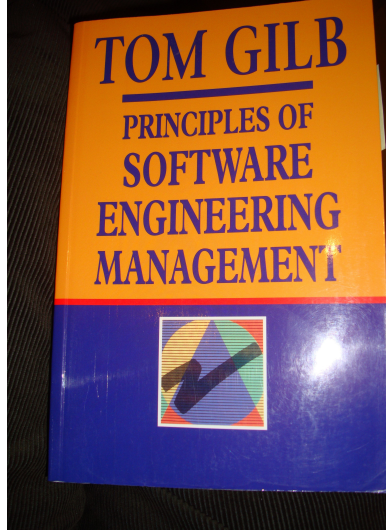
Quinnan describes the process control loop used by IBM FSD to ensure that cost targets are met.

'Cost management. . . yields valid cost plans linked to technical performance. Our practice carries cost management farther by introducing <u>design-to-cost guidance.</u> Design, development, and managerial practices are applied in an integrated way to ensure that software technical management is consistent with cost management. The method [illustrated in this book by Figure 7.10] consists <u>of developing a design, estimating its cost, and ensuring that the design is cost-effective.'</u> (p. 473)

He goes on to describe a design iteration <u>process trying to meet cost targets by either redesign or by sacrificing 'planned capabilit</u>y.' When a satisfactory design at cost target is achieved for a single increment, the 'development of each increment can proceed concurrently with the program design of the others.'

'<u>Design is an iterative process </u>in which each design level is a refinement of the previous level.' (p. 474)

It is clear from this that they avoid the big bang cost estimation approach. Not only do they iterate in seeking the appropriate balance between cost and design for a single increment, but <u>they iterate through a series of increments, thus reducing the complexity of the task,</u> <u>and increasing the probability of learning from experience</u>, won as each increment develops, and <u>as the true cost of the increment becomes a fact</u>.

'When the development and test of an increment are complete, <u>an estimate to complete the remaining increments is computed</u>.' (p. 474)

Source: Robert E. Quinnan, 'Software Engineering Management Practices', IBM Systems Journal, Vol. 19, No. 4, 1980, pp. 466~77
This text is cut from Gilb: The Principles of Software Engineering Management, 1988

"iteration process trying to meet cost targets by <u>either</u> *redesign* or by *sacrificing* 'planned capability' "

**MIlls and Quinnan Slides
http://concepts.gilb.com/dl896**

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Shop Floor Creativity in Practice
The IBM Defect Prevention Process

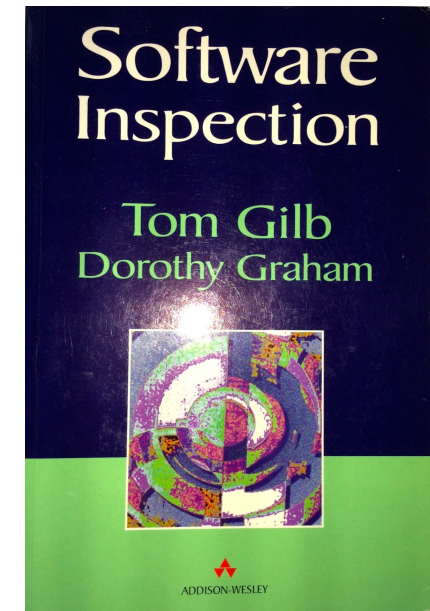# Defect Prevention Process

(IBM 1990)

Metrics Driven Innovation

DPP is described in the Software Inspection book 1993

- 2 Chapters on DPP
  - 7 By Tom (DPP with Inspection)
  - 17 by Robert Mays
  - https://www.amazon.com/Software-Inspection-Tom-Gilb/dp/0201631814

  - R Mays IBM SJ, Paper on
  - 'Defect Prevention Process', DPP
    - http://www.gilb.com/DL457

Defect Prevention Process   Experiences:
Most defects can be prevented from getting in there *at all. (Lean!)*
It takes metrics and teamwork to innovate over time
Innovating your organization: to reduce product defects up front
(= Lean)

Cleanroom levels: approach zero def.
IBM MN 99.99%+ fixes:Key= "DPP"

90% ▬
80% ▬
70% ▬   Mays 1993, User 1996 "72% in 2 years" <-tg

50% ▬
         Mays & Jones (IBM) 1990

% of usual defects
prevented

    1   2   3   4   5   6
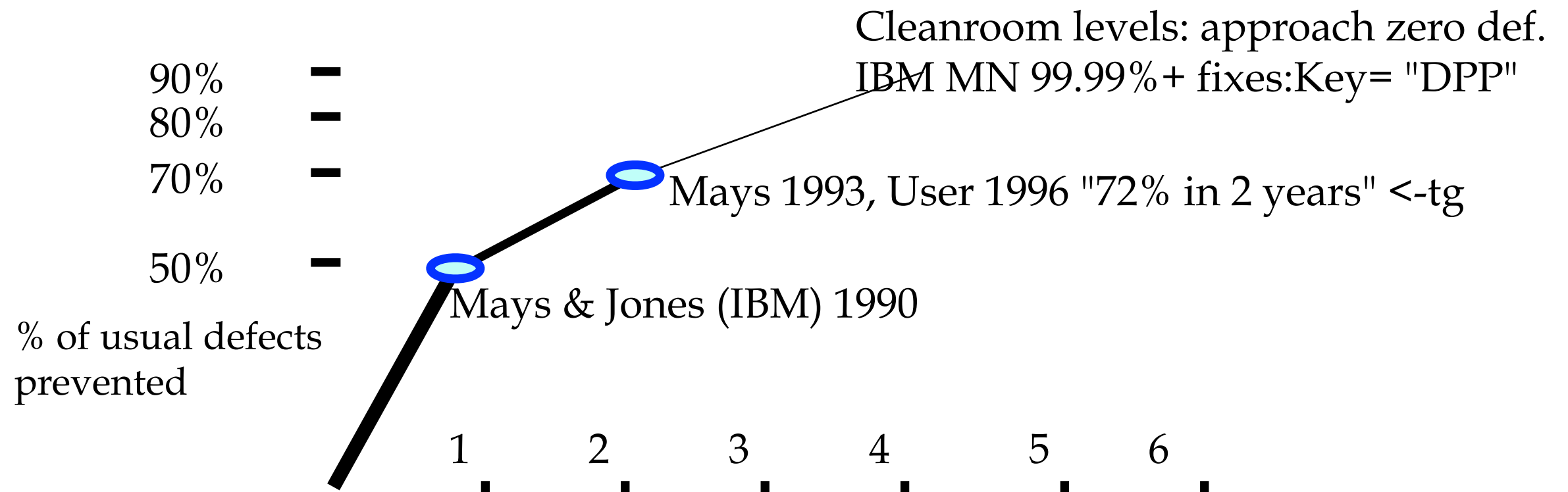
•Years of continuous improvement effort
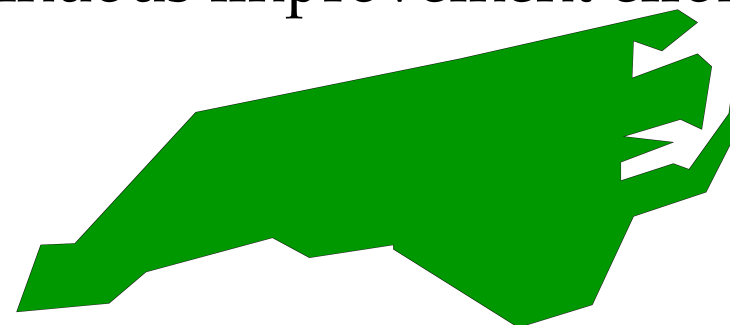
North Carolina

Prevention + Pre-test Detection
is the most effective and efficient way
Cross-Discipline Teamwork and Innovation!

Use

90% —

80% — Test

70% — 70% Detection
by Inspection

"Detected Cheaply"

50% — <-Mays & Jones 50% prevented(IBM) 1990

100%

95% cumulative detection
by Inspection (state of the art limit)

<- Mays 1993, 70% prevented

"Prevented"

1   2   3   4   5   6
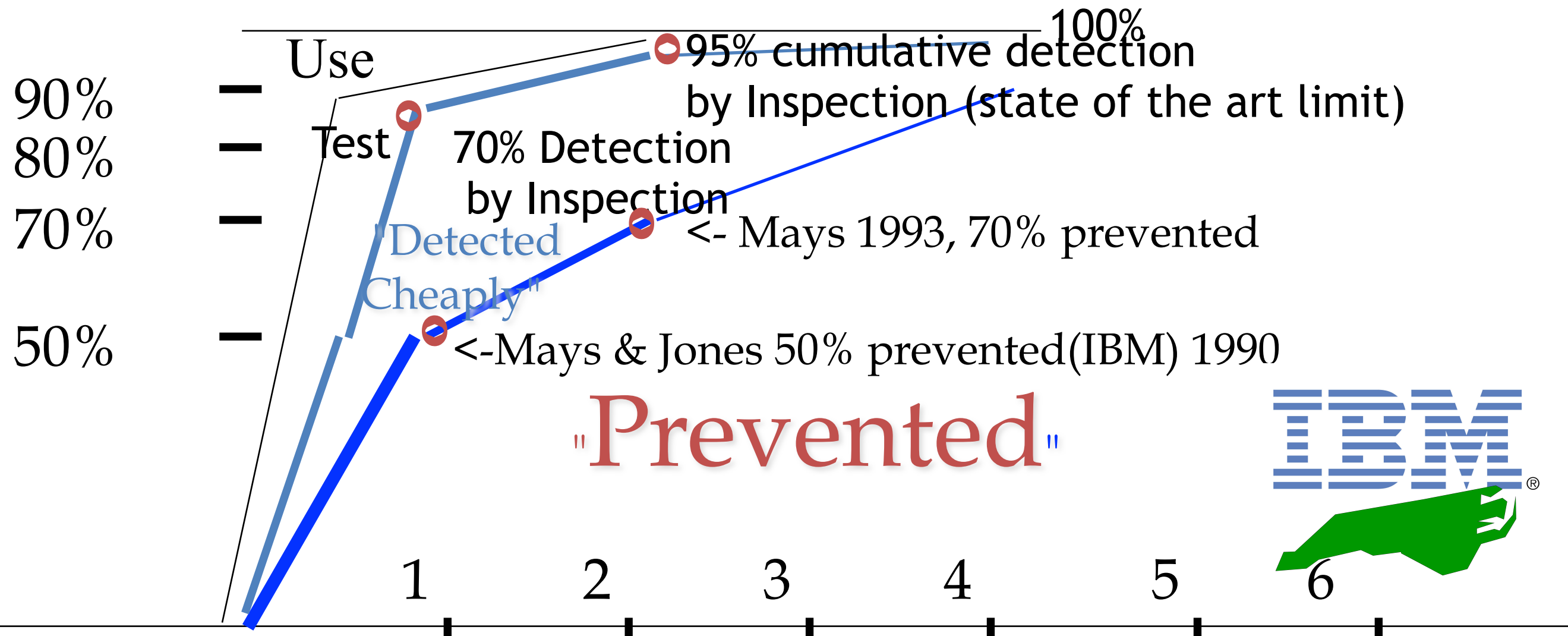
- <u>Prevention</u> data based on state of the art prevention experiences (IBM RTP), Others (Space Shuttle IBM SJ 1-95) 95%+ (99.99% in Fixes)
- Cumulative Inspection <u>detection</u> data based on state of the art Inspection (in an environment where prevention is also being used, IBM MN, Sema UK, IBM UK)

- **2162 DPP Actions implemented in Minnesota**
  – between Dec. 91 and May 1993 (**30 months**)   <-Steve Kan

- Research Triangle Park, about **182 per year for 200 people.**<-Mays 1995
  – **1822 suggested actions in ten years (85-94)**
    – 175 test related
- RTP 227 person org<- Mays slides
  – 130 actions (@ 0.5 work-years
  – 34 causal analysis meetings @ 0.2 work-years
  – 19 action team meetings @ 0.1work-years
  – Kickoff meeting @ 0.1 work-years
  – TOTAL costs 1% of org. resources

- ROI DPP 10:1 to 13:1, internal 2:1 to 3:1

- Defect Rates at all stages 50% lower with DPP

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Long-term massive innovation, driven by metrics
Saving 400 of 1,000 engineers per year

Start of Effort

43%
Rework cost

'Statistically Stable System'

gradual process improvement

Cost of Conformance

%COHC

%COC

Bad Process Change

Cost of Rework

5%

End 1988

Cost of Quality over Time: Raytheon 95
Using DPP and Inspection as numeric drivers

End 1994

Figure 8: Cost of Quality Versus Time

24 April 2018

Oppsummering

- Samskaping
  - *målbarhet* i verdikommunikasjon forbedrer 'teamwork'
- Innovasjon
  - *kvantifisering* av verdimål fremmer innovasjon

Takk !

- Mye gratis å lese: http://concepts.gilb.com/file24
- Competitive Engineering bok; gratis https://www.gilb.com/p/competitive-engineering
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- Snakk med meg 920 66 705
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