

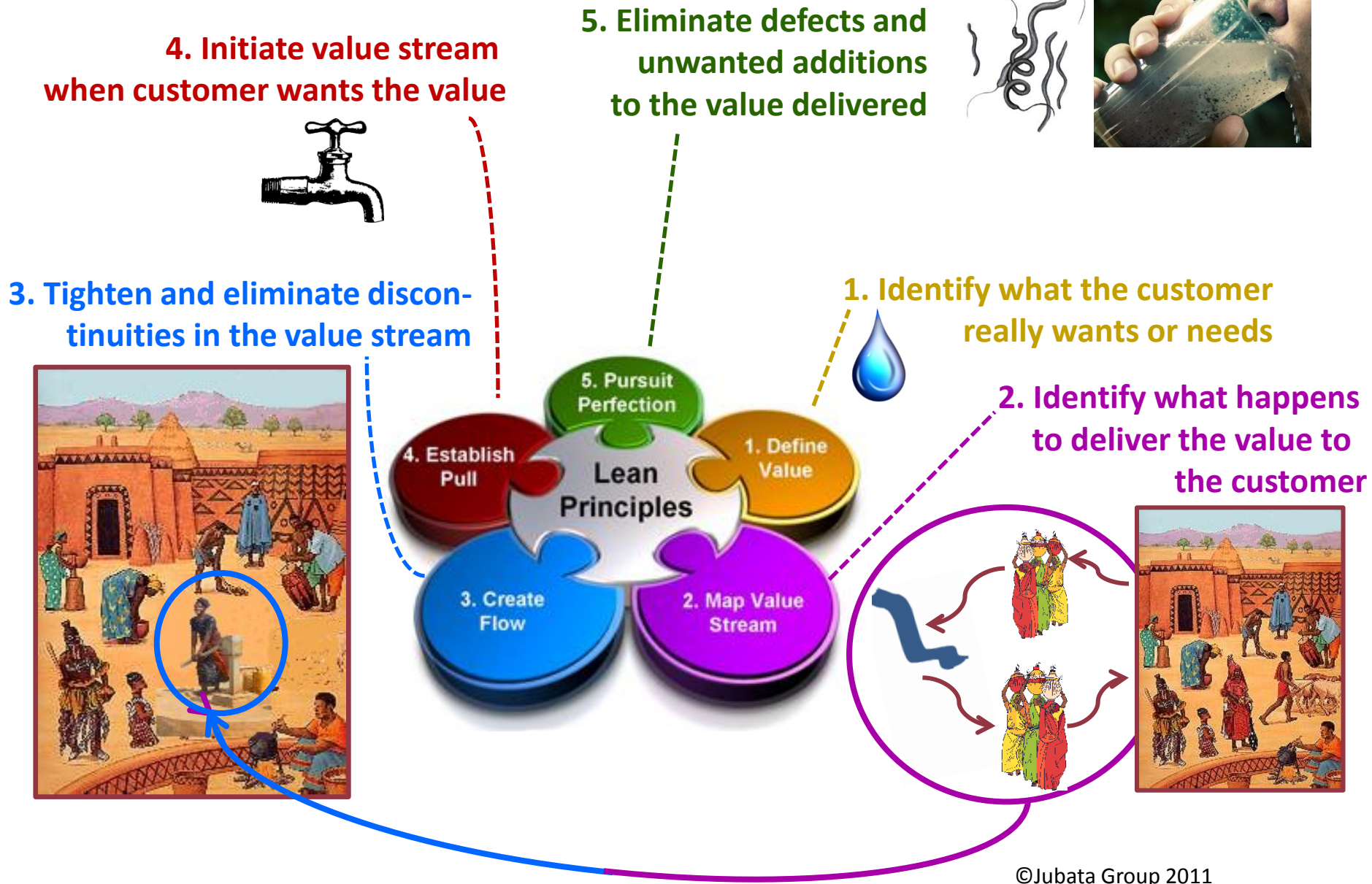
go with the flow



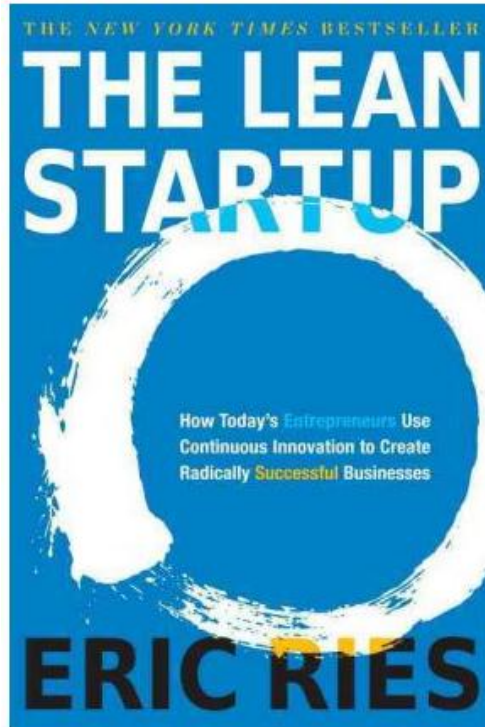
why Lean ideas work
so well in Software



Lean: a general paradigm for human productivity

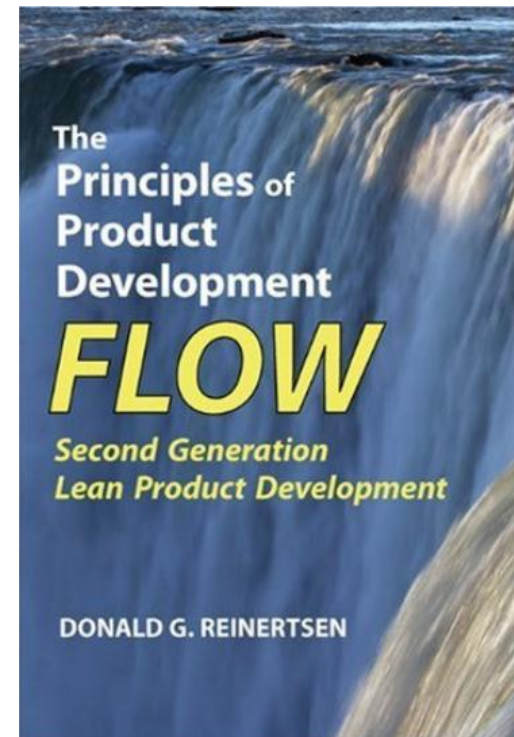
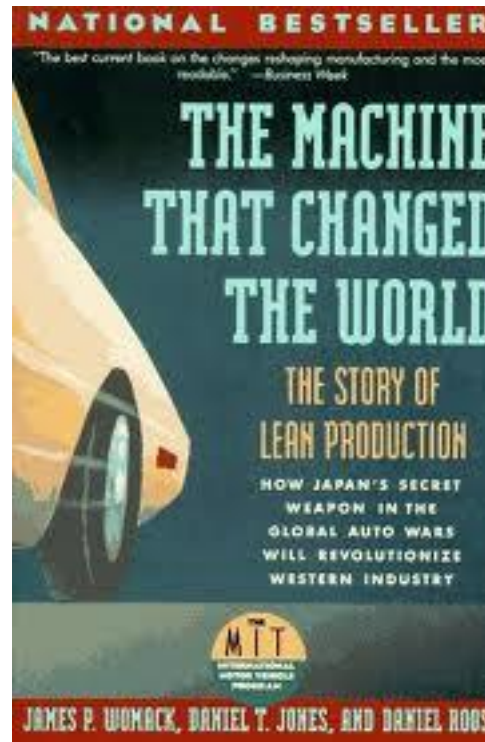


Lean: a general paradigm for human productivity



“How do you apply the fifty-year-old ideas of **Lean** to the fast-paced, **high-uncertainty world of startups**? This book provides a...practical answer”

Don Reinertsen



“ Instead of spending time and energy trying to remove variability, you will learn to use it to your advantage.”

*Mikael Lundgren
Citerus AB*

paradigm

“a philosophical and theoretical framework...within which theories, laws, and generalizations and the experiments performed in support of them are formulated”

merriam-webster.com

Craft

Tools

Skills



Community. Flexibility.

Manifesto for Software Craftsmanship

Raising the bar.

As aspiring Software Craftsmen we are raising the bar of professional software development by practicing it and helping others learn the craft. Through this work we have come to value:

Not only working software,
but also **well-crafted software**

Not only responding to change,
but also **steadily adding value**

Not only individuals and interactions,
but also **a community of professionals**

Not only customer collaboration,
but also **productive partnerships**

That is, in pursuit of the items on the left we have found the items on the right to be indispensable.

© 2009, the undersigned.
this statement may be freely copied in any form,
but only in its entirety through this notice.

manifesto.softwarecraftsmanship.org

Mass

Machines

Process

“Process: A series of operations performed in the making or treatment of a product”

thefreedictionary.com



Scale. Predictability. Speed.



Lean

Minds

**Adaptive
Cognition**

Community.

Flexibility.

Scale.

Predictability.

Speed.

Focus.

Synergy.

“Tools do not think, people think, Lean is about people not tools”

Kathy Balsley, SAP

Lean

is not a

toolset

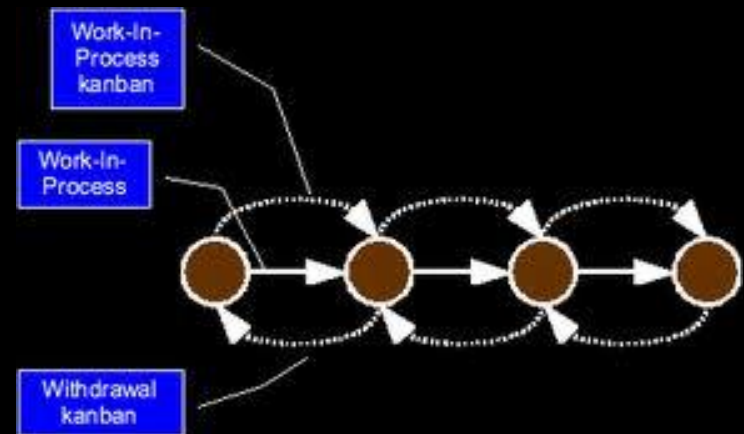
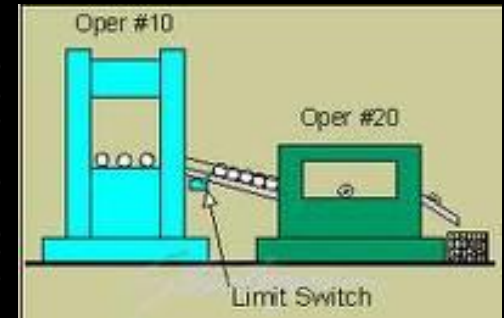
Lean factory-floor tools



Andon lights



Automation

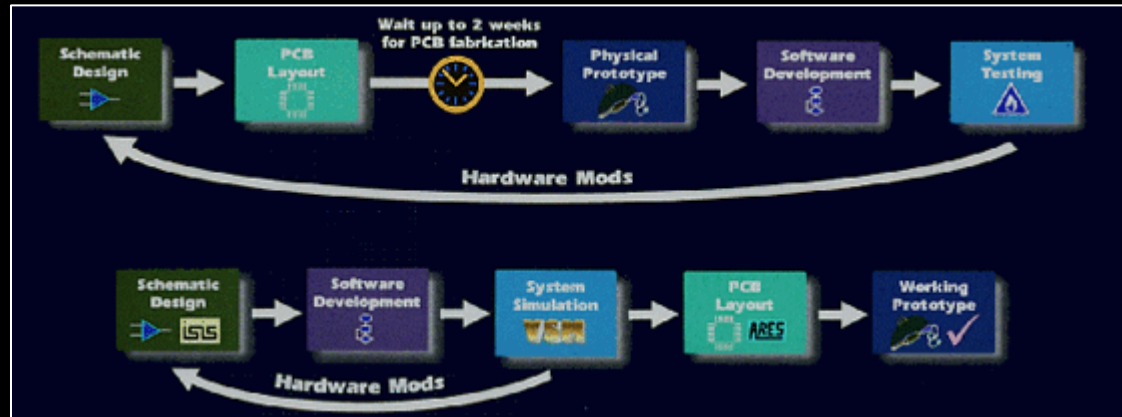


Lean knowledge-work tools

QFD

	Priorities	Post	Getstone	Oracle7	SQLanybase
Java compatible	.1	9	9	3	3
easy to Interface to an O-O App	.3	9	9	1	1
price/ royalties	.3	9	3	3	9
locking granularity	.2	9	9	3	3
nested transactions	.1	1	3	3	3
score		3.2	6.6	2.4	4.2

VSM



A3



Clean Catch January 2004 Team Lead: Mique Tabanan Team members: Jeri Butts, Kathy Canfield, Troy Cooper, Keith Dorsey, Tina Nease, and Cyndi McIntosh OBJECTIVE: Improve 5S compliance in the Bin home positions.		TARGETS Establish individual accountability for 5S in HP E,F And K by January 5, 2004 Incorporate 5S responsibilities into quarterly evaluations		CHECK <table border="1"> <thead> <tr> <th>TARGET</th> <th>RESULTS</th> <th>EVAL</th> </tr> </thead> <tbody> <tr> <td>Establish individual accountability for 5S in HP E,F And K by January 5, 2004</td> <td>Complete</td> <td>0</td> </tr> <tr> <td>Incorporate 5S responsibilities into quarterly evaluations</td> <td>Complete</td> <td>0</td> </tr> </tbody> </table>		TARGET	RESULTS	EVAL	Establish individual accountability for 5S in HP E,F And K by January 5, 2004	Complete	0	Incorporate 5S responsibilities into quarterly evaluations	Complete	0																		
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Background At launch, each associate was assigned specific areas, rotated monthly In 2003, 5 S responsibilities were set by teams to support teamwork Teams were responsible for sharing workload		PLAN Meet with 5S associates (Troy and Cyndi) Add 5S key points to the binning and picking SOP Create a responsibilities chart for evaluation purposes Assign each associate a specific area for one quarter Assign a PM, associate to perform maintenance during 5S		HP associates (Dave and Shaw) have been assigned and provided with the 5 S time to perform maintenance on carts and shelves Shelves have been color coded to ensure that each rack will contain only the items that coordinate with the color on the rack																												
Grasp the Situation / Current Conditions 		Responsibilities <table border="1"> <thead> <tr> <th>Name: Kathy Canfield</th> <th>Area: Gas Valve Yang Room</th> </tr> </thead> <tbody> <tr> <td>1. Develop the checklist</td> <td></td> </tr> <tr> <td>2. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>3. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>4. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>5. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>6. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>7. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>8. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>9. Develop the maintenance checklist</td> <td></td> </tr> <tr> <td>10. Develop the maintenance checklist</td> <td></td> </tr> </tbody> </table>		Name: Kathy Canfield	Area: Gas Valve Yang Room	1. Develop the checklist		2. Develop the maintenance checklist		3. Develop the maintenance checklist		4. Develop the maintenance checklist		5. Develop the maintenance checklist		6. Develop the maintenance checklist		7. Develop the maintenance checklist		8. Develop the maintenance checklist		9. Develop the maintenance checklist		10. Develop the maintenance checklist		Associate Feedback Associates like specific responsibilities - know where to go Observed improvement in activity during Five S time Observed improvement in shelf dusting						
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Yet ... Lean has failed

Why Lean Programs Fail

By Jeffrey Liker and Mike Rother

Toyota's success has inspired tens of thousands of organizations to adopt some form of a lean program. The term was introduced in *The Machine That Changed the World* and later in *Lean Thinking* as a new paradigm that was as monumental as the shift from craft-style to mass production. The focus of lean is on the customer and the value stream. You can say it is a pursuit of perfection by constantly eliminating waste through problem solving. Certainly an organization that is truly dedicated to becoming lean is on a path toward excellence.

Yet a large survey conducted by *Industry Week* in 2007 found that only 2 percent of companies that have a lean program achieved their anticipated results.¹ More recently, the Shingo Prize committee, which gives awards for excellence in lean manufacturing, went back to past winners and found that many had not sustained their progress after winning the award. The award criteria were subsequently changed.² Why is the pursuit of excellence through lean so difficult?

"We have both concluded from our different journeys and experiences with companies that people have had a fundamental misunderstanding of what the Toyota Production System is in practice."

Where Does Improvement Come From?

When we look at a Toyota plant, we see many good ideas, and it appears that the company has a department of Toyota Production System (TPS) geniuses who design and implement all these lean innovations. We might ask whether these ideas are standardized and implemented in all Toyota plants in the exact same way. Are the TPS experts telling the plants what to do and auditing them to see if they are following the best practices?

The reality is that very little that you see at a Toyota site is the result of one person with a big idea that got standardized across plants. More often, what you see is today's condition, which is the result of many small steps, some of which were discarded and others embraced. It was the result of many cycles of plan-do-check-act (PDCA), and it is different throughout Toyota because different organizations are on different learning cycles.

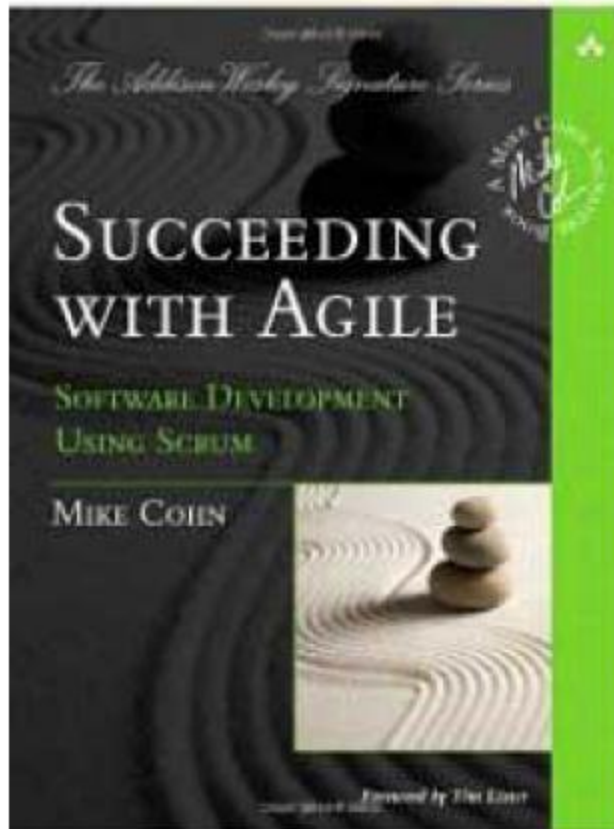
¹ *Everybody's Jumping on the Lean Bandwagon, but Many are Being Taken for a Ride*. Industry Week, May 1, 2008.

² Robert Miller, Executive Director of the Shingo Prize, interviewed on radiolean.com, July, 2010. "About 3 years ago we felt we needed deep reflection. After 19 or 20 years we went back and did a significant study of the organizations that had received the Shingo Prize to determine which ones had sustained the level of excellence that they demonstrated at the time they were evaluated and which ones had not... We were quite surprised, even disappointed that a large percentage of those organizations that had been recognized had not been able to keep up and not been able to move forward and in fact lost ground... We studied those companies and found that a very large percentage of those we had evaluated were experts at implementing tools of lean but had not deeply embedded them into their culture."

“only 2 percent of companies that have a lean program achieved their anticipated results”

“Why Lean Programs Fail”, by Jeffrey Liker (“The Toyota Way”) and Mike Rother (“Toyota Kata”)

... Agile has failed ...



More than 70% of Agile initiatives fail to meet their goals.

... and Traditional Mgt has failed

75% decline in ROIC

S&P500 lifespan -> 5 years

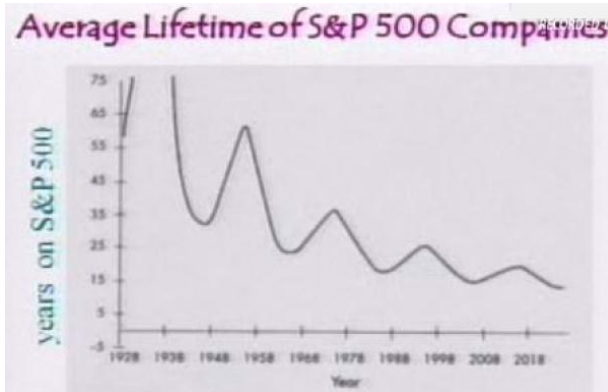
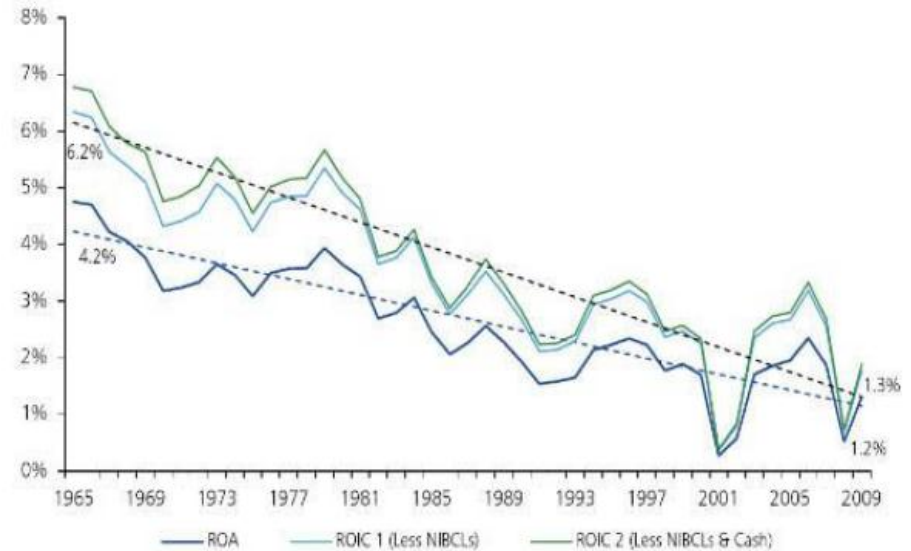


Exhibit 6: Economy-wide Return on Invested Capital (ROIC) (1965-2009)



Source: Compustat, Deloitte analysis

“return on assets for U.S. companies has steadily fallen

to almost one quarter of 1965 levels

at the same time that we have seen continued ... improvements in labor productivity.”

Source: Deloitte's Center for the Edge: The Shift Index (2009)

Why?

paradigm

a “within” implies a “without’:
i.e., a surrounding environment

“a philosophical and theoretical framework...within which theories, laws, and generalizations and the experiments performed in support of them are formulated”

merriam-webster.com

The Mass-Paradigm Environment / Worldview

Mass production lives in a world where products are made using:

- big, expensive tools (machines, software packages), in
- expensive facilities, all of which are
- run or serviced by expendable, expensive people

Everything is governed by the Unit Cost Equation:

$$\text{Unit Cost}(\text{op}_i) = \frac{\$DL(\text{op}_i) + \$MTL + \$OVHD(\text{op}_i)}{n}$$

...where $\$OVHD(\text{op}_i) = \frac{\text{DL Hours}(\text{Op}_i)}{\text{Total Plant DL Hours}} (\$OVHD_{\text{total}})$

n = number of parts produced per hour (rate)

In this, your only tools to improve profits are:

- Cut “DL” Direct Labor (people, their pay, or both)
- Cut “MTL” Materials costs
- Cut “OVHD” Overhead costs
- Increase the number of products made per hour

Cut people / outsource

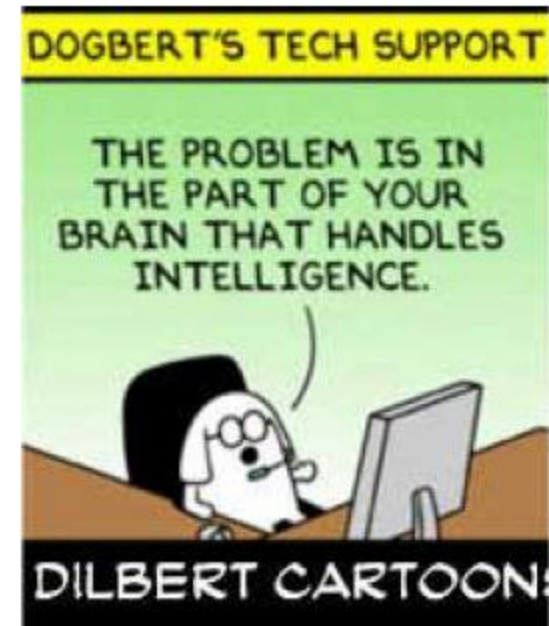
Cut quality

Managers hate their own jobs!

The Three Most Hated Jobs in the USA

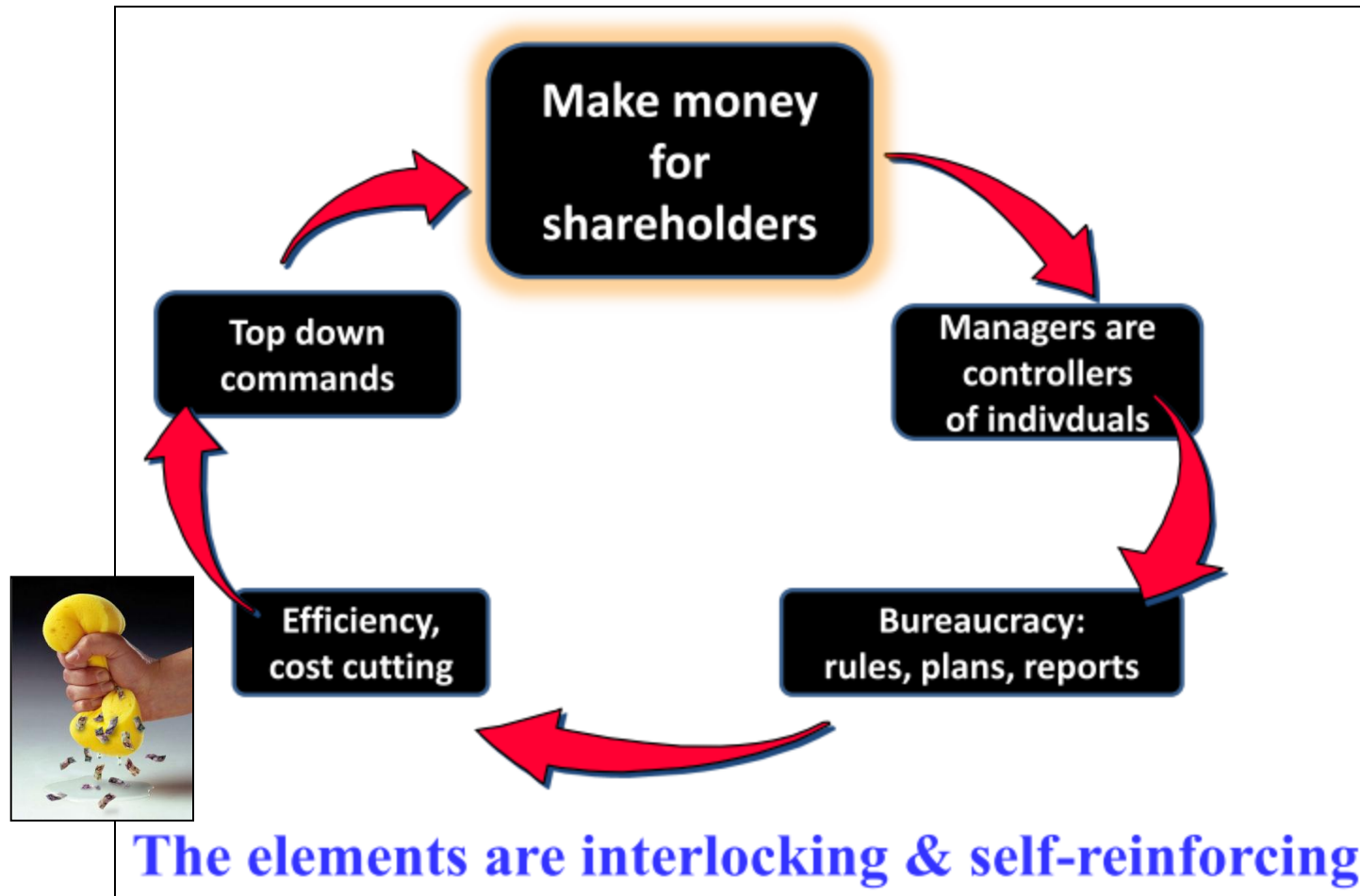
1. Director of Information Technology
2. Director of Sales and Marketing
3. Product Manager

These are bad
situations,
not bad people



<http://www.forbes.com/sites/stevedenning/2011/08/11/think-your-job-is-bad-try-one-of-these/>

Mass Paradigm Management Principles



“It is both scary and amazing to observe

how little management practices have developed over the last fifty years,

a period where we have seen groundbreaking innovation in most other parts of business and technology. My sons who now are finalizing their business studies

could easily have used many of my own textbooks from thirty years ago,

especially those covering budgeting, planning and performance management. Most business schools still teach, and

most companies still practice a “command-and control” approach”



*Bjarte Bogsnes,
VP Performance Management Development, Statoil
world's 13th-largest oil and gas producer;
“#1 most-admired company in petroleum sector”*

The Lean Environment

“Lean culture is characterised by people first

- strong customer orientation
- trust

“The human dimension is the single most important element”

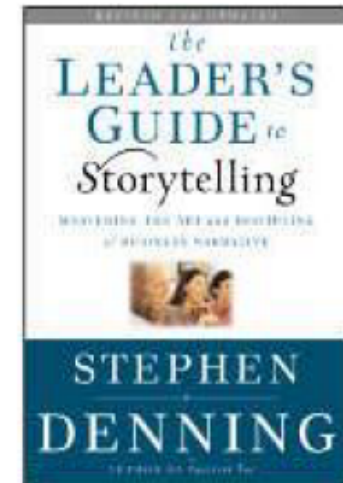
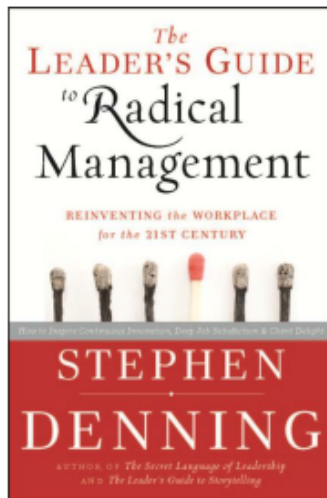
Thorsten Arens

Strong Customer Orientation

Making The Entire Firm Lean & Agile

Steve Denning

Steve's daily blog on Forbes
<http://blogs.forbes.com/stevedenning/>

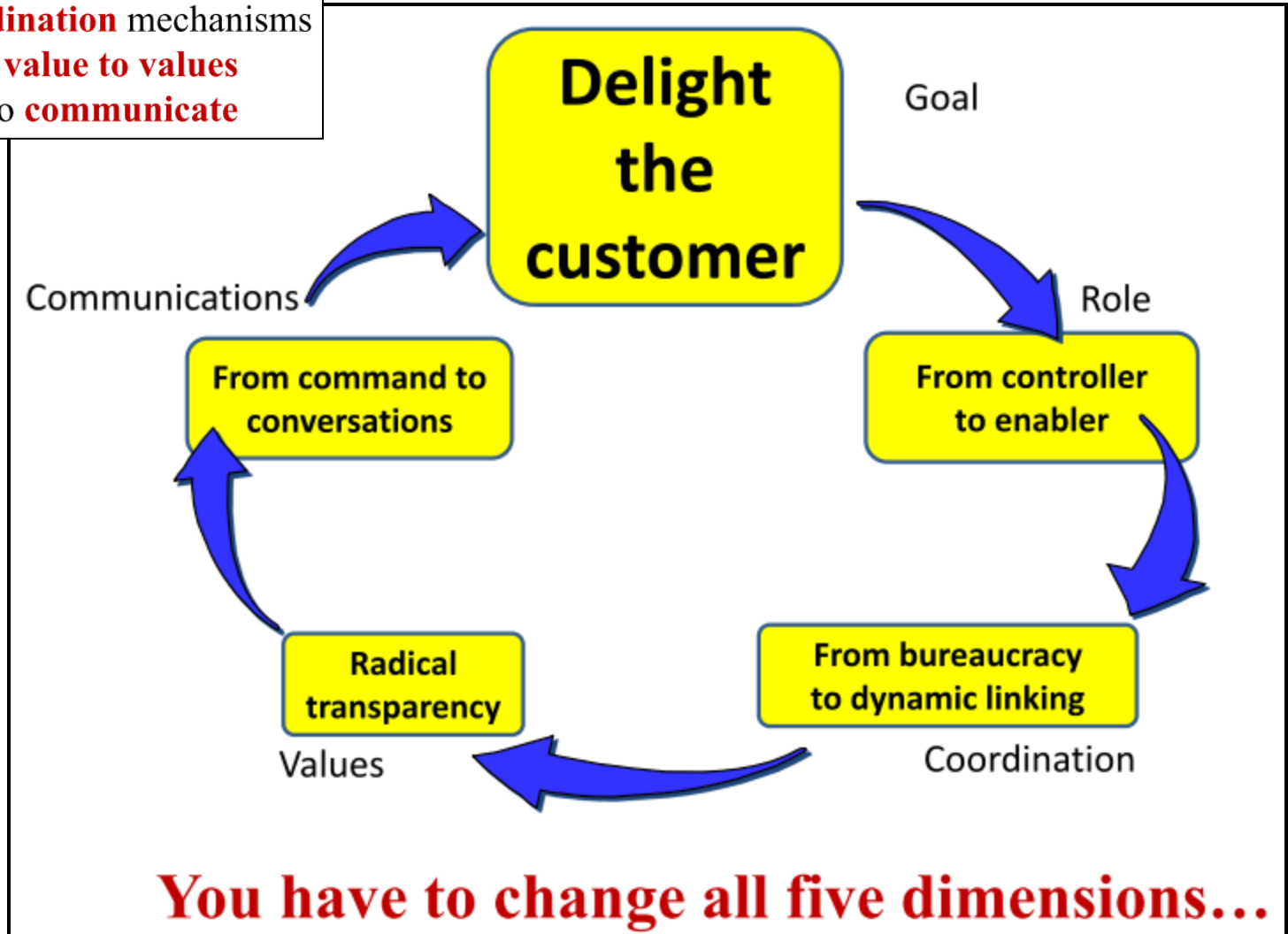


These slides:

<http://www.stevedenning.com/slides/Stockholm.pdf>

To get lasting change, we need all at once

1. **New goal** for the organization
2. **New role** for managers
3. **New coordination** mechanisms
4. Shift **from value to values**
5. New way to **communicate**



A paradoxical discovery!



Customer delight



Costs come down of
their own accord!

The difference is undeniable

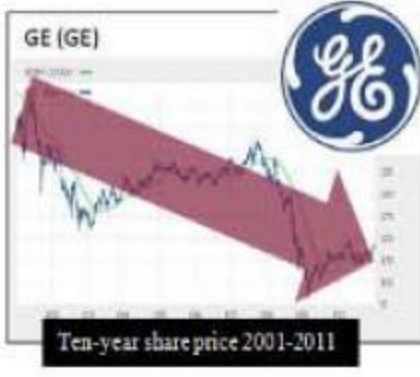
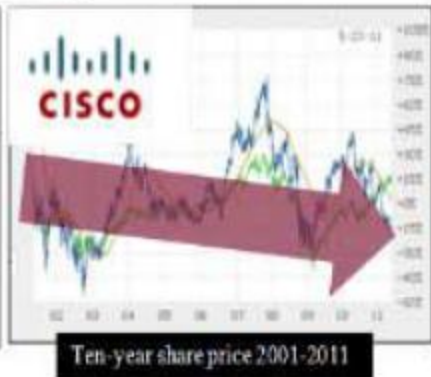
Radical management

a “Lean-friendly” environment

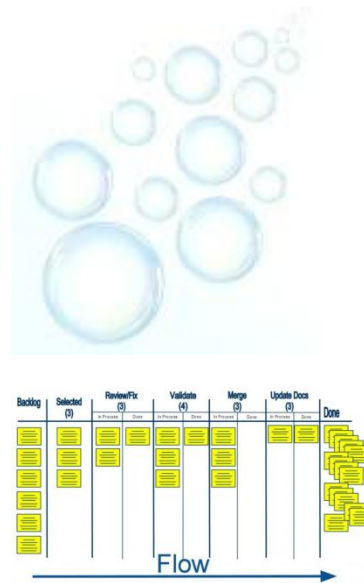
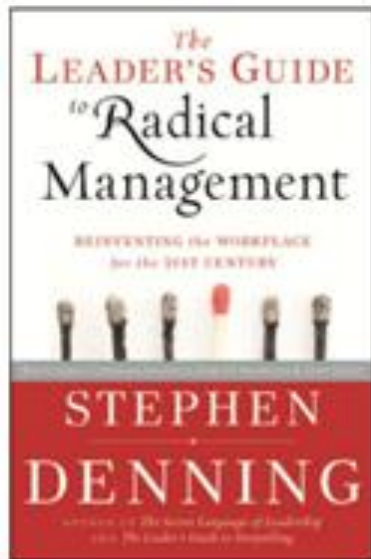


Traditional management

a “Mass-friendly” environment

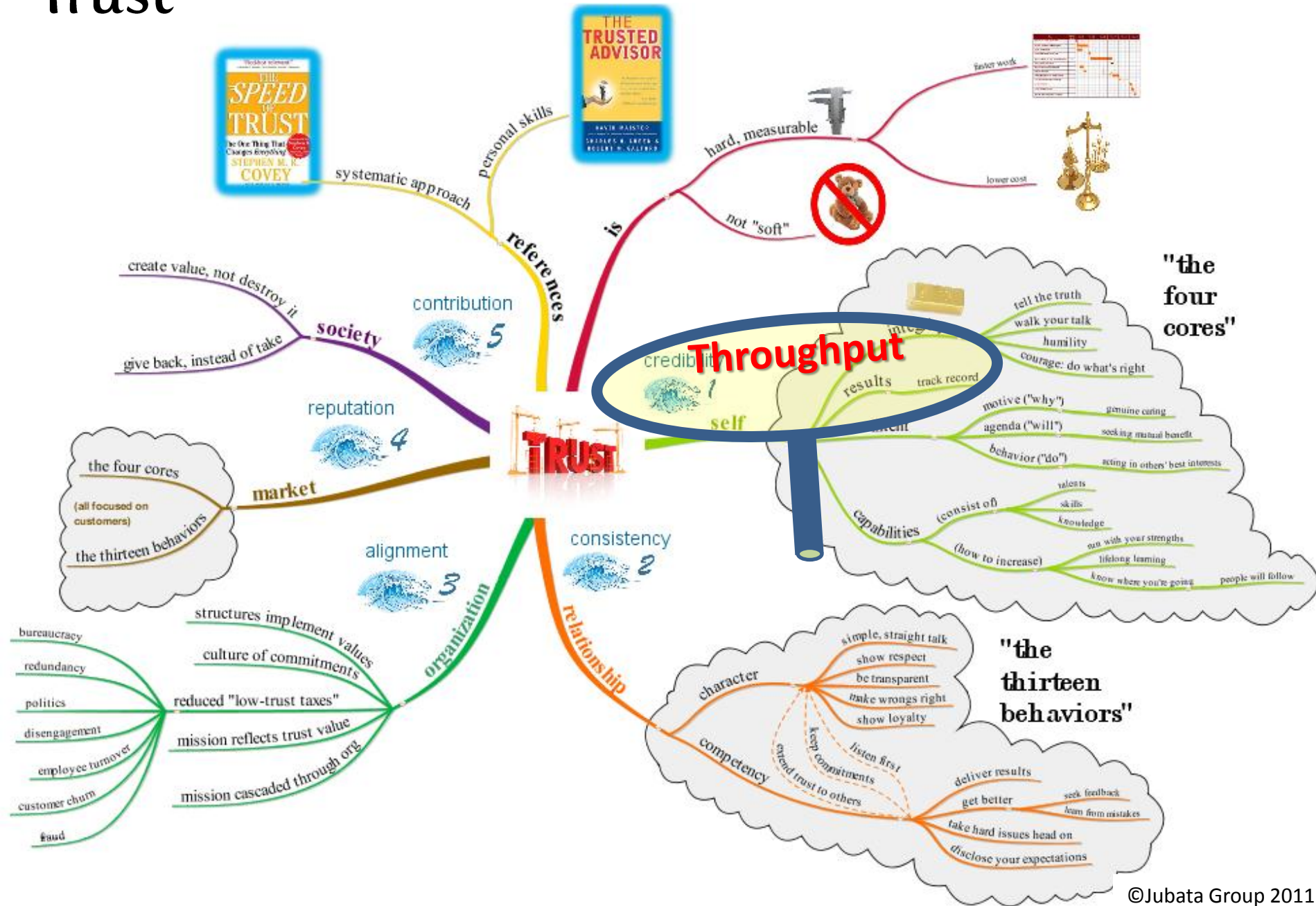


So, what can *you* do about your company's environment?

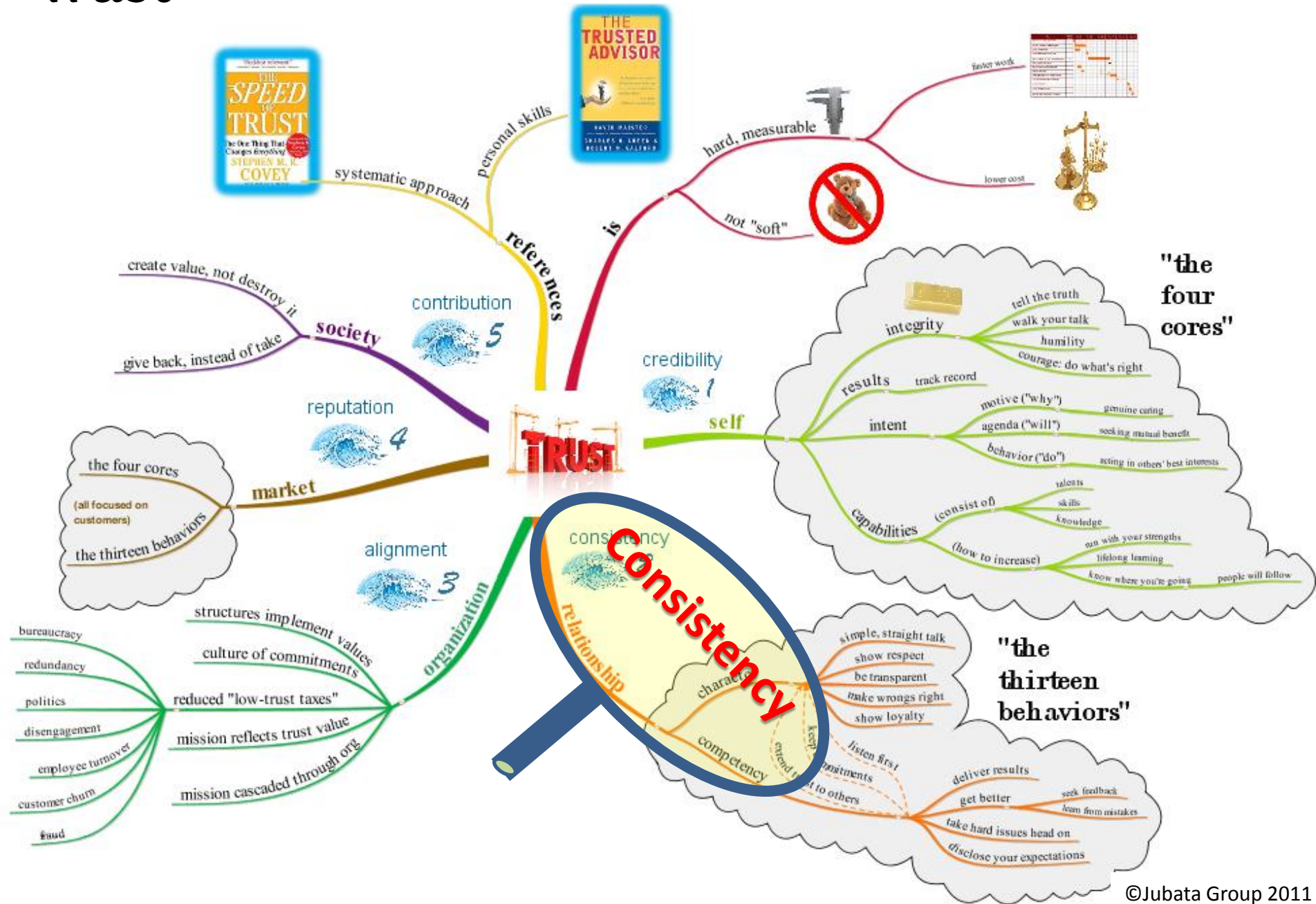


AND ...

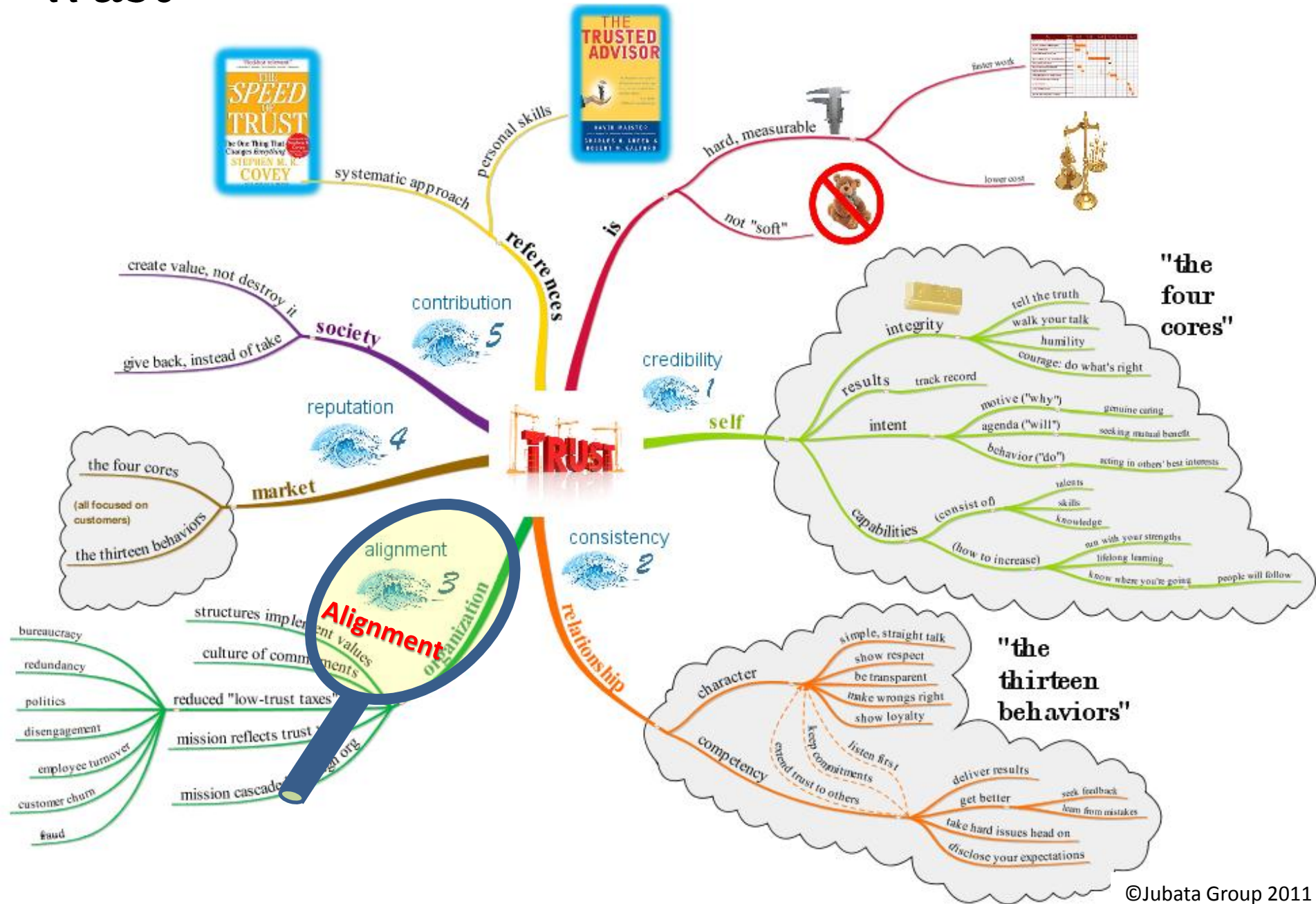
Trust



Trust



Trust



Lean in software development: Value

Building the *right* software

- Experimental, exploratory environment
- Understand the user's mission
 - What's most likely to change
 - What's most likely to stay same
- Anticipate future needs (GTI, Sensemaking)



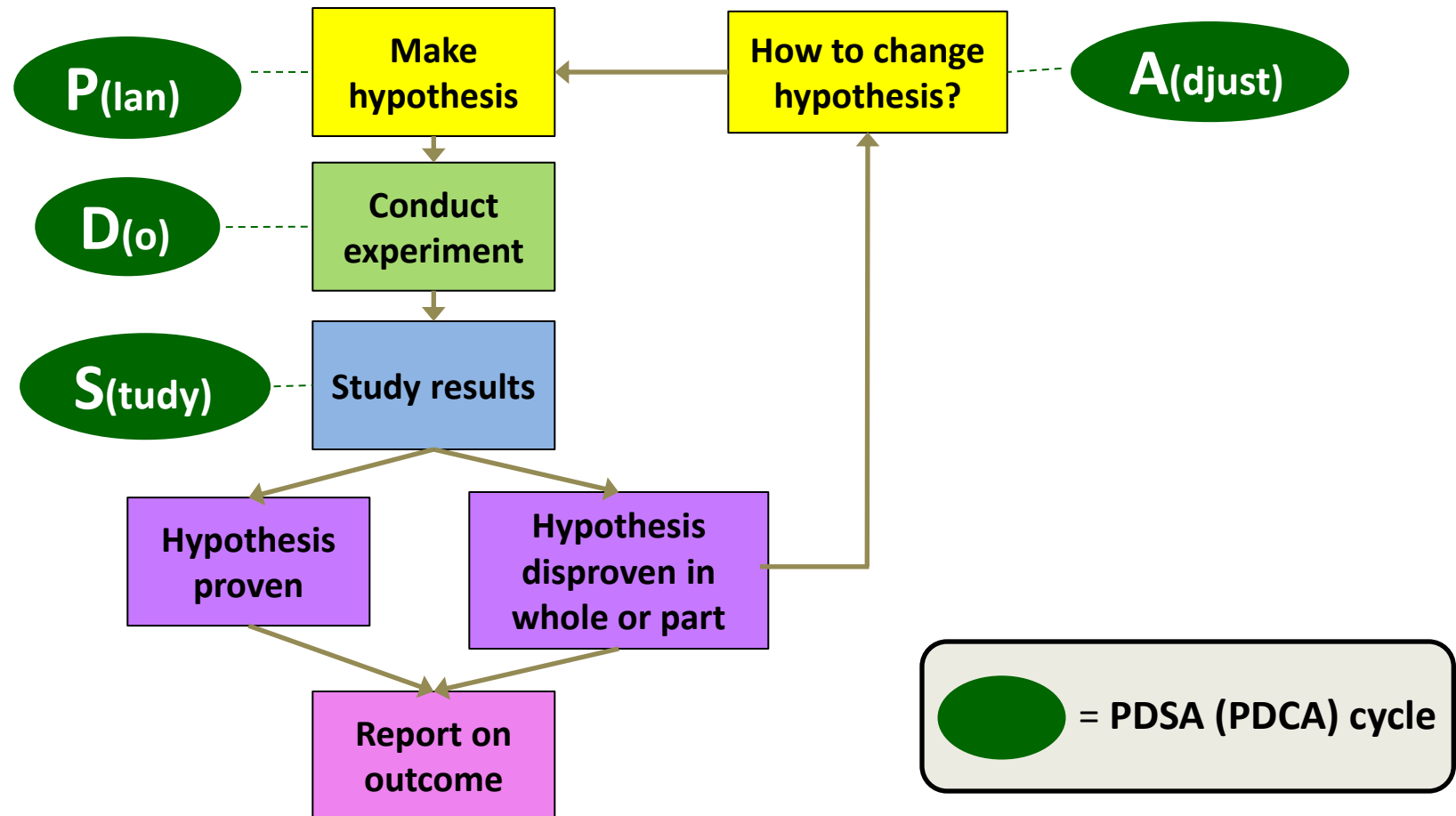
Hypothesis

: an idea or explanation for something that is
based on known facts but has not yet been proved

Cambridge Dictionary

Experiment-based development

(the way most Agile *and* Lean projects implement it)



Lean A3: Starts with Hypothesis

Clean Catch

January 2004
Team Lead: Mique Tatman Team members: Jeri Butcher, Kathy Canfield, Troy Cooper, Keith Dorsey, Tina Nease, Cyndi McIntosh

OBJECTIVE: Improve 5S compliance in the Bin home positions.

Background

Associate was assigned specific areas, rotated monthly

- In 2003, 5S responsibilities were set by teams to support teamwork
- Teams were responsible for sharing workload

Grasp the Situation

Current Conditions

- 5S assignments are not clear (SOP) - No organization - specific assignments, tracking
- No ownership/accountability of area - One area is cleaned by multiple associates
- Shelf dividers and face plates are failing and in need of repair
- A build up of dust has collected on the shelves that are not cleaned
- 5S supplies are not distributed equally and are not placed in the holders
- More supplies are needed in HP E And HP F
- No coverage for associates who are out for an extended period of time
- Parts in location are not being straighten during 5S

Root cause analysis

Problem: 5S is not being performed at the end of the day

Why? Expectations not clear

Why? Individual feedback not provided

Why? No individual accountability

Root cause: Areas assigned by teams

TARGETS

Establish individual accountability for 5S in HP E,F And K by January 5, 2004

- Incorporate 5S responsibilities into quarterly evaluations

PLAN

- Assign STF associates (Troy and Cyndi)
- Add 5S key points to the binning and picking SOP
- Create a responsibilities chart for evaluation purpose
- Assign each associate a specific area for one quarter.
- Assign a P.M. associate to perform maintenance during 5S

Responsibilities

Name: Kathy Canfield Area: Cat Ex2A Temp. Reserve Loc.

Task	Frequency	Responsible	Status
Sweep (As needed)	As needed	Kathy Canfield	Completed
Dust (As needed)	As needed	Kathy Canfield	Completed
Magnet Maintenance (Straighten)	As needed	Kathy Canfield	Completed
Location Maintenance (Straighten)	As needed	Kathy Canfield	Completed
Location check for damage/remove empty boxes/trash/labels	As needed	Kathy Canfield	Completed
Notify PM (Dave Rutzel) if shelves/dividers/signing in need of repair (note location)	As needed	Kathy Canfield	Completed
Change Map Header (Once a month)	Once a month	Kathy Canfield	Completed

DO

ACTION	RESP	DATE
Assign each associate a specific area to 5S	TN KC TC KD	1/5/04
Assign PM associates to perform maintenance during 5S	VS	12/15/04
Create area charts for each associate	MT KC TN JB	12/30/04
Conduct random 5S evaluations for each associate's area	MT TN KC KD JB	1/6/04
Purchase additional supplies for 5S	DB	1/5/04
Code supplies by area - Distribute supplies equally for each HP	MT JB KC MT	1/13/04
Develop a coverage plan	Team	
Add 5S key points to binning and picking SOPs in HP E,F and K	TN	1/6/04

CHECK

TARGET	RESULTS	EVAL
Establish individual accountability for 5S in HP E,F And K by January 5, 2004	Complete	O
Incorporate 5S responsibilities into quarterly evaluations	Complete	O

Associate Feedback

- Associates like specific responsibilities - know where to go
- Observed improvement in activity during Five S time
- Observed improvement in shelf dusting

Evaluation Summary

- Better time management - Five S up to bell
- Significant improvement in cleanliness

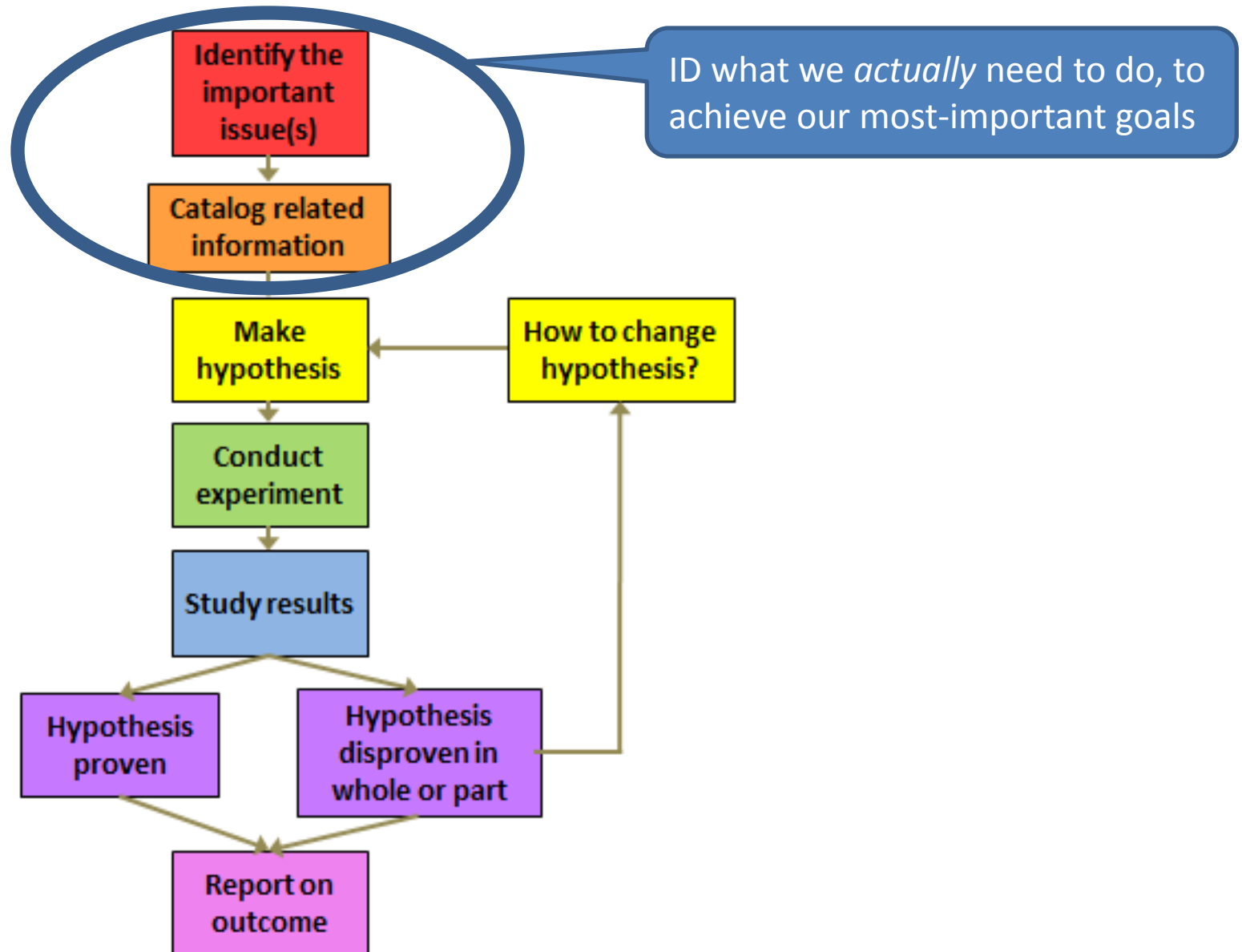
ACT

ACTION	RESP	DATE
Continue to evaluate each associate weekly	TL	1/5/04
Develop coverage plan for associates who are out for a extended period of time	Team	
Monitor 5S throughout HP	GL/TL	
Revisit Five S evaluation process - determine Roles and Responsibilities between STF and TL/GL	GL/TL	

REFLECTIONS

- Good opportunity to advocate for associates - asked for specific responsibilities
- Good buy in from teams
- Experience as associates increased speed of project - 5 weeks to implementation
- 1st project completed as TL

The *Complete* Scientific Method



Pre-Hypothesis Research

“**large volumes of...anecdotes, drawings, pictures or other digital forms are collected from a subject population...and tagged without prior knowledge of purpose**

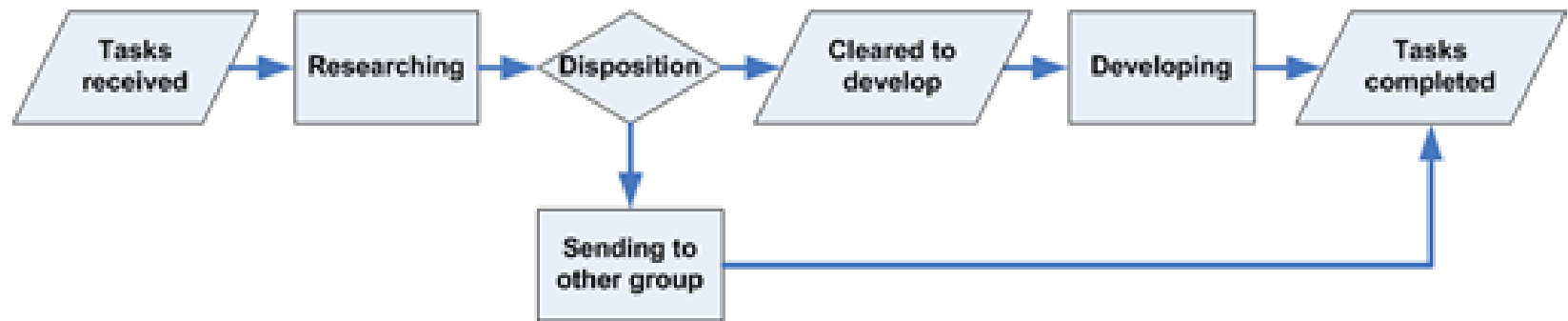
“used to **minimise the danger of expert opinion or bias** which **often corrupts the original data** source [and questionnaires].

“typically **require less than half the investment** often associated with traditional survey techniques.

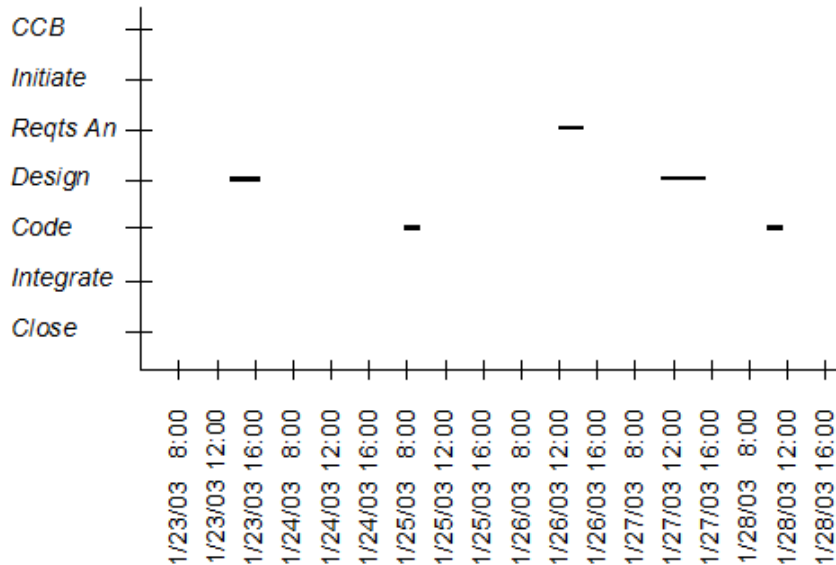
cognitive-edge.com

Lean in software development: Value Stream

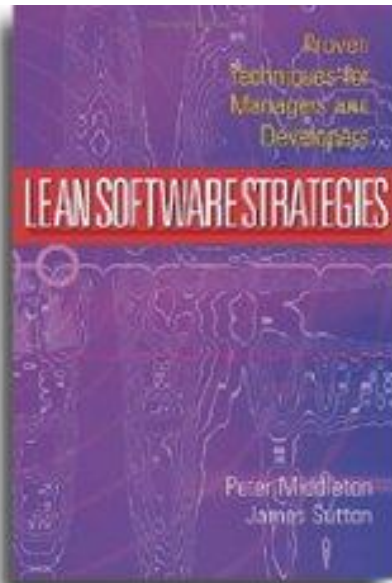
Value-Stream Map



Lean in software development: Flow

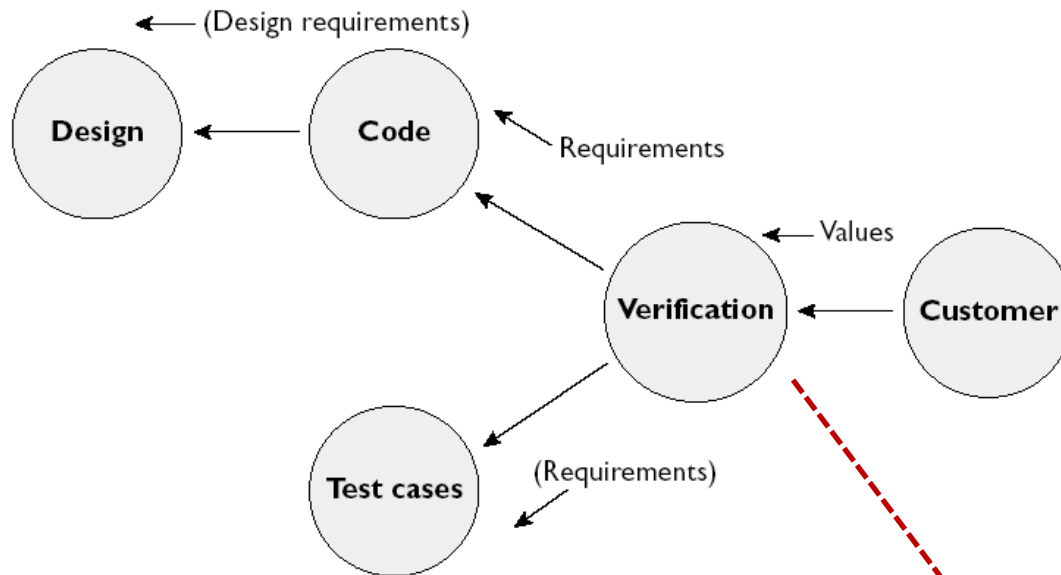


Software DFMA



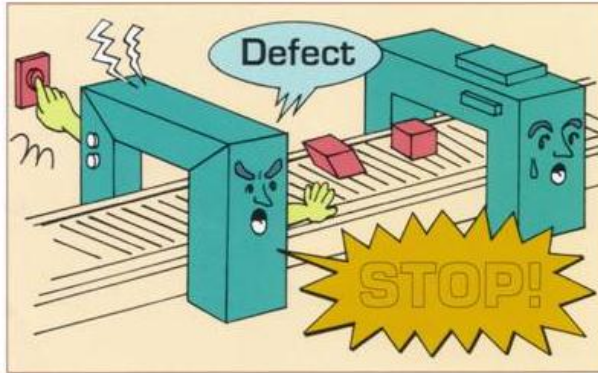
- “Design for Manufacturing and Assembly”
 - Addresses Root Causes of Waste
 - Adaptable to Software
- “Big Parts”
 - Few Classes, Many Instantiations
 - E.g., Using Parnas/Madey Four-Variable Model
 - E.g., Using Parnas [Design] Criteria
 - Requirements-Hiding
 - Hardware-Hiding
 - Decision-Hiding
 - Becomes the Basis for One-Piece Production

Lean in software development: Pull

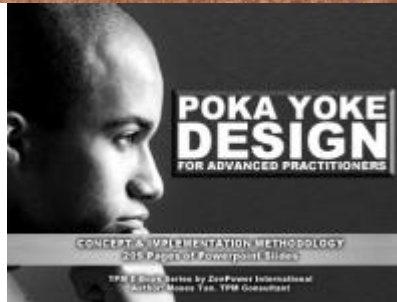


Lean in software development: Perfection

Jidoka (Autonomation)



Poka Yoke (Mistake-Proofing)

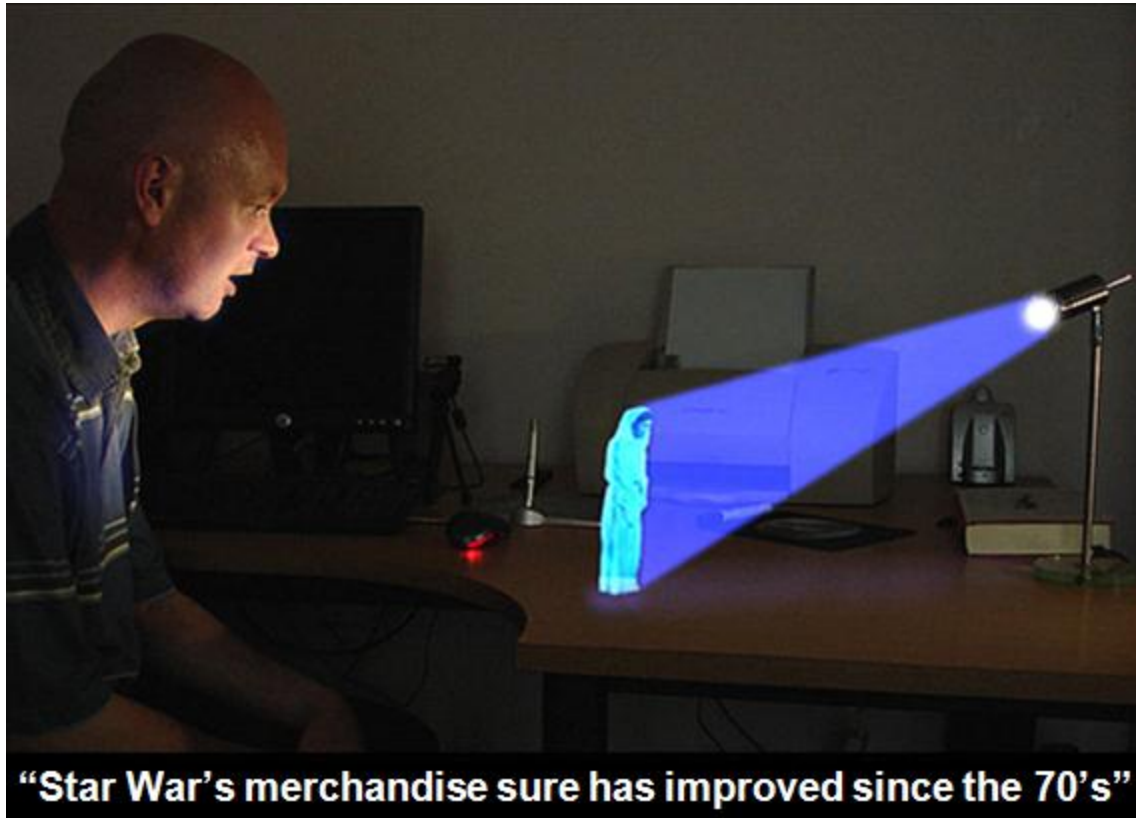


“Lean represents a...shift from focusing on
increasing productivity to focusing on
shortening the time from the beginning of work to the completion
of it.”

Al Shalloway
CEO/Founder, Net Objectives Inc.

Two Things Are Needed to Manage Workflow

1) Make Hidden Things Visible and Concrete



2) Limit WIP



For some physical products, flow is readily visible



And ...



Even then, some things need help to visualize



Visual Controls enable managing queues



A classic “kanban”
(Japanese: “billboard”
or “instruction card”)

“[Kanban is] based on Lean principle of "pull" – or demand-based replenishment and [product] creation”

www.kanban.com

“Kanban is not an inventory control system. Rather, it is a scheduling system that tells you what to produce, when to produce it, and how much to produce”

Wikipedia



Kanban works with your current process



“change as little as possible

**“Resist the temptation to
change workflow,
roles and responsibilities, and
working practices**

**“It is better to optimize what
already exists”**

David Anderson, “Kanban”



But I Still Fit!
Why Don't I
Move?

All too often we equate "free time" with "capacity," and assume we have the ability to fit in more work. In this case, we are not unlike a freeway.

A freeway can support 0-100% capacity. But when its capacity extends beyond 65%, it begins to slow down.

When it reaches 100% capacity, it stops.

Capacity is a horrible measure of throughput.

Similarly, multitasking is a horrible way to manage your synapses, (and as a recent [Stanford study](#) shows, it is likewise ineffective.) If your brain is a highway and you are filling yourself with work, after a while you start to slow down.

Your mental rush hour gets longer and longer. You find yourself struggling to accomplish even the simplest tasks.

That motorcyclist in the picture is that last little 5 minute task you agreed to do.

"It's just five minutes! How could I say no?"

What will workflow/queue mgt do for you?

“The [kanban] system is the foundation for "Leaning" the supply chain throughout the Rexnord business. The integration of [kanban] as a key business process is shortening the lead-time, reducing inventories and has reduced supply chain scheduling. ”

Lower planning overhead
(less “coordination costs”)

Makes work
flow quicker

Less work “backed-up”

V.P. Operations
Rexnord Corporation

How can we make knowledge-work flow visible?

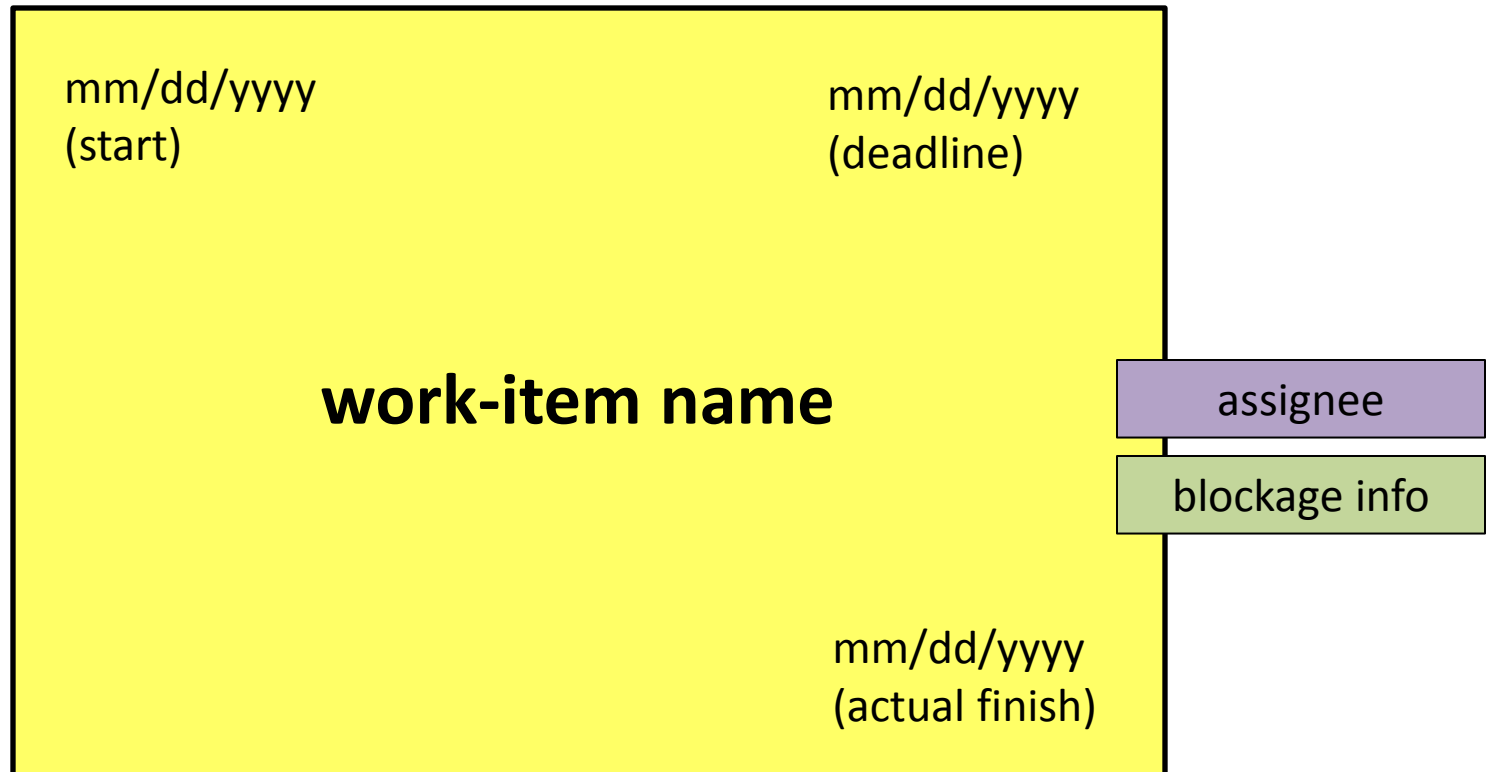


We must depend on constructed visual indicators

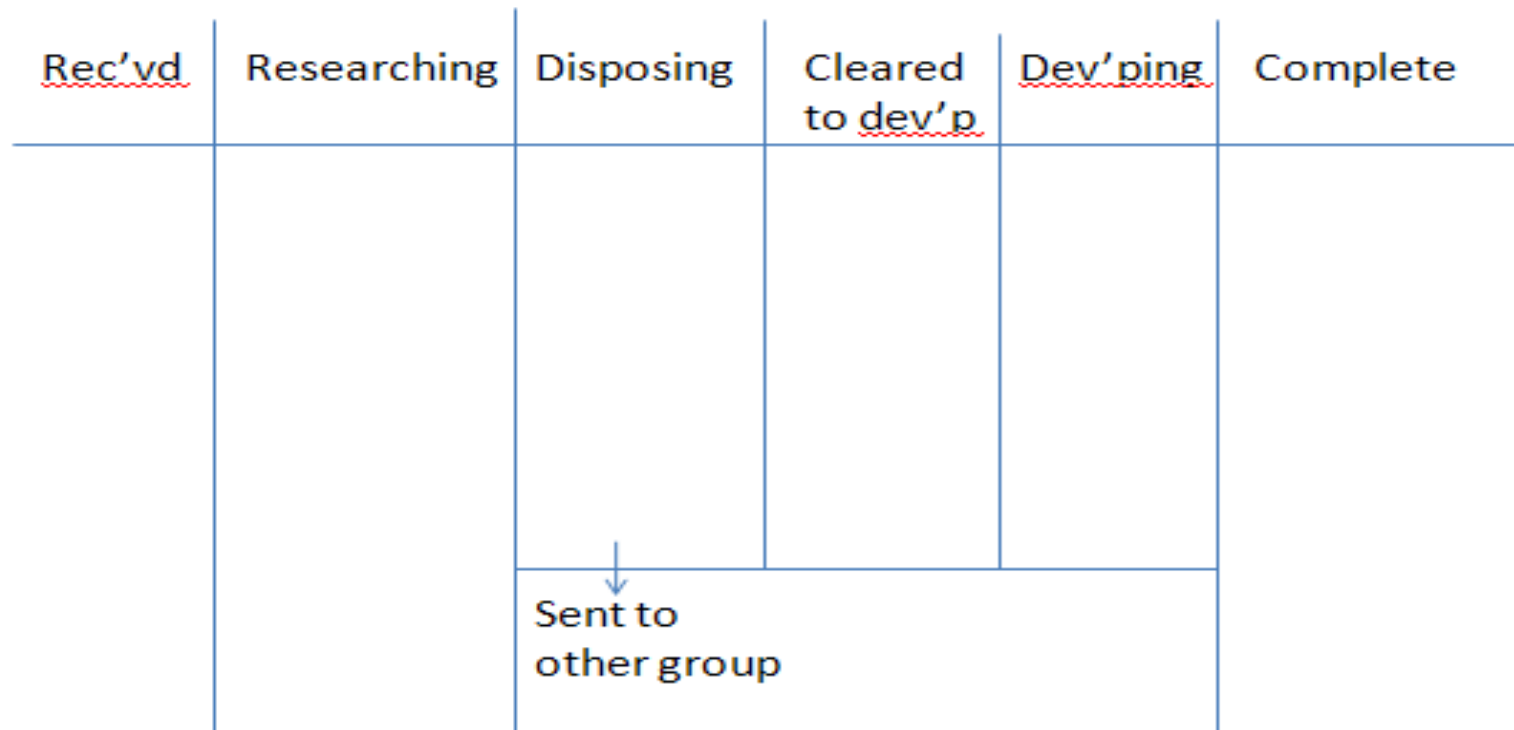
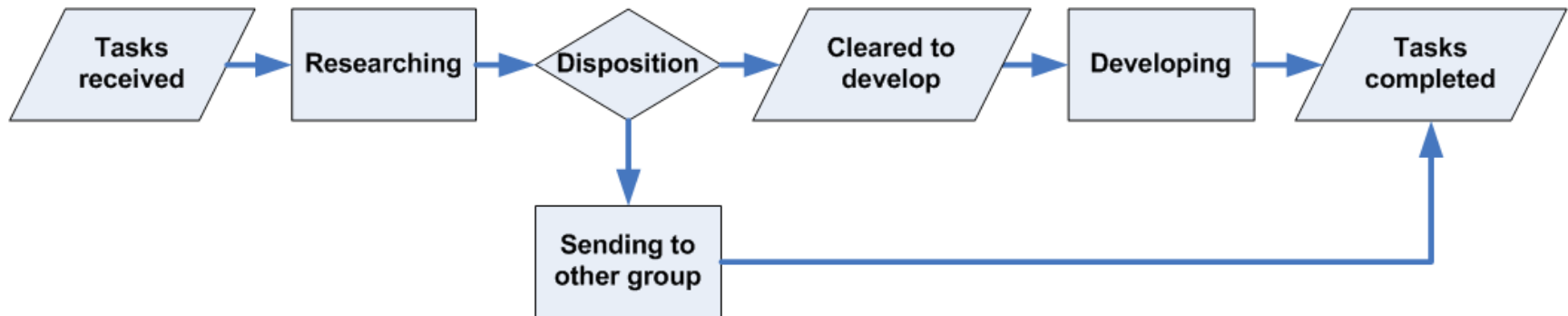
The simplest knowledge-work Kanban board



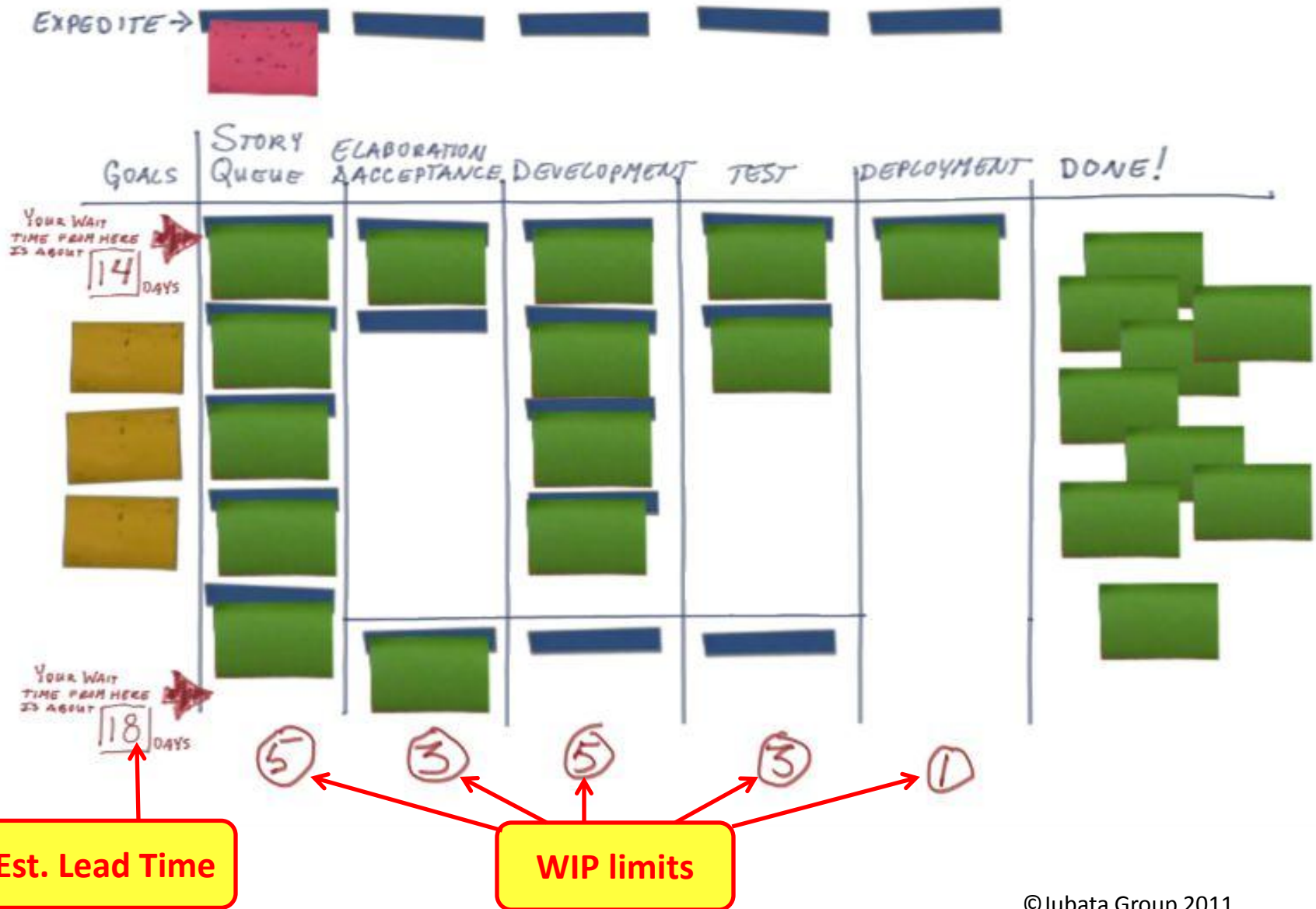
Things on a knowledge-work Kanban card



Slightly-More Complicated Kanban



A software-development Kanban board



A personal example

	Back Log	On-Deck (3)	Doing (3)	★ DONE !!! ★
Jim		Get these books	...	
Deb		orig. carpet padding Snake Cable Paint Fall Garden	...	Paint MSB (not finished) fix upstairs floor in hallway Paint of R. Living Paints out front fix door in hall (not finished)
House	carpet lift Paint Kitchen walls Paint front porch Paint back porch Paint back fence	Decorate front garden Clear garage Painting living room	Decorative house	
Doug	Entry floor Get a new kitchen	Clean up basement remove treadmill	Find a job	
Natalie	Apply for Manual	orig. closets upstairs Apply for Training	clean carpet (finished)	Paint nursery fix downstairs bath Decorate nursery

Unexpected Benefits from Kanban



Kanban is Energizing

“Kanban is like a game!”

Director

**“The more I want to get something
done, the less I call it work”**

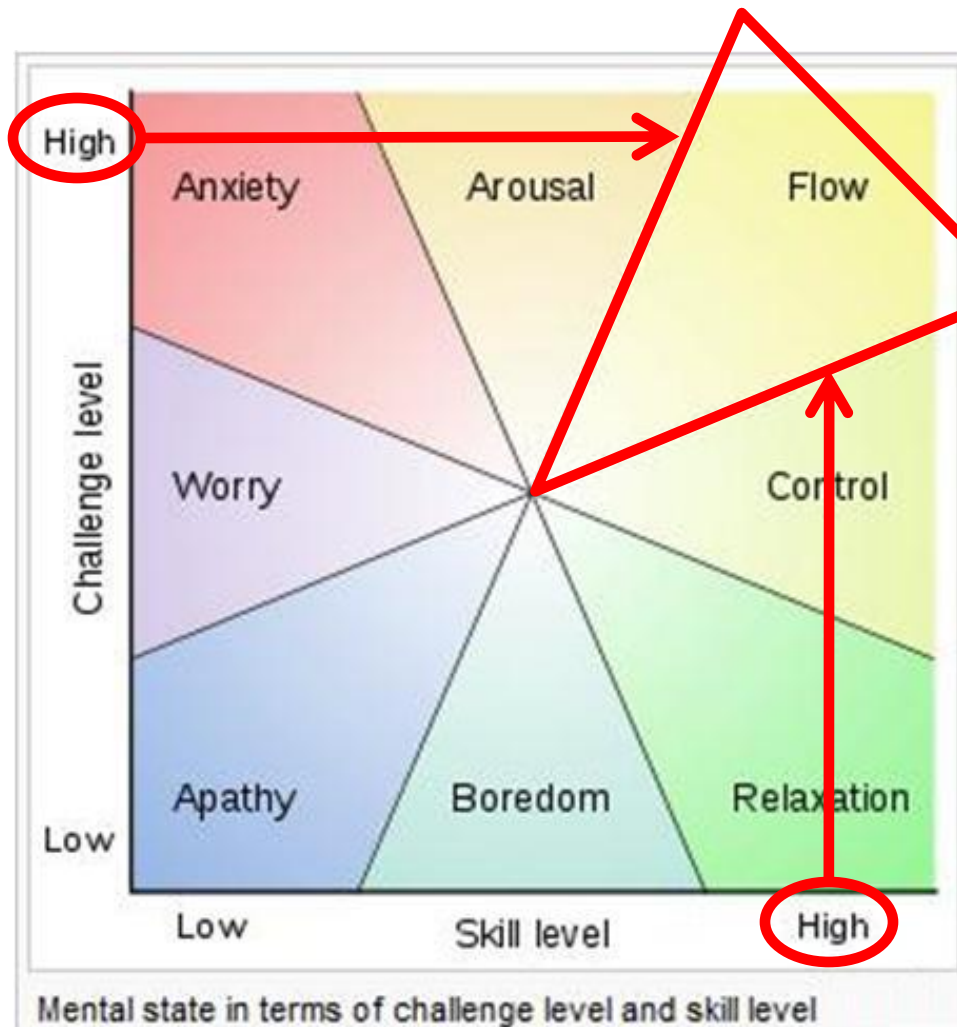
Richard Bach



Kanban builds teamwork



Kanban facilitates “psychological flow” too



You can build a “flow environment”

-Montessori schools (Rathunde & Csikszentmihalyi (2005), *American Journal of Education* 111 (3): 341–371)

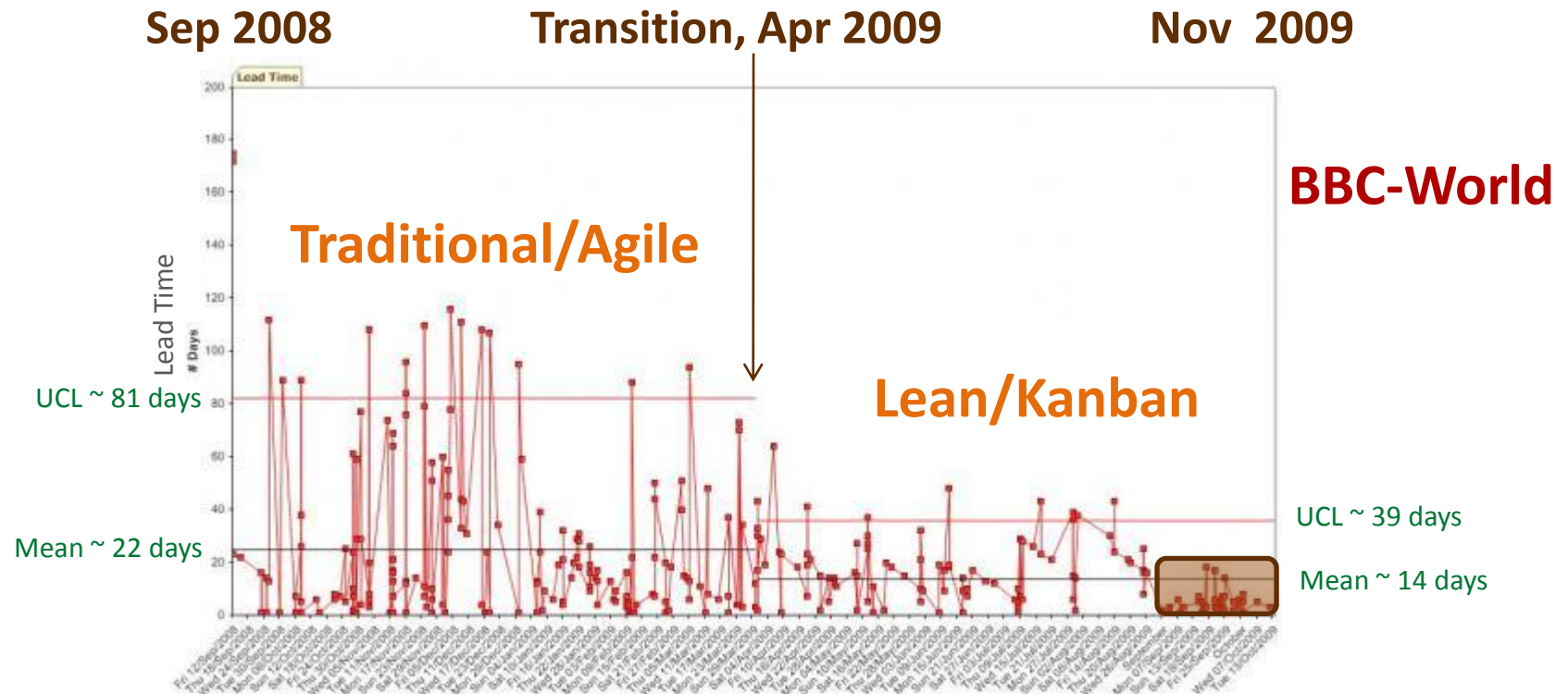
“Flow is **completely focused motivation**

“**emotions** ...not just contained and channeled... but **positive, energized, and aligned with the task**

“The hallmark of flow is a feeling of spontaneous joy, even rapture, while performing a task”

Wikipedia article on “flow”

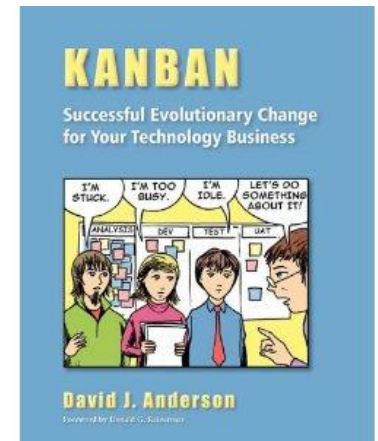
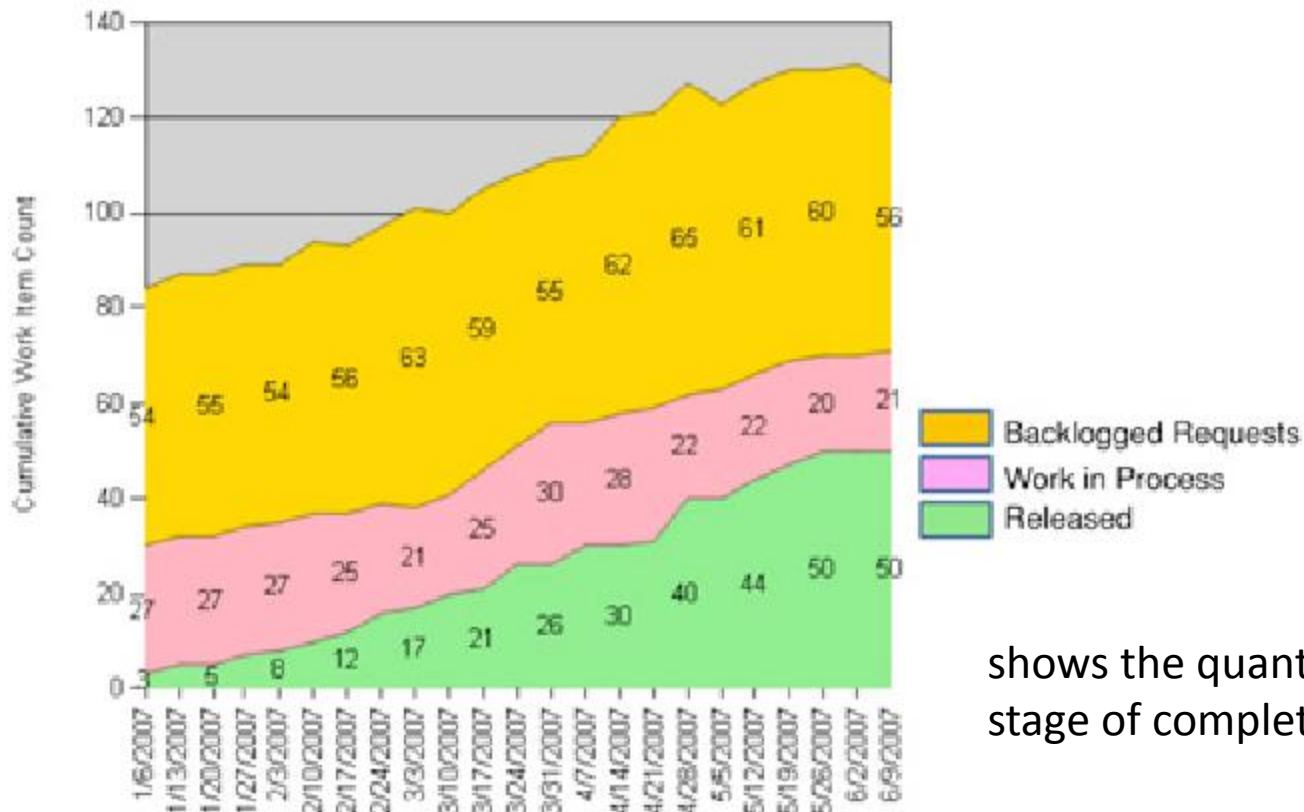
Kanban enables real metrics: lead time



Normal-case deliveries much faster (36% reduction in mean, from 22 days to 14)

Worst-case deliveries improved even more (51% reduction in 2σ , from 81 days to 39)

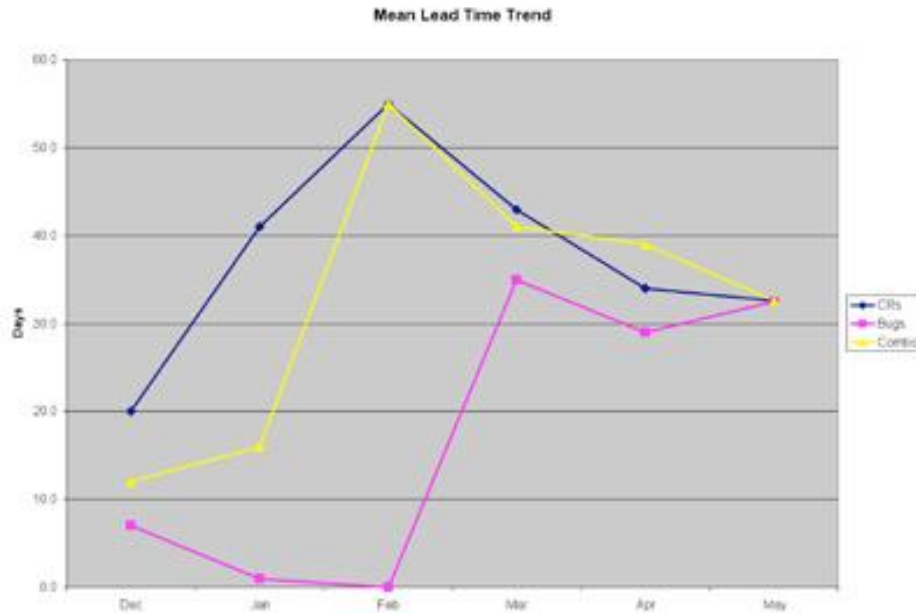
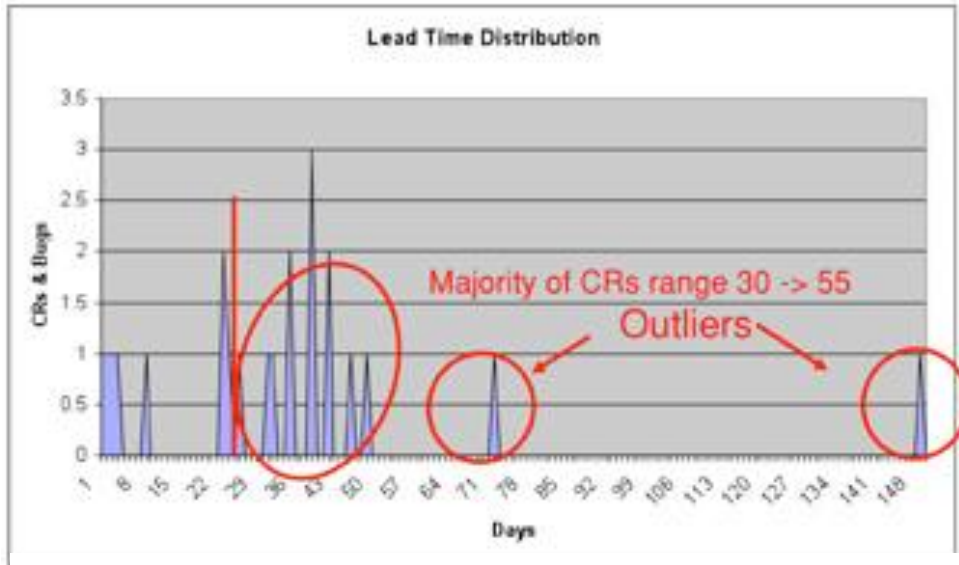
Cumulative-Flow Diagram



shows the quantities of work at each stage of completion at any date

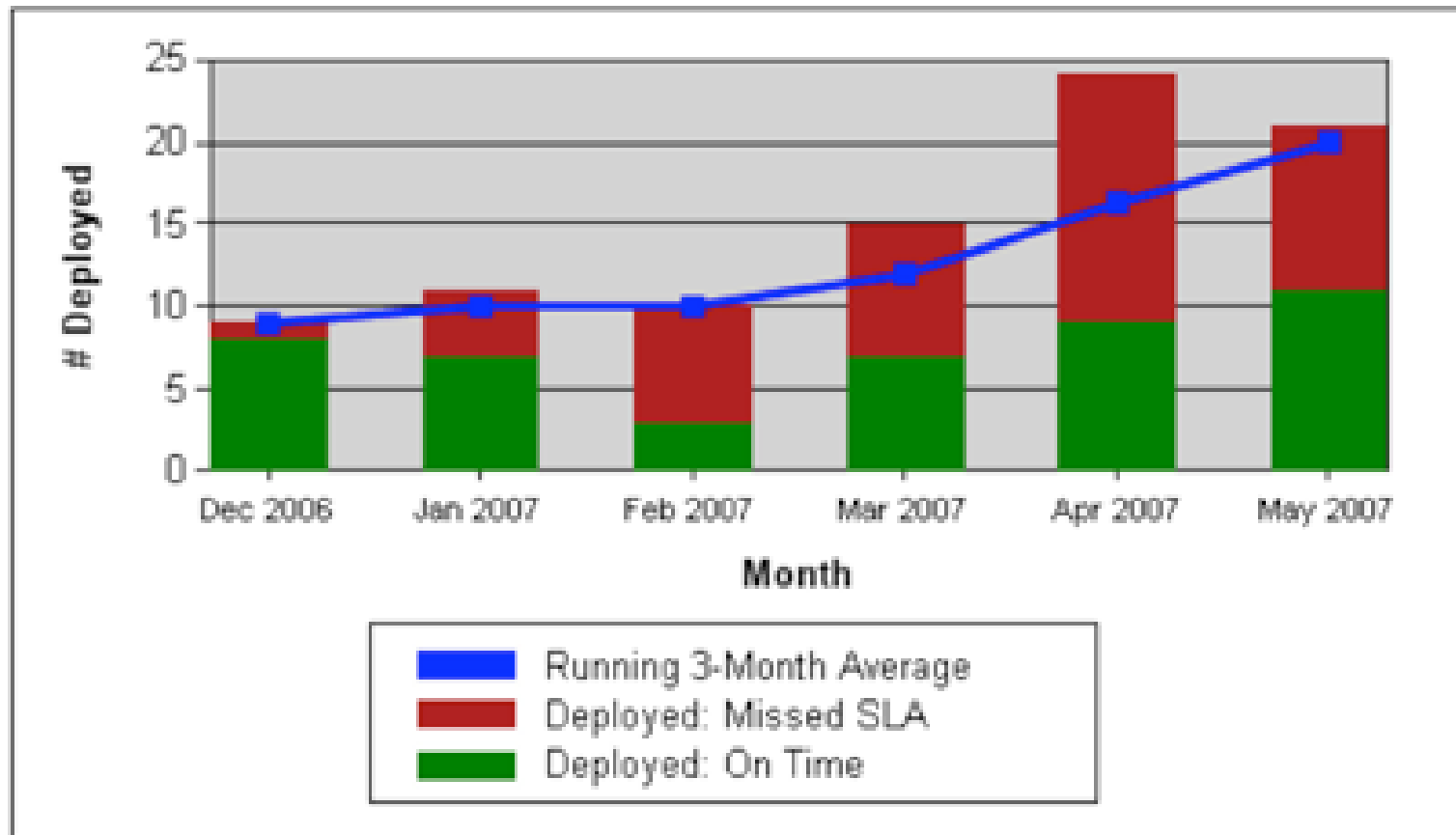
Figure 12.1 Example of Cumulative Flow diagram from a Kanban System

Lead-Time Spectral Analysis (first) and Trending (second)



Throughput

Throughput And Production Rate:



Issues Tracking

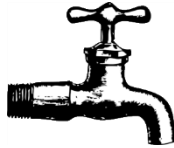
How many issues and blocked work items do we have?



Lean: a general paradigm for human productivity

4. Initiate value stream
when customer wants the value

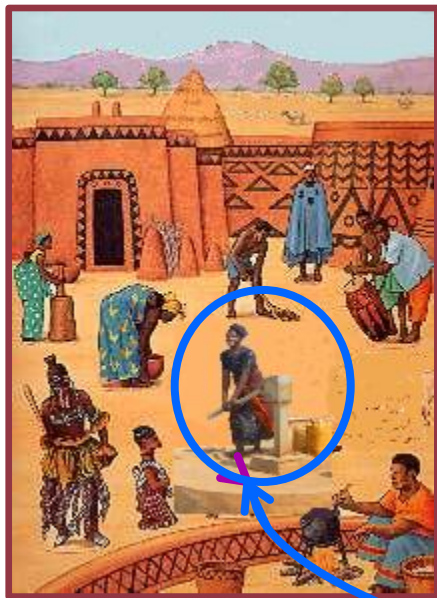
Continuous-
flow devp



5. Eliminate defects and
unwanted additions
to the value delivered



3. Tighten and eliminate discontinuities in the value stream

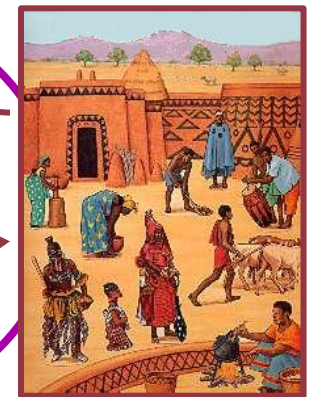
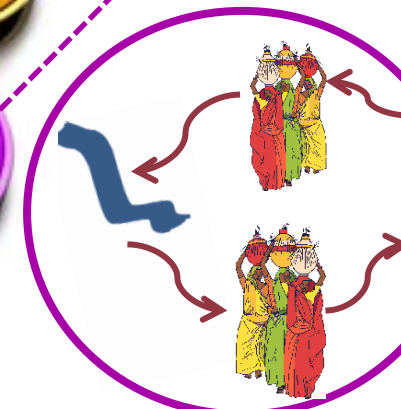


Time-boxed
iterative devp

1. Identify what the customer
really wants or needs



2. Identify what happens
to deliver the value to
the customer

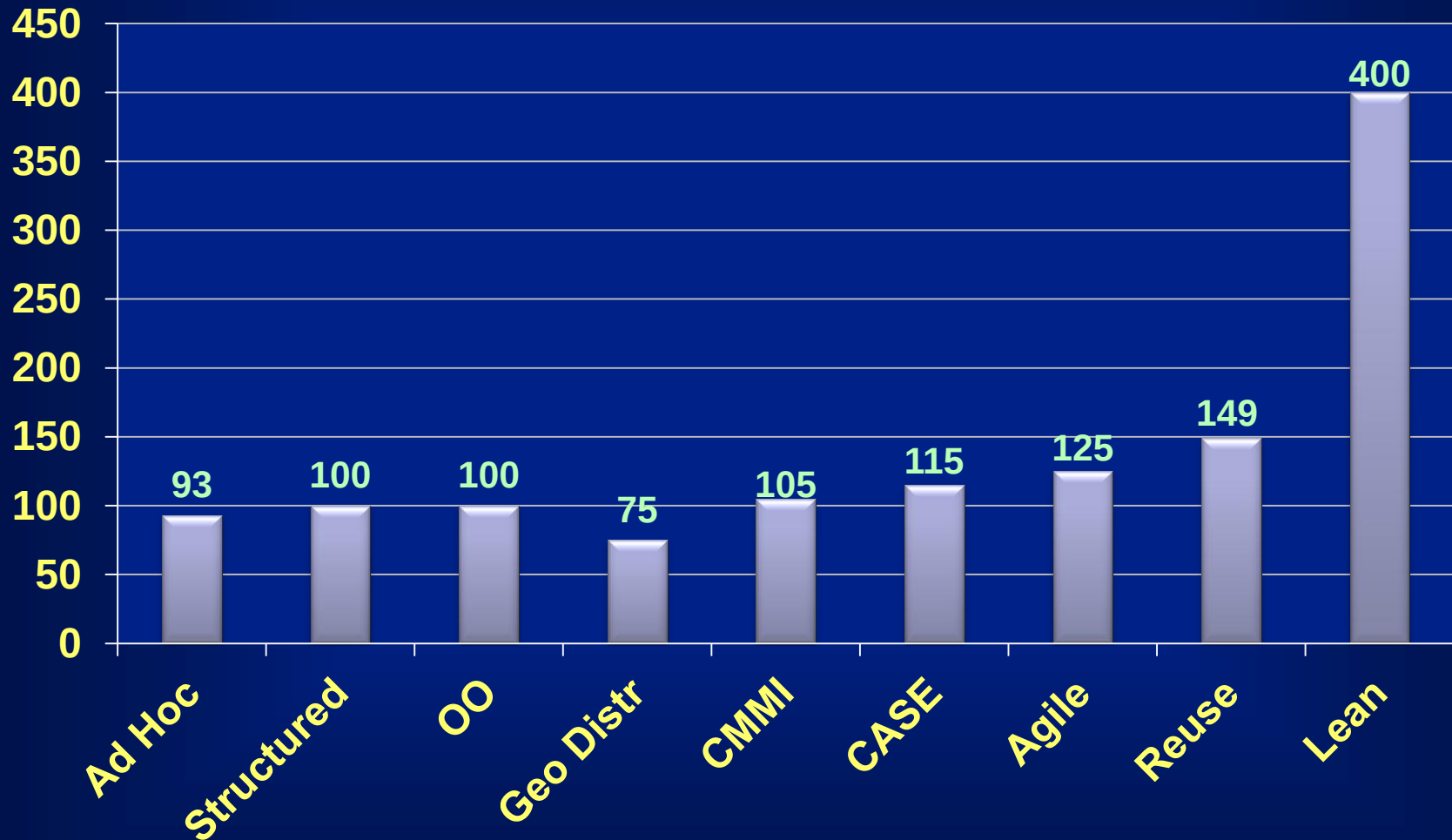


Waterfall devp



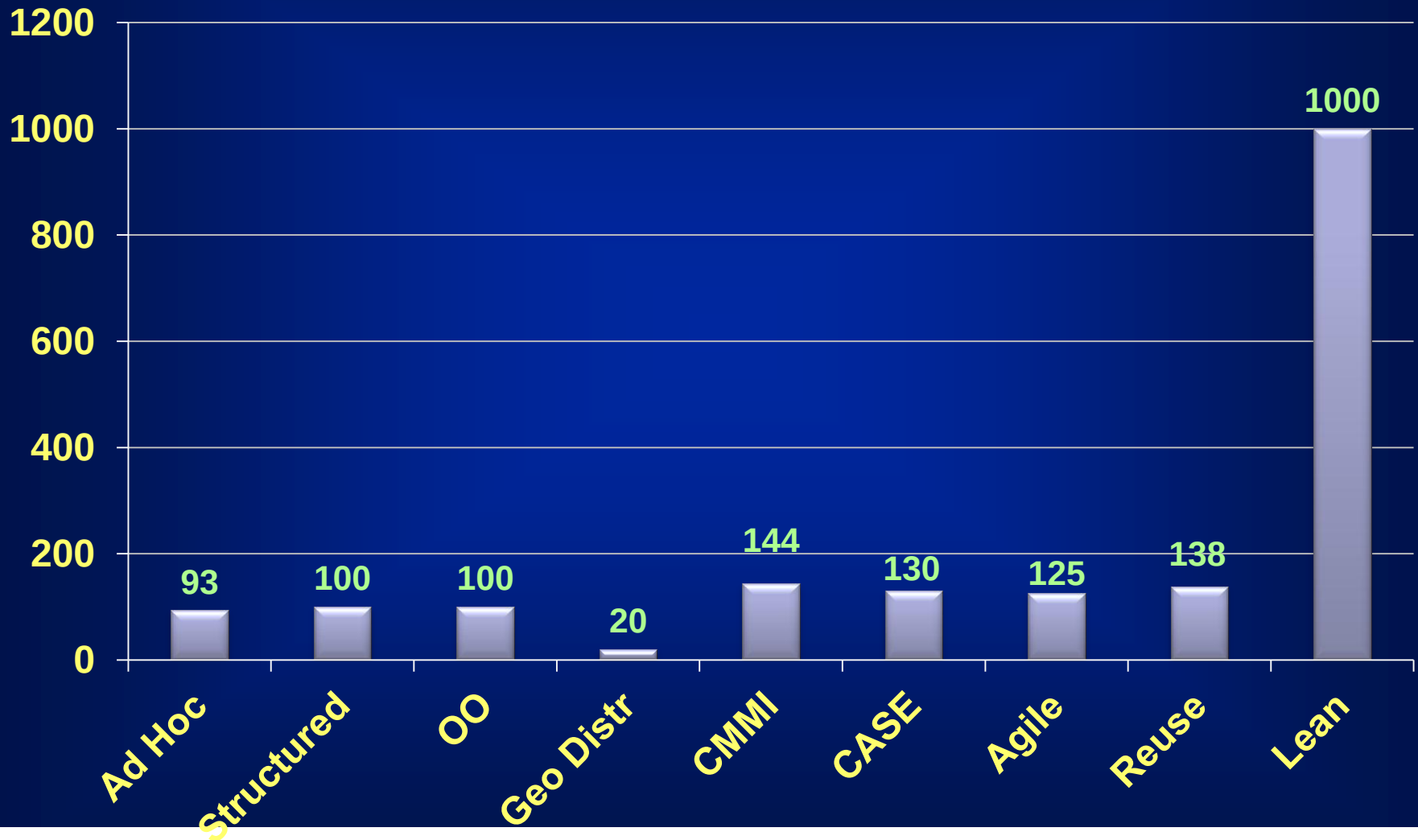


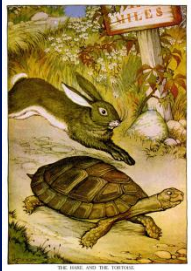
S/W Productivity (%)



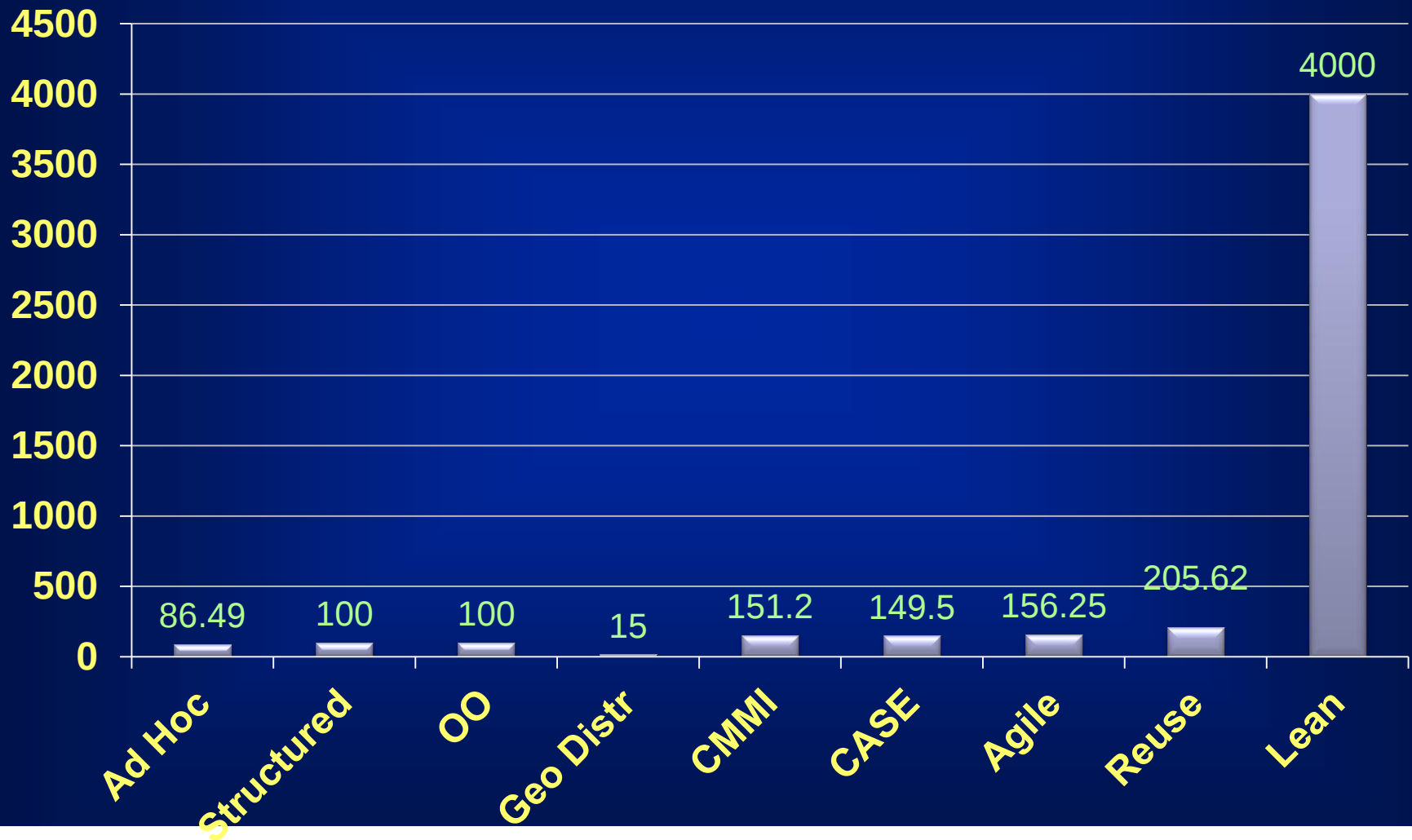


S/W Quality (%)





Productivity WITH Quality (%)



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