

estimate

estimate • analyze • plan • control

Estimation Bias and Mitigation With Agile Estimate Guidance 2017 Edition

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Key Points

Every forecast is subject to estimation bias...a major cause of program failure and corporate mis-spending



Experts Bias is probably costing in cost, schedule, and less than hoped for benefits



Agile is a good thing.

Estimates are still important



Human Nature: YOUR PEOPLE Are Optimism Biased



Harvard Business Review explains this Nobel Prize Winning Phenomenon:

- Humans seem hardwired to be optimists
- Routinely exaggerate benefits and discount costs
- Bias permeates opinions & decisions & causes waste & failure

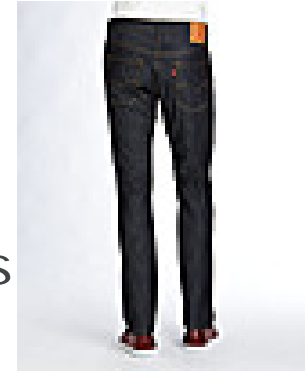
Delusions of Success: How Optimism Undermines Executives' Decisions (Source: HBR Articles | [Dan Lovallo](#), [Daniel Kahneman](#) | Jul 01, 2003)

**Solution - Temper with “outside view”:
Past Measurement Results, traditional forecasting, risk
analysis and statistical parametrics can help**

**Don't remove optimism, but balance optimism and
realism**

IT Failure Can Impact Business Dramatically (Source: HBR)

- Case Study: Levi Strauss
 - \$5M ERP deployment contracted
 - Risks seemed small
 - Difficulty interfacing with customer's systems
 - Had to shut down production
 - Unable to fill orders for 3 weeks
 - **\$192.5M charge against earnings on a \$5M IT project failure**



"IT projects touch so many aspects of organization they pose a new singular risk"

Cognitive Bias: Bias Guesses and Forecasts

(Source BeingHuman.org)



Cognitive bias

- Tendency to make systematic decisions based on PERCEPTIONS rather than evidence
- **"Perception has more to do with our desires—with how we want to view ourselves—than with reality."**
Behavioral economist Dan Ariely



Researchers theorize in the past, biases helped survival

- Our brains using shortcuts (heuristics) that sometimes provide irrational conclusions



Bias affects everything:

- from deciding how to handle our money
- to relating to other people
- to how we form memories

The Planning Fallacy (Kahneman & Tversky, 1979)

Judgment errors
**are systematic
& predictable,**
not random

- Manifesting bias rather than confusion
- Judgment errors made by experts and laypeople alike
- Errors continue when estimators aware of their nature

Optimistic due to
overconfidence
ignoring
uncertainty

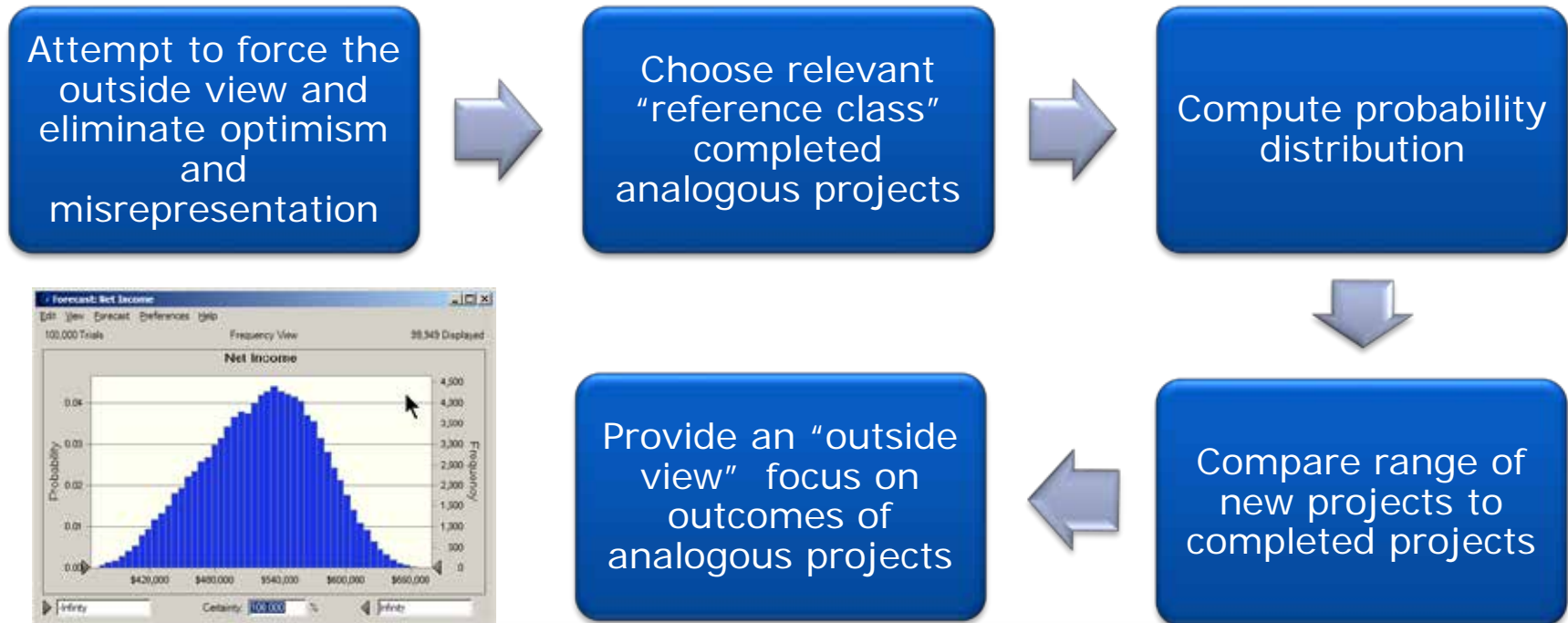
- Underestimate costs, schedule, risks
- Overestimate benefits of the same actions

Root cause: Each
new venture
viewed as unique

- “inside view” focusing on components rather than outcomes of similar completed actions
- FACT: Typically past more similar assumed
 - even ventures may appear entirely different

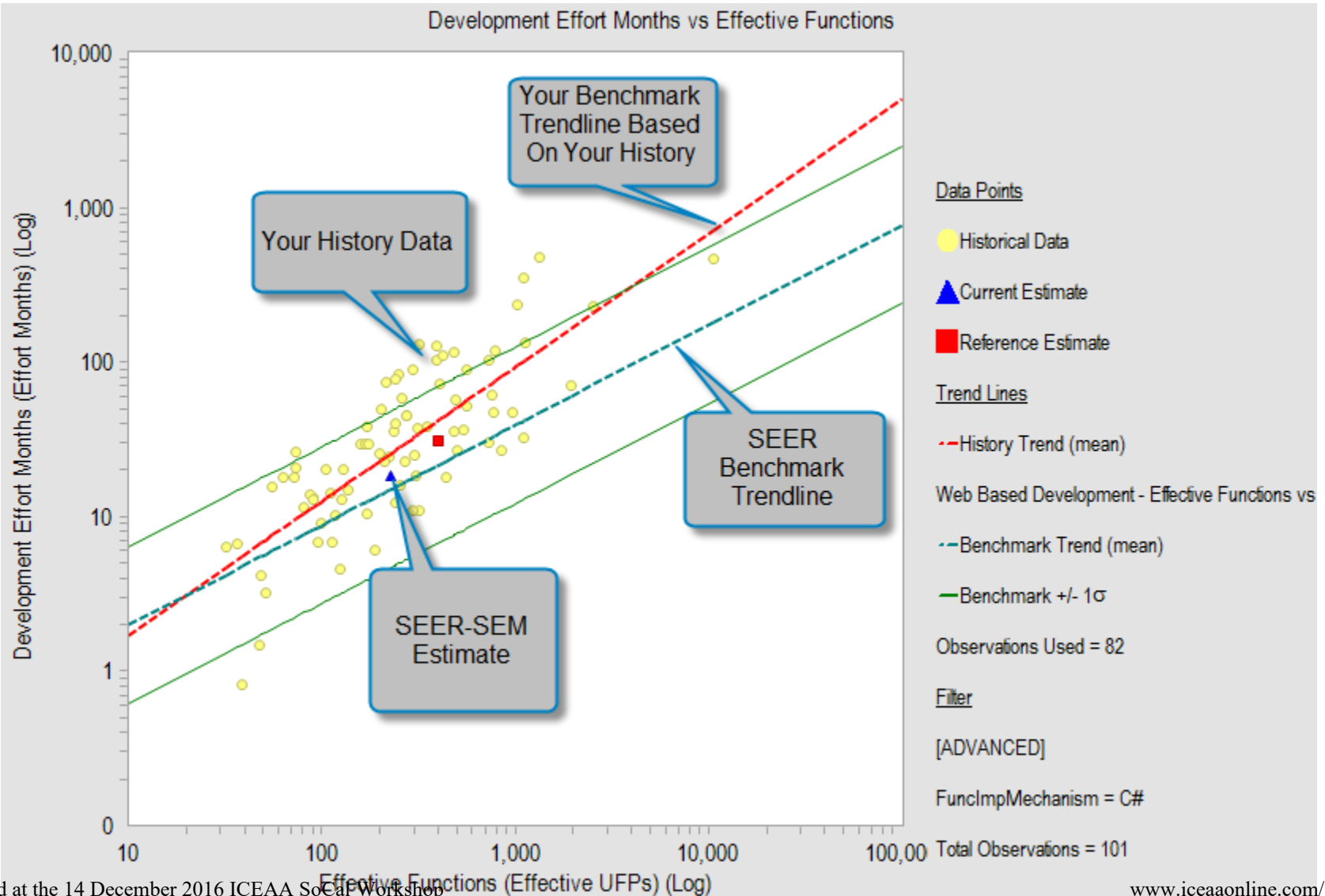
Bias Mitigation Reference Class Forecasting

Predicts outcome of planned action based on actual outcomes in a **reference class**: similar actions to those being **forecast**.



Best predictor of performance is actual performance of implemented comparable projects (Nobel Prize Economics 2002)

Example: Reference Class Forecasting



Anchoring Experiment: Anchoring Biases Estimates

(Source: myweb.liu.edu/~uroy/eco23psy23/ppt/04-anchoring.pptx)

1. Subject witnesses the number that comes up when a wheel of fortune is spun
2. Is asked whether the number of African countries in the U.N. is greater than or less than the number on the wheel of fortune
3. Is asked to guess the number of African countries in the U.N.

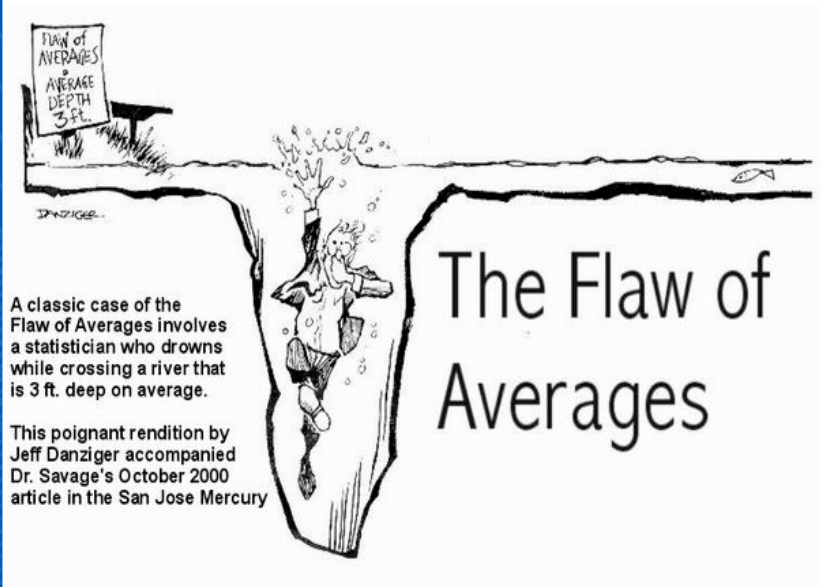


Result: those who got higher numbers on the wheel of fortune guessed bigger numbers in Step 3

If given a number that biases estimates

Flaw of Averages Case Studies (Source: HBR)

- Example: \$2 billion property damage in North Dakota
 - U.S. Weather Service forecast that North Dakota's rising Red River would crest at 49 feet.
 - Made flood management plans based on this average figure
 - In fact, the river crested above 50 feet, breaching the dikes, and unleashing a flood that forced 50,000 people from their homes.



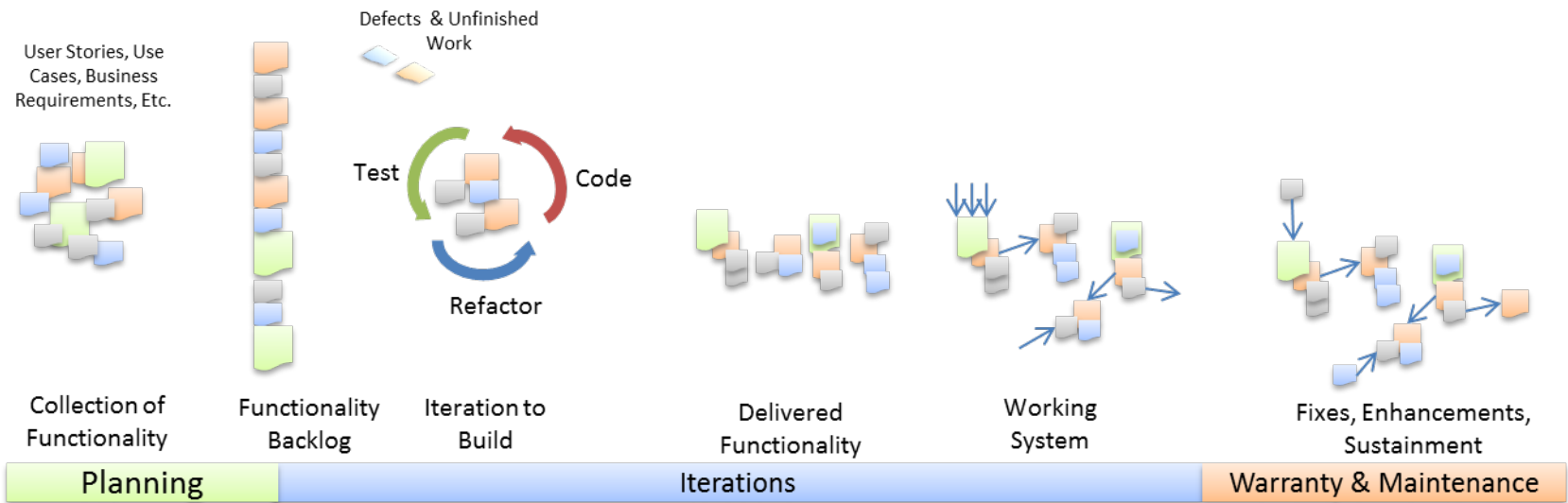
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Agile: Business Leaders Need Estimates for Decision Making

Agile: Detailed Software Development Life Cycle Management (Scrum Example)

- Focus is on what features can be delivered per iteration
- Not fully defined what functionality will be delivered at the end?



- Iterations are often called “Sprints”

An Agile Approach to Planning (Source: Cohn)

1. Projects rapidly and reliably generating useful new capabilities and new knowledge
2. Flow of new capabilities and knowledge to guide the work
3. Plan for what you want to learn – not what the product will be in the end
4. Traditional projects are like a 10K race – you know where the finish line is
 - Try to get there as fast as possible
5. Agile projects are like a timed race
 - See how far you can run in sixty minutes!
 - And iterate until the product owner is satisfied



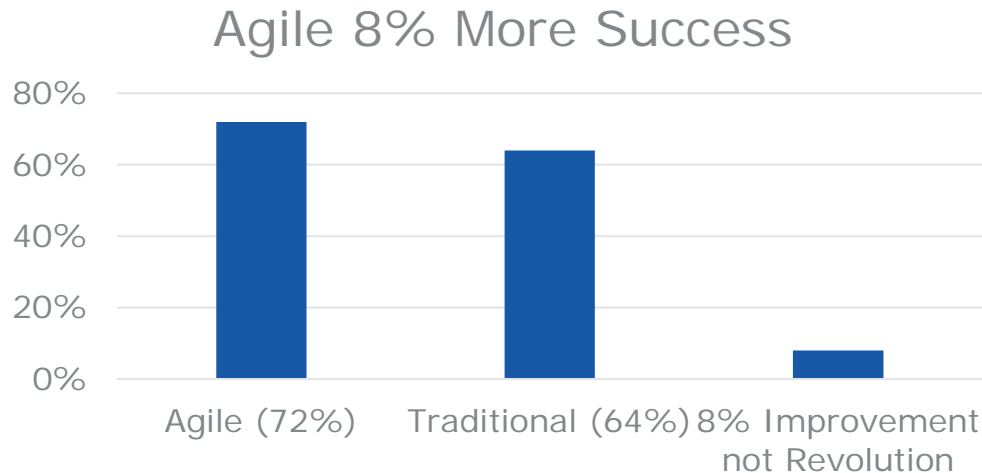
Observations

- Agile is an excellent software development life cycle approach
- For substantial developments management decisions and commitments are still critical
- For some managers at least Agile keeps them from having to think about software (problem and sort of benefit)

Agile Is Not a Silver Bullet

<http://www.jamasoftware.com/blog/rethink-agile-manifesto-projects-still-fail/>

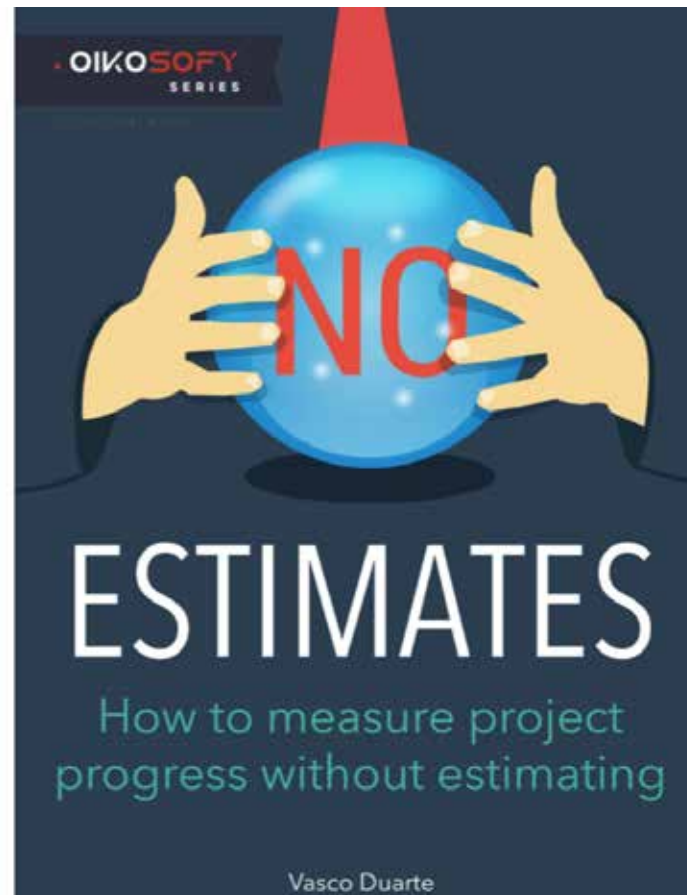
- Projects still fail at roughly the same rate as 2001
- Dr. Dobbs: Agile is not a productivity revolution



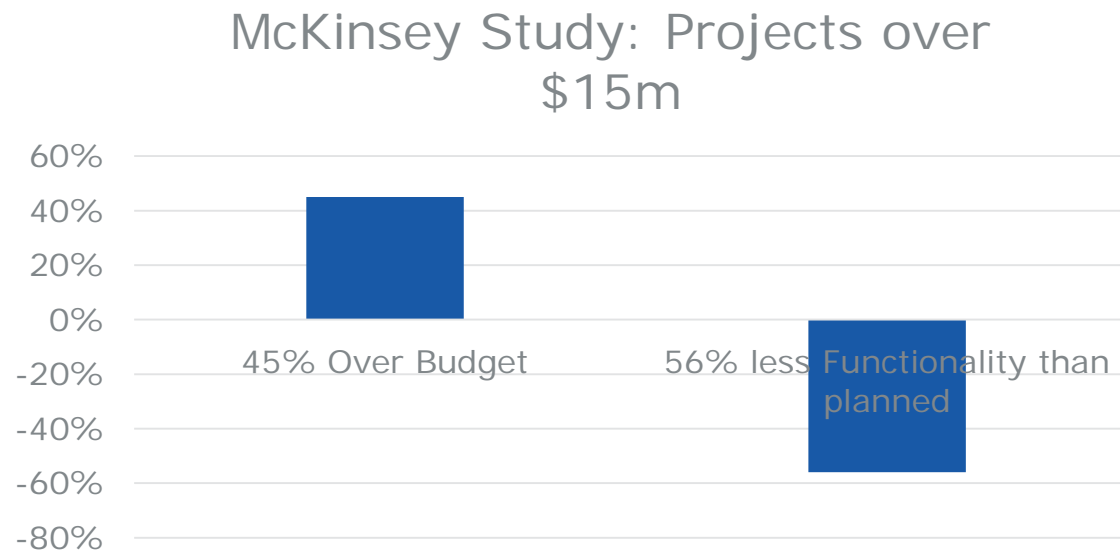
Some think agile is more successful because they remove cost & schedule goals from the evaluation

Agile Trying To Kill Estimates Without Considering Business Needs

- #noestimates



Software Project Performance Still Disappointing (McKinsey)



So does skipping estimating solve this?
Well: If commitments aren't made
there can be no disappointment

If A Promise or Hope Is Good Enough You Don't Need Viable Estimates

- No need to estimate if:
 - A promise of 5 sprints with 4 people is good enough
 - You are willing to spend whatever it costs in whatever time it takes
 - Estimates don't impact planning or decision processes
 - You don't need to know the probability that it will be complete or when
 - You aren't concerned if it overruns substantially
 - You aren't concerned with failure and contingency
 - You don't need to consider total ownership costs
 - You are ok if this is an overestimate and resources are not optimized
 - There will be no system testing on top of development

Management Agile Manifesto

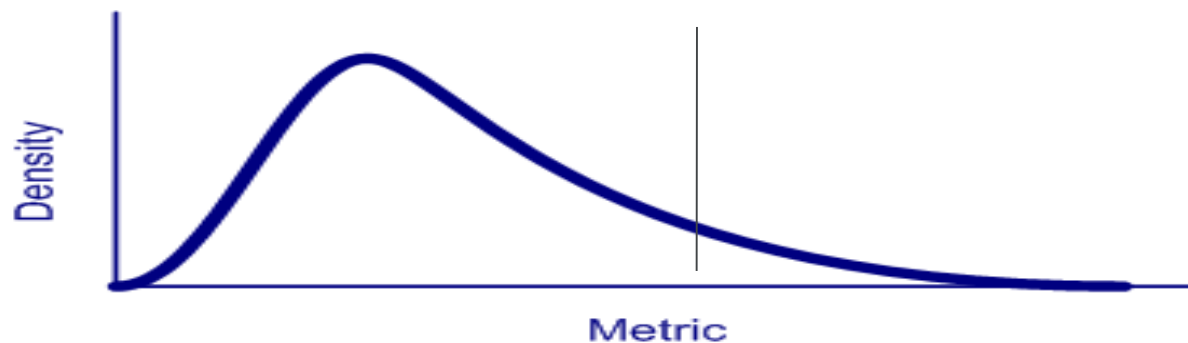
#EstimatesSupportBusiness



- We know you are technically capable... please help:
- Stop overpromising and under delivering
- Support management ROI, schedule needs and investment strategy
- Solve our problem
- Ensure it works, is usable, and secure
- Consider total cost to the business, not just initial costs
- Don't waste too much resource
- "Base choices on those providing the **maximum business value** to the organization" Eli Goldratt

Manual Estimates: Human Reasons For Error EVEN IN AGILE SPRINTS (Goldratt)

- Manual Task estimates yield **SIGNIFICANT** error
- Desire for “credibility” motivates overestimate behavior (80% probability?)
 - Then must spend all the time to be “reliable”
- Better approach: force 50% probability & have “buffer” for overruns
- Technical pride sometimes causes underestimates



Viable up-front estimates provide agile teams with fair terms

Agile Large Systems Back To Waterfall (Estimation & Planning Should Consider Hybrid)

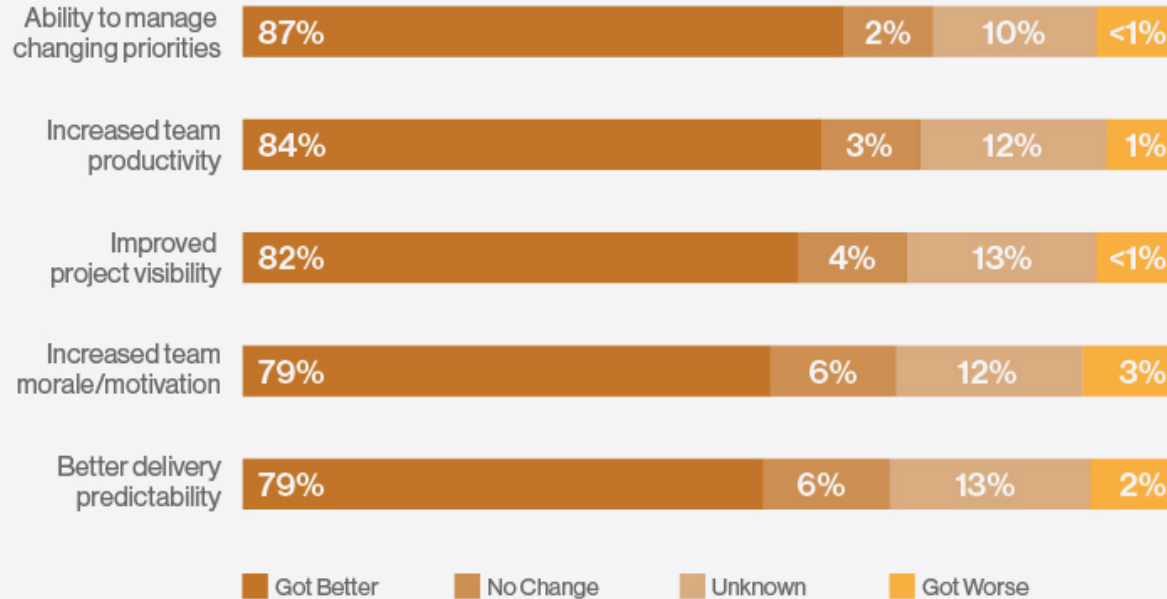


- BACK TO WATERFALL or HYBRID
 - [UK's Universal Credit Welfare System](#) , “a complex IT project that involves switching off multiple benefits and reworking them into a new tax credit system” was, by most accounts, the most ambitious agile software development project in history. Suppliers include Accenture, Cap Gemini, HP, and IBM
 - Quoting Computer Weekly “ [DWP drops agile from flagship government software project](#)”
 - Cast Software research found that applications produced using traditional Agile or Waterfall methods alone have more security vulnerabilities, more reliability and performance issues, and a higher cost to maintain than those produced with a mixed method.

COUNTERPOINT: #noestimate: No Problem?



The results of implementing Agile

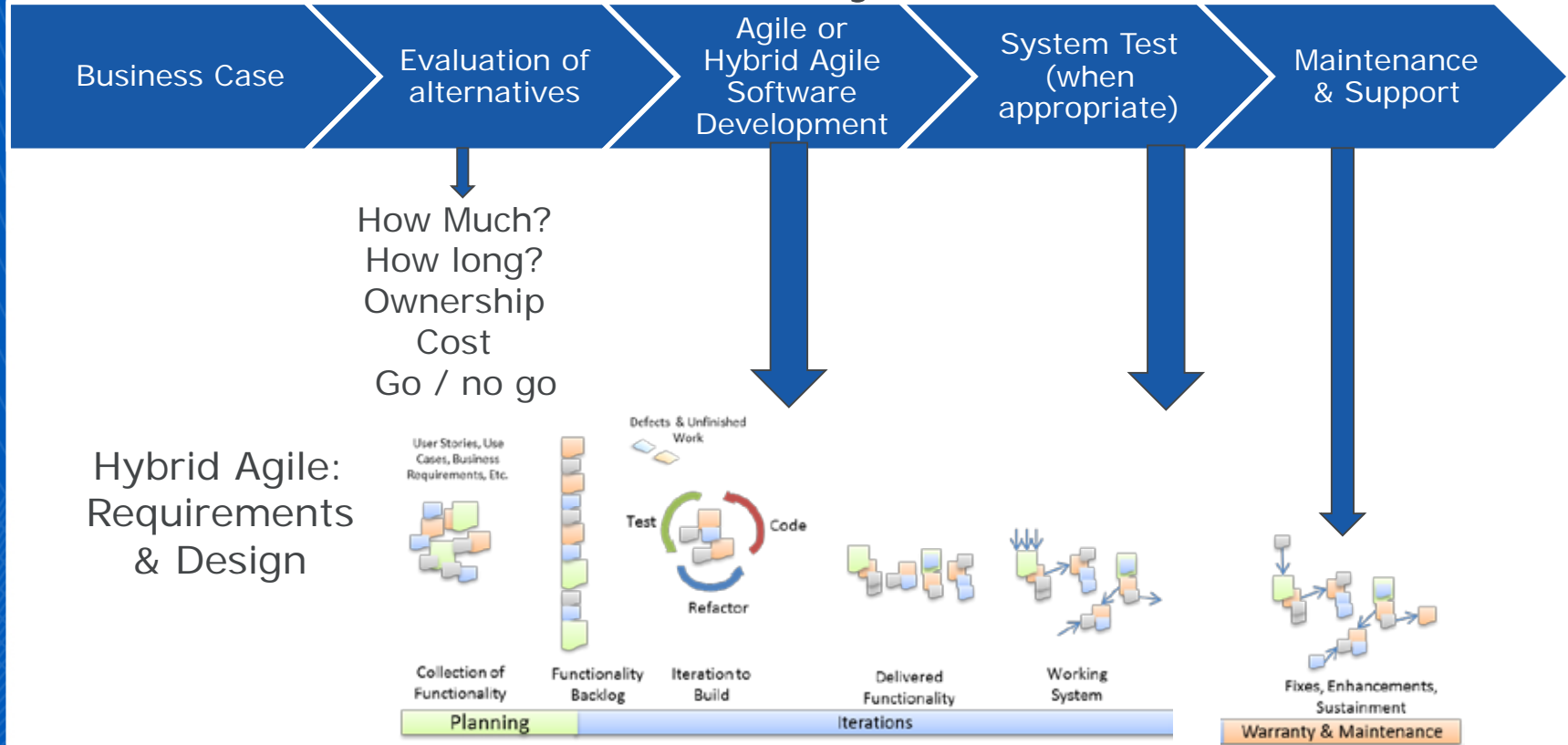


Source - VersionOne

Agile can sometimes remove software worries from the C level

#noestimates Viable For Detailed Development - Should Not Abdicate In Substantial Developments

For substantial systems



Hybrid Agile:
Requirements
& Design

Agile development = root level software development management...

Story point estimating is short term productivity management

Every Decision is a Forecast

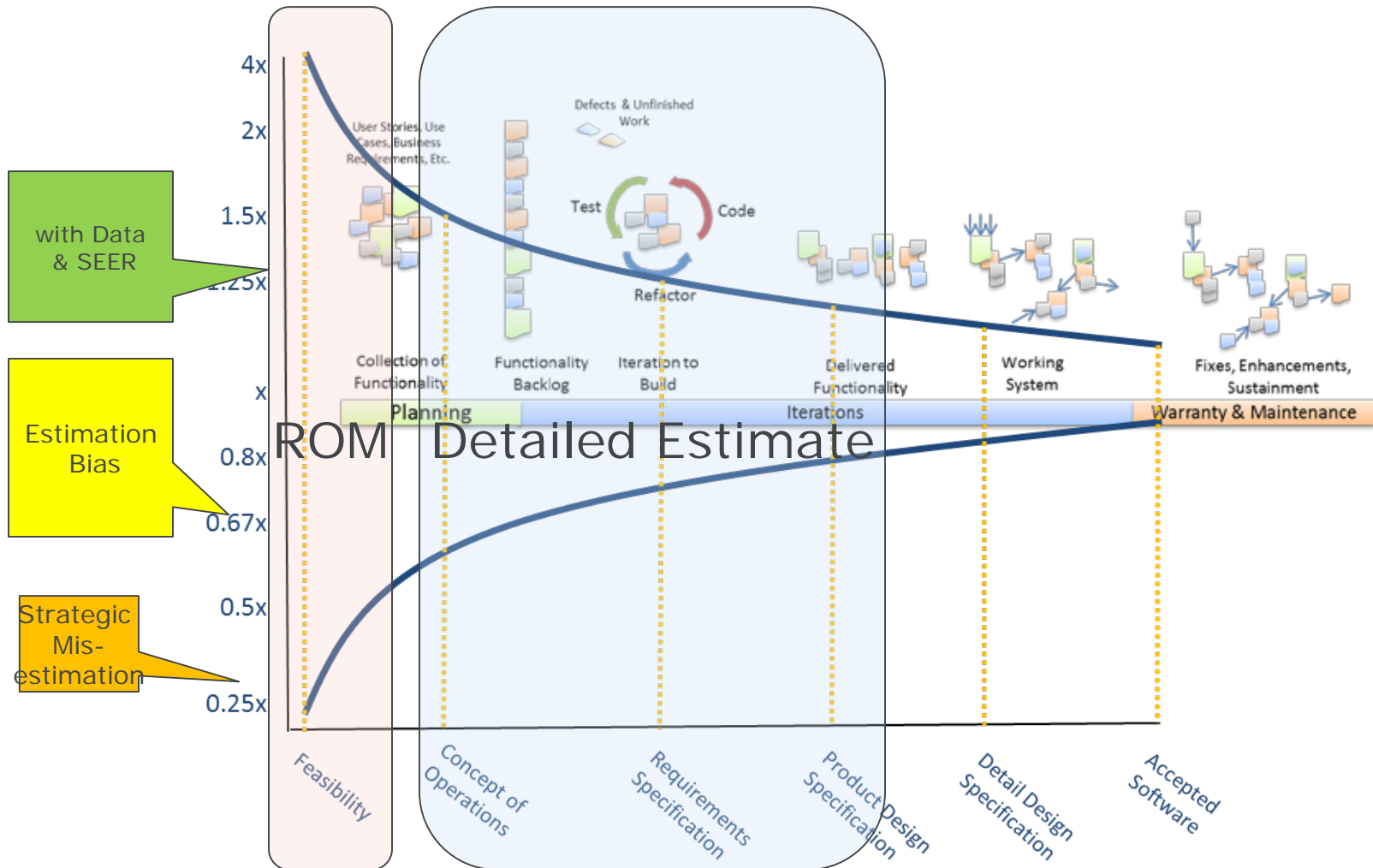
(L. Maccherone, AgileCraft)



- You are forecasting that your choice will have better outcomes than other alternatives
- So quality of decisions depends on
 1. Alternatives considered
 2. Processes and models used to forecast the outcome of these alternatives...
- Probabilistic models are superior
- <http://www.slideshare.net/Imaccherone/you-want-it-when-probabilistic-forecasting-and-decision-making>

Agile Developments Should Consider Risk and Probability

- For Estimation the Cone is the same – AND Loss Aversion may keep projects alive that should be killed



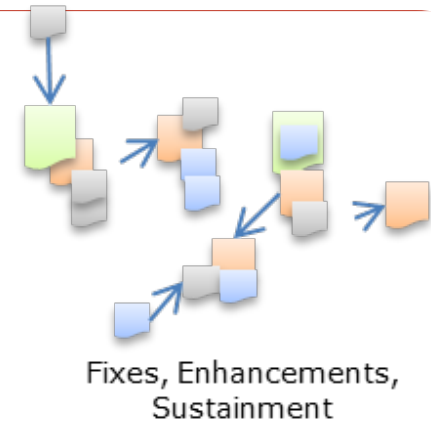
Give Management The Whole Picture: Total Ownership Costs Includes On-Going Support

Development +
Maintenance

Identify Total Ownership
Costs for the Software

Allows Independent
Maintenance Team
Assumptions

Estimate Cost of:
Corrective, Adaptive,
Perfective, and
Enhancement support



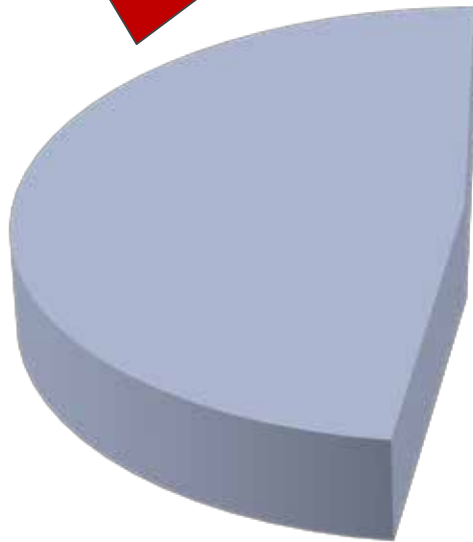
Warranty & Maintenance

Many programs need total ownership cost evaluation...
Estimation is essential

When Making Management Decisions Remember: Software Often Less Than 10% Total Ownership Cost

IT Services &
Infrastructure Are Situational
but
Generally 60% of TOC

Development =
Biggest Risk



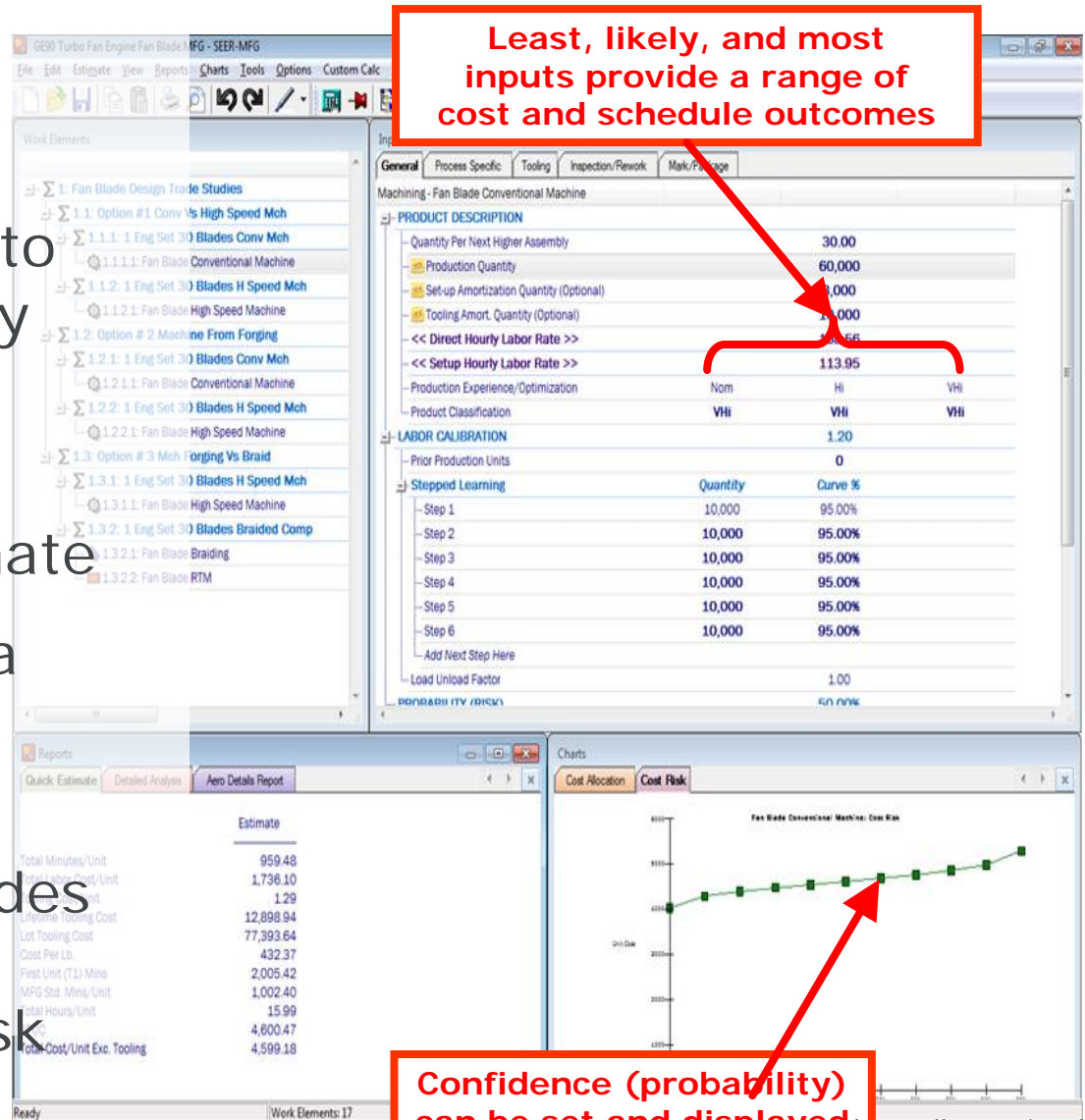
- Software Development
- Software Maintenance
- IT Infrastructure
- IT Services

Software Development is about 6-10% of total ownership cost...
But much more of the risk
Assume \$10m development could be over \$100m total
ownership

Agile Risk Still Needs Consideration

Bias Mitigation: Risk

- SEER *predicts* outcomes
- SEER uses inputs to develop probability distributions
- The result is a probabilistic estimate
- SEER will predict a likely range of outcomes
- Monte Carlo provides project-level assessments of risk



Least, likely, and most inputs provide a range of cost and schedule outcomes

Parameter	Value
Quantity Per Next Higher Assembly	30.00
Production Quantity	60,000
Set-up Amortization Quantity (Optional)	10,000
Tooling Amort. Quantity (Optional)	1,000
<< Direct Hourly Labor Rate >>	113.95
<< Setup Hourly Labor Rate >>	113.95
Production Experience/Optimization	Nom
Product Classification	VHi
LABOR CALIBRATION	1.20
Prior Production Units	0
Stepped Learning	
Step	Quantity
-Step 1	10,000
-Step 2	10,000
-Step 3	10,000
-Step 4	10,000
-Step 5	10,000
-Step 6	10,000
-Add Next Step Here	
Load Unload Factor	1.00

Estimate	Value
Total Minutes/Unit	959.48
Total Labor Cost/Unit	1,736.10
Life Time Tooling Cost	1.29
Lot Tooling Cost	12,898.94
Cost Per Lb.	77,393.64
First Unit (T1) Mins	432.37
MFG Std. Mins/Unit	2,005.42
Total Hours/Unit	1,002.40
Total Cost/Unit Excl. Tooling	15.99
Total Cost/Unit Excl. Tooling	4,600.47
Total Cost/Unit Excl. Tooling	4,509.18

Confidence (probability) can be set and displayed for any estimated item

Key Points

Every forecast is subject to estimation bias...a major cause of program failure and corporate mis-spending



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Bibliography (Partial)

- FLYVBJERG, BENT, Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice, *European Planning Studies* Vol 16 No 1, Jan 2008,
- Kahneman, Daniel, and Amos Tversky. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47, no. 2, March 1979.
- Johnson, H. Thomas. *Relevance Regained*. Free Press.
- Mislick, Gregory K.; Nussbaum, Daniel A.. *Cost Estimation: Methods and Tools (Wiley Series in Operations Research and Management Science)* (p. 143). Wiley.
- Rose, Todd. *The End of Average: How We Succeed in a World That Values Sameness*, HarperCollins.
- Taleb, Nassim Nicholas. *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets (Incerto)*. Random House Publishing Group.
- Glen, Paul; McManus, Maria. *The Geek Leader's Handbook: Essential Leadership Insight for People with Technical Backgrounds*. Leading Geeks Press.
- Kogon, Kory; Merrill, Adam; Rinne, Leena. *The 5 Choices: The Path to Extraordinary Productivity*. Simon & Schuster.
- Patterson. *Crucial Conversations Tools for Talking When Stakes Are High, Second Edition*. McGraw-Hill.
- Kahneman, Daniel. *Thinking, Fast and Slow*. Farrar, Straus and Giroux.
- Hubbard, Douglas W.. *The Failure of Risk Management: Why It's Broken and How to Fix It* . Wiley.
- Hubbard, Douglas W.. *How to Measure Anything: Finding the Value of Intangibles in Business* . Wiley.