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

- 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**.

Attempt to force the outside view and eliminate optimism and misrepresentation

Choose relevant “reference class” completed analogous projects

Compute probability distribution

Provide an “outside view” focus on outcomes of analogous projects

Compare range of new projects to completed projects

Best predictor of performance is actual performance of implemented comparable projects  (Nobel Prize Economics 2002)
Example: Reference Class Forecasting

Development Effort Months vs Effective Functions

- Your Benchmark Trendline Based On Your History
- Your History Data
- SEER Benchmark Trendline
- SEER-SEM Estimate

Data Points:
- Historical Data
- Current Estimate
- Reference Estimate

Trend Lines:
- History Trend (mean)
- Benchmark Trend (mean)
- Benchmark +/- 1σ

Observations Used = 82
Total Observations = 101

Filter:
- [ADVANCED]
  - FuncImpMechanism = C#

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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.
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


- 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)

McKinsey Study: Projects over $15m

- 45% Over Budget
- 56% less Functionality than planned

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
  • If lack of documentation is ok for maintenance
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.
Agile can sometimes remove software worries from the C level

<table>
<thead>
<tr>
<th></th>
<th>Got Better</th>
<th>No Change</th>
<th>Unknown</th>
<th>Got Worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to manage changing priorities</td>
<td>87%</td>
<td>2%</td>
<td>10%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Increased team productivity</td>
<td>84%</td>
<td>3%</td>
<td>12%</td>
<td>1%</td>
</tr>
<tr>
<td>Improved project visibility</td>
<td>82%</td>
<td>4%</td>
<td>13%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Increased team morale/motivation</td>
<td>79%</td>
<td>6%</td>
<td>12%</td>
<td>3%</td>
</tr>
<tr>
<td>Better delivery predictability</td>
<td>79%</td>
<td>6%</td>
<td>13%</td>
<td>2%</td>
</tr>
</tbody>
</table>

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

For substantial systems

- Business Case
- Evaluation of alternatives
- Agile or Hybrid Agile Software Development
- System Test (when appropriate)
- Maintenance & Support

How Much? How long? Ownership Cost Go / no go

Hybrid Agile: Requirements & Design

Agile development = root level software development management...

Story point estimating is short term productivity management...

It is not a business decision making process
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/lmaccherone/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

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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

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

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

Software Development

Software Maintenance

IT Infrastructure

IT Services

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

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Predictive Analytics Provide Outside View: Agile Estimates & Risk Analysis

Using Agile Artifacts: Story Point and Epoch Sizing

Estimate Using Project History:
- Development
- Defects
- Total Ownership Cost

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Agile Risk Still Needs Consideration

- 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

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