Zen and the Art of Software Quality

Jim Highsmith
Director, Agile Practice & Fellow
Cutter Consortium
Agile Books by Jim Highsmith

NEW RELEASE
“There is no more Normal”

“Without exception, all of my biggest mistakes occurred because I moved too slowly.”


“He [Chambers] also radically changed the way he managed, turning a command-and-control hierarchy into a more democratic organizational structure.”
Strategic Agility

Adapting to Change over Conforming to Plans

Conform    Adapt

Business Strategy

Measure of Success

World View

The Case for Agile

“There is no more Normal”

Value

Quality

Constraints

Business Goals

Agile Values
A Measure of Success

“I recently asked a colleague [CIO] whether he would prefer to deliver a project somewhat late and over-budget but rich with business benefits or one that is on-time and under-budget but of scant value to the business. He thought it was a tough call, and then went for the on-time scenario. Delivering on-time and within budget is part of his IT department’s performance metrics. Chasing after the elusive business value, over which he thought he had little control anyway, is not.”

Cutter Sr. Consultant Helen Pukszta
Mixed Messages

Conform to Plan

Be Flexible
Measuring Agile Success

- Measurement concepts
- Quality
- Value
- The Agile Triangle
Measurement Concepts
A Waterfall Failure

In *Artful Making*, Harvard Business School Professor and Cutter Fellow Rob Austin and coauthor Lee Devin discuss a US $125 million IT project disaster in which the company refused to improvise and change from the detailed plan set down prior to the project’s start. “Plan the work and work the plan” was their implicit mantra. And it led them directly to a costly and destructive course of action…. We’d all like to believe that this kind of problem is rare in business. It’s not.”
Standish Reports

- Standish Group “Chaos Reports”
  - 1994 — 82% challenged or failures
  - 2001 — 72% challenged or failures
  - 2009 — 68% challenged or failures

- Definition of project “success”
  - Successful: on time, on budget, all specified features;
  - Challenged: completed and operational, but over budget, late, and with fewer features and functions than initially specified;
  - Failed: canceled before completion or never implemented.

The Standish data are NOT a good indicator of poor software development performance. However, they ARE an indicator of systemic failure of our planning and measurement processes.
Our Current Environment

- Conformance to Plan (schedule, scope, cost) is the norm for measuring success.
- Schedule is more important than customer value.
- Our measures restrict agility and innovation.
Conceptual Background Sources


- Measuring and Managing Performance in Organizations (1996), Rob Austin.
Conceptual Background

“Budgets have since been hijacked by a generation of financial engineers that have used them as remote control devices to ‘manage by the numbers.’ They have turned budgets into fixed performance contracts that force managers at all levels to commit to delivering specified financial outcomes, even though many of the variables underpinning those outcomes are beyond their control.”

-- Jeremy Hope and Robin Fraser
Beyond Budgeting: Principles

- Provide a governance framework based on clear principles and boundaries.
- Create a high-performance climate based on relative success.
- Give people freedom to make local decisions that are consistent with governance principles and the organization’s goals.
- Place the responsibility for value-creating decisions on frontline teams.
- Make people accountable for customer outcomes.
- Support open and ethical information systems.
Conceptual Background

- *Measuring and Managing Performance in Organizations* (1996), Rob Austin:

  “If there is a single message that comes from this book, it is that trust, honesty, and good intentions are more efficient in many social contexts than verification, guile, and self-interest.”
Austin — How Measurement Systems Become Dysfunctional

Step 1: Measurement system installed.

Step 2: Performance tends to improve while people figure out the system.

Step 3: People, under pressure, focus on measurement goals rather than outcomes. (Always a disconnect between the desired outcome and the measurement. Example: (1) productivity; lines of code.

Step 4:
Dysfunctional Measurement Systems

“the implementation of more sophisticated measures caused more sophisticated dysfunctional reactions.” Those being measured “can increase their rewards if they can successfully obliterate the correlation between true output and measured performance.” -- Austin
Agile Measurement — Goals

- To focus on desired strategic or tactical outcomes.
- To encourage teams to perform at a high levels of output.
The Agile Iron Triangle

Traditional Iron Triangle

- Scope
- Cost
- Schedule

Agile Iron Triangle

- Cost
- Scope
- Schedule
Changing to Outcomes

The Traditional Iron Triangle

Scope
Cost
Schedule

The Agile Triangle

Value
Quality
Constraints (scope, cost, schedule)
The Agile Triangle

Value
(Releasable Product)

Quality
( Reliable, Adaptable Product)

Constraints
(cost, schedule, scope)
Quality
Delivering Legendary Quality

- What is Quality?
- How do we manage for Quality?
- How do we measure Quality?
- How do we measure success in Agile organizations?
What is Quality?

“Quality is the continuing stimulus which causes us to create the world in which we live.”

“Quality… you know what it is, yet you don’t know what it is.”

The Dichotomy of Quality

Intrinsic or Extrinsic?

- Does quality exist in the things we observe or is it subjective, existing only in the eye of the observer?

The “House of Cards”

“You take your analytic knife, put the point directly on the term Quality and just tap, not hard, gently, and the whole world splits, cleaves, right in two—hip and square, classic and romantic, technological and humanistic—and the split is clean.”

—Robert Pirsig

Zen and the Art of Motorcycle Maintenance (1974)
What is Quality?

- “Quality is conformance to user requirements.”
  —Phillip Crosby, *Quality is Free* (1980s)

- “Quality is the absence of defects that would make software stop completely or produce unacceptable results.”

- “Quality is achieving excellent levels of fitness for use, conformance to requirements, reliability, and maintainability.”

- “Quality is value to some person.”

- “Quality is customer expectations delivered.”
  —Internal company definition
The Dichotomy of Quality

- A false dichotomy?

Total Quality

Extrinsic Quality = Value

Intrinsic Quality = Quality
Is Intrinsic Quality Important?

- Leading edge enterprises employ technologies that can approach 99% cumulative defect removal rates.

- The norm for US firms is a cumulative defect removal rate of 75%.

- A cumulative defect removal rate of 95% on a project appears to be a nodal point where several other benefits accrue. For projects of similar size and type, these projects:
  - have the shortest schedules.
  - have the lowest quantity of effort in terms of person-months
  - have the highest levels of user satisfaction after release.

Remember this number
Instruments Co. From Technology to Customer Focus

- Overhaul the entire product development process
- Average results from 6 before- and 6 after-Agile projects

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<th>Percent Improvement</th>
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<td>11</td>
<td>-7 (-39%)</td>
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Source: Michael Mah, Cutter Consortium and QSM Associates
Software Company I

- Team about 35 people
- > 1 million LOC, >17,000 automated tests

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Source: Michael Mah, QSM Associates
Software Company II

- Team about 100 people, highly distributed team
- Database: 7,300 projects, 500+organizations, 18 countries: PI among the very highest recorded

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<td>Project Schedule</td>
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<td>6.3 months</td>
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<td>635</td>
<td>78 (-11%)</td>
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<tr>
<td>Staffing</td>
<td>40</td>
<td>92</td>
<td>+52 (+130%)</td>
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Source: Michael Mah, Cutter Consortium and QSM Associates
Productivity Indexes

- Business
- Scientific
- System
- Process Control
- Telecommunications
- Command and Control
- Real Time
- Avionics
- Microcode

Productivity Index (PI) w/ ±1 Standard Deviation

BMC Software, PI=27!
Why is Technical Quality so Important?

- The Impact of code quality on testing
- Error Location Dynamics
- Error Feedback Ratio
- Technical Debt
The Impact of Code Quality on Testing

Development: 10 days, 4 people, 4 KLOC, 1 d/KLOC

Development: 10 days, 4 people, 4 KLOC, 15 d/KLOC

Test time = 2 days

Test time = 30 days

How long to test? Assume 1/2 day to find & fix per defect.

Outcome: no time to finish testing, technical debt increases!
Error Location Dynamics

Difficult errors take longer to find:

1 hr/d to 50 hr/d
The time to finish removing errors is critically dependent on the error feedback ratio. The three simulations differ only in their feedback ratios. A 20% difference in feedback ratio leads to an 88% difference in completion time, but the next 10% increase leads to a 112% increase.

**ERROR FEEDBACK:** Errors put into a system when attempting to correct other faults.

**ERROR FEEDBACK RATIO:** The number of problems created per fix.

EFR = ERRORS CREATED / ERRORS RESOLVED
Technical Debt

- Once on far right of curve, all choices are hard
- If nothing is done, it just gets worse
- In applications with high technical debt, estimating is nearly impossible
- Only 3 strategies
  - Do nothing, it gets worse
  - Replace, high cost/risk
  - Incremental refactoring, commitment to invest
Why Intrinsic Quality is so Important

- The impact of code quality on testing—potential exponential increases in testing time
- Error location dynamics—difficult errors take much more time
- Error feedback ratio—bad fixes can cause catastrophic dynamics
- Technical Debt—the above create a vicious cycle of increasing technical debt, increased pressure, and further quality degradation
Agile Virtuous Cycle

- Technical agility creates a virtuous cycle of ever higher quality code and tests.
- Improves schedules.
- Reduces costs.
Value
Value Strategies

- Define a releasable product
- Manage the value-cost ratio
- Calculate Feature/Story Value
Reducing Cost and Scope

Paul Young, VP Business Capabilities & Integration, MDS Sciex. Presentation at 2005 Information Management Forum.

- For a project, there might be a user requirements list of between 50 and 200 items. They tell their users, “Which three to you want to do first? We’re going to give them all to you, but they’re going to come out one at a time. Which three do you want first?”

- “The most interesting thing I learned—I was totally shocked by this—was by the time you get to number 20, nobody is interested in the remaining 80 anymore. They would say: Forgot about that stuff. We didn’t know what we were talking about when we wrote that.”

- “If you had hired a service provider like xyz to build all those requirements, that would just be putting money in the middle of a room and setting it on fire.”
Features and Functions

Always or Often Used: 20%

Always 7%

Often 13%

Sometimes 16%

Rarely Used 19%

Never Used 45%

Never or Rarely Used: 64%

Standish Group Study, reported by CEO Jim Johnson, XP2002
Traditional Value Curve

Value Cost Ratio Curve (Traditional)

Value %

Cost %

Development Phases

Value Captured vs Cost Expended
Agile Value Curve

Strategies

- Most valuable first
- Evolve features
- Determine right cut-off

Where is the right cut-off point?
# Reducing Marginal Functionality

## Capability

<table>
<thead>
<tr>
<th>Feature 1</th>
<th>Feature 2</th>
<th>Feature 3</th>
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<tbody>
<tr>
<td>Story 1</td>
<td>Story 2</td>
<td>Story 3</td>
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<td>Story 4</td>
<td>Story 5</td>
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<td>Story 6</td>
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</table>

## Marginal Value

### Minimal

Agent processes a special retail sale. 2

### Optimal

Agent processes a special retail sale. 4

### Expansive

Agent processes a special retail sale. 8
Achieving Predictability & Flexibility

**Capability**
Short description & must have, won’t have bullet points

**Features/Stories**
Breadth—Now or Later
Depth—Simple to Extensive

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<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
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In many requirements processes there isn’t a strategy for determining relative importance of requirements which leads to requirements bloat.
Value Point Calculations

- Value-driven planning
  - Focus of agile development
  - Value background
  - Qualitative vs quantitative
  - Calculating value points
  - Relative versus absolute
  - Calculating monetary value points

“If you don’t have time to estimate value, we don’t have time to estimate cost!”
Capability-level Value

- Capabilities assigned a weight—1-4

- Weight based on value determination
  - Purpose alignment model (qualitative)
  - Benefit-cost analysis
  - MoSCoW

- Calculate % of total for each capability (e.g. 6 caps, 24 CVPs, Cap 3 is 4 CVPs, therefore Cap 3 is 16.7% of the total value of the product)

- Adding all the VPs for all the stories in Cap 3, they cannot exceed 16.7% of the total VPs for the product.
Story-level Value Calculation

- Product/customer team determines
- Use “planning poker”
- Use standard values—1, 2, 3, 5, 8, 13
- Total cannot exceed capability allocation
Value Points to Value Dollars

- Depends on company needs
- Value points will be good enough for most product companies
- Value dollars will be desired by many internal IT and government organizations
Stories with Value Points

As a sales associate, the ability to calculate the total amount of the sale.

As a sales executive, the ability to view all sales by product type, geographic region, and sales associate.

As a sales supervisor, the ability to verify the adequacy of the Customer’s Credit Rating.

Story Points are a *calculation* of cost.
Value Points are an *allocation* of revenue.
Value and Priority

- Value and Priority are different

- Priority determinants
  - Planning themes
  - Financial value
  - Risk mitigation
  - Technical dependency
  - Resource Dependency

- Some NCF stories should be prioritized on a cost allocation basis
The New Challenge

Martin Curley, Director IT Innovation, Intel Corporation

Innovation

Business Value

Demand

Compliance

Security

Workload

Cost Reduction
Business Value Maturity Model (Intel)

- Level 1: No or Ad Hoc Practices
- Level 2: Total Cost of Ownership
- Level 3: Simple ROI & IT Business Case Discipline
- Level 4: Options/Portfolio Mgt
- Level 5: Optimized Value
Intel’s 17 Standard Measures of Value

- Days of inventory reduction
- Days of receivables outstanding
- Headcount reduction
- Headcount productivity
- System end-of-life
- Materials discounts
- Capital, hardware, and software avoidance
- Unit cost avoidance
- Factory uptime
- Scrap reduction
- Risk avoidance
- Time-to-Market
- Opening new markets
- Optimizing existing markets
- Cross selling
- Vendor-of-choice

Intel White Paper: *Defining the Value of E-business: Seventeen Standard Measures*
The Agile Triangle
The Agile Triangle

Value
(Releasable Product)

Quality
(Reliable, Adaptable Product)

Constraints
(cost, schedule, scope)

A traditional project manager focuses on following the plan with minimal changes, whereas an agile leader focuses on “adapting successfully to inevitable changes.”
Traditional Gantt Chart — What Does It Emphasize?

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<td>6 Hire FFCS Staff</td>
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A Parking Lot Diagram — What Does It Emphasize?
The Declaration of InterDependence

- We increase return on investment by making continuous flow of value our focus.
- We deliver reliable results by engaging customers in frequent interactions and shared ownership.
- We expect uncertainty and manage for it through iterations, anticipation, and adaptation.
- We unleash creativity and innovation by recognizing that individuals are the ultimate source of value, and creating an environment where they can make a difference.
- We boost performance through group accountability for results and shared responsibility for team effectiveness.
- We improve effectiveness and reliability through situational specific strategies, processes and practices.

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Agile Project Leadership Network

www.APLN.com
Delivering Continuous Value

Total Value

- Customer Satisfaction
  - Functionality
  - User Experience

- Technical Quality
  - Works as specified
  - Adaptable
Beyond Scope, Schedule, Cost

• Weak link to value
• Limiting
• Divides customers and dev
• Inflexible
• Short time horizon
• Looks backward

• Strong link to value
• Expansive
• Unites customers and dev
• Flexible
• Long time horizon
• Looks forward
Strategic Questions

- Why couldn’t we release this product today?
- What is our value-cost ratio?
- What is the product quality?
- Are we within acceptable constraints?
Project Performance Goals

- Value
  - Meet or exceed customer value expectations
  - Value “chunks” are delivered in a release timebox

- Quality
  - All known defects are repaired
  - Defect levels through development are less than ½ industry average
  - Technical debt remains low

- Constraints
  - Scope: all planned major value-generating capabilities are delivered. Story scope varies by mutual agreement
  - Cost: actual costs are within agreed to limits (limits can change by mutual agreement during the project)
  - Schedule: actual schedule is within agreed to limits (limits can change by mutual agreement during the project)
Releasable Product

- Product vision
- Project objectives
- Business objectives
- Capabilities/Features
- Timebox schedule
Strategic Agility

There is no more Normal