Does Use of Agile Practices Support Affordability?

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Objective/Outline

• Software Affordability
  – Objective
  – Framework
  – Example outputs

• Model-based approach for quantitatively determining benefits of agile practices
  – Approach
  – Data
  – Results
  – Summary
Affordability Objective: Develop Process, Techniques & Interactive Tool for

1. Identifying & Quantifying Affordability Opportunities

2. Performing Affordability Trades
   • Custom trade features

3. Assessing Risks and Issues
   • Technical/programmatic topics
   • Cost/schedule impact

4. Estimating, Capturing, and Evaluating Decision Impacts (similar to Risks)

5. Providing/supporting DtC, DfV, and CAIV Capabilities
Trading Process and Outputs

Detailed Staffing Plan / % Work Product Complete

MS Project Plan/Activity Flow

SW Affordability Trade

Risk Assessment

Sat3 FSW Probability of Success

Effort Probability

Sat3

Effort (pMonths)

Schedule (Months)

Trade Cases

Process, tools & automation

Base Estimate with increased scope using 2485 standard practices
Base Proposal Estimate
Increased automated test tool usage for LAV FS during SW I&T with some target experience
Advance automated test tool usage to FQT with greater target and process experience

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Model for Quantitative Assessment of Agile Practices
Approach

• Collect and analyze Agile Cost Reduction Data
  – Identify impact on cost reduction of basic characteristics provided in the data

• Use statistical analysis
Empirical Data Analysis

• The Data
  – **Cost reduction data collected** from 103 projects performing agile practices
  – Assuming all projects are utilizing SCRUM to qualify for inclusion
  – Source is either Engineering Judgment, Cost data, or Productivity values

• Attempted to quantify 5 potential cost impactors
  – Size (SLOC): small, medium, large
  – New /Follow-on
  – Continuous Integration
  – Automated Testing
  – Development Environment Change
  – Team Capability

• Analysis included
  – Correlation matrix
  – Subset averages
  – Regression Analysis
These results suggest factors that can be used in a model: SCRUM, Continuous Integration, and Automated Testing.

Strong correlation between Continuous Integration and Automated Testing suggest if adopt one will adopt both.
## Agile Software Data

**Results (December 31, 2013 version)**

<table>
<thead>
<tr>
<th>Platform / Source</th>
<th>Average Cost Reduction</th>
<th>Domain Expertise</th>
<th>Follow-on Developmen</th>
<th>Significant Environment Changes</th>
<th>Automated Testing</th>
<th>Continuous Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avionics</td>
<td>32%</td>
<td>Very High</td>
<td>Most</td>
<td>Some</td>
<td>Most</td>
<td>Most</td>
</tr>
<tr>
<td>Cyber Security</td>
<td>20%</td>
<td>High</td>
<td>Some</td>
<td>Most</td>
<td>Most</td>
<td>Most</td>
</tr>
<tr>
<td>Ground Mission Critical</td>
<td>20%</td>
<td>High</td>
<td>None</td>
<td>Most</td>
<td>Most</td>
<td>Some</td>
</tr>
<tr>
<td>Ground Mobile</td>
<td>20%</td>
<td>Nominal</td>
<td>Most</td>
<td>Some</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Ground Non –Mission Critical</td>
<td>19%</td>
<td>High</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
<td>Most</td>
</tr>
<tr>
<td>Manned Space</td>
<td>5%</td>
<td>High</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Missile</td>
<td>17%</td>
<td>High</td>
<td>Some</td>
<td>All</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Simulation</td>
<td>20%</td>
<td>High</td>
<td>All</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Unmanned Space</td>
<td>18%</td>
<td>High</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>Web Development</td>
<td>52%</td>
<td>Very High</td>
<td>None</td>
<td>All</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Overall Average</strong></td>
<td><strong>24%</strong></td>
<td></td>
<td></td>
<td><strong>Middle 50th percentile:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(of all projects submitting data)</td>
<td></td>
<td></td>
<td></td>
<td>12%-32%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other benefits: higher quality, customer and employee satisfaction, improved visibility, improved communication, lower risk, earlier working product.
Use of Agile within Affordability Framework (Notional)

- Example shows:
  - Effort reduced -- 193 Person Months (21%)
  - Schedule reduced -- 3.5 months (8%)

1. Trade Case Selection
   - Agile features

2. Model Parameter Selection

3. Model Parameter Adjustment
   - Example shows:
     - Effort reduced -- 193 Person Months (21%)
     - Schedule reduced -- 3.5 months (8%)

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Summary

Data is sufficient for simple modeling
   Data allows for subset analysis to assess impact of various factors, e.g., impact of AT/CI

Data does support assumptions of cost reduction
   Agile reduces cost
   Small programs have greater reduction
   Personnel characteristics are significant factor
   Automated Testing and Continuous Integration tend to be adopted together and do reduce cost
Acknowledgement

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Backup Information
Abstract

Affordability is a key driver in today’s DOD environment and impacts the DOD contractors and supply chain. Use of agile software engineering practices has shown encouraging results within the community. However, collecting, evaluating, and validating empirical data that shows the quantitative impacts and benefits of using agile practices has been challenging. This presentation describes a framework for performing trades in support of affordability goal settings, assessments and decisions. It then describes how the use of agile practices can be used within the framework. Specifically, it describes (a) the approach for collecting and analyzing the empirical data from a set of agile software development projects, (b) the statistical parametric model used for capturing and presenting the characteristics of the agile projects, and (c) the quantitative results of the study. The presentation also describes the challenges and lessons learned from this study, how quantitative results are used within the affordability framework, and the forward plan for improving the overall capability.
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