Achieving the ‘impossible’, improved estimates, progress reporting and visibility

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J Z Young lecture theatre
Anatomy Building, UCL
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Outline

- UCL’s research
- What is agile?
- Getting the goals right
- Progress reporting
- Earlier estimates in agile projects.
At the forefront of research in medicine, neuroscience and psychology, computer science, intelligent systems and project management

- 20 Nobel prize winners within Alumni
- UCL Cancer Research Institute
- Close ties to UCLH, Wellcome foundation
- Research income 200 million
Agile Manifesto

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more

Senior management typically require a high level of governance, including accurate reporting of cost and duration
<table>
<thead>
<tr>
<th>The Agile Principles</th>
<th><a href="http://www.agilealliance.com">www.agilealliance.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Our highest priority is to satisfy the customer through <strong>early and continuous delivery</strong> of valuable software</td>
<td>Agile processes promote <strong>sustainable development</strong></td>
</tr>
<tr>
<td><strong>Welcome changing requirements</strong>, even late in development. Agile processes harness change for the customer <strong>competitive advantage</strong></td>
<td>The sponsors, developer, and users should be able to maintain a <strong>constant pace indefinitely</strong></td>
</tr>
<tr>
<td>Deliver <strong>working software frequently</strong>, from a couple of weeks to a couple of months, with a preference to the shorter time scale</td>
<td>Continuous attention to <strong>technical excellence</strong> and good design enhances agility</td>
</tr>
<tr>
<td><strong>Business people and developers must work together</strong> daily throughout the project</td>
<td><strong>Simplicity</strong> - the art of maximizing the amount of work done – is essential</td>
</tr>
<tr>
<td>Build projects around <strong>motivated individuals</strong>. Give them the environment and support they need, and trust them to get the job done.</td>
<td>The best architectures, requirements, and designs emerge from <strong>self-organizing teams</strong></td>
</tr>
<tr>
<td>The most efficient and effective method of conveying information to and within a development team is <strong>face-to-face conversation</strong></td>
<td>At <strong>regular intervals the team reflects</strong> on how to become <strong>more effective</strong>, then tunes and adjusts its behaviour accordingly</td>
</tr>
<tr>
<td><strong>Working software is the primary measure of progress</strong></td>
<td></td>
</tr>
</tbody>
</table>
Agile a definition

A set of values and principles for software development that use lean production techniques to deliver value to stakeholders quickly and frequently

Perspectives: Lean and Agile

- Lean we consider as a way of thinking, reducing waste, and considers the whole value chain
- Agile methods used are compatible with this approach, reducing complexity – e.g. refactoring
- Many concepts behind Agile approaches are not new and have been used under different terminology
- Morning stand up meetings elicit priorities of the stories according to value (measured in story points).
  - Stories, points (and tasks) outlined on whiteboards. Development work recorded in 2 hour slots, 2 periods a day. Stories agreed for two week iterations.
Having uncertain goals are problems faced by many new development projects and research projects. Agile project management gives an increased understanding of the domain and problem gained through development and by continual prioritisation of business goals. Research and development are often analogous in that they have a process of discovery and must resolve priorities whether business or research value. It is the need to clearly elaborate goals to different stakeholders that is fundamental to this process.
Goal to become leading mortgage provider
Metrics based on percentage of buy-to-let mortgages
Similar situation in US, increase sub-prime lending to increase market share. Objectives seem totally unrelated to a prudent approach to banking.

Lord Turner
FSA
‘demand capital…liquidity’

Newsnight 29th September 2008
Goals

‘A one-sentence definition of specifically what will be accomplished, incorporating an event signifying completion’

APM Body of Knowledge 5th Edition 2006

‘What is the purpose’ Peter Drucker,
as outlined in the APM Passport to Continuing Professional Development: Principles of Project Management course 2008
Goals

- Need to be aligned to strategy
- The psychological issues and frameworks (e.g. Adair model*) need to be considered, i.e. individuals will invariably have their own agenda
- Aligning metrics with goals is essential to ensure that projects are effective.

*as outlined in ‘leadership and motivation’ within UCL’s APMP course folder
Goal-Question-Metric example

Zero tolerance on regulatory issues

Goal: Ensure regulatory standards are embedded

Question: How do we ensure goal is met?

Metric: number of compliance review Non Conformances

adapted from: ‘Using the Goal-Question-Metric approach to formulate a metrics framework’ Sukanya Dasguta Deutsche Bank SEPG 2007
Planned costs compared to actual costs
Earned Value gives another perspective

![Graph showing Planned costs, Actual costs, and Earned Value](image-url)
‘We would like to use earned value management’

‘We would like to predict the outcome of project end date, cost and value’

As a project manager I cannot be there all the time

What is the best way to measure progress with earned value?

‘As developers we would like to experiment with some agile approaches’

Your team will be working on other projects as well

We are hoping to achieve metrics suitable for CMMI level 3 and higher…
The Death March Project Style Quadrant

Edward Yourdon, Death March: The complete Software Developer’s guide to surviving ‘Mission Impossible’ projects, 1997 Prentice Hall
Use of Variance

Variance (Monthly)

Variance (Monthly) graph showing the values for CPI and SPI over six months. CPI peaks in the second month and SPI in the third month. SPI is used in this situation.
## Earned Value compared to Agile Process Planning

<table>
<thead>
<tr>
<th>Earned Value</th>
<th>Agile Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on predictive planning</td>
<td>Adaptive planning</td>
</tr>
<tr>
<td>Estimates effort, cost and completion date</td>
<td>Iteration to iteration tracking</td>
</tr>
<tr>
<td>End-to-end value tracking</td>
<td>Predication of the next iterations effort</td>
</tr>
<tr>
<td>Schedule most of the activities</td>
<td>Near the beginning, it is not always possible to schedule.</td>
</tr>
<tr>
<td>Adaptation to unpredictable events is problematic. Changes may require the</td>
<td>Time based iterations allow initial estimate of duration which can be revised through the adaptive driven build-feedback cycle</td>
</tr>
<tr>
<td>planned to be revised or baselined</td>
<td></td>
</tr>
<tr>
<td>Estimates based on past performance</td>
<td>Estimates are based on progress being made (velocity)</td>
</tr>
<tr>
<td>Change rates often low</td>
<td>Unpredictable change the norm</td>
</tr>
<tr>
<td>Small variations in early measurements of cost and time at the start the</td>
<td>Unknown team development rates</td>
</tr>
<tr>
<td>project give wide variation in forward predications</td>
<td></td>
</tr>
<tr>
<td>Some organisations do not chart progress for an initial period</td>
<td>Progress is tracked immediately</td>
</tr>
<tr>
<td>Earned value well established</td>
<td>Prioritization of the value of user stories</td>
</tr>
<tr>
<td></td>
<td>No earned value approaches in methods</td>
</tr>
</tbody>
</table>
Development Metrics

- Measurements have traditionally included lines of code (LOC) and there are several models based on this including the hierarchy of cost and effort models COCOMO (COnstructive COst MOdel) developed by Boehm.
- Bittner and Spence (2005) indicate that a move to working software is perhaps one of the best measures of progress.
- More recently other metrics have been used such as function points, which give a better indication of size and complexity.
Fundamental shift in measurement

What is iterative development? Part 3: The management perspective 15 May 2005
www-128.ibm.com/developerworks/rational/library/may05/bittnerspence/index.html
Developers are less interested in the business value, benefits realization and return on investment.

They work on a small number of requirements or change requests from their list of outstanding work (backlog).

The developer will therefore be aware of progress via work completed, product backlog and new work allocated.
Velocity, gives an indication of the average rate of work and also a comparison of planned against delivered, each iteration.
Individuals and Moving Range (XmR) Charts

Velocity

<table>
<thead>
<tr>
<th>weeks</th>
<th>story points</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/01/2006</td>
<td>30</td>
</tr>
<tr>
<td>13/01/2006</td>
<td>32</td>
</tr>
<tr>
<td>20/01/2006</td>
<td>25</td>
</tr>
<tr>
<td>27/01/2006</td>
<td>35</td>
</tr>
<tr>
<td>03/02/2006</td>
<td>40</td>
</tr>
<tr>
<td>10/02/2006</td>
<td>38</td>
</tr>
<tr>
<td>17/02/2006</td>
<td>32</td>
</tr>
<tr>
<td>24/02/2006</td>
<td>33</td>
</tr>
</tbody>
</table>

UNPL₂
UCLR
Velocity measures of work rate are useful in that estimates of the next iteration can be planned in a rolling process. The use of σ variation is supportive in this aim. Automated colour coding (Red Amber Green) can be used to show condition requirements.
Burn down charts show progress in terms of story points completed as well as changes made for the rest of the release.
With the appropriate metrics we can improve
More importantly business value (or contribution) should be considered and evaluated. EV can be reporting in terms of business value

The key issue in agile project management is to continually assess with the client the most important work that should be done.

### Emphasis on value rather than work done

<table>
<thead>
<tr>
<th>Story number</th>
<th>‘Business Value’</th>
<th>Story Points</th>
<th>‘Points earned’</th>
<th>Planned (developer hours)</th>
<th>Actual (logged hours)</th>
<th>EV (earned value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>10</td>
<td>10</td>
<td>100</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>60</td>
<td>60</td>
<td>60</td>
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<tr>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>60</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>total</td>
<td>8</td>
<td>24</td>
<td>22</td>
<td>240</td>
<td>210</td>
<td>220</td>
</tr>
</tbody>
</table>
Earned Value Framework (EVF)

Reporting for senior managers, project managers and developers

- EV can be applied to estimates of agile projects
  - this can be complex if more stories are added as the work progresses

- EV may need to be shown to senior managers
  - who are used to EV figures, or comparison to other projects where EV figures have been tracked

- EV estimates can be accurate
  - story points tend to remain static in an iteration when the process is understood by managers and developers. When additional stories are added, stories with lower business priority level may be dropped to compensate and keep the work load (story points) similar.

Reference:
Developing metrics for agile projects that are compatible with CMMI

Graham Collins
SEPG
Amsterdam 2006
1. **Pair reporting** - valuing individuals and team, moving towards self-determining teams

2. **Acceptance testing** - working software

3. **Ensuring Business Value** – continual prioritisation, estimation and understanding there is a cost to development

4. **Measuring progress over shorter time periods** - meeting the needs of process improvement CMMI, velocity tracking in agile methods, and better EV planning

- Individuals and interactions \(\text{over processes and tools}\)
- Working software \(\text{over comprehensive documentation}\)
- Customer collaboration \(\text{over contract negotiation}\)
- Responding to change \(\text{over following a plan}\)
It is only after several iterations we have an idea of the velocity of the project (actual) against planned and we can re-plan the project.

Organisations may have some data from a similar project or we may have to estimate.

‘…or we made one up’ p117 Mike Cohn, *User Stories Applied: For Agile Software Development* Addison-Wesley 2004
Major telecommunication provider

- Uses as a metric stories and story points although there is no consistency between stories or story points between projects
- Benefit; in that it allows teams to make decisions, however
- value is compromised as far as development estimates and progress measures are concerned.
The velocity estimate can be used to determine how much work the team will be able to achieve per iteration.

However we have a measure of functionality (user stories are the description of user or customer valued functionality).

Perhaps we could use another measure of functionality earlier on?

‘The team’s first estimate of velocity will be wrong…’

Mike Cohn, User Stories Applied, Addison-Wesley, 2004
Software estimators sometimes confuse size and effort*

- The size (FP count) is proportional to the functionality of the system
- Function Point Analysis (FPA) measures the software size in terms of functionality.

*Practical Software Estimation: Function Point methods for Insourced and Outsourced Projects

Parthasarathy, M.A., Addison-Wesley 2007
Purpose of Mapping

- An initial assessment of function points provides a measure to map onto stories and create a baseline, a mapping and a possibility to gain consistency to user stories.
- Earlier estimates in terms of functional size.
- Provide an improved basis for story-based progress reporting in terms of functionality delivered.
Achieving consistency

- FPA, has other advantages, it makes developers typically trained in a variety of approaches to consider the system from another perspective.
- Provides a more consistent measure for story points, i.e. reduce variability.
- Reduces the reliance on velocity scaling and re-planning, and provides earlier estimates with less variation.
Agile software development provides an opportunity for an evolving and increased understanding of the domain and requirements through rapid iterations.

This enables the most appropriate solution to be delivered and can be outlined in terms of:

- the continual prioritisation of development activities, to deliver regular releases of working software that achieves the highest business value.

Collins, G., Computer Science, COMP3001 Technology Management and Professional Practice course UCL, 2009