Troy Magennis (@t_magennis)
Risk: The Final Enterprise Frontier
Risk: The Final Agile Frontier

Troy Magennis
@t_magennis
Troy.Magennis@focusedobjective.com
Slides, Forecasting Spreadsheets, Resources

Bit.Ly/SimResources
(case sensitive)

And live tweets direct to material here

@t_magennis
I LOVE IT WHEN
A PLAN COMES TOGETHER
Plan A
Plan B
Plan C
Definition: **Risk**

Anything that causes actual outcome to be different than the planned outcome.
"Expectation is the root of all heartache"

- Shakespeare
Definition: **Risk**

Anything that causes actual outcome to be different than the planned expected or desired outcome.
Ability to alter investment once committed

Nirvana

Staff driven

Fixed

Cost driven

Flexible

Risk driven

Low Loss

High Loss

Penalty of being late – lost revenue, etc.
RISK #1
Network Throughput Test

Slides and spreadsheets at Bit.ly/SimResources

(Case SENSITIVE)
How much does item size (estimates) play a role in lead time?

Item Estimation “may” work

Item Estimation “always” Fails

See full story at http://brodzinski.com/2015/01/slack-time-value.html
Can’t forecast high utilization systems using item size

Trucks move at same speed as cars
Quick Fixes

Pressure to deliver faster than we really can

Technical Debt

Focus on fixed dates & estimates

Work takes longer than expected

New channels to get job done

Work in progress increases

Delays

Task switching

Expedite of work that is late

The Kanban Kick-start Field Guide - Sandvik IT (C. Achouiantz & J. Nordin)

Brilliant!
For high utilization systems we need to track/manage system level impediments

“Things that impact EVERY item”
“System Utilization”
TRADITIONAL RISK MANAGEMENT
PMBOK v5 Six-Step Risk Process

• **Plan Risk Management**
  – the process of defining how to conduct risk management activities for a project.

• **Identify Risks**
  – The process of determining which risks may affect the project and documenting their characteristics.

• **Perform Qualitative Risk Analysis**
  – The process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact.

• **Perform Quantitative Risk Analysis**
  – The process of numerically analyzing the effect of identified risks on overall project objectives.

• **Plan Risk Responses**
  – The process of developing options and actions to enhance opportunities and to reduce threats to project objectives.

• **Control Risks**
  – The process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process.
Prince 2 Five-Step Risk Process

• **Step 1 – Identify**
  – Tailor a risk management strategy for the project and identify the risks including both threats and opportunities.

• **Step 2 – Assess**
  – for each risk identified estimate the probability, impact and proximity. Evaluate the overall risk exposure of the project.

• **Step 3 – Plan**
  – plan the risk responses. Electing to Avoid, Share, Reduce, Accept, Fallback (contingent action) or Transfer risks(threats) and Share, Enhance, Exploit, or Reject Opportunities

• **Step 4 – Implement**
  – Manage, control and report on the risks and their risk management progress.

• **Step 5 – Communicate**
  – continuously communicate the risks and their status to project stakeholders.
<table>
<thead>
<tr>
<th>Risk Matrix</th>
<th>Low Likelihood (1)</th>
<th>Medium Likelihood (2)</th>
<th>High Likelihood (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Impact (3)</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Medium Impact (2)</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Low Impact (1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Risk x Impact = Irrelevant

50% Chance of a 1 month delay

Probability x Impact = 0.5 x 1 month = 2 weeks

NO!
Risk x Impact = Irrelevant
Risk x Impact = Irrelevant
risk events – nothing goes wrong
risk events – 1 delay comes true
risk events – 1 delay 25% chance

- 25% Outcomes
- 75% Outcomes

Date

Probability
risk events – 2 delays @ 25% chance

Outcomes

~ 57% Outcomes

~36% Outcomes

6.25% Outcomes

No Delays!

Either Delay!

Both Delays!

Date

1 2 3
risk events – 3 delays @ 25% chance
risk events – 4 delays @ 25% chance

By 4 delays @ 25%, it's more likely at least one delay occurs versus none!
Monte Carlo Forecasting

Image thanks to Larry Maccherone
What is this chart?
This chart shows the simulated burn-down trends. It shows the first 50 trials and visually shows the general hotspots and outlier dates.
Viability (go/no go)

Ability to start

Multiple teams

Team

Story
Ten #Failed Forecasting Plan Assumptions

By Troy Magennis
@t_magennnis
FocusedObjective.com
1: Missed Start Date

Mistake when planning portfolios
1: Missed Start Date
Actual Start Date > Planned Start

- How the planned date was chosen?
- Who signs off on the decision to do this project?
- Causes of past delays?
- Possible delays of this project?

- Give estimates as duration rather than end-date
- Keep history of planned date versus start date delay
- Model start date risk using the historical range of delays
2: No Team (Team not ready)
2: Team Not “Ready” at Start Date
Actual Team = 0

- Is the team in place already? Can I see them?
- What are they working on now? Is it likely to be delayed?
- Higher priority projects?

- Plans to hire aren’t always achievable by given date
- Plan environment factors: space to sit, equipment, meeting space
- What infrastructure does the team need to “start” work?
3: Partial Team (Team < planned)
4: Partial Body Staffing
5: Missing Skillsets
3, 4 & 5: Team Skill and Strength

- How were the skill-sets required determined?
- Did skill level factor into team planning?
- What other duties do the planned staff perform (production support, etc.)?
- How ramp up time for new members is considered?

- Plan what skills are necessary for the project
- Perform Capability Matrix to find skill gaps and resolve
- Estimate and plan how long it takes from “hire to productive” for skills
- Only plan using “productive date” (not the hire date)
# Capability Matrix

<table>
<thead>
<tr>
<th></th>
<th>CSS</th>
<th>Javascript</th>
<th>Run DB Backup / Restore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Person 1</strong></td>
<td>Can run and use the tools needed</td>
<td>Know nothing</td>
<td>Can run and use the tools needed</td>
</tr>
<tr>
<td><strong>Team 1</strong></td>
<td>Know nothing</td>
<td>Can start from nothing and create</td>
<td>Can tweak it or do easy</td>
</tr>
<tr>
<td><strong>Team 2</strong></td>
<td>Can start from nothing and create</td>
<td>Know nothing</td>
<td>Can start from nothing and create</td>
</tr>
</tbody>
</table>

## Analysis:

<table>
<thead>
<tr>
<th></th>
<th>CSS</th>
<th>Javascript</th>
<th>Run DB Backup / Restore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Player Coaches: Ability to Create</strong></td>
<td><img src="image" alt="Status" /></td>
<td><img src="image" alt="Status" /></td>
<td><img src="image" alt="Status" /></td>
</tr>
<tr>
<td><strong>Players: Ability to Maintain</strong></td>
<td><img src="image" alt="Status" /></td>
<td><img src="image" alt="Status" /></td>
<td><img src="image" alt="Status" /></td>
</tr>
<tr>
<td><strong>Bench: Ready to Train Up</strong></td>
<td><img src="image" alt="Status" /></td>
<td>0</td>
<td><img src="image" alt="Status" /></td>
</tr>
</tbody>
</table>

- **General guidelines:** 0 = bad, 1 = single point of failure, >2 cool!
- **Player Coaches:** These are the people/teams who can create new work and teach others. You need at least one (right?). Are you sure you have one?
- **Players:** These are the people/teams who can maintain current work, but struggle to create new work. If new work isn’t expected, you probably need one (right?). Are you sure you have one?
- **Bench:** These are the people/teams who although haven’t got this skill yet, have the tools required to perform this task if needed. Are you sure you have one?
Amdahl's Law indicates that the speedup from parallelizing any computing problem is inherently limited by the presence of serial (non-parallelizable) portions.
6: Overstated Parallel Effectiveness

Diagram:
- Idea
- Planning / Pre "Go" Decision
- Team 1
- Team 2
- Team 3
- Team n
- Integration / Distribution
- Customer

Serial
Parallel
Serial

@t_magennis
6: Overstated Parallel Effectiveness

\[ S(N) = \frac{1}{(1-P) + \frac{P}{N}} \]

8 parallel teams with 75% parallelizable work = 3x
6: Overstating Parallel Scalability

Actual Benefit < Assumed Benefit

- What are the serial parts of a complete system path (often shared resources)?
- How do teams plan to integrate work?
- How do teams coordinate and plan work?
- What are the interdependencies between teams?

- Find ways to eliminate serial paths.
- Track and prioritize fixing blockers in serial paths.
- Organize teams to reduce inter-dependencies.
- Remind people non-linearity of parallel scaling.
Amdahl was an Optimist
Team Dependency Diagram
Chances at least one team not delayed

1 in $2^n$

or

1 in $2^7$

or

1 in 128
7 dependencies
1 chance in 128
6 dependencies
1 chance in 64
5 dependencies
1 chance in 32
7: Dependency Impacts
Your timetable != Someone else’s

- Determine complexity in build order dependencies
- Determine is-aligned priorities
- Determine what incentives are in place

- Look for re-organization opportunities to reduce dependencies
- Reduce batch sizes
- Communicate initial and updated information often
- Build incentives to align priorities
8: Carried over defects and debt
9: Ship Stoppers
10: Splitting

Mistake when forecasting using data

Product Backlog

Historical throughput/velocity based on pre and post split work

Sprint Backlog
Calls to action...

• Understand when estimation is NOT needed
• Track failed assumptions not work item status
• Build achievable plans and goals
  – Free tools / Spreadsheets / Exercises
    [Bit.ly/SimResources]
• Twitter: @t_magennnis
• Email: troy.magennis@focusedobjective.com
Troy Magennis (@t_magennis)

Entangled: Solving the Hairy Problem of Team Dependencies
Histogram of possible Return on Inv.

- Kills Humans
  - Trial subjects
- Does Nothing or kills rat's
- Kills Humans
  - Trial subjects

Likelihood

-30 -20 -10
0 +10 +20 +30 +40 +50

Break Even.
Key Point

Occurrence of a risk Increases exposure to other risks

Break the chain early
<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Acceptable risk</th>
<th>Unacceptable risk</th>
<th>Unacceptable risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very likely</td>
<td>Medium 2</td>
<td>High 3</td>
<td>Extreme 5</td>
</tr>
<tr>
<td>Likely</td>
<td>Low 1</td>
<td>Acceptable risk</td>
<td>Medium 2</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Low 1</td>
<td>Low 1</td>
<td>Acceptable risk</td>
</tr>
<tr>
<td></td>
<td>Medium 2</td>
<td>Low 1</td>
<td>Medium 2</td>
</tr>
<tr>
<td>Impact Level</td>
<td>Examples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Significant | Financial impact potential > $5m  
Stakeholder faith impact is long-term  
Operational impact significantly challenges the organization  
Significant injury and loss of life  
Significant or multiple events of fine, fraud or legal action  
Complete system crash with loss of critical data  
Inability to recruit, retain staff to operate  
Long-term labour disruption |
| Moderate     | Financial impact potential < $5m  
Stakeholder faith impact is short-term  
Operational impact requires extensive management effort  
Significant injury to one or more  
Isolate incidents of a fine, fraud or legal action  
System crash during a peak period  
Difficulties in recruit and retain staff  
Medium term labour disruption |
| Minor        | Financial impact potential < $500,000  
Short-term negative media focus and some concern raised by stakeholders  
Operational impact requires some management effort  
Isolated injury  
Civil or criminal action threatened  
System off-line periodically during non-peak periods  
Grievance or minor labour disruption |

### Impact on Achievement of Objectives

#### Impact Ratings
- **High Risk** (4-5)
- **Medium Risk** (2-3)
- **Low Risk** (0-1)

#### Likelihood of Occurrence
- Low
- Medium
- High
<table>
<thead>
<tr>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
<th>Week 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.75</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.75</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.25</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0.25</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0.25</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.25</td>
<td>0</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>1</td>
<td>0.25</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0.25</td>
<td>1</td>
<td>0.75</td>
<td>3</td>
</tr>
</tbody>
</table>
What distribution fits cycle time data and why...

THE SHAPE OF CYCLE TIME
If we understand how cycle time is statistically distributed, then an initial guess of maximum allows an inference to be made.

Alternatives -

- Borrow a similar project’s data
- Borrow industry data
- Fake it until you make it... (AKA guess range)
Why Weibull

• Now for some Math – I know, I’m excited too!

• Simple Model

• All units of work between 1 and 3 days

• A unit of work can be a task, story, feature, project

• Base Scope of 50 units of work – Always Normal

• 5 Delays / Risks, each with
  – 25% Likelihood of occurring
  – 10 units of work (same as 20% scope increase each)
Normal, or it will be after a few thousand more simulations.
Base + 1 Delay
5th %: 62  25th%: 64  75th%: 77  95th%: 87

Base + 2 Delays

Histogram

Count

Up to and including values for Intervals (Monte Carlo)
5th %: 62  25th%: 65  75th%: 78  95th%: 91

Histogram

Base + 3 Delays
Sample Count: 5000  Min: 59  Avg: 76.941  Median: 77  Max: 118  Standard Dev: 10.766
5th %: 62  25th %: 66  75th %: 86  95th %: 93

Histogram

Base + 4 Delays
5th %: 63  25th%: 74  75th%: 89  95th%: 103

Histogram

Base + 5 Delays

Count

Up to and including values for Intervals (Monte Carlo)
<backlog type="custom">
  <deliverable name="Base">
    <custom count="50" />
  </deliverable>
  <deliverable name="Delay1" skipPercentage="75">
    <custom count="10" />
  </deliverable>
  <deliverable name="Delay2" skipPercentage="75">
    <custom count="10" />
  </deliverable>
  <deliverable name="Delay3" skipPercentage="75">
    <custom count="10" />
  </deliverable>
  <deliverable name="Delay4" skipPercentage="75">
    <custom count="10" />
  </deliverable>
  <deliverable name="Delay5" skipPercentage="75">
    <custom count="10" />
  </deliverable>
</backlog>

<columns>
  <column id="1" estimateLowBound="1" estimateHighBound="3" wipLimit="2">Work</column>
</columns>

<forecastDate startDate="01-May-2012" costPerDay="2500" />
Exponential Distribution (Weibull shape = 1)
The person who gets the work can complete the work
Teams with no external dependencies
Teams doing repetitive work E.g. DevOps, Database teams,
Weibull Distribution (shape = 1.5)
Typical dev team ranges between 1.2 and 1.8
Rayleigh Distribution (Weibull shape = 2)
Teams with MANY external dependencies
Teams that have many delays and re-work. E.g. Test teams
What Distribution To Use...

- No Data at All, or Less than < 11 Samples (why 11?)
  - Uniform Range with Boundaries Guessed (safest)
  - Weibull Range with Boundaries Guessed (likely)
- 11 to 30 Samples
  - Uniform Range with Boundaries at 5th and 95th CI
  - Weibull Range with Boundaries at 5th and 95th CI
- More than 30 Samples
  - Use historical data as bootstrap reference
  - Curve Fitting software
Probability Density Function

Histogram

Weibull

Scale – How Wide in Range. Related to the Upper Bound. *Rough* Guess: (High – Low) / 4

Shape – How Fat the distribution. 1.5 is a good starting point.

Location – The Lower Bound

\[
\begin{align*}
\alpha & = 1.5178 \\
\beta & = 31.965 \\
\gamma & = 0
\end{align*}
\]
The Economic Impact of Software Development Process Choice - Cycle-time Analysis and Monte Carlo Simulation Results

Troy Magennis
troy_magennis@focusedobjective.com

Abstract

IT executives initiate software development process methodology change with faith that it will lower development cost, decrease time-to-market and increase quality. Anecdotes and success stories from agile practitioners and vendors provide evidence that other companies have succeeded following a newly chosen doctrine. Quantitative evidence is scarcer than these stories, and when available, often unverifiable.

This paper introduces a quantitative approach to assess software process methodology change. It proposes working from the perspective of impact on cycle-time performance (the time from the start of individual pieces of work until their completion), before and after a process change.

This paper introduces the history and theoretical basis of this analysis, and then presents a commercial case study. The case study demonstrates how the economic value of a process change initiative was quantified to understand success and payoff.

Cycle-time is a convenient metric for comparing proposed and ongoing process improvement due to Scrum, and Kanban are some of the well-known processes that have risen to the top of the popularity charts, each with case studies (often just one) showing great impact when applied correctly by the inventors. The final choice appears to fall on faith based lines, with many organizations moving from one process to the next in search of nirvana. A quantitative framework for estimating and assessing true impact is needed for informed decisions.

Measuring the quantitative impact of a software development process change is hard. Measurable change takes weeks or months to evolve, and there is little in the way of control group – change is implemented and the outcome if that change wasn’t performed isn’t an interesting or easily discernable metric. This paper presents one technique for quantitatively estimating the potential economic outcomes both before and after a change has been implemented.

The basis for the method described here is probabilistically simulating the impact of changes in cycle-time samples from a prior project to a completed project using new methodology. To
1997: Industrial Strength Software by Lawrence H. Putnam, IEEE, Ware Myers

Work Item Cycle Time or Lead Time Distribution Through the Ages

Approx 2010

Exponential Distribution, Weibull shape parameter = 1

Batch Size / Iteration Length

Shape = 1.5
Scale = 5
< 1 week

Shape = 1
Scale = 15
~ 2 week sprint

Shape = 2
Scale = 30
~ 1 month

Work Item Cycle Time or Lead Time
Lean, Few dependencies
- Higher work item count
- More granular work items
- Lower WIP
- Team Self Sufficient
- Internal Impediments

- Do: Automation
- Do: Task Efficiency

Sprint, Many dependencies
- Lower work item count
- Chunkier work items
- Higher WIP
- External Dependencies
- External Impediments

- Do: Collapse Teams
- Do: Impediment analysis