Good and Bad Software Projects: by the Numbers

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• Correlation is not Causation
  ▪ 100% of Convicted Felons Have/Had a Mother and a Father
  ▪ No Causal Relationship Between Parenthood and Felony
• “There are three kinds of lies: lies, damned lies, and statistics” – Benjamin Disraeli
• What is Measured Tends to be Optimized
  ▪ Focusing on a Single Factor (Variable) May Lead to Unintended and Undesirable Results
The Government is extremely fond of amassing great quantities of statistics. These are raised to the nth degree, the cube roots are extracted and the results are arranged into elaborate and impressive displays. What must be kept in mind, however, is that in every case, the figures are first put down by a village watchman and he puts down anything he damn well pleases.

Sir Josiah Stamp, Her Majesty’s (Queen Victoria) Collector of Inland Revenues, more than a century ago.
Outline

• Project Selection
• “Normal” Variability for Schedule & Effort
• Best Performing & Worst Performing Projects Defined
• Best & Worst Projects Compared
• Differentiators
• Non-differentiators
• Conclusion
• Questions?
Project Selection

• Business IT (Information Technology) Projects
• Completed in Last 5 Years
• Confidence Level of Average or Better in Quality of Metrics
• 1509 Projects
• 66 Distinct Organizations (Many Divisions within Companies)
### U.S. Postal Service 1 Ounce Letter

<table>
<thead>
<tr>
<th>Service</th>
<th>Time Frame</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Class</td>
<td>1 to 3 days</td>
<td>$0.42</td>
</tr>
<tr>
<td>Priority Mail</td>
<td>2 days</td>
<td>$4.80</td>
</tr>
<tr>
<td>Express Mail</td>
<td>Overnight</td>
<td>$14.55 - $23.40</td>
</tr>
</tbody>
</table>

- You pay a premium for guaranteed quick delivery
- Software functions the same way:
  - The relationship between Cost/Effort and Schedule is non-linear
Normal Variability

Project Duration vs Size

Duration

Project Effort vs Size

Effort

Size

Schedule (Months)

Person Months

Size (thousands)

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Normal Variability, Schedule

2/3 projects between boundaries

Schedule varies 369% from -1σ to +1σ

Average

+1σ

-1σ

4.52 months

16.69 months

Project Duration vs Size

Size

Schedule

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Normal Variability, Effort

Effort (cost) varies 890% from -1σ to +1σ

Average

+1σ

-1σ

25.8 effort months

231.3 effort months

Project Effort vs Size
Best & Worst Defined

• Projects Often Optimize Schedule at the Expense of Effort (Cost) or Vice-Versa
  ▪ Time/Effort Trade-off

• Some Projects Optimize Both; Others Fail on Both Counts

• Best Projects are Defined as Being One Standard Deviation or More Better than Average for Both Schedule and Effort
  ▪ Worst Projects are Just the Opposite
Best & Worst Defined

Best projects
5.4% of total

Worst projects
4.5% of total

Project Duration vs Size

Project Effort vs Size
Best & Worst Compared: Cost/Effort

- For a 10,000 line of code project, the Worst projects average 30.6 times as much effort
  - For a 100,000 line of code project the Worst projects average 23 times as much effort
- Effort is usually the largest cost component in software development
Best & Worst Compared: Duration

- Worst projects’ schedules are 7.3 times as long for a 10,000 line of code project
  - 5.8 times as long for a 100,000 line of code project
Best & Worst Compared: Avg. Staff

- Worst projects had significantly higher staffing levels
  - 4.2 times greater for a 10,000 line of code project
  - 3.8 times greater for a 100,000 line of code project
- All Best Projects had average staff less than 6
Best & Worst Compared: Quality 1

- Worst projects have far more defects
  - 13.3 times as many for a 10,000 line of code project
  - 29.5 times as many for a 100,000 line of code project
- Quality difference increases with project size
Best & Worst Compared: Quality 2

- Few Worst Projects report post-implementation defects
- Best Projects trend parallels entire data set; but is slightly better
Best & Worst Development Type

% Best Projects by Development Classification

(Unknown) 6%
Conversion (<5% new) 4%
Maintenance 10%
Major Enhancement (25-75% new) 15%
Minor Enhancement (5-25% new) 28%
New Development 37%

% Worst Projects by Development Classification

(Unknown) 3%
Conversion (<5% new) 7%
Maintenance 7%
Major Enhancement (25-75% new) 49%
Minor Enhancement (5-25% new) 13%
New Development 14%
Best & Worst Development Type

• Best projects likely to be New Development or Minor Enhancements
• Worst projects are disproportionately Major Enhancements
Best projects allocate nearly 3 times as much effort to Analysis & Design on a percentage basis.
Best & Worst: Difficulty

Average Value of Metrics

- Overall Difficulty: Average 5.3
- Data Complexity: Average 5.7
- Customer Interface: Average 3.1
- Ext Sys Interface: Average 2.3
- Integration Complex.: Average 4.0
- Doc Rqmts: Average 4.4
- H/W Stability: Average 9.0
- Sys s/w stability: Average 8.4
Best & Worst: Personnel

Average Value of Metrics

- Overall People: 6.9
- Mgmt Eff.: 7.5
- Training Avail.: 4.0
- Staff Turnover: 1.8
- Dev Team Skill: 7.4
- Knowledge: 7.5
- App. Experience: 6.3
- Motivation: 8.7
- Cohesiveness: 7.8
- Communication: 3.3

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Best & Worst: Tools

Average Value of Metrics

- Overall Tools: 6.0
- Testing Tools Cap.: 4.3
- Program. Tools Cap.: 4.7
- Config Mgt Tools Cap: 5.3
- Proj Mgmt Tools Cap: 5.9
- Dev Std Robustness: 5.6
- Dev Std Adherence: 5.5
- Dev Std Exp.: 5.5
- Dev Std Adaptability: 6.0

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Differentiators

- People, Communication, Knowledge
- Complexity
- Tools

### Average Value of Metrics

- **Mgmt Eff.**: 7.5
- **Staff Turnover**: 1.8
- **Dev Team Skill**: 7.4
- **Motivation**: 7.4
- **Cohesiveness**: 7.8
- **Communication**: 7.8
- **Knowledge**: 7.5
- **Overall Difficulty**: 7.8
- **Customer Interface**: 5.2
- **Doc Rqmts**: 6.2
- **Program. Tools Cap.**: 8.2

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Non-Differentiators

Average Value of Metrics

- Data Complexity: Average 5.7, Project Management Tools Cap. 5.2
- Integration Complex.: Average 4.0, Dev Std Exp. 4.2
- H/W Stability: Average 9.0, Overall Tools 6.0
- Sys s/w stability: Average 8.4, Proj Mgmt Tools Cap. 5.9
- Overall Tools: Average 7.2
- Dev Std Exp.: Average 6.8

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Non-Differentiators

Number of Projects vs Primary Lang

Primary Lang:
- ABAP
- ACCESS
- Advantage/Gen
- ASSEMBLER
- ColdFusion
- ECL
- EDIFACT
- EIFFEL
- IE65
- IEF/COOL/GEN
- JAVA
- JCL
- KSH
- MONK
- Oracle
- Oracle Dev 2000
- Pacbase
- Smalltalk
- Source File
- SQL
- VB
- Visual Basic
- Visual Page
- VPF
- (Unknown)

Number of Projects:
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15

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Conclusions

• Projects of the same size and complexity can vary dramatically in cost and schedule
• Major enhancements are a “mine field”: comprising half of worst performing projects
• The amount of effort spent in Analysis & Design is a key differentiator between Best and Worst projects
• Social and leadership factors seem to contribute more to project success or failure than technical ones
• Programming language is not a key differentiator
Questions??