Towards Developing Accelerators in Half the Time

IPAC 2011
San Sebastian, Spain
September 7, 2011

No part of this presentation may be reproduced without the written permission of the author.

Donald G. Reinertsen
Reinertsen & Associates
600 Via Monte D’Oro
Redondo Beach, CA 90277 U.S.A.
(310)-373-5332
Internet: Don@ReinertsenAssociates.com
Twitter: @dreinertsen
www.ReinertsenAssociates.com
Overview

• In the 20th century, the dominant paradigm for product development used large batch sizes and sequential processes. This is sometimes called, “Big Up-Front Design” (BUFD).

• This approach results in delivering new technology using gold-plated megaprojects that are both slow and inefficient.

• Now, new approaches are fundamentally changing the way systems, both larger and smaller than accelerators, are being developed.

• This presentation will show you how thinking has changed.
The New Paradigm

- Centralized Control → Decentralized Control
- Efficiency Centric → Flow Centric
- Large Batch Size → Small Batch Size
- Forecast Based → Feedback Based
Decentralizing Control with Decision Rules

Boeing 777 Weight Reduction
Decision Authority

Engineer
Supervisor
Program Manager

Dollars per Pound

$300
$600
$2,500
Decentralizing Control

• All projects have multiple important objectives.

• These objectives interact with each other.

• Thousands of small decisions will influence whether we achieve these objectives.

• The team members, who make these decisions, need good decision support information.

• Economic frameworks provide this, enabling fast, fact-based, decentralized, and transparent economic decisions.
Almost Any Analysis Beats Intuition

Range of Cost of Delay Estimates

- Quality Analysis: 1.2:1
- Average Analysis: 2:1
- Best Case Intuition: 10:1
- Average Intuition: 50:1
- Poor Intuition: 200:1

Source: Reinertsen & Associates Clients
The Effect of Capacity Utilization

Queue Size vs. Capacity Utilization

- **Deterministic**
- **Stochastic**

Note: Assumes M/M/1/Infinite Queue
Efficiency-Centric View

To Maximize Profits, Minimize Excess Capacity

Cost of Excess Capacity

Dollars

Excess Product Development Resource
Flow-Centric View

To Maximize Profits, Minimize Total Cost

Although I label this view as Flow Centric, it is actually optimizing total cost by including the effect of Cost of Delay.
Managing Queues

• Product development queues are typically invisible and unmanaged.

• They hurt all aspects of economic performance:
  • Cycle time
  • Quality
  • Efficiency

• In a system with variability, capacity utilization is the primary driver of cycle time.

• To manage queues we must make them physically and financially visible.
### Visual WIP Control Boards

<table>
<thead>
<tr>
<th>Ready Queue</th>
<th>Coding</th>
<th>Ready to Test</th>
<th>Testing</th>
<th>Test Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td></td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td></td>
<td>E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WIP Constraint = 10 units

Little’s Formula

\[ W_s = \frac{L_s}{\lambda} \]
Reducing Batch Size

• Reducing batch size improves all aspects of product development performance:
  • Cycle time
  • Quality
  • Efficiency

• The key to enabling small batch sizes is to reduce the transaction cost per batch.
Megaprojects Geometrically Increase Slippage

Megaprojects magnetically attract increases in scope and gold plating.
The Large Batch Lottery

- A lottery ticket pays $200 to the winning two digit number.

**Large Batch Approach**
- Pay $2.00 to pick both digits at the same time.

**Small Batch Approach**
- Pay $1.00 for 1st digit.
- Get feedback.
- Decide if you wish to buy the 2nd digit for $1.00
Value of Feedback

Probability of Occurrence

Cumulative Investment

100% 10%

Savings = $0.90

$1 90%

$2

0 $1
Rapid Feedback

• Most companies do not explicitly measure or manage their feedback loops.
• Rapid feedback enables us to exploit the value emerging information.
• We can accelerate feedback by:
  • Reducing batch size
  • Limiting in-process inventory
  • Using colocated, cross-functional teams.
• We can enable early risk reduction by investing to create a strong testing infrastructure.
Product Architecture

• Architecture is an unappreciated dimension of design. It enables:
  • Reuse of subsystems.
  • Parallel development.
  • Reduced system integration problems.
• It gives us the ability to concentrate variability.
• Interface management is the crucial skill:
  • Buffer risky subsystems with interface margin.
  • Decouple subsystem development.
• Good product architecture enables the use of good development process architecture.
Summary

• With good decision support information we can get fast, fact-based, correct, and transparent decisions.

• We can simultaneously improve quality, cycle time, and efficiency by:
  • Making queues visible
  • Reducing batch size

• Fast feedback allows us improve speed and efficiency by truncating unproductive paths quickly.

• Good product architecture can enable efficient and rapid development with low risk.

• Strong testing environments facilitate early risk reduction.

• We should use as much science in the design of our development processes, as we use in the design of our products.
Going Further

- Developing Products in Half the Time
  - 1991 / 1997
- Managing the Design Factory
  - 1997
- Flow: The Principles of Product Development
  - 2009