Bathtub Management: Refocusing Our Attention

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Three Fundamental Ideas
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• Dynamic complexity
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- Dynamic complexity
- Mental Models
Complex Systems Are...

- Dynamic
- Tightly coupled
- Governed by Feedback
- Nonlinear
- Self-Organizing
- Adaptive
- Evolving
But our mental models are characterized by:

- Short time horizons
- Narrow boundaries
- Open loop perspective
- Monocausal explanation
- Poor understanding of chance & uncertainty, time delays, stocks and flows, nonlinearities

http://www.infomotions.com/gallery/uiuc/Pages/DSCN2390.shtml
Bathtub Dynamics
<table>
<thead>
<tr>
<th>Deposits</th>
<th>Cash Balance</th>
<th>Withdrawals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>FG Inventory</td>
<td>Shipments</td>
</tr>
<tr>
<td>Installations</td>
<td>Installed Base</td>
<td>Discards</td>
</tr>
<tr>
<td>Learning</td>
<td>“..................”</td>
<td>Forgetting</td>
</tr>
<tr>
<td>Investments</td>
<td>Assets</td>
<td>Depreciation</td>
</tr>
<tr>
<td>Improvements</td>
<td>Capability</td>
<td>Degradation</td>
</tr>
</tbody>
</table>
Three Fundamental Ideas

- Dynamic complexity
- Mental Models
- Stocks and Flows
Motivation

- Organizations use a range of approaches to process improvement, aimed at enhancing organizational performance.
- But, the track record is rather inconsistent.
- The tools work, …
- But the implementation often fails.
  - IMPLEMENTATION FAILURE
  - WHY?
Getting Started in the Plant

• Recruited salaried and union leaders
• Selected one work group for pilot activity
• Formed an implementation team
• Conducted training, including:
  – Seven forms of waste
  – Visual factory
  – 5S
  – One-piece flow
• Formed a steering committee
Early Results - A Successful Start

After a few months, management and shop workers proudly point to the initial success of the effort.

- Process Improvements
  - “We got the layout running.”
  - “You got a pull system in place.”
  - “The area was starting to really look uniform.”

- Performance Results
  - “Some of the overall numbers - they're outstanding.”
  - “Scrap has come down [thousands of dollars].”
  - “Performance went up from 70% to 94%.”

- Employee Motivation
  - “The people that were there, ... when they saw the results, ... they got kind of excited about it.”
Start, and then The Fizzle
Progress as Perceived by a Production Worker

“We’ve got stuff all over the place … all in disarray.”

“The wheels are coming off.”
The “Physics” of Process Improvement

Tasks To Do (T) + Task Completion Rate (TCR) + Process Improvement (PI) + Process Degradation (PD) = Improvement per Task (IPT)

Idea Generation (IG) → Tasks To Do (T) → Task Completion Rate (TCR) → Process Capability (PC) → Process Degradation (PD)
The Key Role of Support Personnel

- Workers generate ideas for improvement, but these create task demands on support personnel.

<table>
<thead>
<tr>
<th>TASKS TO DO</th>
<th>SUPPORT PERSONNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint lines on floor</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Make overhead signs</td>
<td>Tool room</td>
</tr>
<tr>
<td>Install overhead signs</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Buy storage containers</td>
<td>Engineering</td>
</tr>
<tr>
<td>Develop kanban cards</td>
<td>Materials handling</td>
</tr>
</tbody>
</table>

"Very rarely is it the person that came up with the idea."  
(Production manager)
Accumulating Ideas

"The workers will always be able to generate ideas faster than we can implement them.” (Production manager)
Coping with the To Do List

Where There's a Will
There's a Way Loop

Tasks To Do → Task Completion Rate → Process Improvement → Process Degradation

Idea Generation → Tasks To Do

Indicated Completion Rate → Process Capability

Process Degradation → Process Capability

Time Available → Productivity

Productivity → Workarounds

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Interaction with the Learning Curve

Tasks To Do → Task Completion Rate → Process Improvement

Process Capability → Process Degradation

Idea Generation

Indicated Completion Rate

Time Available

Productivity

Where There's a Will There's a Way Loop

Workarounds

Learning By Doing Loop

Experience with New Skill

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A Model of Process Improvement

Tasks To Do → Task Completion Rate → Process Capability → Process Degradation

Idea Generation → Indicated Completion Rate → Time Available → Productivity

Where There’s a Will There’s a Way Loop

Workarounds → Improvement Value

Learning By Doing Loop

Experience with New Skill → Forgetting

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A Model of Process Improvement

Tasks To Do → Task Completion Rate → Process Improvement → Process Capability → Process Degradation

Idea Generation → Indicated Completion Rate → Time Available → Productivity

Where There's a Will There's a Way Loop

Productivity with New Skill → Experience with New Skill → Learning with New Skill

Learning By Doing Loop

Workarounds → Experience with New Skill → Forgetting
The Allure of Shortcuts

• Cognitive and perceptual biases
  – Salient nature of task work
  – Results with minimal delays
  – More certain outcomes

• Social and organizational factors
  – Incentives and rewards

• Comfort Zone
  – Familiar skills
  - “You do the easiest ones first.”
A Shortcut That Works

• **We didn’t do a good job of sharing** what we were doing. The vision, the knowledge, the tools, so that they [the work group] could then apply their thinking and have input into this process.

• Q. Who’s we?

• You know, a few of us. [The work group advisor], the engineer, one operator, [a plant manager], and [an outside consultant] actually did it. Okay? And, the intern. And so you know, we did it, right? **We implemented** this new layout and the work group **seems to be working reasonably well with it.** (Production manager)
The Temporal Pattern of Resources

Test inputs to introduce new ideas and extra resources

Test Inputs

Test input: In week 10, add 60 new ideas and a matching quantity of resources over 10 weeks.
Efficiency Orientation: Temporary Success

Process Capability

Test input: In week 10, add 60 new ideas and a matching quantity of resources over 10 weeks.
Beyond the Tipping Point

Response to new ideas and various quantities of resources over 10 weeks

Process Capability

Test inputs: In week 10, add 60 new ideas and resources, in various multiples of the indicated amount, over 10 weeks.
Key Takeaway
It’s all about the “second-order” stock
Application to Your World

• What could you do to help “fill the bathtub?”

Become a Bathtub Manager!