

Building an Even-Flow Production System

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.. Umm, speaking of flow

Where does even-flow production come from?

How even-flow affects operating and financial performance.

The components and terminology of an even-flow system.

Building an even-flow production system.

Roots: Process Improvement

Process Improvement/Reengineering

- natural, horizontal structure aligned with work
- elimination of non-value-added work associated with waste, errors, , delays, and rework
- cycle time reduction

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Roots: Lean Manufacturing

Lean Manufacturing

- value streams
- elimination of non-value-added work and inventory
- continuous flow of single-piece work
 - simple solutions
 - physical alignment and layout
 - complex tasks → simple processes
- Pulling demand v. pushing inventory

Roots: Six-Sigma

Six-Sigma

- focus on customer outcomes and customer-driven processes
- elimination of variation in processes
- 'boundary-less collaboration'

Roots: Theory of Constraints

Theory of Constraints

- focused and continuous improvement
- systems-thinking
- cause-effect relationships
- constraint-management
- measures of **Throughput, Inventory, Operating Expense**
- Critical Chain Project Management

The Hierarchy of Speed

1. Processes
2. Even-Flow Production
3. Constraint Management
4. Project Scheduling and Trade Partnering
5. Building Technology

Interpretations of Even-Flow

Reduced cycle time, single-source vending, even-flow payments, and zero-base working capital.

Units of production per day, multi-trade teams, and right-sizing of work crews.

Even and sufficient rate of sales, starts, and closings.

The Goal of Even-Flow

The goal of even-flow production is to . . .

. . . *maximize the amount of Throughput* . . .

. . . that can be pushed (or pulled) through a *planned and finite level of production capacity*.

Understanding the Connection

Profitability, cash generation, and economic return are financial outcomes driven by operating performance, productivity, and cycle time.

Operating performance, productivity, and cycle time are linked by the common elements of **Throughput**, **Inventory**, and **Operating Expense**.

What happens to money?

Throughput (T) = the rate at which a builder *generates money* through sales.

Inventory (I) = all the *money* a builder *invests* in things it intends to sell.

Operating Expense (OE) = all the *money* a builder *spends* turning Inventory into Throughput.

The Impact on Profitability and Economic Return

Productivity = $\text{Throughput} \div \text{Expense}$

Inventory Turns = $\text{Throughput} \div \text{Inventory}$

Net Income = $\text{Throughput} - \text{Expense}$

ROA = $(\text{Throughput} - \text{Expense}) \div \text{Inventory}$

C/T = $(\text{Inventory} \div \text{Throughput}) \times \text{days}$

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Operating Performance

Operating Performance is determined by the impact of operating decisions on *Throughput*, *Inventory*, and *Operating Expense*.

Improves whenever *Throughput* is increased and *Inventory* and *Operating Expense* are decreased.

Productivity

Productivity is the ratio of *Throughput* (Contribution) to *Operating Expense* - the ratio of money *generated* to money *spent*.

Increases when you produce the same revenue at a lower level of fixed cost, or produce more revenue at the same level of fixed cost.

Cycle Time

Conventional view: Average length of time required to complete a home.

New view: Ratio of Units-in-Process to Units Completed over time.

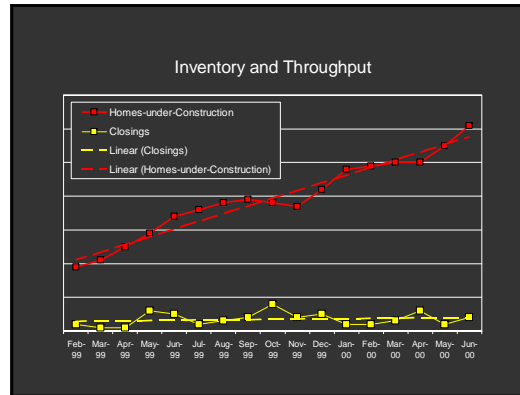
Reduced only by generating more money (*Throughput*) while investing less money (*Inventory*).

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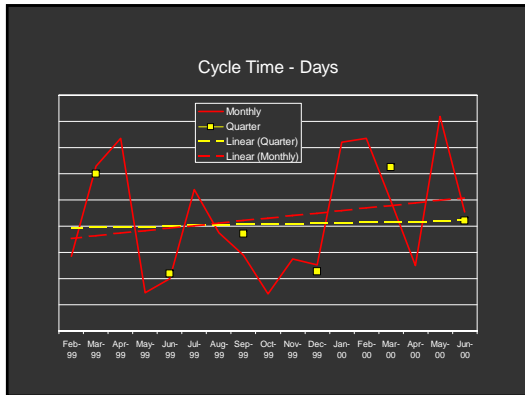
Cause-and-Effect

When Cycle Time gets . . .
longer . . . *shorter . . .*

- Throughput
- Backlog
- Working Capital
- Work-in-Process
- Operating Expense



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So – why build an Even-Flow Production System?

It is the link between the financial and operational performance.

It answers the velocity side of the economic return equation.

It increases Throughput and optimizes production capacity.

It leverages processes and opens the door to better scheduling and partnering.

Characteristics of Even-Flow Production Systems

Plans and manages production at the community level.

Sets production capacity at a finite level.

Focuses on the rate of sales, starts, and closings.

Manages constraints.

- uses constraints to its advantage
- controls the flow of work to the constraint
- uses protective capacity

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Production Capacity

The rate at which **Throughput** can be pushed through the production system with a controlled level of work-in-process (or **Inventory**).

It is a pipeline.

The production system's investment in non-variable expense (or **Operating Expense**).

Constraint

The paradox between balanced flow and balanced capacity.

It is the resource that limits the **Throughput** – and the capacity – of the entire production system.

Types: internal v. external constraints

Control

The mechanism that sets the production pace for the constraint and prevents the production system from producing too much work-in-process upstream from the constraint.

Start Slot Matrix

Protective Capacity

The excess or reserve capacity on non-constrained resources that protects the constraint from idleness or having too much work-in-process.

- excess capacity (feeding buffers)
 - upstream v. downstream resources
- reserve capacity (resource buffers)
 - variable v. non-variable costs

Production Planning and Management

Production Planning

- community stages:
 - sustaining production in a mature community
 - starting production in a new community
 - exiting a built-out community

Production Management

- control mechanism (start slot matrix)
- control protection (start buffer)
- schedules

'Cruising Altitude'

- | | |
|--------------------------------|-----------------------------|
| 1. Set the product | 1. product mix |
| | 2. cycle time |
| | 3. gross margin |
| 2. Set the production capacity | 4. work-in-process |
| | 5. superintendents |
| | 6. external resources |
| 3. Set the Throughput | 7. closings per month |
| | 8. starts in the matrix |
| | 9. size of the start buffer |

'Takeoff'

Added to the production plan:

1. maximum allowable inventory starts
2. length of the start-up period
3. minimum acceptable start buffer
4. additional reserve resource capacity
5. accelerated number of presales
6. gross margin at the higher presale rate

'Final Approach'

The point of counter-productivity, when the rate of **Throughput** will no longer support the investment in production capacity.

Options:

1. Sell the remaining lots
2. Build out with a scattered lot subsidiary
3. Drop the takedown on the remaining lots

Unconstrained Resources:

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This presentation ('Building an Even-Flow Production System') will be made available in a downloadable format at www.saiconsulting.com.
