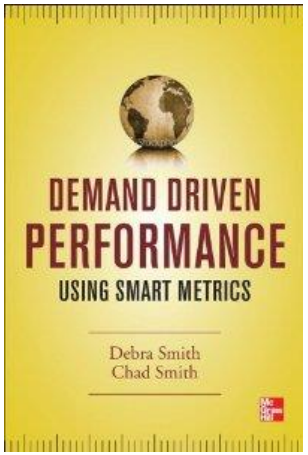
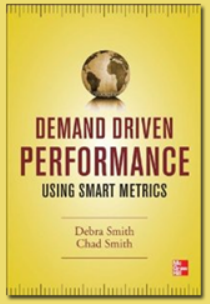
Smart Metrics for



Fooling Ourselves With Irrelevant Information

Hosted by Debra Smith and Chad Smith, co-authors of *Demand Driven Performance – Using Smart Metrics*

Complex Supply Chains



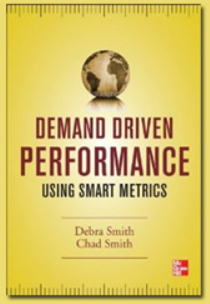
Today's Deep Truth

↓ Unit Cost = ↑ Return on Investment (ROI)

What if Today's Deep Truth is Totally, Completely, Unequivocally False?

To prove this we will need to understand two key principles of supply chains.

Principle 1: Flow Comes First



The History of the Strategy of Flow

Henry Ford –
Father of Mass Production:

- The slowest task governs flow;
- Synchronization of activity to, through and from those tasks create system speed and velocity;
- The value of "no wait time".

Primary Objective:
Improve system velocity at scale

Frederick Taylor –
Father of Operations Management:

- Standards for time, product routings, tools, methods and instructions;
- Variable costing system;
- Planning as a function;
- "Standard" Variance analysis

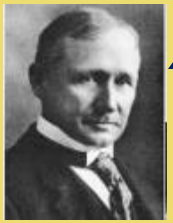
F. Donaldson Brown –
Father of Management Accounting:

- The ROI equation;
- Cost, Volume, Profit Analysis;
- Flex Budgeting;
- Defined relevant information for decision making
- Market segmentation

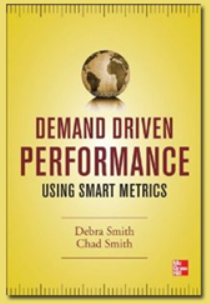
Industrial Revolution

Sir Isaac Newton – Father of the Scientific Revolution

Primary Objective:
Standardization of work and focus on reducing variation



Primary Objective:
Relevant information to drive ROI improvement



Flow the Intersection of Improvement

Lean

Primary Objective:
Reduce Waste

Common Sense leading to a common strategy!

So why do we struggle and where are the sustainable results?

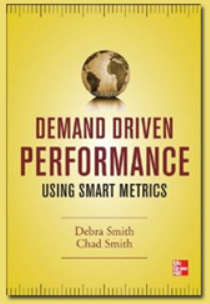
FLOW

Six-Sigma

Primary Objective:
Reduce
Variability

Theory of Constraints

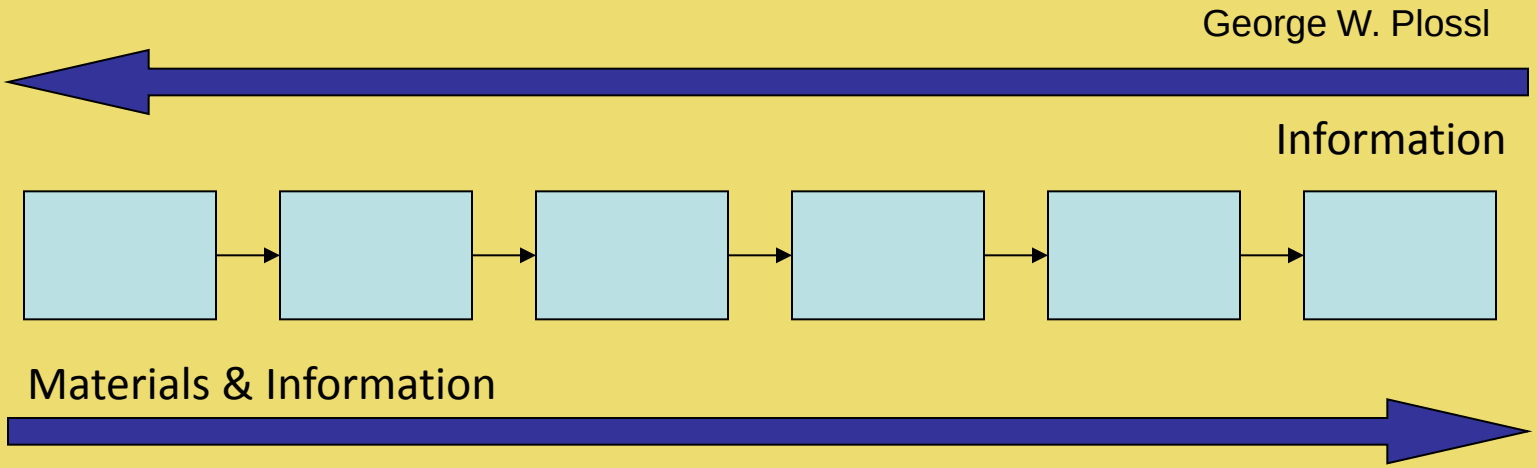
Primary Objective:
Improve
Throughput



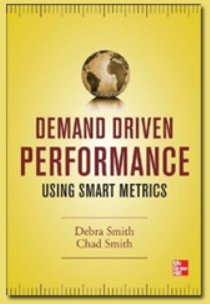
Principle #1: Flow Comes First

The First Law of Manufacturing:

All benefits (ROI) will be directly related to the speed of FLOW of materials and information.



Caveat:
Both Materials and Information must be RELEVANT

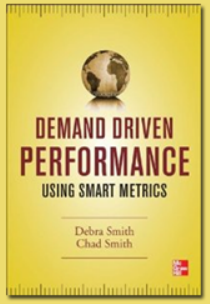


System Flow a Strategy Foundation

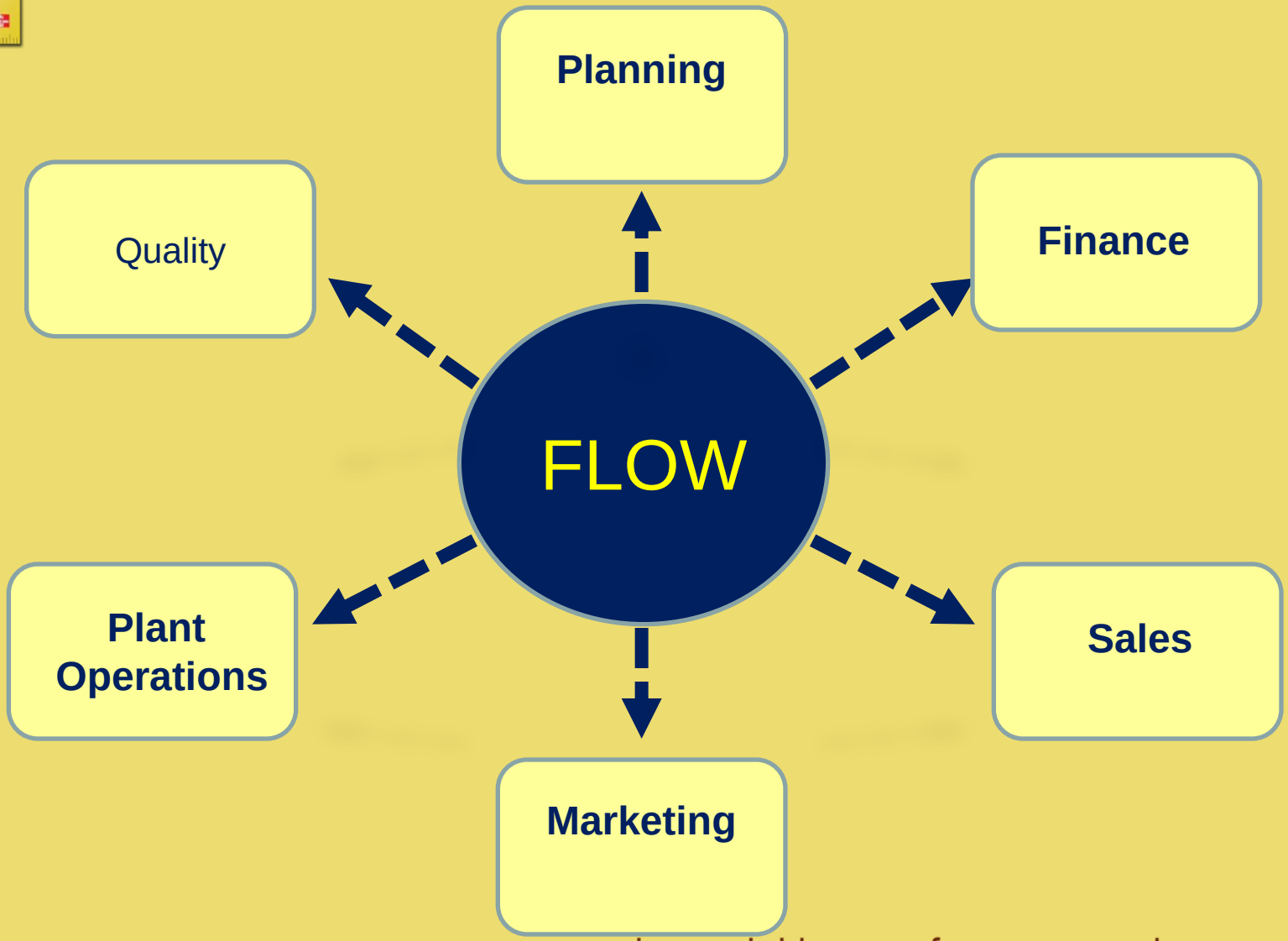
"All Benefits" Encompass:

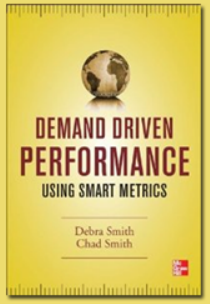
- **Service** is consistent and reliable when a system flows well.
- **Revenue** is maximized and protected.
- **Inventories** are minimized.
- **Expenses** ancillary and/or unnecessary are minimized**.**
- **Cash flow** follows the rate of product flow to market demand.

Protect and Promote Flow = ROI Maximization



Flow Enables Primary Area's KPIs





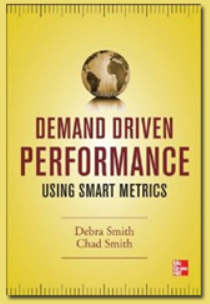
Formula Connecting Flow to ROI

$$\Delta\text{Flow} \rightarrow \Delta\text{Cash Velocity} \rightarrow \Delta\left(\frac{\text{Net Profit}}{\text{Investment}}\right) \rightarrow \Delta\text{ROI}$$

Plossl's First Law of Manufacturing the connection to ROI

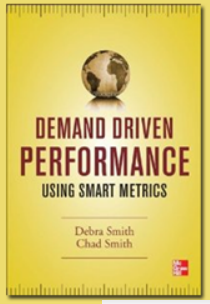
- Flow is the rate at which a system converts material to product required by a customer.
- Cash velocity is the rate of net cash generation; sales dollars minus truly variable costs (also known as throughput dollars or contribution margin) minus period operating expense.
- Net profit/investment is the equation for ROI.

Demand Driven Performance – Using Smart Metrics, Smith and Smith, McGraw hill , 2013, p72



Five Decades of Declining Return On Investment

WHY CHANGE?



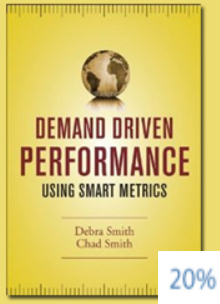
ROI Decline 1965 to 2012

Business Reality – Return on Asset Decrease

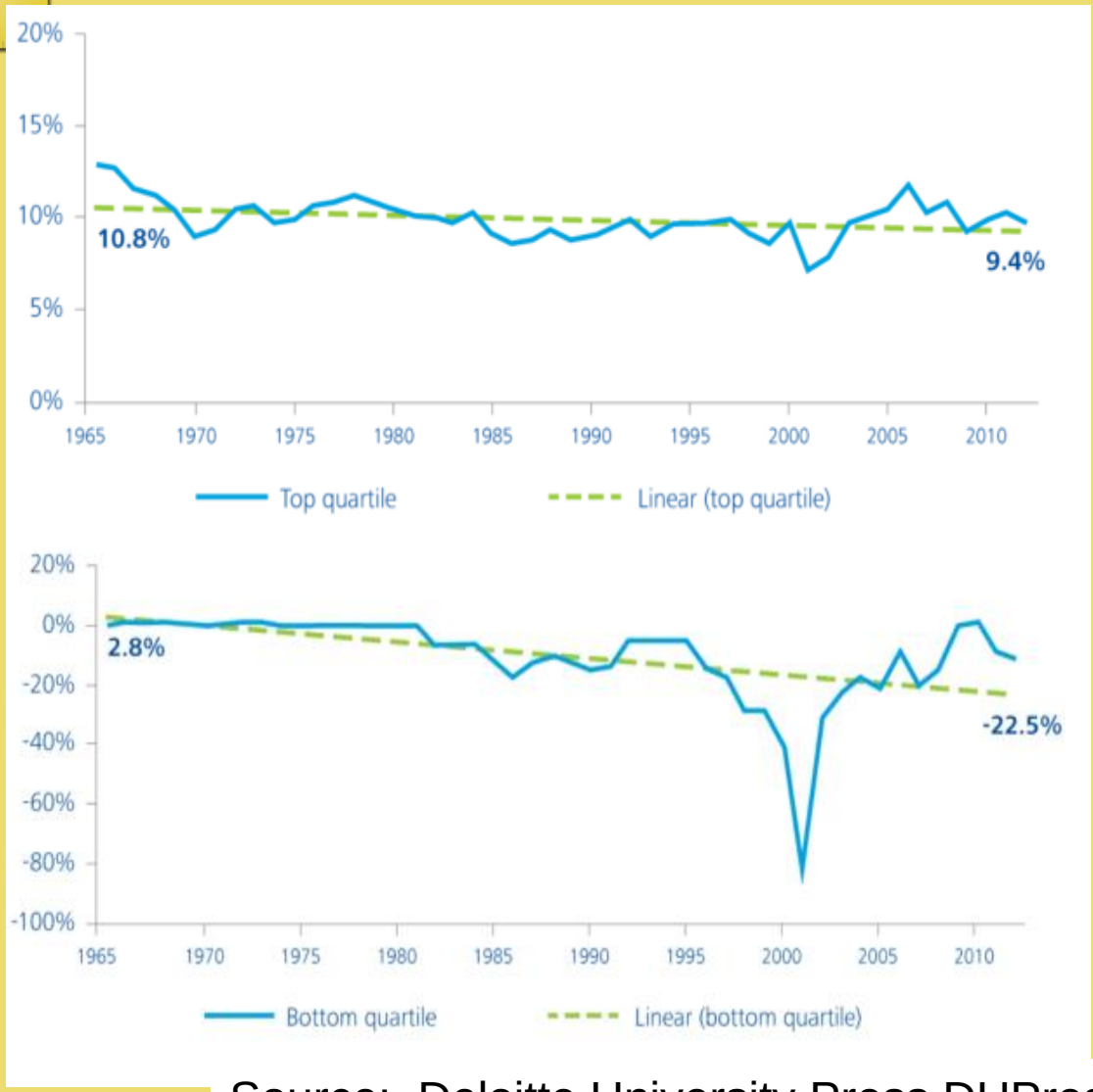
Figure 1. Return on assets for the US economy (1965–2012)

US firms' ROA fell to a quarter of its 1965 levels in 2012. To increase, or even maintain, asset profitability, firms must find new ways to create value from their assets.

Source: Deloitte University Press DUPress.com



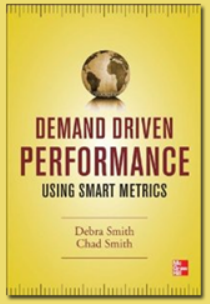
ROI Decline Top & Bottom Quartiles



"The continuing ROA gap between top performers and bottom performers is not unexpected.
What is significant is the top quartile ROA has declined from 12.9 percent in 1965 to 9.7 percent in 2012.

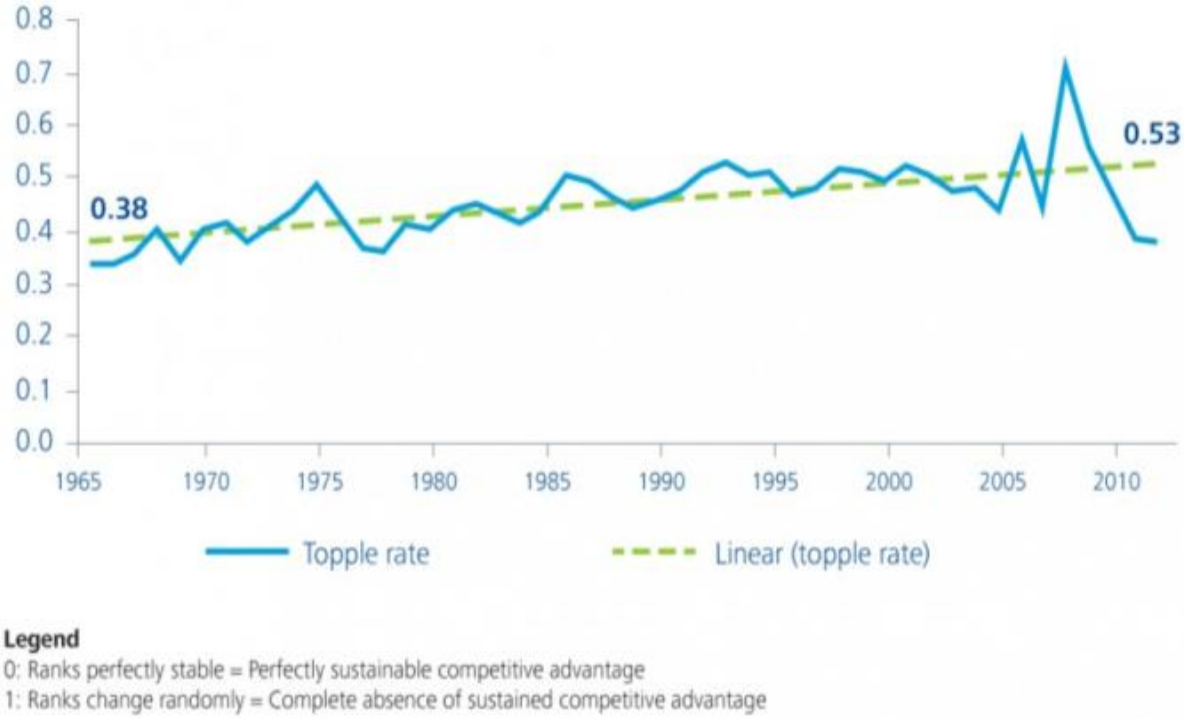
The bottom quartile has declined more—from 1.2 percent in 1965 to -11.5 percent in 2012."

Source: Deloitte University Press DUPress.com



The Topple Rate Increased 40%

Figure 23. Economy-wide firm topple rate (1965–2012)



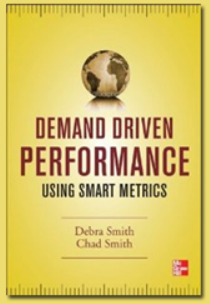
Legend
0: Ranks perfectly stable = Perfectly sustainable competitive advantage
1: Ranks change randomly = Complete absence of sustained competitive advantage

"It is increasingly difficult for companies to sustain performance. Between 1965 and 2012. The topple rate (the rate at which companies change ranks) for all companies with more than $100 million in net sales increased as competition exposed low performers and ate away at returns.

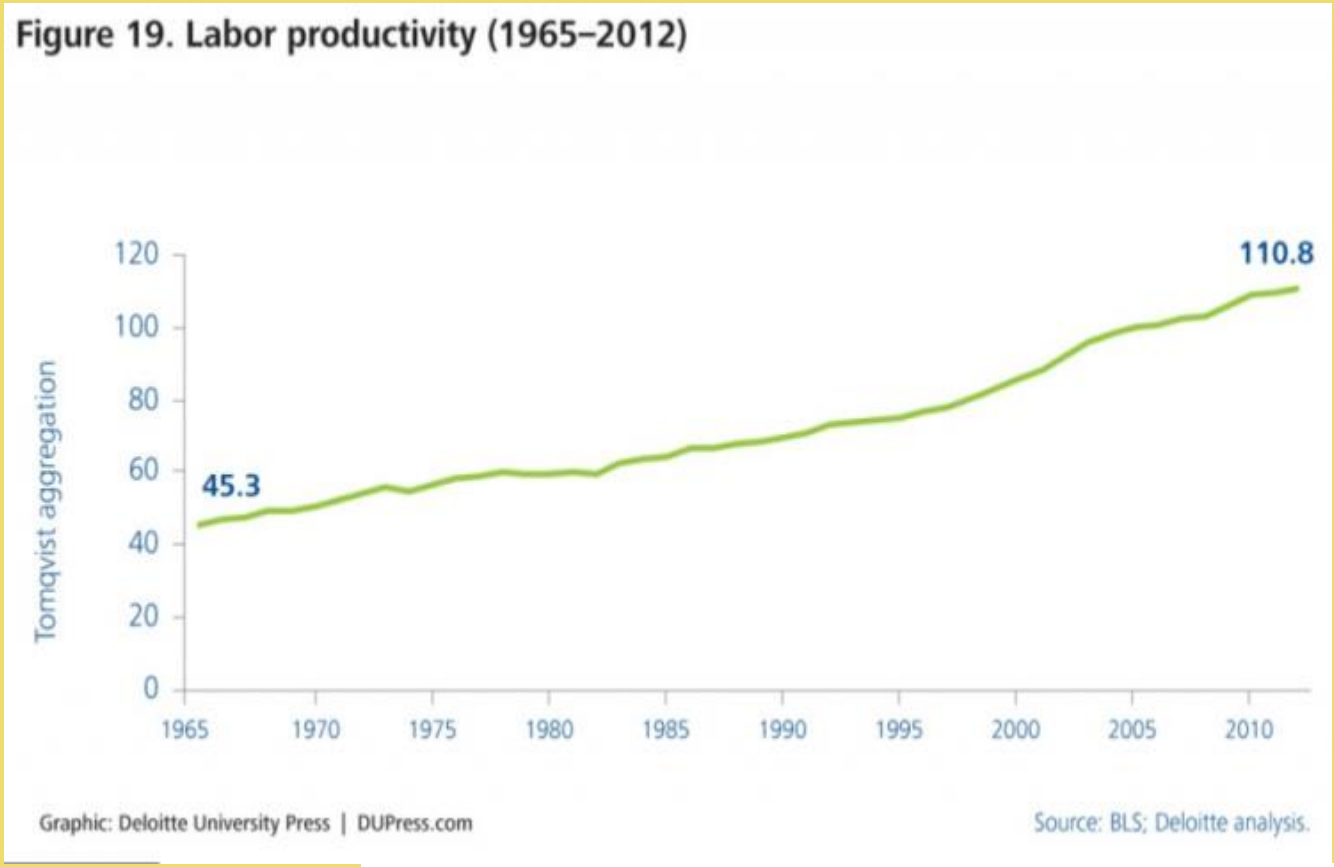
The recent fall after the spike in 2008 may be explained by the increase in government support."

Source: Deloitte University Press DUPress.com

Source: Thomas C. Powell and Ingo Reinhardt, Rank friction, an ordinal approach to persistent profitability.



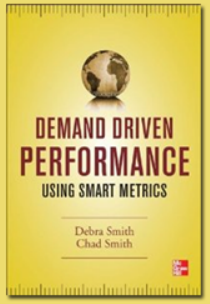
Labor Productivity More Than Doubled



As a whole, productivity in the US economy has steadily improved for nearly five decades, from 45.3 in 1965 to 110.8 in 2012.

Source: Deloitte University Press DUPress.com

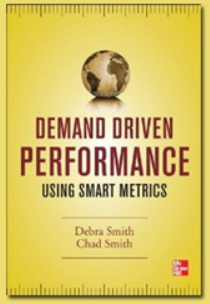
Measured by the Tornqvist aggregation, which shows how effectively economic inputs are converted into output.



What Can We Conclude?

- Global supply relative to global demand? Global oversupply.
- The practical life of Asset/Infrastructure? Shorter recovery life.
- The massive effort invested in Forecast improvement? Forecast error is still on the rise - building the wrong things (FMCG = 55% to 60% accuracy).
- The effect of off-shoring and outsourcing to lower cost? Service levels declined, inventory up and expedite costs have increased.
- The effect of billions invested in ERP? Companies are doing the wrong things sooner and faster and paying a premium to attempt to recover.
- The effect of billions invested in Improvement Methodologies? Gains in resource productivity have not translated to sustainable system ROI.

Clearly Companies Do Not Understand What Drives ROI

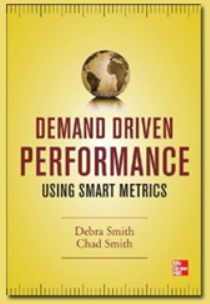


"The greatest obstacle to discovering the shape of the earth, the continents and the oceans was not ignorance but the illusion of knowledge."

Daniel Boorstin

WHAT TO CHANGE?

The assumption that we understand the systems we are trying to control and manage.



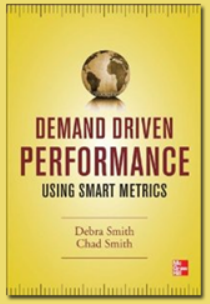
Challenging A Deep Truth

Today's Deep Truth

↓ Unit Cost = ↑ Return on Investment (ROI)

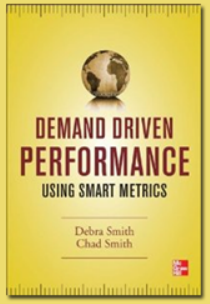
Today's deep truth is totally, completely, unequivocally false but ….

Can you explain why and how it came to be?



Some Historical Reference

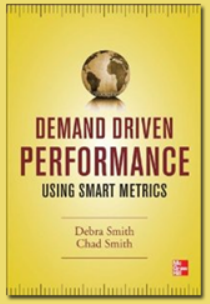
- Mass Production created the need for capital markets and reporting;
- Pre-1934 management accounting was the focus of reporting information – The connection of Flow to ROI was understood;
- 1934 SEC is legislated and GAAP accounting is born;
- 1965 material requirements planning (MRP) revolutionized the way companies calculated what to make and buy and when;
- 1972 closed loop MRP integrated capacity scheduling and reconciliation;
- 1980 financials were integrated and MRPII was born. Manufacturing system designed to capture routing time and material usage input became focused primarily on providing a costing system for GAAP.



1990 MRPII Evolves into ERP

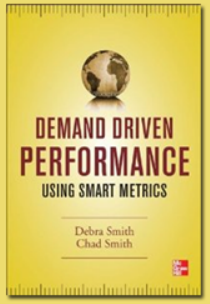
Today at the core of every fast, powerful, expensive ERP is MRPII and all of the problematic unit cost rule assumptions.

Most managers, executives and even accountants have come to relate/accept GAAP costing as relevant information to direct tactics, make decisions and judge resource performance.



The Trouble With Convention

- Today companies act as if unit cost minimization is undeniably the 1st law of supply chain.
- All reporting , measures, tactical planning and execution actions seek the following objectives:
  - Minimize total product unit cost
  - Maximize resource efficiency
  - Strive for positive overhead variances for both labor and volume
  - Initiate cost-reduction efforts with emphasis on machine, labor and inventory reductions quantified on fully absorbed standard costs

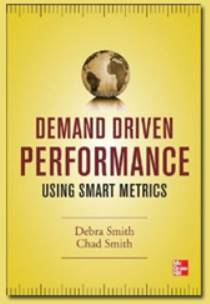


2/13/14 IMA Poll Question

What do you think is the biggest factor in ROI?	Answer
a. Lowest unit cost	12.0%
b. Best resource efficiency	53.3%
c. Best total system flow	34.7%

Best Resource Efficiency = Least Unit Cost

Attendees	
CMAs in attendance	1028
CMA candidates in attendance	52
Number of countries represented	41
Finance executives, Controllers, Accountants from fortune 100's to small job shops	856



The Consequences of Focusing on Unit Cost

Some make to stock products incur stock outs

Plants tend to produce to stock even when there is no demand signal (e.g. "extend the forecast").

Some make to stock products are overstocked

Make to order backlogs grow – we ship late

Departments tend to produce the high CoGs dollar items at the expense of the low items.

Plants receive CoGS dollar credit when they ship to DCs

Plants pull ahead orders to increase the batch size for make to stock orders.

Make to order and make to stock share common capacity and material

Plants try to maximize making "high CoGs dollar" products

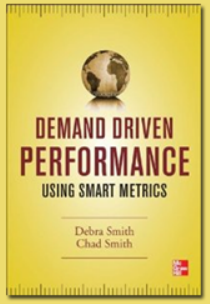
Some items have more CoGs dollars than others.

Setting up more increases product unit cost and lowers resource efficiencies.

Plant feel pressure to maximize monthly profit plan (CoGS dollar credit) KPI

+

People behave according to metrics



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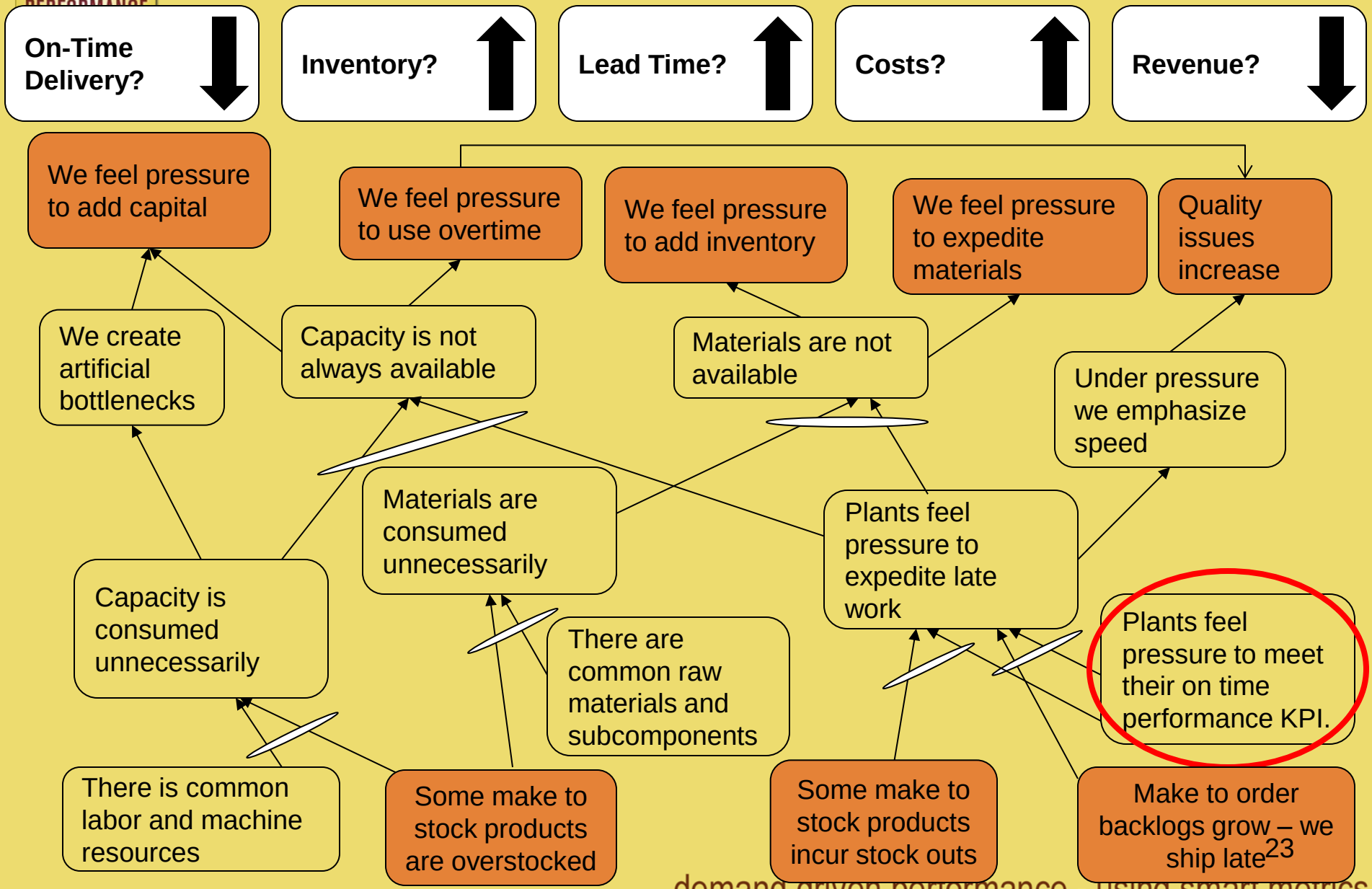
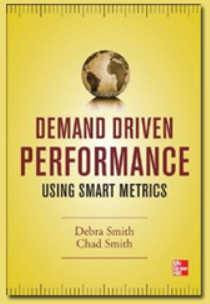
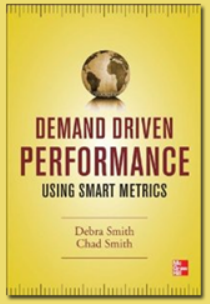




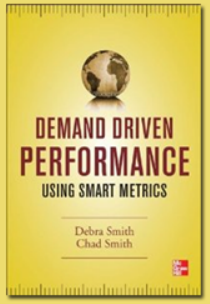
Conflicting Actions

Tactical Objective	Cost-Centric Action	Flow-Centric Action
Efficiency	Run larger batches; extend the forecast; run only on optimal resource	Protect critical resources; run smaller batches to pull; run on any process capable resource
Margin Maximization	Focus on lowering unit product cost	Focus on increasing service level, premium pricing, leveraging constrained resources and incremental revenue opportunities
Inventory Turns	Impose an inventory dollar value; postpone inventory receipt; mandate across the board reductions	Commit to strategic stock positions that meet the lead time strategy



Conflicting Actions (cont.)

Objective	Cost-Centric Action	Flow-Centric Action
Budget Performance	Focus on actions to achieve standard unit cost	Focus on the incremental costs of leveraging flow to the market
Volume Maximization	Lower price and raise order minimums	Focus on service, lead times and lower order minimums
Continuous Improvement	Identify unit cost reduction opportunities through increasing resource efficiency or labor reduction	Identify the largest sources of variation and remove them to lower lead times and reduce investment in all strategic buffers



2/13/14 IMA Poll Question

What wins out in your organization?	Answer
a. Cost centric tactics and actions	38.8%
b. Flow centric tactics and actions	17.7%
c. We oscillate back and forth between expediting to protect flow and actions to protect cost	43.4%

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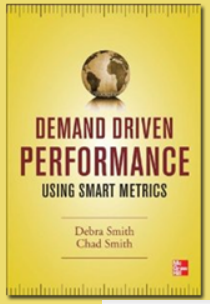
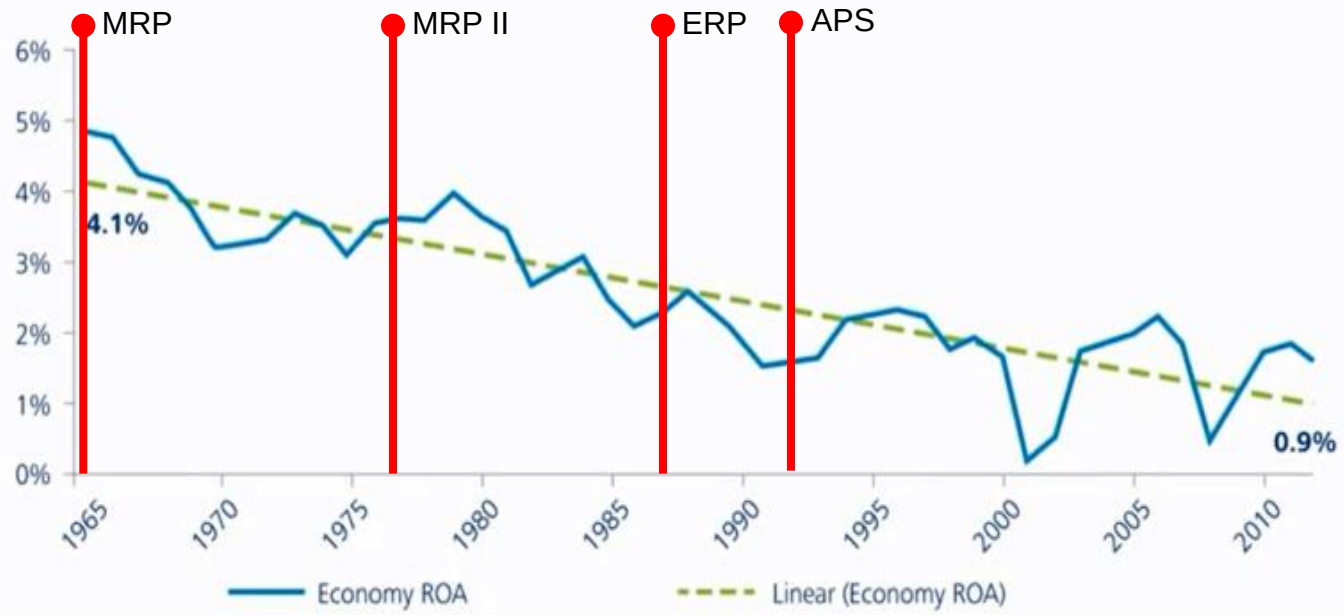


ROI Decline & Information Technology Breakthrough

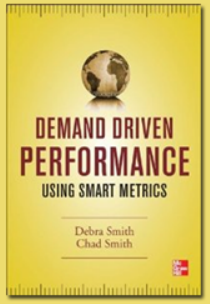
Business Reality – Return on Asset Decrease

Figure 1. Return on assets for the US economy (1965–2012)



US firms' ROA fell to a quarter of its 1965 levels in 2012. To increase, or even maintain, asset profitability, firms must find new ways to create value from their assets.

Source: Deloitte University Press DUPress.com



What Have We Missed?

ΔVisibility → ΔVariability →

Necessary Realization For Flow

ΔFlow → ΔCash Velocity → Δ $\left(\frac{\text{Net Profit}}{\text{Investment}}\right)$ → ΔROI

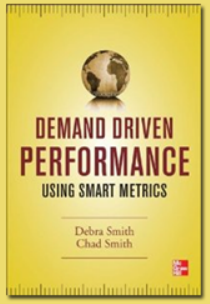
Plossl's First Law of Manufacturing on flow improvement

Visibility is defined as relevant information for decision making.

Variability is defined as the summation of the differences between what we plan to have happen and what happens.

Can we even define what is relevant information and quantify its impact on FLOW and ROI?

Demand Driven Performance – Using Smart Metrics, Smith and Smith, McGraw hill , 2013, p72

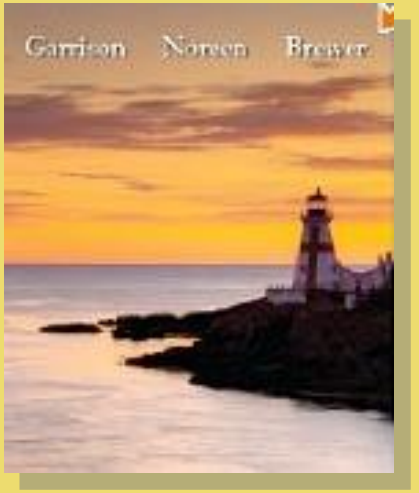


The Importance of "Relevance"

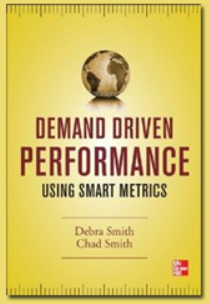
"Every decision involves choosing from among at least two alternatives. In making a decision, the costs and benefits of one alternative must be compared to the costs and benefits of other alternatives. ***Costs and benefits that differ between alternatives are called relevant costs.***

Distinguishing between relevant and irrelevant costs and benefits is critical for two reasons. ***First irrelevant data can be ignored – saving decision makers tremendous amounts of time and effort.***

Second, bad decisions can easily result from erroneously including irrelevant costs and benefits *when analyzing alternatives. To be successful in decision making, managers must be able to tell the difference between relevant and irrelevant data in analyzing alternatives."*



Noreen, Brewer, Garrison, "Managerial Accounting for Managers", McGraw Hill Irwin, 2008, page 500

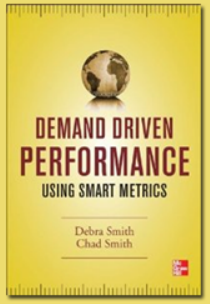


Relevant Range and Unit Cost

Relevant range is the range of activity within which the assumptions about variable and fixed costs remain valid.

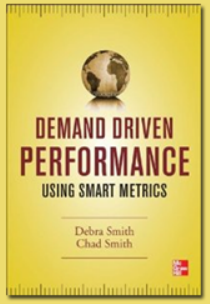
- In the “long run” all costs are variable.
- In the “short run” all period costs including, direct labor, are fixed and irrelevant.

Unitizing fixed costs create the false impression that overhead costs and direct labor will vary up or down with changes in activity/volume levels.



Blame it on Newton's clock work universe

GAAP FITS HOW WE ASSUME THINGS WORK



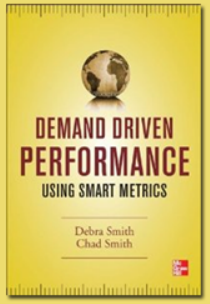
Newton's Linear, Ordered Universe

Order: given causes lead to known effects at all times and places. *Things happen because something causes them*.

Reductionism: We can understand what happened by reducing things to their components or parts and examining those parts. *Small changes lead to small effects and large changes lead to large effects.*

Predictability: The universe is orderly, follows natural laws, and works like an incredibly complicated machine. The inputs always equal the outputs. *These models can be optimized.*

Determinism: processes flow along orderly and predictable paths that have clear beginnings and rational ends. *There is no chance, no choice, and no uncertainty.*



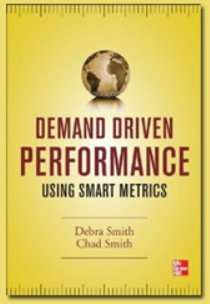
Newton's Far Reaching Effect

Today's management strategy core beliefs:

1.The best way to manage people is to break the organization into functions and organize them into a clear structure. Controlling *their actions with clear directions regarding their specific function will control the system.*

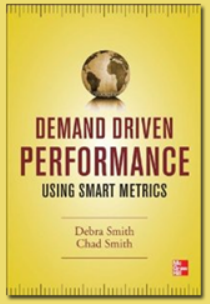
2.The best results are obtained when work is streamlined at each unit to be as efficient as possible, with a minimum of wasted effort, producing the most output in the least amount of time. *The lean-machine strategy will optimize any system output.*

3.All cost structures are linear, additive, and divisible and can be directly associated with time increments, linearly, additively, and divisibly. *The sum of all the average best times will equal the average system's best time and the least cost.*



The Rise in Complexity

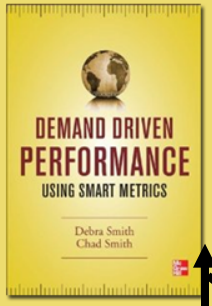
Circumstance	1965	2013
Supply Chain Complexity	Low. Supply chains looked like chains – they were more linear. Vertically integrated and domestic supply chains dominated the landscape	High. Supply chains look more like "supply webs" and are fragmented and extended across the globe.
Product Life Cycles	Long. Often measured in years and or decades (e.g. rotary phones)	Short. Often measured in months (particularly in technology)
Customer Tolerance Times	Long. Often measured in weeks and months	Short. Often measured in days with many situations dictating less than 24 hour turns
Product Complexity	Low.	High. Most products now have relatively complex mechanical and electrical systems and micro-systems. Can you even work on a modern car anymore?
Product Customization	Low. Few options or custom feature available.	High. Lots of configuration and customization to a particular customer or customer type.
Product Variety	Low. Example – toothpaste. In 1965 Colgate and Crest each made one type of toothpaste.	High – in 2012 Colgate made 17 types of toothpaste and Crest made 42!
Long Lead Time Parts	Few. Here the word "long" is in relation to the time the market is willing to wait. By default if customer tolerance times were longer it stands to reason that there were less long lead time parts. More so, however, is that fact that supply chains looked different. Most parts were domestically sourced and thus often much "closer" in time.	Many. Today's extended and fragmented supply chains have resulted in not only more purchased items but more purchased items coming from more remote locations.
Forecast Accuracy	High. With less variety, longer life cycles and high customer tolerance times forecast accuracy was almost a non-issue. "If you build it, they will buy it."	Low. The combined complexity of the above items is making the idea of improving forecast accuracy a losing battle.
Pressure for Leaner Inventories	Low. With less variety and longer cycles the penalties of building inventory positions was minimized.	High. At the same time operations is asked to support a much more complex demand and supply scenario (as defined above) they are required to do so with less working capital!
Transactional Friction	High. Finding suppliers and customers took exhaustive and expensive efforts. Choices were limited. People's first experience with a manufacturer was often through a sales person sitting in front of them.	Low. Information is readily available at the click of the mouse. Choices are almost overwhelming. People's first experience with a manufacturer is often through a screen sitting in front of them.



The Challenge To Protect Flow

The Law of System Variability

- The more that variability is passed between discrete areas, steps, or processes in a system, the less productive that system will be.
- The more areas, steps, or processes and connections in the system, the more erosive the effect to system productivity will be.



Variability Accumulation & Amplification

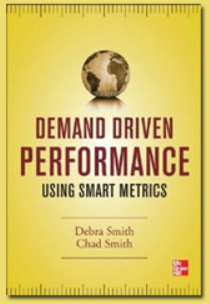
Output

Lead time

Variation Accumulation

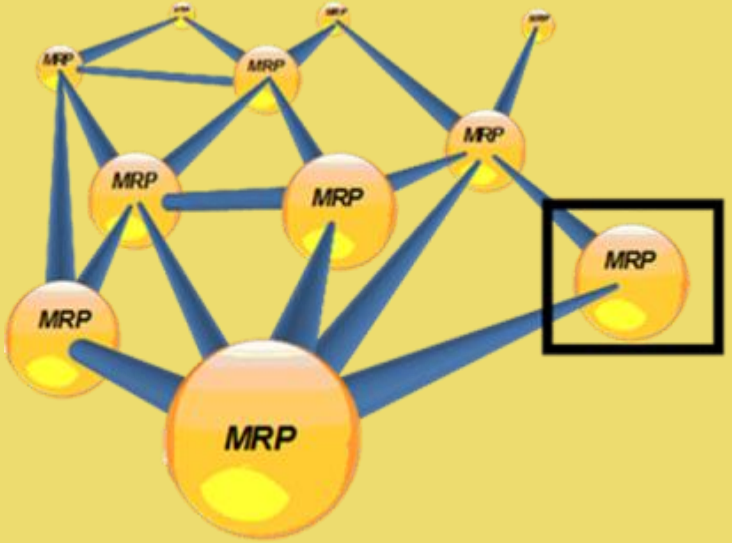
Variability Wave

Variation Amplification



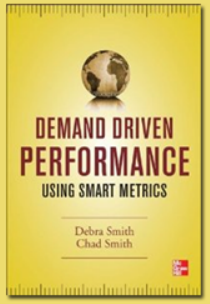
Today's Supply Chains are Complex!

Embedded at the heart of every node is an ERP system and MRPII with all of its problematic forecast planning and cost centric rules and the major source of the "Bullwhip Effect"



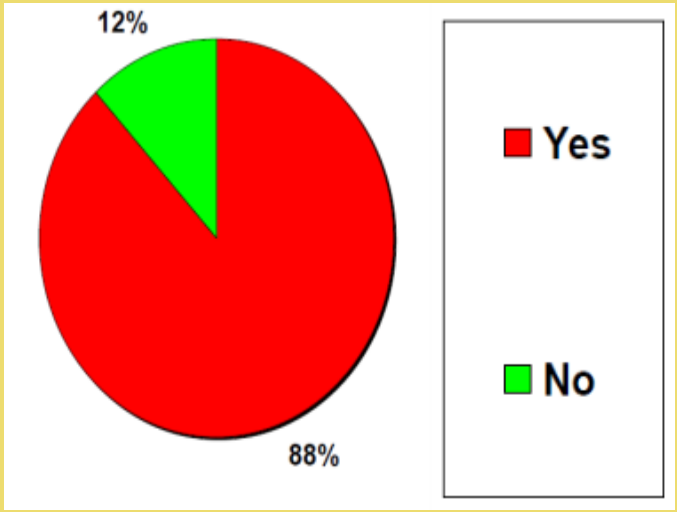
Supply chains are both more fragmented and more connected:

- The wrong rules inside each node transfer variability
- The greater amount of connections amplifies variability



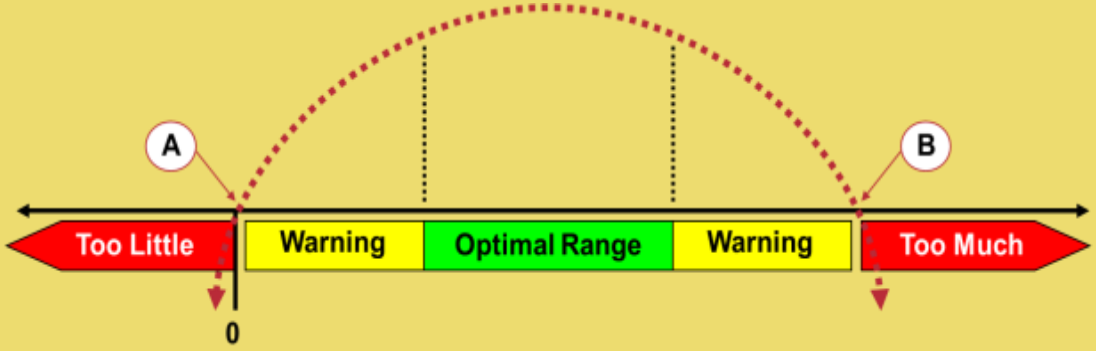
The Bull-whip Effect & Bi-modal Inventory Swings

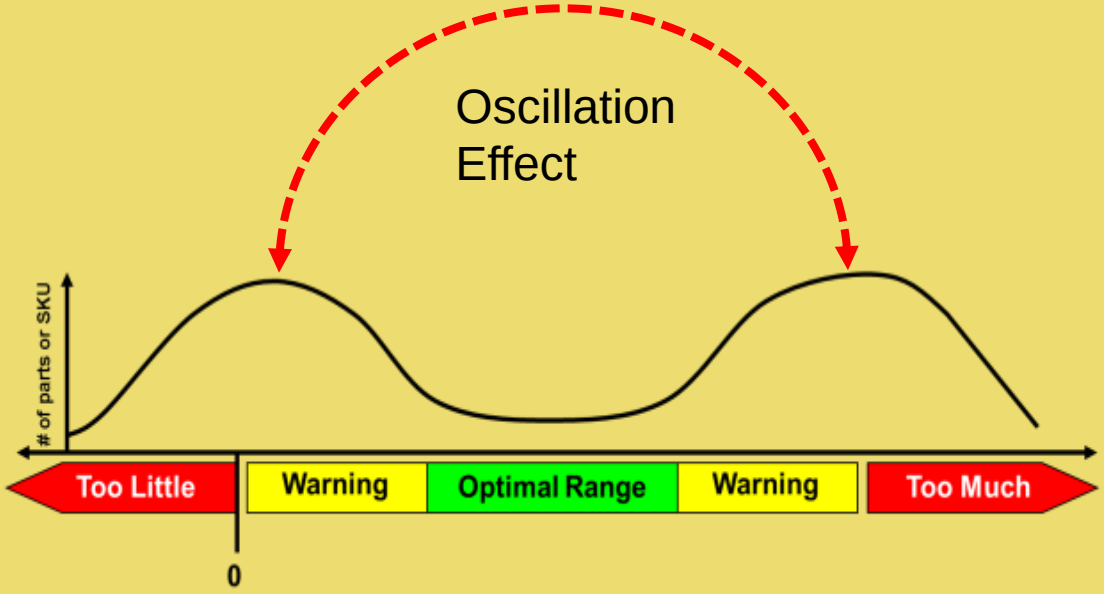
Poll Question: Are you Experiencing the Bi-modal Effect?

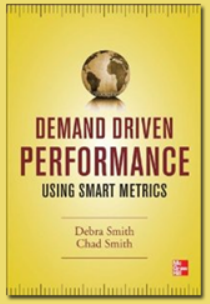


Three Effects:

1. Persistent Unacceptable Inventory Performance
2. Service Challenges
3. High Expedite and Waste Related Expenses





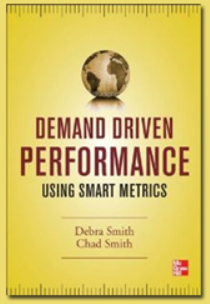


The Game Has Changed

Protecting and maintaining flow requires a shift from Newtonian linear rules and GAAP math to Complex Adaptive System (CAS) nonlinear rules and math.

- First understand the rules of flow for the system you are attempting to manage;
- ONLY then can we build the tools to provide visibility to the status of flow and relevant information to drive tactics and actions.

Smart Metrics is an outcome of the Right Rules & Tools



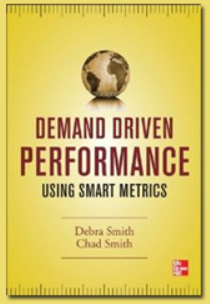
Order, Complexity & Chaos

"Complexity" represents the middle area between order at one end and chaos at the other. Thus complexity is sometimes called the edge of chaos. If we think of order as ice and chaos as water vapor, complexity would be liquid water."

Dr. Christopher Langton, founder and research scientist at the SFI

The science of CAS has to do with structure and order, especially in living systems including:

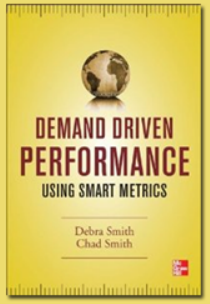
- The development of the embryo,
- Ecosystems,
- Social organizations - Business and nonprofit organizations and their interactions with the technological-economic environment.



Complex Adaptive Systems (CAS)

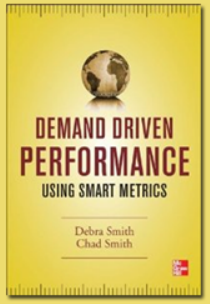
- CAS is the “new” science explaining complexity.
- CAS have well defined rules and predictable behaviors that govern system flow and cost behavior.
- Conventional thinking is based on a linear system rule set and mathematics.
- CAS rules are different and many are the opposite.

Most business leaders, operational personnel and academics don’t know or understand these differences, their implications/opportunities



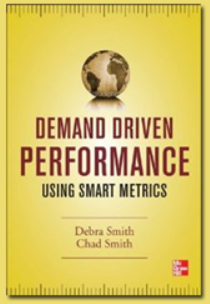
CAS Are Very Different

System Traits	Linear	Nonlinear Complex
The Method to Understand the System	Linear systems can be understood by studying the individual part; the whole is the sum of its parts	Nonlinear systems can only be understood by mapping the dependencies and interconnections
System Predictability	Linear system "state" is stable and predictable	Nonlinear system "state" is dynamic and no predictions remain valid "too" long
System Output Behavior	The output of a linear system is proportional to it's inputs	The output of nonlinear system is governed by a few critical points – the leverer point phenomena

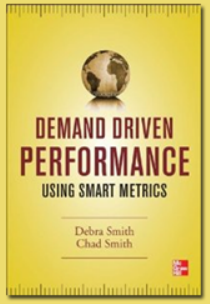


CAS Are Very Different

System Traits	Linear	Nonlinear Complex
Mathematical Models of the System	Gaussian statistical model (normal bell shaped distribution curve) - The sum of the averages are a predictable model of the system and the tails of the statistical distribution are ignored as anomalies	Paretian statistical model – The tails of the distribution identify the few critical points that define the relevant information predict and manage nonlinear complex systems. They contain the lever point phenomena
System Output Maximization	A linear system can be optimized	A nonlinear system cannot be optimized but it can continually learn and improve



Quantifying the Opportunity



The Gap Formula Between Flow and Cost Centric Strategies

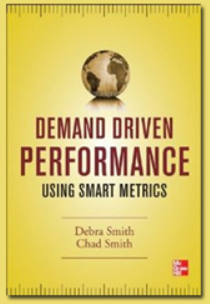
ΔVisibility $\rightarrow$ ΔVariability $\rightarrow$

Core Conflict Area

$$\Delta\text{Flow} \rightarrow \Delta\text{Cash Velocity} \rightarrow \Delta \left(\frac{\text{Net Profit}}{\text{Investment}} \right) \rightarrow \Delta\text{ROI}$$

Plossl's First Law of Manufacturing and the Demand Driven Model

- **Visibility** is defined as relevant information for decision making.
- **Variability** is defined as the summation of the differences between what we plan to have happen and what happens.
- **Flow** is the rate at which a system converts material to product required by a customer.
- **Cash velocity** is the rate of net cash generation; sales dollars minus truly variable costs (also known as throughput dollars or contribution margin) minus period operating expense.
- **Net profit/investmen**t is the equation for ROI.



Manage Flow With Relevant Information

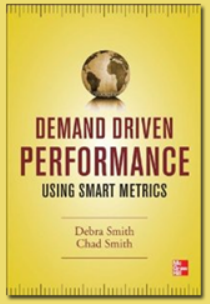
ΔVisibility → ΔVariability

Core Conflict Area

You can't measure what you can't see!

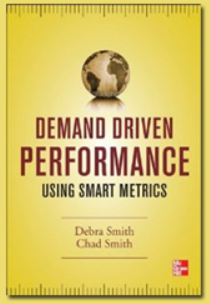
Visibility to the same relevant information across the supply chain ensures:

- System coherence – the key to synchronizing flow
- Aligns priorities and schedules
- Speeds conflict resolution
- Defines when and where to act
- People will self organize to solve/act



IMA Poll Questions 2/13/14

Poll	Poll Question	Poll Responses
1	What do you think is the biggest factor in ROI?	
	a. Lowest unit cost	12.0%
	b. Best resource efficiency	53.3%
	c. Best total system flow	34.7%
2	What wins out in your organization?	
	a. Cost centric tactics and actions	38.8%
	b. Flow centric tactics and actions	17.7%
	c. We oscillate back and forth between expediting to protect flow and actions to protect cost	43.4%
3	How would you describe the complexity of your company's supply chain in the last decade?	
	a. Stayed the same	15.4%
	b. Complexity has increased	78.2%
	c. Complexity has decreased	6.3%
4	How would you rate your ERP system's ability to focus on the relevant information?	
	a. Poor	22.5%
	b. Moderate	60.8%
	c. Good	16.8%



Become Demand Driven

Step 1 Accept The New Normal – Variability, Volatility and Complexity are here to stay.

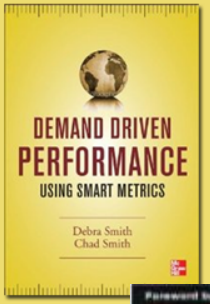
Step 2 Embrace Flow and its implications for ROI.

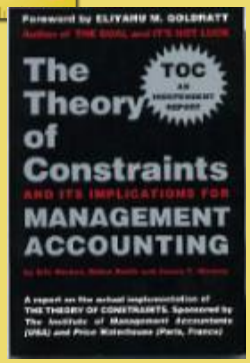
Step 3 Design an operational model for flow.

Step 4 Bring the Demand Driven model to the organization – Implement.

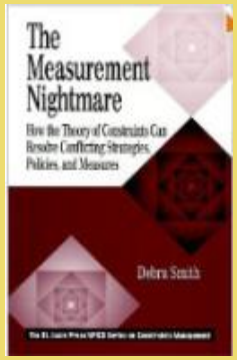
Step 5 Use smart metrics to operate, sustain and drive improvement.

Our Journey of Exploration

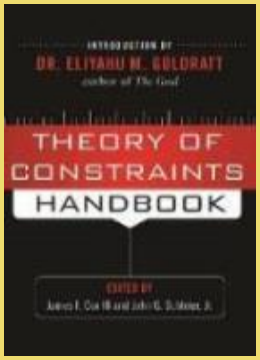




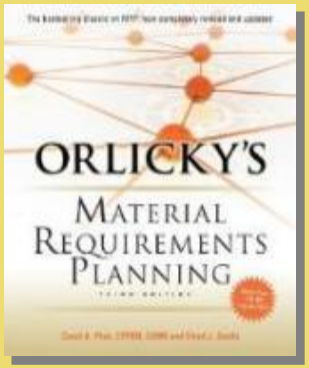
1995



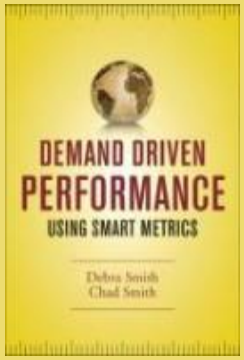
1997



2010



2011



2013

Ditch Witch

1998

The Power of Decoupling:

- $35M inventory decrease
- Lead time 90 to 14 days

Roseburg

2001 -2003

The Power of Vertical Integration:

- $30M inventory decrease
- ROI from 4 to 18%
- Lead time 3 weeks to 3 days

LeTourneau TECHNOLOGIES™

Built On Experience. Driven By Vision.

2004-2009

Analyze Deep and Broad Product Structures:

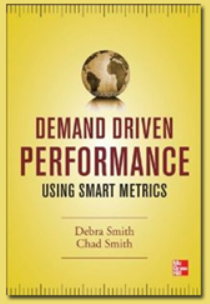
- ROI from 5 to 22%
- Lead time 24 to 10 weeks
- 6 X revenue .8 inventory increase

Unilever

2011 -2014

The Prioritized Share Equation & Hybrid Distribution:

- 45% decrease finished goods
- 18% decrease raw and pack
- 99.7% service levels



Questions?

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