DFMA and Lean: Partners in Competitiveness

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Presenter

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This presentation includes research and topical materials incorporated into a 2008 Richard Schonberger book (John Wiley & Sons):

Best Practices in Lean Six Sigma Process Improvement: *A Deeper Look*

. . . with Telling Evidence from the *Leanness Studies*

Topic Outline

- ***Three Major Pathways to Lean:*** ***Lean Core, Lean in Supply/Distribution, De-Proliferation***
- ***DFMA's Impacts on Lean:*** ***Wide and Deep***
- ***DFMA's/Lean's Common Problem:*** ***Executives***
- ***The Leanness Studies:*** ***Lean, Six Sigma, DFMA, Process Improvement in Deep Flux***

Lean's/DFMA's Woes

Some in Every Company/Industry – Examples

- Weak recognition of their primary *competitive*, *customer-side* benefits; treated as operational, not strategic, not *enduring*
- So many parts, SKUs, suppliers, customers you can't even find the value streams
- Persistent, wrong-headed financial hurdles
- Things going wrong everywhere all the time—and no systematic recording of the wrongs
- 95% improvements done by 5% of people
- And many more

What is Lean (*ends*, not means)?
That is, what does it *achieve—competitively*?

Best (customer/competitive) answer:
Ever quicker, more flexible, higher-quality, greater-value—response throughout the value chain

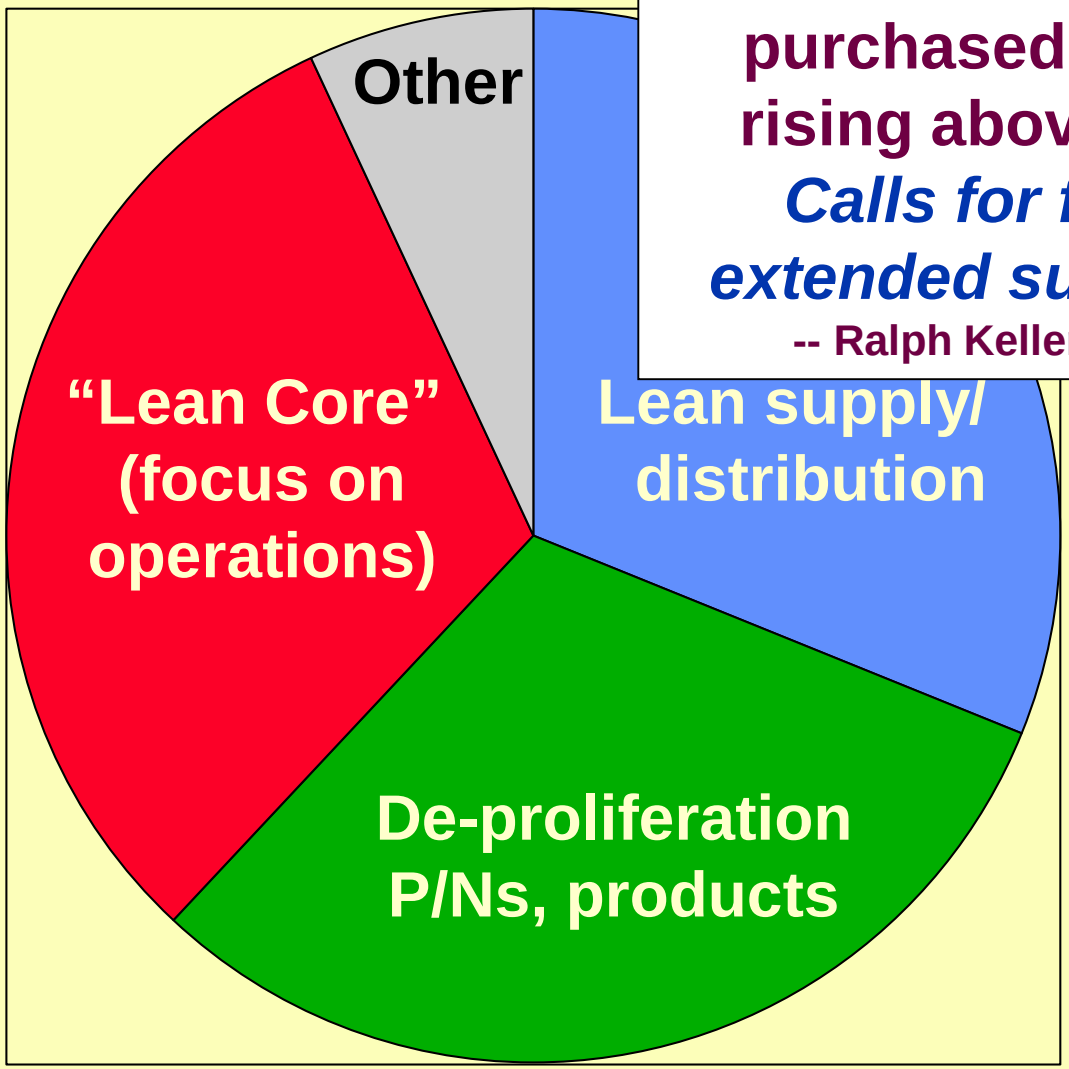
What are the primary means? 

Three Major Pathways to Lean

- **The “lean core”**
- **De-proliferation—of part numbers, etc.**
- **Tight collaborative external links**

The Lean Value Chain—Not Just Operations

D.L. below 10% of COS; purchased materials rising above 60% . . .
Calls for focus on extended supply chain
-- Ralph Keller, AME Pres.

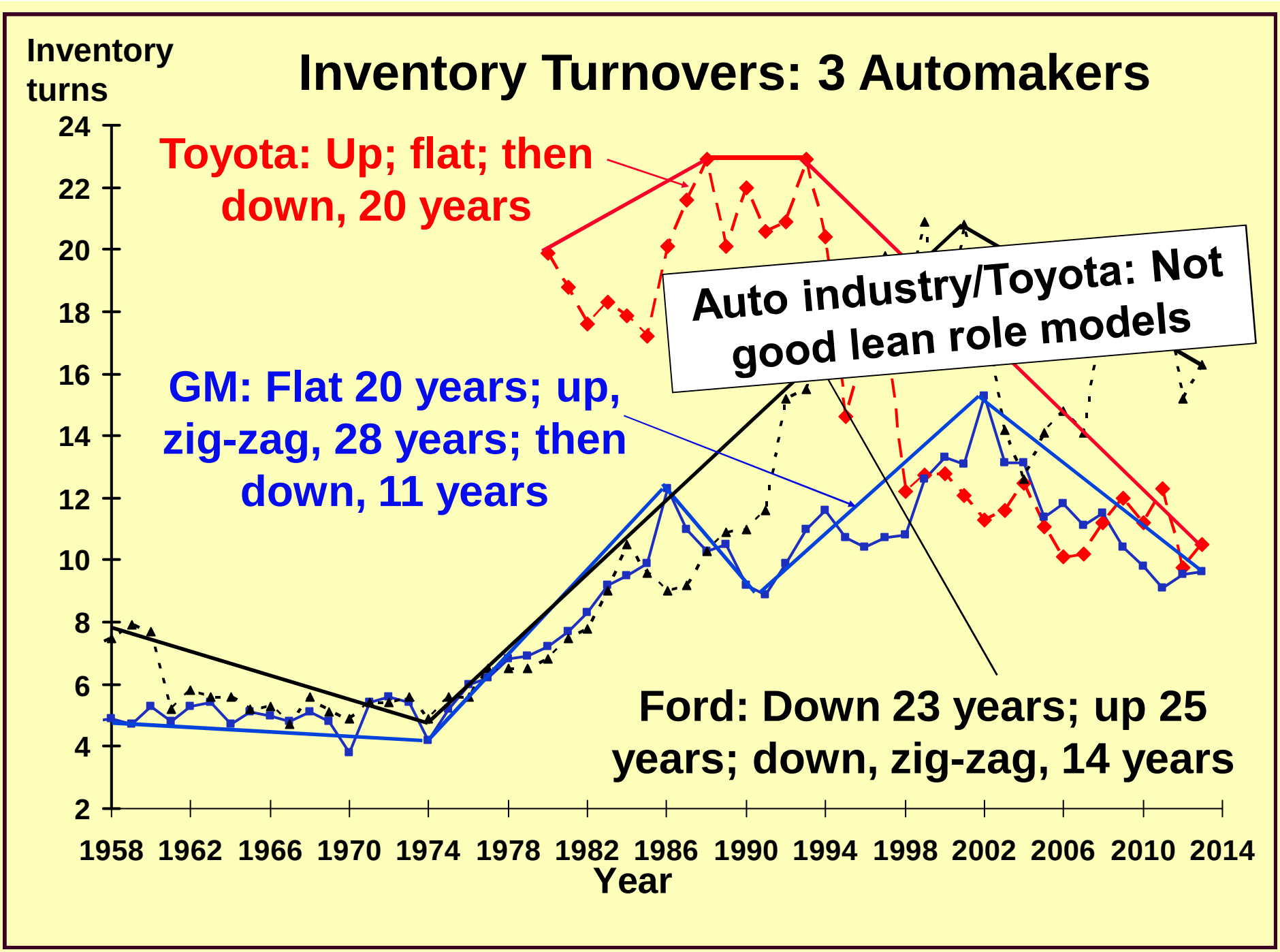


Global Leanness Studies
10-year inventory trends for 545-company U.S. segment (data from annual reports)

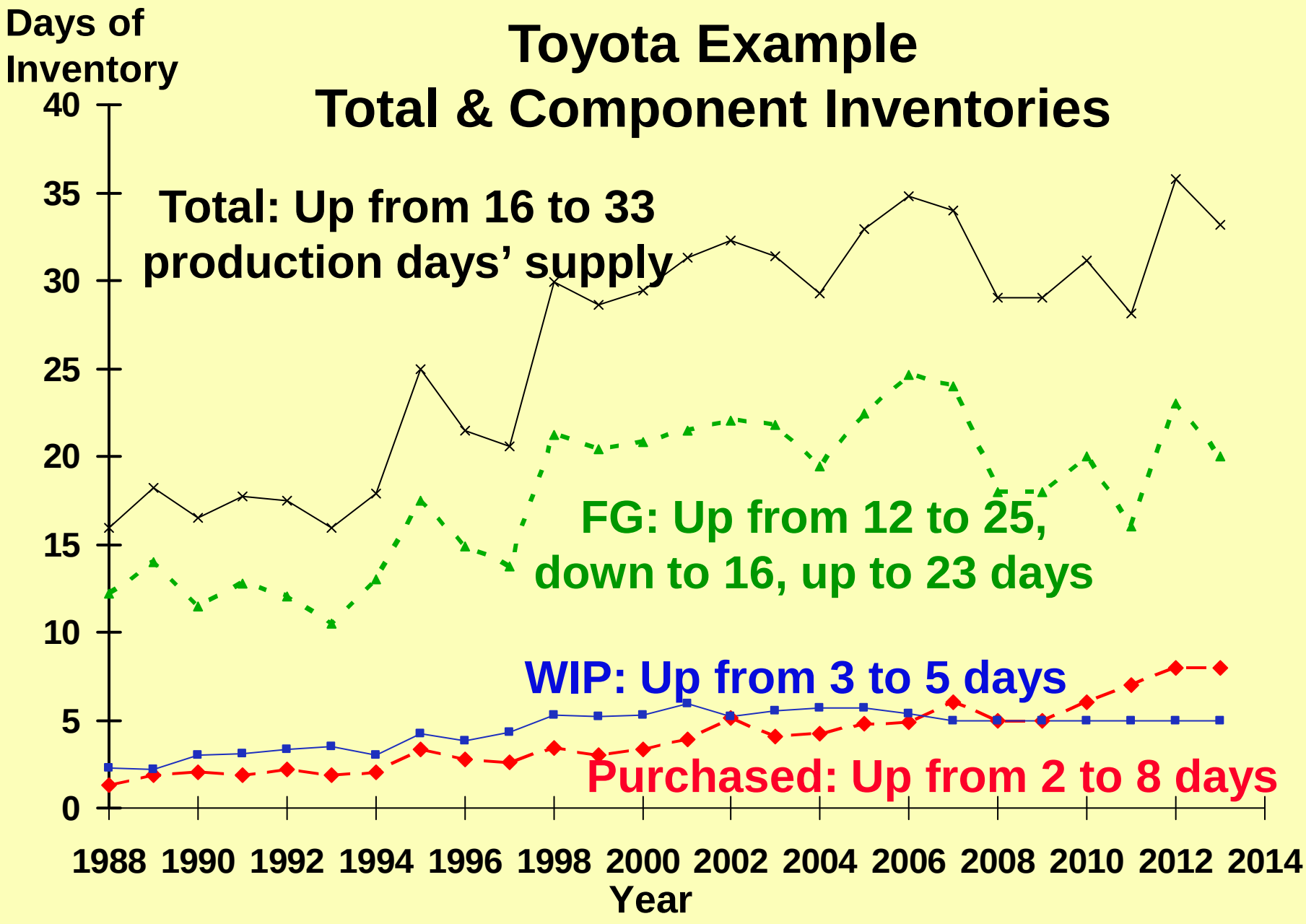
- **Majority (419): *Worsening*, or not improving, trend in WIP inventory**
- **Minority (126): *Good* WIP trend—indicator of leanness in operations**
- **Details: Of the 126 with leanness in operations . . . most are *weak** in supply (88), *very weak*** in distribution (99)**

Weak: No long-term inventory *reduction

****Very weak: Clear long-term inventory *growth***

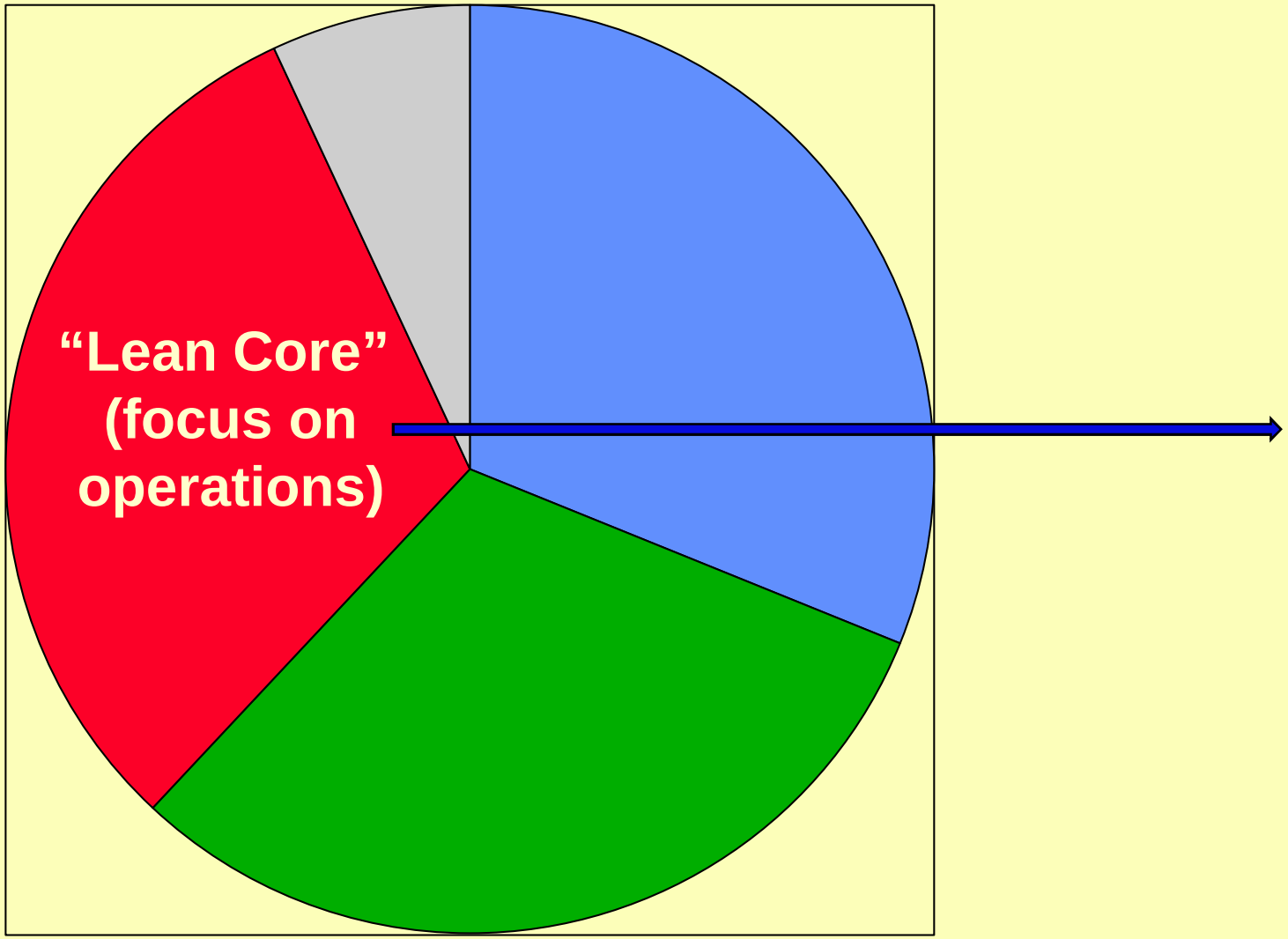

Inventory Turnovers: 3 Automakers
Inventory turns
24
22
20
18
16
14
12
10
8
6
4
2
Toyota: Up; flat; then down, 20 years
Auto industry/Toyota: Not good lean role models
GM: Flat 20 years; up, zig-zag, 28 years; then down, 11 years
Ford: Down 23 years; up 25 years; down, zig-zag, 14 years
1958 1962 1966 1970 1974 1978 1982 1986 1990 1994 1998 2002 2006 2010 2014
Year

Toyota Example
Total & Component Inventories



Schonberger & Associates

The Lean Value Chain—Not Just Operations

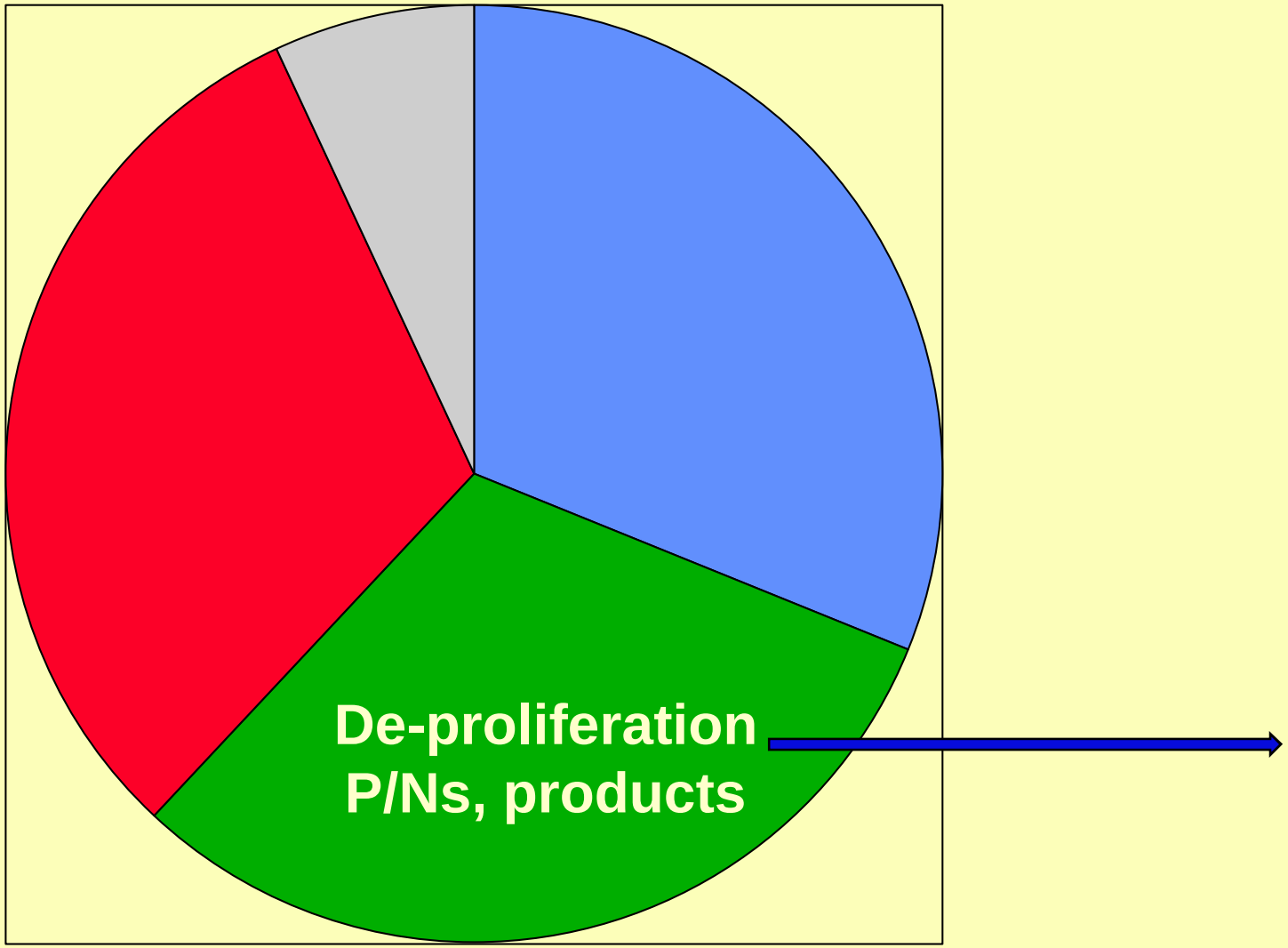


The Lean Core (Japan, 1970s)

- **Physical resources:** Plants-in-a-plant, cells, kanban/pull, quick setup, small containers/ lots, point-of-use tools/materials/equipment
- **Human resources:** Few job classifications, cross-training/job rotation, operator-centered quality (TQ) &maintenance (TPM)
- **Supplier partnership:** Supplier reduction/ certification, external kanban, dock-to-line deliveries

TPM – Total productive maintenance

The Lean Value Chain—Not Just Operations



Lean, via De-Proliferation

The Law of Reduction:

Cut the Complexity and Lose the (Money) Losers

De-Proliferation

Reduce, simplify, consolidate . . .

- **Part numbers—via DFMA**
- **Product SKUs, suppliers, machine makes, customers, ... , e.g., via intensive 80-20 analysis at Illinois Tool Works—applied to "everything"**

SKU: Stock-keeping unit, product type

DFMA: Wide and Deep

Lean Benefits

Hypothetical Comparison: 4 Modes

Mode 1. Control group: Conventional—no lean (all batch, complex flows, siloed organization)

Mode 2. DFMA/de-proliferation only:

- **Far *fewer*, *simpler* flows—both in operations and in supply/distribution**
- **Result: Large gains in *lead times*, *flexibility* to change products or volume, quality (far fewer things to go wrong), greater value (lower costs)**

Hypothetical Comparison: 4 Modes

Mode 3. Lean in operations only (lean core):

- **Striving for fewer, simpler flows & smaller batches, but often stymied by complexities owed to far too many parts/SKUs**
- **Result: Good, not great gains in *lead times*, *flexibility*, *quality*, *value* (costs)**

Moreover … shortened production lead times, often via *level loading*, conflict with flexible response to *un*-level downstream demand

Hypothetical Comparison: 4 Modes

Mode 4. Lean applied only in supply and distribution channels:

- **Lean efforts: Milk runs, cross-docking, collaboration, etc. – hampered by complex flows (too many parts/SKUs); and by un-lean production (large batches, complex flows, etc.)**
- **Result: Only modest gains in *lead times*, *flexibility*, *quality*, *value* (costs)**

Hypothetical Comparison: 4 Modes

Mode 4. Lean applied only in supply and distribution channels:

- **Result: Only modest gains in *lead times*, *flexibility*, *quality*, *value* (costs)**
- **Conclusion: Lean in external channels can't do well independently; depends a lot on prior or concurrent lean efforts in operations & via DFMA/de-proliferation**

DFMA Achieves Much of Lean by Itself through . . .

- **Early-life p** **numbers = scrap/rew external value chains**
- **Halting/reversing…** **Part-number proliferation, thus reducing reliance on *quick setup*, etc.**

"Through … SMED … we reduced many lot sizes to one—but even for that one piece, we had to activate our entire production system."*

***Bruce Hamilton: GM, United Electric Controls, 1990s**

DFMA Achieves Much of Lean by Itself through . . .

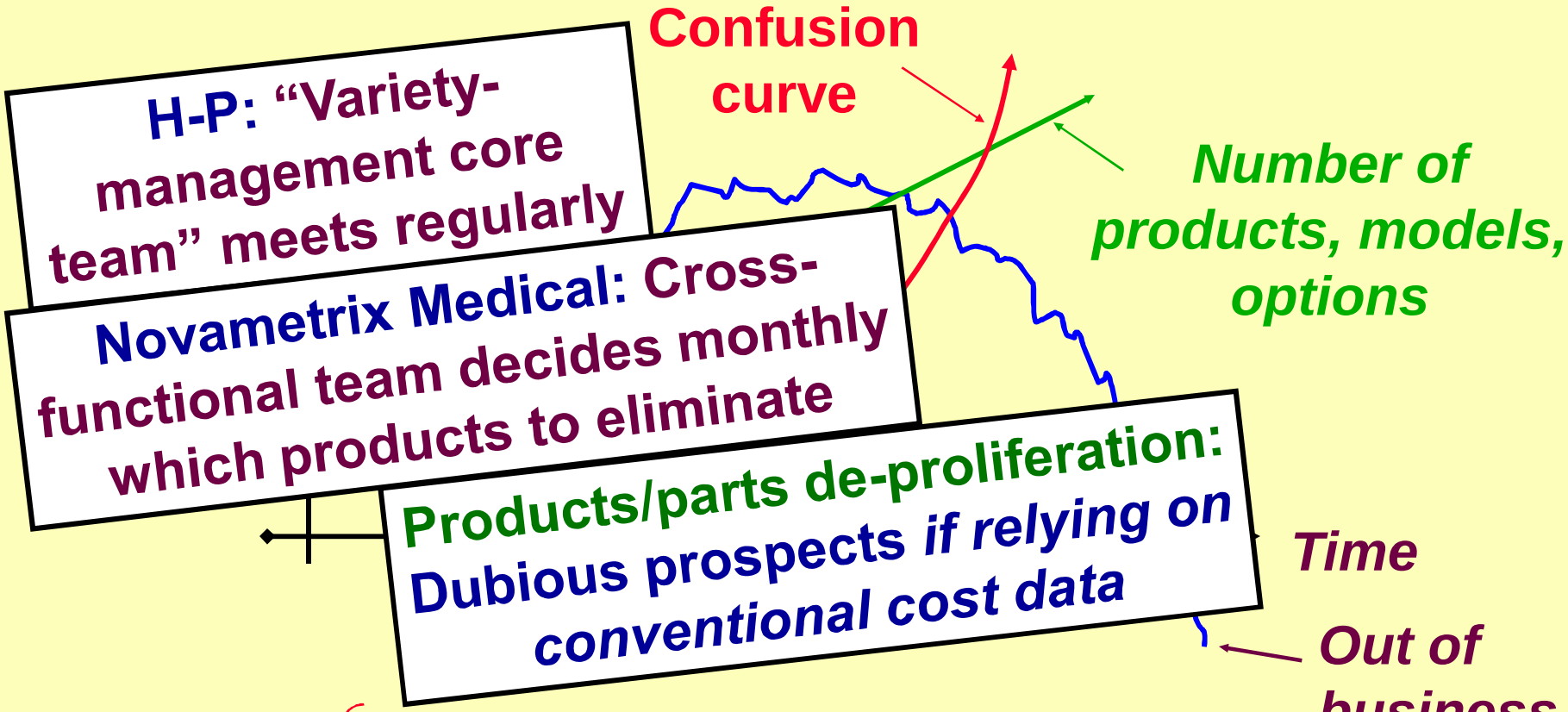
- **Early-life prevention:** Fewer part numbers = less inventory, cycle time, scrap/rework, both in operations and external value chains
- **Halting/reversing…** Part-number proliferation, thus reducing reliance on *quick setup*, etc.

DFMA may eliminate the part entirely …
which eliminates multi-step activation of production system entirely

DFMA Achieves Much of Lean by Itself through . . .

- **Early-life prevention:** Fewer part numbers = less inventory, cycle time, scrap/rework, both in operations and external value chains
- **Halting/reversing…** Part-number proliferation, thus reducing reliance on *quick setup*, etc.
- **Simplifying…** product costing validity

Focus on Money-Makers



Confusion { Complexity Loss of focus
Growth of overhead
Delays/wastes (that lean cannot fix!)

Accurate Costs for Competitive Decisions

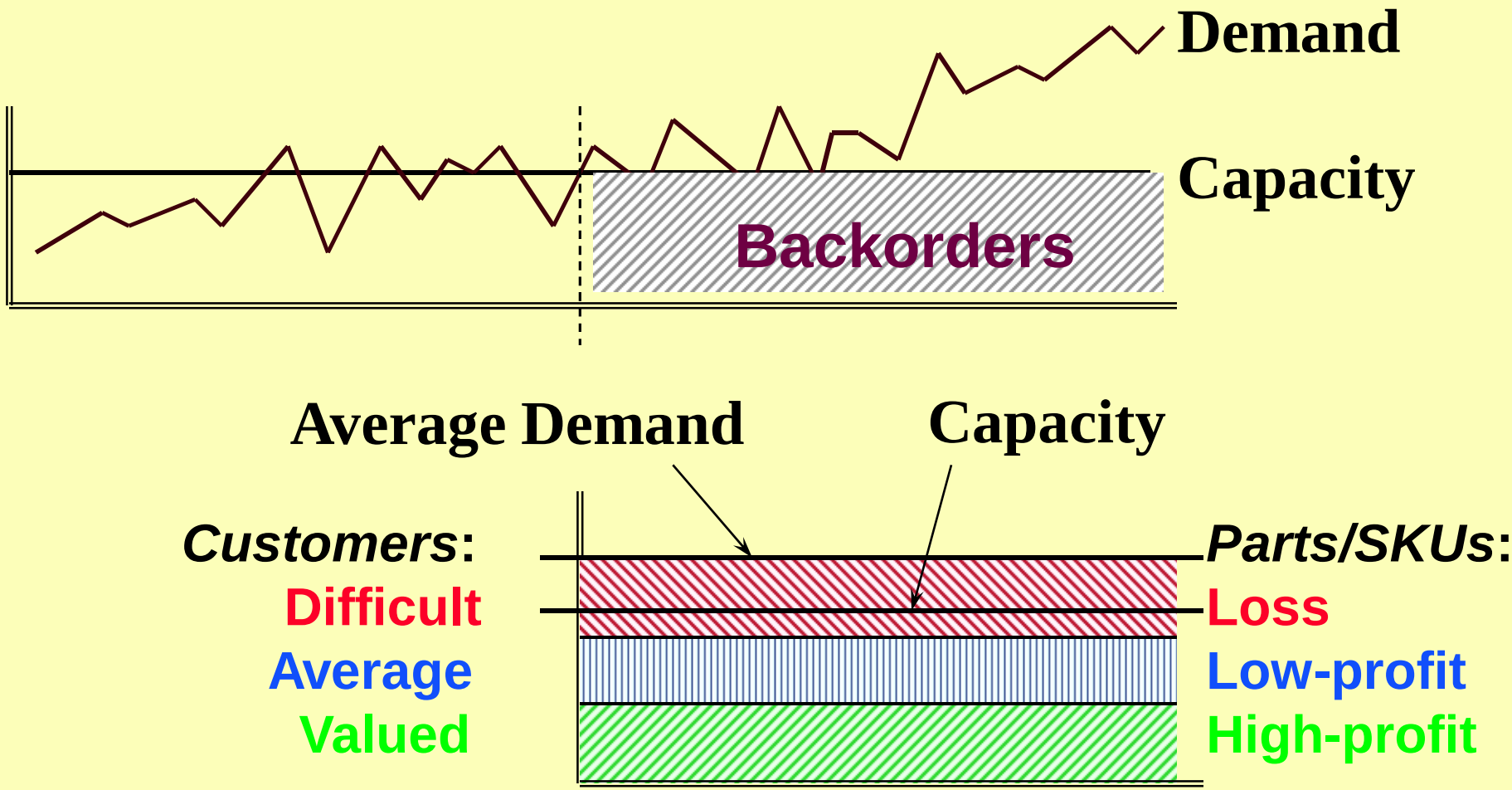
1. Create *cost-containment centers* (product-family-focused cells/plants-in-a-plant)
2. Shrink/eliminate non-value-add overheads, via DFMA, short flow paths, kanban, etc.
3. "Catch" remaining overheads (e.g., physical plant, purchasing) via activity-based cost (ABC) audit

Costing a Needed Item

	Few common-ized hi-vol.	*Many* low-volume
Price per batch	**$500**	**$500**
Accounting cost: $50 material + $50 labor + $250 overhead	**$350**	**$350**
Gross per-batch profit (30%)	**$150**	**$150**
Actual ABC cost: $50 + $50 + ...		
Process planning	**$ 80**	**$ 250**
Production control	**6**	**40**
Material control	**4**	**30**
Accounting	**5**	**50**
Design, purchasing/distribution	**15**	**50**
Facilities, administration	**70**	**140**
Unit cost	**$280**	**$660**
Gross unit profit	**$220 (44%)**	**$-160**

Coping with *Irrational* Backorders

Team decomposes sales, diverts demand away from unprofitable parts/products/customers



Forward to De-Proliferation

- **Parts:** Strong campaign on competitive DFMA benefits—infused as permanent element of company/marketing strategy
- **Parts/end products:** Activity-based cost (ABC) audits—to prove some % of parts/ products are capacity hogs/money-losers
- **Both:** Systematic attacks on existing parts/products (as in value engineering/ value analysis)

DFMA Morphing, for Services, into . . .

DFSO: Design for Service Operations →

Design for Operations (DFO)

	Piece goods	*Process Industry*	*Services*
1	Minimize number & variety of parts	Minimize number of ingredients & materials	Minimize number of operations
2	Modularity;	Modularity;	arity; lity
3	Mult mult		nctional/ se service ts
4	Ease fabrication	Ease of mixing or processing	Ease of combin-ing into complete service
5	Avoid fasteners & connectors	Avoid combining agents, splicers	Avoid off-line, misfit elements

Examples:

Piece goods: 1985 – IBM Proprinter

Services: U.S. fast foods; also its banks, insurance companies

DFO (continued)

	Piece goods	*Process Industry*	*Services*
6	Uni-directional assembly	Minimize back-tracking	Minimize back-tracking
7	Ease of meeting specifications	Ease of meeting specifications	Ease of following procedures
8	Minimize handling	Minimize handling	Minimize travel
9	Evaluate assembly methods	Evaluate processing methods	Evaluate combining service elements
10	Eliminate/simplify assembly adjustments	Eliminate/simplify processing adjustments	Eliminate/simplify service adjustments
11	Avoid physically flexible parts	Avoid changeable ingredients	Avoid elements that tempt deviations

DFMA's/Lean's Common Problem:

Senior Executives & Marketing

DFMA's and Lean's Disconnect

- Seen by senior executives as "operational" pursuits—easily delegated and put out of mind
- Seen scarcely at all by marketing, which has dominion over the customer
- Symptoms/evidence

Bored by Lean

Apathy is a cancer that affects lean continued process improvement.

Despite the best intentions, people tire of everyday tasks, whether it's exercise, housecleaning, or mowing the lawn. Similarly, apathy creeps into all lean initiatives. Unless such apathy is strategically countered, it will metastasize throughout the organization.

Apathy is a state of indifference, which is diametrically opposed to the lean principle of continued process improvement. Apathy is a common reaction to stress, where it manifests as "learned helplessness" and is commonly associated with depression. For a lean initiative team, it reflects a lack of interest in things that team members don't consider important. Nothing improves when people stop caring.

USA Today recently profiled Textron CEO Lewis Campbell, who said, "Companies that couldn't make Six Sigma work weren't doing it right." The feature acknowledged that the data-driven approach to problem solving recently came under fire, citing 3M's CEO George Buckley as the latest executive to de-emphasize Six Sigma. Buckley wondered if the methodology hurt the company's creativity. Conversely, Textron—a company headquartered in Providence, Rhode Island, whose products include Cessna jets and E-Z Go golf carts—launched a Six Sigma initiative in 2002. Since then, the company has seen its stock climb as high as 173 percent. Textron has trained 10,000 in-house Black Belts and Green Belts, according to *USA Today* corporate management reporter Del Jones. ("CEO Expects Good Things as Textron Does Six Sigma Right," *www.usatoday.com/money/companies/management/2008-01-20-six-sigma-textron_n.htm*).

From *Quality Digest*, May 2008, pp. 46-48

Also, bored by . . .

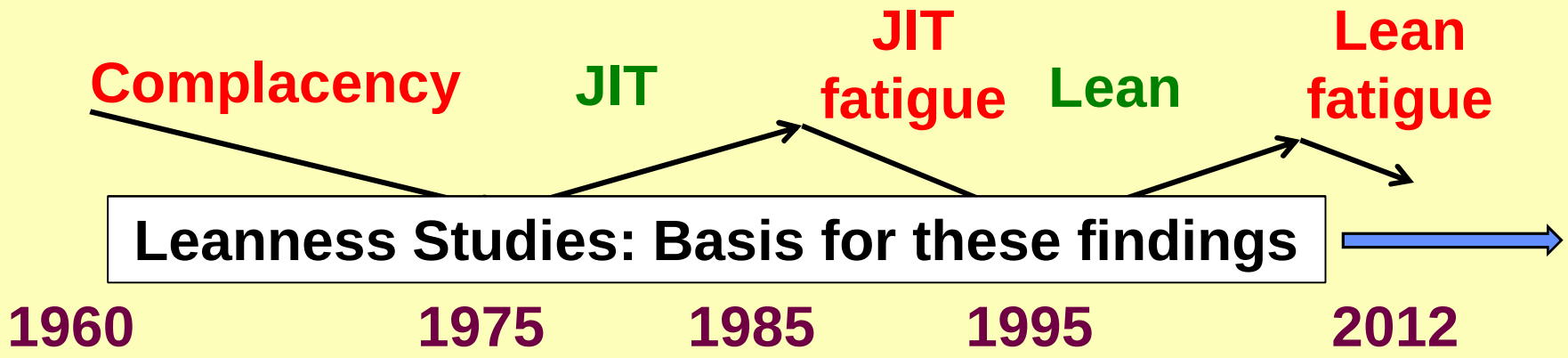
Six Sigma?

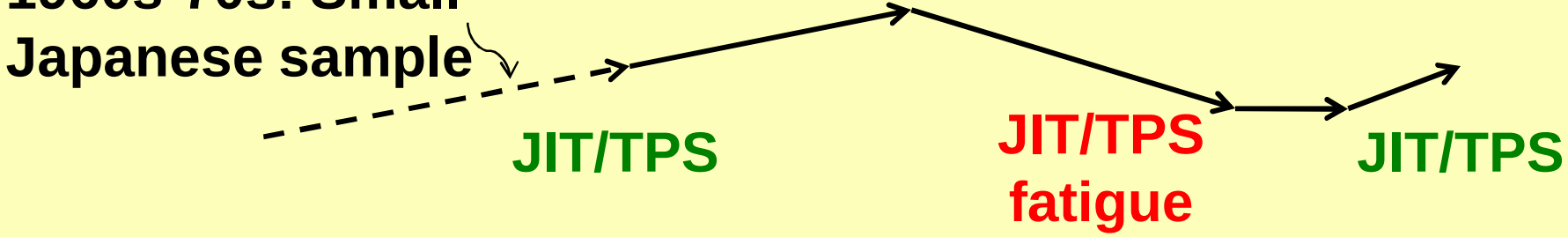
TQ?

DFMA?

Rising, then falling long-term inventory turns, many companies: Boredom/fatigue?

U.S.: Decline-Rise-Decline-Rise-Decline





Japan: Rise-Decline-Rise

Leanness Research, 1994-2011/14

Main issue: **Find world's best in *long-term* improvement**

Common, hard-data measure: **Inventory turnover (cost of goods sold ÷ value of inventory)**

Scope:

- **1600 inventory-intensive companies in 36 countries; all publicly-held, using audited financial records**
- **At least 15 and up to 50 years' data on graphs; inspection-based scoring & grading for each graph**

Sample Findings/Conclusions

- **Inventory – All global regions grown fat, but Nordic countries have best overall leanness score**
- **Process improvement – Lean operations (the "lean core") gets maximum attention; lean via de-proliferation & lean in supply/ distribution promises much more**
- **Staying power – Inability to keep process improvement going, hold gains**

Enduring Improvement, Best to Worst Regions*

Metric: Long-Term Inventory Turnover#

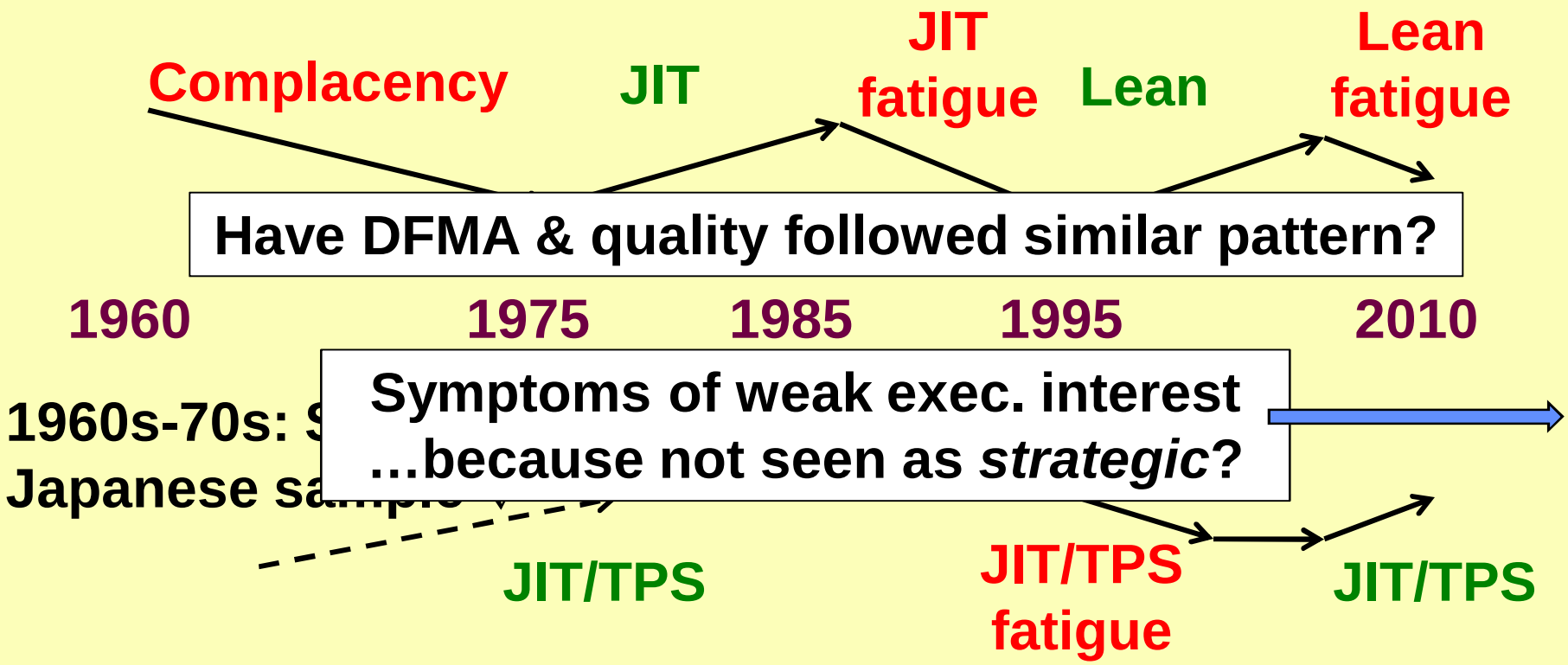
	Sectors	Score	Sample Size	Recent Trend
1	Nordic countries	.79	←1.09 in '03	
2	United States	.44	←0.83 in '02	
3	United Kingdom	.44	←1.20 in '00	
4	Southern Europe	.43		
5	Germany/Austria	.42		
6	Japan (.27 if no electronics)	.40	←0.27 in '03	
7	Benelux/Ireland	.26		

#Positive 10-to-50 year trend, 2 points
Same but lapse last 5-7 years, 1 point
No clear trend, 0 points. Negative 10-or-more-year trend, minus ½
5-or-more-year reversal of long negative trend, plus ½

*Not yet updated (likely to rank between Japan & Benelux/Ireland):
Asiana/South Africa; Latin America/Israel

Rising, then falling long-term inventory turns, many companies: Boredom/fatigue?

U.S.: Decline-Rise-Decline-Rise-Decline



Japan: Rise-Decline-Rise

Summary

- **Lean: 3 major pathways:** Lean core; Lean in supply/distribution; Lean via de-proliferation
- **Lean, potent enabler of other 2:** DFMA/de-proliferation can achieve much of lean—in both operations and external flows—by itself
- **Major impediment to all three:** Executives' fleeting interest, marketing's *dis*interest
- **Prescriptions – Present . . .**
  - ✓ **Lean** competitively/strategically—as continuous improvement in responsiveness along downstream chain of customers
  - ✓ **DFMA** as de-proliferation—of "everything"

Related Schonberger Articles – sainc17@centurylink.net

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"The Human (HR) Side of Lean," *Target*, 4th Issue 2009 (Inaugural "Insights …" Feature), pp. 54-59.

"The Skinny on Lean Management: Learn Why This Process Falls Flat in Marketing . . . and Why It Matters," *Sales and Marketing Management*, Nov.-Dec. 2008, pp. 11-12.

"Lean Performance Management (Metrics Don't Add Up), *Cost Management*, Jan.-Feb. 2008, 5-10.

"Japanese Production Management: An Evolution—With Mixed Success," *Journal of Operations Management*, 25, Issue 2 (March 2007), pp. 403-419.