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& Company

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in operations



Bauer Supply Chain Spring 2015 Symposium

Supply Chain Complexity

March 6, 2015

Agenda

- Complexity facing companies today
- Quantifying the impact of complexity
- Eliminating and managing complexity

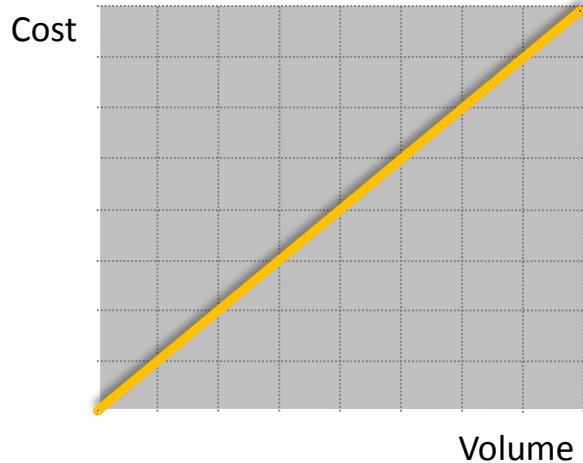
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The world has changed!

Pre-Industrial Age

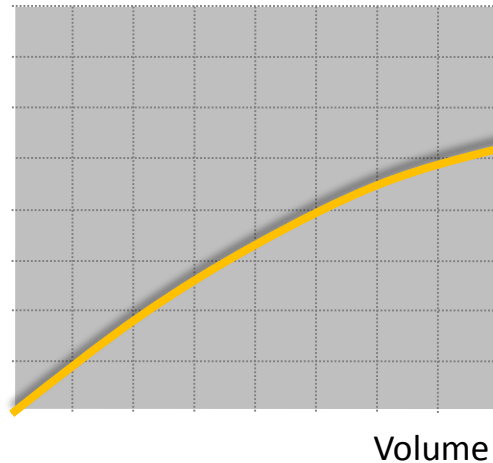
“Individual productivity”



Dominated by
variable costs

Industrial Age

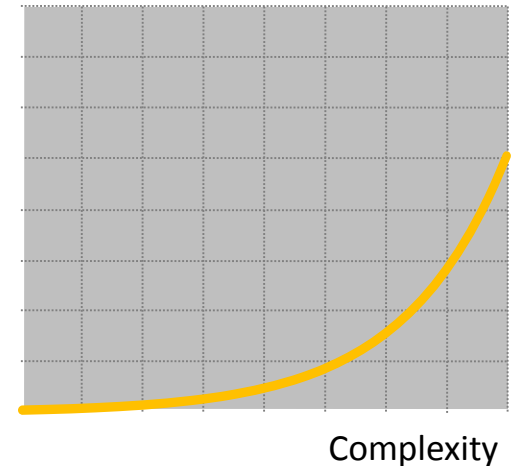
“Economies of Scale”



Dominated by
fixed costs

Post-Industrial Age

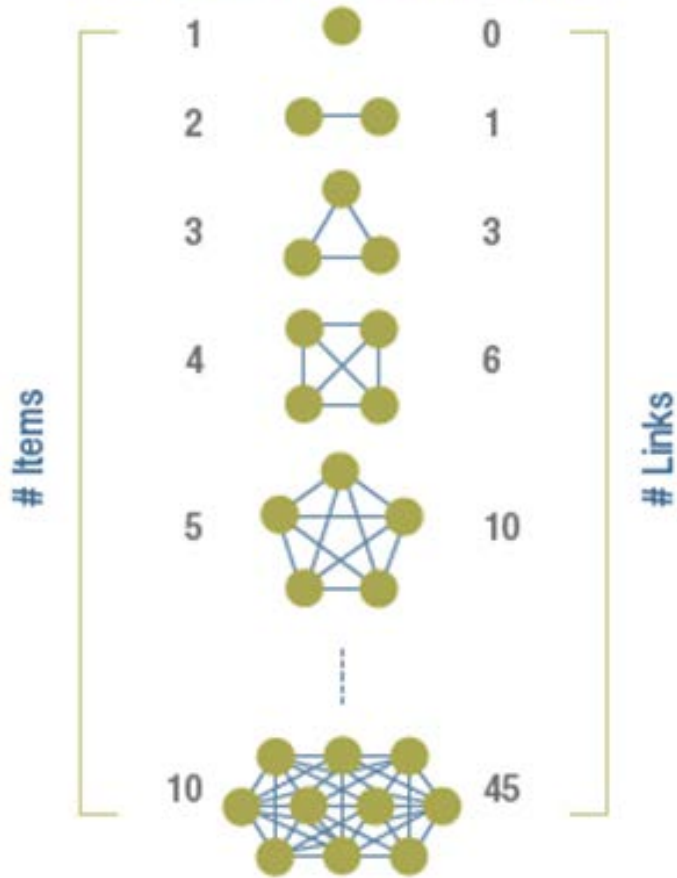
“Complexity”



Dominated by
complexity costs

Complexity and its impacts grow exponentially

The Number of Links Increases Geometrically with the Number of Items



Characteristics of Complex Systems

1. Non-linear reactions
2. Emerging properties
3. Feedback loops
4. Unknown interactions

These characteristics make Complex Systems almost impossible to predict and control

Complexity is stretching companies' capabilities

TECHNOLOGY IS MORE COMPLEX

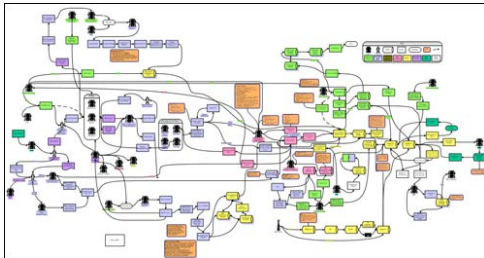


PRODUCTS AND SERVICES MORE COMPLEX



X

PROCESSES MORE COMPLEX



ORGANIZATIONS MORE COMPLEX



X

MARKETS MORE COMPLEX



X

X

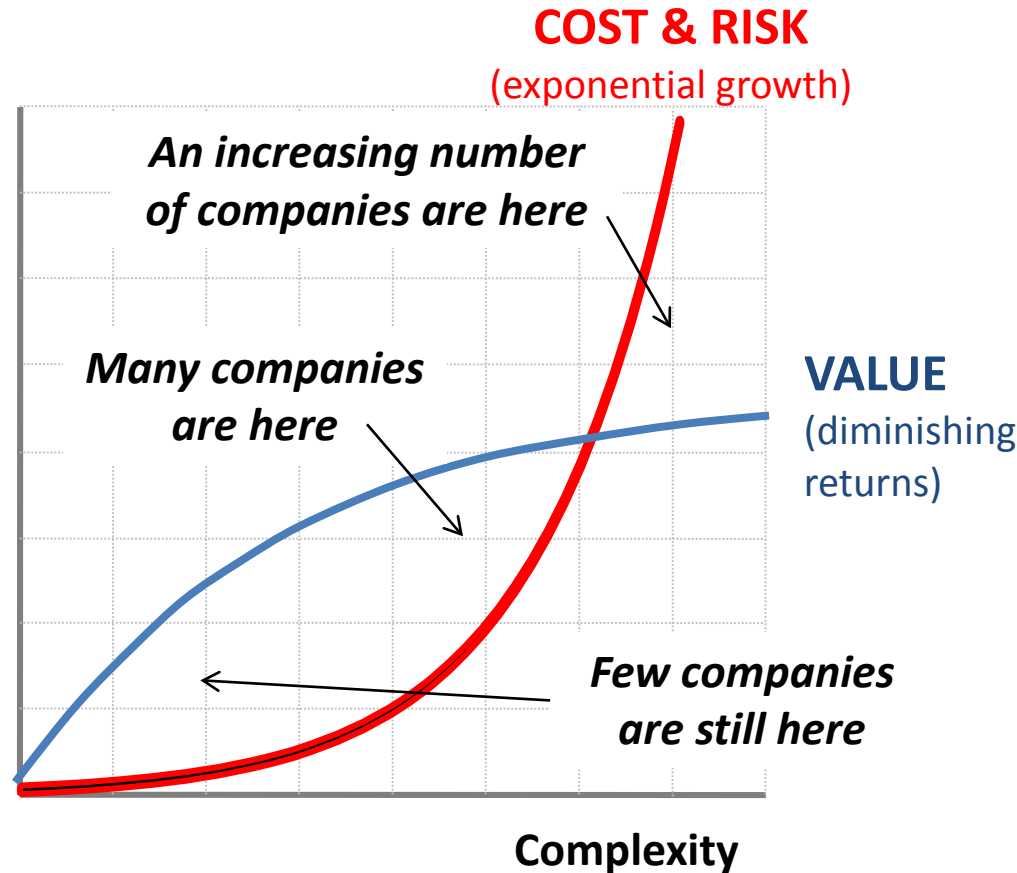
X

REGULATIONS MORE COMPLEX



Many companies are passing a complexity threshold

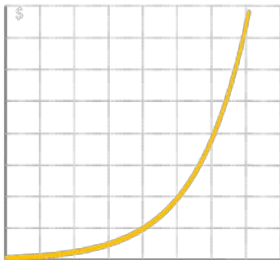
Costs and operational risk grow exponentially with complexity



Complexity impacts all aspects of your business

Cost & Operations

- Hidden costs
- Exponential growth
- Cross subsidization
- Most products are unprofitable



Business & Operational Risk

- Grows exponentially with complexity
- Cannot anticipate all points of failure



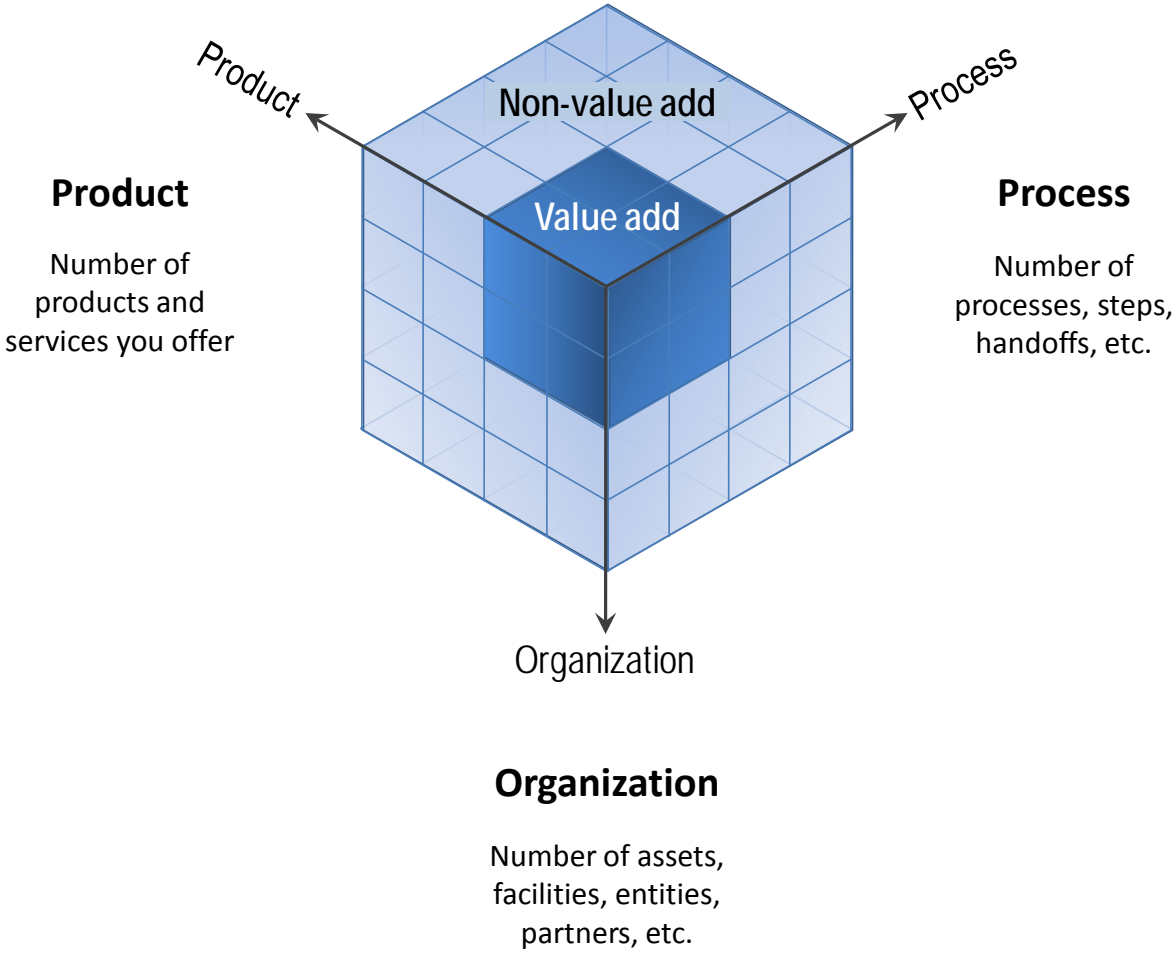
Growth & Innovation

- Slows new product development
- Overwhelms customers
- Distracts sales force



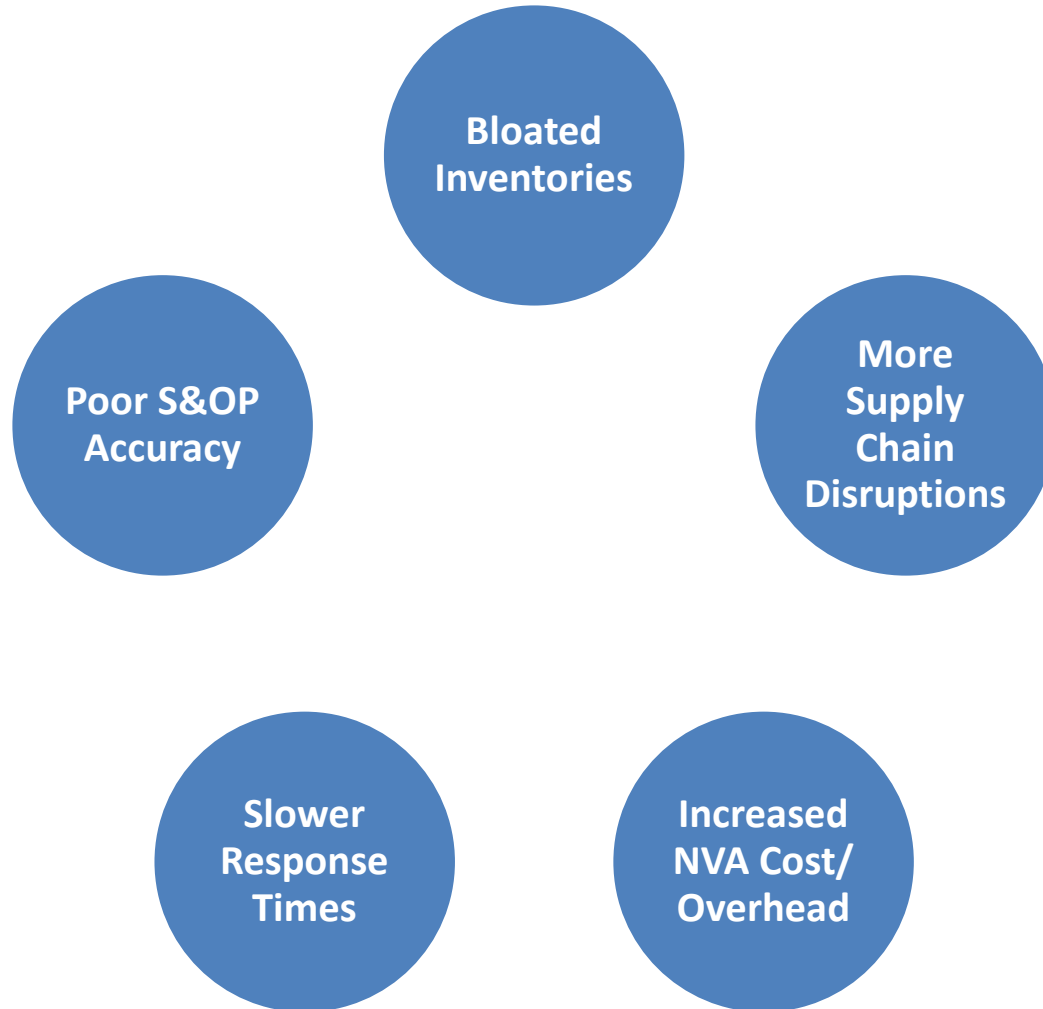
Product, Process & Organization Complexity interact to drive higher costs & risk

The Complexity Cube



Complexity impacts all aspects of supply chain performance

Complexity-driven supply chain challenges

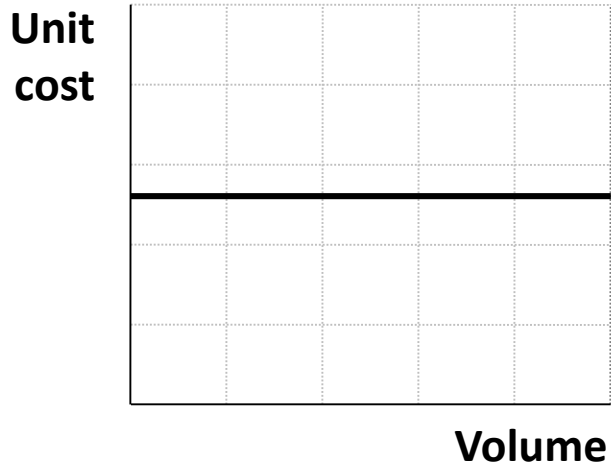
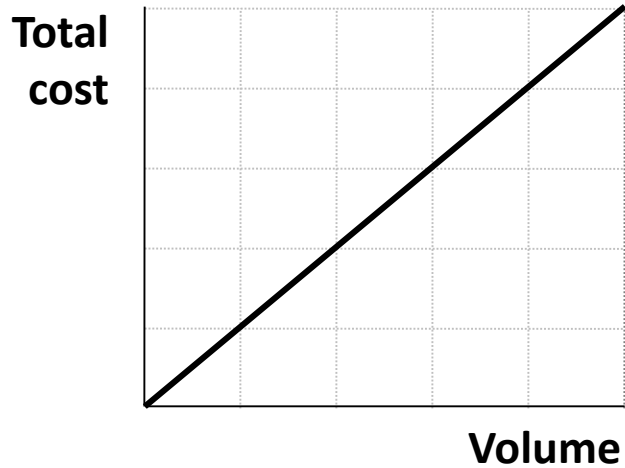


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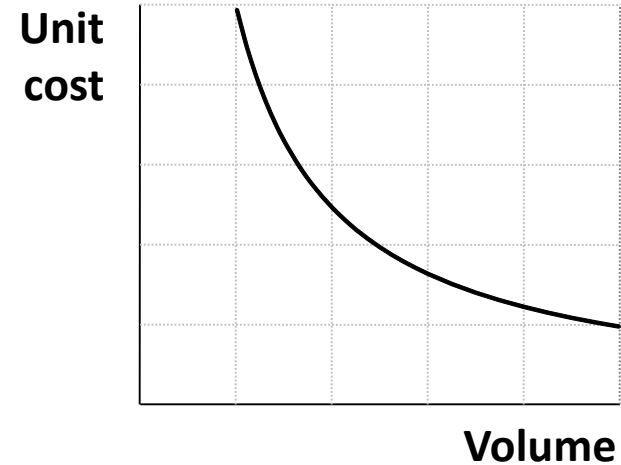
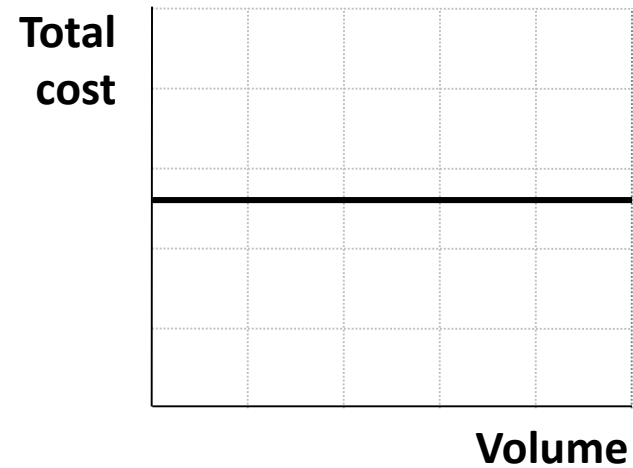
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How do you allocate costs?

By "Volume"



By "Item"

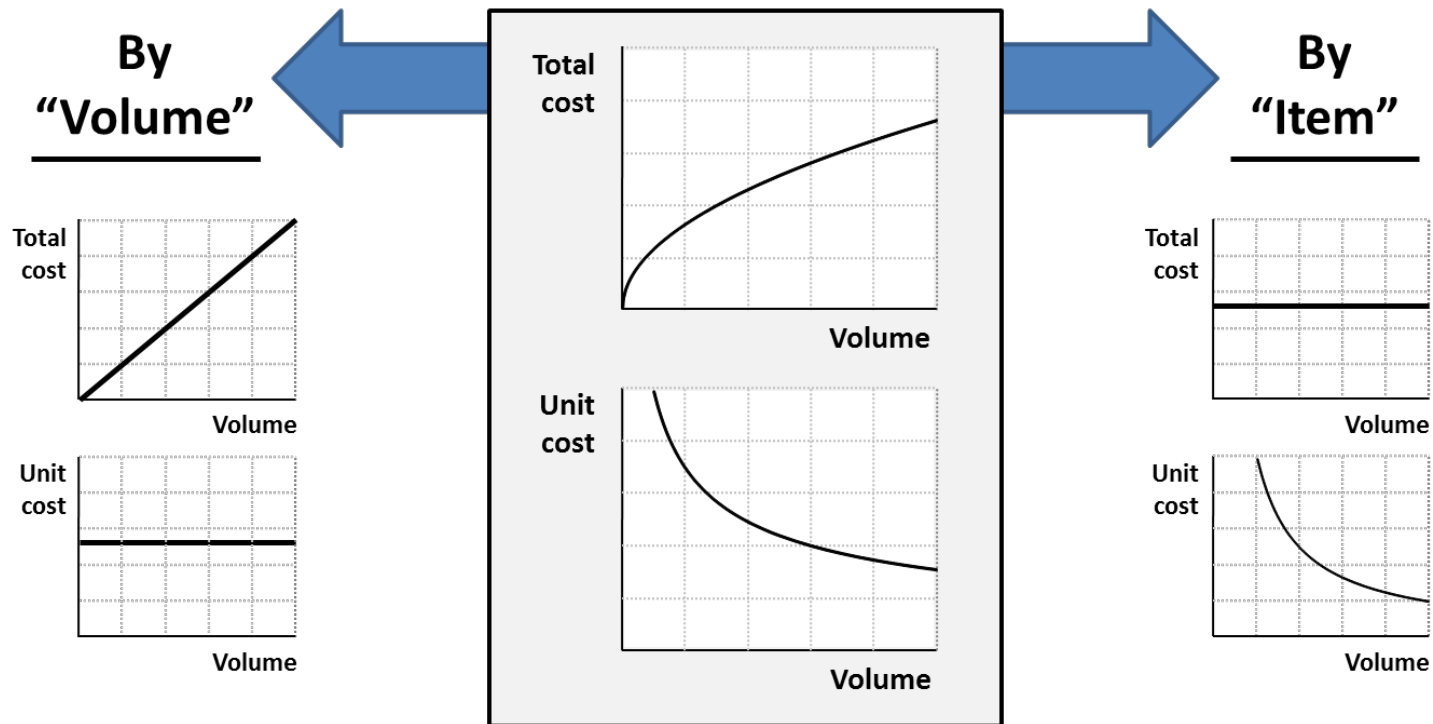


Complexity costs follow a square root of volume relationship

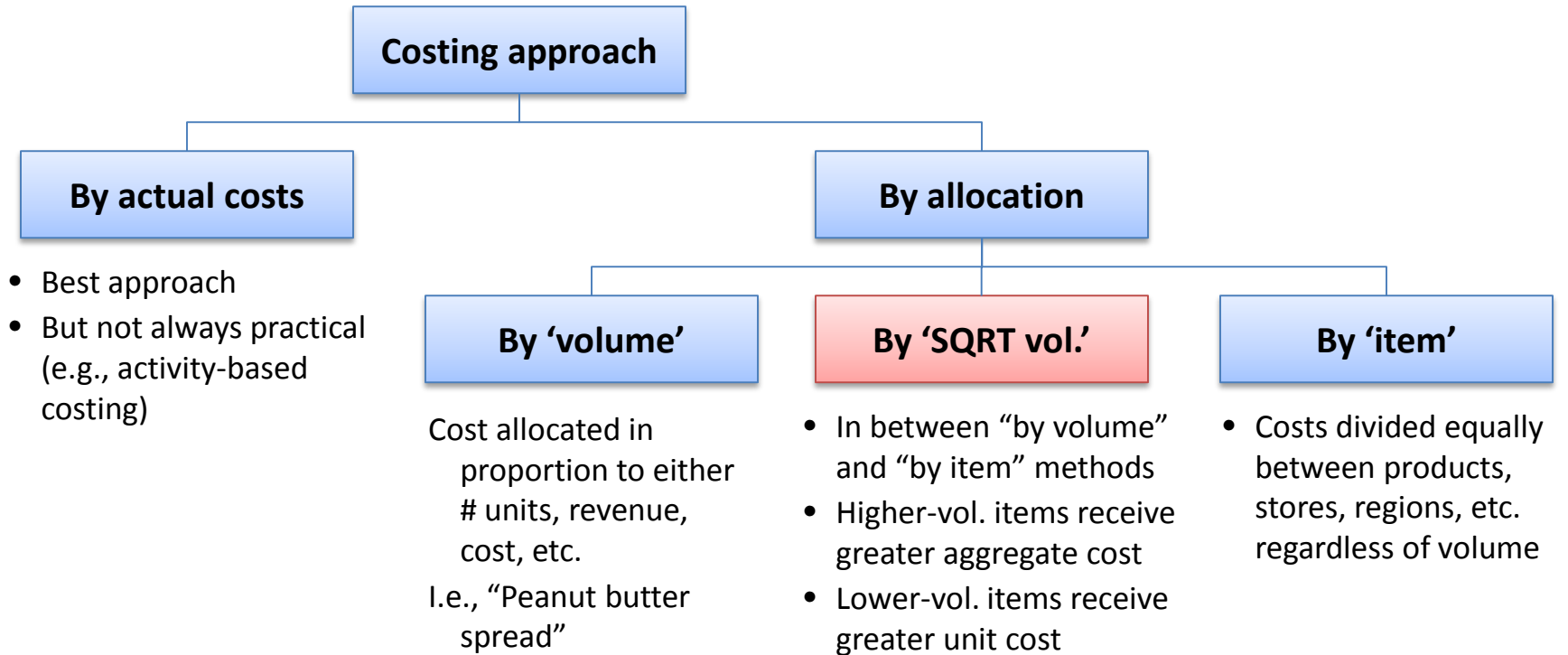
- **Cost** rises with volume but not as much as in “by volume” approach
- **Unit cost** drops off with volume but not as much as in “by item” approach

Most NVA costs fall in between “by volume” and “by unit” extremes

We see the SQRT relationship over and over



Cost allocation methods



- NVA/complexity costs follow the **"SQRT of volume"** relationship
- Without this tool, most companies allocate these costs using the "by volume" method, leading to **over-costing of high-volume items and under-costing of low-volume items**

EXAMPLE: Square root costing

Scenario:

- Product "A": volume of 1 unit
- Product "B": volume of 50 units
- Total cost to allocate = \$50

"In between" is not simply the average of the two extremes

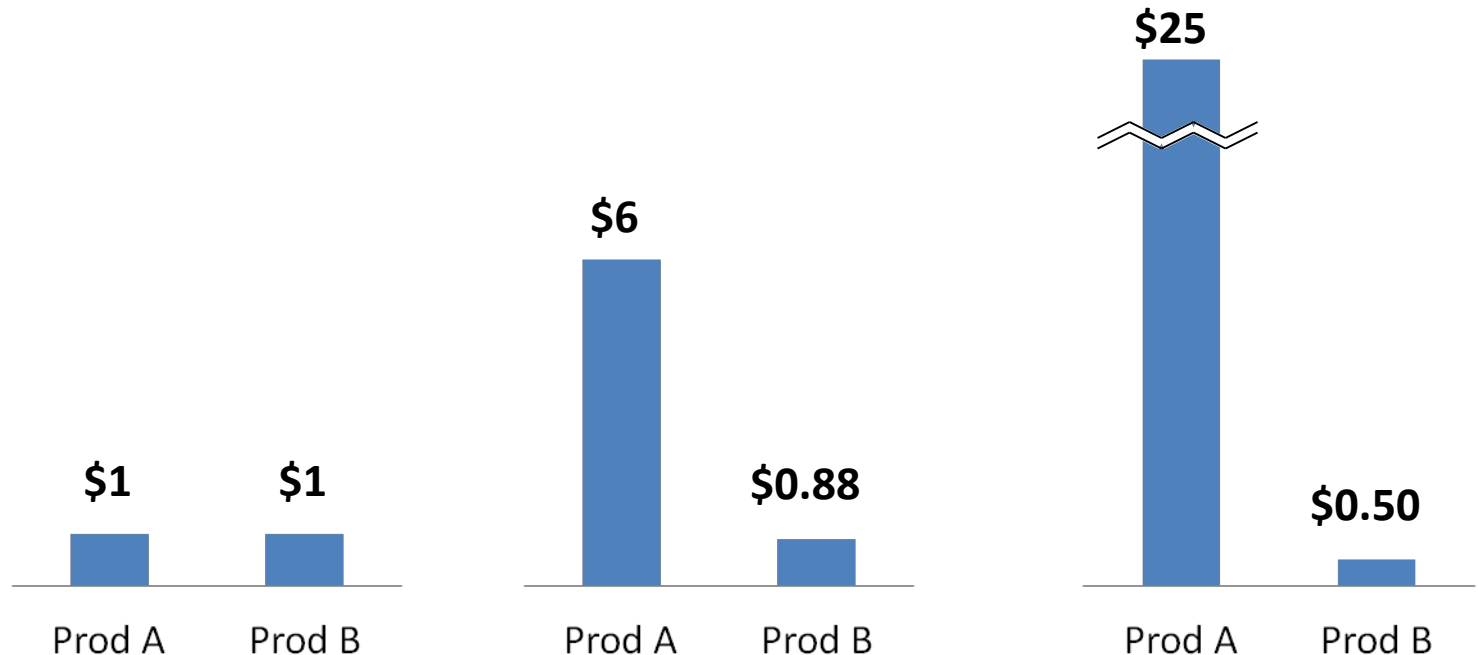
Allocation method:

"By Volume"

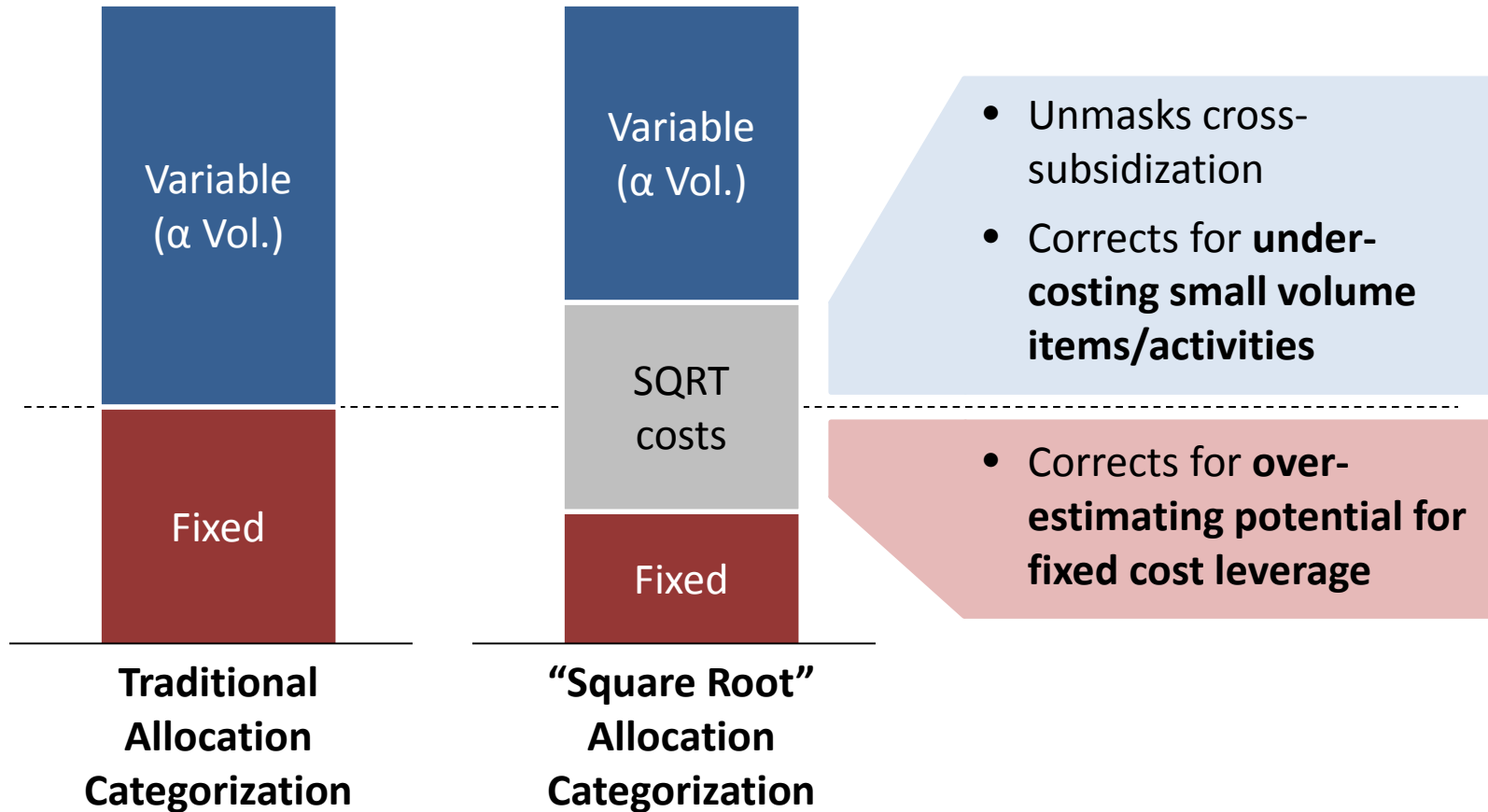
"By SQRT Vol."

"By Item"

Unit cost:



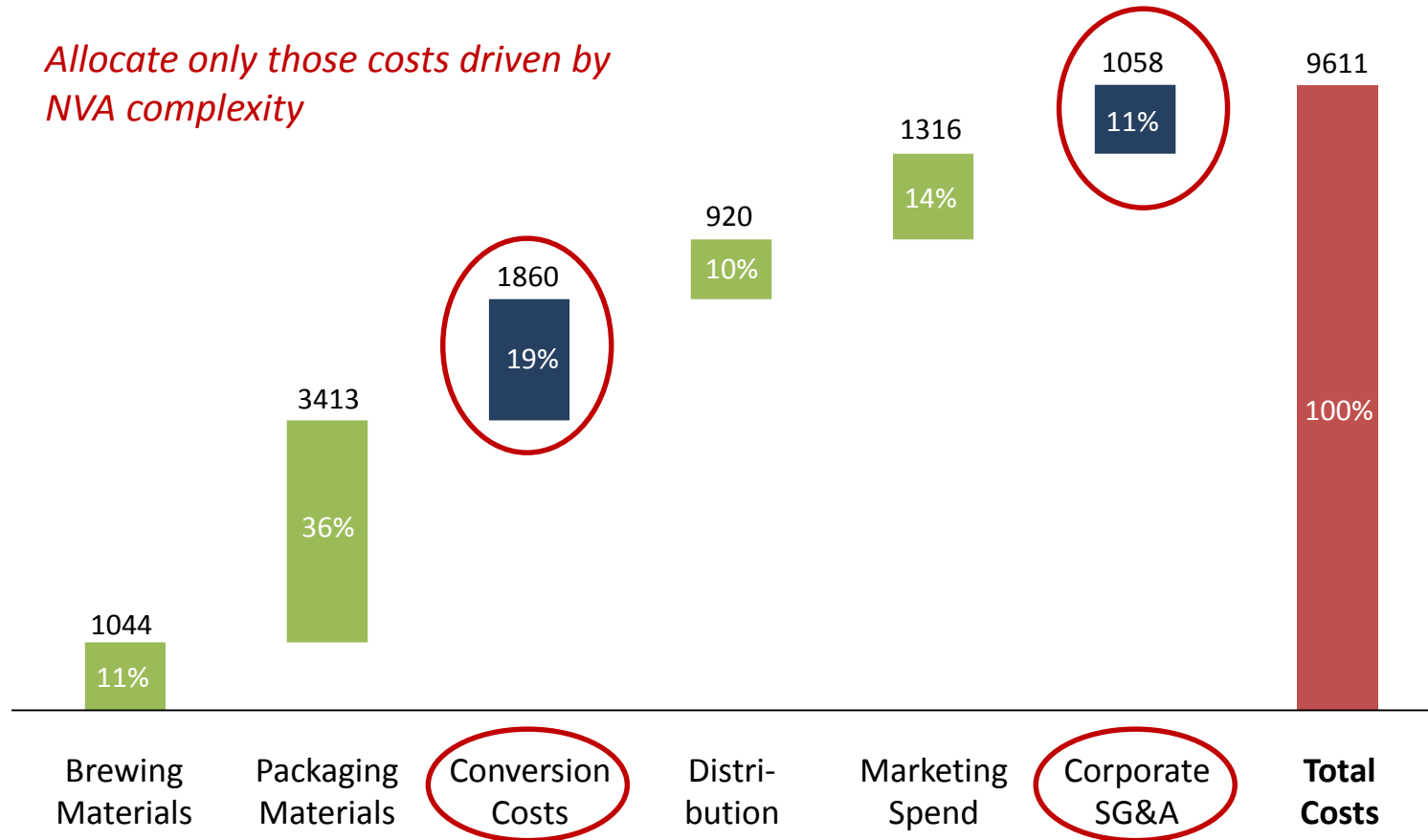
Only complexity-driven costs are allocated using square root costing



Reallocating costs

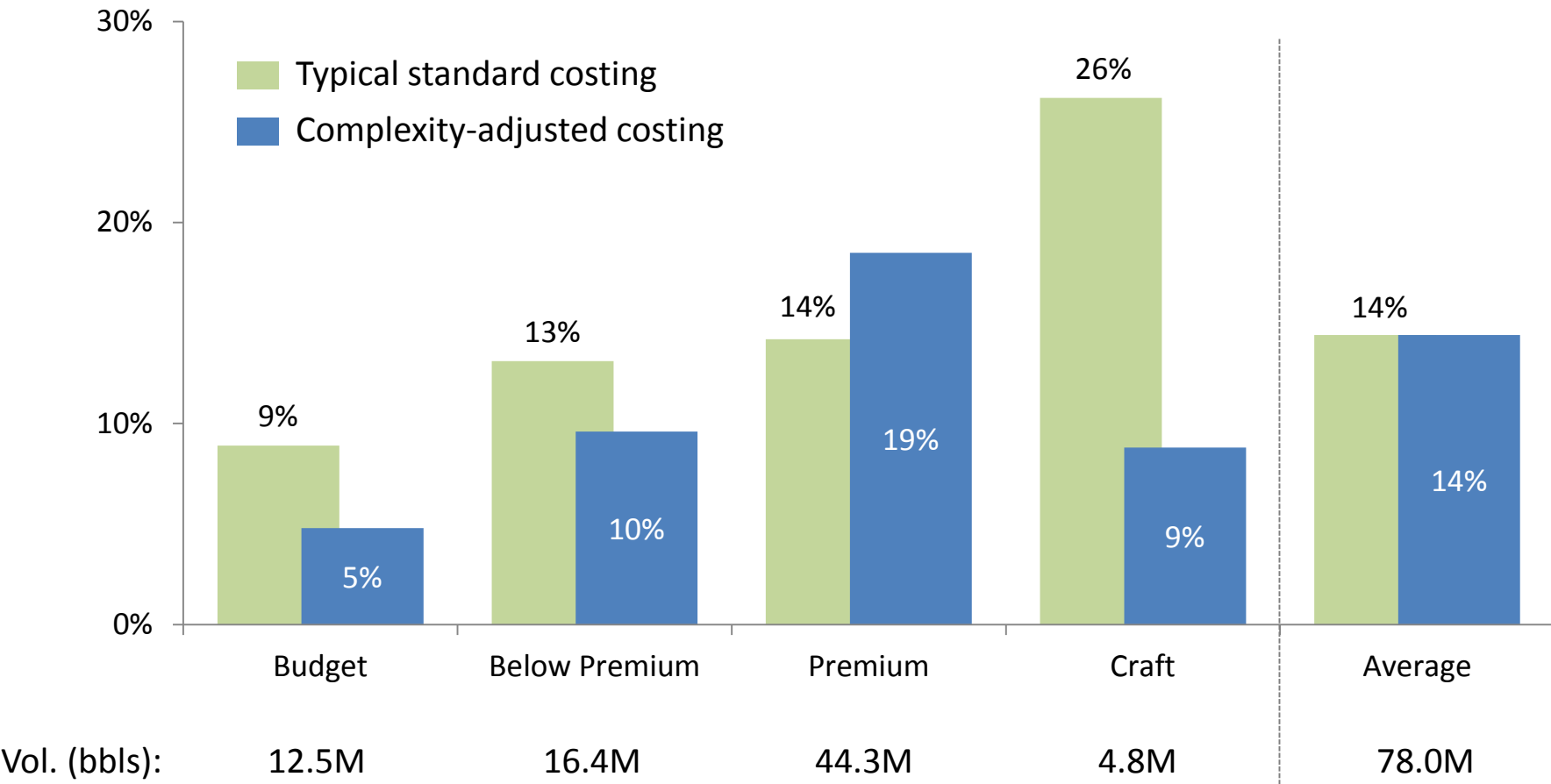
Annual Costs (\$M)

Allocate only those costs driven by NVA complexity



The powerful impact of complexity cost allocation

% Operating Margin



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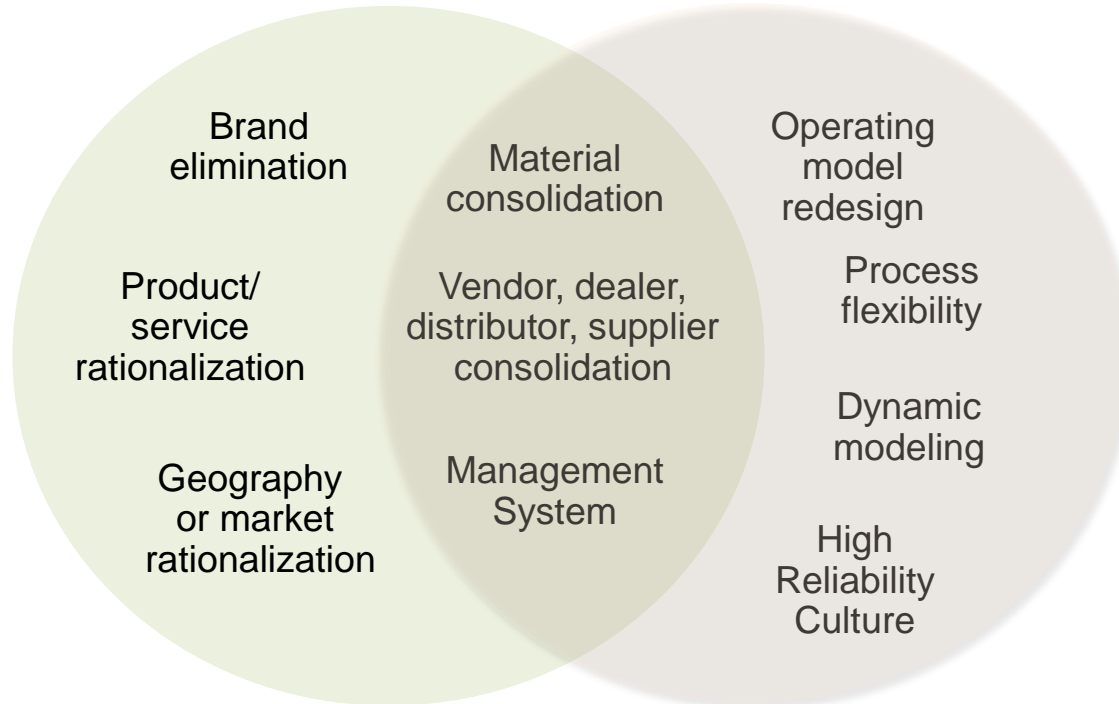
Complexity creates a vicious cycle



.. But ultimately, mastering complexity requires a two-pronged approach

QUESTION:

Reduce amount of complexity?



Or make complexity less expensive?

ANSWER:

- **Both**
- **We do not live in a “plain vanilla” world (we need variety)**
- **Customers demand good prices (we need cost-competitiveness)**
- **But no real operation is lean enough to support infinite variety**

Conclusion

- Complexity has become a key factor driving performance for many companies...
- ...but most companies are ill-prepared to identify and manage complexity in their operations
- Companies can better deal with increasing complexity by:
 - Understanding the sources of complexity and the impacts (cost & performance)
 - Eliminating NVA complexity and better managing necessary complexity