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RAND PROJECT AIR FORCE

Lean Manufacturing, Supply Chain Management, and Sense and Respond Logistics: Implications for Supplier Relationships

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Air Force Institute of Technology

Executive Seminar Program

September 2, 2004

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"Up to 80 percent of total costs and lead times are with suppliers"

James Womack and Daniel Jones

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Outline

- **Background**
- **Lean Manufacturing**
- **Supply Chain Management (SCM)**
- **Sense and Respond Logistics (S&RL)**
- **Implications for Supplier Relationships**

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DoD's Logistics Goals

- Transformation Planning Guidance (TPG)
  - Transforming how we
    - Fight
    - Do business
    - Work with others
  - Capabilities to deal with uncertainty and turbulence
    - Sense and Respond Logistics (S&RL)
- JV2020
  - Focused Logistics:
    - Precise, time-definite asset delivery

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DoD's Logistics Challenges

- Budget pressures to support operations in Afghanistan, Iraq, War on Terrorism, modernization, retention
- Higher than planned ops tempo
- Programmed manpower reductions
- Aging
  - Weapon platforms
  - Workforce
- Diminishing sources of supply
- Increasing number of unprogrammed/unbudgeted bills
- Aggressive inventory reductions
- Laws, regulations, and socioeconomic goals

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DoD's Logistics Threat Environment

- Unhappy customers: performance and costs
- BRAC - consolidating similar activities
- Outsourcing
  - A-76
  - Weapon system support contracts
- Defense industry
  - Marketing logistics services
  - Adopting
    - Lean manufacturing
    - Supply chain management
    - Six Sigma
    - Strategic Sourcing

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Purchased Goods and Services Have Been Growing In Importance to Most Enterprises

- **Growing portion of budgets**
  - **20 years ago: ~ 30 %**
  - **Today: ~ 70 %**
- **$150 billion segment in DoD FY02 budget and growing**
  - **Competitive sourcing**
  - **Reengineering**
- **Personnel segment shrank 8 percentage points in past 4 years**

DoD FY02 budget $345 billion

Source: OUSD(Comptroller), *National Defense Budget Estimates for FY 2004*, March 2003, Tables 1-3, 6-14. $345B=budget, $62B=procurement/weapons, $133B=personnel ($87B=Mil Pers, $46B=Civ Pers) http://www.dod.mil/comptroller/fy2004budget/index.html

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DoD Has Multiple Business Units Buying Goods and Services from Many Different Companies

	DoD-wide FY03 data for transactions ≥ $25K						
	Total*	Air Force	DLA	Navy	Army	USMC	Other
Contracts $B	209	55	18	55	57	2	22
Contracts #	190,558	24,830	33,738	41,236	76,015	2,041	18,522
Purch ofc codes #	908	240	16	343	203	18	95
Contractor I.D. codes #	63,072	11,940	6,661	17,699	33,854	1,548	11,795
NAICS** codes #	1,095	782	563	858	1,010	453	778
Small Biz $	17%	12%	26%	15%	20%	24%	20%
Small Biz Contracts	50%	48%	54%	46%	51%	50%	54%

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*Some totals may be affected by rounding.
**North American Industry Classification System (NAICS). Source: FY03 DoD-wide DD350 data

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DoD Has Many Contracts with the Same Provider Like It Has with United Technologies

	Air Force	DLA	Navy	Army	USMC	Other	Total*
Contracts #	226	239	121	148	9	9	736
$ M	2,085	130	1,279	1,050	3	1	4,548
% sales	7	<1	4	4	<<1	<<<1	15
Sole source #	146	50	86	103	5	5	383
$M	1,696	97	1,219	1,015	3	1	4,030
Purch. Off. Codes #	39	5	54	46	2	6	152
NAICS Codes #	21	63	56	47	6	8	112
Contractor ID Codes #	30	10	29	24	4	6	58

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*Numbers may not add due to rounding.
Source: FY03 DoD-wide DD350 data. North American Industry Classification System (NAICS).

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DoD Has Many Contracts in the Same Commodity Group Like It Has for Gas Turbines & Jet Engines, Aircraft, & Components

FY03	Air Force	Navy	Army	USMC	DLA	Total*
Contracts						
#	346	137	140	14	626	1,241
$M	2,852	1,364	596	1	357	5,169
Sole source						
#	94	82	47	7	84	293
$M	2,138	1,254	539	<1	277	4,207
Purch ofc** codes #	6	20	6	1	4	38
Contractor ID #s	111	57	62	13	183	309
Small businesses						
#	105	41	48	5	327	526
$M	27	13	14	<1	35	89

RAND

*Source: FY03 DoD-wide database; totals may be affected by rounding.

**Purchasing offices do not sum because some buy on contracts from several different services.

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DoD Had Many Short-term Supplier Relationships from 1997-2003

# Years	# Contractor I.D. Codes in consecutive years	# Contracts I.D. Codes in non-consecutive years	Total
1	0	62,786	62,786
2	18,367	6,776	25,143
3	7,543	5,050	12,593
4	4,365	3,621	7,986
5	2,929	2,741	5,670
6	2,395	2,153	4,548
7	8,188	0	8,188
Total	43,787	83,127	126,914

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*Unique company I.D. codes
Source: FY97-FY03 DoD-wide DD350 data.

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DoD Had Many Short-term Contracts from 1997-2003

# Years	# Contracts in consecutive years	# Contracts in non-consecutive years	Total
1	0	515,667	515,667
2	47,586	7,680	55,226
3	18,914	4,264	23,178
4	11,089	2,290	13,379
5	5,896	1,108	7,004
6	2,993	452	3,445
7	1,860	0	1,860
Total	88,338	531,461	619,799

Source: FY97-FY03 DoD-wide DD350 data.

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Outline

- Background
- Lean Manufacturing
- Supply Chain Management (SCM)
- Sense and Respond Logistics (S&RL)
- Implications for Supplier Relationships

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"…lean manufacturing efforts …'won't mean a hill of beans if we don't have a supply base that can deliver complete, on-time, zero-defect product to flow lines.'"

Kent Brittan
vice-president
United Technologies Corp.

Source: Drickhamer, David, "Supply –Chain Superstars," *Industry Week*, May 1, 2004.

DRAFT - Do not copy, quote, or cite

Lean Manufacturing Originated in the Automotive Industry

- Developed by Toyota
- Publicized by MIT researchers in 1990 book
  - The Machine that Changed the World
- Benefits claimed for lean
  - Reduced cycle times: + 60%
  - Reduced inventory: +50%
    - Higher fill rates: ~99%
  - Improved quality: +50%
  - Greater throughput: +25%
  - Improved worker productivity: +20%

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Key Lean Definitions

- **Lean production: Doing more and more with less and less**

- **Lean thinking: Looking at the whole: the entire set of activities entailed in creating and producing a specific product**

- **Lean enterprise: All the concerned parties to create a channel for the entire value stream**

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

DRAFT - Do not copy, quote, or cite

Five Principles of Lean Thinking

1. Precisely specify value
2. Identify the value stream for each product
3. Make value flow without interruptions
4. Let the customer pull value from the producer
5. Pursue perfection

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Value and "Waste"

- **Value – defined by ultimate customer**
  - **Specific to each product (good or service)**
  - **Must be consistent throughout value chain**
- **Waste - activity which uses resources but creates no value**
  - **Mistakes that need correcting (i.e., poor quality)**
  - **Products that no one wants (i.e., excess inventory)**
  - **Unnecessary processing steps**
  - **Movements without a purpose**
  - **Downstream personnel waiting**
  - **Products that do not meet customer needs**

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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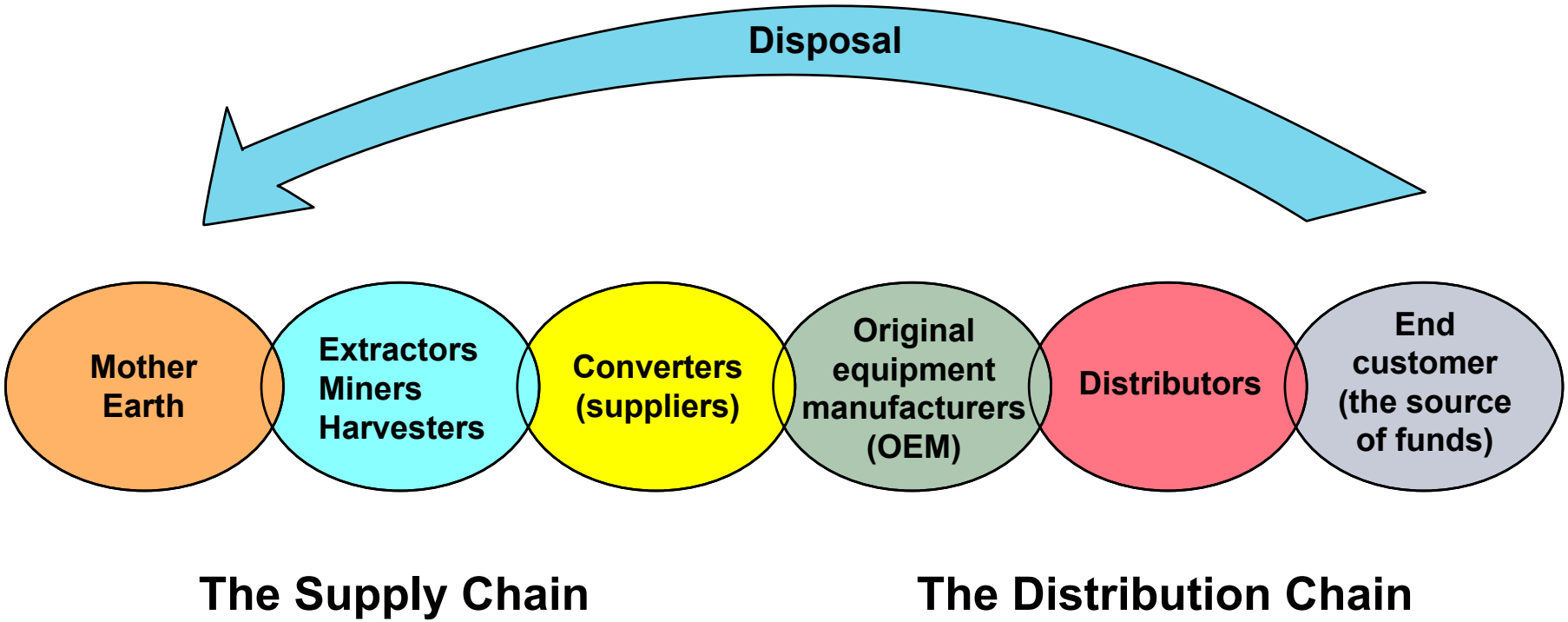
Value Stream



SOURCE: Adapted from: Dobler, Donald W., and Burt, David N., *Purchasing and Supply Management, Text and Cases*, Sixth Edition, The McGraw-Hill Companies, Inc., New York, 1996.

DRAFT - Do not copy, quote, or cite

Flow: Continuous Movement with Minimal Queuing or Non-value-added Activity

- All value creating activities moving at the same pace
  - Design → order → produce → deliver
- Requires
  - Eliminating all causes of variability
    - Waiting/stoppages/rework/backflows/scrap
  - Ignoring traditional boundaries
    - Jobs/careers/functions/firms
  - Locating each activity to reduce
    - Costs/lead-times/forecasts/advanced orders
  - Synchronizing all value chain activities precisely to the rate of customer demand

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

DRAFT - Do not copy, quote, or cite

Pull: No One Upstream Produces A Good or Service Until the Customer Downstream Asks for It

- Goods flow only when pulled by the next step
- Requires
  - Order frequently and accurately
  - Produce quickly
  - Distribute responsively
- Results
  - No longer need sales forecasts
  - Customer demands become more stable

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

DRAFT - Do not copy, quote, or cite

Perfection: Continuous Improvements to Eliminate Errors and Wasted Effort, Time, and Space

- Can be both radical and incremental
- Requires focusing energy to banish waste
  - *Policy deployment*
    - Align goals and lean initiatives with available people and resources
    - Deselect or defer some projects

"To succeed everyone along the value stream must believe they are being treated fairly by the new lean system."

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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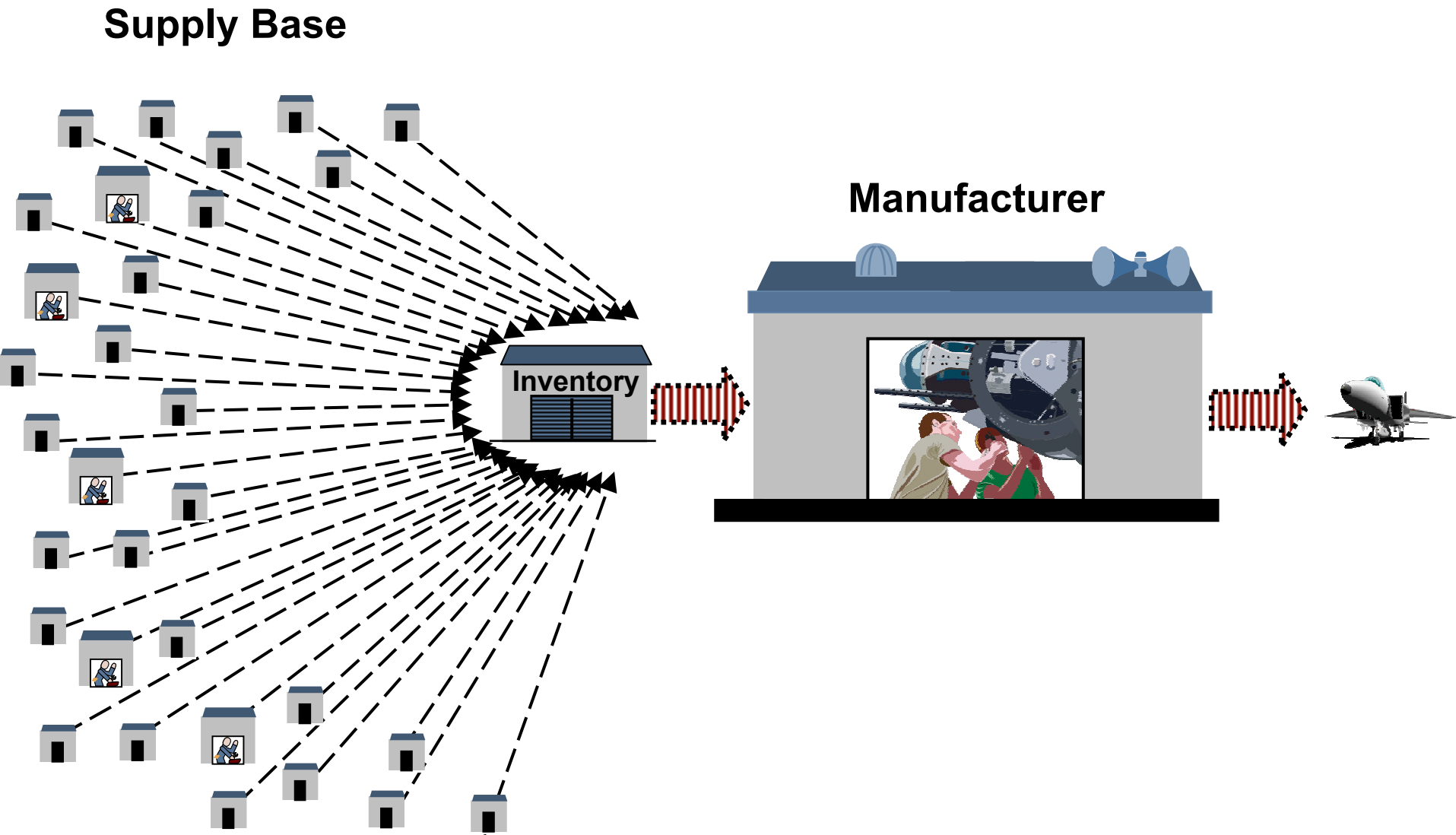
Industry's Old Batch and Queue Mass Production Value Chain



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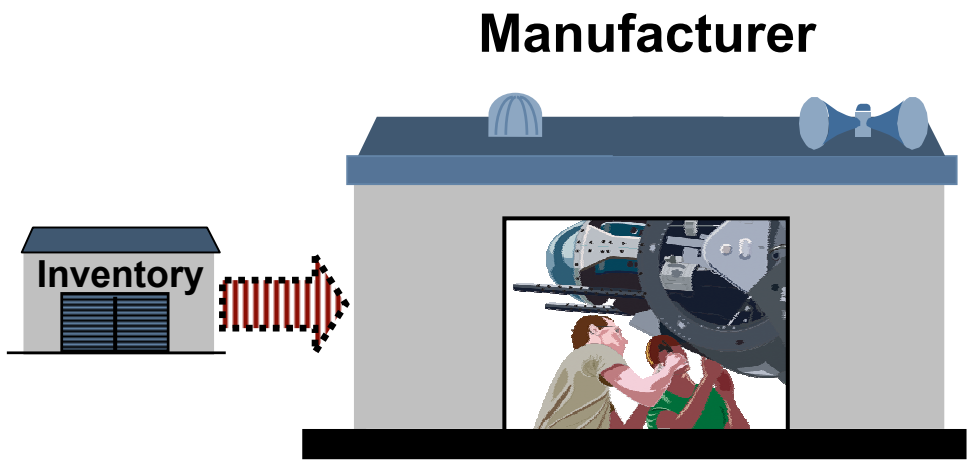
Lean Manufacturing Focuses on Improving Intra-enterprise Processes



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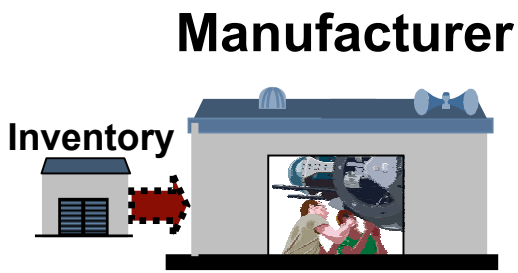
…and Typically Reduces Inventory and Production Areas and Improves Flow and Throughput



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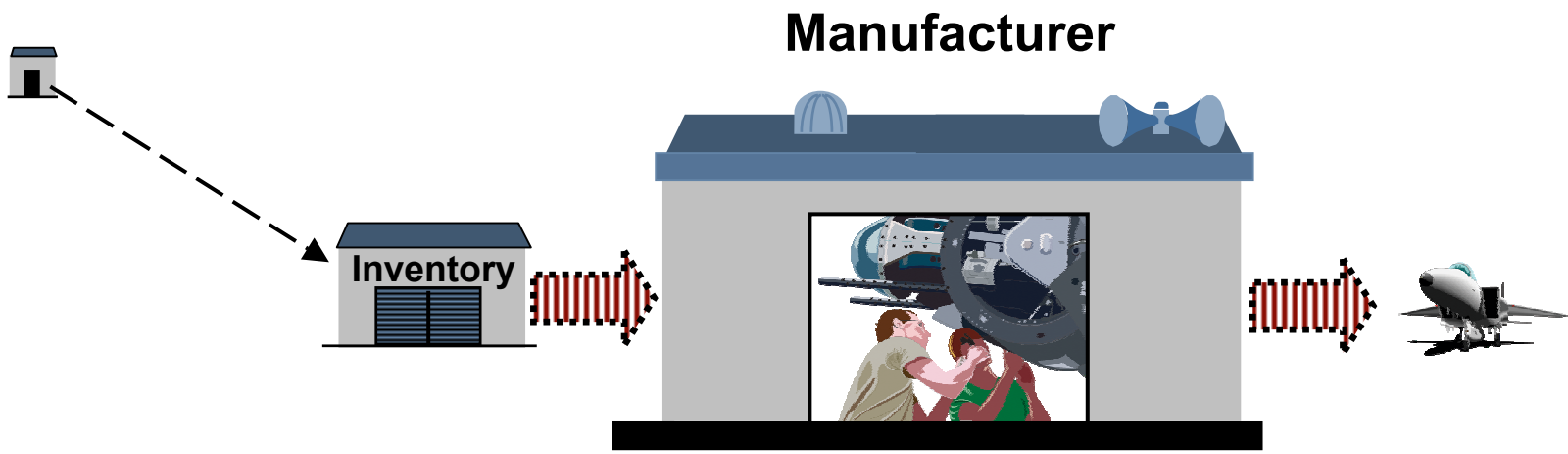
Lean Logistics Focuses on Improving the End-to-end Process



Raw materials, piece parts, and components

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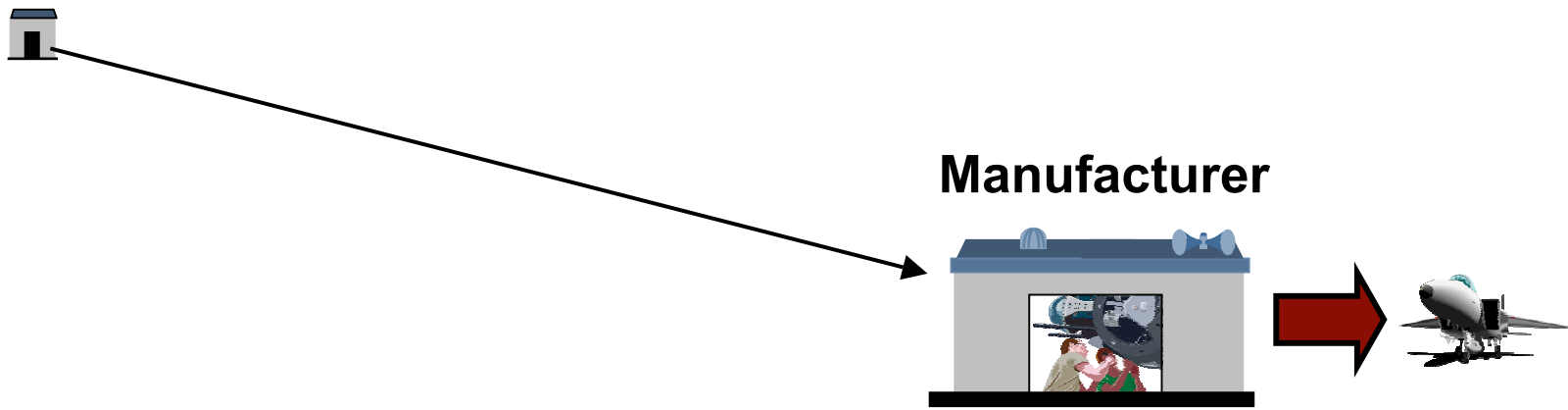
…and Typically Reduces Delays, Touch Points, and Inventory and Speeds and Smoothes Process Flow



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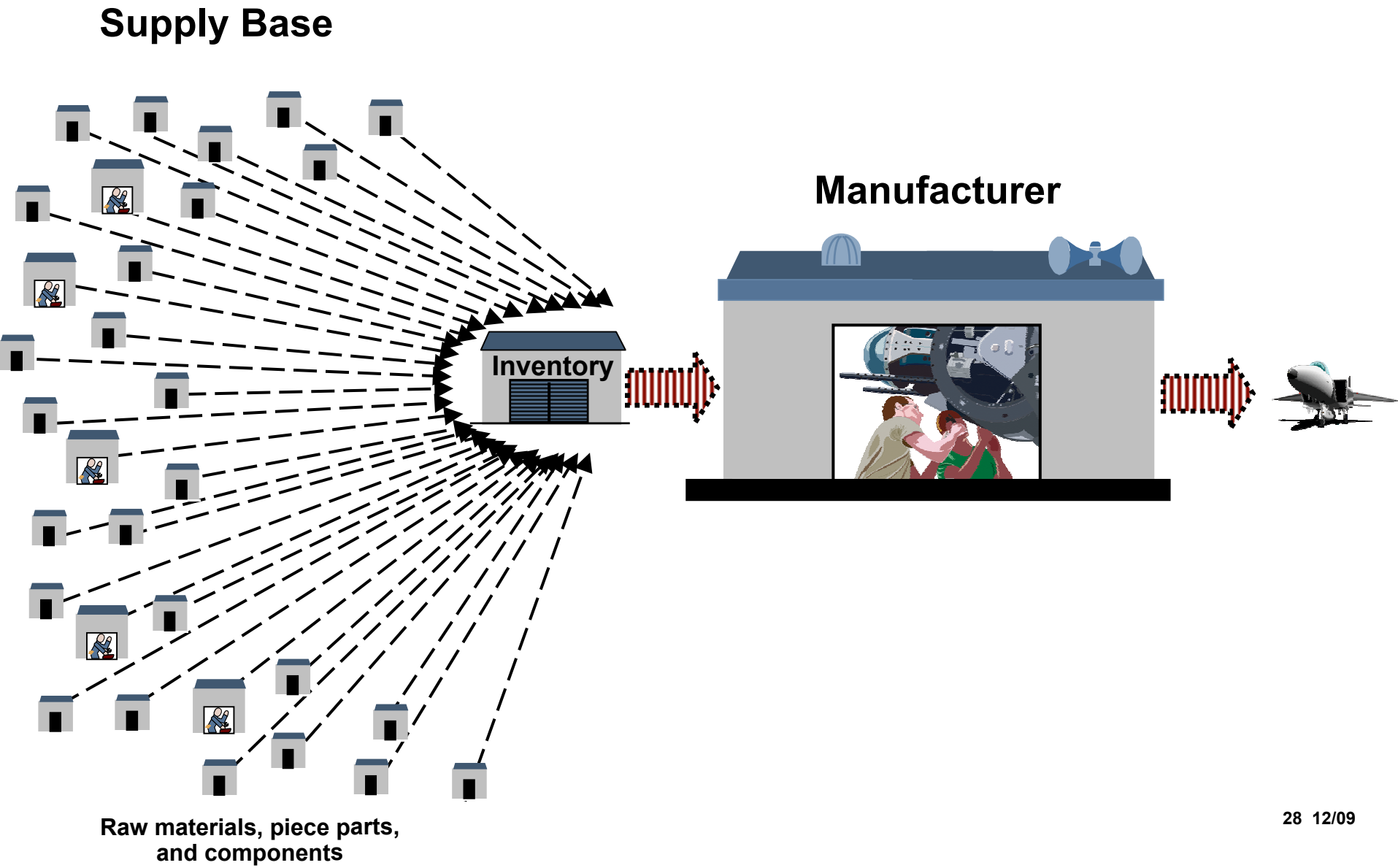
Purchasing and Supply Management (PSM) Adds Rationalizing and Improving the Supply Base



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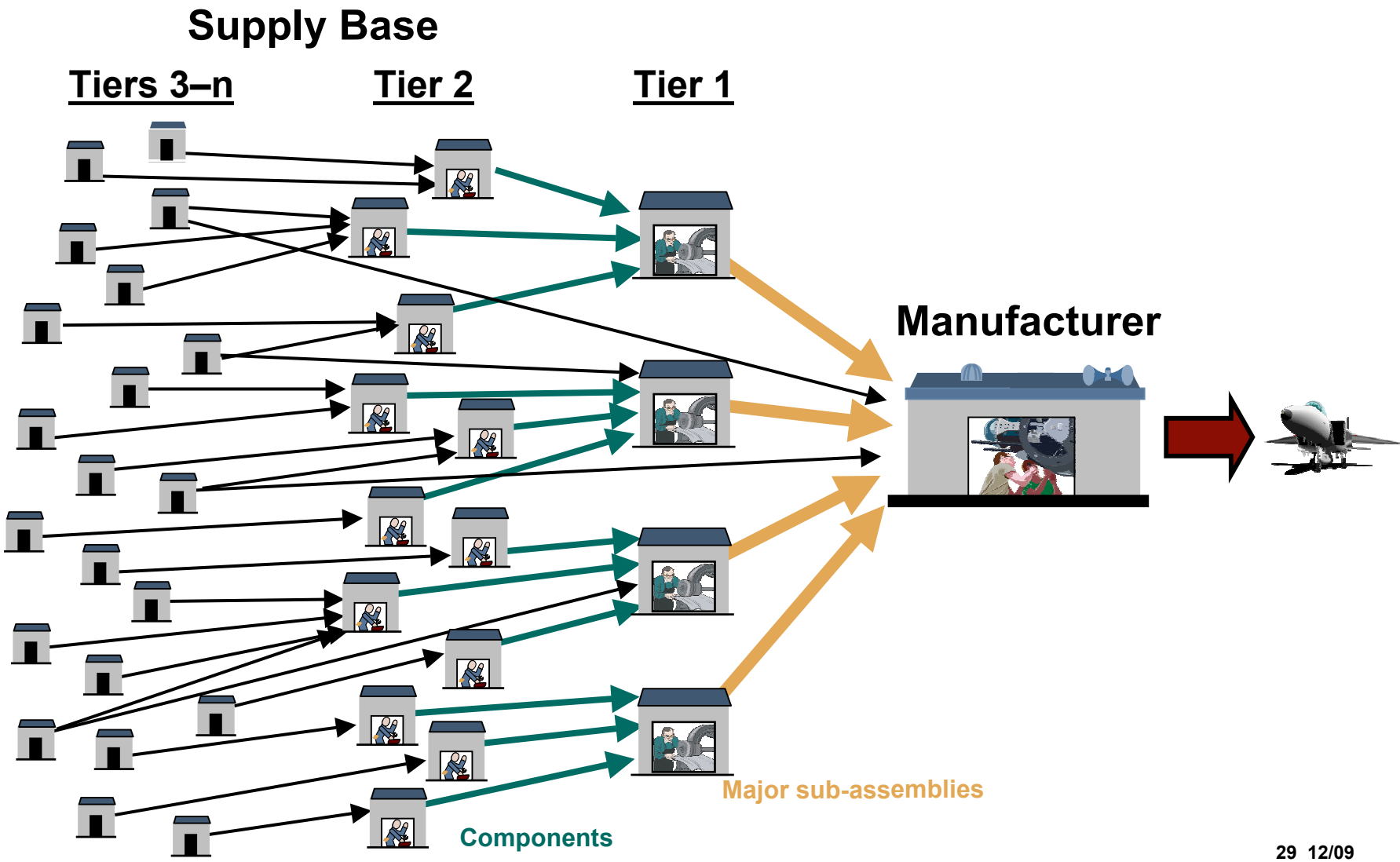
…and Typically Also Reduces the Number of Tier 1 Suppliers and Improves their Overall Quality



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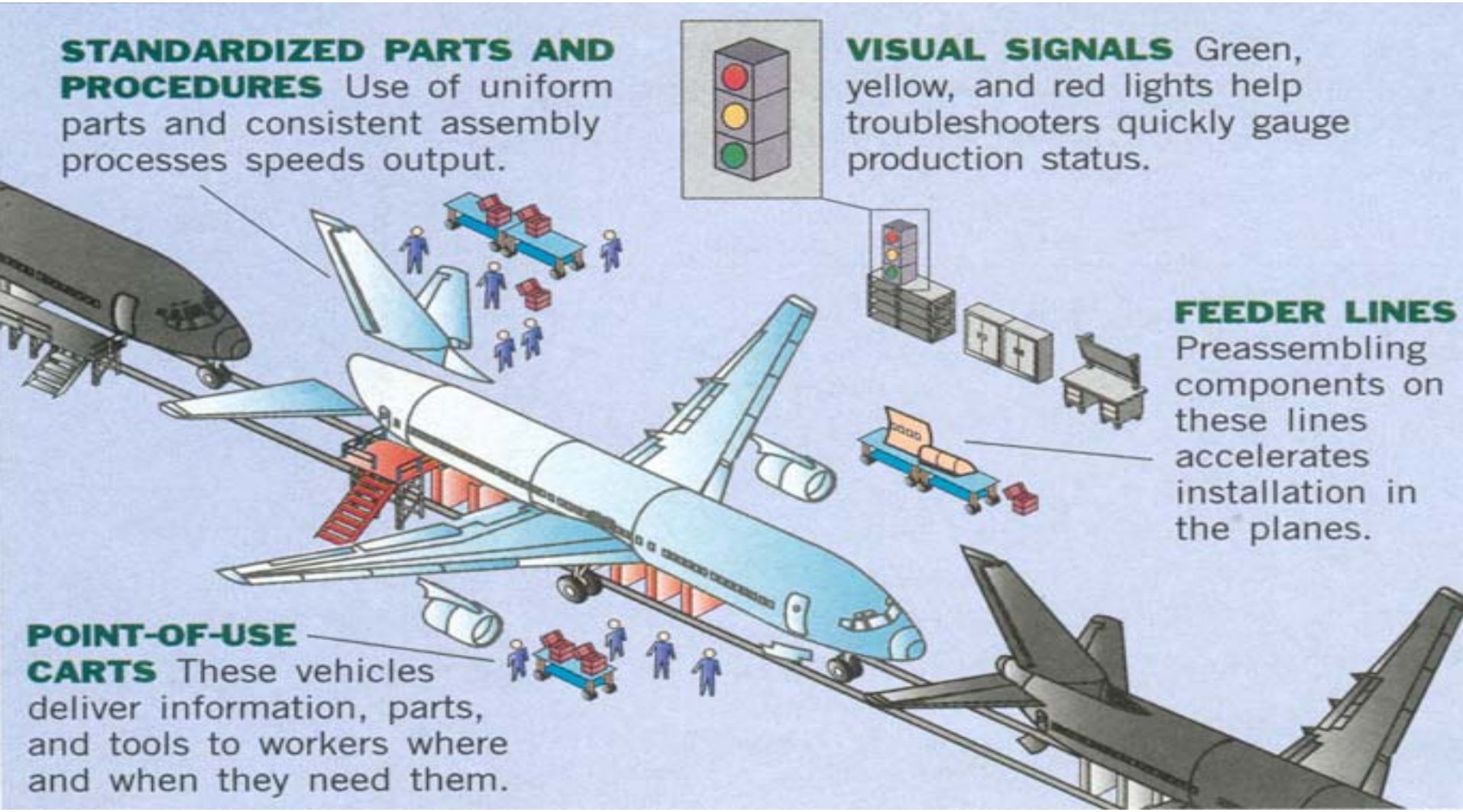
Industry Example: Boeing Commercial Aircraft Group (BCAG) Moving Assembly Line



SOURCE: "Boeing Goes Lean," *Business Week Online*, June 4, 2001.

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Industry Example: Boeing Commercial Aircraft Group (BCAG) - Continued

- **Integrating suppliers → just-in-time deliveries**
  - **Increasing outsourcing 49% → 60%**
    - **Closing factories that build component parts**
  - **Reducing**
    - **Supply base 13% by 2002, 53% by 2005**
    - **Purchased materials costs 3-5% per year**
  - **Using supplier report cards with clear performance expectations**
    - **Basing purchasing decisions on quality, service, price, delivery, best value**
  - **Sharing master schedule on Web-based procurement system**

Sources: Holmes, Stanley, "Boeing Goes Lean," *Business Week Online*, June 4, 2001. Holmes, Stanley,"Is Boeing Cutting Too Close to the Bone?" *Business Week Online*, November 26, 2001. Stundza, Tom, "New Era Dawns at Boeing," *Purchasing*, August 10, 2000.

DRAFT - Do not copy, quote, or cite

"…without suppliers adapting to lean manufacturing, the entire supply chain grinds to a halt"

Sources: Holmes, Stanley, "Boeing Goes Lean," *Business Week Online*, June 4, 2001.

DRAFT - Do not copy, quote, or cite

Outline

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DRAFT - Do not copy, quote, or cite

"To state that one embraces supply chain management is one thing; to actually do it is quite another."

Source: Pinkerton, Richard, "The Evolution of Purchasing to Supply Chain Management," in Woods, John A. and National Association of Purchasing Management, Editors, *The Purchasing & Supply Yearbook: 2000 Edition*, McGraw-Hill, New York, 2000

DRAFT - Do not copy, quote, or cite

Supply and Supply Chain Management

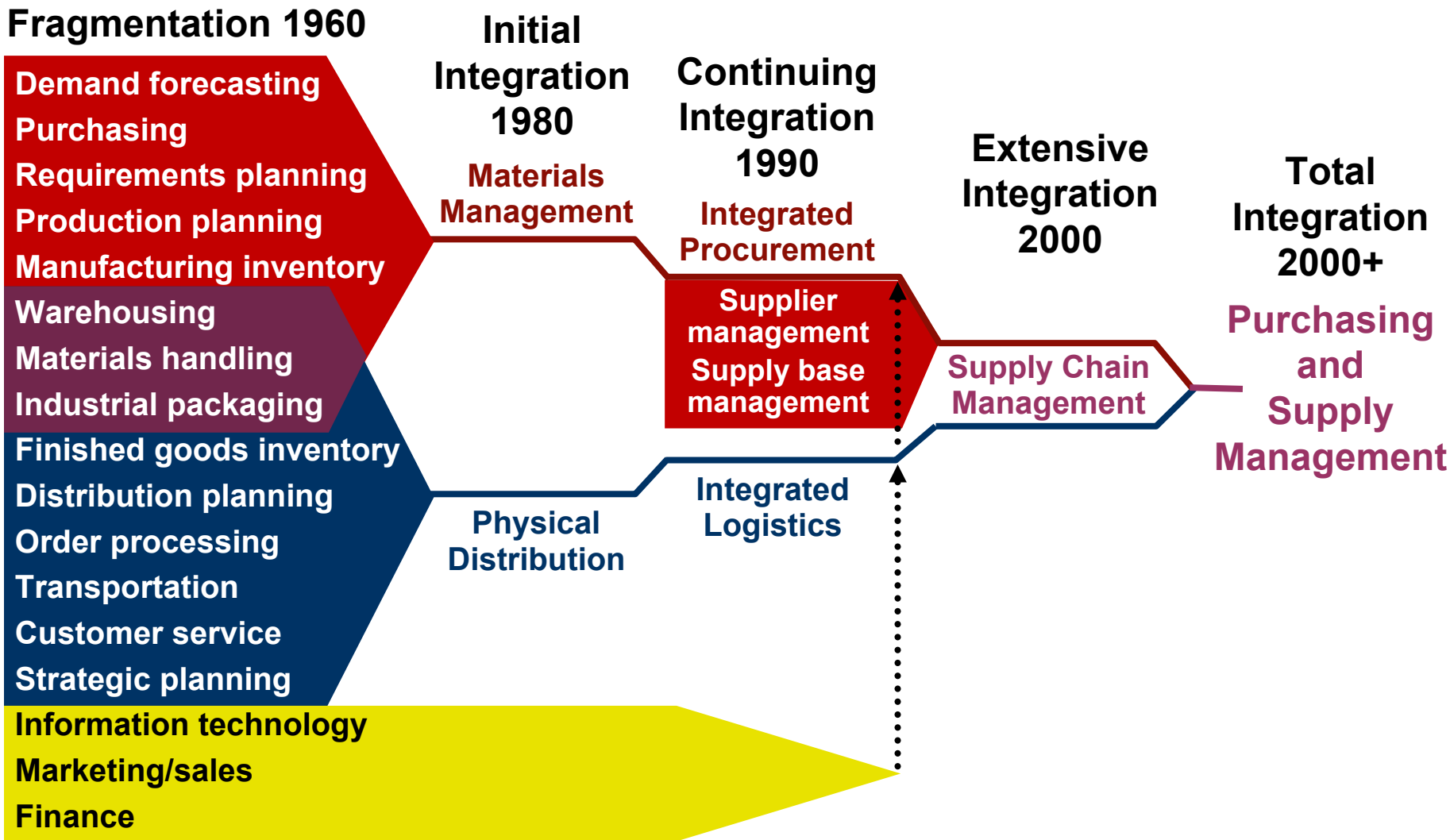
- **Supply Management: the identification, acquisition, access, positioning, and management of all resources needed to attain strategic objectives**

- **Supply Chain Management: the systemic, strategic coordination of functions and tactics within and across businesses within the supply chain to improve the long-term performance of each business and the supply chain as a whole**

Sources: Roberts, Julia, "Value X 4 Equals Excellence," ***Inside Supply Management*****,** Institute for Supply Management (ISM)* **August 2002.**
Council of Logistics Management, http://www.clm1.org/aboutus/aboutus_policy.asp

DRAFT - Do not copy, quote, or cite

Industry Evolution to Purchasing and Supply Management (PSM)



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Adapted from: Novack, Robert A., Cavatino, Joseph, and Kauffman, Ralph G., "Introduction to Supply Chain Management," in *The Purchasing Handbook: A Guide to the Purchasing and Supply Professional*, Sixth Edition, McGraw-Hill, 2000.

DRAFT - Do not copy, quote, or cite

"Successful supply managers know that waiting for a request to come limits the number of creative solutions that could be implemented."

Source: Julie S. Roberts, "Help Wanted: Business and Supply Management," *Inside Supply Management*™, December 2002, page 36.

DRAFT - Do not copy, quote, or cite

Proactive Supply Chain Management Offers More Flexibility to Improve

Time

- Reactive purchasing and supply:
  - Short timelines executed at the operational level
  - Very little in the overall situation can change
    - Requirements aggregations
    - Suppliers number, composition (size, location, and performance) and workload (volume and mix)
    - Resources levels, capacity/capability, and location
      - Inventory mix, size, and location
    - Policies, practices, operations, and organizations
- Proactive supply strategy:
  - Longer timelines developed at the strategic level
  - Anything can change except customer requirements

Adapted from: Hicks, Donald A., "The State of Supply Chain Strategy," in Woods, John Ed., *The Purchasing & Supply Handbook, 2000 Edition*, National Association of Purchasing Management, 2000.

DRAFT - Do not copy, quote, or cite

Three Complimentary Supply Chain Improvement Approaches and Camps

1. **Purchasing/procurement**
   - Supply base rationalization
     - Number of upstream nodes
   - Supplier selection
     - Sources of product flow
   - Supplier relationships
     - Level of communication and cooperation
2. **Logistics**
   - Structures, processes, and operations
     - Volume and flow
3. **Information technology (IT)**
   - Intra- and inter-enterprise integration

DRAFT - Do not copy, quote, or cite

1. Purchasing / Procurement

- Argues suppliers/supply base are key to improvement
- Focuses on identification, development, integration, and management of suppliers and supply base
  - Shifts to fewer, better, longer-term suppliers
  - Improves the quality, cost, and velocity of flows
  - Increases the capability to change the flow mix and volume
- Excels at relationship creation and management

"Shrinks and stabilizes the cow paths"

DRAFT - Do not copy, quote, or cite

2. Logistics

- Argues supply chain process is key to improvement
- Focuses on applying high powered numerical analysis and optimization models to structures, processes, and operations
- Excels in industrial engineering, operations research, and traditional supply functions
  - Warehousing
  - Transportation
  - Inventory management
- Assumes suppliers of inputs largely fixed

"Straightening cow paths"

Adapted from: Hicks, Donald A., "The State of Supply Chain Strategy," in Woods, John Ed., *The Purchasing & Supply Handbook, 2000 Edition*, National Association of Purchasing Management, 2000.

DRAFT - Do not copy, quote, or cite

3. *Information Technology (IT)*

- Argues IT integration is key to improvement
- Focuses on collaborative planning, sharing information, and synchronizing with both internal and external suppliers and customers
  - Complex, sweeping, expensive, time driven projects
- Excels at marketing approach
  - Large following
- Assumes supply network configuration fixed

"Paving cow paths"

Adapted from: Hicks, Donald A., "The State of Supply Chain Strategy," in Woods, John Ed., *The Purchasing & Supply Handbook, 2000 Edition*, National Association of Purchasing Management, 2000.

DRAFT - Do not copy, quote, or cite

The Order of Supply Chain Strategy Improvements Impacts Expected Benefits

- **Greatest benefits from systematically and synergistically improving**
  - **Supply base**
  - **Suppliers**
  - **Structures, practices, processes, operations**
  - **Integration**

- **That is,**
  1. **Shrink and stabilize the cow paths,**
  2. **Straighten the cow paths, and then**
  3. **Pave the cow paths**

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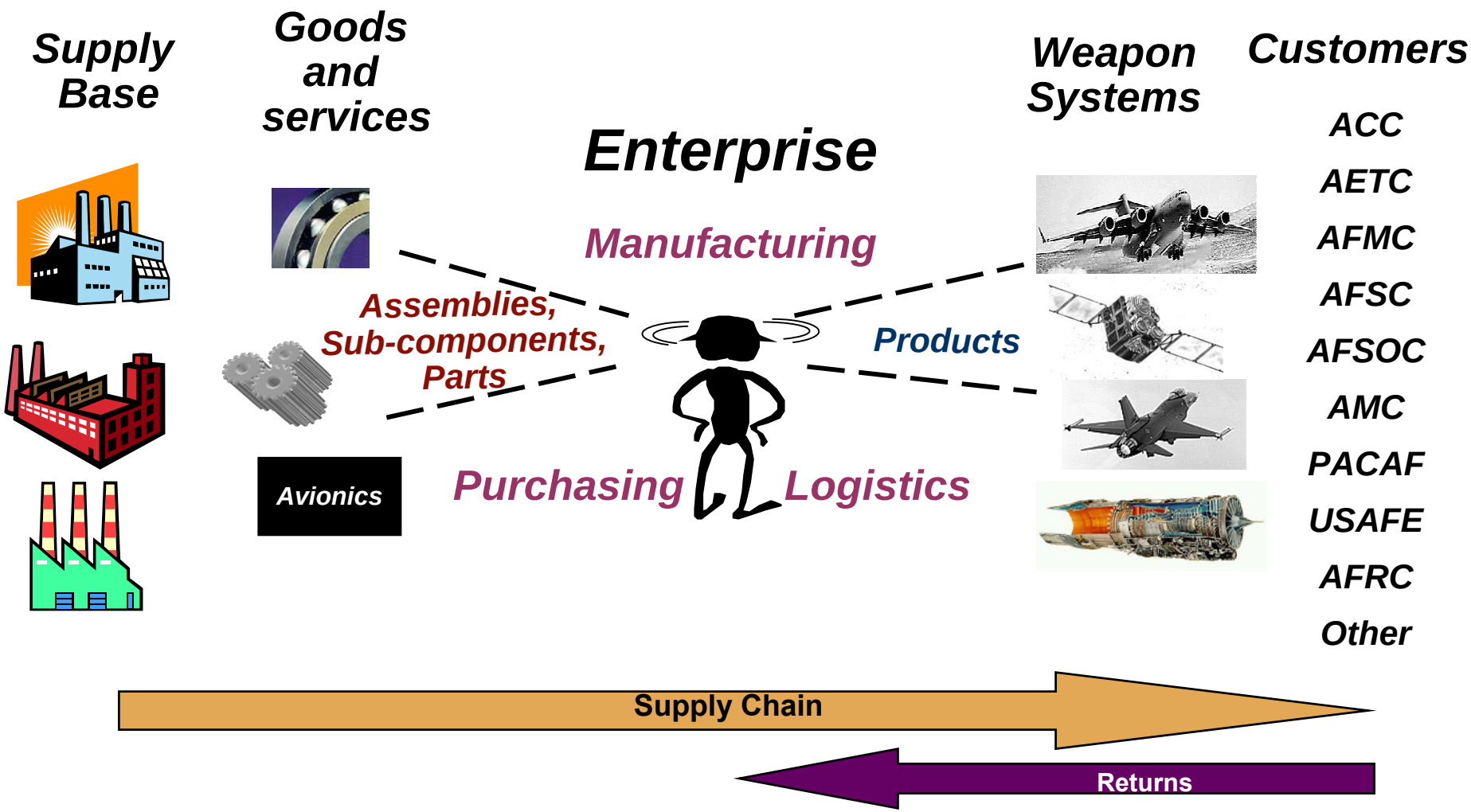
Where You Are In the Value Chain Determines Your Customers, Suppliers, and Focus



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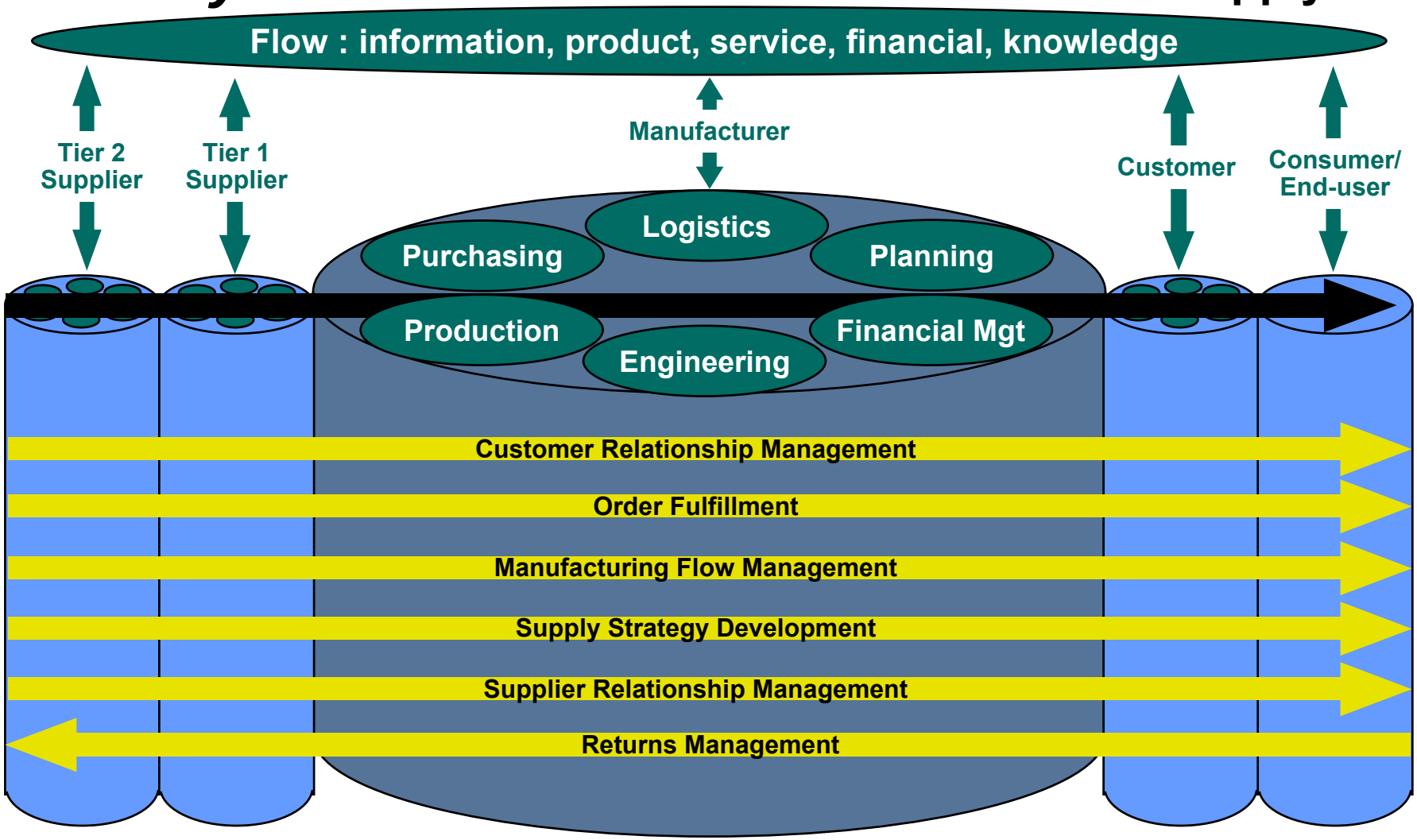
Supply Chains Are Complex and Have Many Different Flows and Constraints Supply



Constraints: capacity, information, core competencies, capital, and human resource

Source: Adapted from Cooper, Martha C., Lambert, Douglas M., and Pagh, Janus D., "Supply Chain Management: More Than a New Name or Logistics," *The International Journal of Logistics Management*, V 8, N 1, 1997, p. 10.

DRAFT - Do not copy, quote, or cite

Two Kinds of Supply Chain Variability

1. **Predictable - Customer demands vary in ways that do not change and can be forecast**
   - **Can require inventory safety stock**
2. **Unpredictable – Customer demands vary in unknown ways that cannot be predicted**
   - **Can lead to overages (excess inventory) and shortages (backorders)**

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Bullwhip Effect: Order Variability Amplifies As It Move Upstream

Four major causes:

1. **Updating demand forecasts based on demand history**
   - **The longer the lead time, the less accurate the forecast**
2. **Batching orders**
   - **Periodic ordering - economic order quantity (EOQ) buying/shipping**
   - **Push ordering - for demand surges, budget, and other incentives**
3. **Fluctuating prices**
   - **Price/quantity discounts, coupons, rebates create forward buying**
4. **Rationing and gaming shortages**

Source: Lee, Hau L., Padmanabham, V., and Whang, Seungjin, "The Bullwhip Effect in Supply Chains," *Sloan Management Review*, Spring 1997..

DRAFT - Do not copy, quote, or cite

Ways to Reduce Order Variability

1. Avoid multiple demand forecast updates
   - Make downstream demand/inventory data available to upstream sites
2. Reduce order/shipment size and increase frequency
   - Automate ordering
   - Coordinate orders internally and externally with others
3. Stabilize prices
   - Estimate total costs of forward buying
4. Eliminate gaming, particularly during shortages
   - Allocate shortages based on past demands
   - Increase customers confidence by sharing information
   - Create incentives for accurate customer orders

Source: Lee, Hau L., Padmanabham, V., and Whang, Seungjin, "The Bullwhip Effect in Supply Chains," *Sloan Management Review*, Spring 1997.

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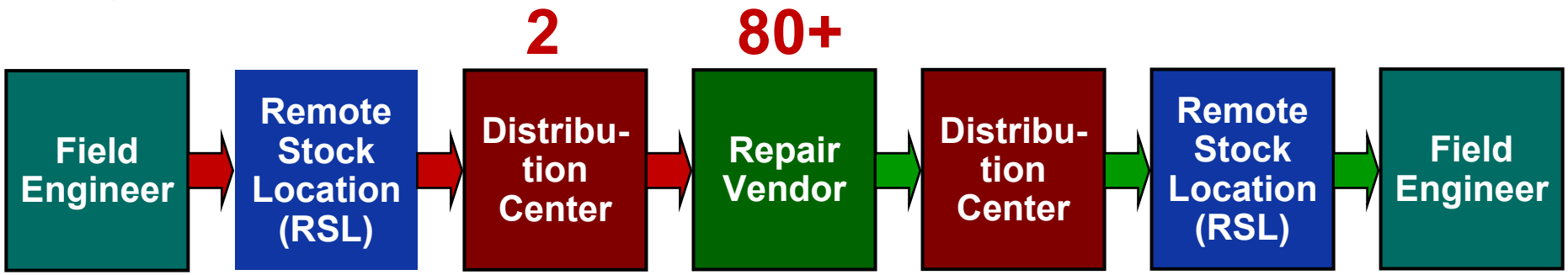
Aftermarket Support: Sun Microsystems' Repair Parts Supply Chain

Original Process



*Adapted from: White, Michael, "Establishing Competitive Advantage Through Significant Capital and Operational Cost Reductions," INTERLOG 2002: The Aftermarket & Service Parts Logistics Conference, San Diego, June 20-21, 2002.

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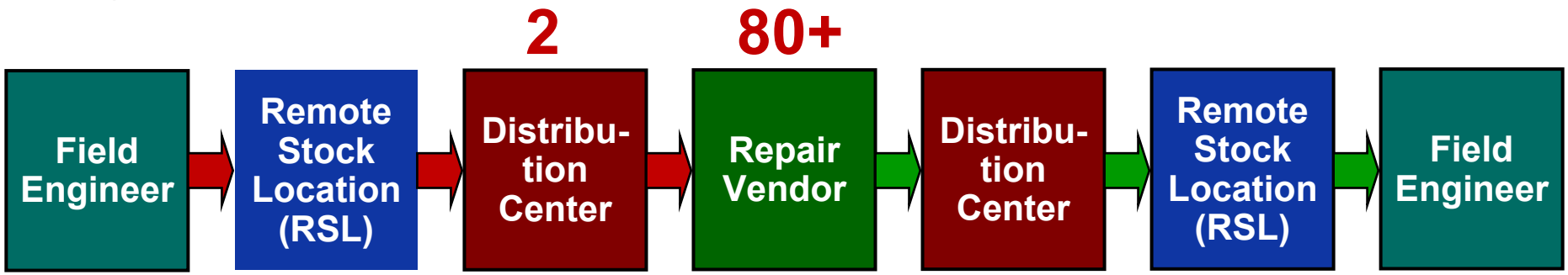
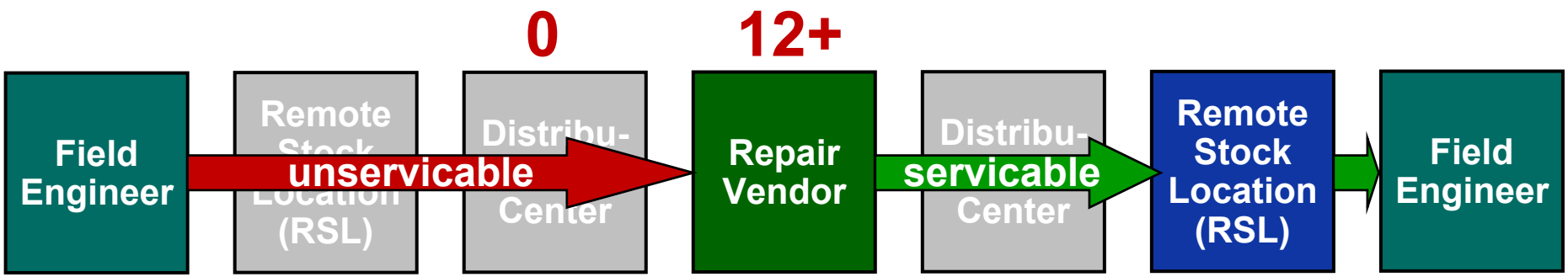
Original Process



Restructured Process



*Adapted from: White, Michael, "Establishing Competitive Advantage Through Significant Capital and Operational Cost Reductions," INTERLOG 2002: The Aftermarket & Service Parts Logistics Conference, San Diego, June 20-21, 2002.

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Industry Example: Sun Microsystems' Leaner Repair Parts Supply Chain Architecture - Continued

- **Invested $4.5 M**
  - **PCs**
  - **Call Center Management Tool**
  - **IT development/support**
- **Results**
  - **98 % local level parts availability, + 11%**
  - **Cost savings/avoidance > $21 M**
  - **Inventory reduction > $ 65 M**
  - **Transactions avoided > 5 M**

*Adapted from: White, Michael, "Establishing Competitive Advantage Through Significant Capital and Operational Cost Reductions," INTERLOG 2002: The Aftermarket & Service Parts Logistics Conference, San Diego, June 20-21, 2002.

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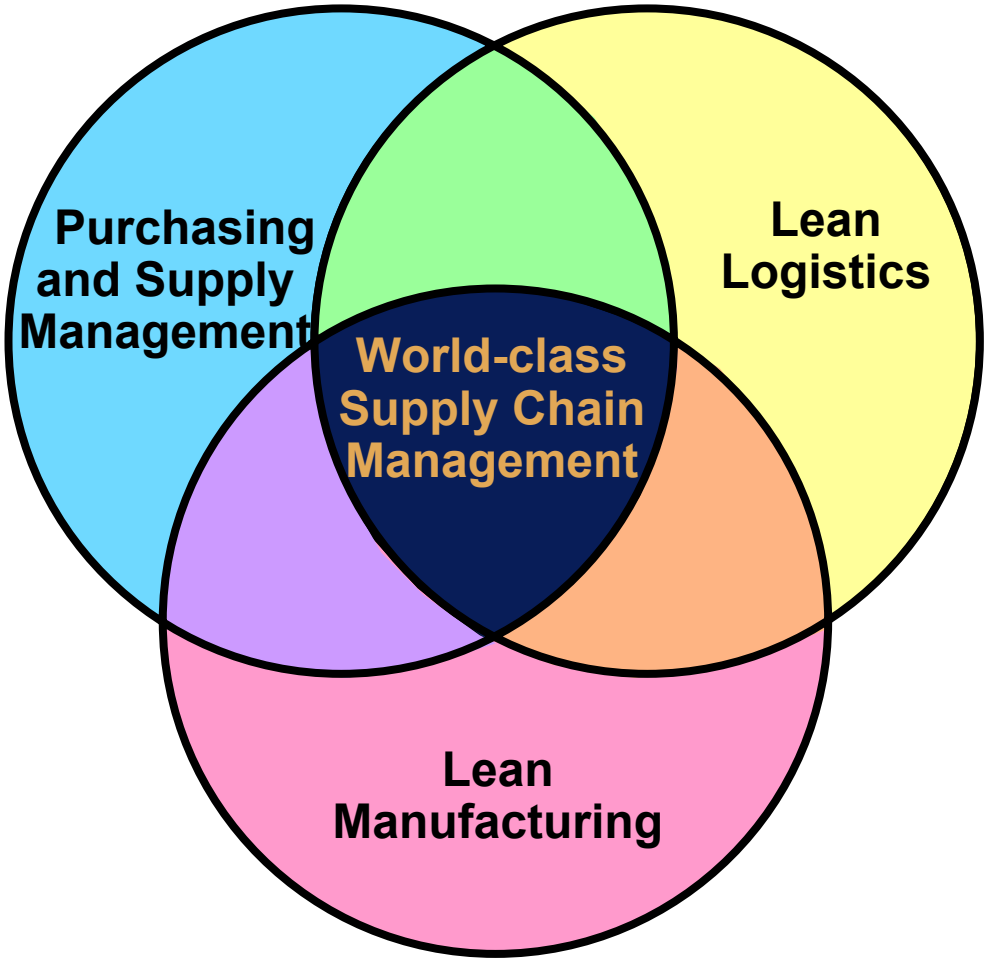
Components of World-class Supply Chain Management



Source: Adapted from Monczka, Robert, Trent, Robert, and Handfield, Robert, *Purchasing and Supply Chain Management*, Second Edition, South-Western, 2002.

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Outline

- Background
- Lean Manufacturing
- Supply Chain Management (SCM)
- Sense and Respond Logistics (S&RL)
- Implications for Supplier Relationships

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Sense and Respond Logistics (S&RL)

"an adaptive method for maintaining operational availability of units by managing their end-to-end support network"

"based upon highly adaptive, self-synchronizing, dynamically re-configurable demand and support networks that anticipate and stimulate actions to enhance capability or mitigate support shortfalls."

*Source: Office of Force Transformation, *Sense and Respond Logistics CONOPS*, Version 2.0, 25 Sugust, 2003.

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S&RL Overarching Themes

- Assume demand is ultimately unpredictable
- Highly flexible supply chain
- Organize into "modular capabilities"
- "Self synchronizing" networks
  - Common environment and shared objectives
- Sophisticated IT support

"S&RL will change the way we interact with our suppliers…"

*Source: Office of Force Transformation, *Sense and Respond Logistics CONOPS*, Version 2.0, 25 Sugust, 2003.

DRAFT - Do not copy, quote, or cite

S&RL Fundamental Principles

- Speed and coordination
- Adaptability and flexibility
- Networked organization
- Robustness
- Dynamic synchronization
- Survivability
- Shared awareness
- Precision
- Shockproof – coherent between levels of scale

*Source: Office of Force Transformation, *Sense and Respond Logistics CONOPS*, Version 2.0, 25 Sugust, 2003.

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Implications of S&RL

Shifts in:	From →	To
Operations	Make-and-sell	Sense-and-respond
	Optimization	Adaptation and learning
	Push	Pull
	Forecasts	Actual demand
Supplier relations	Inflexible	Flexible
	Short-term	Long-term
	Many	Fewer

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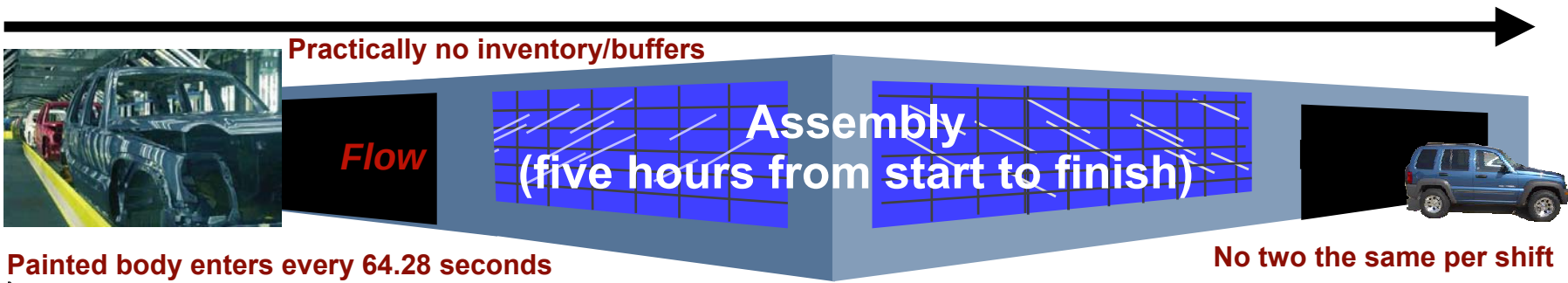
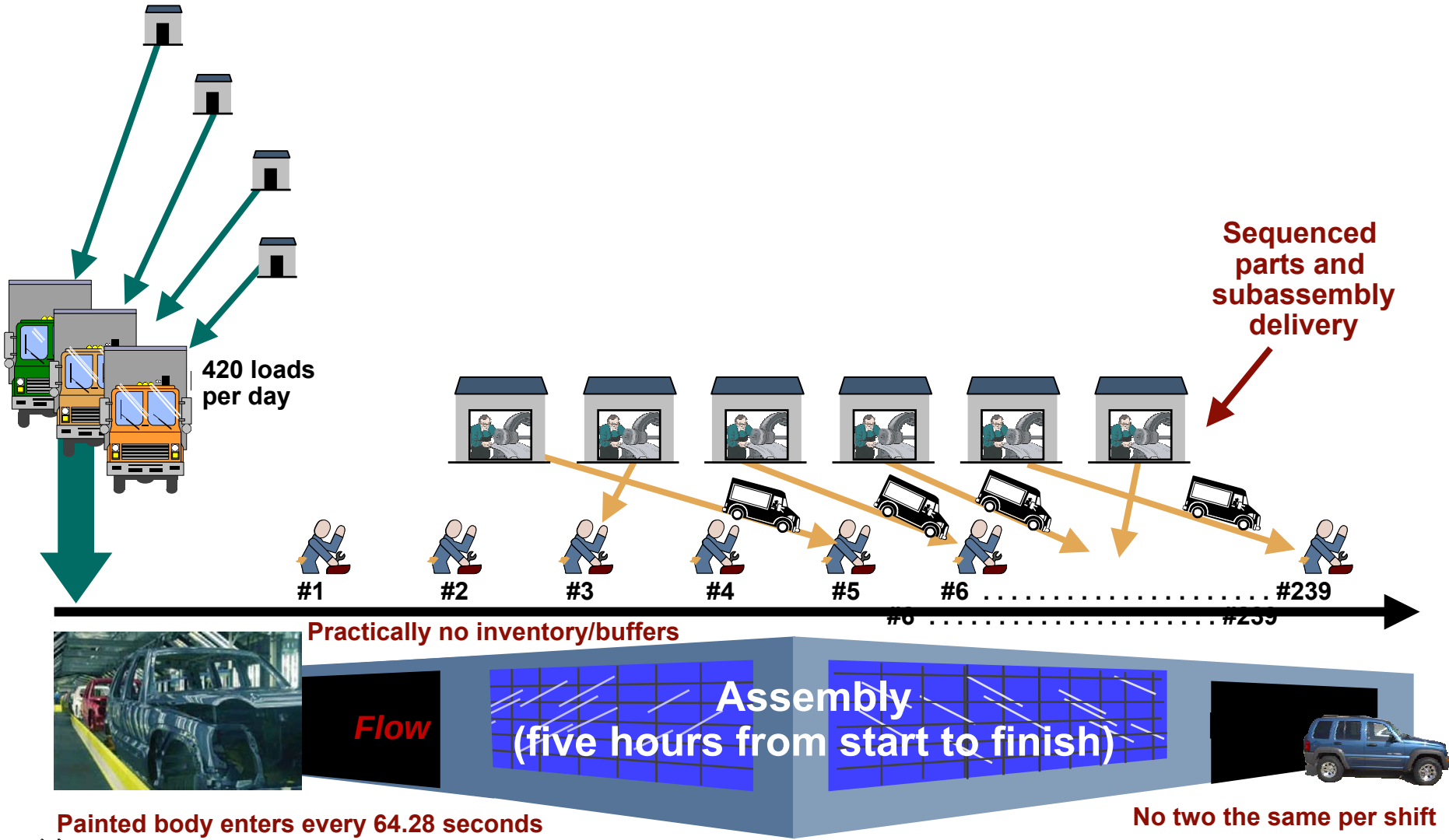
Manufacturing: Assembly of DaimlerChrysler's New Jeep Liberty Launched April 2001 (1 of 5)



Source: Siekman, Philip, "Jeep Builds a New Kind of Plant," *Fortune*, November 11, 2002.

DRAFT - Do not copy, quote, or cite

Manufacturing: Assembly of DaimlerChrysler's New Jeep Liberty Launched April 2001 (2 of 5)



Source: Siekman, Philip, "Jeep Builds a New Kind of Plant," *Fortune*, November 11, 2002.

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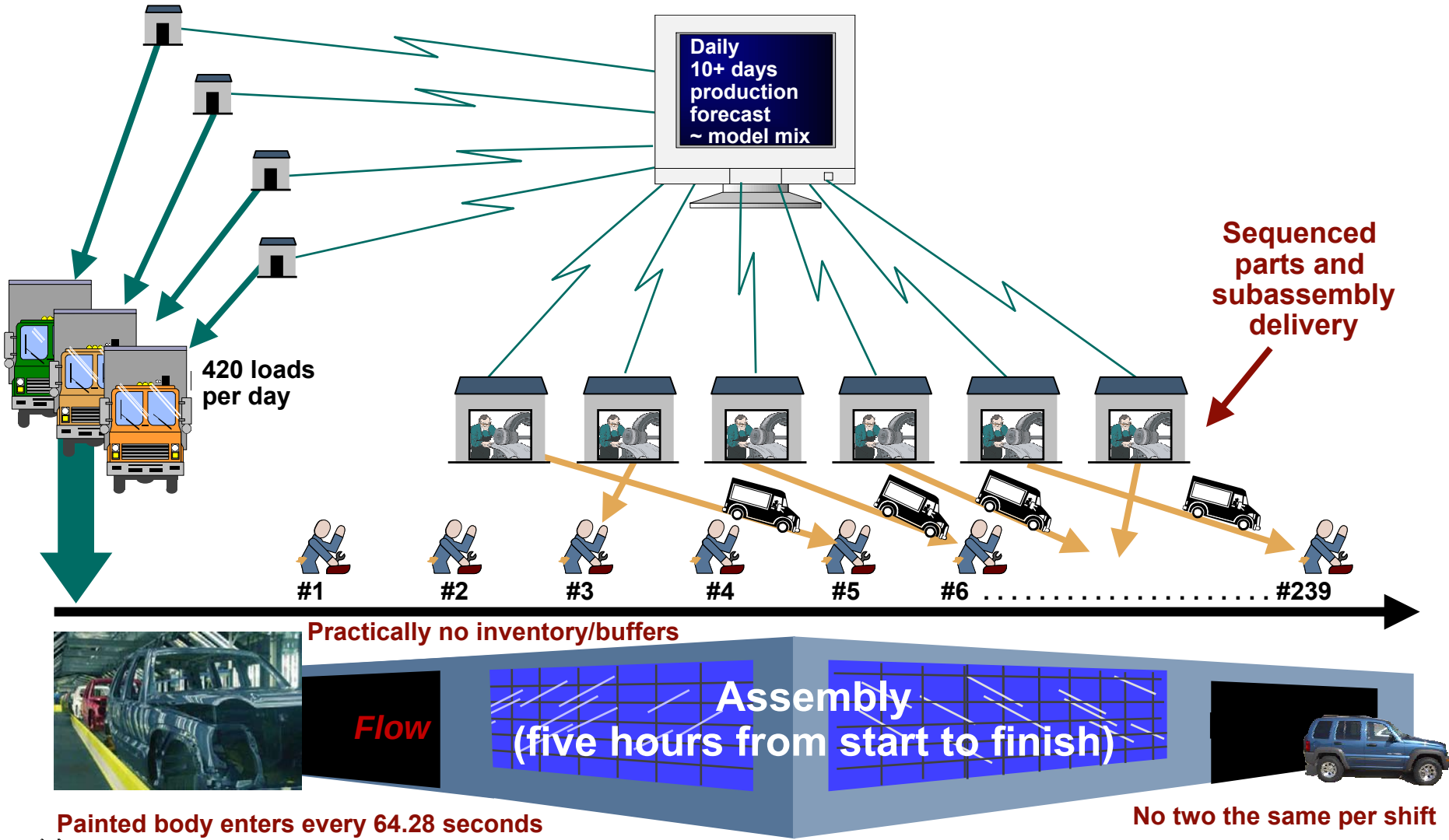
Manufacturing: Assembly of DaimlerChrysler's New Jeep Liberty Launched April 2001 (3 of 5)



Source: Siekman, Philip, "Jeep Builds a New Kind of Plant," *Fortune*, November 11, 2002.

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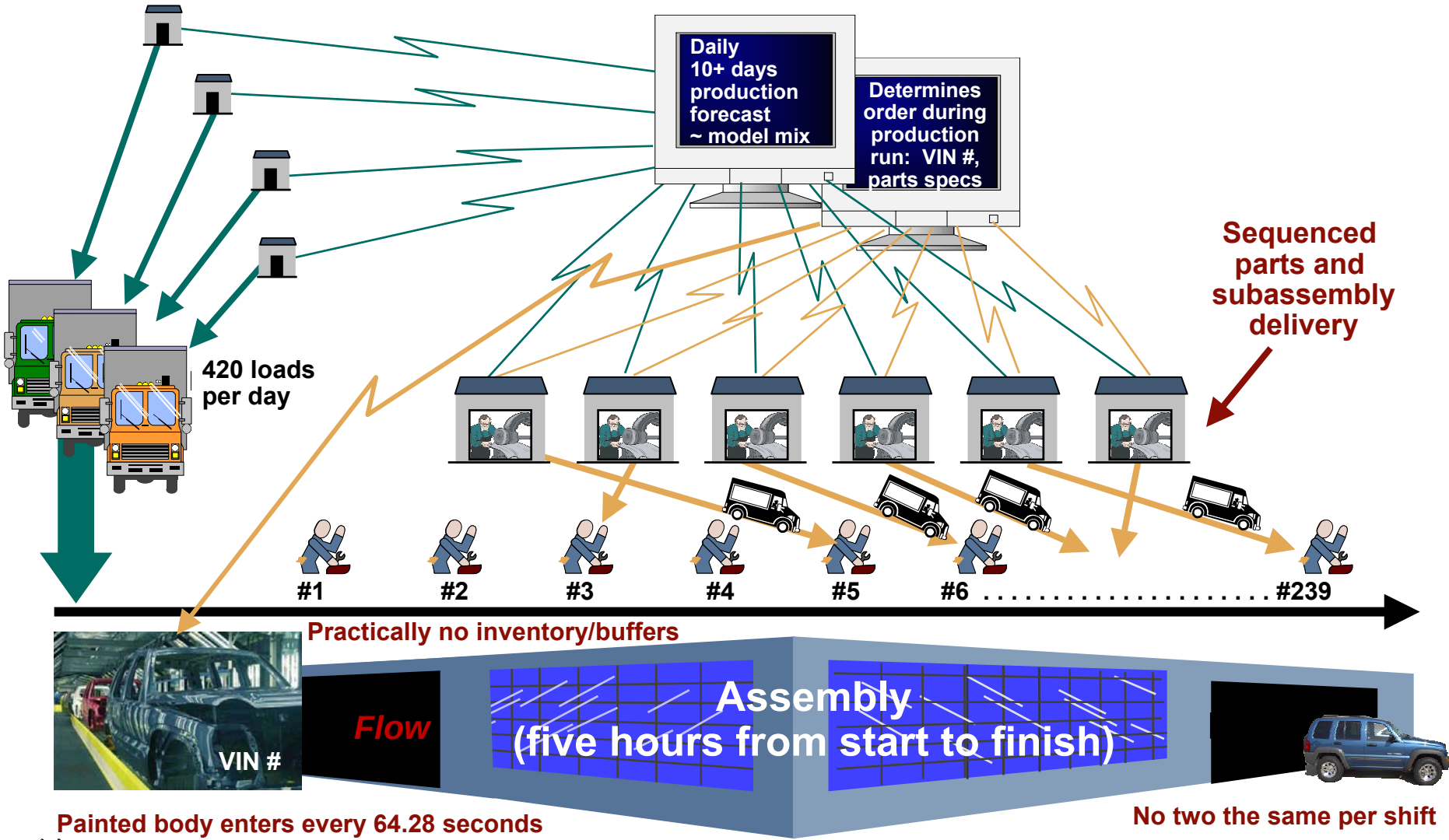
Manufacturing: Assembly of DaimlerChrysler's New Jeep Liberty Launched April 2001 (4 of 5)



Source: Siekman, Philip, "Jeep Builds a New Kind of Plant," *Fortune*, November 11, 2002.

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Manufacturing: Assembly of DaimlerChrysler's New Jeep Liberty (5 of 5)

- Supplier selection based largely on earlier Jeep/Chrysler relationships
  - Designing parts/planning production since 1997
  - Responsible for quality control
  - Heavy penalty if they stop the line
- Key suppliers work in lock step with assembly line
  - Similar shifts, hours, breaks, and mealtimes
  - Produce subassemblies at the same speed
- Implemented changes to cut costs or refine design
- Results for Chrysler Group
  - Fewest worker-hours to assemble
  - Fastest assembled vehicle
  - Quality higher than Jeep Cherokee after 18 years of production

Source: Siekman, Philip, "Jeep Builds a New Kind of Plant," *Fortune*, November 11, 2002.

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A Large Supply Base and Many Small Contracts Increases Variability and Decreases Flexibility

- **Variability**
  - **Lead-times**
  - **Material consistency**
  - **Interpretation of specifications and requirements**
  - **Transportation and delivery**
  - **Quality of relationships**
- **Flexibility**
  - **Change requirements**
  - **Capacity**
  - **Capability**

Source: Trent, Robert J., "Applying TQM to SCM," *Supply Chain Management Review*, May/June 2001.

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Lean, SCM, and S&RL Practices Require a Relatively Stable, Small Supply Base

- Close communication and coordination
  - Link end user demands to suppliers
  - Flexible requirements
- Joint waste elimination and value adding efforts
  - Inefficient with short-term suppliers
  - Easier with fewer suppliers
  - Impossible with thousands of suppliers

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Lean, SCM, and S&RL Require Very High Performing Suppliers

- Rigorous supplier evaluation and selection
  - Reward highest performers
    - More business, longer-term, collaborative relationships
  - Target below world-class performers
    - Removal or development
- Supply base rationalization – right mix/number
  - Usually leads to dramatic reductions in total number of suppliers, longer-term contracts, and higher switching costs
    - Concentrate spend (up to 80 %) with top suppliers
    - Improve quality through supplier development
    - Enable continuous improvement

Source: Trent, Robert J., "Applying TQM to SCM," *Supply Chain Management Review*, May/June 2001..

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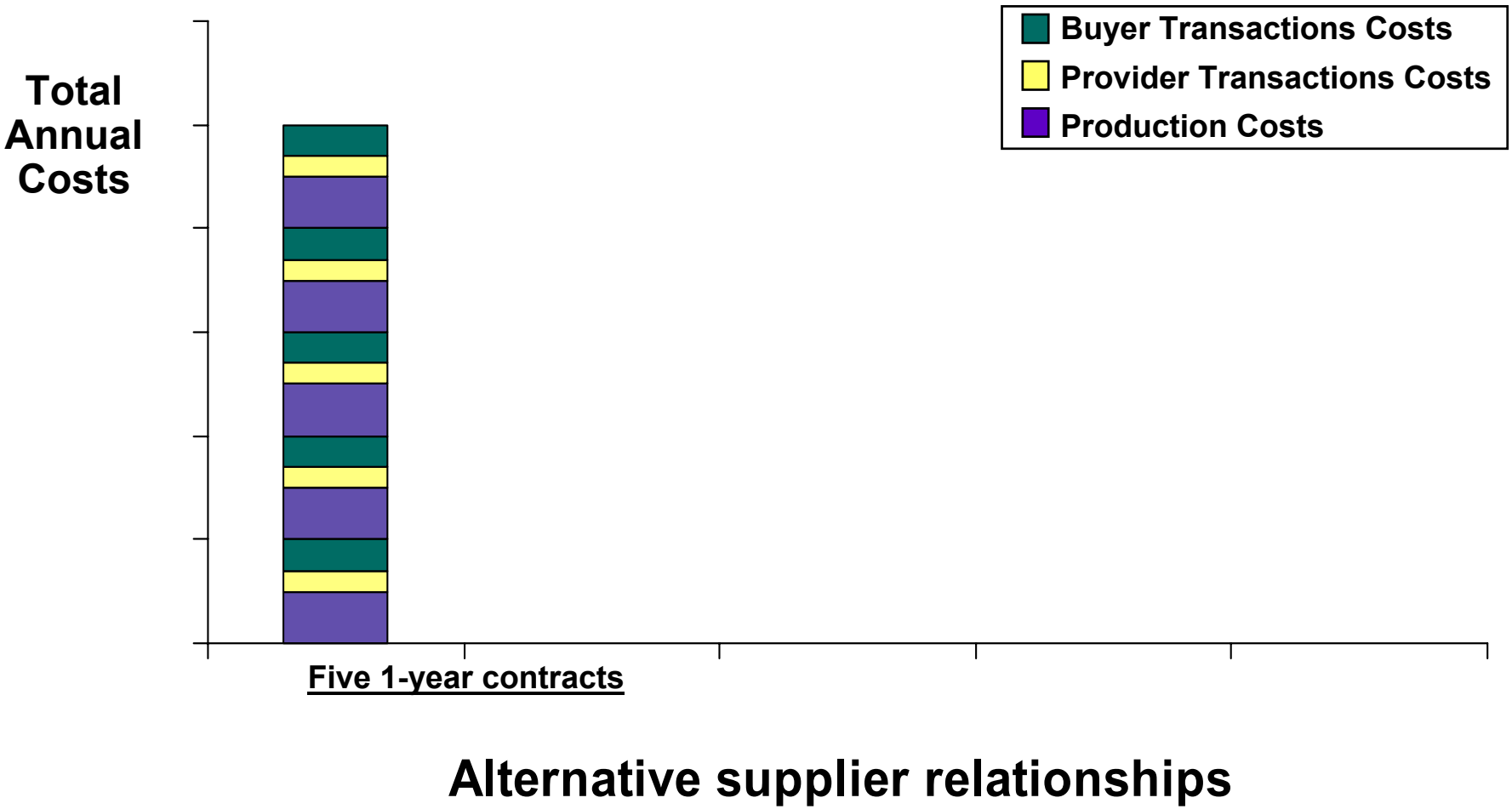
Notional Example of How Alternative Supplier Relationships Can Reduce Total Costs*



Note: Transactions costs have been exaggerated for illustration purposes

RAND

*Consolidation and changing contract terms will not always produce savings of the magnitude or in the categories as illustrated above. However, they should be consider as options to further reduce costs and improve performance.

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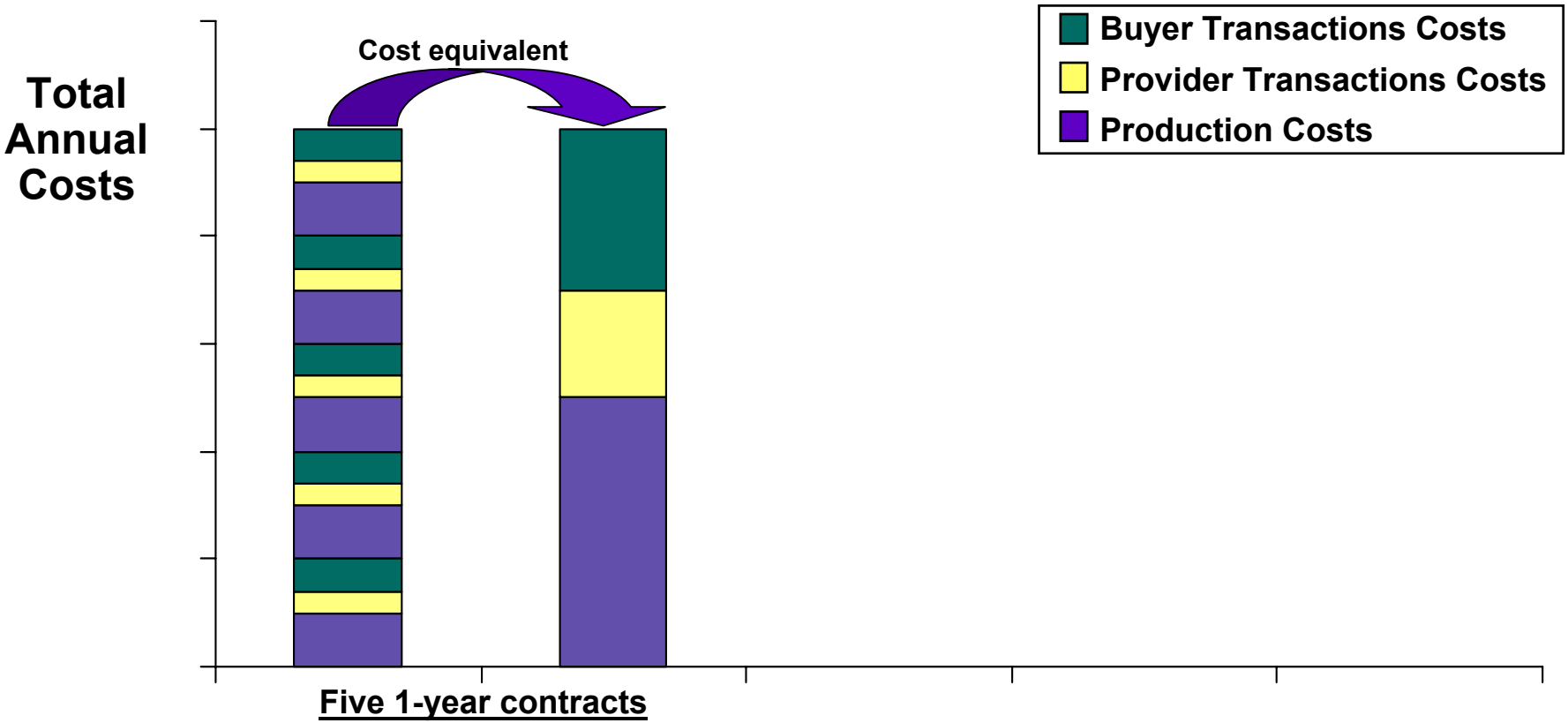

Alternative supplier relationships

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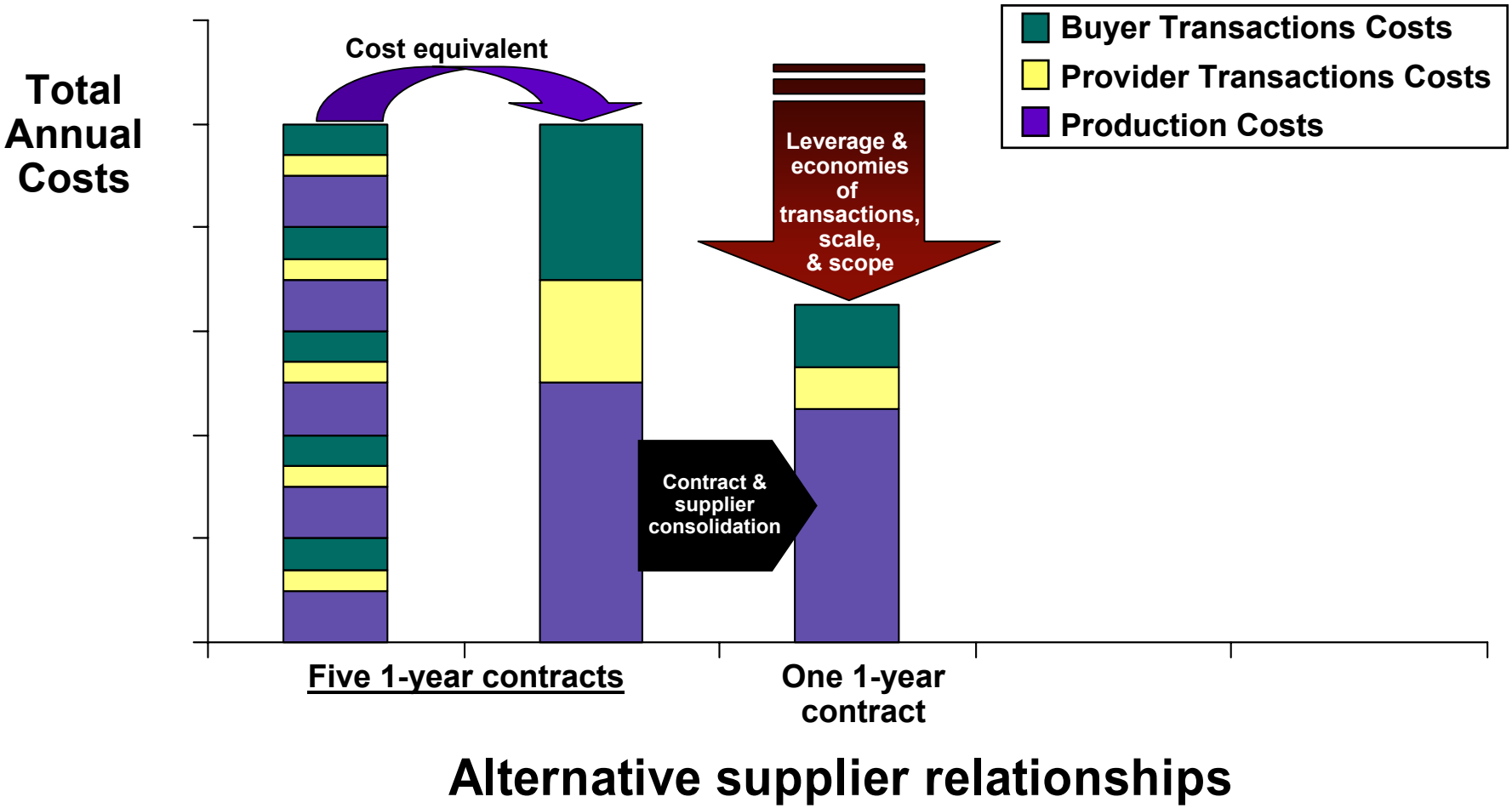

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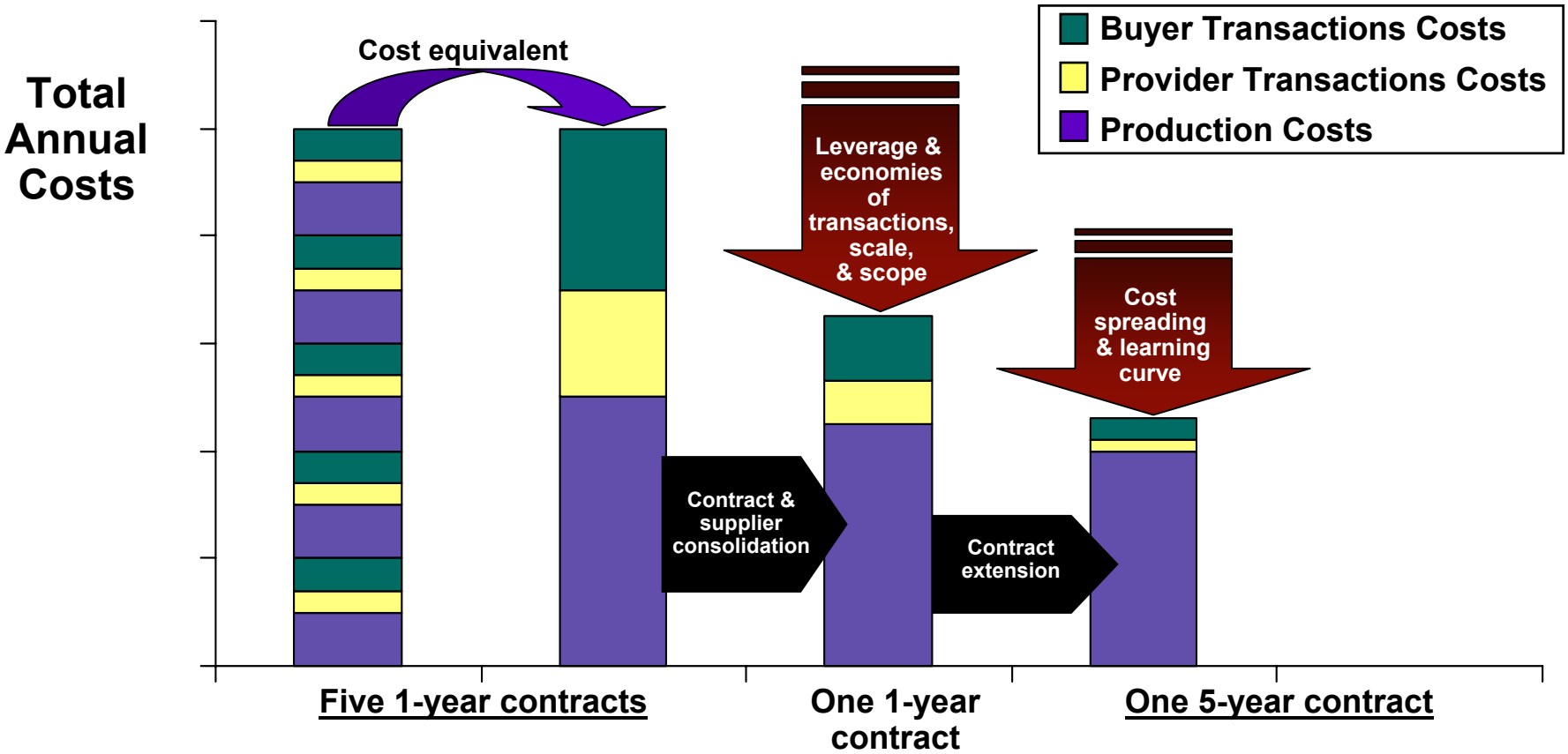

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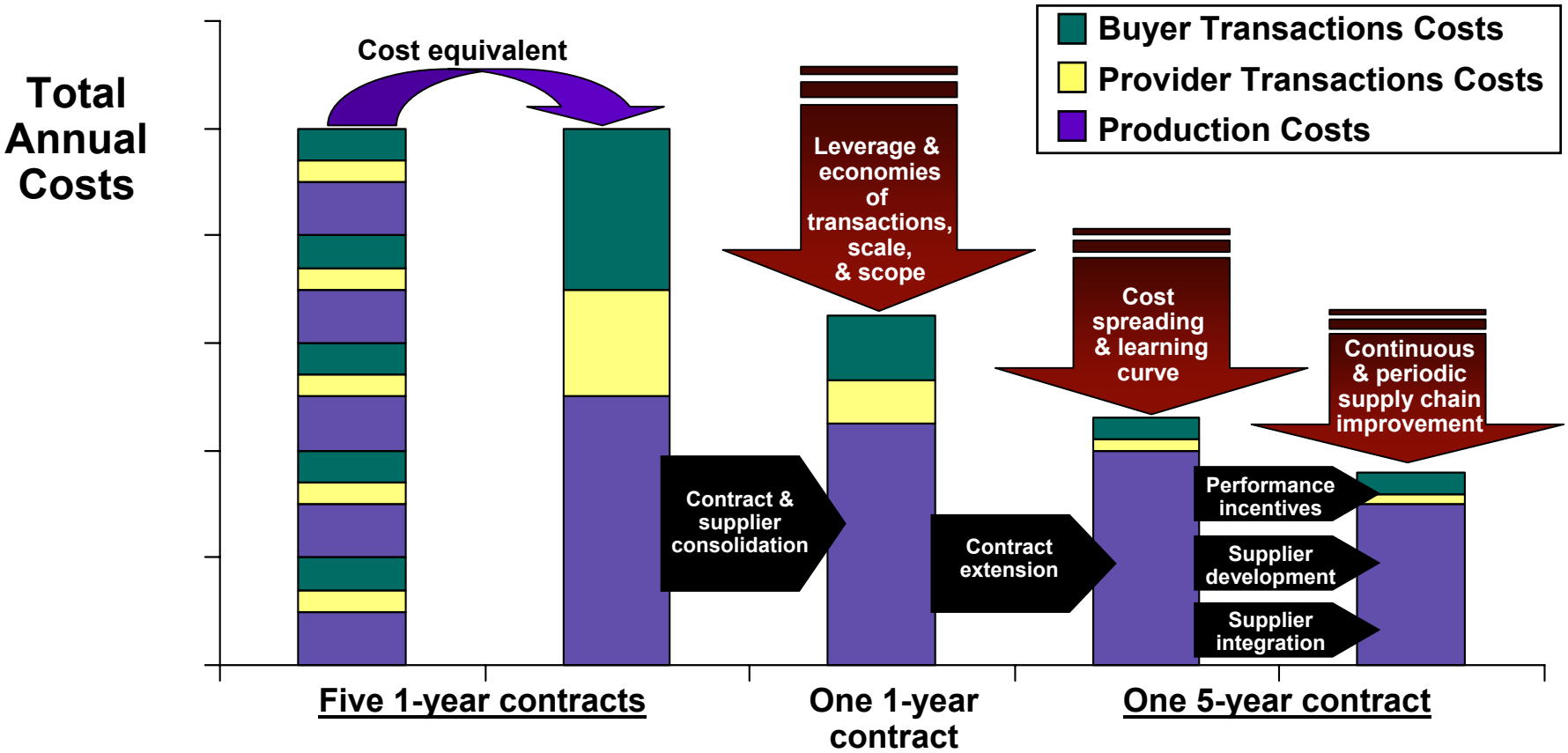

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Implications for Supplier Relationships

- Fewer, larger, longer-term contracts
  - Partnering is essential for large, complex contracts
- A must: Very high quality, reliability, and responsiveness
  - Develop core competencies in statistical process control, Six Sigma, lean mfg., other techniques for improving performance
- Work closely with suppliers/customers to reduce costs and improve performance throughout the value chain
  - Map value streams, adopt lean practices
- Implications for smaller businesses
  - More likely to be a Tier 2 or lower supplier than Tier 1
    - Revise policies to count Tier 2 and lower small business support?
  - Work with larger suppliers who can help them get lean/grow

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Prospective Roles for Logistics Personnel

- Develop proactive, tailored supply strategies
- Actively manage suppliers and supply base to assure supply
- Help key suppliers implement lean, SCM and S&RL practices
- Organize performance improvement projects
- Advise on new capabilities development
  - Electronic communication/collaboration
  - Product design
- Support small businesses
  - Match with lean mentors
  - Identify and promote
    - Growth opportunities
    - Areas where they have the best chances of success

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Questions?

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www.rand.org

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Selected References

- Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.
- Rother, Mike, and Shook, John, *Learning to See*, Lean Enterprise Institute, Brookline, MA, 1998.
- Rother, Mike, and Harris, Rick, *Creating Continuous Flow*, Lean Enterprise Institute, Brookline, MA, 2001.
- Womack, James P. and Jones, Daniel T., *Seeing the Whole: Mapping the Extended Value Stream*, Lean Enterprise Institute, Brookline, MA, 2002.
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- Lee, Hau L., Padmanabham, V., and Whang, Seungjin, "The Bullwhip Effect in Supply Chains," *Sloan Management Review*, Spring 1997.
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Back Up

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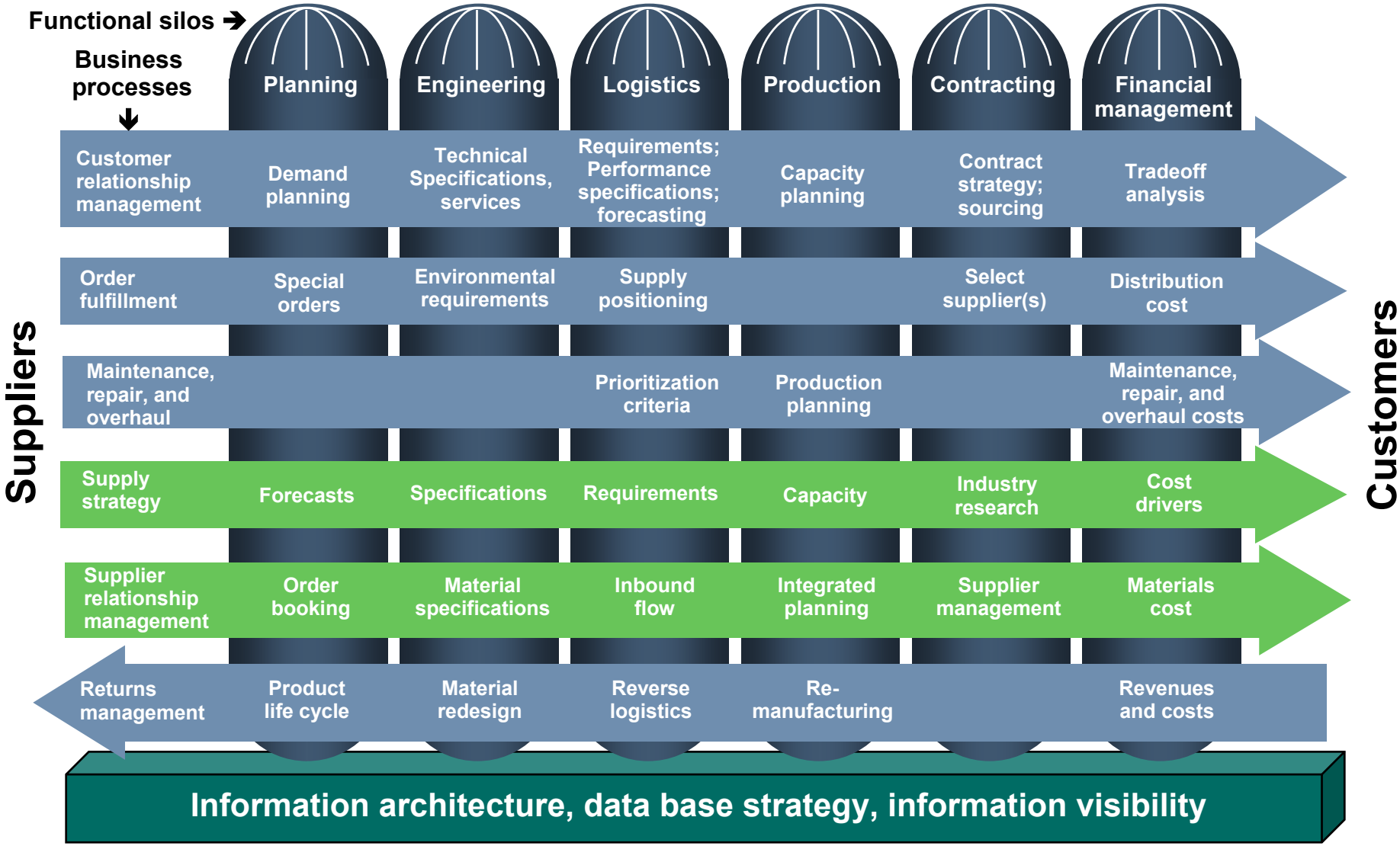
Traditional Supply Chain Management Activities and Processes



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SOURCE: Adapted from Douglas M. Lambert, Larry C. Guinipero and Gary J. Ridenhower, "Supply Chain Management: A Key to Achieving Business Excellence in the 21st Century," unpublished manuscript, as published in Croxton et al.

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Four Components of the Entire Supply Chain

- **Physical Supply Chain**
  - **All movements and flows within and between firms, transportation, service mobilization, delivery, movement, storage, and inventories**
- **Financial Supply Chain**
  - **Flows of cash from firm to firm, expenses, investments, and costs of all processes to create and deliver goods and services**
- **Informational Supply Chain**
  - **Processes and electronic systems, data capture, use, and triggers, key information, enabling processes, and market intelligence that drive the flow of products and services throughout the supply chain**
- **Relational Supply Chain**
  - **Linkages between suppliers, the enterprise, and its customers for maximum benefit**

Source: Robeerts, Julia, "Value X 4 Equals Excellence," *Inside Supply Management*, August 2002..

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Industry Example: General Electric Aircraft Engine's (GEAE) Durham, NC Plant est. 1993

- **Totally self-managing – work schedules/continuous improvement**
  - **Teams plan every job: how to do, who does it, and when**
    - **Technicians - multi-skilled, motivated, demanding**
      - **FAA Powerplant Mechanic's license required**
- **Maintenance, receiving, and parts kits delivery to assembly stations outsourced**
  - **Parts arrive in/are packaged into kits for building specific modules**
- **Results:**
  - **Defects ↓ 75 %, GE90 costs ↓ 10%+/yr, CF6 costs ↓ 30% from 1995 to 1999**
  - **First moving CF34 assembly line began in 2000**
  - **Takt time per engine type in 2002**
    - **GE90: 1 per week, CF6: 1 every 3 days, CF34: 1 every two-shift day**

Sources: Fishman, Charles, "Engines of Democracy," *Fast Company*, October, 1999. Siekman, Philip, GE Bets Big on Jet Engines, *Fortune*, December 19, 2002.

DRAFT - Do not copy, quote, or cite

Action Plan: Getting Started - First Six Months

1. **Find a change agent**
2. **Get the knowledge**
3. **Find a lever**
4. **Map value streams**
5. **Begin *kaikaku* – radical improvement of an activity**
6. **Expand scope as you gain momentum**

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Action Plan: Creating A Lean Organization - Six Months Through Year Two

1. **Reorganize by product family/value stream**
2. **Create a lean function**
3. **Devise a policy for excess people**
4. **Devise a growth strategy**
5. **Remove anchor-draggers**
6. **Instill a "perfection" mind-set**

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Action Plan: Install Business Systems - Years Three and Four

1. Initiate policy deployment
2. Introduce lean accounting
   - Value stream/product-based total costing
3. Relate pay to enterprise performance
4. Implement transparency
   - Visibly show rate of improvement
5. Introduce lean learning
   - Thinking horizontally about total flow of value and how to pull it
   - Methods of root cause analysis
6. Right-size tools
   - Production equipment, information management systems, test equipment, prototyping systems, organizational groupings

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Action Plan: Complete the Transformation - By End of Year Five

1. **Apply steps to suppliers/customers**
   - **Up to 80 percent of total costs and lead times are with suppliers**
2. **Develop lean global strategy**
3. **Transition from top-down leadership to bottom-up improvement**

Source: Womack, James P. and Jones, Daniel T., *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, Simon & Schuster, New York, 1996.

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Typical Sustainment Support Process for Stocked Items

- Forecast item requirement based on past usage and inventory
  - Assumes
    - Stable demand, sources, structures, processes, and organizations
    - Accurate input data
- Task contracting to write a contract for forecasted requirement
  - Assumes forecast is accurate
- Manage suppliers to produce items to contract
  - Assumes contract is for right amount
- Store items in depots or at supplier (DVD)
- Distribute items in response to customer demands
- Repeat process

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Typical Reactive Sustainment Process for Non-stocked Items

- Receive order from customer
- Task contracting to write a contract
- Identify prospective supplier(s)
- Solicit bids
- Award contract
- Manage supplier
- Distribute item to customer

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