



Supply Chain Evolution

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Supply Chain Evolution



Lean out
Internal
Operations

Leaning Internal Operations is Hard

- Culture change is hampered by the chain of command in multi-leveled, complex organizations
 - Keep our worst problems to ourselves (fear of discovery)
 - Risk adverse at lower levels
 - Little resources for change at the shop floor level
- The change problem resides at all levels; Corporate, Group Presidents, General Managers, their reports, First Line Supervisors
- No one wants to invite criticism. “Why didn't we make these obvious improvements before now?”
- Employee concern with job security
 - GM, middle management, shop floor
 - Union issue

Breaking the Status Quo: People

PEOPLE

- Have Corporate expertise
- Have at least one no nonsense, lean positive change person per facility
- Use outsiders (other facilities, customers, suppliers)
- Suspend chain of command during event (team leaders in charge)
- Have “Barn Raising” atmosphere
- Include and educate hourly workers to the changes
- Include the CEO, Group Presidents, General Managers as team MEMBERS
- Limit use of consultants after tools are established

Breaking the Status Quo: Process

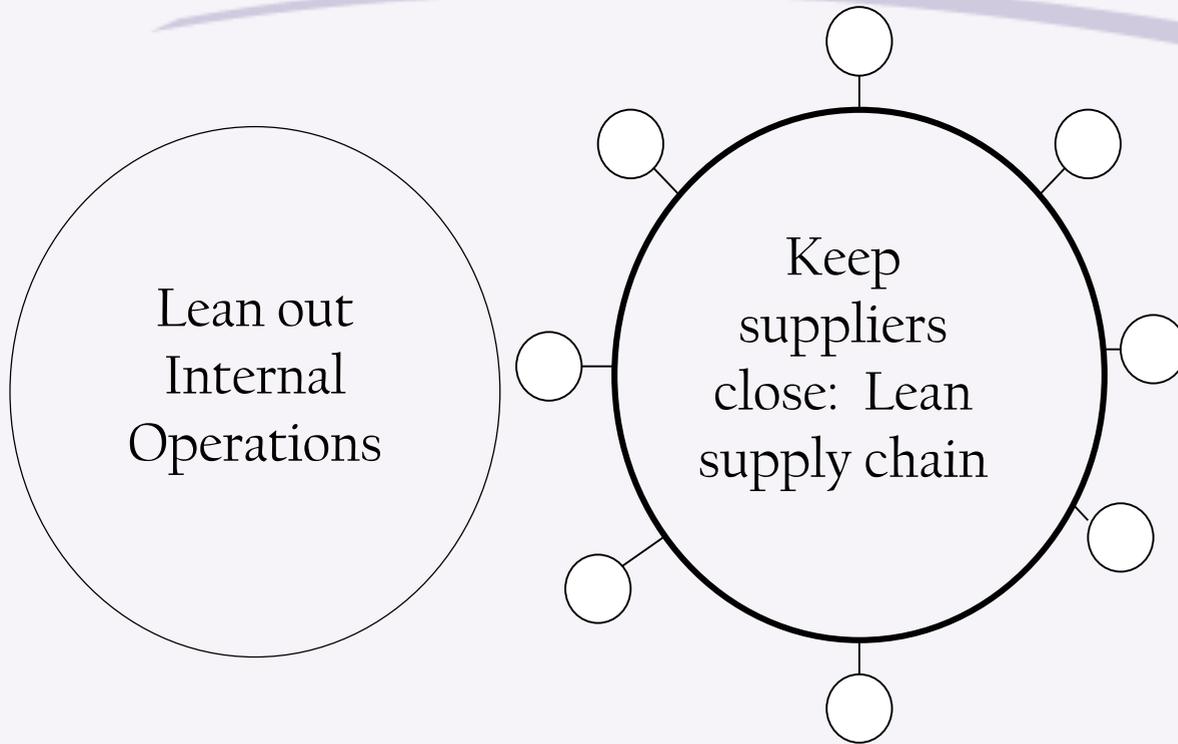
PROCESS

- Shop floor or front office: It doesn't matter
- Kaizen continuously
- Pick toughest problems (3 to 6 per event)
- Deal with problems in a fact based manner (no sacred cows)
- Pre-plan objectives and resources. Move machines and people. Blow out walls.
- Emphasize creativity over capital spending
- Focus on results, not process
- Never accept slow startup, long 30 day lists, non standard work
- Limit back sliding
- Every facility takes it's turn: NO FAVORITES

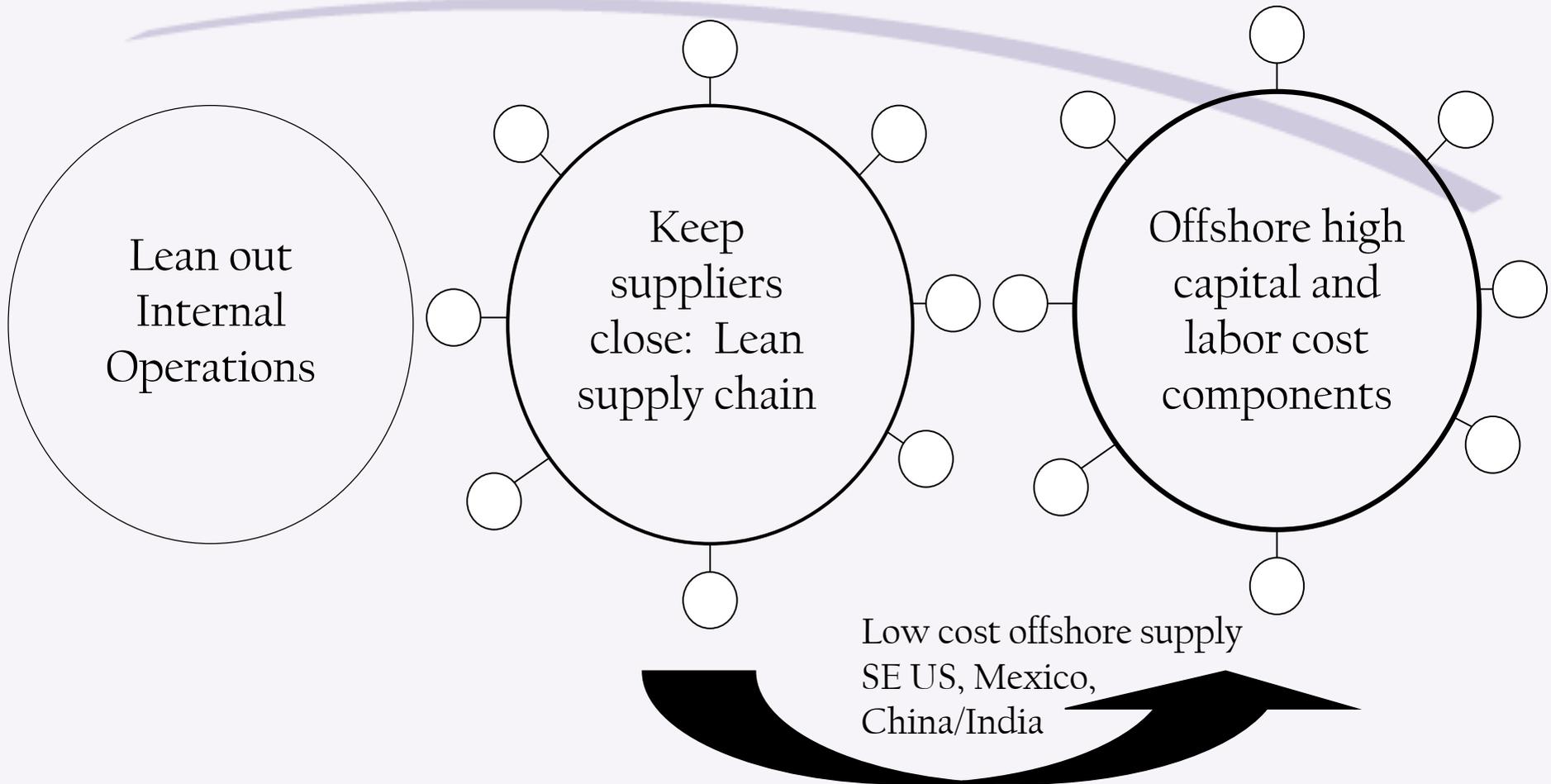
Some Examples

	Before	2001	Today
Slack Adjusters	1991 35,000 ft ² 1,500 in process 2.5 units/person/day	3,000 ft ² 7 in process 22.5 units/person/day	2,800 ft ² 6 in process 28 units/person/day
Locomotive Compressors	1984 2/day 60,000 ft ² hundreds in process 150 - 250 people Standard compressor	4/day 3000 ft ² 4 in process 14 people Many upgrades	4/day 3400 ft ² 3 in process 12 people
Freight Car Valves	1991 46,000 ft ² 420 in process 3.5 valves/person/month 2 combinations	36,000 ft ² 41 in process 11.1 valves/person/month 47 combinations	40,000 ft ² 56 in process 51 valves/person/Month Wilmerding 20 valves/person/month Stoney Creek 47 combinations
Friction Materials	1993 2.5 Million/lb/person/yr 3 formulas 1994 8 hr mold change 7.4 x inventory turns 1992 \$88 sales/man hour	5.0 million/lb/person/yr 12 formulas 6 min mold change 17.3 x inventory turns \$240 sales/man hour	5.2 million/lb/person/yr 28 formulas 19 inventory turns \$257 sales/man hour

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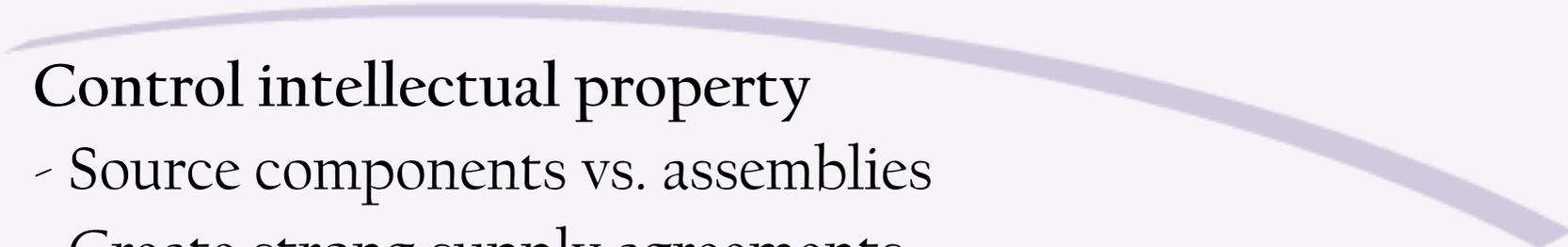


Reasons to Offshore



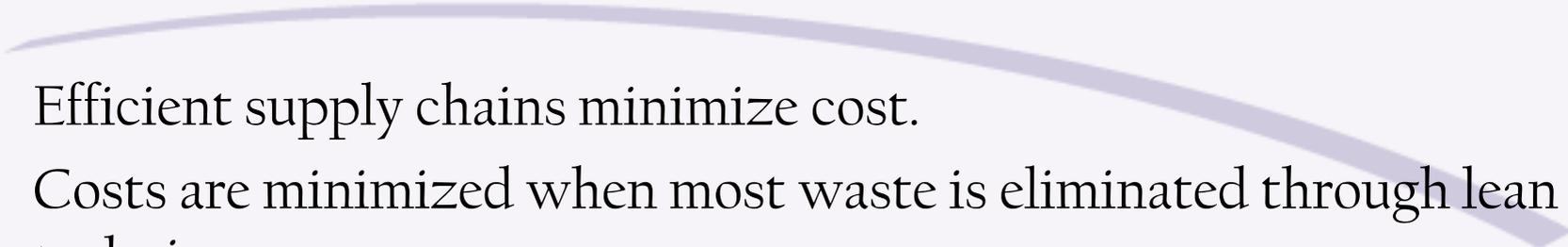
- De-Assetize cyclical businesses
 - Eliminate high fixed cost internal supply
 - Foundries, component machining, fabrication
- Lower cost base for components
 - Compare offshore costs to actual internal cost (not standard cost)
 - Target 30-60% reduction including inventory, transportation

Needed Protections/Mitigate Risk



- **Control intellectual property**
 - Source components vs. assemblies
 - Create strong supply agreements
 - Use reliable suppliers
 - Own facilities vs. outside suppliers
- **Control quality**
 - Retain second sources
 - Establish strong specifications and qualification criteria
- **Control cost**
 - Price FOB landed, not FOB source
 - Price in selling currency
 - Compare actual internal cost, not standard cost

Summary



- Efficient supply chains minimize cost.
- Costs are minimized when most waste is eliminated through lean techniques.
- Lean techniques can be practiced at all levels: core internal operations, local suppliers and offshore supply.
- Core internal operations are those which contain key intellectual property.
- Offshore supply carries risk of loss of quality and intellectual property which needs to be minimized.
- True offshore savings versus internal and local supply is not known unless lean techniques are applied as a part of the culture.
- Outsourcing locally or offshore can minimize fixed costs for cyclical businesses.