LEAN ENTERPRISE

PRINCIPLES AND PRACTICES

September 11, 2002

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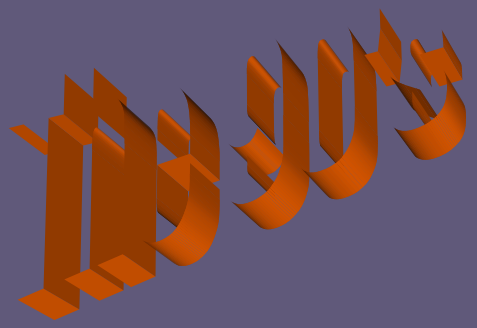
Objectives

- Enterprise perspective
- Enterprise value streams
- Three levels of enterprises
- Stakeholders
- Principles of lean enterprises
- Enterprise value stream analysis

The Early Lean Message



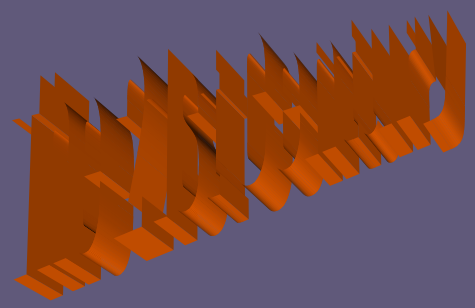
The emphasis was on Lean Production.

… stressed minimizing waste.
Sometimes "less" adds up to "more."

- less waste
- less design time
- less costs
- fewer organizational layers
- fewer suppliers

- more employee empowerment
- more flexibility and capability
- more productivity
- more quality
- more customer satisfaction
- more long-term competitive success

The Evolving Lean Message



The emphasis is on Value Added Activities

Moving beyond lean "production" to an extended lean enterprise.

- Lean Production
- Lean Enterprise
- Extended Lean Enterprise

Enterprise Definition

"One or more persons or organizations that have related activities, unified operation or common control, and a common business purpose"

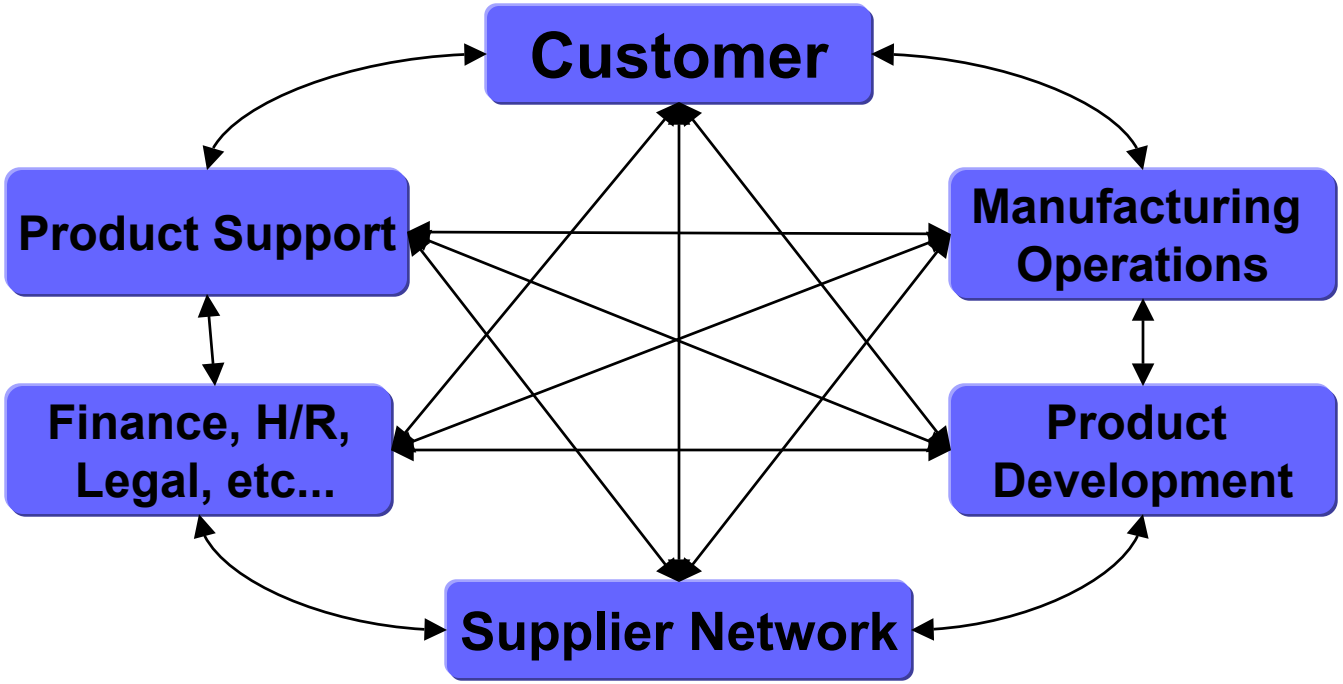
-Blacks Law Dictionary, 1999

Lean Enterprise Defined

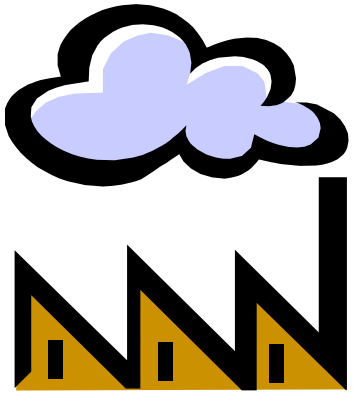
"A lean enterprise is an integrated entity which efficiently creates value for its multiple stakeholders by employing lean principles and practices."

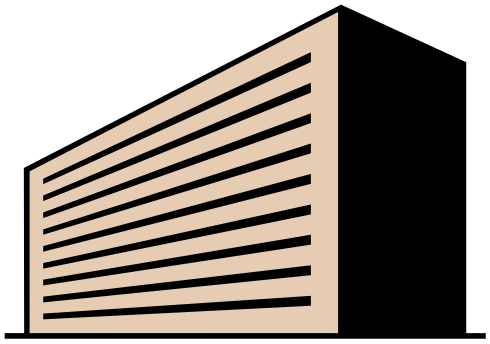
-Lean Aerospace Initiative, MIT, 2001

Integrated Enterprise



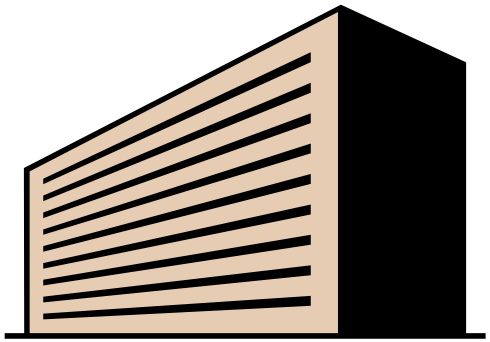
Program Value Stream

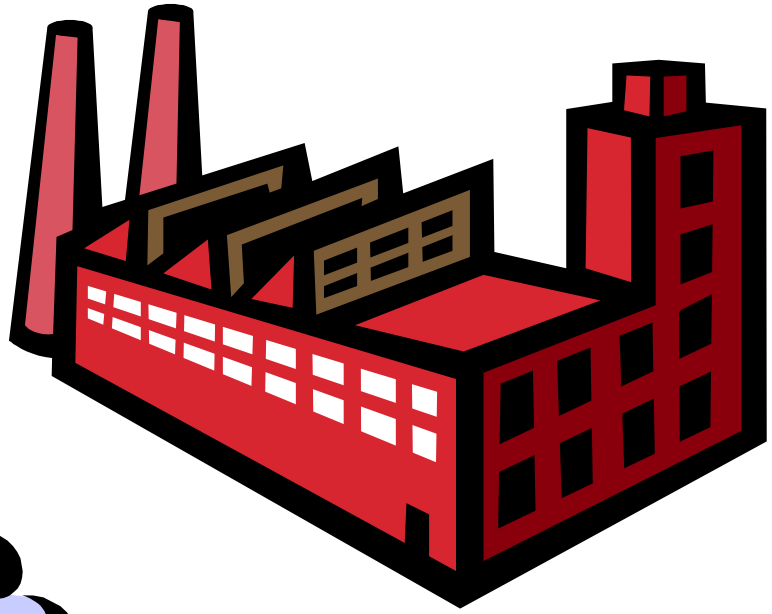


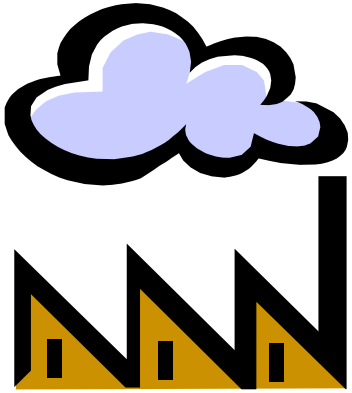


Value

Multi-Program Value Stream







Value

Value

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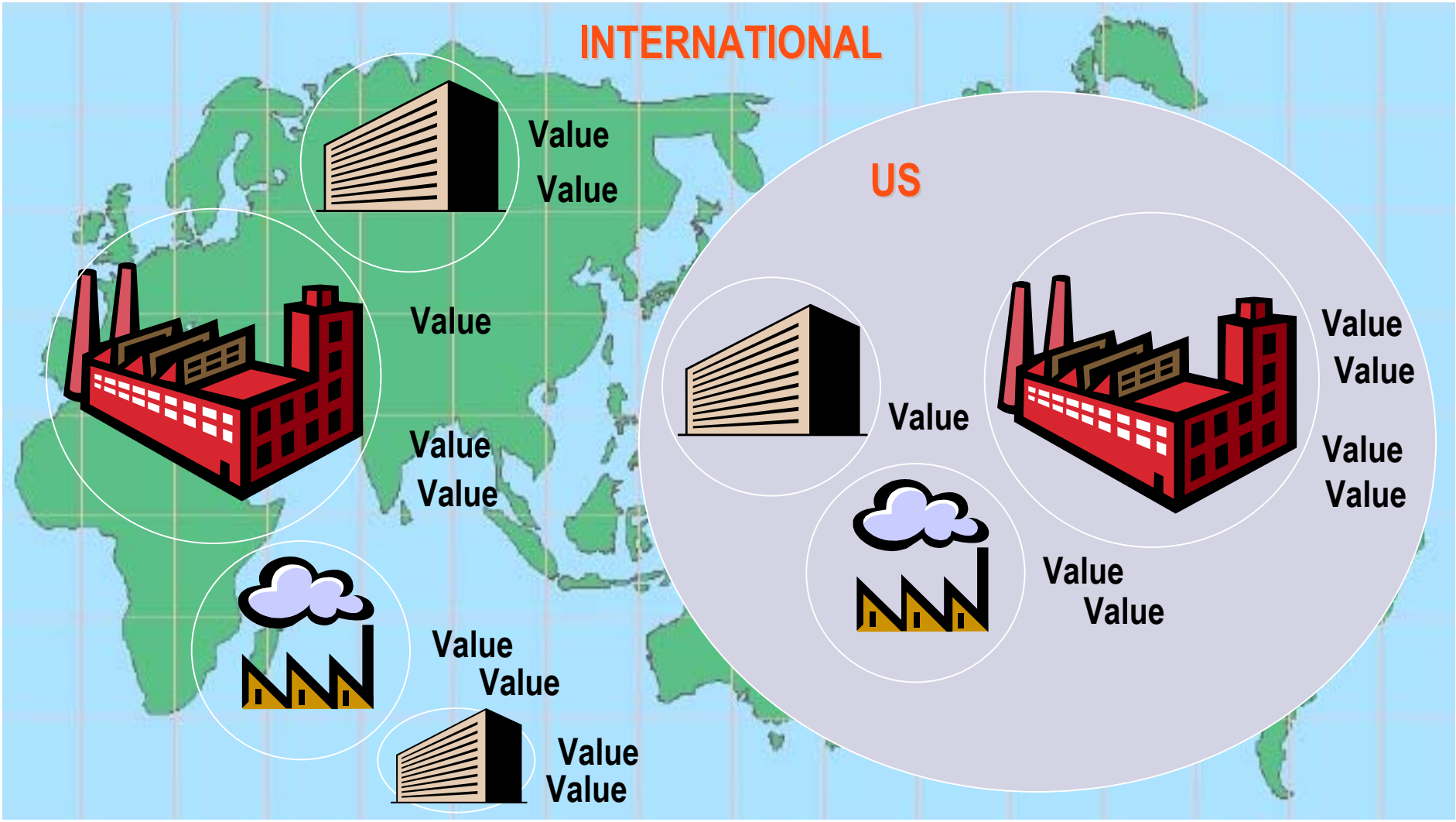
National and International Value Stream



Identify Three Levels of Enterprises

Program	F-22
Multi-Program	Boeing, USAF, Lockheed Martin
National or International	Primes, Suppliers, Government

JSF Example of a Program Enterprise

Centralized Control

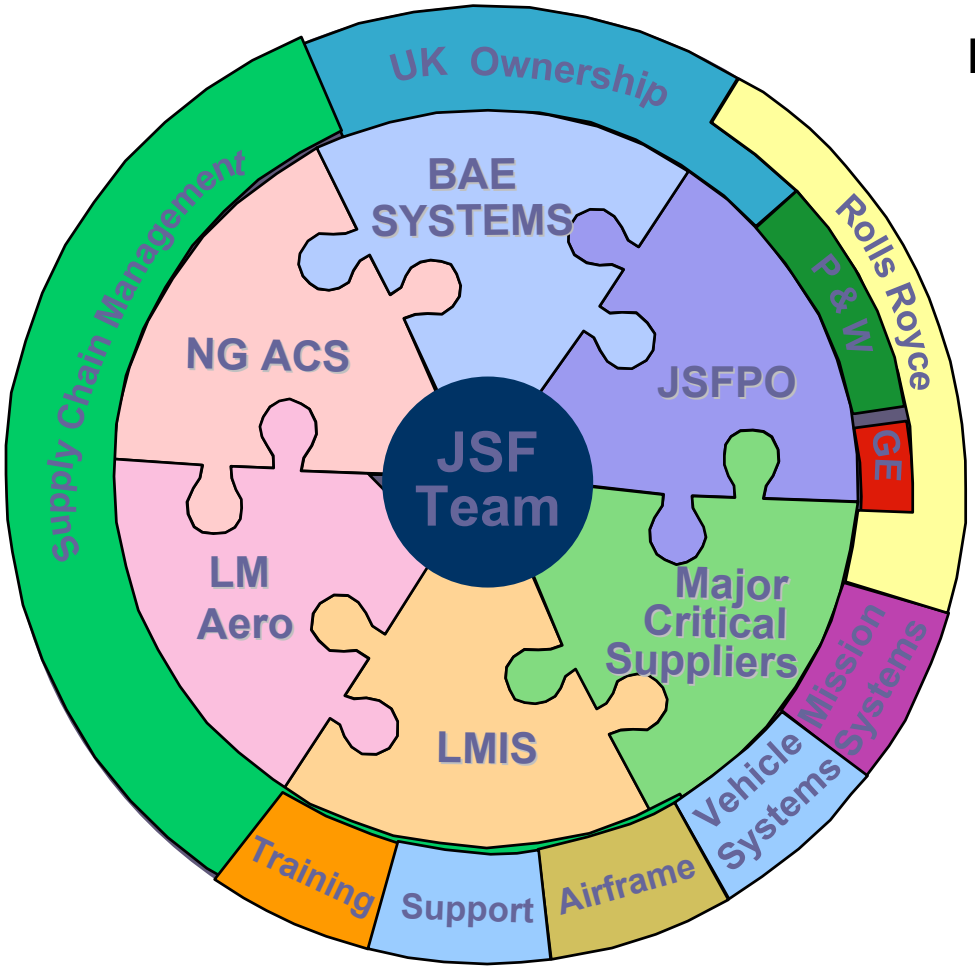
Decentralized Execution

Status at a Glance Metrics

Rapid Decision Making

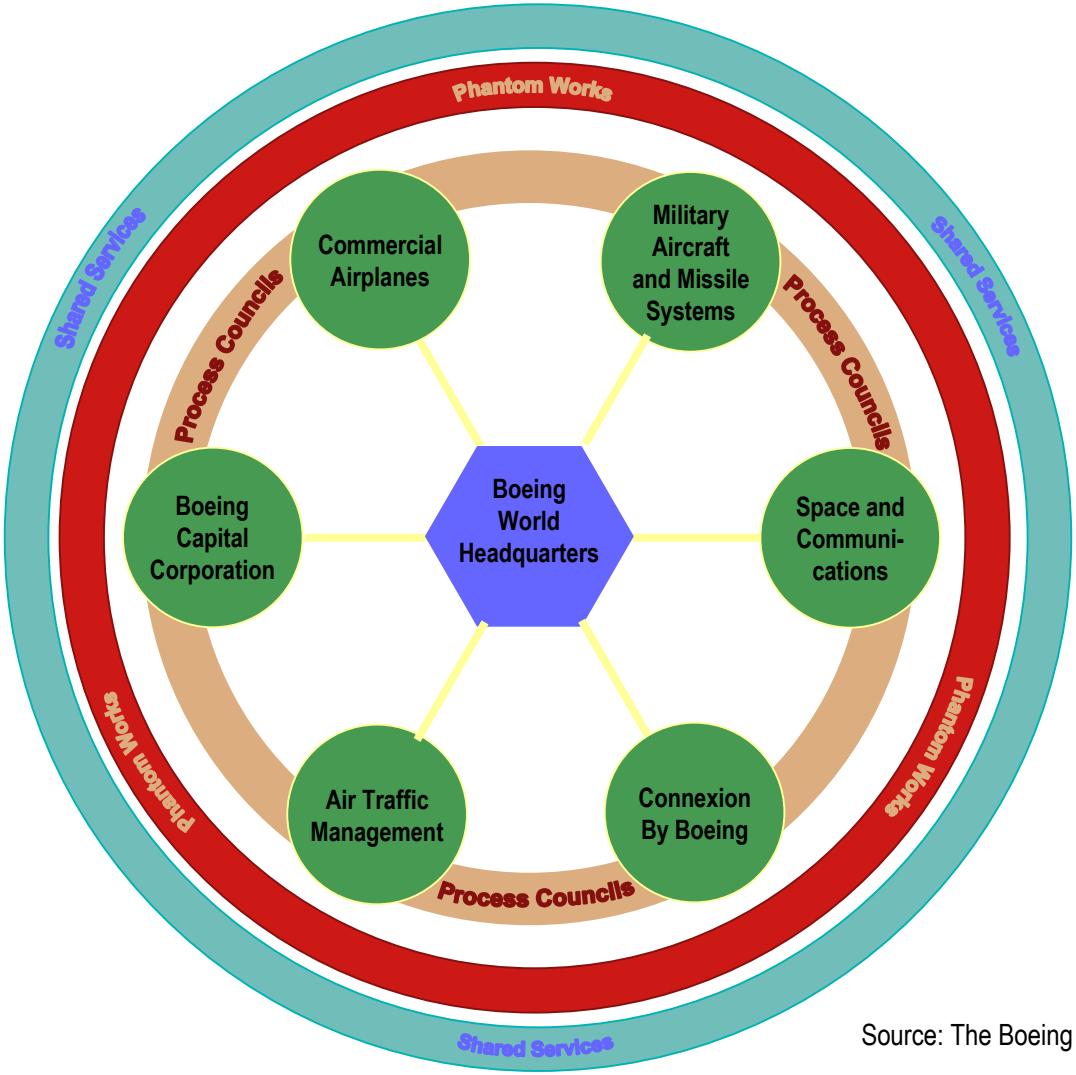
Flexible Repositioning

World Class Team



Source: Lockheed Martin Aeronautics Co. "JSF - A Winning Environment". *Presentation at MIT.* Mar. 6, 2002

Boeing Example of a Multi-Program Enterprise



Source: The Boeing Co. 2001 Annual Report

Customer Value

"Value measures the worth of a product or service to a customer. It is a function of the product's usefulness to the customer, its relative importance to the customer's need, its availability relative to when it is needed, and how much the customer has to pay for it."

-Rebentisch, MIT, 2000

Manufacturing Excellence

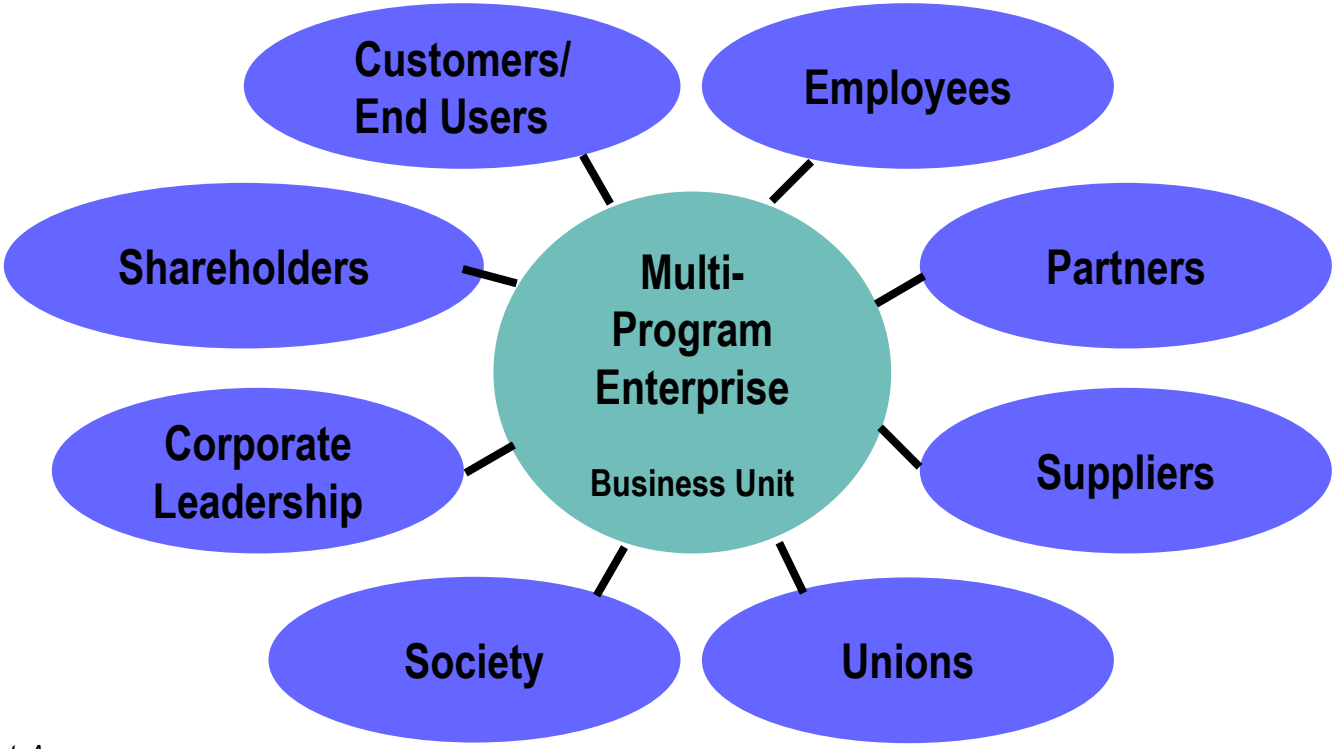
- "...deliver what the customer wants, including design changes, when wanted, where wanted, at reasonable cost, with no quality glitches and no environmental degradation" (Dr. Robert Hall -- Association for Manufacturing Excellence)
- 21st century ideal - meet any need or change instantly

Increased Emphasis on the Customer

- Customer as consumer will play increasingly proactive role
- “Prosumer” -- a customer who participates in own service or order fulfillment
- Prosumers will change character of industry
- Surviving enterprises will be different in form and practice

Stakeholder Defined

Any group or individual who can affect or is affected by the achievements of the organization's objective*



* Source: Freeman, *Strategic Management: A Stakeholder Perspective*, Pittman, 1984

Lean Enterprise System

- A Lean Enterprise Requires the Integration of
  - Processes
  - People / Organization
  - Information
  - Technology
- Holistic View
- Enterprise as a System

Lean Thinking Embraces the Entire Enterprise Value Stream, Focuses on Processes, Cuts Across all Functions & Covers all Phases of the Product Lifecycle

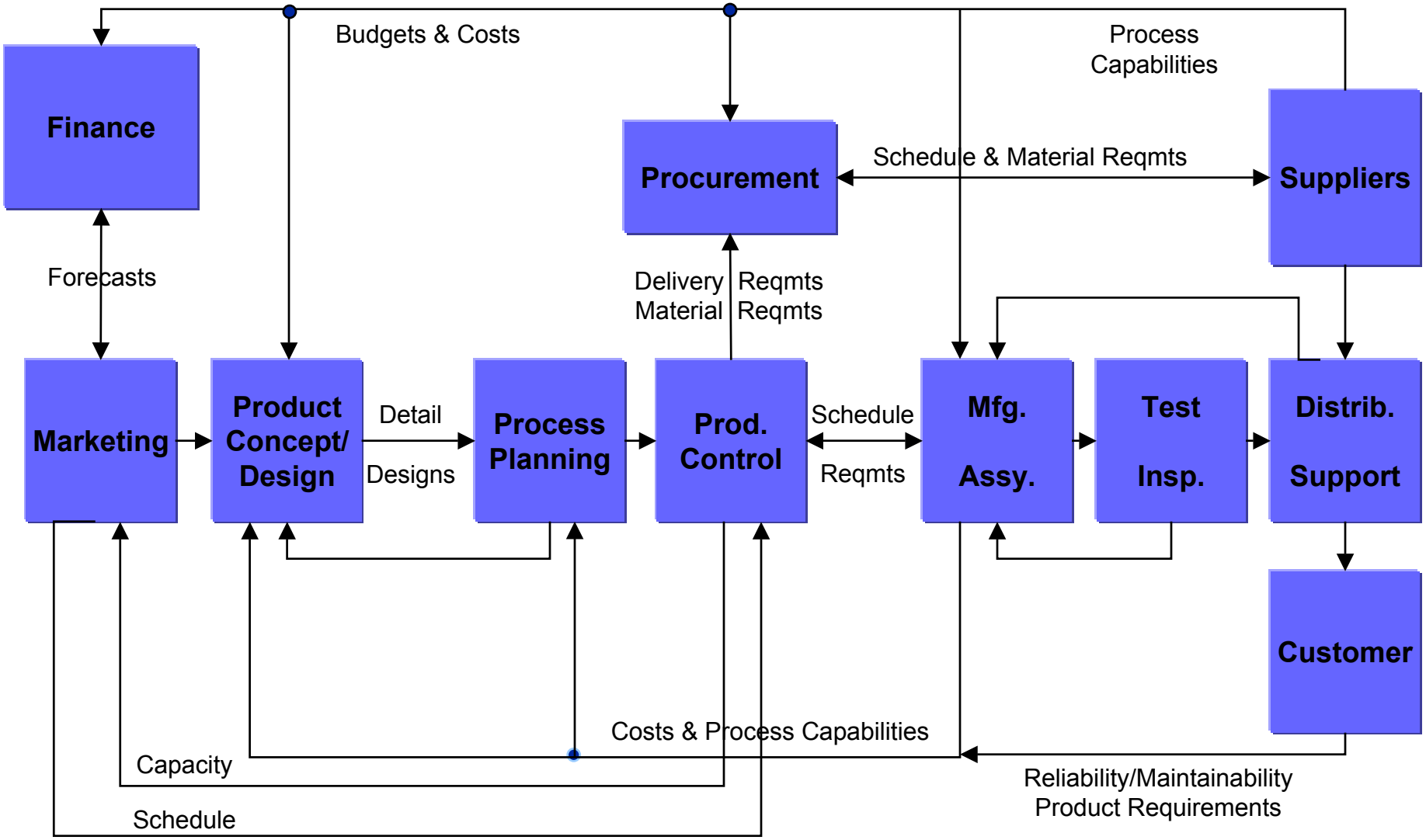
- Enterprise perspective: Lean requires an enterprise perspective, encompassing the entire enterprise value stream (extended enterprise), for successful implementation
- Process focus: Lean views the enterprise as a network of processes; optimizing each process does not optimize the entire set of enterprise processes
- Functional integration: Lean cuts across & integrates all enterprise functions (product development, manufacturing, finance, human resources, customer support)
- Lifecycle orientation: Lean spans from product development to production to operations & support to deliver best lifecycle value

Best Life Cycle Value

"A product introduced at the right time and for the right price which delivers best value in mission effectiveness, performance, affordability, and sustainability, and comparatively retains these advantages over the useful life of the product."

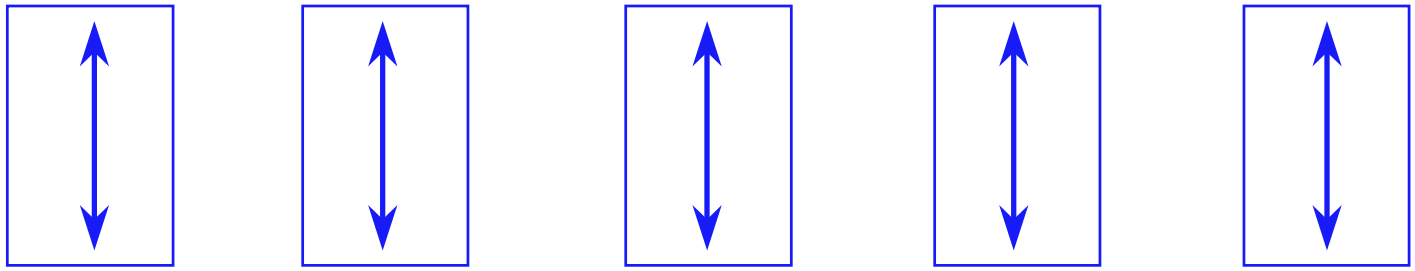
- Murman et al, MIT, 2000

Processes Must Be Integrated to Deliver Value

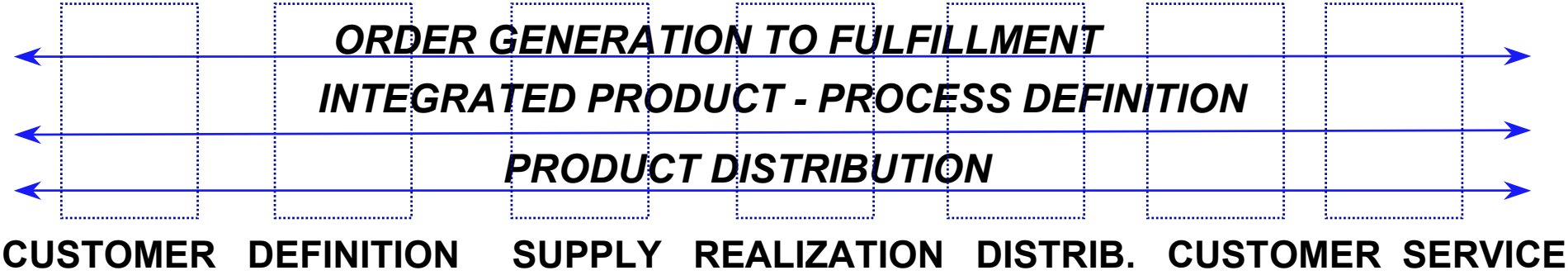


Traditional vs. Core Process

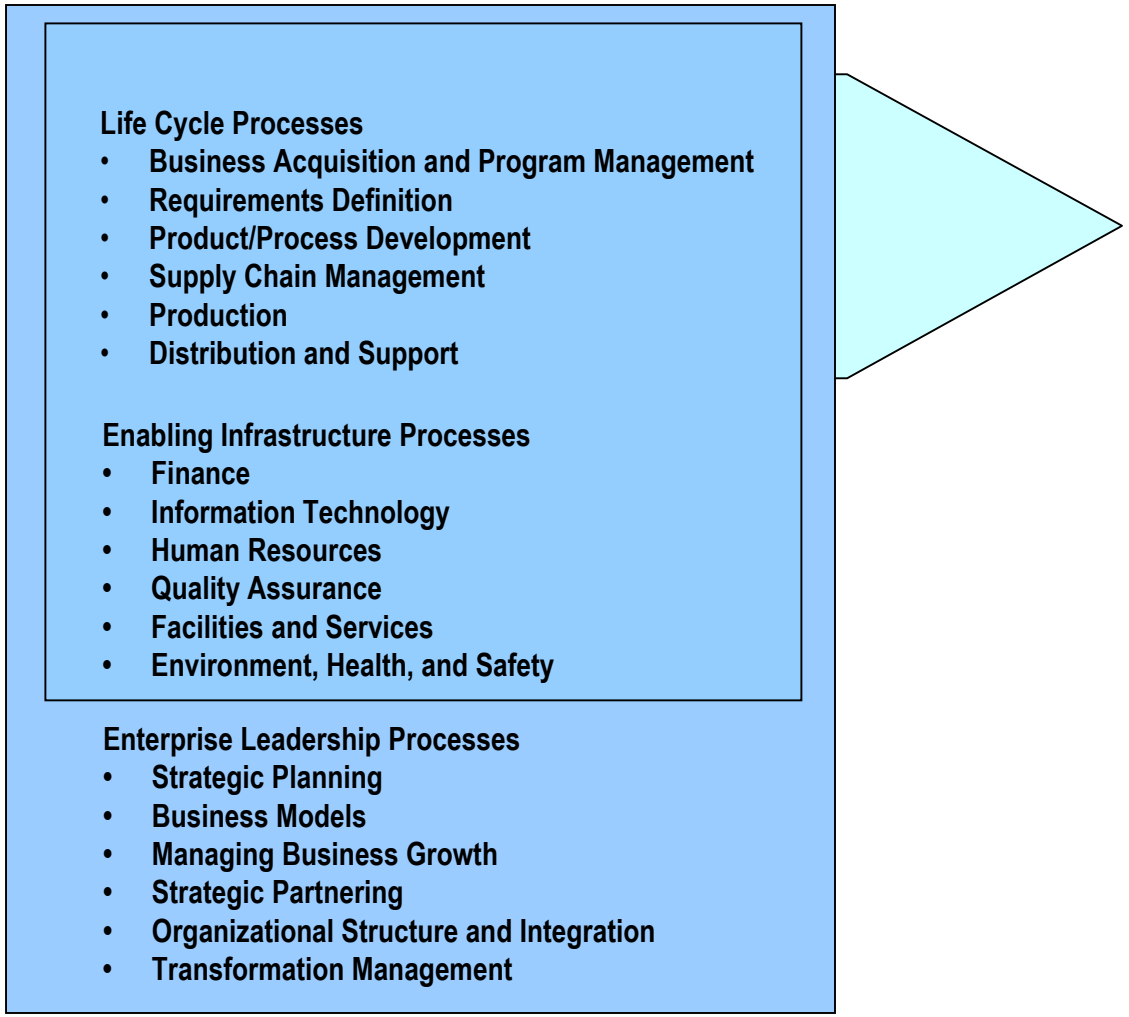
TRADITIONAL



Core Process Approach



Enterprise Process Architecture



What is the Vision of the Future Lean Industrial Base?

A Future Manufacturing Base That Responds Quickly and Efficiently to Gov't and Commercial Sector Needs

Characteristics and Competencies of This Future Industrial Base

- Workforce
- Products
- Organizations
- Customer

Vision of the Future Lean Industrial Base: Workforce

- Flexible organizations where workers are treated as the most valuable company resource
- Multi-skilled, continuously trained, highly committed workforce
- Easy access to industry knowledge, data, and lessons learned
- Advanced, integrated information systems
  - Seamless access to information without regard to geographic distance or corporate boundaries
  - Revolution in manner in which individuals work individually and together

Vision of the Future Lean Industrial Base: Products

- Dramatically reduced costs, cycle times, and improved quality in all aspects of product life cycle
- Technical risk, producibility, and affordability will be considered early in R&D process
- Quantum advances in key materials technologies including composites, metal alloys, and ceramics
- Modular systems and low-cost upgrades to take advantage of technology advances
- Extensive use of Commercial standardized components in military applications

Vision of the Future Lean Industrial Base: Organizations

- Agile engineering and manufacturing systems
- Seamlessly integrated flexible supply chains
- Expansive use of partnerships to achieve product, technology, and service breakthroughs
- Civil and military industrial bases will be more fully integrated
- Globally competitive companies and leadership
- Virtual Enterprises on a global basis

Vision of the Future Lean Industrial Base: Customer

- Quick response to global queries for products with affordable, high-quality solutions
- Products enter production with predictable and affordable costs, schedules, and funding
- Global customers delighted by quality, price, and environmental friendliness

Lean Enterprises Principles

- Create lean value by doing the job right *and* by doing the right job.
- Deliver value only after identifying stakeholder value and constructing robust value propositions.
- Fully realize lean value only by adopting an enterprise perspective.
- Address the interdependencies across enterprise levels to increase lean value.
- People, not just process, effectuate lean value.

** Source: "Lean Enterprise Value"*

Lean Enterprise Model (LEM)

Lean Aerospace Initiative

What is the LEM?

- A systematic framework for organizing and disseminating LAI research results
- Comprised of lean enterprise principles, practices and metrics
- Populated by data derived from surveys, case studies and other research activities

A Major Product of the Lean Aerospace Initiative!

The LEM is a "Lean" Enterprise Tool

- Assists in the self-assessment of leanness of consortium organizations and processes
  - By examination of existing practices
  - By comparison of quantitative performance
  - By assessment of rate of improvement
- Serves as a guide for identifying leverage points for organizational change
- Provides insights as to where lean efforts should be directed

Supports Consortium Members in their Journey toward Lean

Lean Enterprise Model

Practices and Benchmark Data

Meta-Principles/Enterprise Principles

Enterprise Level Metrics

Overarching Practices

Identify & Optimize Enterprise Flow	Assure Seamless Information Flow	Optimize Capability & Utilization of People	Make Decisions at Lowest Possible Level
Implement Integrated Product & Process Development	Develop Relationships Based on Mutual Trust & Commitment	Continuously Focus on the Customer	Promote Lean Leadership at all Levels
Maintain Challenge of Existing Processes	Nurture a Learning Environment	Ensure Process Capability and Maturation	Maximize Stability in a Changing Environment

Metrics - Barriers - Interactions

Data Sheets (~225)

Enabling Practices (~ 60)
Metrics -Data - Barriers - Interactions

Supporting Practices(~300)

Internet Links (~600)

LEM Overarching Practices Address People and Process

People Practices

- Promote lean leadership at all levels
- Relationships based on mutual trust and commitment
- Make decisions at lowest appropriate level
- Optimize capability and utilization of people
- Continuous focus on the customer
- Nurture a learning environment

Process Practices

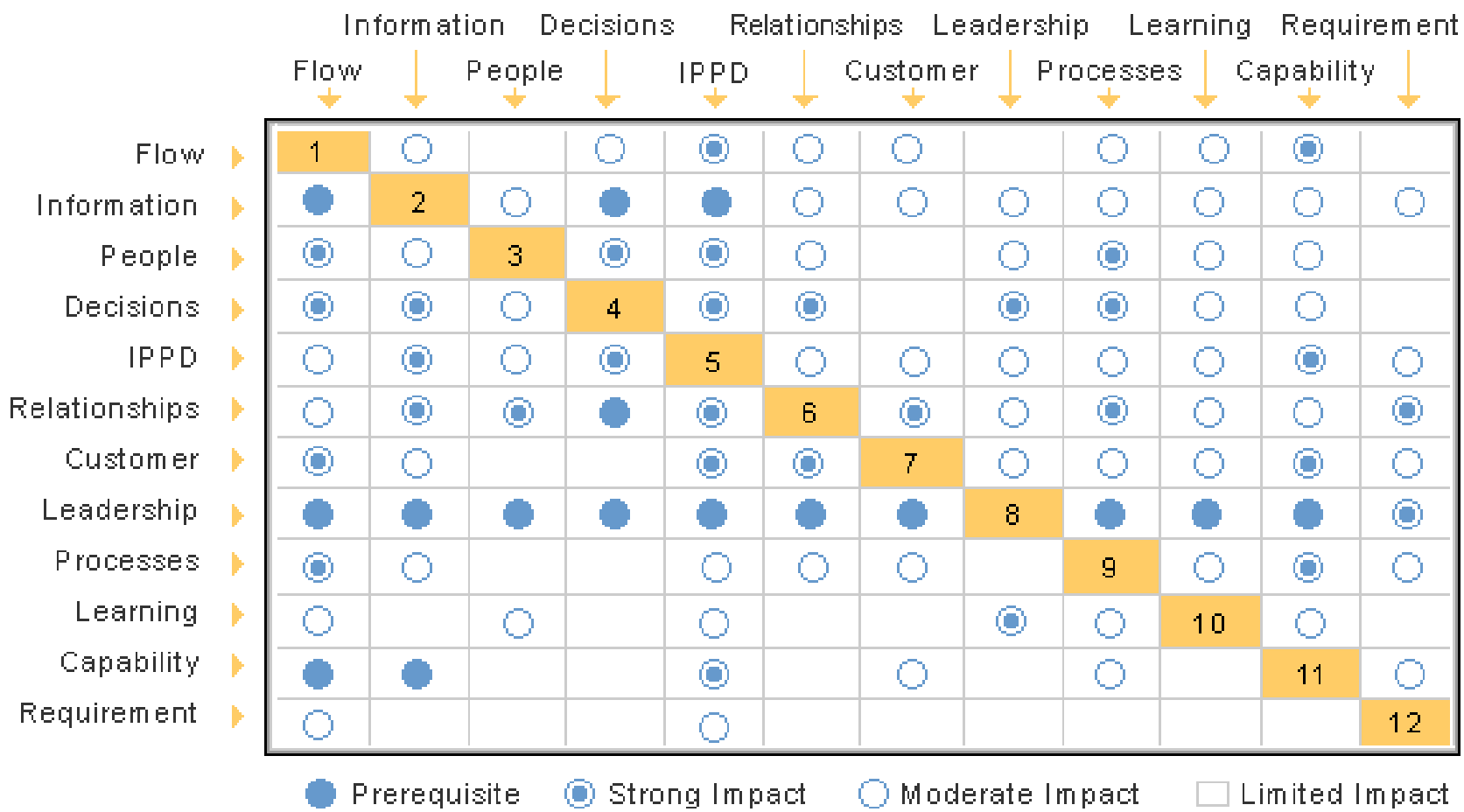
- Assure seamless information flow
- Implement integrated product and process development (IPPD)
- Ensure process capability and maturation
- Maintain challenges of existing processes
- Identify and optimize enterprise flow
- Maintain stability in changing environment

LEM Principles Enterprises

- Waste minimization
- Responsiveness to change
- Right thing at right place, and in right quantity
- Effective relationships within the value stream
- Continuous improvement
- Quality from the beginning

**Source: LAI*

OAP Interaction Matrix



Where Should Enterprises Begin?

	Actual Cost Percentage	Life Cycle Cost Influence Percentage
Product/Process Design	5 %	70 %
Material	50 %	20 %
Labor	15 %	5 %
Overhead	30 %	5 %

From Ford Motor Company Information, reflecting leverage for improvements in life cycle costs.

Source : Boothroyd and Dewhurst

Enterprise Value Stream Analysis