Supplier Networks Transformation Toolset (VERSION 1.0)

Presented By

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LEAN AEROSPACE INITIATIVE

Background

- **The Supplier Networks TransformationToolset updates and expands an earlier LAI framework for lean supply chain management (1995)**
- **Toolset "pulled" by LAI consortium members to meet an important & growing need**
  - What are lean supply chain management concepts and practices?
  - How do we develop lean supplier networks?
  - How do we assess where we are in evolving lean supply chain management capabilities?
- **Toolset differs from tools that LAI member companies use to assess the "leanness" of their own individual supplier companies**
- **Toolset has been developed by the Supplier Networks Working Group representing a cross-section of LAI community**
- **Toolset Version 1.0 is introduced after an extensive alpha & beta testing process**

Supplier Networks Transformation Toolset-- Quick Overview

- **What does it do?**
  - Provides an integrated framework for transforming aerospace supplier networks
- **Who should use it?**
  - Targeted for use primarily by primes and first-tier suppliers
  - Supply chain management, engineering, manufacturing & other parts of the enterprise
- **What are the benefits?**
  - Significantly enhanced competitive advantage (lower costs, higher quality, reduced reduced cycle time) throughout the enterprise's end-to-end-linked value stream
  - Greater value creation for multiple enterprise stakeholders

Core Concepts

Creation of value for multiple enterprise stakeholders through:

- **Network-wide thinking --** System optimization rather than local optimization; dynamic, adaptive, learning network; multilateral relationships rather than bilateral relationships; deliberately constructed, not an accident of history.
- **Network-wide mutual trust and commitment --** Shared vision, goals and objectives; mutual commitment "in good times and bad'; risk-sharing, cost-sharing; knowledge-sharing relationships; across multiple programs & over program lifecycle; balance between competition and cooperation.
- **Sustained competitive advantage for the network --** Customer-focused delivery of value to multiple stakeholders; lifecycle perspective; culture of continuous improvement; building dynamic capabilities by fostering on-going innovation across the network.

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Key Principles

- Optimize network-wide efficiency
- Create mutually-beneficial relationships
- Instill a culture of customer-focused best value solutions
- Ensure visibility and transparency throughout the network
- Foster innovation across the network
- Enable a robust and adaptive network

Lean Supply Chain Management– Overarching Practices

1.0 Design supplier network architecture ***Design size, structure & composition of supplier network to ensure efficient creation of value for all stakeholders.***
2.0 Develop complementary supplier capabilities ***Develop complementary supplier capabilities to help enhance the portfolio of competencies in the extended enterprise.***
3.0 Create flow and pull throughout supplier network ***Create synchronized flow throughout supplier network to evolve "pull"-based production system that ensures continuous flow maximizing advantage of speed.***
4.0 Establish cooperative relationships and effective coordination mechanisms ***Develop a differentiated set of relationships with suppliers including supplier partnerships and strategic alliances, while balancing cooperation and competition, to optimize network-wide performance.***
5.0 Maximize flexibility and responsiveness ***Integrate processes, practices and information flows across the supplier network to maximize network-wide flexibility, adaptability and responsiveness to cope effectively with sudden external developments.***

SOURCE: K. Bozdogan

Lean Supply Chain Management -- Overarching Practices

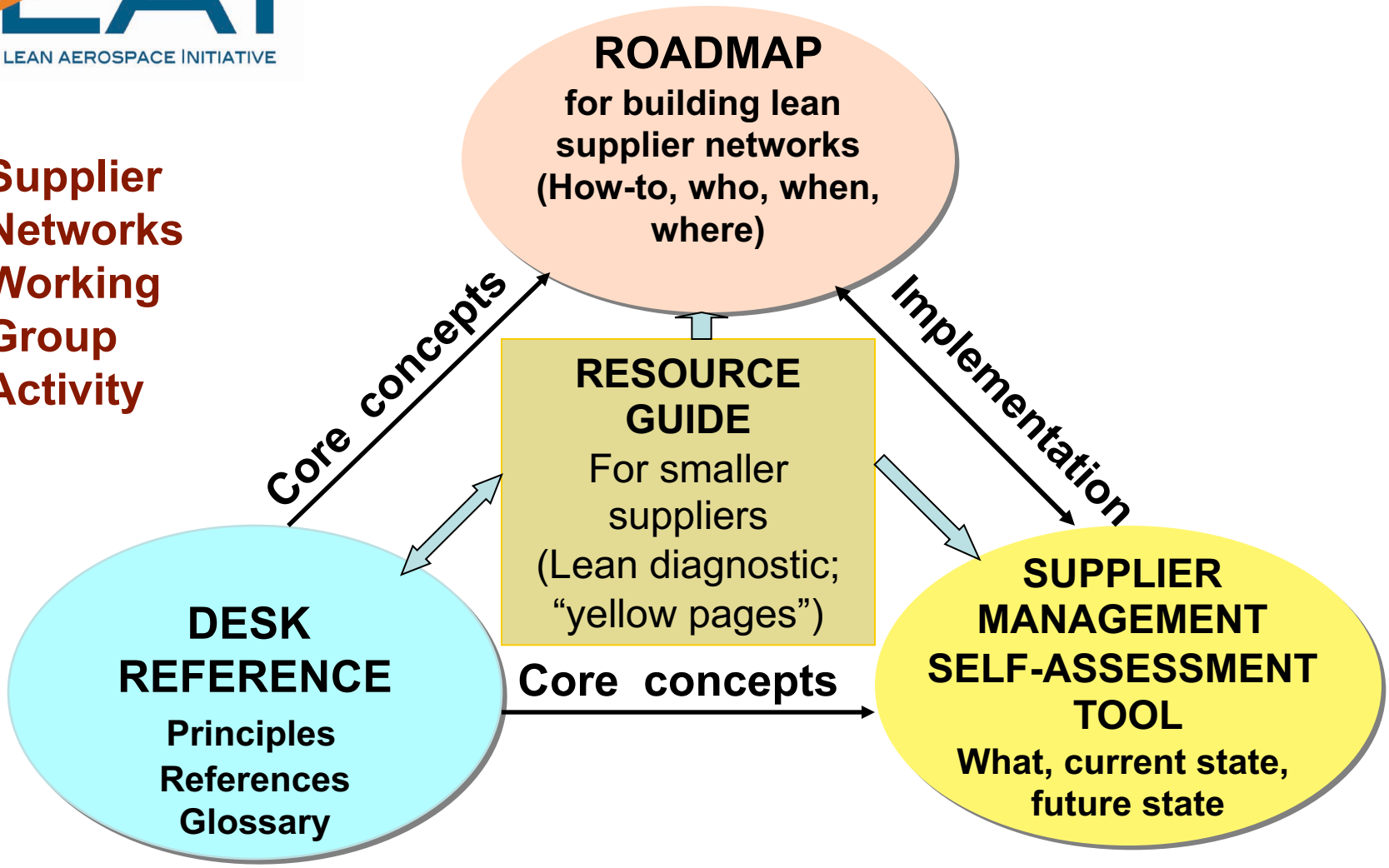
6.0 Pursue supplier-integrated product and process development ***Integrate suppliers early into the design process to ensure delivery of best lifecycle value.***
7.0 Integrate knowledge and foster innovation ***Create knowledge-sharing processes and foster innovation across the supplier network to ensure continuous flow of innovative solutions benefiting the customer and other enterprise stakeholders.***
8.0 Demonstrate continuous performance improvement ***Institutionalize formal processes and reward systems for continuous improvement throughout the supplier network to deliver best value to all stakeholders on an on-going basis.***

SOURCE: K. Bozdogan

OVERVIEW OF THE TOOLSET

LEAN AEROSPACE INITIATIVE

Supplier Networks Working Group Activity



OBJECTIVE: Enable the transformation of existing aerospace enterprise supplier networks through the adoption of lean supply chain management concepts and principles to build high-performance, innovative, adaptive, value-creating, supplier networks through the accelerated adoption of lean supply chain management concepts, principles, and practices

Focus Here on the Roadmap and Self-Assessment Tools

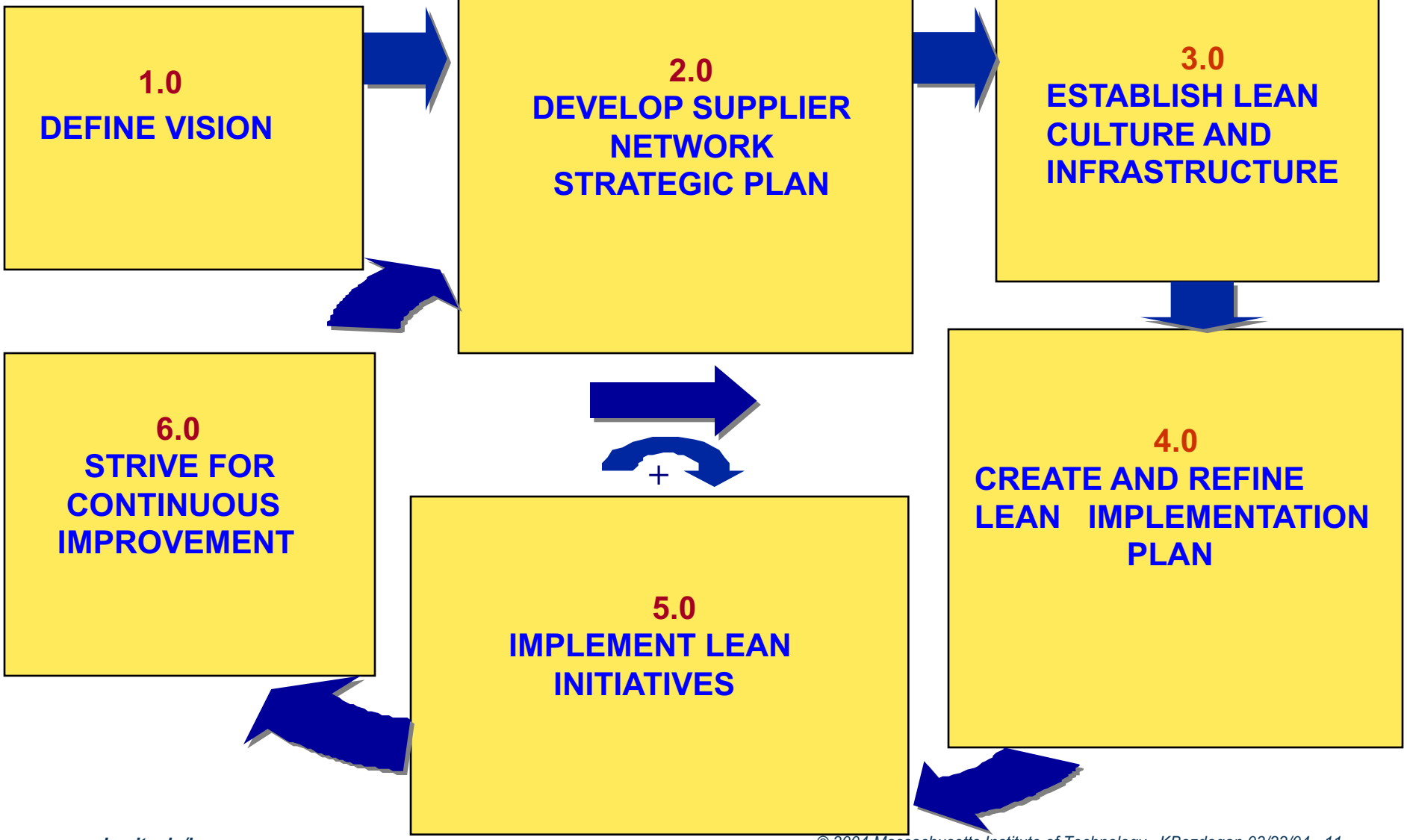
These two tools are integrated and should be used together

- **ROADMAP TOOL**
  - Provides "how-to" structured implementation guide for transforming supplier networks (from "as-is" to "to-be-lean")
  - Emphasis on processes
- **SELF-ASSESSMENT TOOL**
  - Enables self-assessment of progress made in evolving lean supply chain management capabilities
  - Emphasis on practices ("what")
- **The combined toolset fills a real need in the aerospace industry and can serve as a new industry standard in the future for building lean supplier networks**

ROADMAP Tool

- **Represents a "how-to" guide**
  - Focuses on actionable roadmap for building lean supplier networks
  - Designed to accelerate supplier integration efforts of member companies
- **Links to Transition-to-Lean Roadmap (TTL)**
  - Follows similar process architecture
  - Concentrates on putting into place lean supply chain management processes
- **Defines major building blocks & specific steps**
  - Lays out implementation actions & sequences
  - Identifies relationships & feedback loops
- **Provides implementation aids (Roadmap Explorations)**
  - Defines inputs, outputs, barriers, enablers, potential metrics & tools/methods
  - Addresses "why", "what", "who", "how", "where" & "when" questions and identifies potential "tensions" that should be anticipated & addressed
- **Guides enterprises at different stages in lean journey**
  - Can be used to accelerate on-going lean transformation efforts
  - Can also be used by companies in early stages of lean journey

ROADMAP: Major Building Blocks



ROADMAP: Major Building Blocks and Implementation Steps

1.0 Define Vision

1.1 Develop knowledge of basic lean supply chain design & management principles

1.2 Ensure stakeholder commitment & align expectations

1.3 Define enterprise vision for supplier integration

1.4 Establish guiding principles for strategic planning of supplier network

2.0 Develop Supplier Network Strategic Plan

2.1 Develop operational knowledge of lean supply chain design & management principles

2.2 Define value creating processes across the supplier network

2.3 Perform self-assessment of supplier network management using the Supplier Management Assessment Tool

2.4 Define future state goals and metrics (consider assessment results and enterprise objectives)

2.5 Develop strategic plan

2.6 Define roles and responsibilities, relationships, governing principles and rules of behavior

2.7 Define infrastructure support requirements

2.8 Develop resource plan for executing strategic plan

3.0 Establish Lean Culture and Infrastructure

3.1 Align organizational structure and interfaces

3.2 Align processes and procedures

3.3 Align and develop IT/IS infrastructure

3.4 Align incentives

3.5 Identify & empower change agents

3.6 Develop knowledge infrastructure and expertise for lean transformation

4.0 Create and Refine Lean Implementation Plan

4.1 Define, map and analyze supplier network value stream

4.2 Create tactical metrics and implementation plans to address gaps identified in self- assessment

- *Design supplier network architecture*
- *Develop complementary supplier capabilities*
- *Create flow and pull throughout supplier network*
- *Establish cooperative relationships & effective coordination mechanisms*
- *Maximize flexibility & responsiveness*
- *Pursue supplier-integrated product and process development*
- *Integrate knowledge and foster innovation*
- *Demonstrate continuous improvement*

4.3 Assemble and provide training utilizing implementation tools (consult Reference Guide)

4.4 Commit resources for lean implementation

5.0 Implement Lean Initiatives

5.1 Communicate goals, objectives and metrics throughout the supplier value stream

5.2 Implement lean transformation initiatives (on-going)

- *Design supplier network architecture*
- *Develop complementary supplier capabilities*
- *Create flow and pull throughout supplier network*
- *Establish cooperative relationships & effective coordination mechanisms*
- *Maximize flexibility & responsiveness*
- *Pursue supplier-integrated product and process development*
- *Integrate knowledge and foster innovation*
- *Demonstrate continuous improvement*

5.3 Capture feedback on strategic barriers to lean implementation

6.0 Strive for Continuous Improvement

6.1 Evaluate results against future state goals and metrics (for all eight practice areas)

6.2 Communicate needed changes in vision, strategy, support infrastructure, implementation plan & strategy

6.3 Modify and refine tactical implementation plans

- Measure progress (metrics)
- Report metrics (ROI, "lean dividend")
- Define areas for further improvement
- Recognize achievements
- Transfer ownership of lean process to suppliers

6.4 Nurture the process of continuous improvement (internal, external)

6.5 Capture, adopt, and share new knowledge

Supplier Management Self-Assessment Tool

- **Enables self-assessment of lean progress**
  - Addresses: “How much progress have we -- as an enterprise -- made in evolving lean supply chain management capabilities”?
  - Complements tools used to assess “leanness” of suppliers
- **Links to Lean Enterprise Self-Assessment Tool (LESAT)**
  - Follows similar process architecture
  - Defines 5 capability maturity levels
- **Defines lean practices; provides diagnostics & metrics**
  - Defines 8 overarching *and* 30 enabling practices
  - Provides diagnostic questions & lean indicators
  - Identifies potential metrics
- **Organized as a user-friendly tool**
  - EXCEL-based
  - Provides automated self-scoring
  - Generates summary tables and charts

Supplier Management Self-Assessment Tool

Generic Capability Maturity Levels*

Level I — **Traditional --** Very little awareness of this practice; sporadic improvement activities may be under way in a few areas.

Level II — **Adopter -** General but limited awareness; informal and piecemeal approach deployed in a few areas focusing on specific projects with varying degrees of effectiveness and sustainability.

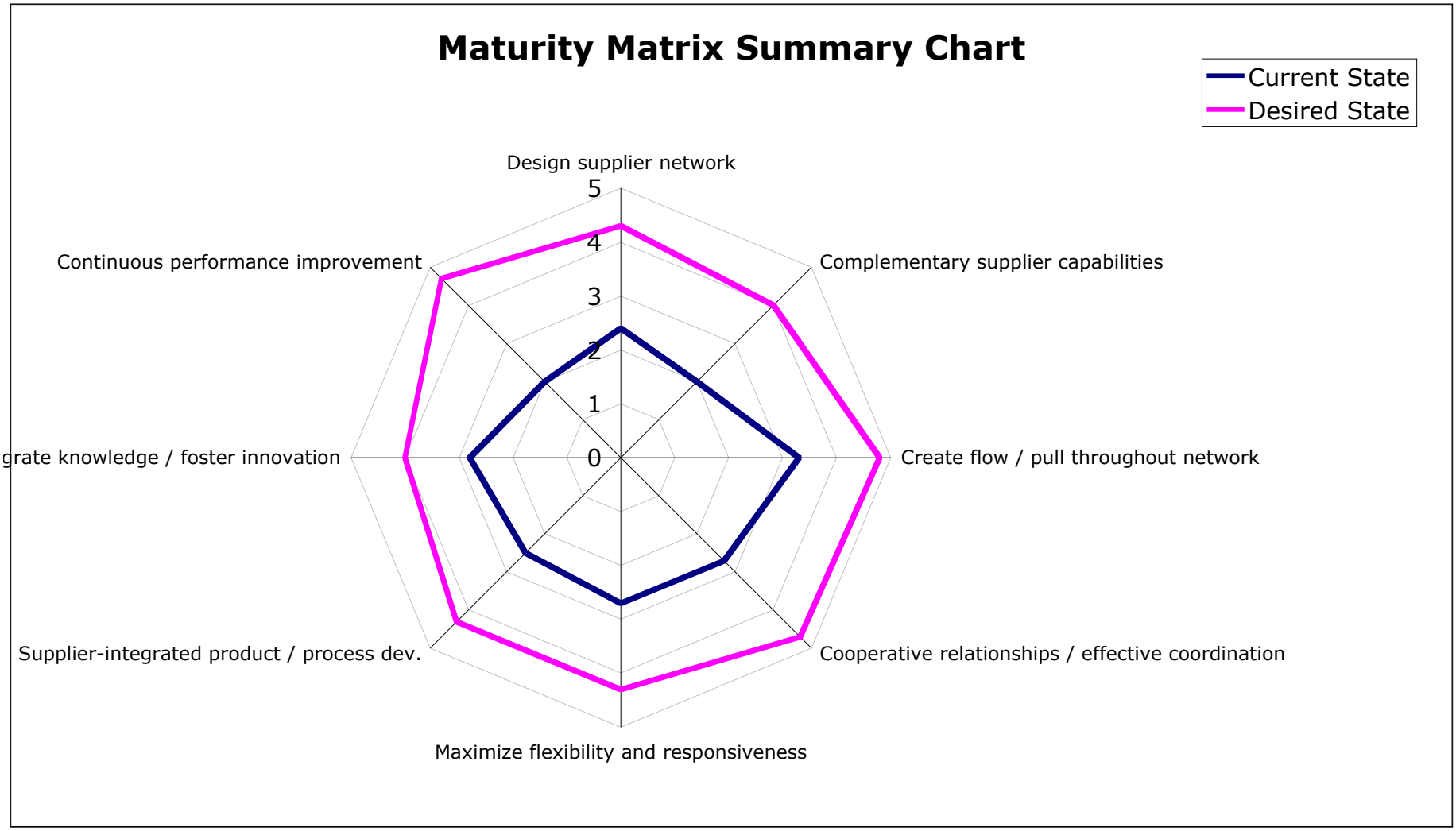
Level III — **Performer -** A systematic approach is deployed in all appropriate areas, functions and processes, with appropriate metrics; varying stages of implementation across most areas, exhibiting varying degrees of success; some deployments are still in relatively early stages.

Level IV — **Reformer -** On-going deployment, refinement and continuous improvement of applicable practices across the enterprise, facilitated by the use of appropriate metrics, exhibit mature, well-developed approach.

Level V — **Transformer -** Exceptional, well-defined, innovative approach is fully deployed across the extended enterprise; recognized as world-class best practice.

***Note:** Levels are cumulative; each higher level represents the achievement of the prior levels.

Summary of Self-Assessment Scores (Illustrative Radar Chart)

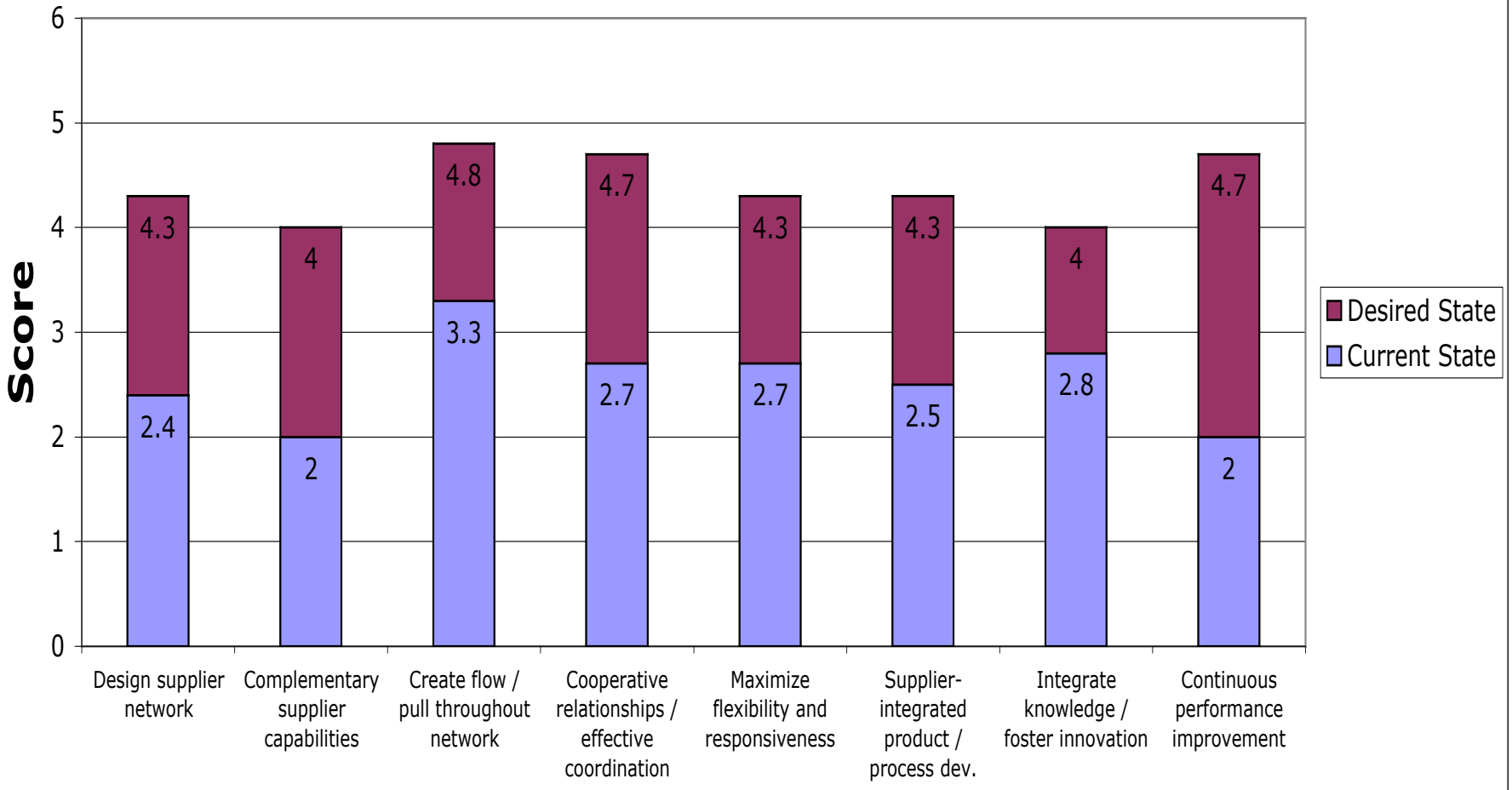


SOURCE: K. Bozdogan

Summary of Self-Assessment Scores

(Illustrative Bar Chart)

Maturity Matrix Summary Chart



SOURCE: K. Bozdogan

web.mit.edu/lean

Progress Report

- **VERSION 1.0 -- Roadmap and Self-Assessment** Modules (COMPLETED)
  - Alpha & beta-tested
  - Detailed descriptions of these two core modules are provided as separate full-length documents (attached)
- **VERSION 2.0** – (PLANNED; NOT EXECUTED DUE TO TIME ANDS RESOURCE CONSTRAINTS)

  The plan was to include two more modules to the toolset:

  - **Desk Reference:** Core concepts & principles; glossary
  - **Resource Guide:** Basic lean resource guide for smaller suppliers (“yellow pages”)

Desk Reference (As it was planned)

- Summarizes basics of lean enterprise thinking
- Explains core concepts & principles guiding the development of lean supplier networks
- Presents lean glossary
- Shows links to related LAI products & tools
- SUGGESTION: In lieu of the planned Desk Reference Module, please refer to the ATTACHMENT – RESEARCH AND PUBLICATIONS

Resource Guide (As it was planned)

- Designed to help primes and major suppliers raise the "lean awareness" of their lower-tier suppliers
- Also intended as a "go to" resource guide for smaller suppliers not ready or likely to benefit fully from the other modules of the toolset
- Provide:
  - Quick overview of lean concepts
  - Answers to frequently asked questions
  - Short descriptions of key lean practices & references
  - List of other resources ("yellow pages") -- publications, websites, videos, lean tutorials, bibliography
  - LAI tools

SUGGESTION: As a partial Resource Module, please see the Supplier Management Self-Assessment Tool "Lite"

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ATTACHMENT

RESEARCH AND PUBLICATIONS

Research & Publications (1)

Developments in aerospace supply chain management practices

- Dr. Maryellen Kelley (NIST; formerly Carnegie-Mellon Univ.) and Cynthia Cook (Harvard Univ.), "The Institutional Context and Manufacturing Performance: The Case of the U.S. Defense Industrial Network," Working Paper (Revised/Updated Mar 98). Paper based in part on LAI-supported research.
- Ernest (Jay) Campbell, *Transition to Commercial Practices in the U.S. Aircraft Industry*, MS Thesis, Sloan School of Management; Thesis Supervisors: Dr. Donald Rosenfield and Dr. K. Bozdogan (May 98)
- William Gostic, *Supply Chain Management Practices in the U.S. Engine Sector,* MS Thesis, Sloan Fellows Program, Sloan School of Management; Thesis Supervisors: Dr. Donald Rosenfield and Dr. K. Bozdogan (May 98)
- Daglar Cizmeci, *Boeing and Global Large Commercial Aircraft Supply Networks,* Master of Engineering in Logistics (MLOG) Thesis; Thesis Supervisor: Dr. K. Bozdogan (May 05)).
- Mohit Tiwari, *Study of Supply Chain Practices in the Aerospace Industry and in Rolls-Royce,* Master of Engineering in Logistics (MLOG) Thesis; Thesis Supervisor: Dr. K. Bozdogan (May 05)
- Tzu-Ching Horng, *A Comparative Analysis of Supply Chain Management Practices by Boeing and Airbus: Long-Term Strategic Implications,* Dept. of Civil and Environmental Engineering, MS Thesis in Transportation Systems; Thesis Supervisor: Dr. K. Bozdogan (Nov 06)

SOURCE: K. Bozdogan

Research & Publications (2)

Supplier Network Architecture; Strategic Make-Buy Decisions

- Robert Perrons, *Make-Buy Strategies in the U.S. Aerospace Industry,* MS Thesis in Technology and Policy; Thesis Supervisor: Dr. K. Bozdogan (Aug 97)
- Prof. Todd Watkins (Lehigh Univ.), *Dual-Use Supplier Management and Strategic International Sourcing in Aircraft Manufacturing,* Working Paper (Oct 97)
- Rudy Prudente, *Strategic Outsourcing and Supplier Integration in the Helicopter Sector,* MS Thesis in System Design and Management (SDM);Thesis Supervisor: Dr. K. Bozdogan (Feb 99); collaborative project with the Lean Aircraft Research Program (LARP) at Linköping University (Sweden)
- Prof. Charles Fine (MIT) and Prof. Morris Cohen (Wharton School), *Three-Dimensional Concurrent Engineering: Product, Process and Supply Chain Development,* main results published in Charles Fine, *CLOCKSPEED* (Reading, MA: Perseus Books, 1998)
- Reine Wasser, *The Outsourcing Process -- Strategic and Operational Realities,* Licentiate Thesis, Linköping University (Sweden); Supervisors: Prof. Ove Brandes and Prof. Staffan Brege (Oct 99); collaborative project with the Lean Aircraft Research Project (LARP) at Linköping University

SOURCE: K. Bozdogan

Research & Publications (3)

Supplier Network Integration
(product development, production; information infrastructure)

- Teng-Cheng (Ted) Hsu, *Causes and Impacts of Class One Engineering Changes: An Exploratory Study Based on Three Aircraft Acquisition Programs,* MS Thesis in Aeronautics and Astronautics *and* Technology and Policy (TPP); Thesis Supervisors: Dr. K. Bozdogan & Prof. John Deyst (May 99)
- Michael Bravo, *Achieving Supplier Integration through Implementation of Supplier Managed Inventory Programs,* MS Thesis in System Design and Management (SDM), Thesis Supervisor: Dr. K.Bozdogan (May 99)
- Michelle Antonelli, *Building Information Systems to Integrate the Manufacturing Supply Chain*, MS Thesis in Electrical Engineering and Computer Science *and* Technology and Policy (TPP); Thesis Supervisors: Dr. K.Bozdogan and Dr. Daniel Whitney (May 99)
- Anna Öhrwall Rönnbäck, *Information Infrastructure for Collaborative Product Development,* Licentiate Thesis, Linköping University (Sweden); Thesis Supervisor: Prof. Staffan Brege (March 2000); collaborative project with the Lean Aircraft Research Project (LARP) at Linköping University
- William Blake, *Using System Dynamics to Understand Barriers to Cost Reduction,* MS Thesis in System Design and Management (SDM); Thesis Supervisors: Prof. Daniel Frey and Dr. K. Bozdogan (May 2000)

SOURCE: K. Bozdogan

Research & Publications (4)

Managing Supplier Relationships (Coordination, Cooperation, Collaborative Relationships; Knowledge-sharing; Fostering Innovation)

- Malee V. Lucas, *Supplier Management Practices of the Joint Direct Attack Munition Program,* MS Thesis in Aeronautics and Astronautics *and* Technology and Policy (TPP); Thesis Supervisors: Dr. David Hoult and Prof. John Deyst (Jun 96)
- Cynthia Cook, *Production Networks Revisited: Causes and Consequences of Supplier and Customer Linkages in the Metal Manufacturing Sector,* Ph.D. Thesis, Harvard University; Thesis Supervisor: Prof Peter Marsden; (Jun 99). LAI-funded doctoral research at Harvard University.
- Kirkor Bozdogan, John Deyst, David Hoult and Malee Lucas, *"Architectural Innovation in Product Development through Early Supplier Integration," R& D MANAGEMENT,* Vol. 28, No. 3 (July 1998), 163-173.
- Prof. Duncan Simester (MIT) and Prof. Marc Knez (Univ. of Chicago; Sibson Consulting), "Direct and Indirect Bargaining Costs and the Scope of the Firm," *The Journal of Business,* Vol. 75, No.2 (June 2000), 282-304. LAI-funded research project.
- Prof. Sandy D. Jap (MIT), "Pie-Expansion Efforts: Collaboration Processes in Buyer-Supplier Relationships," *Journal of Marketing Research,* Vol. XXXVI (Nov 1999), 461-475. LAI-funded research project.

SOURCE: K. Bozdogan

Research & Publications (5)

- Aaron Kirtley, *Fostering Innovation Across Supplier Networks,* MS Thesis in Mechanical Engineering *and* Technology and Policy (TPP); Thesis Supervisor: Dr. K.Bozdogan (Jun 02)

- Christopher Glazner, Enterprise Integration Strategies Across Virtual Extended Enterprise Networks: A Case Study of the F-35 Joint Strike Fighter Program Enterprise, MS Thesis in Technology and Policy, Engineering Systems Division; Thesis Supervisor: Dr. K. Bozdogan (Feb 2006)

SOURCE: K. Bozdogan

Research & Publications (6)

Aerospace Offset Policy Issues

- K. Bozdogan, "Emerging Challenges and Diverging Interests," in Charles W. Wesner (ed.), *Trends and Challenges in Aerospace Offsets,* National Research Council, Board on Science, Technology and Economic Policy (Washington, DC: National Academy Press, 1999)
- Todd A. Watkins (Lehigh Univ.), "Dual-use Supplier Management and Strategic International Sourcing in Aircraft Manufacturing," in Charles W. Wesner (ed.), *Trends and Challenges in Aerospace Offsets,* National Research Council, Board on Science, Technology and Economic Policy (Washington, DC: National Academy Press, 1999)

