

**MIT Auto Industry System Study
(2003.001 v1.0)**

**Integrating Social and
Technical Systems**

Overview and Expected Outcomes – Unit 1

■ Overview

- ◆ Welcome and overview
- ◆ The “big picture”
- ◆ Social and technical framework
- ◆ Exercise: Focus on the Seven Wastes and the 5 S's
- ◆ Sample Socio-Tech Implementation
- ◆ Exercise: Cellular Design Socio-Tech Analysis
- ◆ Conclusion

■ Expected outcomes

- ◆ Awareness of shifts in social and technical systems over time
- ◆ Understanding of the interdependency between social and technical systems
- ◆ Identification of potential “guiding principles” for designing, implementing and sustaining change in social and technical aspects of new work systems

The “Big Picture”

Social Systems

Technical Systems

Craft Production

Decentralized Enterprises
Mastery of Craft

Custom Manufacture
Specialized Tools

Mass Production

Vertical Hierarchies
Scientific management

Assembly Line
Interchangeable Parts

Knowledge-Driven Work

Network Alliances
Team-Based Work Systems

Flexible Specialization
Information Systems

Adapted from: “Knowledge-Driven Work: Unexpected Lessons from Japanese and United States Work Practices” (Oxford University Press, 1998)



MIT Auto Industry Systems Study 2003.001 v1.0 Unit1: Integrating Social and Technical System
© Joel Cutcher-Gershenfeld

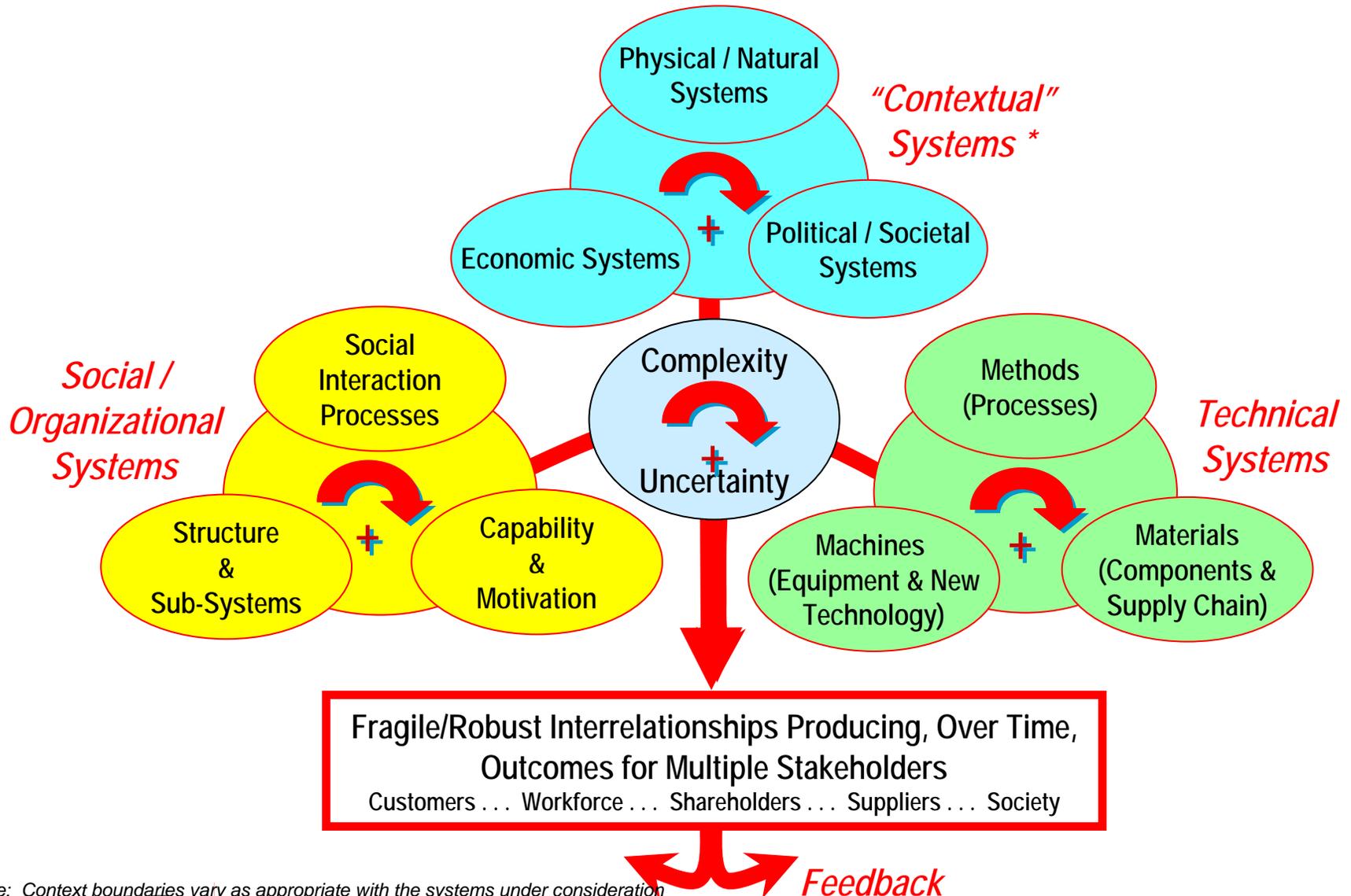
Auto 2003.001 v1.0

9/12/2005 -- 3

Sample Social System Transformation Initiatives

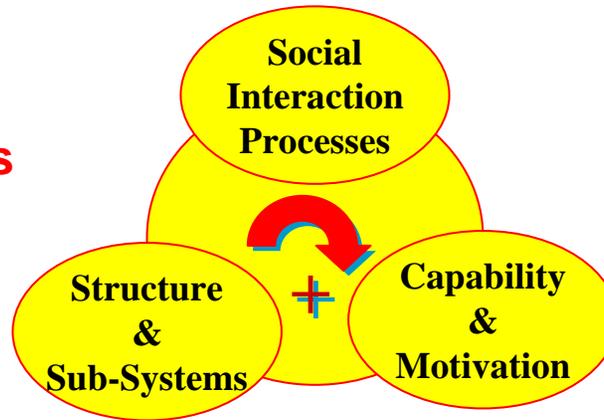
- Socio-Technical Work Systems Semi-autonomous teams
 - ◆ 1950s-1980s
- Employee Involvement/QWL. EI/QWL groups (off-line)
 - ◆ Late 1970s-1990s
- Total Quality Management Quality circles (off-line)
 - ◆ Early 1980s-1990s
- Re-engineering Work-out events (off-line)
 - ◆ 1990s
- Six Sigma Black belt let project teams (off-line)
 - ◆ 1990s-present
- Lean Production/Enterprise Systems Lean production teams/Integrated product & Process teams
 - ◆ 1950s-present

Sample Social and Technical Systems Framework



* Note: Context boundaries vary as appropriate with the systems under consideration

Focus on Social / Organizational Systems



Structure & Sub-Systems

■ Structure

- ◆ Groups
- ◆ Organizations
- ◆ Institutions

■ Sub-Systems

- ◆ Communications
- ◆ Information
- ◆ Rewards & reinforcement
- ◆ Selection & retention
- ◆ Learning and feedback
- ◆ Conflict resolution

Social Interaction Processes

- Leadership
- Negotiations
- Problem-solving
- Decision-making
- Partnership

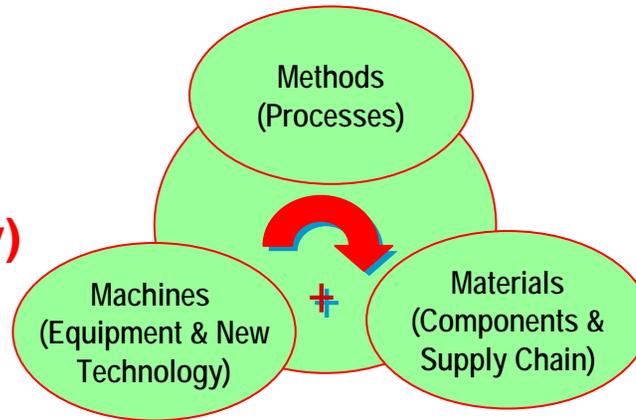
Capability & Motivation

- Individual knowledge, skills & ability
- Group stages of development
- Fear, satisfaction and commitment

Focus on Technical Systems

Machines (Equipment & New Technology)

- Equipment and machinery
- Physical infrastructure
- Information technology
- Nano-technology, bio-technology, and other developments at the frontiers of science



Methods (Processes)

- Job design/office design
- Work flow/process mapping methods
- Value stream mapping
- Constraint analysis
- Statistical Process Control (SPC)
- System optimization and decomposition methods

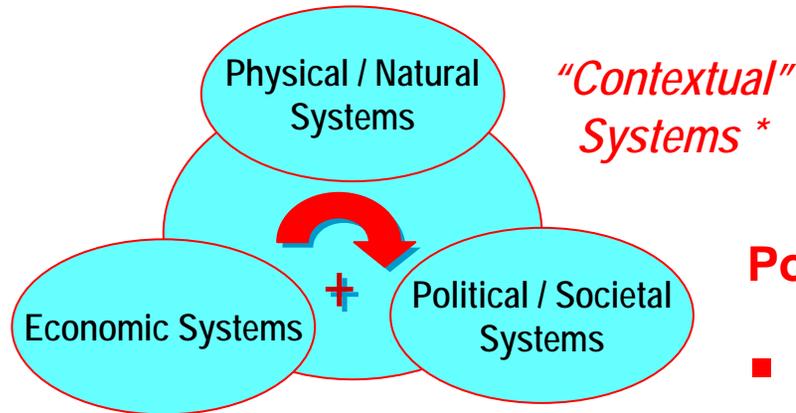
Materials (Components & Supply Chain)

- Assembly – Interchangeable parts and mass production systems
- Logistics – Just-In-Time delivery (JIT) systems and Synchronous material flow systems
- e-commerce and supply chains

Focus on Contextual Systems

Economic Systems

- Markets
- Incentives
- Trade relations
- Public, private, and non-profit sectors
- Industry structures
- Product/firm/industry life-cycles
- Externalities and other “market failures”



Physical / Natural Systems

- Atmospheric systems
- Geo-thermal systems
- Aqueous systems
- Biological systems
- Chemical systems
- Bio-chemical systems
- Sub-atomic systems
- Laws of physics
- Extra-terrestrial systems

Political / Societal Systems

- Regulatory systems
- Standards and protocols
- Institutional arrangements
- History
- Cultures and sub-cultures
- Values and assumptions

* Note: Context boundaries vary as appropriate with the systems under consideration

Exercise: The Seven Wastes and the Five S's

The Seven Wastes

- ◆ Over Production
- ◆ Waiting
- ◆ Transportation
- ◆ Inventory
- ◆ Processing
- ◆ Motion
- ◆ Defects

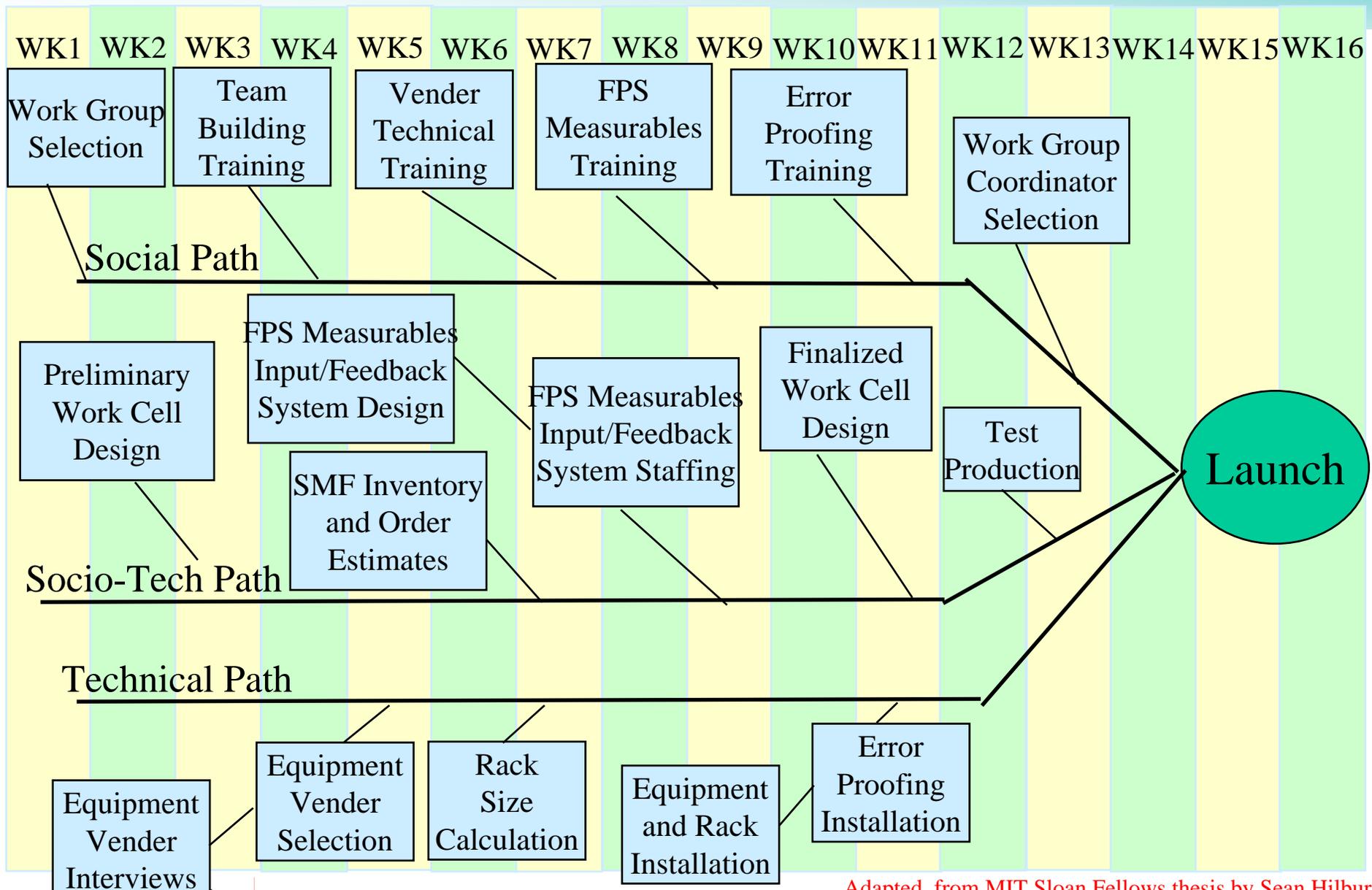
The Five S's

- Simplify or Sort
- Straighten or Simplify
- Scrub or Shine
- Stabilize or Standardize
- Sustain or Self-Discipline

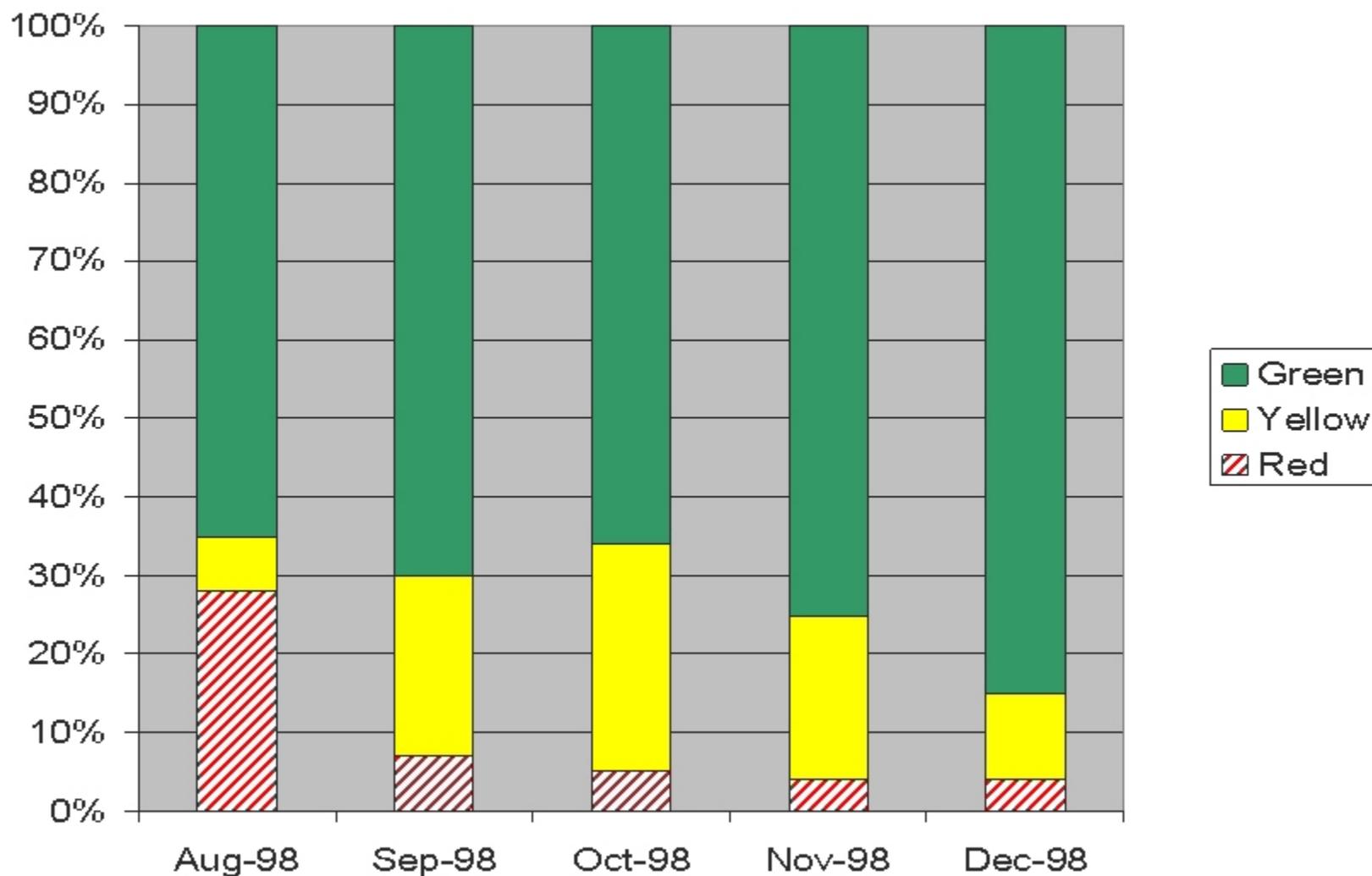
How are social and technical systems interdependent when it comes to addressing the Seven Waste?

How are they interdependent when it comes to the 5S's?

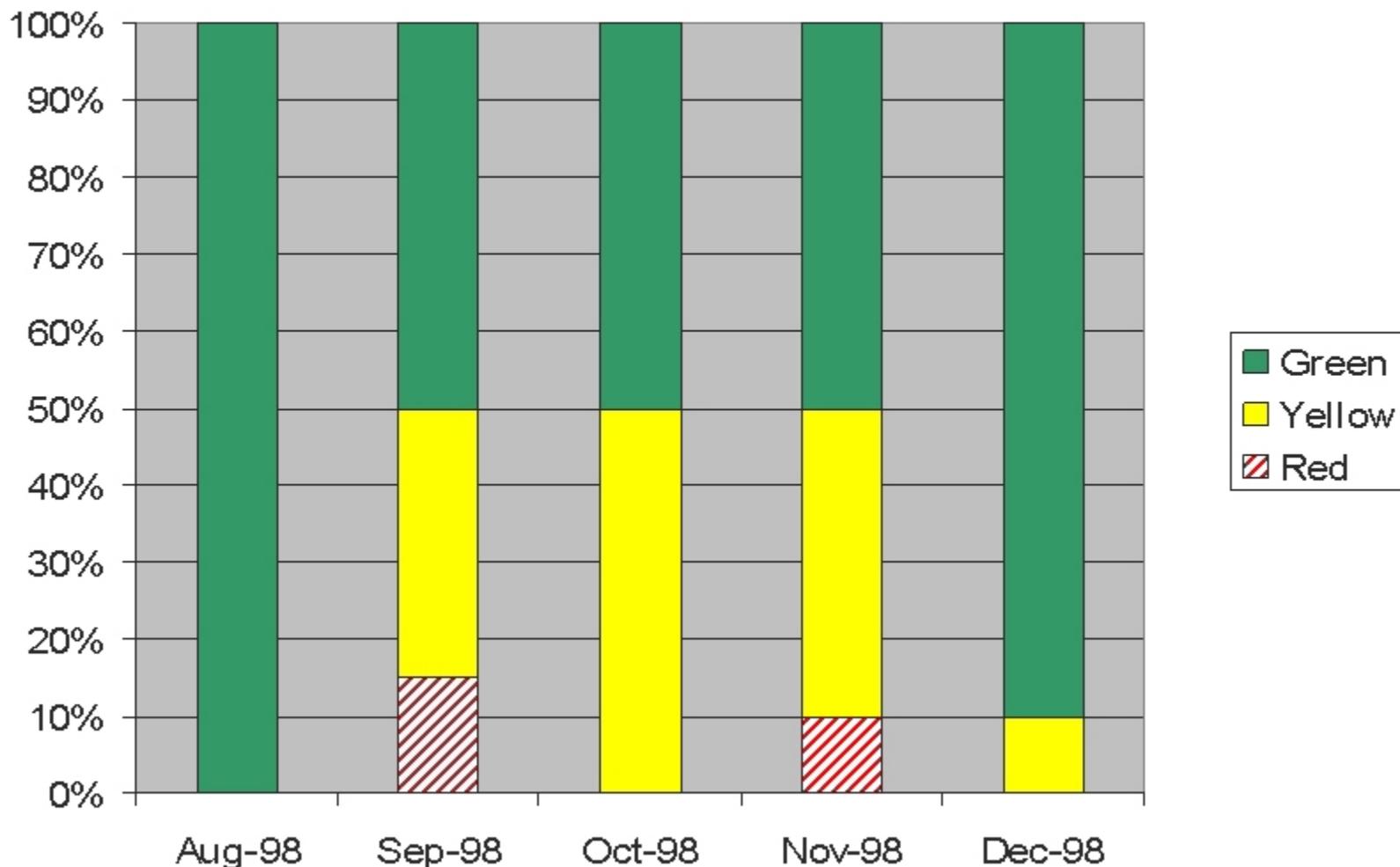
Sample Socio-Tech Implementation



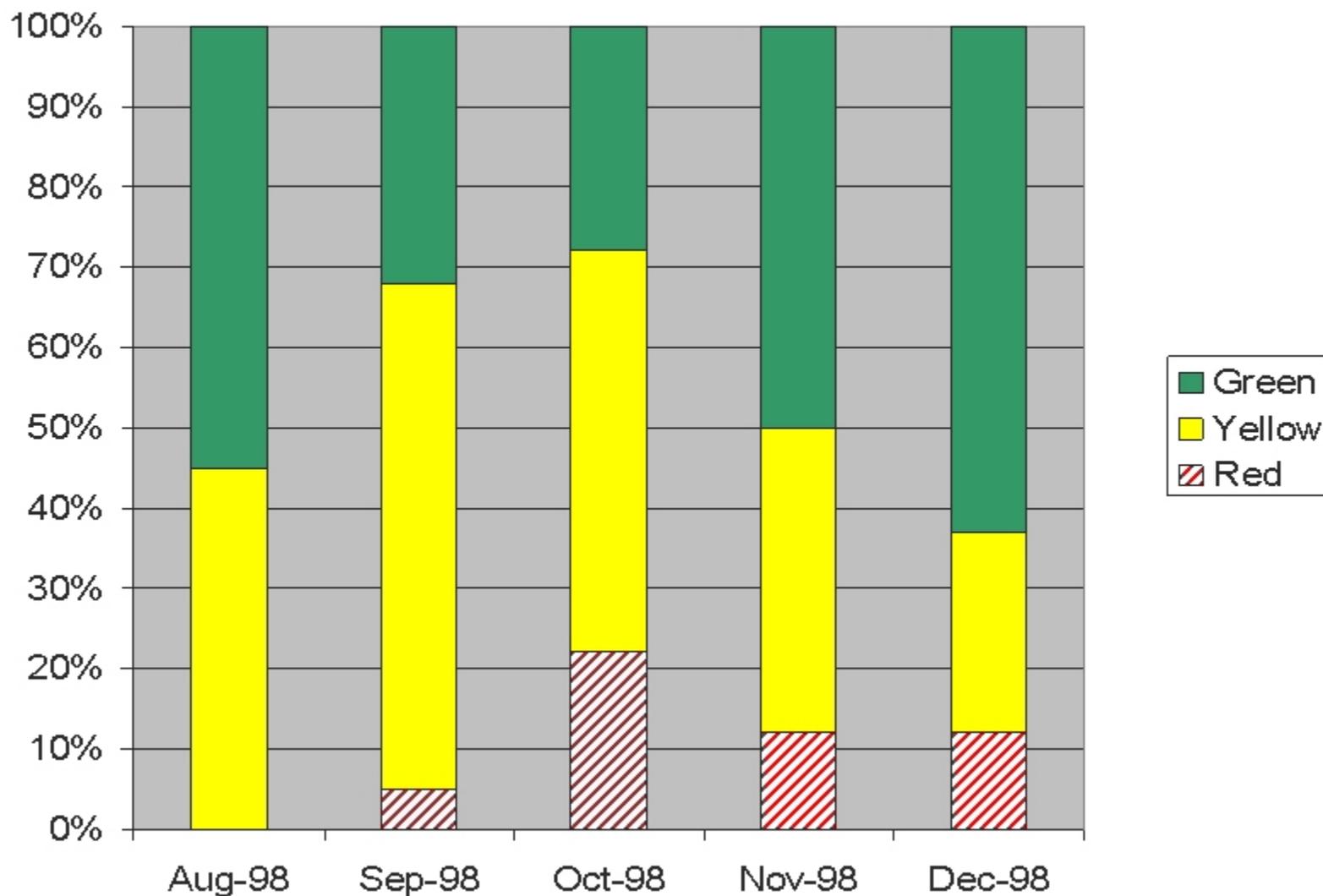
Data on Technical Milestones



Data on Social Milestones



Socio-Tech Data



Exercise: Cellular Manufacturing Socio-Tech Analysis

Step 1: Group Formation and Stakeholder Analysis

Form small groups of 2-3 people (individuals at remote locations may link by phone), study the “current state” and “desired state” illustrations on a hypothetical cellular manufacturing intervention (next slide), and list stakeholders involved in your phase of this intervention.

Note: Some groups will be assigned to “Preparing,” “Implementing,” and “Sustaining” phases of this intervention

Step 2: Social Systems

Identify the most important social system changes in this work system that are relevant to your phase of the intervention.

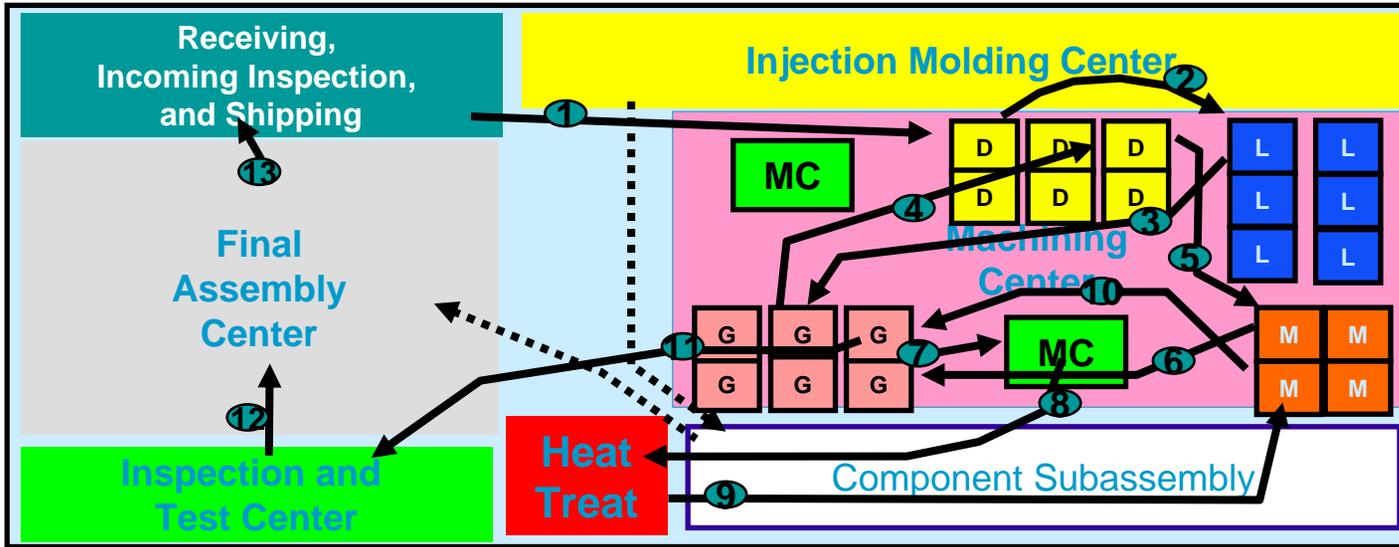
Step 3: Technical Systems

Identify the most important technical changes in this work system that are relevant to your phase of the intervention.

Step 4: Integration and Guiding Principles

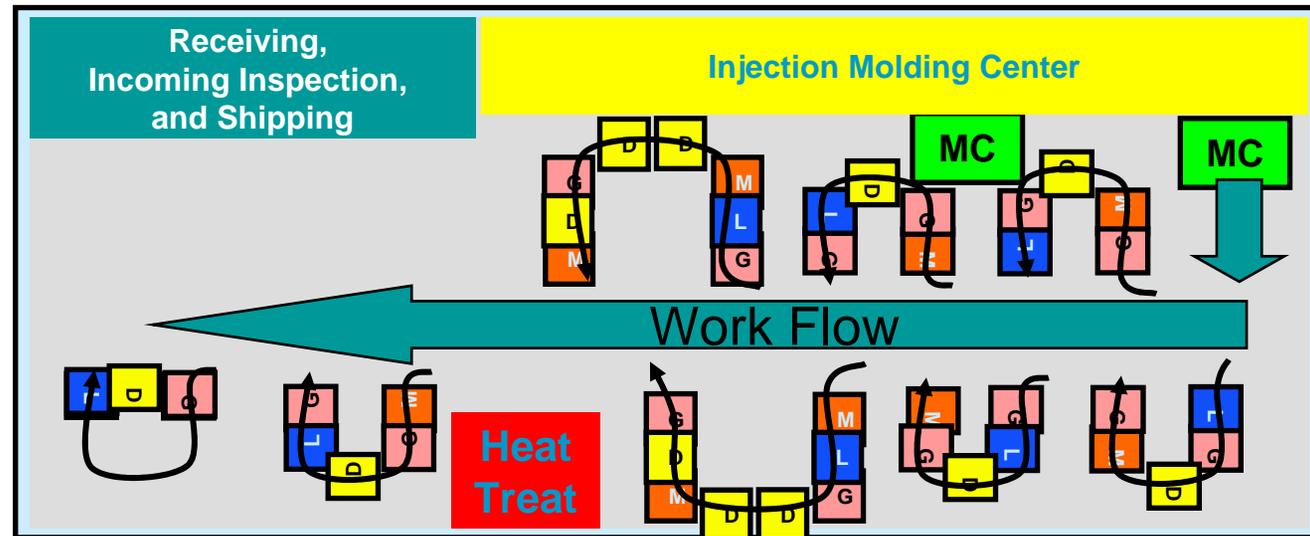
Discuss ways in which the social and technical changes are or are not interdependent. Derive 1-3 “Guiding Principles” for implementing a systems change of this type.

Exercise: Cellular Manufacturing

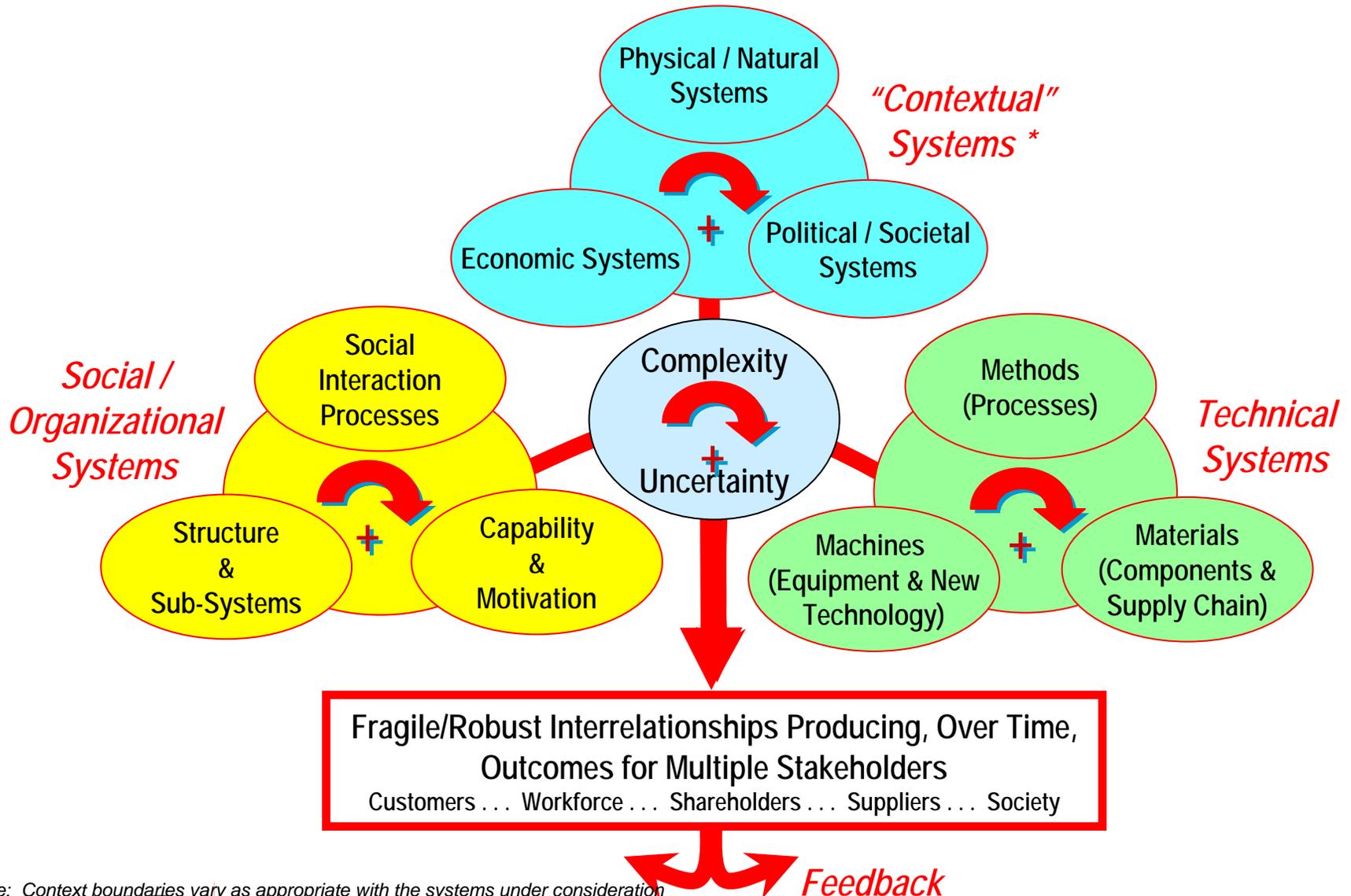


Current State

Desired State



Revisit the Social and Technical Systems Framework

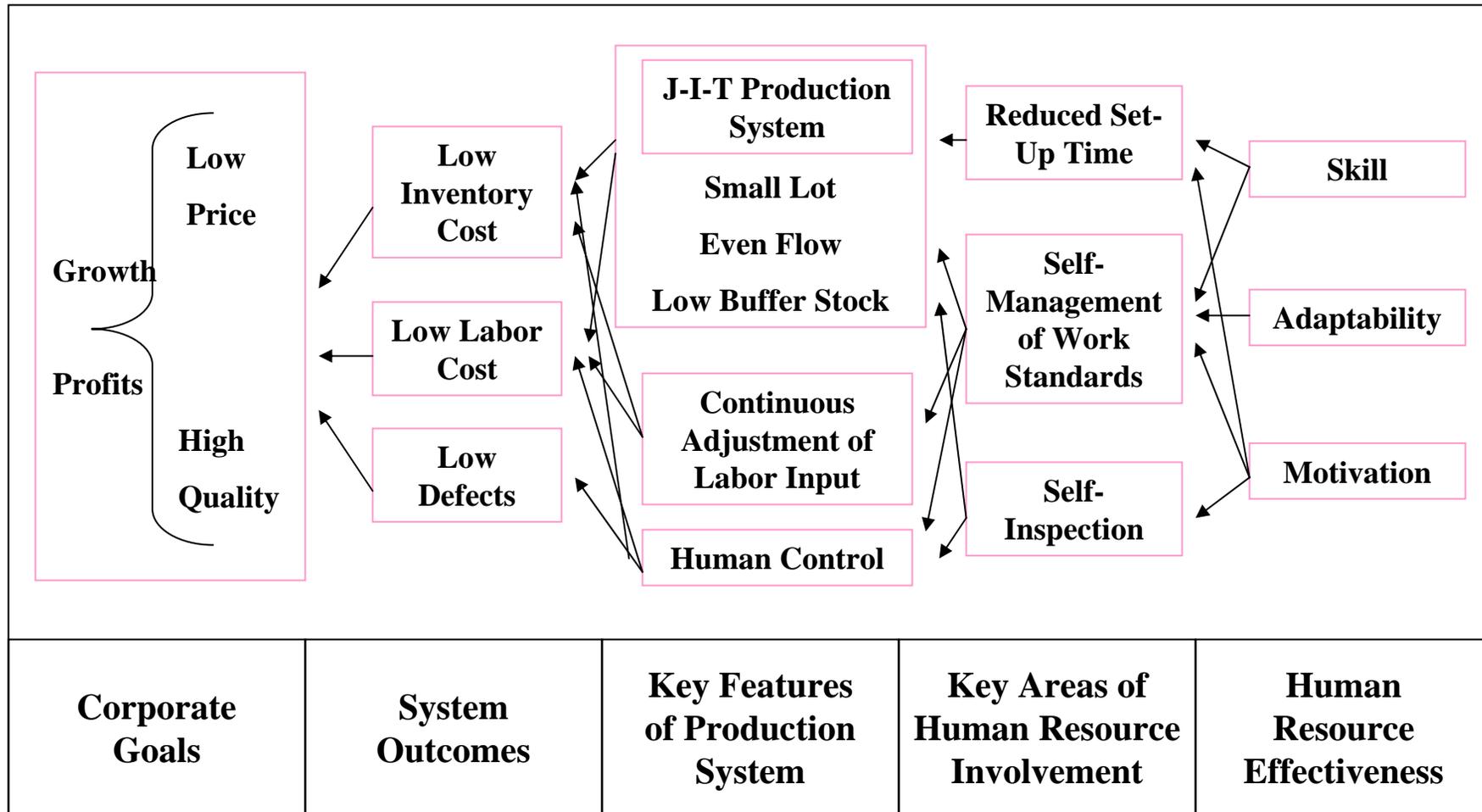


* Note: Context boundaries vary as appropriate with the systems under consideration

Conclusion

- A unique historical moment
- The constant challenge and opportunity presented by social and technical interdependency
- A fragile foundation for a global transformation

Appendix: Japanese Model of Production System and “Humanware”



Source Haruo Shimada and John Paul MacDuffie, *Industrial Relations and “Humanware”* (Sloan School of Management Work Paper, September, 1986)