

# Knowledge-Driven Work

## SPL 4.3

**Joel Cutcher-Gershenfeld**

*Senior Research Scientist, MIT Sloan School of Management and  
Executive Director, MIT Engineering Systems Learning Center*

**Presentation for:**

ESD.60 – Lean/Six Sigma Systems  
MIT Leaders for Manufacturing Program (LFM)  
Summer 2004

*These materials were developed as part of MIT's ESD.60 course on "Lean/Six Sigma Systems." In some cases, the materials were produced by the lead instructor, Joel Cutcher-Gershenfeld, and in some cases by student teams working with LFM alumni/ae. Where the materials were developed by student teams, additional inputs from the faculty and from the technical instructor, Chris Musso, are reflected in some of the text or in an appendix*

# Overview

## ➤ Learning Objectives

- [list 3-5 key learning objectives]

## ➤ Session Design (20-30 min.)

- **Part I:** *Introduction and Learning Objectives (1-2 min.)*
- **Part II:** *Key Concept or Principle Defined and Explained (3-5 min.)*
- **Part III:** *Exercise or Activity Based on Field Data that Illustrates the Concept or Principle (7-10 min.)*
- **Part IV:** *Common “Disconnects,” Relevant Measures of Success, and Potential Action Assignment(s) to Apply Lessons Learned (7-10 min.)*
- **Part V:** *Evaluation and Concluding Comments (2-3 min.)*

# Overview

- Introduction
  - Fundamental Changes in the Nature of Work
  - A Definition, an Observation and Two Questions
- The Global Diffusion of Knowledge-Driven Work Systems: Research Findings
  - Structure
    - Primary, Secondary, Reverse
  - Strategy
    - Piecemeal, Imposed, Negotiated
  - Process
    - Tangible and Intangible Factors – Virtual Knowledge
- Conclusion
  - A Fragile Foundation for the Global Diffusion of Innovation

# The Big Picture

- Fundamental changes in the nature of work and organizations across the last century
  - **Craft Production – Small Decentralized Enterprises**
  - **Mass Production – Large Hierarchical Enterprises**
  - **Knowledge-Driven Work – Interdependent Networks**

*Key Source: "Knowledge-Driven Work: Unexpected Lessons from Japanese and United States Work Practices" (Oxford University Press, 1998) – published in Spanish as "Trabajo impulsado pro el conocimiento" (Oxford University Press, 2000)*

# A Definition, an Observation and Two Questions

## ➤ A Definition:

- An organization is knowledge-driven to the extent that it depends on the knowledge of all stakeholders in order to accomplish its goals

## ➤ An Observation:

- Knowledge doesn't "exist" as such -- it is created over time, it resides in people, it deteriorates unless sustained, and it is potentially transformative

## ➤ Two Questions:

- In what ways is the work in your organization more knowledge-driven and the business strategy more knowledge-dependent than it was ten years ago?
- How is this like to change over the next ten years?

# Knowledge-Driven Work: Research Findings

## Sites

AAI (Mazda) / UAW  
Coil Center Corporation  
Hitachi Magnetics Corp. / UAW  
I/N TEK and I/N KOTE / USWA  
NUMMI / UAW  
Nippondenso Manuf., U.S.A.  
Ogihara  
Yamaha Musical Products / UAW

Tomen Corporation  
Hitachi Metals, Ltd.  
Nippon Steel, Nagoya Works  
Toyota Motor Corp., Takaoka Plant  
Nippondenso Co., Ltd., Nishio Plant  
Ogihara Corporation

## Location

Flat Rock, MI  
Howell, MI  
Edmore, MI  
South Bend, IN  
Fremont, CA  
Battle Creek, MI  
Howell, MI  
Grand Rapids, MI

Tokyo  
Kumagaya  
Nagoya  
Toyota City  
Nishio City  
Ota City

## Primary Products

Auto Assembly  
Metal Blanking  
Permanent Magnets  
Cold Rolled Steel  
Auto Assembly  
Auto Parts  
Metal Stamping  
Musical Instruments

Trading Company  
Permanent Magnets  
Steel, Blast Furnace  
Auto Assembly  
Auto Parts  
Metal Die Making

## Research Methods

- Over 200 individual/group interviews in U.S.; over 50 individual/group interviews in Japan
- Multi-cultural, multi-disciplinary team with matrix-based data collection and analysis

# Diffusion of Knowledge-Driven Work Systems

*Towards a theory of diffusion:*

## I. Strategy

- **Piecemeal, Imposed, Negotiated**

## II. Structure

- **Primary, Secondary Reverse**

## III. Process

- **Knowledge-Driven**

# Toward a Theory of Diffusion – I. Strategy

➤ Three alternative strategies for diffusion

➤ **Piecemeal**

➤ **Imposed**

➤ **Negotiated**



# Toward a Theory of Diffusion – II. Structure

➤ Three structural channels for diffusion

➤ **Primary**

➤ **Secondary**

➤ **Reverse**

## II. Structure -- An Example of Reverse Diffusion

トヨタ基本理念

### Guiding Principles at Toyota

- 1) Be a company of the world
- 2) Serve the greater good of people everywhere by devoting careful attention to safety and to the environment
- 3) Assert leadership in technology and in customer satisfaction
- 4) Become a contributing member of the community in every nation
- 5) Foster a corporate culture that honors individuality while promoting teamwork
- 6) Pursue continuing growth through efficient, global management
- 7) Build lasting relationships with business partners around the world

## II. Structure – Discussion Questions

- Three groups
  - **Group 1: What factors enable or undercut primary diffusion of knowledge-driven aspects of work systems?**
  - **Group 2: What factors enable or undercut secondary diffusion of knowledge-driven aspects of work systems?**
  - **Group 3: What factors enable or undercut reverse diffusion of knowledge-driven aspects of work systems?**

# Toward a Theory of Diffusion – III. Process

- Limitations of a focus just on tangibles or intangibles
  - ***Dominant focus on “tangible” work practices (material flow, information systems, pay practices, team size, etc.)***
  - or
  - ***Dominant focus on “intangible” work practices (trust, partnership, communication, leadership, learning, etc.)***
- ☞ Lessons from a kaizen-teian system
- ☞ Virtual knowledge – a key moment in the knowledge creation process in between tacit and explicit knowledge

# III. Process -- Data from a Kaizen-Teian System

Dependent Variable	Tangible Suggestions	Productivity	Quality
Intercept	+	+ ***	+ ***
Tangible suggestions		+ ***	- *
Tangible -1		+ ***	+
Tangible -2		+ ***	-
Tangible -3		+ ***	- *
Intangible suggestions	+ ***	-	- *
Intangible -1	+	+	- ***
Intangible -2	+ *	+	+ **
Intangible -3		-	+
Management training (hours)	+ *	+ ***	+
Self Development training (hours)	+	+ *	-
Technical training (hours)	+	-	- *
Safety (OSHA first-time visits)		+	+ ***
Quality (index of customer complaints)		- ***	
Size (number of people in department)	-	+ ***	
Overtime (hours)	-		+
Absenteeism (hours)		+ **	+
Assembly (0)/Machining (1)	-	+	
Leadership Change (10/92)	+ ***		
adj. R <sup>2</sup>	.134	.419	.19
F	11.601	36.839	7.909

Key: + = positive co-efficient; - = negative co-efficient; \*\*\* = p<.005; \*\* = p<.01; \* = p<.05

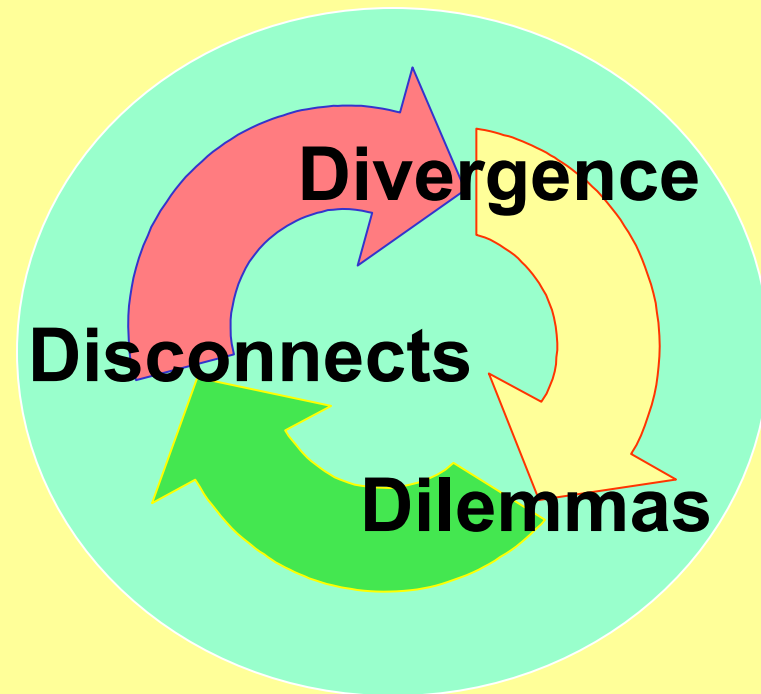
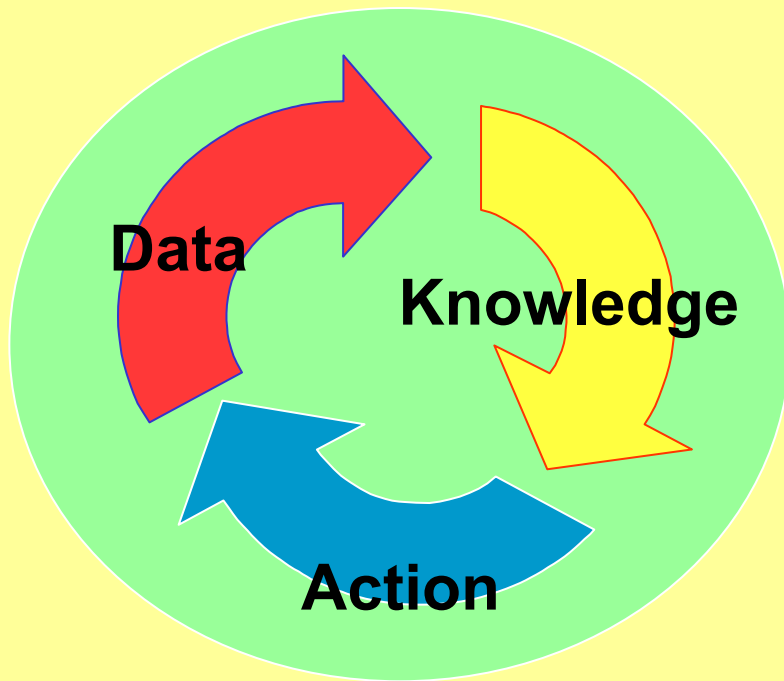
Pooled time series analysis by Wen-Jeng Lin, with Joel Cutcher-Gershenfeld on 19 Departments over 44 months (1/91 to 8/94)



# III. Process – Discussion Questions

- On the upcoming plant visits, how will you identify and analyze the knowledge-driven aspects of the work systems you are observing?
  - Indicators of the flow and utilization of knowledge?
  - Indicators of the way knowledge, skills and abilities are valued?
  - Attention to tangibles and intangibles?
- What are the potential ways that these visits will contribute to the global diffusion of knowledge-driven work systems?

# Disconnects in Learning Systems



# Implications

- Shared vision
  - Knowledge-driven work
- Diffusion of knowledge-driven work systems
  - Structures for primary, secondary and reverse diffusion
  - Mechanisms and skills for negotiated strategies of change
  - Appreciation and support for knowledge creating processes
- Change at every level -- individual, organizational, institutional, societal



# Conclusion

- The Challenge:
  - *How do you manage the creation and appreciation of “virtual knowledge?”*
- The knowledge-creation process
  - **Establishing mechanisms for tacit knowledge to become explicit, shared and enhanced -- at all levels**
  - **Managing the interdependency between the “tangible” and the “intangible”**
  - **Virtual knowledge -- what is being diffused and the way it happens**
- The fragile foundation for the global diffusion of knowledge-driven work systems