The Knowledge Sharing Environment

Gene Meieran
Sr. Intel Fellow
Intel Corp.
Chandler, AZ

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Each of these technology inventions grew to enormous value because they *provided highly desirable functionality* and were *commercially manufactured at affordable prices*.

The success of each was NOT predicted and what eventually resulted was far beyond the inventor’s expectations.

Predicting the future is most always wrong!
20th Century Top Science and Technology Achievements*

1. Electrification
2. Automobile
3. Airplane
4. Water supply and distribution
5. Electronics
6. Radio and television
7. Agricultural mechanization
8. Computers
9. Telephone
10. Air conditioning/refrigeration
11. Interstate highways
12. Space flight
13. Internet
14. Imaging
15. Household appliances
16. Health technologies
17. Petrochemical technology
18. Laser and fiber optics
19. Nuclear technologies
20. High-performance materials

* National Academy 2001 Survey results as presented by Neil Armstrong
These efforts led to trillions of dollars of business

They led to significant improvements in the quality of life

They fundamentally changed the world
Four Technical Opportunities

Internet
MEMS and Nano-Technology
Bio
Knowledge Sharing Technology

{ Bio, Info, Nano }
Why Faster?

“Business data collecting is doubling every 1.5 years...

Workers accessing business intelligence systems will increase 25X in 2 years”

Source: Survey.com, Meta Group, IBM
Impact of Complexity

- More complex product (finer feature size, more features per chip)
- More process steps per product
- More sophisticated, expensive and integrated equipment; new technology
- Stricter reliability and quality standards
- Stricter factory standards; government regulations
- Shorter product life cycles
- Greater cost pressures
- Fiercer competition
- Global marketplace
COMPLEXITY
Manufacturing = Transformation

We need to continuously create, develop, deploy, categorize, store, apply, and recreate the systems to handle the voluminous data, information, knowledge, and wisdom that applies to and relates these activities to each other.
MEMS Devices

- **Micro-Electro Mechanical Systems**
  - 3D structures - smaller than the head of a pin
  - Integrates mechanical sensing and motion with electronics
  - Fabricated using IC-compatible batch-processing techniques
  - Also known as “microsystems” and “micromachines”
  - MEMS is not “nanotechnology”
TI’s DMD
BioMEMS
Increasing Complexity …and Opportunity

Today (~$300M)

- Layout of biotin / streptavidin competitive binding experiment

Tomorrow (~$1B in 2005)

- Advanced MEMS technology with integrated components

Source: Univ. of Michigan

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Nano Technology
Info: Knowledge Sharing
Data: Independent, unrelated records or facts

Information: Related records and facts

- At rush hour, use Ray Road, not Chandler
- There is a speed trap at Rural and Chandler
- There is ample parking behind C7
- The light at 10 South is interminable!

Wisdom: Expertise applied to knowledge
Knowledge Half Life

- Long (centuries)
- Short (seconds)

- Tactical
- Strategic
- Foundation

Half Life

- News
- Plans
- Procedures
- Physical Science

Systematization

- Email
- Specs
- Information Science
- Math

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Sharing Knowledge

Create Knowledge

Make decisions

Innovate

Research

Brainstorm

Create Knowledge

Solve problems

Apply Knowledge

Store

Organize

Purge

Secure

Knowledge Environment

Assimilate Knowledge

Structure Knowledge

Read

Learn

Visualize

Model

Disseminate Knowledge

Internet

Mail

Learning

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Knowledge Structure

- Business Practices
  - Interactive People Network
  - Distributed Knowledge Repository

Better Decisions

About people

About objects

KM Tools and Technology

From the Knowledge Ecology
Need for an Architecture

The Winchester Mystery House

Westminster Abbey

The architecture determines success
Challenges to Workforce

Language and culture differences

Interdisciplinary problem domain

Older workforce trained in new technology

Global collaboration on 24 x 7

Recent graduates trained in emerging businesses

Old capabilities and technology

Rare expertise remotely needed

New skills remotely needed

New knowledge assimilation; Knowledge overload

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Why Knowledge Management

- Size of knowledge domain; exponentially growing
- Scope of knowledge domain; exponentially widening
- Rapid globalization and technology diversity expansion
- Global and competent competition
- Need to make better and faster decisions

- We therefore need to know what we know and have and where we have it, and how to get it, and how to use it
Transformation of Knowledge

**Biology**
- One cell
- Many cells
- Billions of cells
- Intelligence

**Technology**
- One transistor
- Many transistors
- Millions of transistors
- Machine Intelligence

**Sociology**
- One person
- Many persons
- Billions of people
- Collective Intelligence
Information Management Opportunities: 2003-2010

- Modeling and simulation
- Ubiquitous environment
- Wireless and remote
- Knowledge sharing
- Bringing ideas to market
- Security
- Architecture & system interoperability
- User-friendly environments
- Supply Network Management
- Intelligent Processes & products
- Global collaboration
- Global cultural integration
- Advanced learning
- User-friendly environments
- Technology
- Infrastructure
- Problem resolution
- Opportunities
The World Atlas

- What’s there?
  - Where are the mountains?
  - Where are the cities?
  - Where are the roads?
  - Where are the lakes, rivers, oceans?
  - Where are the canyons, swamps, deserts?

- How do I get there?
  - Boat?
  - Plane?
  - Car?
  - Train?
  - Horse?
  - Walk?

- What can I bring back?
  - Food
  - Minerals
  - Products
  - Knowledge
The Knowledge Atlas

- What’s there?
  - Where are the experts?
  - Where is the knowledge?
  - Where are documents?
  - What are the core competencies?
  - Where are the obstacles (bureaucracy, incompatibilities, etc.)?

- How do I get there?
  - Phone?
  - Internet?
  - Learning?
  - Meetings?
  - Seminar?
  - Luck?

- What can I bring back?
  - Questions and answers
  - Ideas
  - Data, information, knowledge, wisdom
  - Decision making
### Need for Collaboration Capabilities

<table>
<thead>
<tr>
<th>Year</th>
<th>Communication Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>One to one</td>
</tr>
<tr>
<td></td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Phone</td>
</tr>
<tr>
<td></td>
<td>Exchange disks</td>
</tr>
<tr>
<td>1990</td>
<td>One to few</td>
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<tr>
<td></td>
<td>Fax</td>
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<tr>
<td></td>
<td>Networked PC’s</td>
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<td></td>
<td>Phone conferences</td>
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<td></td>
<td>Teleconferences</td>
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<td></td>
<td>Email</td>
</tr>
<tr>
<td>2010</td>
<td>Many to many</td>
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<tr>
<td></td>
<td>Networked PC’s</td>
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<tr>
<td></td>
<td>Phone conferences</td>
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<td>Teleconferences</td>
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<td></td>
<td>Email</td>
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<tr>
<td></td>
<td>Net Meeting</td>
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<td></td>
<td>Work boards</td>
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<tr>
<td></td>
<td>Intelligent objects</td>
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<tr>
<td></td>
<td>Virtual presence</td>
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<tr>
<td></td>
<td>Intelligent interfaces</td>
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<tr>
<td></td>
<td>Shared experiences</td>
</tr>
<tr>
<td></td>
<td>Shared environments</td>
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<td></td>
<td>Shared values</td>
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<tr>
<td></td>
<td>New protocols</td>
</tr>
<tr>
<td></td>
<td>Speech and language</td>
</tr>
<tr>
<td></td>
<td>Translation</td>
</tr>
<tr>
<td></td>
<td>Caves</td>
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### 21st Century Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>P</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource protection (water, air, land, space)</td>
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<td>Genetic manipulation and human cloning</td>
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<td>O</td>
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<tr>
<td>Food production and distribution</td>
<td>P</td>
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<td>Energy development and conservation</td>
<td>P</td>
<td>O</td>
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<tr>
<td>Waste management</td>
<td>P</td>
<td>O</td>
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<tr>
<td>Internet knowledge sharing and globalization</td>
<td>P</td>
<td>O</td>
</tr>
<tr>
<td>Artificial intelligence, interfaces and robotics</td>
<td>O</td>
<td></td>
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<tr>
<td>Medicine, medical care, and aging life</td>
<td>P</td>
<td>O</td>
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<tr>
<td>Space exploration</td>
<td>O</td>
<td></td>
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<tr>
<td>Weather prediction and control</td>
<td>P</td>
<td>O</td>
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<tr>
<td>Security and counter-terrorism</td>
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<tr>
<td>Population logistics (traffic, sprawl, etc.)</td>
<td>P</td>
<td>O</td>
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<tr>
<td>Integration of electronic environment</td>
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<tr>
<td>Entertainment</td>
<td>O</td>
<td></td>
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<tr>
<td>Global communication</td>
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</tbody>
</table>

**Knowledge-rich programs**
Challenges

Challenge to the company:
Prepare people, teams, organizations, companies to make wise decisions in a rapidly changing and highly unpredictable world

Challenge to academia:
Identify challenging areas of interest to academics and to industry

Challenge to students:
Figure out your role in this new world; then be REALLY GOOD at filling your role