The Information Revolution

C15.0042
Lesson 03
Edward M. Kerschner
The Information Revolution
Share of Private-Sector GDP

E. Kerschner
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Share of Private-Sector GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1849</td>
<td>42%</td>
<td></td>
<td>18%</td>
</tr>
<tr>
<td>1899</td>
<td>20%</td>
<td></td>
<td>40%</td>
</tr>
<tr>
<td>1949</td>
<td>8%</td>
<td>30%</td>
<td>53%</td>
</tr>
<tr>
<td>1999</td>
<td>2%</td>
<td>31%</td>
<td>72%</td>
</tr>
<tr>
<td>2049</td>
<td>1%</td>
<td>19%</td>
<td>82%</td>
</tr>
</tbody>
</table>

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Share of Private-Sector GDP

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**Economic Cycles**

- **Agricultural**
  - Cycle: Annual
  - Driver: Weather

- **Industrial**
  - Cycle: 5-7 years
  - Driver: Inventory

- **Information**
  - Cycle: ?
  - Driver: ?
Major technological revolutions are always bigger than anyone ever expects.

- Railroads grew by about 10,000% in fifty years;
- Car and truck production rose 2,400% in just eight years.
When Billy Durant, founder of General Motors, remarked that the auto industry would be producing 500,000 cars within a few years, George W. Perkins, a senior partner in J.P. Morgan and Co., exclaimed that such an idea was preposterous. Perkins advised Durant to stop mouthing such nonsense if he wanted financial aid.

In 1908, the year that Perkins dispensed this piece of wisdom, 65,000 cars and trucks were produced.

Eight years later the figure was 1,617,708—more than three times Durant’s forecast.
The “Information Revolution” began with the digitization of individual enterprises, which created networks of increasingly ubiquitous computers:

- mainframes in the 1950s and 1960s,
- mini-computers in the 1970s and 1980s,
- and PCs in the 1980s and 1990s.
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Information Age versus Industrial Age

- Information Revolution makes the economy less commodity-intensive.

Commodity companies as a % of DJIA components

- 1896: 83%
- 1916: 55%
- 1928: 43%
- 1998: 23%
- 1999: 13%
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Paper Versus Paperless

- Convenience of paper, human nature to prevent a paperless world; selective printing replaces mass storage.

U.S. consumption of uncoated free sheet

Short tons consumed per 1000 employed
Tech start-ups have easy access to cheap capital; being first is not a major advantage.
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Producer versus Distributor

- Who owns the brand?
  Internet increases the power of producers, threatens distributors and middlemen that do not add value.

Dell™ versus CompUSA

Time Warner versus Blockbuster

Polo Ralph Lauren versus Nordstrom
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New versus Established Brands

- New brands are created as “brand arbiters” help consumers select products.

The evolution of “brand arbiters”

<table>
<thead>
<tr>
<th>Store</th>
<th>Paper</th>
<th>Cyber space</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Home Depot</td>
<td>Consumer Reports</td>
<td>AOL.COM</td>
</tr>
</tbody>
</table>
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*E-tailing Versus Brick and Mortar*

- Real barrier to entry is fulfillment, not the Web site itself.
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Commoditized Information Versus Proprietary Content / Insight

- Information is free in the Information Age.

Britannica Free Online
231-year-old encyclopedia company debuts its retooled Website

October 19, 1999
Gorillas Versus Monkeys

- Gorilla dominance is only likely to increase as they acquire or co-opt some competitors while others drop out.

![Bar Chart]

Percent of surfers visiting the 3 “gorillas”

- AOL Sites: 69.1%
- Microsoft Sites: 51.9%
- Yahoo Sites: 50.8%
- Next 10 sites avg.: 26.1%

As of March 1999
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◆ Just as, in the early 20th century, electric utilities permitted firms and households to “outsource” the age-old function of power generation . . .
◆ . . . so is the Internet making it possible in the early 21st century to outsource another age-old function: information management.
◆ Driven by:
  • The collapsing cost of bandwidth
  • Information management is critical
  • Economies of scale
  • Economies of skill
  • Minimizing “total cost of ownership”
  • Digital democratization
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When did the Revolution start?

Moore’s Law

Number of transistors per chip (in thousands)


2.3 K 6 K 29 K 134 K 275 K 1 M 4.5 M 7.5 M 14.0 M 1 G

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When did the Revolution start?

Mechanical Calculating Devices

- Used in the 1890 U.S. Census
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When did the Revolution start?

Turing’s Relay-Based Machine

- Cracked the Nazi enigma code
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*When did the Revolution start?*

Vacuum Tube Computer

- *Predicted the election of Eisenhower*
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When did the Revolution start?

Transistor-Based Machines

◆ Used in the first space launches
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When did the Revolution start?

Integrated Circuit Based PC

- Ubiquitous today
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When did the Revolution start?

What’s Next?

• Three-Dimensional Chips?
• Nanotube Circuitry?
• Optical Computing?
• Crystalline Computing?
• DNA Computing?
• Quantum Computing?
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When did the Revolution start?

Changing business structures define the age
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The Agrarian Economy

- Craftsman
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The Industrial Economy

• The Assembly Line
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Division of Labor

“The greatest improvement in the productive powers of labor . . . have been the effects of the division of labor.”

An Inquiry into the Nature and Causes of the Wealth of Nations, 
Adam Smith, 1776
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The Information Economy

• Virtual Businesses
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In the Information Age division of labor moves from the worker to the entire organization. Productivity gains.

**Productivity**

*Per Capita GDP Growth*

- Agricultural: 0.3%
- Industrial: 1.8%
- Information: 3.0%
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The “Early” Information Age

- Convergence of computer, communications, consumer applications, content.
- PC is central, multipurpose consumer device of the “early” Information Age. While there will not be one single “information appliance,” the PC will be the single most important tool.
- Internet is a key medium. Net is home to three business models chasing three revenue sources:
  - entertainment (advertising/subscription revenues);
  - information (subscription revenues);
  - commerce (sales revenues).
- Most valuable Web sites owned by companies with strong brands. Net also offers huge cost saving opportunities.
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◆ What is the next growth industry?
◆ What is the next growth structure?

◆ Changing business structures define the age
Successive economic revolutions have led to greater “customer empowerment.”

So too, the Information Revolution will see:
• Greater customer empowerment which leads to
  • Mass customization supported by
  • Deeper tech penetration which leads to
  • Fragmentation and ultimately
• Consolidation
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1. Customer Empowerment

Push Model —
of the early Industrial Age
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1. Customer Empowerment

*Advanced* Push Model — of the middle Industrial Age
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1. Customer Empowerment

Pull Model —
of the late Industrial Age
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1. Customer Empowerment

*Interactive Pull Model — of the early Information Age*
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2. Mass Customization

Content
Sneakers
Food
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3. Deeper Tech Penetration

**Automotive Electronics**

**Chip Count**

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<tr>
<th>Year</th>
<th>1995</th>
<th>2000</th>
<th>2005E</th>
</tr>
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<tbody>
<tr>
<td>Average Per Car</td>
<td>600</td>
<td>800</td>
<td>1,200</td>
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**Semiconductor Content**

<table>
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<tr>
<th>Year</th>
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<th>2000</th>
<th>2005E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Per Car, $ US</td>
<td>200</td>
<td>300</td>
<td>400</td>
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4. Fragmentation
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5. Consolidation
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*Risks investing in the tech sector*

♦ One can pay too much for even the best company.
♦ Even an “industry leader” may not survive for long.
♦ Beware of mediocre companies that come to market simply because there is a demand for them.
♦ High-tech booms occur when cyclical trends in the stock market and economy favor an industry, but these trends can change rapidly.
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*Net for Naught*

- Most early “new technology” companies do not survive, even as the technology thrives.

**Auto companies in the early 1900’s**

- 1900-08: 485
- 1908: 223

**Personal Computers in the early 1980’s**

- 1984 change from high 24 leading PC stocks
  - Acquired at lower price: 10
  - Acquired at higher price: 1
  - Never above peak price: 10
  - Higher than Q4 '91 / Q1 '92 peak price: 11
  - Not above peak price: 3

**Biotech stocks: in the early 1990’s**

- 35 leading 1991 biotech companies
- Prices at May 1998 vs. Q4 '91 / Q1 '92 peak

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Booms & Busts in the Past 30 Years

Standard deviation of Global Sector 12-month returns


Real Estate
Financial Svcs
Information Technology

Shipping
Gold
Aero

Energy
Data Processing
Construction

Gold
Steel