Tracking the Technology Revolution:
Highlights from the TechCast Project

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Overview

- The TechCast Method
- Other Applications
- Forecast Highlights
- Macroforecasts of Scenarios

Participation Invited

- Impact on you, your organization?
- Your industry in 2020?
- Issues? Strategies?

Books available at author’s discount
TechCast Online Research System
Collective Intelligence for Tough Questions

- Status Quo Defined as 100% Uncertainty
- 30 - 40% Decrease In Uncertainty
- Uncertainty about 30% +/- 3 years

**Scanning**
- 7 Editors
- Internet
- Periodicals
- Literature
- Interviews
- Conferences

**Background Data**
- Trends Pro & Con
- Adoption
- Market Size
- Other Forecasts

**Expert Survey**
- 100 Experts
- Diverse Sample
- Leading Thought
- Estimates

**Results**
- Forecasts
- Comments
- Validate
- Rank 2-3/50 M hits

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Typical Analysis – Virtual Education

Summary
Virtual education (VE) makes sense because education is a knowledge transferring process, but obstacles abound. Teachers resist changes in traditional methods, it is hard to convey complex ideas online, and costs often exceed revenues. But improvements in technology and methods are likely to overcome these barriers in time. TechCast thinks virtual education will enter mainstream use about 2015.

PROS: Trends Driving this Event
CREATIVE METHODS EMERGING
1) Teachers are putting their course lectures, syllabi, and study guides on websites, creating an online market for educational materials. (TechnologyReview, 6/27/06)
2) Children are being tutored by well-qualified, low wage Indian teachers using distance learning methods. TutorVista in Bangalore has 2,600 students. "We're seeing a globalization of education," said an official. (LA Times 5/11/07)

GOOD FOR BASICS Virtual education offers a cost advantage for teaching languages, math, statistics, information technology, and other well-established courses. Cisco spends $120 per employee on web-based training compared to $1800 for classroom training.

NO SIGNIFICANT DIFFERENCE Studies conclude that there is no significant difference in effectiveness compared to classroom learning. (Chronicle of Higher Ed, 9/15/03)

Other Forecast Data
1) Universities are experimenting with various approaches, but only 10% of courses are online. An expert forecasts online education to reach 14% of all courses by ’10
2) Revenues grew from $1.2 billion in 2000, to $7 billion in ’03, and could reach $200 billion
3) E-Training accounts for about 30% of corporate instruction and is expected to exceed 50% soon.

CONS: Obstacles Opposing this Event
RESISTANCE TO CHANGE
1) A major university tried to transition to virtual education but faculty opposition forced the president to resign.
2) One study found only 26% of employers accept online degrees. (BusinessWeek 8/18/05)

LIMITATIONS Some scholars claim VE degrades learning, but this is controversial. Highly complex or subjective fields may not be appropriate.

DOUBTS ON THE ECONOMICS Temple, NYU, and other universities have cancelled VE programs because of high costs, estimated at $1 million for designing one course. (US News & World Report, 1/15/01). The President of Temple U. said "It's apparent that no one has yet found a way to make online learning economically viable." (Chronicle of Higher Education, 5/11/01)
Typical Results of Expert Survey

**Virtual Education:** Electronic methods are used in 30% of university courses

<table>
<thead>
<tr>
<th>Mean</th>
<th>Std Dev</th>
<th>N (# Experts)</th>
</tr>
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<tbody>
<tr>
<td>Most Likely Year</td>
<td>2016</td>
<td>5</td>
</tr>
<tr>
<td>Market Size (1-10)</td>
<td>3.9</td>
<td>1.8</td>
</tr>
<tr>
<td>Confidence (%)</td>
<td>65</td>
<td>14.2</td>
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In addition, 6 experts predicted that this event would never occur.
Overview of Technology Revolution

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contact

Deep Space
off scale

Solar
Satellites

Humans
On Mars

Moon Base

Commercial
Space

Space
Tourism

Most Likely Year

2040

2035

2030

2025

2020

2015

2010

Energy, & Environment

Information Technology

E-Commerce

Manufacturing & Robotics

Medicine & Biogenetics

Transportation

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Possibly the Best Forecasting System Available

- **Comprehensive**  Covers strategic technologies in all fields
- **Authoritative**  Pools trend data and knowledge of 100 experts
- **Current**  Updated constantly by editors & experts in real time
- **Validated**  Annual accuracy study of forecasts over time & arrivals
- **Recognized**  Ranks 2 - 3 out of 5 million hits on Google search
- **Cited**  Top three systems in National Academies report
- **Awarded**  First Prize in AOL competition for creative IT research
- **Published**  *Technology’s Promise, Washington Post, Newsweek, Futurist*, etc.
- **Consulted**  FDA, EPA, DoD, DNI, Corning, AMD, Asian Development Bank, Saudi Arabia, Korea, Singapore, Kuala Lumpur, etc.

Strategic Implications

• Online Collective Intelligence a robust tool for pooling knowledge
• Most organizations unaware of the knowledge residing in their system
• Process aids understanding and integration
• Possible applications
  Corporate sales, issues, strategy, etc.
  Federal Center for Technology Forecasting
  Integrate knowledge of intelligence agencies
Alternative Energy

- Geothermal, wind, biomass growing
- Clean coal, gas, sequester/recycle CO2
- Concentrated solar/photovoltaic in 2013-14
- Biggest source is conservation (Lovins)
- Nuclear growing – from 440 plants to 500-600
- Deregulation, distributed energy, smart grids
- Growth rates of 30-50%/year similar to Moore’s Law
- Potential Market ~ $10-20 billion/year

TechCast: from 17 to 30% of energy use by 2024
(hydro - 6%, bio - 3 to 6%, nuclear - 6 to 9%, wind - .5 to 3%, solar - .5 to 6%, plus conservation, clean coal, etc.)
Global Access

- 5 billion cell phones in 2011 (76% of world)
- Gartner: 2 billion PCs by 2014
- Cheap smart phones for 25% of world by 2012
- Wireless, shared devices, $100 laptop, etc.
- H-P, Intel, Phillips, AT&T, MIT entering market
- Global IT market ~ $7 trillion (Forrester)
- Explosion of awareness and change
- TechCast: 50% use Internet by 2016
AI

• Growth: $1 B in ’93, $12 B in ’02, $21 B in ’07
• Speech recog, robots, games & simulations, GPS nav, language trans, emotion recog, etc.
• Intelligent systems: Siri, IBM Watson, Microsoft Bing, Wolfram Alpha, Google, Stanford, MIT, DOE
• 5 robotic vehicles completed DARPA competition
• IBM simulating the human brain (8,000 neurons)
• Kurzweil: $1000 PC with power of the brain by 2020
• TechCast: AI replaces routine mental work (“weak AI”) about 2025

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Robotics

State-of-the-Art (Sony, Honda, Toyota)

- 60K vocabulary, speech recognition
- 30 motor joints, walks, runs, stairs
- Learn faces, surroundings
- Security guards, receptionists, aides, serving tea, other simple tasks

Coming

- Emotional interactions – Kizmet (MIT)
- Improved AI, speech, consciousness?
- Care givers, servants, warriors, etc.
- Rodney Brooks (MIT): “Like PCs in ’75”
- TechCast – 30% of homes by 2026
Medicine & Biogenetics

[Graph showing trends in experts' confidence and market size over time for different categories such as Telemedicine, Body Monitoring, Artificial Organs, Personal Medicine, Genetic Therapies, Cancer Cure, Synthetic Grown, Child Traits, Neurotech, and Life Extension.]
Telemedicine

- About 90% of medical tasks use paper/phone
- US medicine $1.7 trillion/16% GDP. Could be cut by 20%
- Resistance by physicians, administrators, patients
- Point of care terminals/records/PDAs/smart phones
- Publication of patient outcome data
- Remote patient monitoring/video conferencing
- Prescription management
- Non-invasive/robotic surgery
- Interactive models of patients (EU Future of Med)
- Computerized diagnostics
- Self-care management/knowledge management
- National Medical IT Czar, Kaiser Permanente – “inevitable”
- Google Health failure. Dossia, Microsoft?
- TechCast: 30% of care by 2016
Space Tourism

- Space Ship One (Virgin Galactic) - “like commercial air travel”
- Space Adventure Co. has 1000 clients interested in going to the Int'l. Space Station for $20 M and around the moon for $100 M
- Robert Bigelow – Building cruise ships and hotels
- Market surveys (10,000 people @ $1 M)
- NASA: 2010 -12
- TechCast: High orbit around Earth – 2015

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2015
The World Online

**Devices:** Smart phones, $100 PCs, Web 2.0/3.0, wall monitors, convergence

**Infrastructure:** Faster BB and wireless, cloud, language translation, speech recognition, etc.

**E-Commerce:** 30% take-off adoption levels - $20/30 billion/year

**Green Tech, TeleMed, Autos,** etc.

**Global Brain:** Half the world joins the Internet

**Next 35 yr Upcycle:** About 2015-2050
2020 - High-Tech Arrives

**Sustainability** Green business, alternative energy, climate control, GMO, smart grids, etc.

**Green Transportation** Hybrid/electric/smart cars, hi-speed trains, small aircraft, hypersonic flight

**Mastery Over Life** Artificial organs, DNA testing, grown organs, cancer cure, life extension, neurotech.

**Infinite Knowledge and Intelligence** 2nd generation IT (bio, optical, quantum), AI, robotics, virtual reality

**Global Consciousness** Automation of routine thought moves beyond knowledge to address the MegaCrisis. Restructuring institutions and society.
Technologies of Consciousness
The Next Frontier Beyond Knowledge?

**Neurotech** – Prostheses for Parkinson’s, adding memory, etc.

**Biofeedback** – Use of EEG for focused attention, stress, control, etc.

**Machine-Brain interface/Thought Power** – Brain waves controlling machines, comm.

**Virtual Reality** – Simulating environments to live in fully.

**HyperMedia** – Consumerism, sex, violence, hype, etc. - the over connected society

**The Experience Economy** – Travel, dining, sports, the arts, etc

**Drugs** – Medicinal (Prozac, etc), professional (Modafinil), recreational (marijuana, etc )

**Vision & Strategy** – Purpose, vision, forecasting, strategy, etc.

**Institutional Change** – Collaborative enterprise in business & government

**Collaboration** – Politics, diplomacy, labor-mgt coop., joint problem-solving

**Servant Leadership** – GM Saturn, Good to Great Studies, Japanese, etc.

**Conflict Resolution** – Peace Studies, arbitration, mediation, etc.

**Physical Practice** – Yoga, dance, athletics, art, etc.

**Religion** – Synthesis of world’s religious values?

**Science** - Study of spiritual energy?

**Meditation & Prayer**

**Sexuality**

**Other ways to shape awareness**

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Creative Destruction of Institutions

- Government: E-government, budget deficits?
- Health Care: Patients vs profits, performance data, cost?
- Media/Entertainment: Moving to Internet
- Education: Distance learning, cost?
- Banking, Insurance: Internet?
- IT Industry: Technology Gap?
- Auto Makers: 50K deaths/yr, congestion, environment?
- Manufacturing: Mass customization, environment?
- Military: WMD, culture, peace-keeping?
Thank you

Questions?