



# Technological Entrepreneurship

Why, how, and an example.

Dr. Jack M. Wilson, Distinguished Professor  
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# Technological Entrepreneurship

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Inventions and applications of new technologies often change the world in very profound ways. The invention of the practical steam engine in 1765 James Watt drove the following industrial revolution and remade transportation systems eventually creating the steam ship and the steam locomotive. Like all inventors, Watt built on earlier, but less practical work by others like Newcomen and Savery. There was even a crude version of a steam engine created by the Greek scientist Hero of Alexandria in the first century CE.

- <http://www.livescience.com/44186-who-invented-the-steam-engine.html>
- <http://www.history.com/topics/industrial-revolution>

Like all technologies, before and since, there were those who resented and resisted the new ways. The Luddites in England often attacked factories and destroyed equipment. Today we often refer to those who resist new technologies as “**Luddites**.”

In 1936, Charlie Chaplin, made a film depicting the challenges of living in “**Modern Times**” that captured the angst of those who found technological change difficult.

Today is no different.



# Technological Entrepreneurship

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Development of the first electrical generators, by Faraday and improved by others, was quickly followed by methods of distribution and widespread deployment of electrical motors and other systems. The world we live in was much shaped by these scientific discoveries.

<http://instituteforenergyresearch.org/history-electricity/>

The invention of radio by Guglielmo Marconi, an Italian Inventor, in 1895-1899, (also Nikola Tesla who got the first patent!) launched a new wave of technological entrepreneurship and this was quickly followed by the invention of television by Philo T. Farnsworth in 1927.

- <http://inventors.about.com/od/rstartinventions/a/radio.htm>
- <https://www.nyu.edu/classes/stephens/History%20of%20Television%20page.htm>

The automobile began in the late 19<sup>th</sup> century with steam power, but after Rudolph Diesel invented the first petroleum fired engine and Karl Benz used it to power an automobile, the automobile began to become more widespread. Henry Ford applied the principles of “**Mass Production**” to enable the automobile to be afforded by many. Mass production required that the product be very standardized in order to reduce cost and increase output efficiency. It was claimed that Ford said that you could “*have any color that you wanted –as long as it was black.*”

We will see that modern computing has helped to turn that paradigm around and now offer “**mass customization.**”



# Technological Entrepreneurship – Computing and Networks.

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Two major related events have converged to create the boom in technological entrepreneurship in the 90's -which inflated a bubble that burst at the beginning of the new millennium, but which created a medium in which new kinds of industries grew to dominate our economy.

The first of those two events was the invention of personal computing marked by the introduction of the Apple II computer in 1976, created by Steve Wozniak in partnership with Steve Jobs, ([https://en.wikipedia.org/wiki/History\\_of\\_Apple\\_Inc.](https://en.wikipedia.org/wiki/History_of_Apple_Inc.) ) and the introduction of the IBM PC in 1981 created by a team of IBM “skunk works” engineers in a Boca Raton, FL site under Bill Lowe.

([https://www-03.ibm.com/ibm/history/exhibits/pc25/pc25\\_birth.html](https://www-03.ibm.com/ibm/history/exhibits/pc25/pc25_birth.html) )

Most notably, the PC needed an operating system and, rather than license the popular CPM system, IBM contracted with Harvard drop-out Bill Gates to write a near clone of CPM.

The second event was driven by the first. Computers needed to find a way to speak to one another. Networking was created to allow them to communicate and then the internet was created (first as ARPANet in 1969) by the Boston based BBN consultancy for the Defense Advanced Research Programs Agency (DARPA) in order to create a communication protocol that would allow worldwide communication that could survive even nuclear warfare. That network was then extended to the National Science Foundation and then became the internet we know today.

<https://en.wikipedia.org/wiki/ARPANET>

# Do these people look like entrepreneurs?



← Apple Founders -1978  
Steve Jobs and  
Steve “Woz” Wozniak

Microsoft Founders -1978 ->  
Top-Steve Wood, Bob Wallace, Jim  
Lane  
Mid- Bob O’Rear, Bob Greenberg,  
Mark McDonald, Gordon Letwin  
Front – Bill Gates, Andrea Lewis,  
Marla Wood, Paul Allen



# The Boom in BioTech

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Discoveries in the areas of biology, biochemistry, biophysics, and related fields have driven another wave of technological entrepreneurship.

## **Biotech: The High Stakes Table of Entrepreneurship**

- *“Science and entrepreneurship are both acts of experimentation. Both involve taking risks to reach a positive end, changing course when needed, and attempting the never-been-done. While many start-ups now are focused on creating the next Facebook or some genius e-commerce play, there are also scientists tinkering in labs. Biotechnology is sometimes forgotten about, but the field leads to real products -- new drugs and medical devices that aid human health. Want to cure cancer? These people will be the ones to do it. Biotech is also risky. It’s a high cost, high stakes field. These entrepreneurs ask for large sums (\$3 to \$5 million just to start) without knowing the final outcome. The visions are lofty -- eliminating rare diseases, shrinking tumors, curing cancers.”*
- <http://www.forbes.com/sites/lorikozlowski/2012/03/23/biotech-the-high-stakes-table-of-entrepreneurship/#1a88ae6b40e9>

Indeed the figure of \$ 3 to 5 million is “just to start.” Bringing a new drug to market generally reaches to single digit billions.

Internet start-ups can often be bootstrapped or begun with very low funding. Biotech start-ups require far more resource and are thus far more difficult.

# Two Key Concepts

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- Joseph Schumpeter –Harvard University economist from Austria
  - **Creative Destruction** – 1934- new products and technologies make old products and technologies obsolete
- Clayton Christensen –Harvard University Management
  - **Disruptive Innovation**-1997 – new products begin in new, unexplored markets but grow in quality and capability to displace older markets.
    - Mini-computer disrupted mainframes and were in turn disrupted by PC's.
    - Steel mini-mills created poor quality steel at low prices to take the least profitable part of the steel market. They then grew to displace the old-line steel companies.
- I cannot over-emphasize how important these two topics are in understanding entrepreneurship. Creative destruction and disruptive innovation are indeed closely related, disruptive innovation is a very special case when a company enters into a very low end of a market at a place where the dominant players are not so interested because it is not profitable or not able to satisfy their largest customers. But, the company doing the disruption gets a foothold in the market, establishes itself, and then learns how to do the things it needs to do to enter the more profitable and sophisticated portions of the market.
- Often the established companies never see it coming.
  - <http://www.claytonchristensen.com/key-concepts/>
  - [http://en.wikipedia.org/wiki/Clayton M. Christensen](http://en.wikipedia.org/wiki/Clayton_M._Christensen)
  - [http://en.wikipedia.org/wiki/Disruptive innovation](http://en.wikipedia.org/wiki/Disruptive_innovation)

# Three technology advances that defined our present

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- The incredible advances that we have seen in computing, communication, and cognition have been driven by three rules:
- Moore's Law
  - The number of components on a chip, and hence the computing power, doubles every 18 months.
- Metcalfe's Law (Network Economics)
  - The Value of a network scales as the square of the number of those connected to it.
    - Value: economic, personal, societal,....
    - Double the network = four times the value!
    - "network economics" or "network externalities"
  - Social media depends upon capturing the largest network. If you double your network, you quadruple the desirability of your social media network.
- Gilder's Law (Bandwidth deployment)
  - Bandwidth deployment doubles every 6 months (three times as fast as computing power doubles).
- More details on these three can be found at:  
<http://www.jackmwilson.net/Entrepreneurship/Cases/Moores-Meltcalfes-Gilders-Law.pdf>

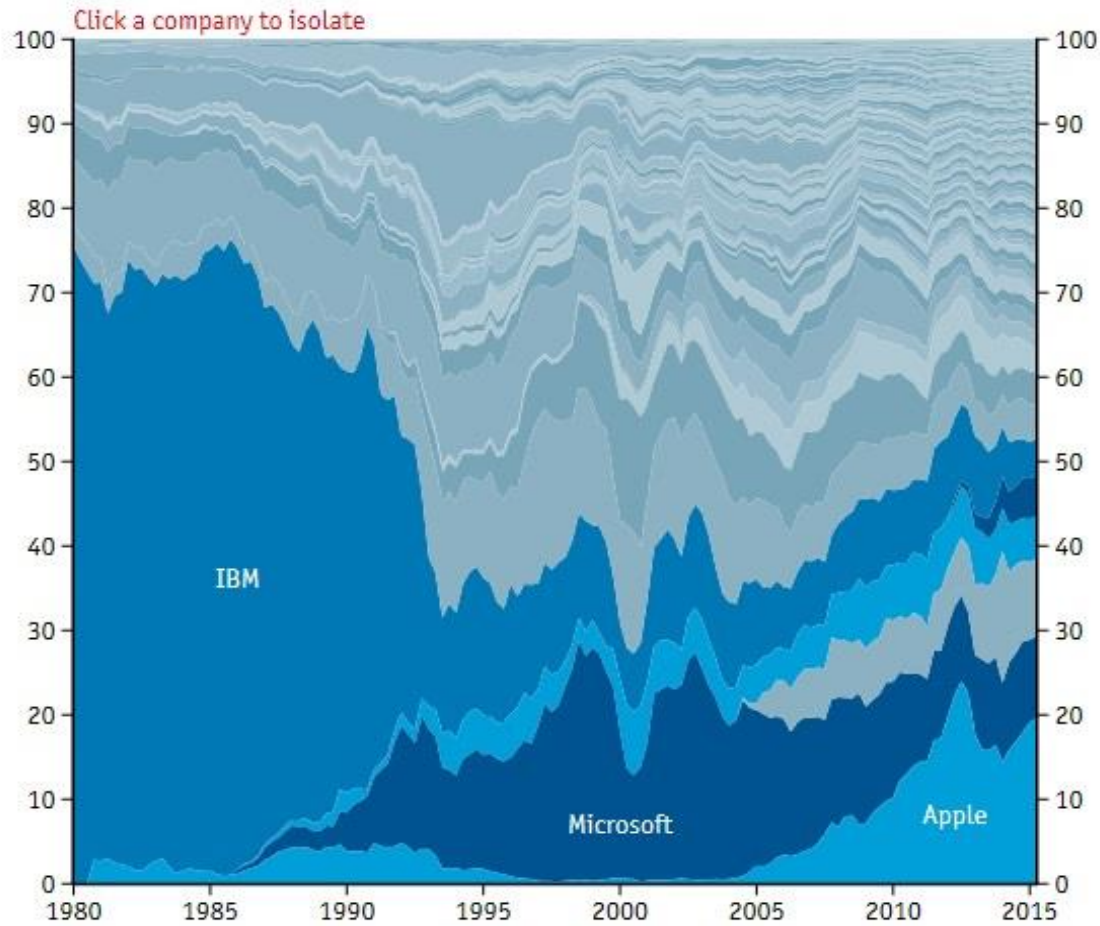


# The Fortunes of Companies Rise and Fall with Time

## The changing US technology sector

Market value, top 100 firms\*, % of total

**% of total** Nominal Real



Sources: Thomson Reuters; *The Economist*

\*As of Q2 2015

<http://www.economist.com/news/briefing/21659722-tech-boom-may-get-bumpy-it-will-not-end-repeat-dotcom-crash-fly>











# Entrepreneurs are constantly creating new companies

## Legendary startups

Biggest American "unicorns"

(Date founded)

Unicorn (noun): Any startup worth more than \$1bn

		Company valuation, \$bn*, July 2015	Funds raised, \$bn	Revenue, \$m, 2014†	Employees, '000‡
 <b>UBER</b> (2009)	Taxi hailing	41	6	800	7.5‡
 <b>airbnb</b> (2008)	Accommodation for tourists and millennials	26	2.3	450	3.0
 <b>Snapchat</b> § (2011)	Ephemeral messaging app	16	1.2	nil	0.4
 <b>Palantir</b> (2004)	Big data	15	1.1	600	1.5
 <b>SPACE X</b> § (2002)	It is rocket science	12	1.1	825	3.0
 <b>Pinterest</b> (2009)	Photo sharing	11	1.3	15	0.7
 <b>Dropbox</b> (2007)	Cloud-based file sharing	10	1.1	400	1.5
 <b>wework</b> § (2010)	Office space provision	10	1.0	145	0.4
 <b>theranos</b> (2003)	Diagnostics through blood sampling	9	0.1	45	0.2
 <b>Square</b> (2009)	Mobile-payments system	6	0.6	900	1.3

Sources: CB Insights; Mattermark; PrivCo; *The Economist* \*Latest post-money †Estimate ‡Drivers are not employees §Not in Silicon Valley

Economist.com

<http://www.economist.com/news/briefing/21659722-tech-boom-may-get-bumpy-it-will-not-end-repeat-dotcom-crash-fly>

# Compare the list of Global Unicorns to the list above of US Unicorns

	Name	Value (\$ B)	Date Joined	Country
1	<a href="#">Uber</a>	\$68.00	8/23/2013	United States
2	<a href="#">Didi Chuxing</a>	\$50.00	12/31/2014	China
3	<a href="#">Xiaomi</a>	\$46.00	12/21/2011	China
4	<a href="#">Airbnb</a>	\$29.30	7/26/2011	United States
5	<a href="#">SpaceX</a>	\$21.20	12/1/2012	United States
6	<a href="#">Palantir Technologies</a>	\$20.00	5/5/2011	United States
7	<a href="#">WeWork</a>	\$20.00	2/3/2014	United States
8	<a href="#">Lu.com</a>	\$18.50	12/26/2014	China
9	<a href="#">China Internet Plus Holding</a>	\$18.00	12/22/2015	China
10	<a href="#">Pinterest</a>	\$12.30	5/19/2012	United States
11	<a href="#">Flipkart</a>	\$11.60	8/6/2012	India
12	<a href="#">Toutiao</a>	\$11.00	4/7/2017	China
13	<a href="#">DJI Innovations</a>	\$10.00	5/6/2015	China
14	<a href="#">Dropbox</a>	\$10.00	10/5/2011	United States
15	<a href="#">Infor</a>	\$10.00	11/16/2016	United States
16	<a href="#">Stripe</a>	\$9.20	1/23/2014	United States
17	<a href="#">Spotify</a>	\$8.53	6/17/2011	Sweden
18	<a href="#">Snapdeal</a>	\$7.00	5/21/2014	India
19	<a href="#">Lyft</a>	\$6.90	3/12/2015	United States
20	<a href="#">Lianjia</a>	\$6.20	4/8/2016	China
21	<a href="#">Global Switch</a>	\$6.02	12/22/2016	United Kingdom

[https://www.cbinsights.com/research-unicorn-companies?utm\\_source=Facebook&utm\\_medium=Paid&utm\\_campaign=Unicorn%20Club](https://www.cbinsights.com/research-unicorn-companies?utm_source=Facebook&utm_medium=Paid&utm_campaign=Unicorn%20Club)

# The money flowing into new companies continues to accelerate



<http://www.economist.com/news/briefing/21659722-tech-boom-may-get-bumpy-it-will-not-end-repeat-dotcom-crash-fly>



# Recognizing Opportunities and Generating Ideas.

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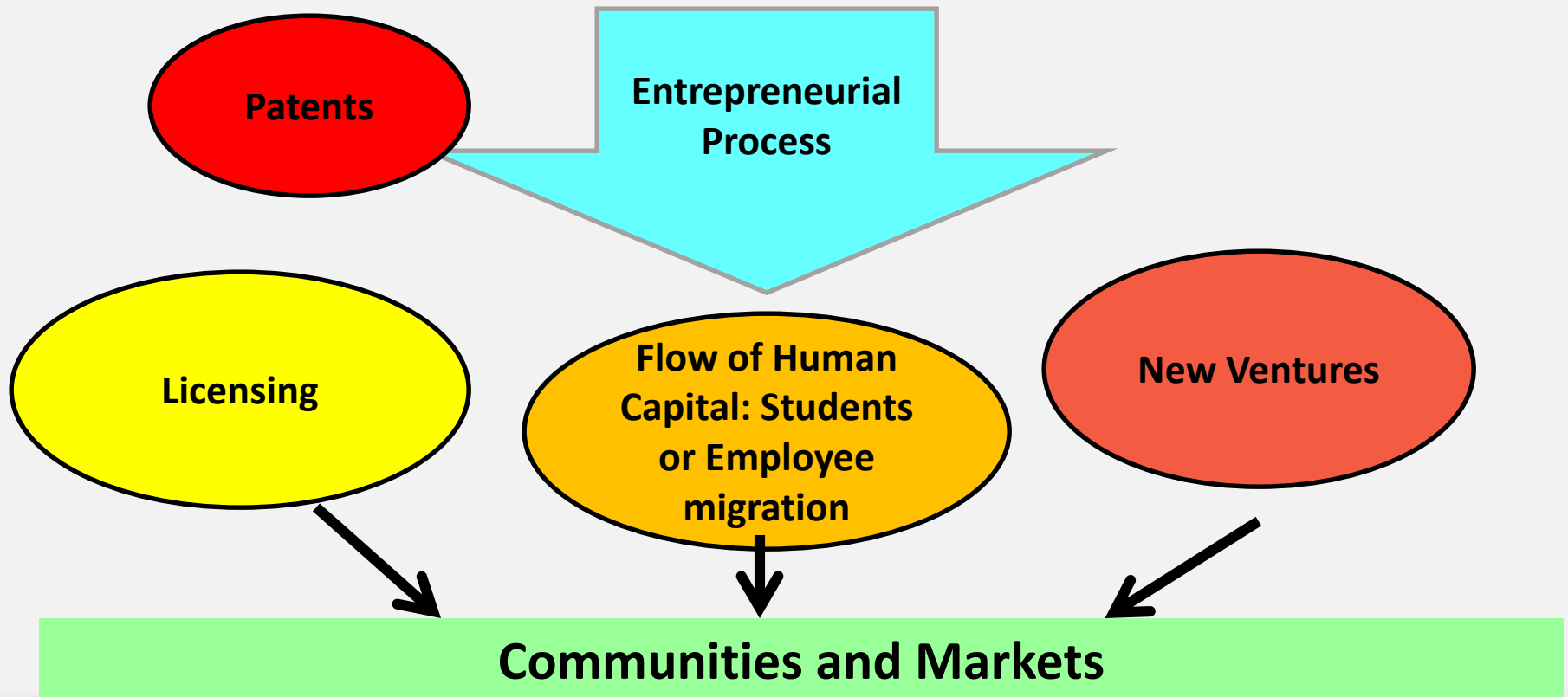
# Where do opportunities start

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- Technological opportunities almost always start with breakthroughs in new technologies. Those breakthroughs can come from:
  - University research labs
  - Industry research labs like Bell Labs, Google Labs, IBM Labs, General Electric Labs, Phillips Research Labs, Microsoft Labs, Amazon, Pfizer, Novartis, Sanofi, etc.
    - Industrial laboratories are generally seen as sources of incremental innovation rather than radical innovation.
      - <http://www.jstor.org/discover/10.2307/1828511?uid=3739696&uid=2129&uid=2&uid=70&uid=4&uid=3739256&sid=21104913961097>
    - Over the last three decades, the center of gravity of research has shifted further toward universities and away from industrial laboratories.
    - The biotech industry has been an exception –particularly in the applied research areas.
  - Government research laboratories like FermiLab, Argonne National Laboratories, Sandia, National Institutes of Health, National Institute of Standards and Technology, and others.
- To get to market they need to either be **licensed** to existing organizations or used to develop **new ventures**.
- Students who graduate and then go into existing organizations also carry the intellectual property with them into their new positions. This is an important flow of ideas into the marketplace or community.

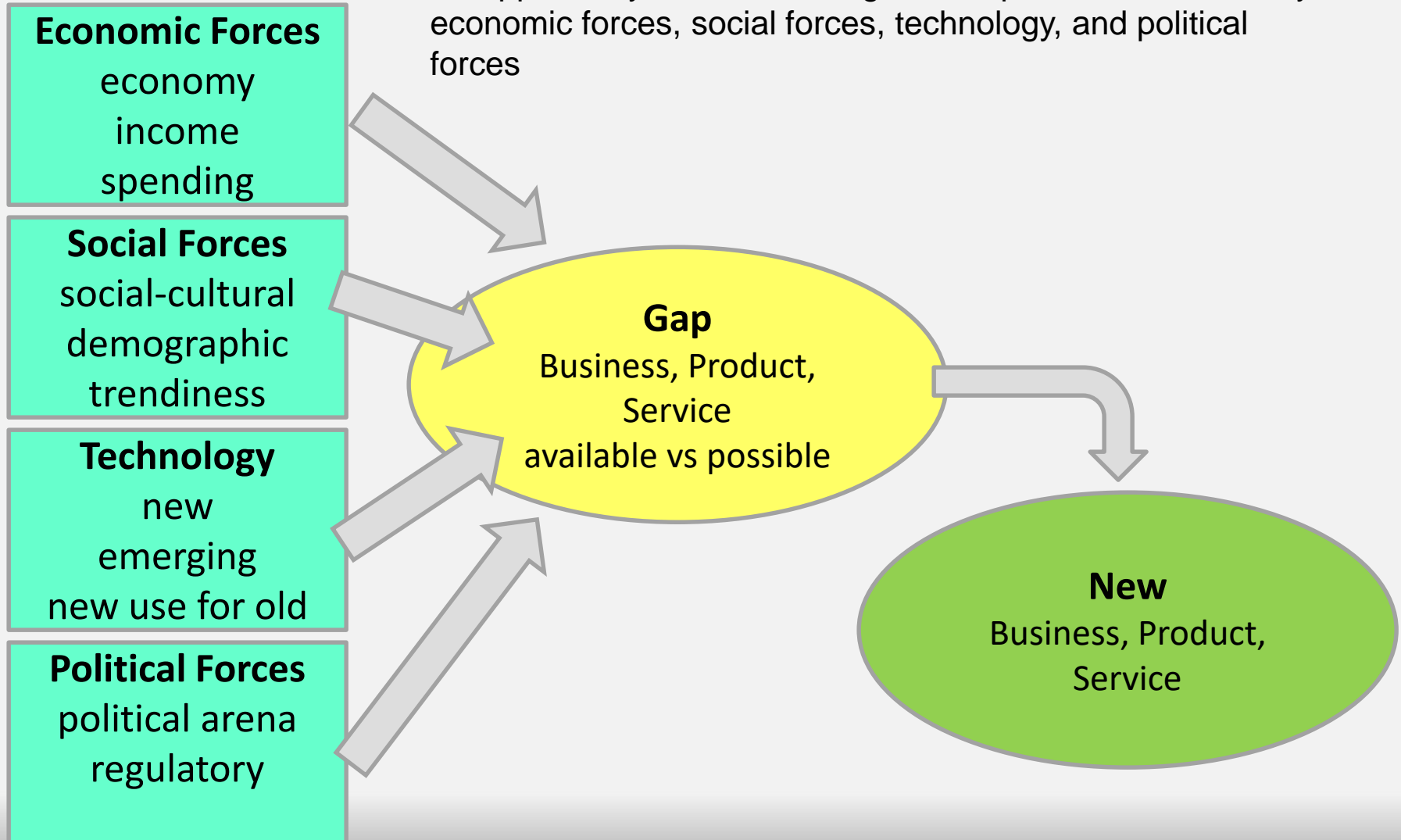
# From Idea to Market or Community Use

**Idea Generators:** University Research, Corporate Innovation, Individual Invention, Government Labs, Social Innovation, Intellectual Capital



# From Trends to Opportunity

- An opportunity takes advantage of the pressures exerted by economic forces, social forces, technology, and political forces





# Tesla Motors -all electric high performance cars

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- Economic Trend – increasing gas prices
- Social Trend –desire to be green
- Technology Advances –Battery and motor improvements
- Political Regulatory Trend – favorable treatment and support for alternative energy systems.



# Nonspec -A student generated company

- Nonspec (previously known as Developing Nation Prosthetics) provides low cost, high functionality replacement limbs with an acceptable amount of customization for children in other nations.
- The team consists of Katherine Cain, Jonathan De Alderete, Brendan Donoghue, Sean Gibson, Olivia Keane and Erin Keaney with majors in plastics and mechanical engineering, as well as minors in business administration and history.
  - <https://www.uml.edu/Innovation-Entrepreneurship/DifferenceMaker/Meet-the-DifferenceMakers/DM-Nonspec.aspx>



# Global Entrepreneurship

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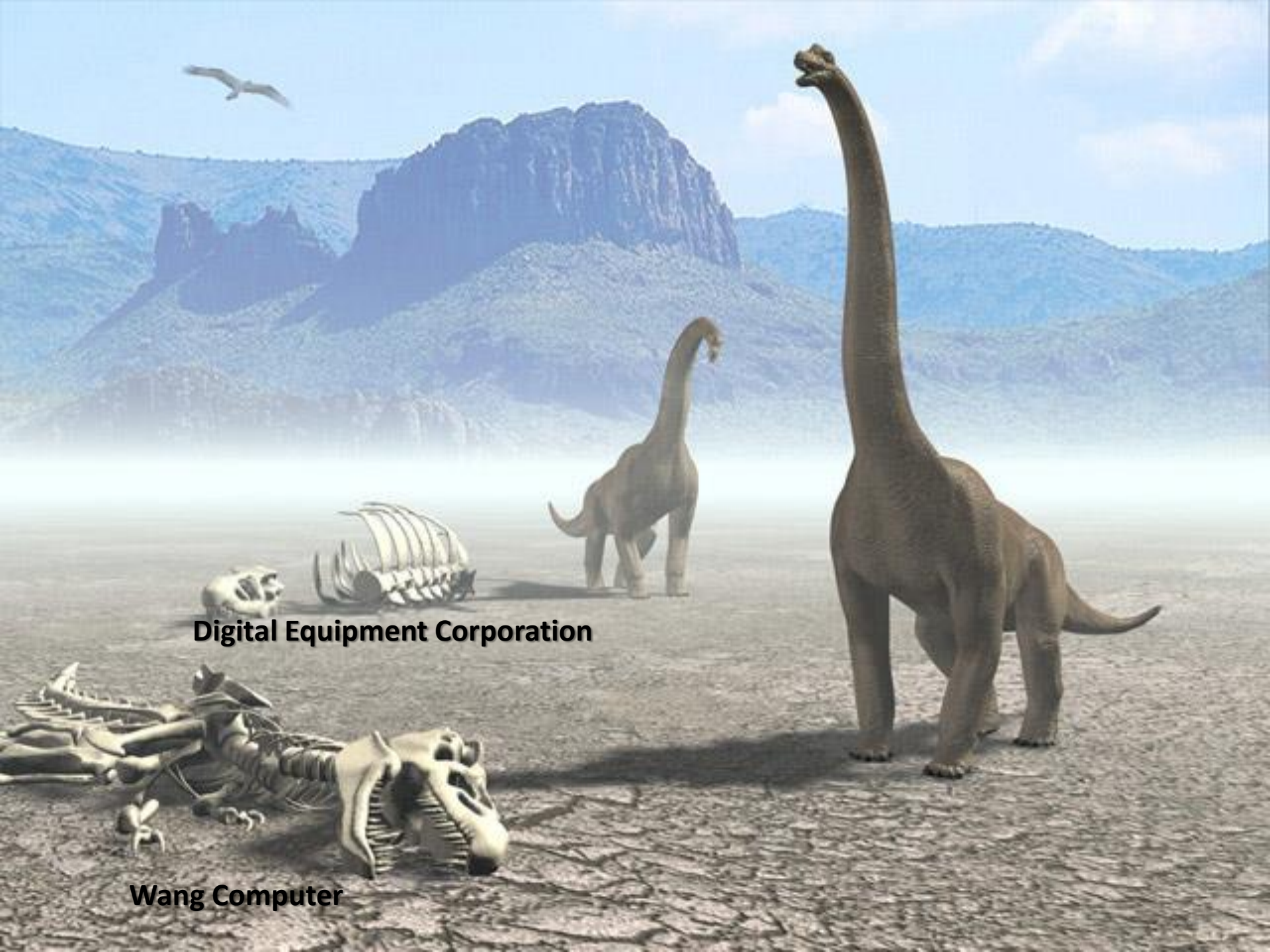
- Global Entrepreneurship has flourished over the last 50 years. Major changes in world governments, economic systems, and cultural interactions have created an environment in which entrepreneurship has become a significant factor in regional economic development, global geo-politics, and even cultural change.
- There have been three significant issues that have enabled much of this innovation.
  - The incredible advances in technology –particularly in computing and the internet, but also in the life and medical sciences.
  - The dismantling of barriers to trade and the movement of goods and ideas across borders that has found expression in world trade organizations like the WTO and in multi-national trade agreements like the European Union (EU), North American Free Trade Agreement (NAFTA) and many others.
  - The opening of borders to a much freer movement of people who emigrate and immigrate to find better opportunities in education and employment.

# Why do Innovation and Entrepreneurship Matter?

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- Innovation and Entrepreneurship has proven to be the most successful way to address problems and create both economic and social opportunity.
- Companies that fail to innovate often disappear.
  - Digital Equipment and Wang Computer, both born and operated right here in this region, were once two of the largest and most important computer companies on the globe. They did not see the microcomputer (PC) coming and today they do not exist, and Apple and Microsoft are two of the largest companies in the world.
  - Borders once operated 659 bookstores all across the county. They never saw Amazon.com coming, and by the time they did it was too late. Gone.
  - Blockbuster dominated the video rental business, but now they are gone and video are delivered on demand by Netflix and others.
- Companies that do innovate can succeed wildly.
  - Google, Amazon, Facebook, Twitter, Instagram, and so many others are major companies who are younger than many of our university students!
- Geographic regions that foster and support innovation –often around great research universities are flourishing economically.
- Innovation and Entrepreneurship create jobs for our citizens, cures for our diseases, and new ways for human beings to interact.





**Digital Equipment Corporation**

**Wang Computer**

# Why study international entrepreneurship?

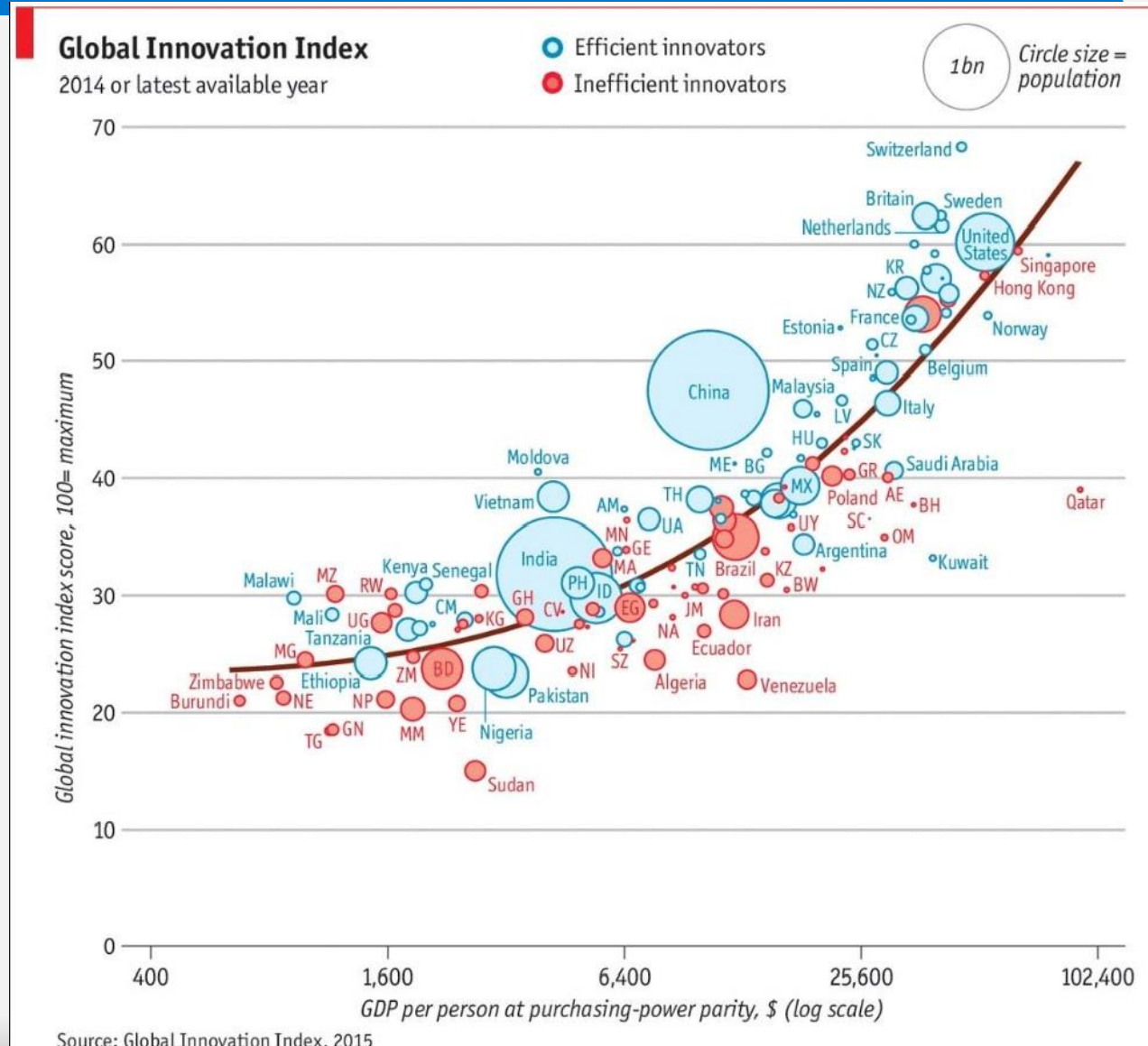
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- World markets are **larger and faster growing** than domestic ones.
- **Changes in technology, transportation, and trade** liberalization have made international trade more accessible to companies, especially new entrepreneurial firms.
- In a global economy, **consumers worldwide** choose from a wide variety of goods and services.
- Collectively, the movement of goods, labor and capital across national borders is part of a growing trend toward globalization—the creation of an **integrated interdependent** world economy.
- Entrepreneurs are on the cutting edge in creating international businesses; they are often the first movers into new markets, new products, and new services.
- Firms that choose to remain domestic miss great opportunities and often face increased risks.
  - For example, a company that has achieved the enviable position of having one-third of the US consumer market for its products has only a 1.5% share of the global market, 98.5% of the market is still available.
  - <http://data.worldbank.org/indicator/IC.BUS.NREG/countries>

# Why do countries care?

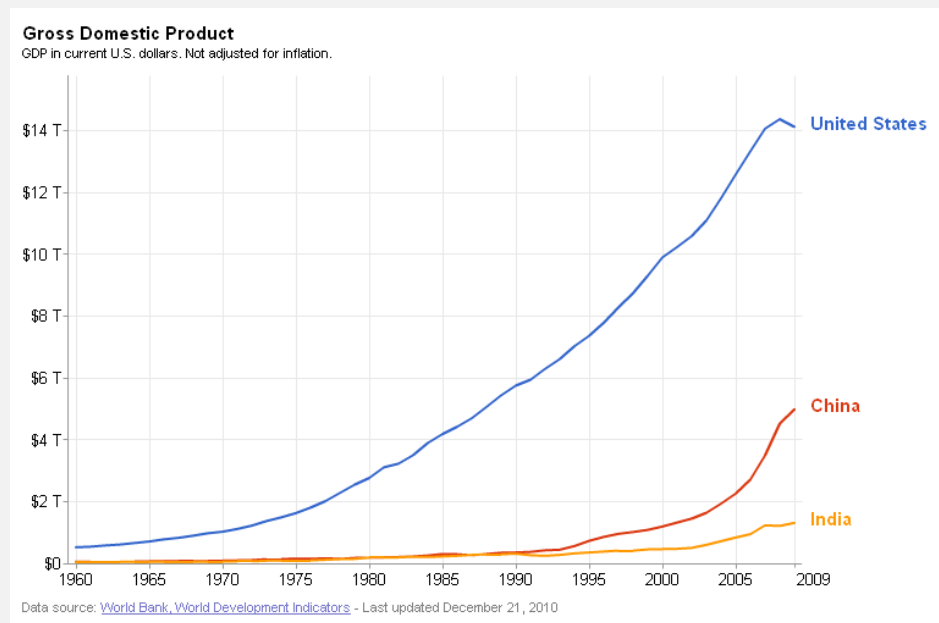
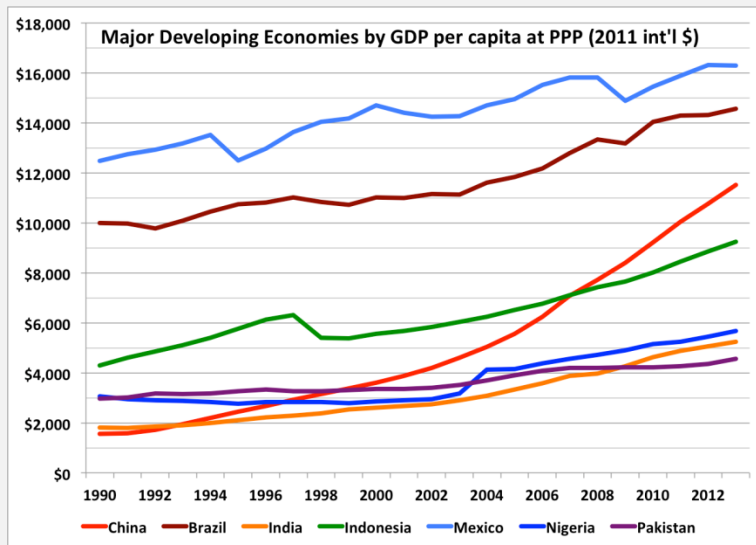
Because the more innovative that a country is the larger is their GDP per person.

The economic development of countries is very dependent upon innovation.



# Growth in Economies varies by country

Entrepreneurial activities take place within an ecosystem of the countries involved. As we can see below, that ecosystem varies by country and is always changing.



In 1974, China's GDP was about 280 B CNY  
In 2014, China's GDP was 63,646 B CNY or \$ 10,361 B US.  
This is a growth of 22,700 %

- "Graph of Major Developing Economies by Real GDP per capita at PPP 1990-2013" by CircleAdrian - Created on Excel from World Bank World Development Indicators 2014 data. Licensed under CC BY-SA 3.0 via Wikimedia Commons - [http://commons.wikimedia.org/wiki/File:Graph\\_of\\_Major\\_Developing\\_Economies\\_by\\_Real\\_GDP\\_per\\_capita\\_at\\_PPP\\_1990-2013.png#/media/File:Graph\\_of\\_Major\\_Developing\\_Economies\\_by\\_Real\\_GDP\\_per\\_capita\\_at\\_PPP\\_1990-2013.png](http://commons.wikimedia.org/wiki/File:Graph_of_Major_Developing_Economies_by_Real_GDP_per_capita_at_PPP_1990-2013.png#/media/File:Graph_of_Major_Developing_Economies_by_Real_GDP_per_capita_at_PPP_1990-2013.png)
- <http://www.theamericanconservative.com/articles/how-social-darwinism-made-modern-china-248/>

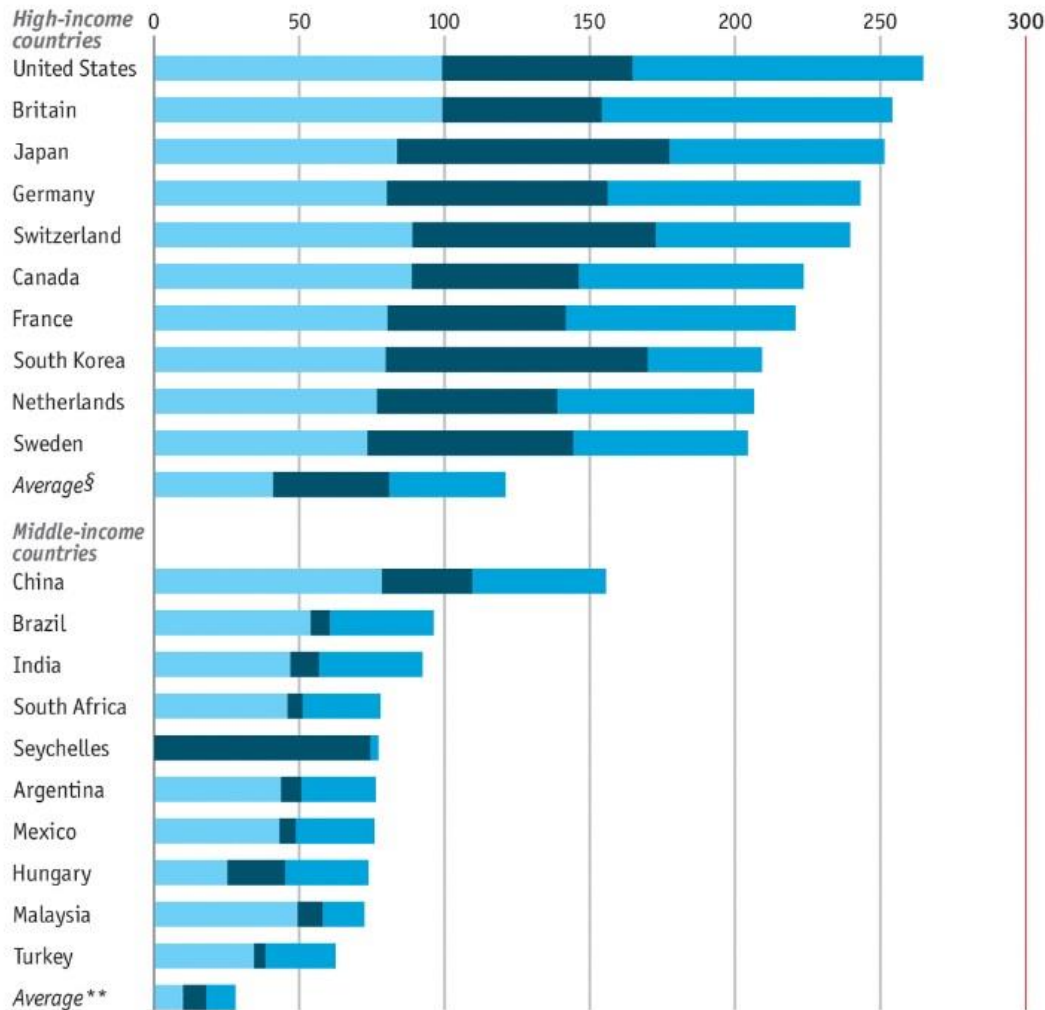


# Great Research Universities are a key to innovation quality.

## Innovation quality

300=maximum quality

Universities\* Patents† Citations‡



Source: Global Innovation Index, 2015

\*Average rating of top three universities †Number of patents filed per unit of GDP  
‡Cited articles as % of published articles §Of 48 countries \*\*Of 72 countries

<http://www.economist.com/blogs/graphicdetail/2015/09/global-innovation-rankings?fsrc=scn%2Ffb%2Fte%2Fpe%2Fed%2Ftheinnovationgame>

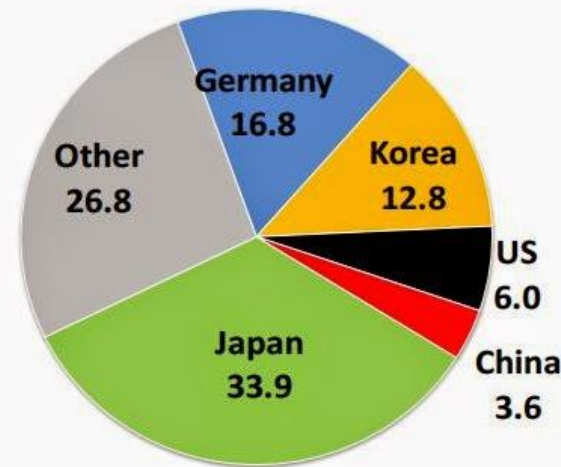
# Apple Global Supply Chain -iPhone

Table 1 . Apple iPhone 3G's Major Components and Cost Drivers

Manufacturer	Component	Cost (USD)
Toshiba (Japan)	Flash Memory	\$24.00
	Display Module	\$19.25
	Touch Screen	\$16.00
Samsung (Korea)	Application Processor	\$14.46
	SDRAM-Mobile DDR	\$8.50
Infineon (Germany)	Baseband	\$13.00
	Camera Module	\$9.55
	RF Transceiver	\$2.80
	GPS Receiver	\$2.25
	Power IC RF Function	\$1.25
Broadcom (USA)	Bluetooth/FM/WLAN	\$5.95
Numonyx (USA)	Memory MCP	\$3.65
Murata (Japan)	FEM	\$1.35
Dialog Semiconductor (Germany)	Power IC Application Processor Function	\$1.30
Cirrus Logic (USA)	Audio Codec	\$1.15
<b>Rest of Bill of Materials</b>		<b>\$48.00</b>
<b>Total Bill of Materials</b>		<b>\$172.46</b>
<b>Manufacturing costs</b>		<b>\$6.50</b>
<b>Grand Total</b>		<b>\$178.96</b>

[http://tomjconley.blogspot.com/2014\\_10\\_01\\_archive.html](http://tomjconley.blogspot.com/2014_10_01_archive.html)

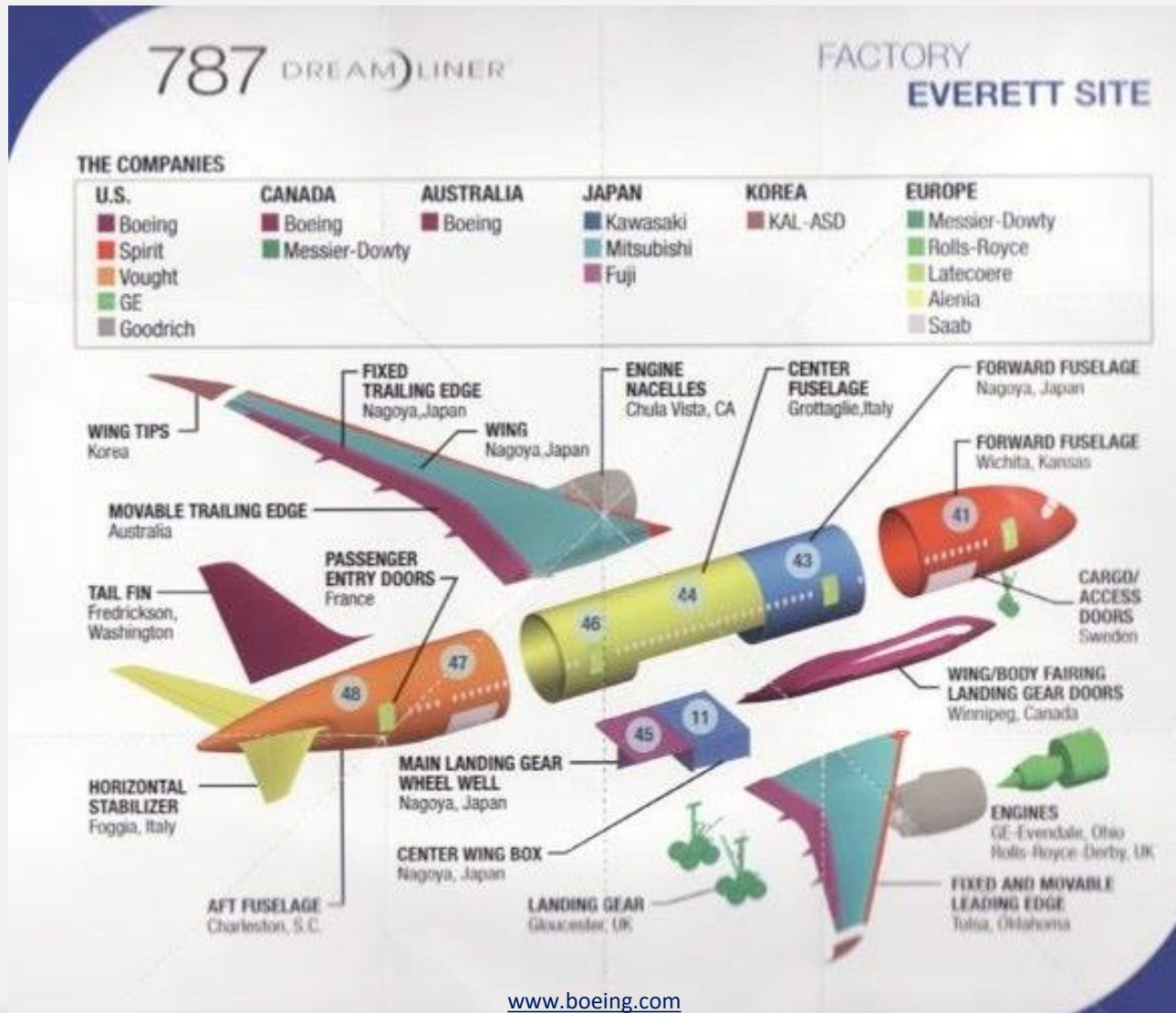
iPhone Manufacturing Cost Distribution by County (%)



Source: Xing and Detert (2010)



# The Boeing 787 is another great supply chain example



# Entrepreneurship is an Emigrant thing too.

- Migrant Brainpower

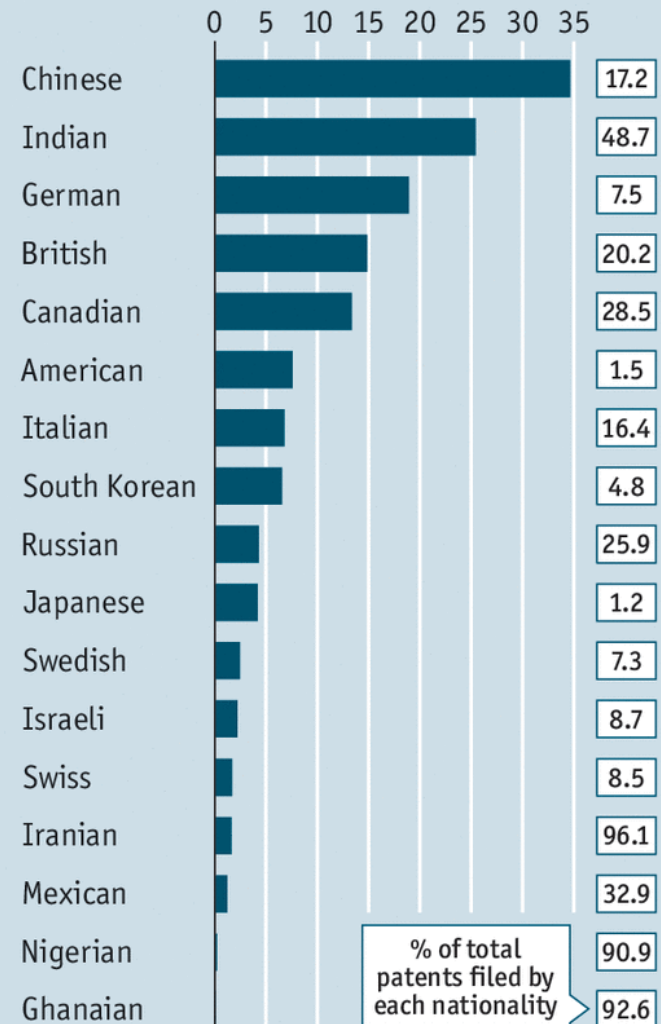
<http://www.economist.com/news/international/21656175-migrant-brainpower>

<http://www.economist.com/news/international/21656176-governments-believe-their-diasporas-can-solve-all-sorts-problems-they-are-picky>

- It is interesting that Indian inventors seem to need to leave home to file a patent (48.7%) while the German inventor usually does so at home -only 7.5% are done abroad.
- Technically this only shows patents and not entrepreneurship, but it indicates how influential immigration is upon innovation.
- This **diaspora** of innovation often becomes a source for new ventures as well as a built in support structure.

## Patents filed by emigrants

2007-12\*, '000



Source: WIPO

\*To September



Dr. Jack M. Wilson  
Distinguished Professor of Higher Education, Emerging Technologies, and Innovation

# Reprinted from THE WALL STREET JOURNAL.

THURSDAY, AUGUST 6, 1998

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## TECHNOLOGY JOURNAL / NET INTEREST

# Software Seeks to Breathe Life Into Corporate Training Classes

## Workers Avoid Long Courses — And Long Trips

By REBECCA QUICK

Staff Reporter of THE WALL STREET JOURNAL

**T**HE INTERNET promises a lot of miracles, but here's one thing even it can't do: make corporate training classes actually enjoyable.

But maybe it can make them a little less painful.

A handful of Web companies are designing software packages that allow workers, sitting at their own desks, to learn everything from basic computer skills to accounting methods from live instructors. With just a computer and an Internet connection, these software applications allow you to dial in to a virtual classroom—along with colleagues from around the globe. The instructor can call on students, lead them through a presentation or throw out a pop quiz to make sure the class is paying attention.

For businesses, the biggest advantage is that cyberspace training cuts out the ex-

The screenshot shows the ILinc software interface. On the left, there's a 'File Control' window with a list of 'Current Attendees' including Amanda Emphre, Dawn Carr, and Olivia Lee. Below that is an 'Application Showcase' and a 'Feedback' section. On the right, a 'Project Schedule' table is displayed, showing tasks like 'Project Lead', 'Developer', and 'Marketing' with associated hours. Below the table is a 3D pie chart titled 'Hours this week' showing the distribution of hours among participants like 'Project Lead', 'Developer', and 'Marketing'.

Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	30
Robin Mason	Developer	5	40
Nancy Davison	Developer	5	65
Andrew Fuller	Marketing	12	10
Michael Sorama	Writer	9	12
Janece Leventing	Writer	12	30
Linda Callahan	Testing	5	30
Johnathan King	Testing	0	15

**Hours this week**

Participant	Percentage
Project Lead (Owen Carter)	17%
Developer (Robin Mason)	6%
Developer (Nancy Davison)	6%
Marketing (Andrew Fuller)	22%
Writer (Michael Sorama)	17%
Writer (Janece Leventing)	22%
Testing (Linda Callahan)	6%
Testing (Johnathan King)	0%

Here is what an instructor using ILinc software sees. The left side displays a list of students logged on, command buttons for turning the floor over to a student, and a dialog box for typing messages to an individual student. The right side is where the teacher guides the students through presentations via an application like a browser.

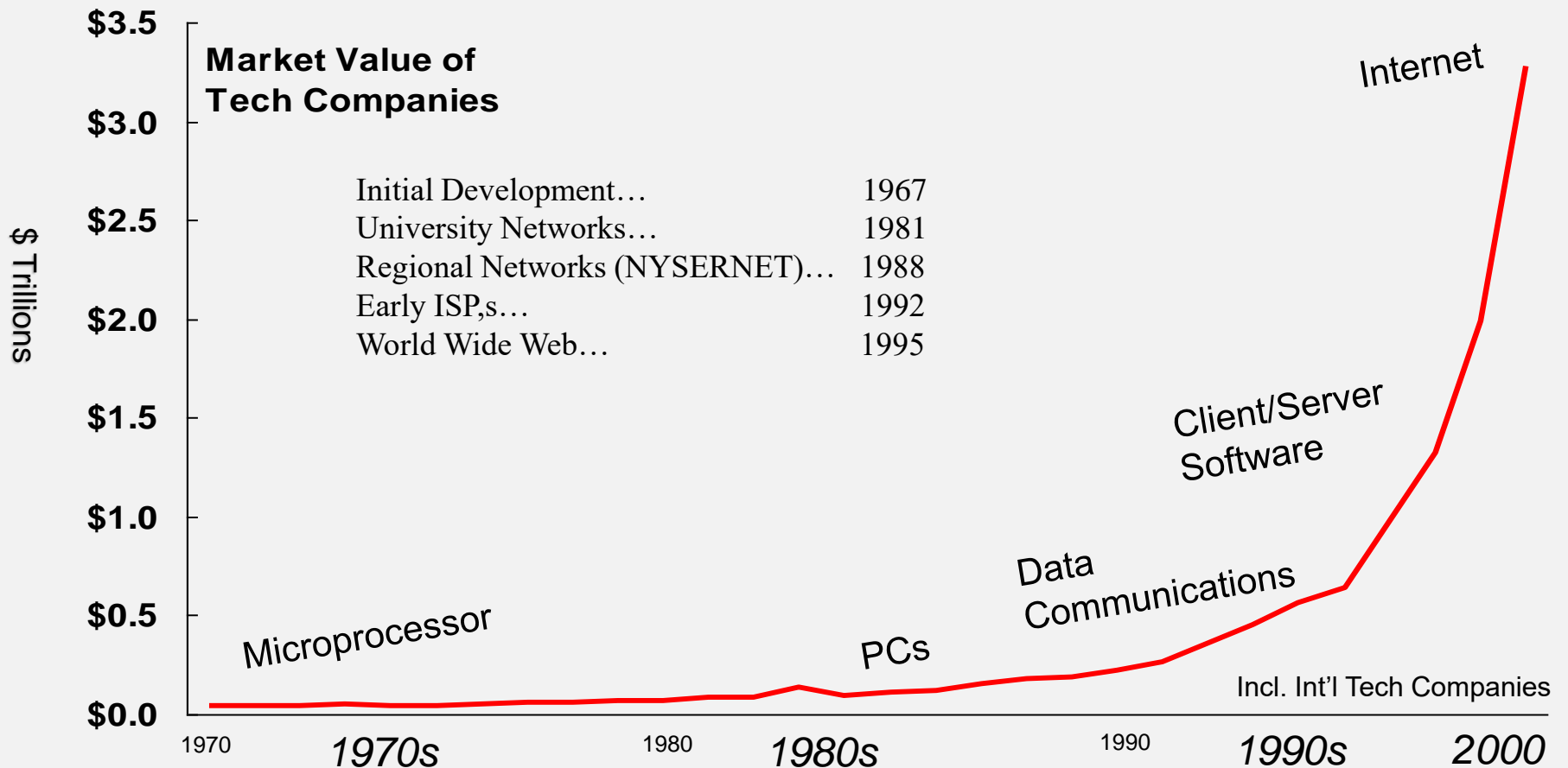
# Opportunity Recognition

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- Solving a problem
  - Every problem is a brilliantly disguised opportunity –Gardner
- A major problem in the 90's: The Learning Corporation
  - Rapid changes in technology, computers, the internet, globalization, and intense economic competitiveness were forcing companies to adapt. To adapt, their employees had to learn many new things.
  - Employee training is expensive –especially for large geographically distributed firms.
  - How could they provide rapid learning opportunities to employees without breaking the bank at a time when economic competition was ferocious?

# The Internet Tsunami

- Do you think the pace of change is accelerating?



Source: Securities Data Company

# Introduction

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- The founding, growth and eventual acquisition of the ILINC Corporation is a typical small example of technological entrepreneurship.
- ILINC was founded in 1993 by a professor (the author) and two students at Rensselaer Polytechnic Institute.
- Later the name was changed to LearnLinc to match the name of its popular product and eventually
- LearnLinc entered a triple merger in early 2000 with Gilat Communications and Allen Communications to form the Mentergy Corporation (NASDAQ).



# The Research:

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- It all began with an idea, and that idea eventually became a research project.
- In the late 80's and early 90's, my scientific colleagues and I were working on the application of computing and communication technologies to science and engineering education.
  - After producing several multimedia projects, I turned my attention to the management of large quantities of educational materials on networks.
    - The early focus was on the modularization of materials and the ability to store and retrieve those modules in an object oriented fashion.
- In order to fund my research I had obtained research grants from the
  - National Science Foundation (NSF),
  - the Dept. of Ed. Fund for the Improvement of Post-Secondary Education,
  - The Research Corporation for Scientific Advancement,
  - the Annenberg/CPB Foundation,
  - The Sloan Foundation,
  - the AT&T Foundation,
  - Lucent Technologies,
  - The Defense Advanced Research Projects Agency (ARPA), and the IBM Corporation.

## The Idea. The Research

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- Managing learning on networks
- Consulting with IBM, AT&T, GTE, Boeing, NeXT, Microsoft, Intel, etc
- I had served as an IBM Consulting Scholar and was a frequent speaker at conferences on multimedia on networks.
  - At one point I was invited to present my vision of the future of networked multimedia education to a group of executives that included several key executives from AT&T. That speech led to an invitation to Bell Laboratories to discuss potential cooperation and to present my vision to a broader and more technical audience.
- Apparently the speech was a great hit with the audience, because the AT&T Executives asked me to create a prototype of the vision -in partial collaboration with scientists from Bell Laboratories
- Joint Venture between AT&T Bell Labs and RPI
  - WorldWorx product released
- New technology releases allow a better idea.

## The Opportunity

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- Propose a significantly enhanced and advanced version to AT&T
  - AT&T declines
  - But Bell Labs excited!
- Research continues in Wilson's Lab
- Design and Manufacturing Learning Environment
- Degerhan Usluel, MBA student, BSEE, former entrepreneur
- Degerhan recruits Mark Bernstein, former CA "TopGun."
- They want to start company and want Wilson to lead it.
- Distributed learning environment with multicast video, application sharing, agents to control bandwidth.
  - None of these had been done reliably and internet was not ready.

# The Team: ILinc LearnLinc Founders

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- Degerhan Usluel, Mark Bernstein, Jack Wilson



Chief Technology  
Officer

Vice President  
Marketing

Chairman and CEO









# Exit Strategy

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- Need to decide ahead of time how we wanted this to end.
  - Private Company
  - Public Company
    - IPO or acquisition
  - Life Style Company
- We all wanted to create a public company and either IPO or Sell.

# ILinc Business Model Canvas

<p><b>Key Partners</b> </p> <p>Microsoft – Early OS Intel – ProShare Video and Capital AT&amp;T – Early OEM Customer CISCO – Router software</p>	<p><b>Key Activities</b> </p> <p>Create multi-cast video and audio conferencing to large #s Screen sharing Training Development tools Market to Fortune 500</p>	<p><b>Value Proposition</b> </p> <p>Allow customer to provide “just in time training to large numbers of employees at a very low cost. Reduce employee down time (cost) for training. Improve quality and quantity of training. Reduce cost of training programs by eliminating travel and ending large corporate training centers.</p>	<p><b>Customer Relationships</b> </p> <p>Close partnerships with companies that want our software and are willing to help development. Early relationships with AT&amp;T, IBM, Intel, News Corp. Business model is sales and customization of software for Fortune 500</p>	<p><b>Customer Segments</b> </p> <p>Our most important customers are Fortune 500 companies with large training needs, large training expenses, and a recognition that success required the deployment of new technologies.</p>
<p><b>Key Resources</b> </p> <p>Early access to new hardware and software tech. Solving the video multicast problem. Deployment of networks with sufficient bandwidth. Customers who buy and test and fund early products.</p>		<p><b>Channels:</b> Direct sales to Fortune 500. First addressed the Corporate training dept. Pivot: Sell to CEO/COO/CFO Use Wilson’s extensive corporate contacts to gain an audience. Presentations at large conferences like ComDex, Educom, etc.</p>		
<p><b>Cost Structure:</b> Costs are primarily personnel costs for a development team, a quality assurance team, and a sales/marketing team. Smaller expenses for leased office space, tech. acquisition (some provided by partners for free) Business is primarily value driven. Costs small in comparison to the saving of corporate expense. Because we have very low variable expenses, the ability to achieve scale will quickly lead to profits. Building ten thousand units of software is only marginally more expensive than building ten.</p>		<p><b>Revenue Streams:</b> Sales of software in the form of corporate licenses to Fortune 500 firms. Software costs are small in comparison to training costs. Want revenue now in return for software later. A challenge in selling to trainers since this sidelined them and reduced their budget. Qui Bono? Executives with bottom line responsibility.</p>		

# Intellectual Property

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- The Team considered whether to patent the software or proceed while trying to make it a trade secret.
- Advantage of patenting
  - Protect our intellectual property from being copied.
  - Dissuade competitors.
- Disadvantages:
  - Could get to market faster,
  - patenting (and defending) is a long and expensive process.
  - Potential dispute with AT&T who had funded earlier project.

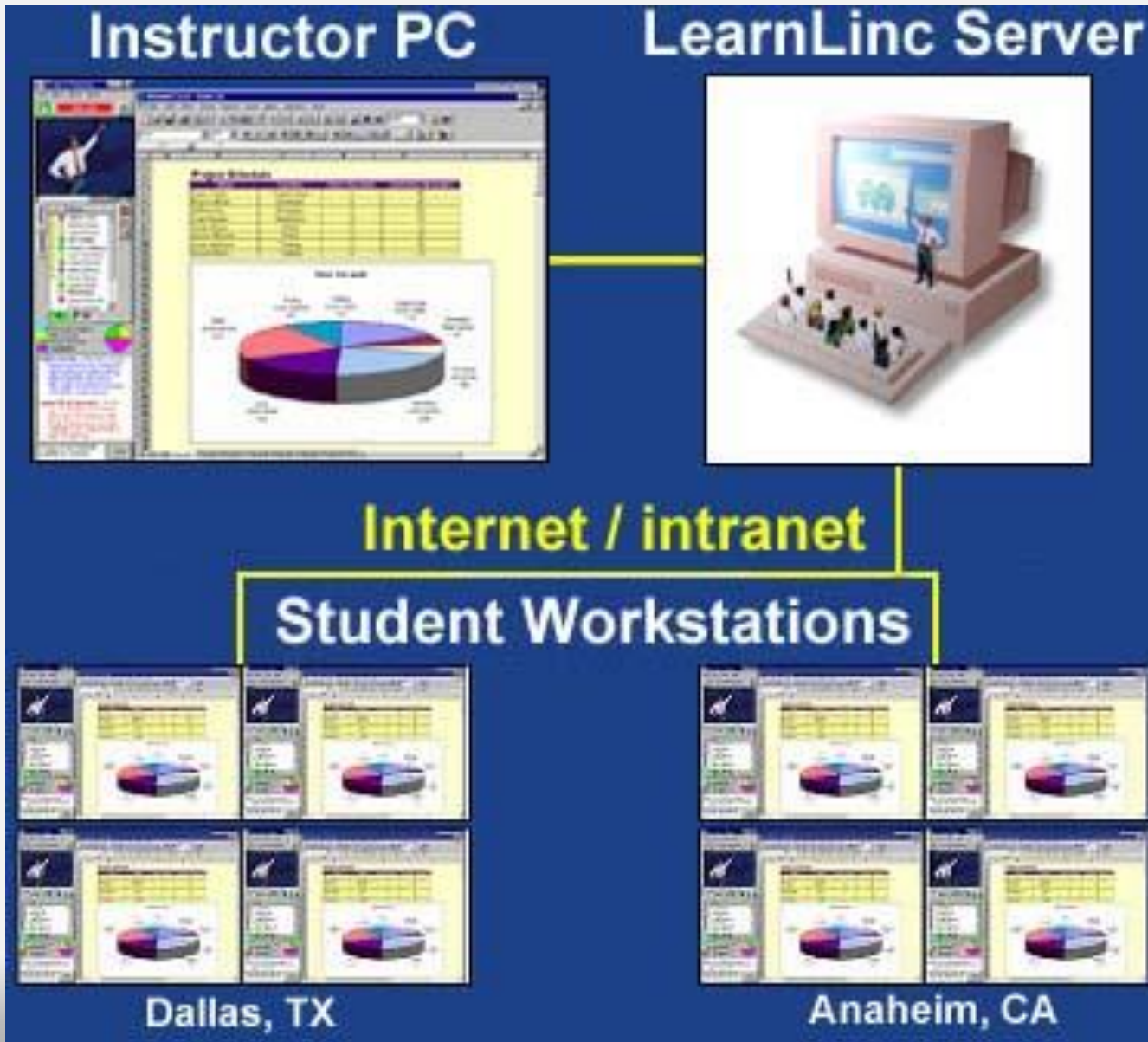
# Creating a Prototype

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- Need a prototype to raise money.
- Need a prototype to acquire early customers.
  - In order to create the prototype, we had to solve the problem of excess bandwidth on the network due to so many interacting individuals on computers. The primary problem was the video and graphics.
  - The problem was solved by creating agents to shut off video that was not being used and by making reliable IP multi-casting work.
- Need a polished pitch







# LearnLinc Instructor

Project Planning ... shared by Robin Jacobs

ON AIR

Live from Detroit, Michigan

Mute

People

Name
Jolene Wait
Dennis Bates
Luke Hansen
Jill Donnelly
Darren Stahlman
Laura Sheehan
Suzie Drexel
Brian LaRosa
Owen Carter
Karen Meyer
Mick Brady
Janice Marcola
Robin Jacobs

9 25

Not much progress  
5 Still working  
2 Almost finished  
13 Completed

Robin Jacobs: Welcome to project planning with Excel. During the next two hours, we'll cover the basic functions of Excel as they apply to tracking resources, schedules, and expenses.

Jolene Wait (private): Hi, I'm new to the class and I don't have a lot of experience with Excel. Can you give me some material I can study outside of class to catch up?

I'll make review materials available to everyone.

Send

Microsoft Excel - Book2.xls

Project Schedule

Name	Function	Hours this week	Total hours for project
Owen Carter	Project Lead	9	80
Brian LaRosa	Developer	3	40
Jill Donnelly	Developer	3	65
Luke Hansen	Marketing	12	10
Karen Meyer	Writer	9	12
Janice Marcola	Writer	12	30
Linda Callahan	Testing	5	30
Dennis Bates	Testing	0	15

Hours this week

Function	Person	Hours	Percentage
Project Lead	Owen Carter	9	17%
Developer	Brian LaRosa	3	6%
Developer	Jill Donnelly	3	6%
Marketing	Luke Hansen	12	22%
Writer	Karen Meyer	9	17%
Writer	Janice Marcola	12	23%
Testing	Linda Callahan	5	9%
Testing	Dennis Bates	0	0%

## Funding the Enterprise

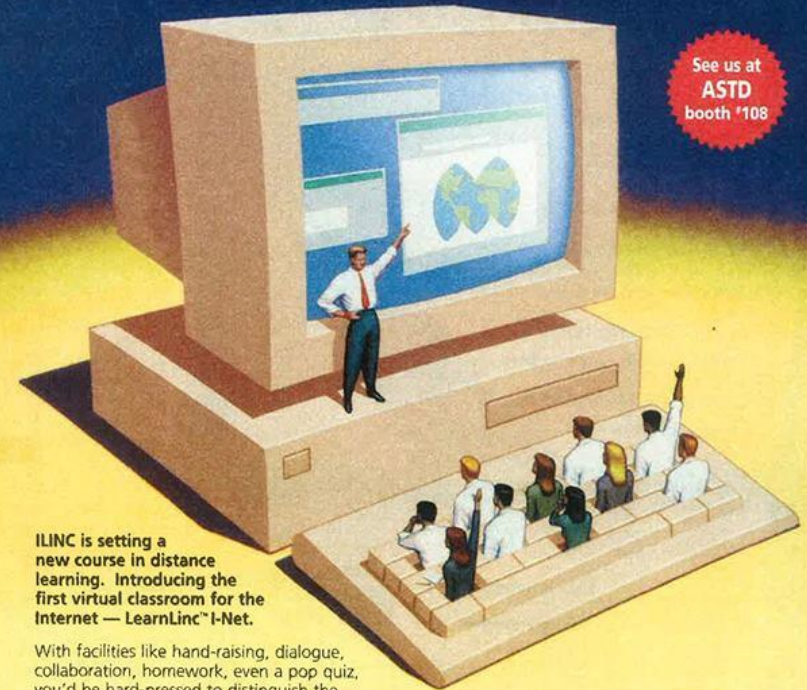
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- Met with many successful entrepreneurs
  - Bugle Boy, Wellfleet, Interlan, Bay Networks, Nortel, MapInfo, etc
- Went against advice
- Decided to sell vaporware.
- Success magazine called it the “Wimpy method”
  - Wimpy: “I’ll gladly pay you Tuesday for a hamburger today!”
  - ILinc: “I’ll gladly give you software next year for \$300,000 today.”
- Against all odds (and reason): It worked!
- First Customers: IBM, AT&T, GTE, Sprint, Office Depot, and News Corp.
- We also had received funding from the Air Force SBIR program.

## Building the Product

- Degerhan actually conquered the reliable multicasting challenge and made the product work!
- Bernstein sold lots of vaporware.
- Every customer, except for one, was very satisfied.

A real classroom experience. Virtually.



See us at  
ASTD  
booth #108

ILINC is setting a new course in distance learning. Introducing the first virtual classroom for the Internet — LearnLinc™ I-Net.

With facilities like hand-raising, dialogue, collaboration, homework, even a pop quiz, you'd be hard-pressed to distinguish the LearnLinc I-Net virtual classroom from the real thing.

Truth is, this award-winning software for distance learning is boosting retention rates and bottom lines around the world.

Only LearnLinc I-Net allows for instructor-led learning with synchronized multimedia and Web-based content. And with text chat, shared whiteboard, and flexible floor controls, you've got a host of tools to maximize your training.

Plus, LearnLinc I-Net runs over the Internet or your corporate intranet. So it offers easy access to students, either at home or at work, with just a PC and phone line (or any number of audio/video options).

The classroom is virtual, but the results are concrete. You'll reach more students with the best instructors, cut costs, eliminate travel, reduce workflow interruptions, and boost the learning power of your people.

For a **FREE** Internet demonstration of how our virtual classroom can save your organization time and money, call ILINC at **518-283-8799** for the name of a LearnLinc Reseller near you.

**LearnLinc I-Net is shipping. Today!**

**LearnLinc**  
The first virtual classroom  
for the Internet. **I-Net**

**ILINC** Setting a new course in distance learning.

Visit our web site:  
[www.ilinc.com](http://www.ilinc.com)



FOR MORE INFO, CIRCLE # 166



## Winning Many Awards

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# Venture Capital

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- Once company was up and running, we were short of working capital and tired of co-signing bridge loans!
- First Round of Venture Capital:
  - Exponential Investors and New York state development fund.
- Board asks Wilson to leave RPI permanently to continue as CEO of ILinc.
- Instead Wilson hires a new CEO who would bring advanced start-up experience.
- Second and Third Rounds of Venture Capital:
  - GeoCapital Investors, Intel, and original investors.
- Total outside investment was less than 50% of the company.
  - Very rare, but left the company short of cash compared to new arrivals.
  - We were using the old model. They used the TechBoom model.

# Intel Invests millions

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- I made a presentation to Andy Grove, CEO of Intel, at their headquarters. They told me that I would only have ten minutes to present and answer questions and then he had to run to another appointment. He ended up sitting down and spending a fascinated hour with me exploring the software.
- They then made their investment.
- Here is Andy Grove with Mark Bernstein when he presented the ILinc software at a major conference before thousands.







Top: Jack Wilson Founder 1<sup>st</sup> CEO, Chair –Mark Bernstein, Founder, VP of Marketing and Business Development –John Waiveris, Web Design

Bottom: Mike Marvin, 3<sup>rd</sup> CEO –Degerhan Usluel, Founder, VP of Technology, & 4<sup>th</sup> CEO – James; Tolga Lazare, Adam Stewart, Software Engineers



## Fortune Magazine on ILinc:

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- “Interactive Learning International Corp. (ILINC), a two-year-old company in Troy, New York, has shown what's possible in today's world of limited telecommunications bandwidth. ILINC's interactive training programs can be transmitted to users' PCs over local- and wide-area networks, as well as high-speed communications links such as ISDN (integrated services digital networks). A live instructor can appear in a window on the screen and address students in dozens of locations. He can launch video and audio clips for all the "class" to see and hear. And at discussion time, a student can click on a "raise hand" icon to get the floor. “
  - REPORTER ASSOCIATE Alicia Hills Moore
  - *Copyright © 1996, Time Inc., all rights reserved.*

# Wall Street Journal on ILinc -1998

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- "It's great -- by using it, we've cut our travel expenses substantially," says Gary Schweikhart, a spokesman for Office Depot, an office-supply company in Delray Beach, Fla. Office Depot first took its corporate training sessions on-line in May 1996. It was one of the first customers of Interactive Learning International Inc., or ILINC, a Troy, N.Y., maker of distance-learning software. Since then, about 1,500 Office Depot employees have completed on-line training, on everything from how to write a business letter to how to use the company's proprietary order-taking system.
- "We were in a situation where we were doing a lot of training of trainers" in order to have enough qualified instructors to teach employees at 629 stores and 68 sales offices across the country, says Doug Kendig, the company's manager of training technology. "We had to deputize a lot of people [to train employees], and you don't always get the best results that way."
- But now Office Depot uses the ILINC software for about 20% of its training, with classes in Florida, California and Texas using just six instructors. "I think it's fantastic," says Jeannette Perez, who works in Office Depot's commercial credit-card department. "It just holds my attention more, because you're interacting with the computer."
  - Wall Street Journal –Thursday August 6, 1998

TECHNOLOGY JOURNAL / NET INTEREST

# Software Seeks to Breathe Life Into Corporate Training Classes

*Workers Avoid Long Courses — And Long Trips*

By REBECCA QUICK

Staff Reporter of THE WALL STREET JOURNAL

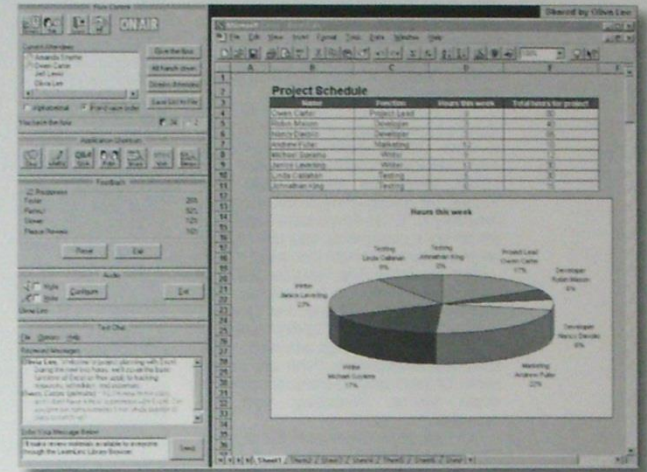
**T**HE INTERNET promises a lot of miracles, but here's one thing even it can't do: make corporate training classes actually enjoyable.

But maybe it can make them a little less painful.

A handful of Web companies are designing software packages that allow workers, sitting at their own desks, to learn everything from basic computer skills to accounting methods from live instructors. With just a computer and an Internet connection, these software applications allow you to dial in to a virtual classroom—along with colleagues from around the globe. The instructor can call on students, lead them through a presentation or throw out a pop quiz to make sure the class is paying attention.

For businesses, the biggest advantage is that cyberspace training cuts out the expense of getting the instructor and students in the same place. It also means that training classes can be pared into shorter sessions and spread out over a number of days or weeks—meaning you don't lose an employee for entire days at a time. Even better, instructors can train employees in multiple locations at one time, allowing for rapid deployments of, say, new software being rolled out to a corporate empire.

The no-travel-required aspect may also be the biggest benefit for the folks who actually have to endure corporate training classes. That means more time at home and less on the road—no more trips to headquarters to learn how to make a spreadsheet. Shorter training sessions are also a plus for



Here is what an instructor using Ilic software sees. The left side displays a list of students logged on, command buttons for turning the floor over to a student, and a dialog box for typing messages to an individual student. The right side is where the teacher guides the students through presentations via an application like a browser.

students: Studies show that retention levels drop (and doodling, no doubt, rises) significantly after two hours.

Of course, some things can't readily be learned over the Internet. Teaching presentation skills, for example, is largely about eye contact, voice projection and body language, skills that don't translate well in the digital realm. And some critics argue that on-line training will never replace the good old-fashioned way of learning.

Still, demand is clearly growing. One interactive-software supplier, Centra Software Inc. of Lexington, Mass., says its revenue has doubled each quarter for the past year. And earlier this year, International Business Machines Corp. acquired Data-

Beam Corp., a Lexington, Ky., firm that sells distance-learning software.

Here's how the software packages work: Students go to a special Web site, on either the Internet or a corporate intranet, and sign in. Once on-line, their screens split in two: On the left side are a set of controls for communicating with the instructor and other students, while the right side shows an application such as a browser, whiteboard or word processor.

Anything the instructor does on the right side of the screen automatically appears on the right side of the students' screens. So, if the instructor, say, moves to a Web site, the entire class is automatically dragged along. Speakers and microphones on the computers

(over please)

# Going Public

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- Rapid Growth meant much more capital needed.
- Arrival of several “fast-followers” meant that we had competitors nipping at our heels.
- Potential IPO was about \$100 million.
- Acquisition was only about \$50 million but could create some beneficial alliances.
- Investment Banker hired.



# Mentergy formed

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- With help of Investment Banker and VC advisors:
- A triple reverse merger.
- Sold control of LearnLinc to GILAT Communication of Israel and at the same time used LearnLinc to acquire Allen Communications, John Bryce Training, and GILAT itself.
- Closed deal on February 29, 2000 for \$52 million.
- Combination called Mentergy
  - Value was \$500 million in March
  - New York, Salt Lake City, Europe, and Israel.
  - Created headquarters in Atlanta
  - As tech bust came they entered bankruptcy in 2002.
  - Text: <http://www.jackmwilson.net/ILincLearnLincStory-text.htm>