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Disruptive Ideas, Open Innovation, and New Value Chains: Trends in Asia

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Outline

- Introduction to EE-402A requirements for credit
- Conceptual framework: disruptive ideas, open innovation
 - How things work in Silicon Valley
- Disruptive ideas and stages in economic growth
- Some trends in Asia
- Looking ahead

Welcome to everyone!

 Weekly <u>public</u> lecture / panel discussion series presented by the US-Asia Technology Management Center

- Every Thursday, through December 5, 2013
- Thanks: sponsorship support from Allen Miner Foundation
- See <<u>http://asia.stanford.edu</u>> for schedule, info
- Intro's: Siejen Yin-Stevenson (Assistant Director, US-ATMC) Sebastian Karl (Course Assistant)
- 2013 Theme: Impact of selected new technologies on value chains (in traditional industries), with focus on Asia
- Available for credit to Stanford students: EE-402A "Topics in International Technology Management"
 - No pre-requisites, open to undergrads and graduate students
 - May be repeated in future years for credit; each series is separate

EE-402A Requirements for Credit

- Obtain <u>Syllabus</u> for official statement of credit requirements
- MAY BE DIFFERENT THAN REQUIREMENTS FOR OTHER SEMINARS
 - A. On-site attendance at seven (7) of nine (9) sessions
 - Requirement A waived for official SCPD students
 - Today fill out survey, then weekly sign-up sheet at auditorium
 - B. Submit a comment / summary each week for eight (8) of the nine (9) sessions
 - Send comment by email within two weeks of the session
 - To me (Prof. Dasher) <rdasher at stanford dot edu>
 - Always cc to Sebastian Karl <skarl [at] stanford [dot] edu>
 - Comment must provide evidence that you watched the session

Request to everyone (visitors and students) for today, 10/03

Please fill out incoming-survey and leave with Siejen, Sebastian, or me

- Even if you have attended our programs in the past
- For students registering for credit, <u>this survey</u> is your on-site attendance record for 10/03/2013
 - In addition, you will need to submit your comment / summary about the content of this session within two weeks

Conceptual framework: Disruptive ideas, start-up companies, and open innovation

Definition: disruptive idea (a.k.a. a "disruptive innovation")

- A new product or service that creates a new market and / or value network...
 - Typically by selling the new thing or service to a new set of customers
- ... <u>and</u> eventually disrupts an existing market or value network
 - Displaces an earlier industry (set of companies) that previously dominated the (old) market
 - Causes major changes in a supply chain or value chain
 New suppliers, new loci of high value (versus commodity)
- Theory of disruptive innovation: esp. studies by Christensen (1995, 1997, 2003, etc.)

Example: smartphone cameras versus the camera industry

- Early experiments of phones with built-in cameras in 1990s; first camera-phone sold by mobile operator <u>J-Phone</u> (now part of Softbank) in Japan in 2000; more than half of J-Phone subscribers were using cell phone cameras in two years
- Early phone cameras were low quality (compared to compact digital cameras at the time) but had <u>connectivity</u>; people carry phones most of the time – <u>convenient</u>
- Appearance of smartphones (with standard OS, downloadable applications) added even more possibilities for photo <u>sharing</u>, etc.
- <u>Cost</u> of camera is bundled into cost of phone
- Performance improvements: esp. sensor (e.g. Nokia Lumia 1020 (2013): 41 Megapixel sensor on Windows 8 OS), application software
- Compact camera sales fell by 30 percent in 2011 (TechRadar)
- 37% of images taken in the U.S. in 2011 were with camera phones, number expected to rise to 50% by 2015 (*Nat'l Geo / CEA*)

"Disruptive" because taking away business from earlier industries / markets

Smartphone cameras (continued)

- Sales of big digital cameras by Nikon, Canon, etc. still growing
- But: "Canon and Nikon should pay heed...or risk sequestering themselves in the ultra high-end camera ghetto." (*The Guardian*, 3/19/2012)

Typical pattern of a disruptive innovation

- (a) creation of a new technology for a new market / customer base,
- (b) performance improvements in the new device, <u>and</u> then
- (c) disruption / displacement of some earlier product/market
- Often involves new firms taking over an industry, new industry structures (new supply chains, etc.)

Food for thought: automobiles as a disruptive innovation (acc. to Christensen 2003)

The <u>invention</u> of the automobile was not really a disruptive innovation

- It was a revolutionary technological achievement
- Created a new market that did not exist before
- But, early automobiles were expensive luxury items that did not take much business from the market for horse-drawn vehicles
- The automobile became disruptive with the introduction of the Ford Model-T
 - Lower priced, mass-produced (= readily available)
 - Then the auto changed the transportation market
 - What did the Model-T disrupt? (Carriages? Trolleys? Rail transportation? Many early automobile companies & their suppliers,...) – yes to all of these

Some more recent disruptive innovations

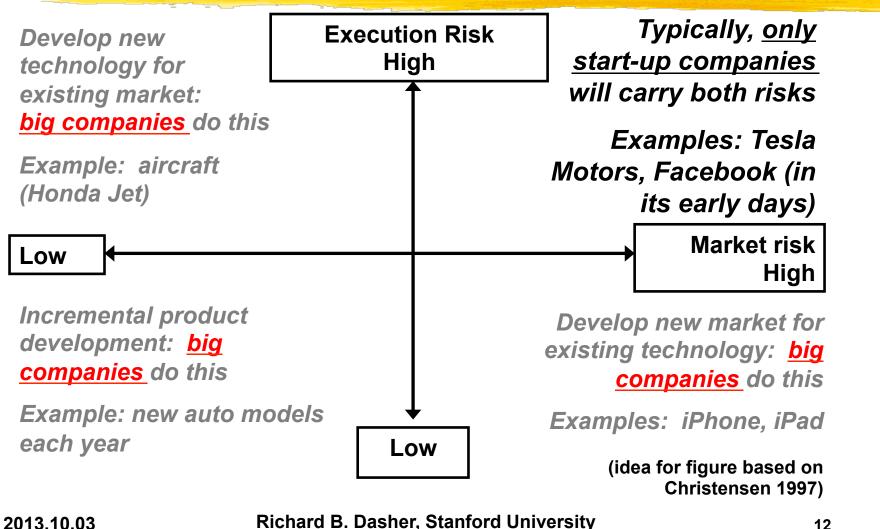
Online advertising

- At the center of a new supply chain
 - Real-time bidding
 - Supply side platforms, demand side platforms
- Disrupting traditional advertising industry (newspaper ads, TV commercials)

Online retailing (ecommerce)

- Cutting into sales of "brick-and-mortar" retail businesses (bookstores, department stores, etc.)
- Changing the way that <u>all</u> retailers compete (e.g. use of email & SMS for loyalty programs)

Start-up companies are great sources of disruptive innovations



But, (as with the auto), it's not the initial invention that is really disruptive; it's:

(A) the pattern of growth

- Ultimate size of market: potential to reach billions of lives
- Impact on multiple industries
- Impact on an economy (size of an industry)
- (B) the transformative effect
 - Change the supply chain (value chain) of an industry
 - Change the way people live or work
- Compare criteria for disruption in May 2013 report by McKinsey Global Institute:
 - Study 12 disruptive technologies (out of possible 100)
 - Likely to yield up to \$33 trillion of new value by 2025 (to a world economy that is about \$100 trillion at the time)

Disruptive innovations and new value chains

Value chain

- Similar to supply chain, "value chain" refers to interlinked activities that are necessary to deliver a product to a market
 - E.g. system design > component design & manufacturing > final assembly > distribution > sales
- But, value chain includes analysis of the relative contributions of the interlinked activities to the value of the final product
 - How revenue is distributed or credited to upstream partners, degree of competition at each node in the chain (e.g. how many other suppliers could deliver an equivalent product?)
- Two ways to create a major new value chain
 - Start from nothing (new product category that creates a new industry)
 - Transform (disrupt) some existing value chain (including the value chain of another industry)

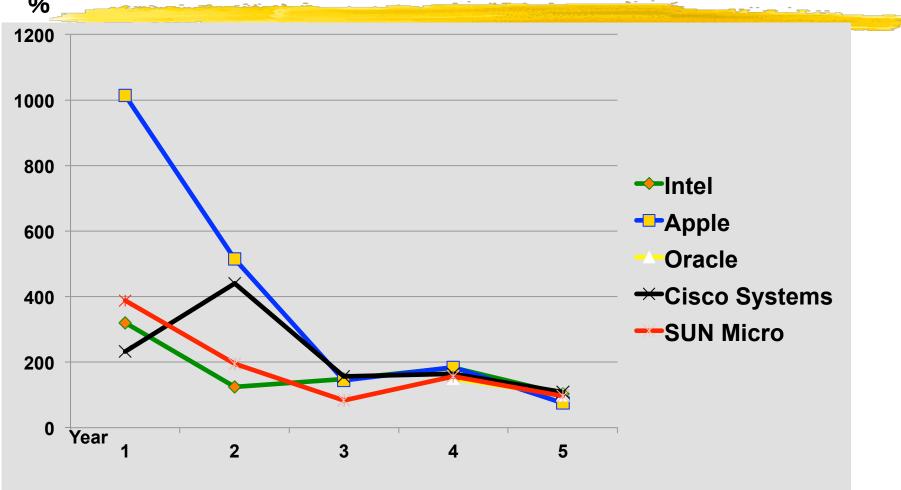
Silicon Valley economy: series of booms around new industries – each had high growth companies that became world leaders

"Silicon Valley" term first used in 1971					
Key S.V. industry Disruptive innovation Rising stars					
Early 1970s	Silicon wafer manufacturing	Silicon crystal growth			
Late 1970s	(Highly) integrated microelectronics	Microprocessor	Intel, others		
Early 1980s	New computer systems	RISC chip, new OS	SUN, Silicon Graphics		
Late 1980s	Software	Relational databases, graphic user interface	Oracle		
Mid 1990s	Internet	Hypertext	Netscape		
Late 1990s	E-commerce	DSL, business enablers	Yahoo, eBay		
Early 2000s	Web 2.0	Search engines	Google		
Late 2000s	Social networking	New business models	Facebook, Twitter		

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Some Silicon Valley superstar companies: Sales growth rates during their first five years

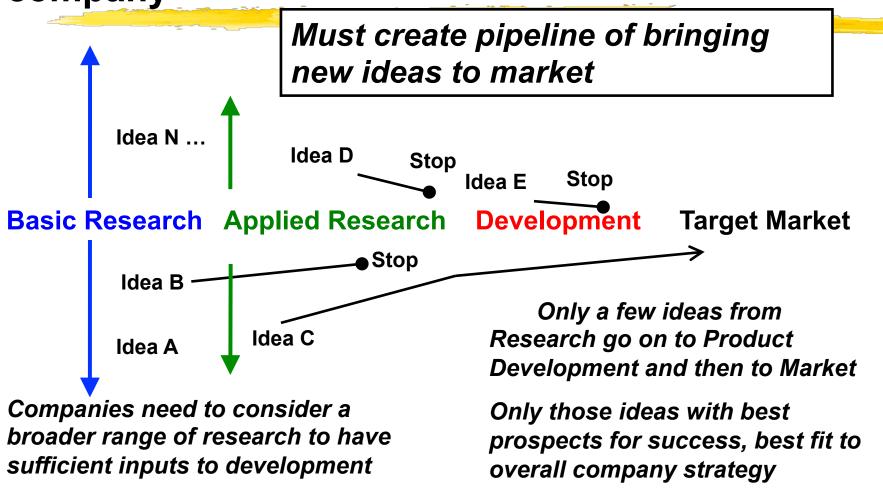


Key Silicon Valley companies sustained high growth rates for at least ten years

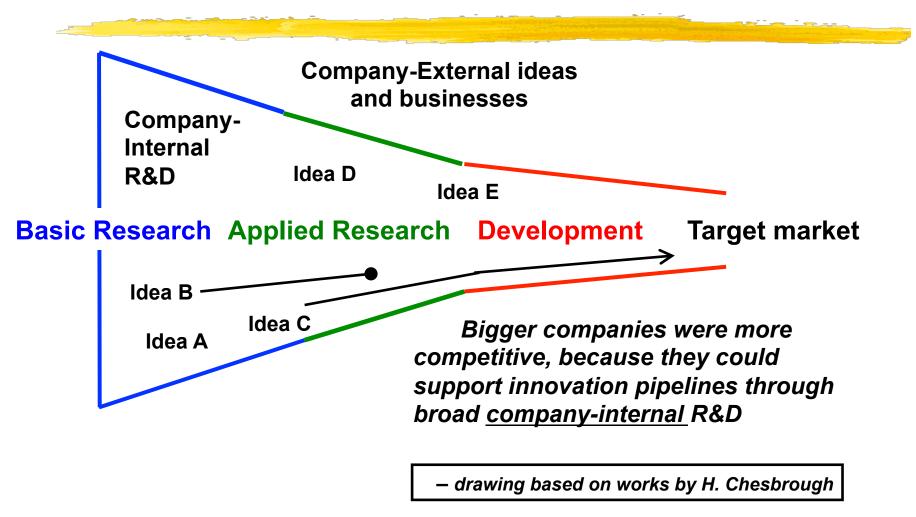
	Average annual growth rate over the first five years of sales	Average <i>annual</i> growth rate over the first ten years of sales
Intel	167 %	91 %
Apple	284	125
Oracle	123	100
Cisco	203	131
SUN Microsystems	165	88

- Only a few companies achieved such sustained high growth
- Superstar companies became a model for most start-up companies and their investors in Silicon Valley
- But, economic success of the Valley not **just** from these companies -- 90% of <u>successful</u> exits are via acquisition by big firm

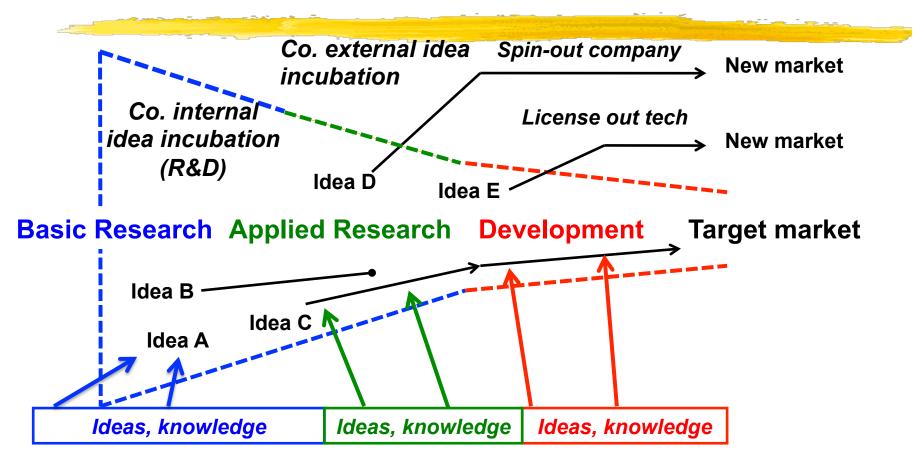
Challenge of innovation management for a company



Traditional solution: (primarily) closed innovation

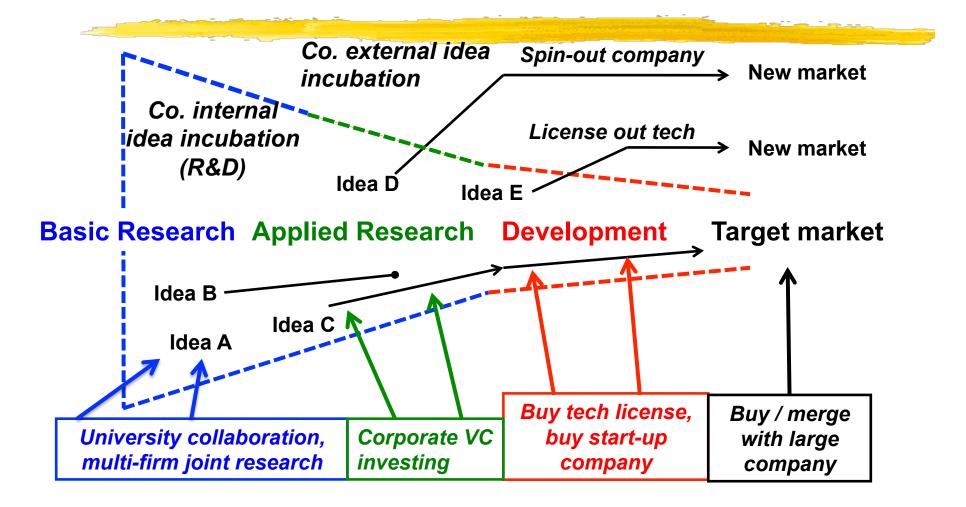


Open innovation: use of inflow and outflow of knowledge across company boundary



Based on drawings by H. Chesbrough

Incoming open innovation: sources of ideas



Google: big company practicing open innovation

- Company-internal R&D spending in the year from 2011Q4 – 2012Q3 = \$6.217 billion
 - 13.1% of revenues; average for software industries was 13.3%
- In 2011, Google made <u>one large company acquisition</u>
 - Motorola Mobility (2011, \$12.5 billion) was about present day business
- In 2011, Google made <u>24 start-up company acquisitions</u>
 - Areas expected to be critical to Google business within two years or so
 - Probably spent around \$700 million (terms of some deals not public)
- Google established <u>corporate VC fund</u> (Google Ventures) 2009
 - Fund size \$100 million, increased to \$300 million in 2013
 - Makes minority investments in start-up companies (not complete ownership) that are 3 – 7 years from market
- Active supporter of university research at Stanford and elsewhere

Established (large) company motivations to engage in open innovation

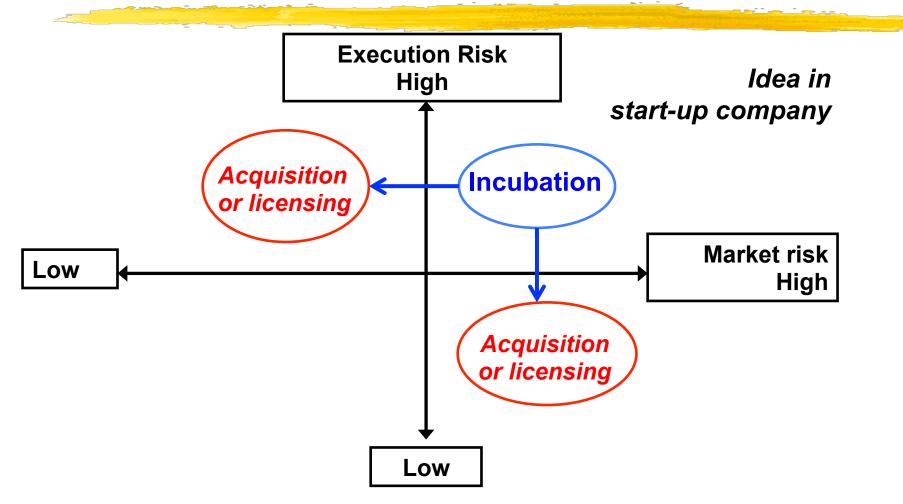
Very different motivations than "outsourcing"

 Outsourcing is to entrust something the company already knows it needs to an external partner, because of the partner's efficiency (lower cost), expertise, or other qualitative advantage

Open innovation motivations:

- Increase the number of new ideas in its innovation pipeline
- Let others pay for idea incubation until the idea reaches the optimum balance (for the big company) of value, cost, and risk
- Most important: obtain access to different types of ideas than are already being incubated inside the company's R&D group

As entrepreneurial innovations are incubated, they become targets for big firms



Big companies, disruptive ideas, and open innovation

- Disruptive innovations: it is very difficult for company-internal R&D to incubate ideas that may disrupt existing business
 - Sales division will usually not allow idea to get through to product stage
 - Possible only with "personal attention of CEO" (Christensen 2000)
- Big companies need to deliver disruptive ideas once in a while
 - Otherwise, inevitable slowdown of existing markets, apparent lack of creativity in R&D division, loss of business to less expensive competitors
- Big companies seek disruptive ideas from outside
 = open innovation
 - Also seek unexpected opportunities: ideas not already in the companyinternal R&D pipeline



Disruptive ideas (and open innovation) become more important as an economy becomes more advanced

Creativity-based innovation becomes more important as an economy advances

	Factor-driven Economies*	Efficiency-driven Economies*	Innovation-driven Economies*
Typical per-capita GDP	Below approx. \$15,000 / year	Approx. \$15,000 - \$35,000 / year	Approx. over \$35,000 / year
Societal developments	Industrialization, urbanization	Labor and capital shortages, needs for higher skills	Wealth spreads throughout pop, higher educ. levels
Business opportunities	"Gold rush" to supply basic demands	Develop new markets - domestic or international	Creative, fresh new ideas, "out of the box" thinking
Key competitive strengths	Get there first!	Operational efficiency, rapid scaling, high quality	Manage (allow) risk, early ID of great new ideas, sustain high growth
Focus of new government policies	Basic laws, establish industry base	IPR, select & promote key industries	Encourage entrepreneurs, bridge over "valley of death"

* Terms from Global Entrepreneurship Monitor, chart & analysis original to RD

Innovation occurs at <u>every</u> stage of economic growth

- But, types & motives of innovations tend to shift along with types of economic / business opportunities
 - Factor-driven: "create an industry" (usually where no industry existed beforehand)
 - Efficiency-driven: "expand existing business to (world) markets"
 - Innovation-driven: "fresh new ideas, new ways of looking at old problems"
 - General: Why incur any more risk than one has to incur?
- Likelihood that an innovation will cause some disruption increases along with the evolution of an industrial base
 - Need disruptive innovations more in innovation-driven advanced economies

GDP of the top five national economies of the world

	2010 \$ trillions	2010 GR - %	2011 \$ trillions	2011 GR - %	2012 \$ trillions	2012 GR - %	2012 GDP / person \$
World total	77.71	5.1	80.61	3.7	83.23	3.3	12,500
U.S.A.	15.05	2.4	15.32	1.8	15.66	2.2	49,800
China	10.51	10.4	11.48	9.2	12.38	7.8	9,100
India	4.21	10.1	4.49	6.8	4.74	6.5	3,900
Japan	4.55	4.5	4.52	(-0.8)	4.62	2.2	36,200
Germany	2.99	3.7	3.10	3.0	3.19	0.9	39,100

 Ranking excludes EU (which would be bigger than U.S.A.)

Estimated amounts in 2012 dollars, according to **PPP** 2012 CIA World Factbook, data retrieved 4/01/2013

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GDP of other Asia economies in the top 50

World ranking	2010 \$ billions	2010 GR - %	2011 \$ billions	2011 GR - %	2012 \$ billions	2012 GR - %	2012 GDP / person \$
12. S. Korea	1,524	6.3	1,579	3.6	1,622	2.7	32,400
15. Indonesia	1,074	6.2	1,143	6.5	1,212	6.0	5,000
19. Taiwan	856	10.7	890	4.0	902	1.3	38,500
24. Thailand	612	7.8	612	0.1	646	5.6	10,000
27. Pakistan	482	3.1	496	3.0	515	3.7	2,900
29. Malaysia	448	7.2	471	5.1	492	4.4	16,900
32. Philippines	383	7.6	398	3.9	417	4.8	4,300
35. Hong Kong	340	7.1	357	5.0	364	1.8	50,700
39. Singapore	305	14.8	320	4.9	327	2.1	60,900
41. Vietnam	288	6.8	305	5.9	321	5.1	3,500

- Not included: Middle East countries
- Ranking excludes EU

Estimated amounts in 2012 dollars, according to **PPP 2012 CIA World Factbook**, data retrieved 4/01/2013

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China (GDP average \$9.1K / pers) as a "factor-driven" economy

 Great business opportunities through creation and growth of new domestic markets

- Much economic growth (until recently) was fueled by investment
- More recently: consumer spending growth increasing faster than GDP growth
- Often not necessary to disrupt an existing industry
- U.S. venture capital firms became active in China from early 2000's
 - But they tend to invest in somewhat "lower tech" business ideas that arise along with evolution of industry, consumer demands
- Regional differences
 - East coast cities: GDP / person is higher, urbanization obvious
- Disruptive innovations do happen: e.g. ecommerce (disrupting retail industries)

India (\$3.9K/pers): innovation-driven economic "islands" in the middle of a factor-driven economy

Advanced IT services innovation is a world-market phenomenon

- Very little domestic sales by Infosys, Wipro
- In this sector, opportunities and risk is similar to situation in advanced economies
- Bottom-of-pyramid businesses: a classic "factordriven economy" opportunity
 - May or may not involve disrupting some existing industry
 - Redbus and Innoz from Spring 2013 "EE-402T" seminars
 - Redbus disrupted existing channels of bus ticket sales
 - Innoz provides Google-type search via cellphone SMS often not accessible to target market via other channels

S. Korea (\$32.4K/pers): at cusp from efficiencydriven to innovation-driven

 Big company successes still happening through world market expansion

- DRAM: industry focus shift from U.S. to Japan to S. Korea
- LCD TVs: """"""
- Automobiles: """""""
- Cellphones: from U.S. (Scandinavia, & Japan) to S.Korea
- Disrupted existing industry, but basically with existing technology
 - At first: quality "as good," efficiency (cost-perform) "better"
 - To: quality "even better"
- New focus on "creative economy" (gov't policy)
 - Promotes entrepreneurship, internal creation (not copying)
 - An attempt to mitigate the danger of high centralization of national capital and labor force in existing big companies

Japan (\$36.2K/person): finding its way as an innovation-driven economy

Some disruptive new ideas

- Uniqlo (Fast Retailing Inc.) disrupting chain retail industries
- But most superstar innovations in Japan have been firstmoves that create new industries / big new markets (without disrupting existing ones...?)
 - Suica prepaid cash card for micropayments (from train system to other transportation, convenience stores, etc.)
 - DeNA, Gree mobile game publishing (platforms)
 - Earlier: Softbank delivered standard software products distribution to Japan
- Older big firms have difficulty with open innovation
 - Too difficult to break out of old customer relationships
 - Incentives for open innovation (to R&D personnel) not developed

Taiwan (\$38.5K/pers): early stages of innovation-driven economy

- Recent out-flow of much manufacturing to mainland
- Companies don't compete on growth of domestic (Taiwan) market
- Long history of science and technology parks
- Still strong base of contract / component manufacturing
 - Competing via world market expansion: Hon Hai Precision Industry Co. (major supplier to Apple) forming JV to sell cellphones in Indonesia (9/30/2013)
 - But shift in TSMC business (from cost-based competition to manufacturing excellence-based competition to customer service-based competition) – Lee and Whang 2006 case

Hong Kong (\$50.7K/pers) and Singapore (\$60.9K/ pers): investment-driven urban economies

- Some characteristics of being innovation-driven <u>urban</u> centers
 similar to Silicon Valley, etc.
 - Strong R&D institutions: universities, research institutes
 - Entrepreneurship centers on "entrepreneurship of opportunity" (not "entrepreneurship of necessity")
- Economic growth probably driven mostly by external (not domestic) investments
 - Especially in growth of other Asia markets
 - Some innovation services strong (IP law, accounting, etc.)
- But, top students tend to aim more for jobs in financial industries, government
- Governments: working to promote innovation

U.S. economy – growth of the entrepreneurial sector in innovation

Share of total corporate R&D spending in U.S.

	Small firms (< 1,000 employees)	Medium (1K – 25K)	Large firms (25K+ employees)
1981	4%	25%	71%
2005	24%	38%	38%

- Share of U.S. patents to firms with less than 1,000 employees
 - 1972: 5% of new U.S. patents
 - 2000: 30% """

(Borchardt 2008)

This pattern shows a shift in the funding of innovation
 – from big company R&D budgets to venture investors

Open innovation still lags behind U.S. in Asia economies

Data from Kingston & Scally 2006

	Total U.S. patents (1994 – 2003)	"Small entity" U.S. patents	SE %
U.S.	746,359	271, 785	36.4
OECD (excl. US)	1,338,182	350,136	26.2
Japan	287,219	12,647	4.4
S. Korea	26,891	3,864	14.4

- A firm tends only to file "high value" patents in a foreign country; may skew U.S. filing percentage higher for U.S. small firms
- But, higher percentage of small firms in non-US OECD countries filed in U.S. than did Japan (OECD member) and Korea (non-OECD)
- Some non-US countries have high percentage: 52.4% of U.S. patents from Israel were filed by "small entities," 19.1% of UK filings in U.S.



Where do we go from here?

Examine some (potentially) disruptive innovations / new value chains in Asia economies

Explore whether these new value chains are indicating an increase in open innovation activities

Some upcoming sessions

New platforms for data-driven analysis (10/10)

- CrowdANALYTIX (India): crowdsource problems to community of data scientists
- Algorithms.io (U.S. with Korea investment): modularized platform for easy custom data analytics development
- Nano-electronics
 - New industry consortium in Japan
- Data-driven marketing (S. Korea: SK Planet)
- Hydrogen energy storage (Japan)
- Water resource management (India)
- Ecommerce and retailing (China)