Sources of Innovation

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

Let us begin again with our Two Key Concepts

- 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/Disruptive_innovation

World Changing

- Thus the world can change due to new technologies either directly because the new technology displaces the old directly (**Creative Destruction**) or because the new technology enables an indirect entrance into the market at the low end of price and sophistication –but then grows to devour the entire market (**Disruptive Innovation**)
- Examples of creative destruction:
  - Records were replaced by tapes which were replaced by compact discs (CDs) which are being replaced by network based digital delivery.
  - Movie theaters were partially replaced by loaned video tapes from stores (Blockbuster) which were replaced by mailed out video discs (NetFlix) which are being replaced by network delivery of video (NetFlix, Youtube, FIOS, Xfinity, Amazon, DirectTV, etc.)
  - The Polaroid Instant Camera was replaced by digital cameras.
- Examples of disruptive innovation:
  - Floppy disk drives captured the home market but then replaced the business market.
  - Steel mini-mills learned to make rebar, the cheapest, lowest quality, and least profitable steel product, but then learned to make better quality steel and took away the higher profit market from big steel.
  - Personal computers captured the low end home market, but then displaced mainframes and mini-computers in the business market.

Drivers of Innovation

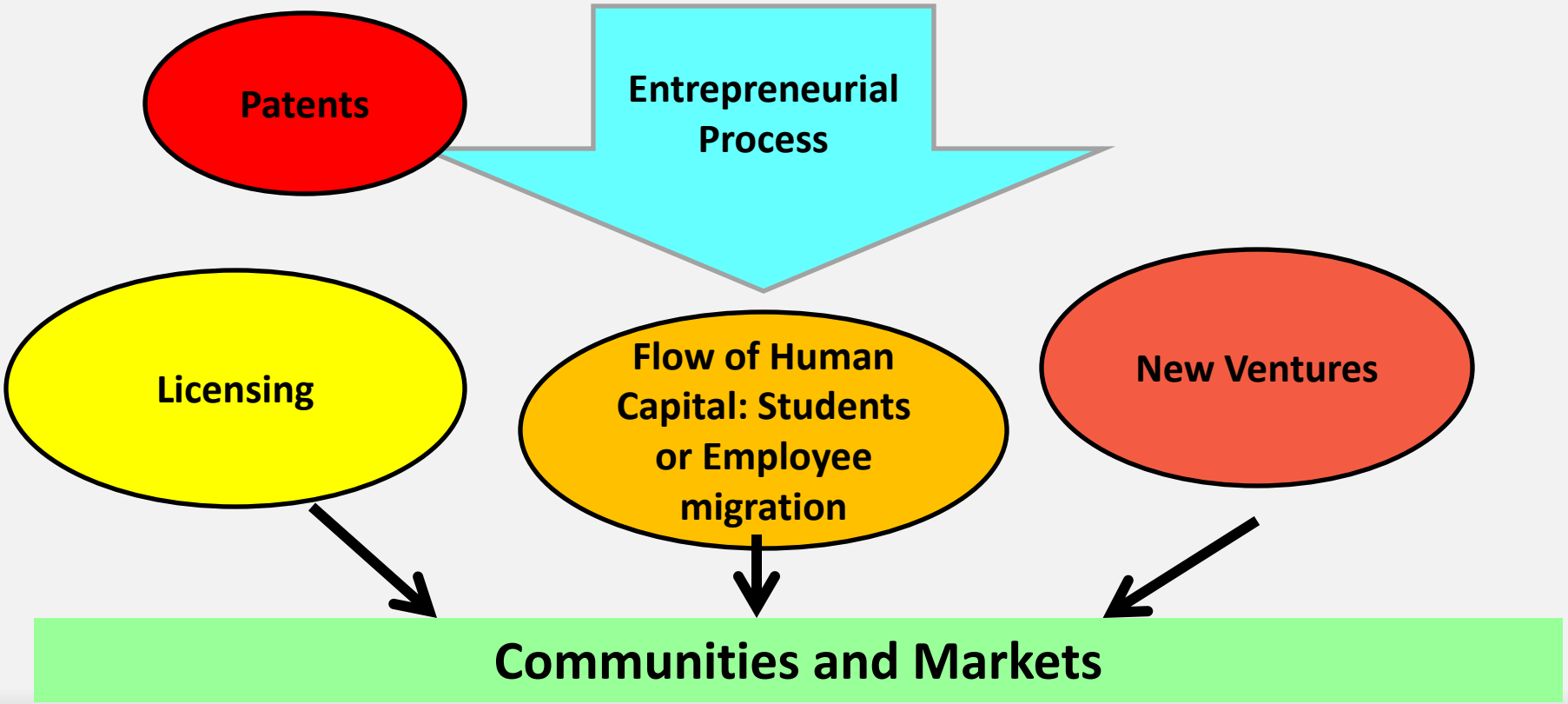
- **Knowledge Push** – New knowledge or research suggest some new opportunities
- **Need Pull** – When an unfulfilled need is present and someone comes up with an idea to fill that need.
  - Note that these two are often related. Frequently a new technology enables a previously unfulfilled need to be fulfilled.
- **Process Innovation** – making an existing process work better
  - Total quality management, business process re-engineering, Six Sigma, Lean Management, etc.
- Discovering customers at "**The Base of the Pyramid**" as Prahalad described. We covered this in the chapter on Globalization.
- **Crisis Driven** –Need pull on steroids. Zika Virus vaccine
- **Mass Customization**: Have it your way. Dell Computer, in 80s and 90s built PCs to order and shipped direct to customer. Converse allows customers to order personalized athletic shoes.
- **User Innovation** – crowd sourcing and extreme users
- **Imitation** –Often the first source of innovation in emerging economies.
- **Recombinant Innovation** –New combinations of existing things.
- Changes in **regulatory** and legal processes.
- **Design driven innovation** – Apple always focused on design even when releasing products that were not that much different than existing products.
- **Pure accidents** –discovery of penicillin, Post-it notes, Viagra, Teflon

Knowledge driven

- Technological opportunities almost always start with breakthroughs in new technologies. Those breakthrough can come from:
  - University research labs
  - Industry research labs like Bell Labs, Google Labs, IBM Labs, General Electric Labs, Phillips Research Labs,
    - 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 positons. 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



The virtuous value chain

- Research
- Applied Research and Development
- Licensing to new or established ventures

- New venture
- Business plan
- Elevator speech
- Early stage funding from bootstrapping, friends and families, angels, loans, or other sources such as the Small Business Innovation Research (SBIR) program.
  - http://sbir.nih.gov/
- Establish company structure (Corporate, partnership, LLC, sole proprietorship, etc)
- Prototyping the product or service
- Middle stage financing from venture capitalists or others
- Growth of new company
- Exit strategy
  - Acquisition
  - IPO –Initial Purchase Offer for stock
  - Remain a private business

- Licensing to established ventures
- New Product Development process.

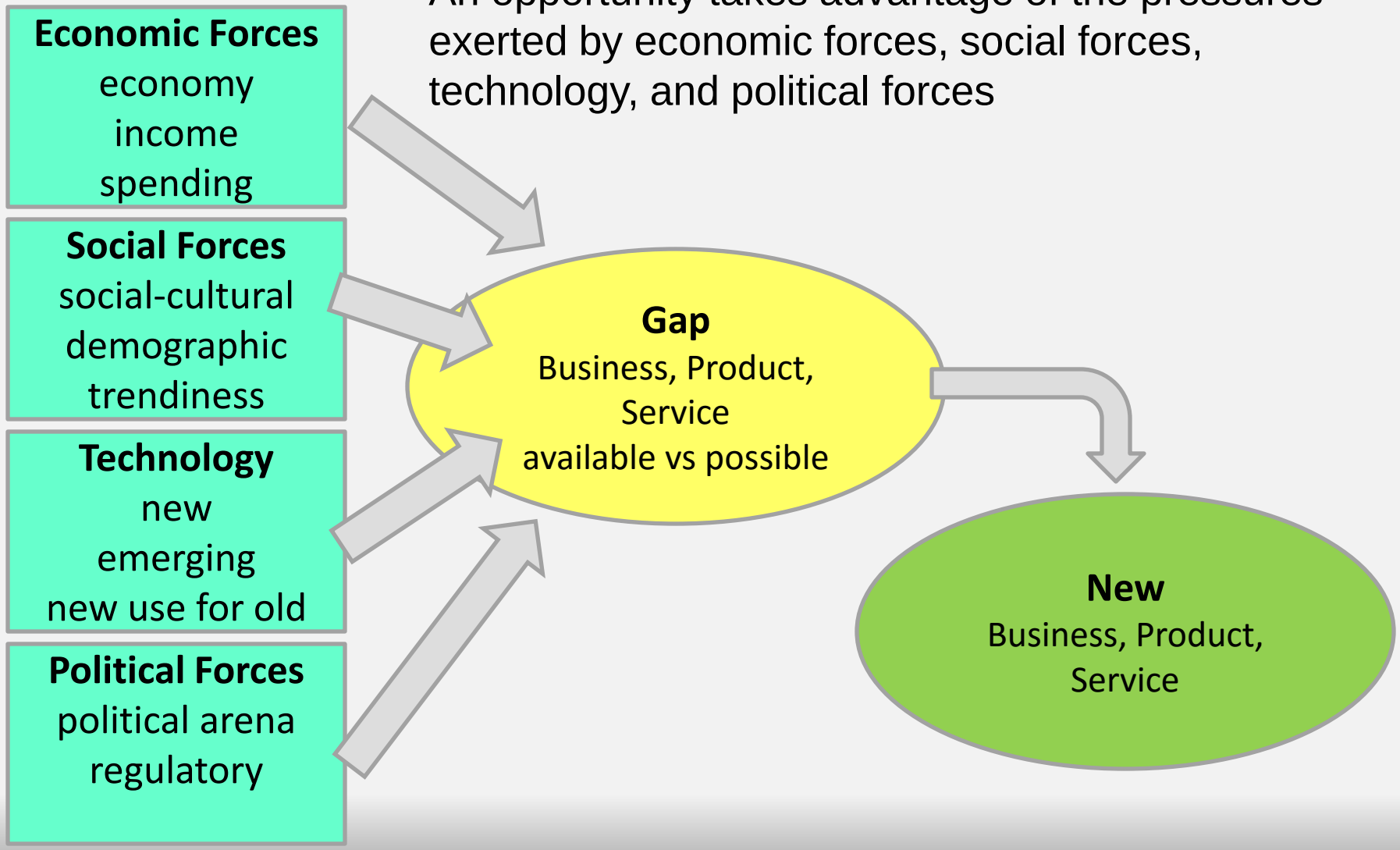
Need driven

- Owning an automobile in an urban area is a difficult and expensive proposition. Solution: Zipcar
- Some of us absolutely hate to go shopping (yep, that would be me) but we still want to buy things. Solution: **Amazo**n.com or **eBa**y.
- Some of us want to sell things. Solution **eBay**.
- Meeting potential dates in a new place can be awkward and time consuming.
  Solution: **Tinder**
- We all like to tell others our opinions on everything, but no one listens. Solution: **Twitter**
- We want to share a picture but only for an instant. Solution: **SnapChat**
  - Many users were embarrassed to discover that users could save their pictures!
- I want my music and I want it now!
  Solutions: **iPod, iPhone. Spotify, Pandora**, etc.
- The traffic is terrible! Solution: **Waze**
- Notice that many of these need driven innovations were enabled by technology.


"On the Internet, nobody knows you're a dog."

From Trends to Opportunity

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



Economic forces -examples

Here are some examples of economic forces:

- A rising economy – more discretionary income
  - Until recently the growing China market has been one of the key factors driving the world economy.
- A falling economy – products that cut costs or expenses
- Increasing or decreasing energy prices
  - Gas prices are falling. Hybrid sales are down and truck sales are up.
- Increasing income disparity between groups.
- Interest rates are rising or falling, are low or high.
- Access to less expensive labor for products
- There are many others. Can you think of some?

Social forces

- This is the biggie for the last four decades: the **baby boomers** have changed every part of society as they have gone through the many stages of life from birth to retirement!
- The increasing diversity in the workforce has created many new opportunities.
- The formation of online communities and popularity of social networks
- The change from wired phones to mobile phones as the dominant communication device.
- An interest in healthy living (see boomers above!)
- Increasing use of alternative energy –especially “clean” energy.
  - Popularity fluctuates wildly with variation in energy cost.
  - As oil and gas prices decrease –alternative energy is less economical
- Educational need –continuing education. We are living in a learning economy in which a large premium is paid for education and skills.
- Income disparity is also a social force as well as an economic force.

Technology advances

Here a few technology advances that have helped to define the economy we live in today:

- Personal computing
- The Internet
- Mobile phones.
- Medical Imaging
- Pharmacology
- Biologics
- RNAi – microRNA- gene silencing
- Genomics –personal medicine

Take a few moments to reflect and consider some of the new products, services, and companies that have been enabled by these advances.

Political and Regulatory Changes

- Tax policy –gasoline, cigarettes, oil depletion allowances
  - Taxes do 2 things:
    - 1. raise revenue
    - 2. decrease the use of the thing being taxed
- Health and safety regulation –OSHA, EPA
- Energy policies –alternative energy tax credits etc.
  - Solar energy credits
  - Net metering –forcing utilities to buy energy back from homeowners solar panels.
- Cyber-security
- National Health Policy –Medicare, Medicaid, Obamacare, Drug coverage, etc.
- Education policies –financial aid, standards, compliance, Clery Act, FERPA, Deemed Exports,

Tesla Motors -all electric high performance cars

- 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.