Information and Society-E2

- Information Economy 1-

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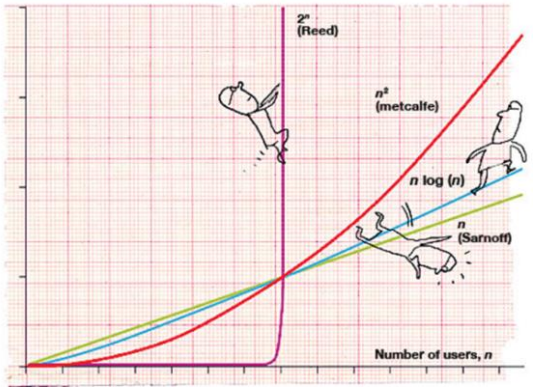
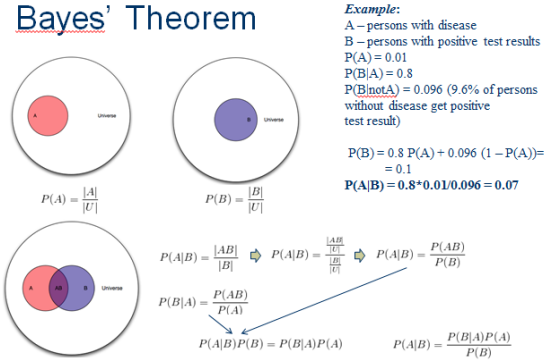
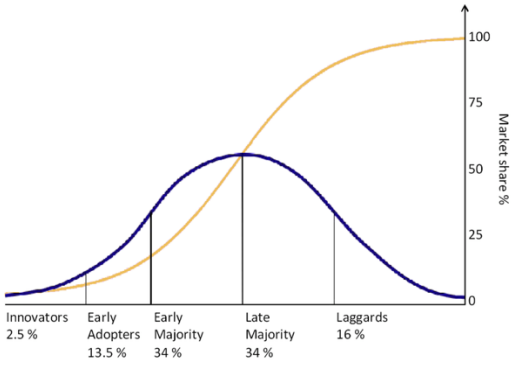
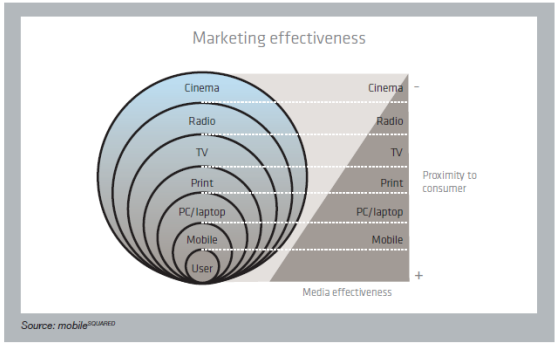
Information Economy (3 lectures)

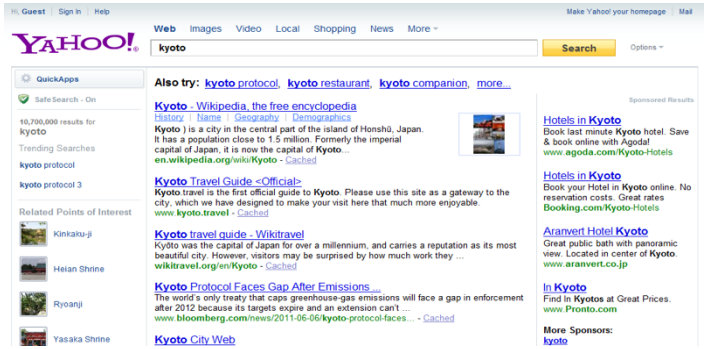
- Impact of Internet on economy
- Externality, network externality
- Consumer search theory
- Information asymmetry
- Online advertising







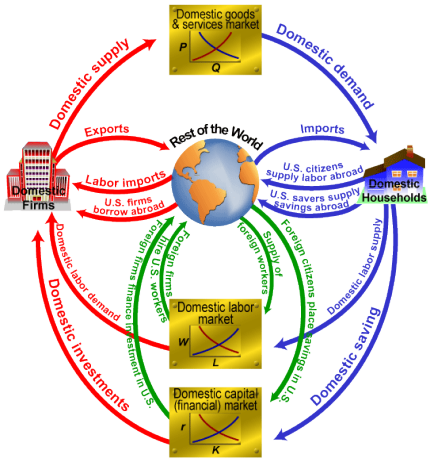


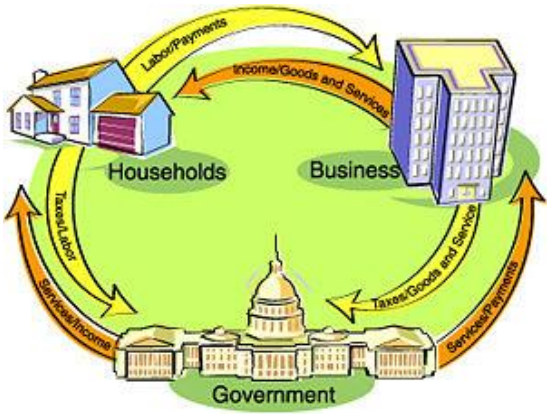


OVERVIEW OF INFORMATION ECONOMY

Microeconomics and Macroeconomics

- **Microeconomics** - study of actions and behavior how individual companies and households decide to allocate their resources
- **Macroeconomics** - study of sum of the total activity of individual market players
  - Treats economy as a whole
  - Focuses on questions such as:
    - What causes the economy to grow over time?
    - What are the reasons for cycles?
    - Why bubbles form?
    - What causes short-run fluctuations in the economy?





Things (industrial society) vs. Information (information society)

Things

- Seller looses thing
- Manufacturing costs
- Thing wears out
- Thing exists in a location

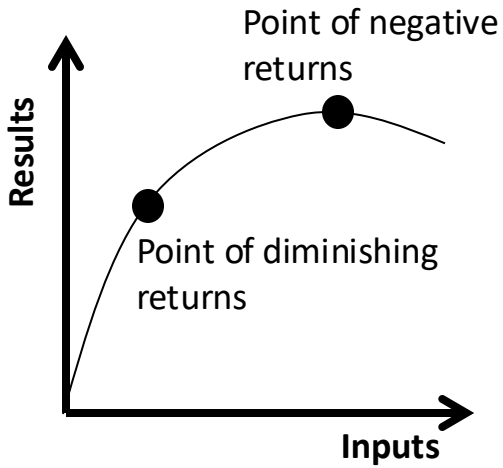
Information

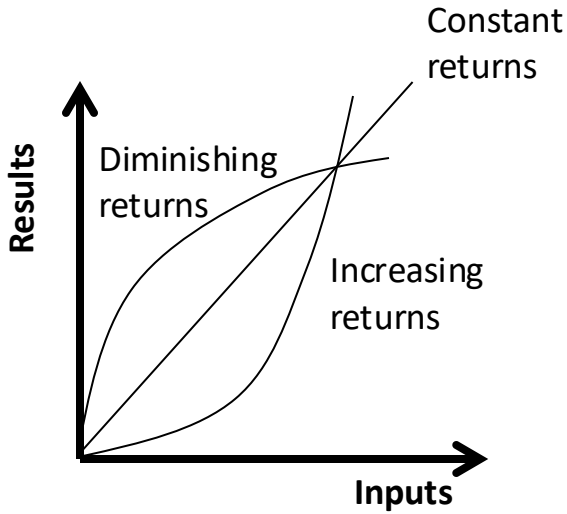
- Seller retains information
- Free copies – near zero marginal cost(*)
- Never wears out (but can become obsolete)
- Everywhere and nowhere

* Marginal cost: cost of producing one more unit of a good.

Diminishing Returns

- **Things**
  - Diminishing returns: traditional industries (ex. agriculture (fertilizers))
    - E.g., getting 100% bigger may only generate 90% more value
    - The bigger the business gets, the less optimal its last venture





Law of Returns Concerning Scale

- Production Function
  - x_1, x_2,…,x_n : production elements (input elements necessary for production)
  - q: Highest possible output producible with current technology (according to optimum production plans)

$$q = f(x_1, x_2, ..., x_n)$$

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- Increasing / constant / diminishing returns relating to scale
  When increasing t(>1) of all input production elements
  - **Constant returns** : production volume $f(tx_1, tx_2,\ldots,tx_n) = tq$
  - **Increasing returns** : production volume $f(tx_1, tx_2,\ldots,tx_n) > tq$
  - **Diminishing returns** : production volume $f(tx_1, tx_2,\ldots,tx_n) < tq$

Things vs. Information

- **Things**
  - Diminishing returns: traditional industries (ex. agriculture (fertilizers))
    - E.g., getting 100% bigger may only generate 90% more value
    - The bigger the business gets, the less optimal its last venture
- **Information**
  - Nearly perfectly increasing returns: doubling the sales → halves the cost per production. In software and information industries, getting 100% bigger may generate, say, 150% more value
    - Cost of **reproduction** and **distribution** is very small (e.g. Windows OS distributed by mastercopy sent to retail sellers who then provide customer support; writing e-books)
    - Companies have more **flexibility** to choose prices, even zero or negative prices to achieve large market share. Market monopoly or oligopoly often happen

Information Product Pricing

- Since marginal cost is close to 0, the price of a product should be estimated solely based on what a customer wants to pay
- Which type of customer?

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- Since marginal cost is close to 0, the price of a product should be estimated solely based on what a customer wants to pay
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- As company cannot differentiate customers to set different prices, versioning is applied:
  - Similar to cinemas charging more than the price of a DVD rental of the same movie later
  - Manipulating data to create versions is easy (small cost of version creation)
  - Issue of how to divide versions based on potential customer segments
    - Which features are valuable to given customers kind and of no value to others? What prices to set to the numbers of versions?
      - Time is a simple dividing strategy as in providing real-time stock price quotes or with 20min delay
      - Manipulation, comprehensiveness, community, annoyance (ads), speed, data processing, user interface, support, etc.

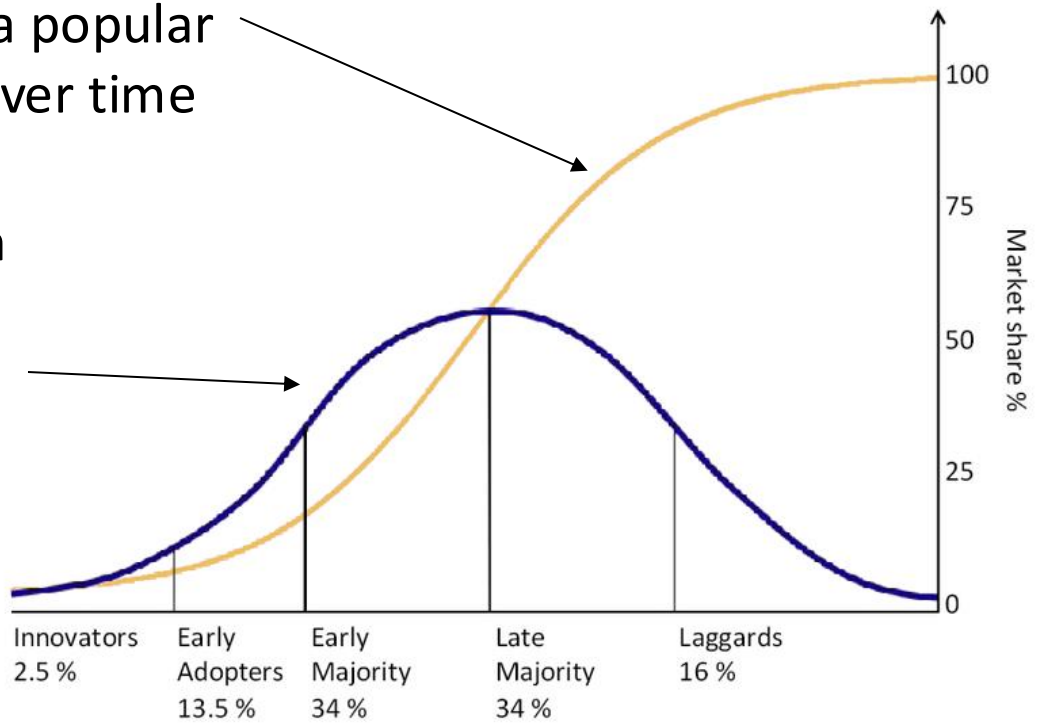
Market Growth of New Product

- **What makes an innovation spread quickly?**
  - Relative advantage (economic advantage, social prestige, convenience, satisfaction, etc.)
  - Compatibility with existing values and practices
  - Simplicity and ease of use (degree to which an innovation is perceived as easy to understand and use, and does not require new skills)
  - Trialability (amount of uncertainty that can be decreased)
  - Observable results (visible results lower uncertainty and stimulate peer discussion)
  - Reinvention (degree to which innovation can meet requirements of more demanding and risk-averse users)

Market Growth of New Product, Diffusion of Innovations

The total number of adopters of a popular innovation over time

How population members are distributed by their rate of innovation



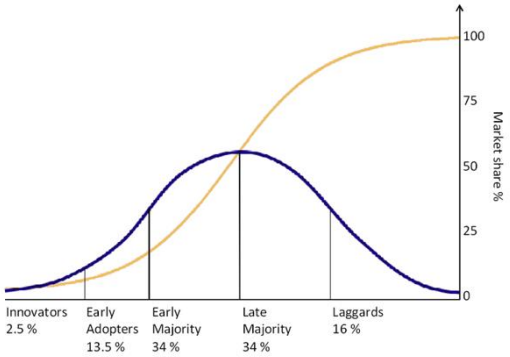
Time / Customer categories distributed by the rate of innovation

Everett M. Rogers. “Diffusion of Innovations”. Free Press of Glencoe, 1962 - Technology & Engineering

Innovation Spread over Different Customer Segments

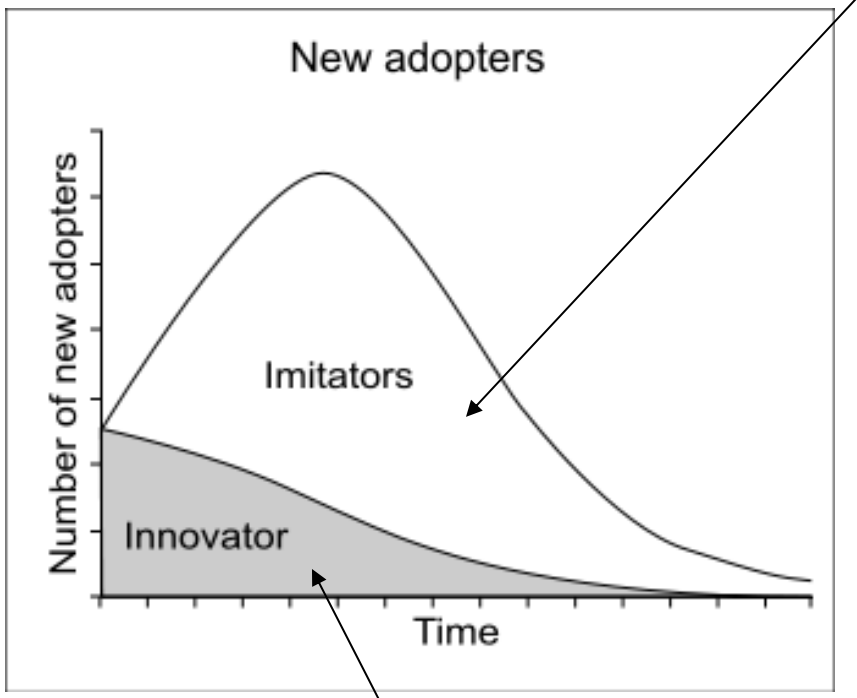
Innovation adoption involves risk, uncertainty

- Innovators
  - Small number of visionary, imaginative innovators
  - Have much energy and creativity to find new ideas and gadgets. Like to talk about them
- Early adopters
  - On lookout for new technologies, confident, financially secure, better informed
  - Want new technologies that will fulfil their personal needs. Desire to be trend-setters. Like to talk and make buzz
  - Vital for reinventing the innovation (independent test bed)
- Early majority
  - Pragmatists that will not act without solid proof of benefits
  - Followers influenced by mainstream fashion
  - Cost-sensitive and risk-averse. Hate complexity (plug-and-play, no-sweat, value for money)
- Late majority
  - Conservative pragmatists who hate risk and are uncomfortable to
    is the fear of not fitting in so they follow mainstream fashion and i
- Laggards
  - Very worried and critical



Bass Diffusion Model

Adoption due to interpersonal communication



Adoption due to mass-media

FM Bass, "A New Product Growth Model for Consumer Durables," Management Science, 1969

Path Dependence: Are best Technologies always Wining?

- **Path Dependence (Paul David 1985)**
  - Critical concept for IT
  - Markets do not necessarily always spread the most **rational** technologies, as the foothold of existing technologies leads to “Path Dependence”
  - Extending the life of one technology due to Path Dependence results in substantial cost when later switching to another technology

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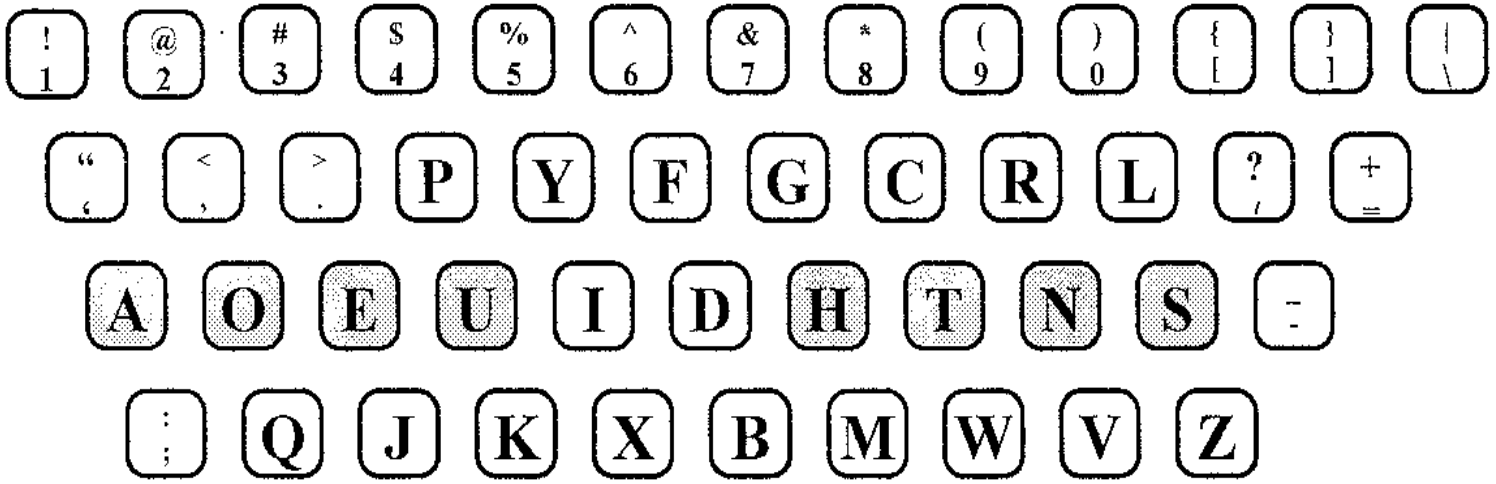
- QWERTY Keyboard Layout
  - Typewriter character layout of the second row from top left: Aligned in QWERTY order
    - Developed to prevent typebar jamming when typewriters were in wide use
    - Inefficient layout (not rational)
- Keyboards with more efficient layout begin to appear
  - Dvorak, Hammond, Nelson, Hawk
  - OASYS (Fujitsu)
- QWERTY layout becomes universal keyboard

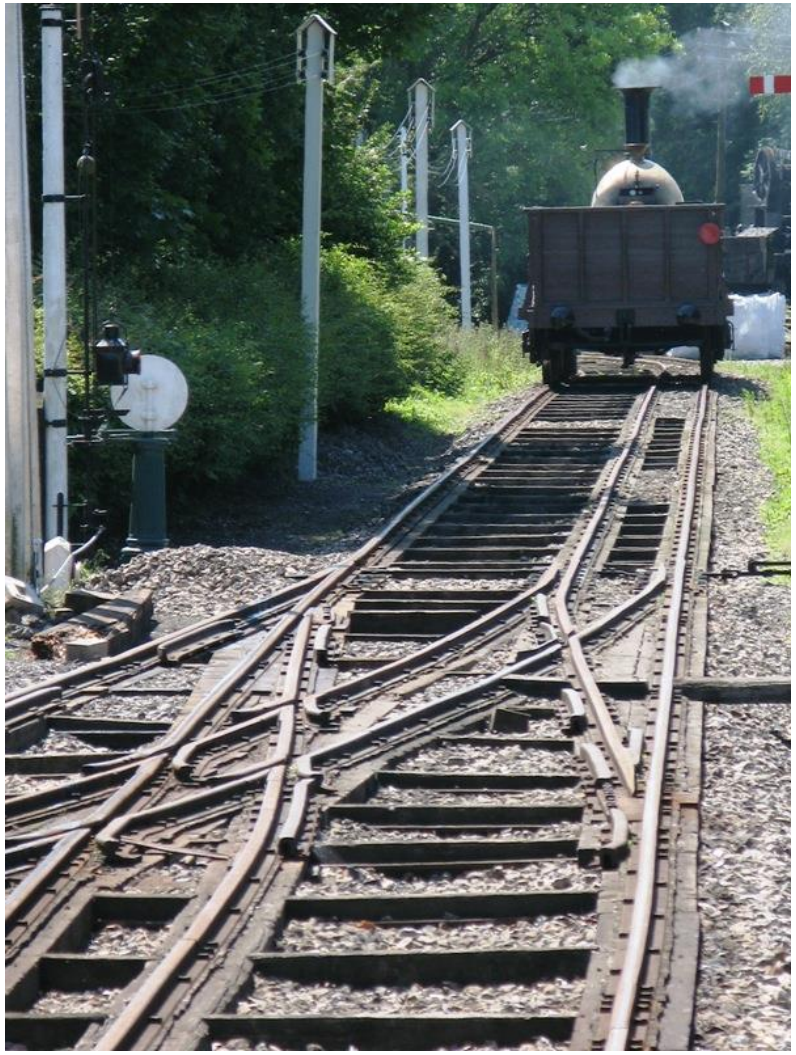
typebar

Dvorak Keyboard



Many typing competitions banned the Dvorak keyboard as unfair

Another Example: Standard Gauge

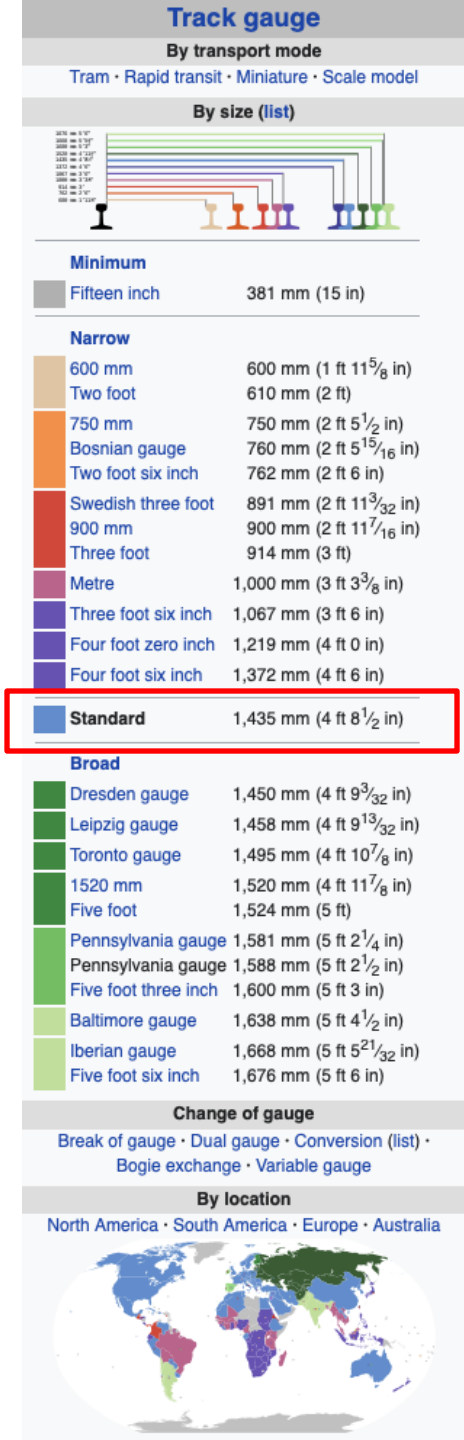


https://ja.wikipedia.org/wiki/標準軌

Another Example: Standard Gauge

- The standard gauge of railway tracks is another example of path dependence which explains how a seemingly insignificant event or circumstance can change the choice of technology over the long run despite contemporary know-how showing that such a choice is inefficient.
- More than half the world's railway gauges are 4 feet 8+1⁄2 inches (143.5 cm), known as standard gauge, despite the general consensus among engineers being that wider gauges have increased performance and speed.
- The path to the adoption of the standard gauge began in the late 1820s when George Stephenson, a British engineer, began work on the Liverpool and Manchester Railway. His experience with primitive coal tramways resulted in this gauge width being copied by the Liverpool and Manchester Railway, then the rest of Great Britain, and finally by railroads in Europe and North America.

https://ja.wikipedia.org/wiki/標準軌



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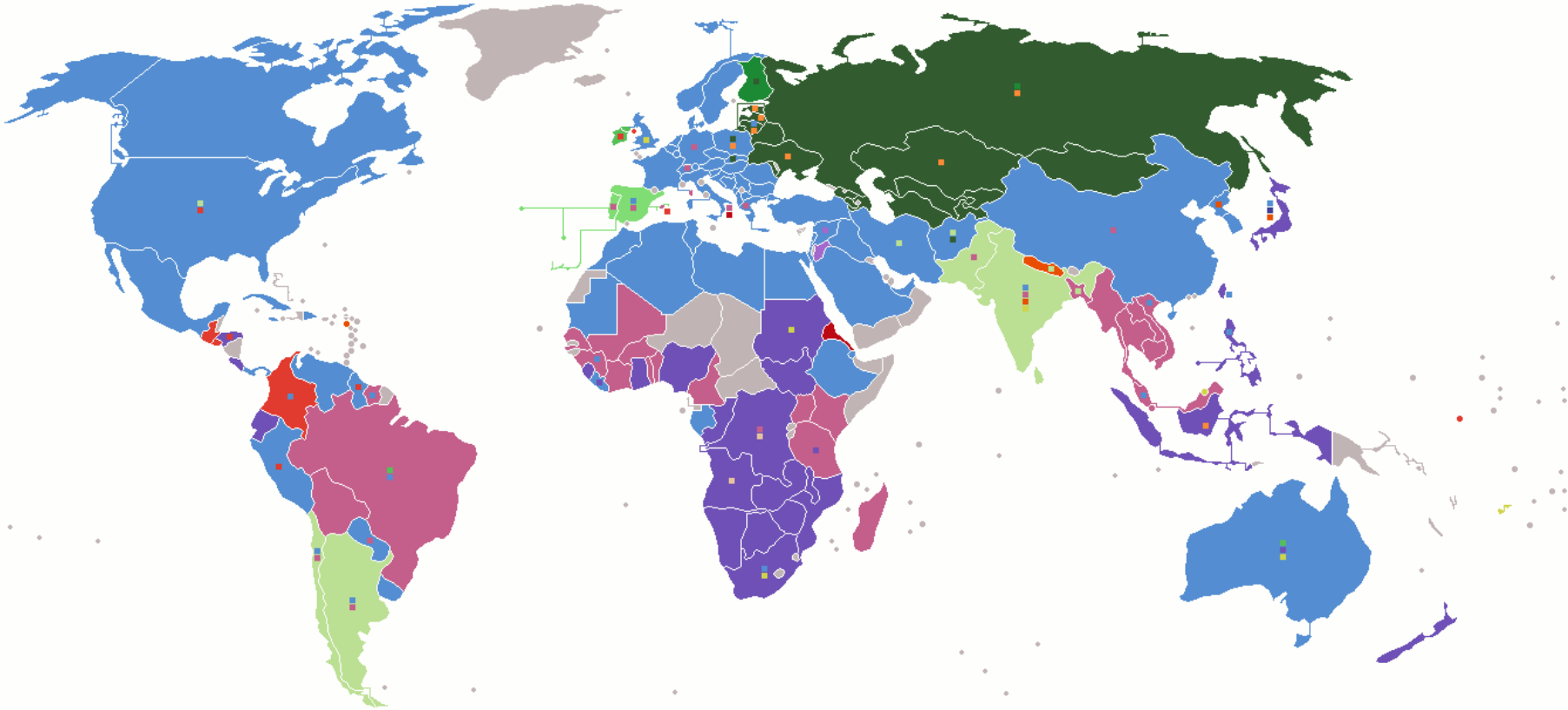

mm	1676	1668	1600	1524	1520	1435	1372	1067	1050	1000	950	914	762	750	610	600
ft in	5'6"	5'5.67"	5'3"	5'	4'11.8"	4'8.5"	4'6"	3'6"	3'5.3"	3'3.4"	3'1.4"	3'	2'6"	2'5.5"	2'	1'11.6"

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An Example in Information Goods

- In the computer and software markets, legacy systems indicate path dependence:
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  - E.g., a customer may need not merely the best available word processor but rather the best available word processor that can read Microsoft Word files
    - Such limitations in compatibility contribute to lock-in (described later), and more subtly, to design compromises for independently developed products if they attempt to be compatible

CONCEPT OF EXTERNALITY, NETWORK EXTERNALITY（外部性）

Law of Demand: Example of Deterring Crime

- *The greater the fine, the more a potential criminal should be discouraged from committing the crime,* ceteris paribus
  - Assumption of rationality and perfect information

- If the benefit of saving time in searching for a parking space is $5 then a fine of, e.g., $6 would make the net benefit of the crime negative assuming it costs nothing to detect the crime
  - Only few users whose net benefit was higher (e.g. emergency parking) should violate the law

- In practice, it is however costly to catch lawbreakers
  - Enough to impose $50 and catch only 1 in 10 violators or $500 and catch 1 in 100 (same deterrence effect)

Law of Demand and Consumption Externality

- **Law of demand**: ***price*** *and* ***quantity of good*** *that users are willing to buy are* ***inversely related***
  - E.g., cake price vs. sales, rate of cheating on test or during voting vs. expected price of being caught (penalty and probability)

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- Changes in demand of a fixed product (while keeping key product attributes stable)
  - Changes in disposable income and price → Changes in demand
  - Changes in knowledge/liking of product → Changes in demand
  - Other factor causing demand change is **Consumption Externality**

Externality Examples

- **Externality** is *the cost or benefit that affects a party who did not choose to incur that cost or benefit*
  - **Positive examples**:
    - Renovated houses in neighborhood
    - Going to university as one can later teach others
    - Taking medicine which prevents spread of infectious disease
  - **Negative examples**:
    - Smoking (others breathe in smoke)
    - Company polluting as a result of increased production, e.g. steel production; the cost is borne by society

Consumption Externality

- **Consumption Externality**
  - **Occurs when consuming a good causes either a positive or negative externality to third parties**
  - **Bandwagon Effect / Snob Effect**
    - Product is popular so everyone else wants to have one (Bandwagon Effect)
    - Demand declines because everyone has one (Snob Effect)
  - **Demonstration Effect** (Deusenberry 1949)
    - Increase in the demand/pursuit of good consumption from seeing improvements in the consumer lifestyle of others
    - E.g. “Affluent households in affluent neighborhoods have a relatively higher tendency toward consumption than non-affluent households in non-affluent neighborhoods”
  - **Network Externality**
    - **Change in the benefit, or surplus, that an agent derives from a good** when the **number of other agents consuming the same kind of good changes**

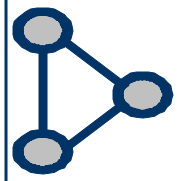
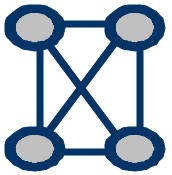
Network Externality (Network Effect)

- **Change of product value occurs due to factors other than ones of products and services. It occurs due to the number of users, e.g.:**
  - Fundamental value of a mobile phone rests not in quality of the handset, but is determined by the total number of people that can be called using that mobile phone
  - Increase in the number of participants in stock exchange → higher liquidity, lower transaction costs
  - Windows OS is popular as it is well-supported (compatible with lots of hardware and software). It is actually well supported because it is popular (positive feedback)
- Traditional concept: "*when a good becomes scarce its price should increase*" does not work in case of a network good
- **Direct Effect of Network Externality**
  - Metcalfe's Law
    - Network effect rapidly increases with the growth of network
    - Total network value for all users is proportional to n^2 when the number of users is defined as n

Metcalfe's Law

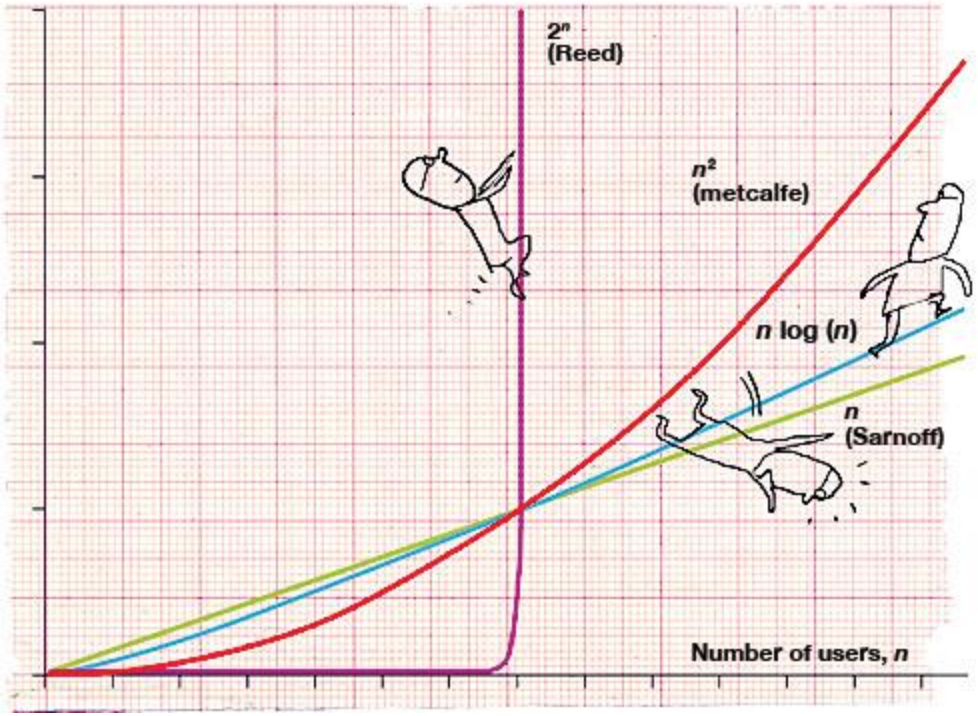
Bob Metcalfe
- Developed Ethernet

- Proposed the law "the value of network is proportional to the square of the number of nodes" in 1995

Nodes	1	2	3	4
Number of connections (network value)	0	1	3	6
				

Briscoe et al claimed that the value of network is proportional to nlog(n), not n^2

- Metcalfe's Law is Wrong
  (By Bob Briscoe, Andrew Odlyzko, and Benjamin Tilly, IEEE Spectrum July 2006, http://spectrum.ieee.org/jul06/4109)



Controversies with Metcalfe's Law

- Quality of “network” vs. Quantity

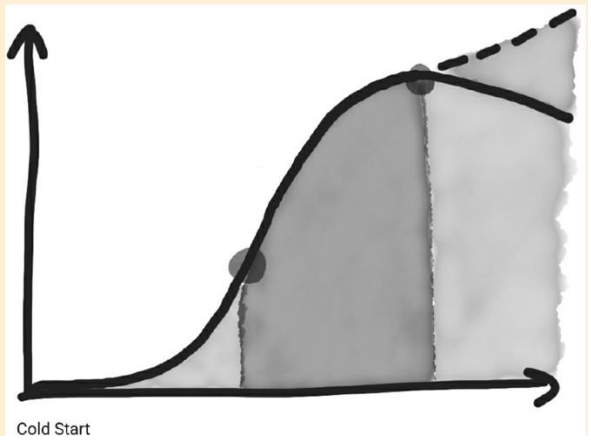
- Examples
  - **Network congestion problem (increase in the number of subscribers cannot continue indefinitely)**
  - **Potential number of contacts** - not all networkers present the same value, e.g., **English vs. non-English language speaking participants**
  - Etc.

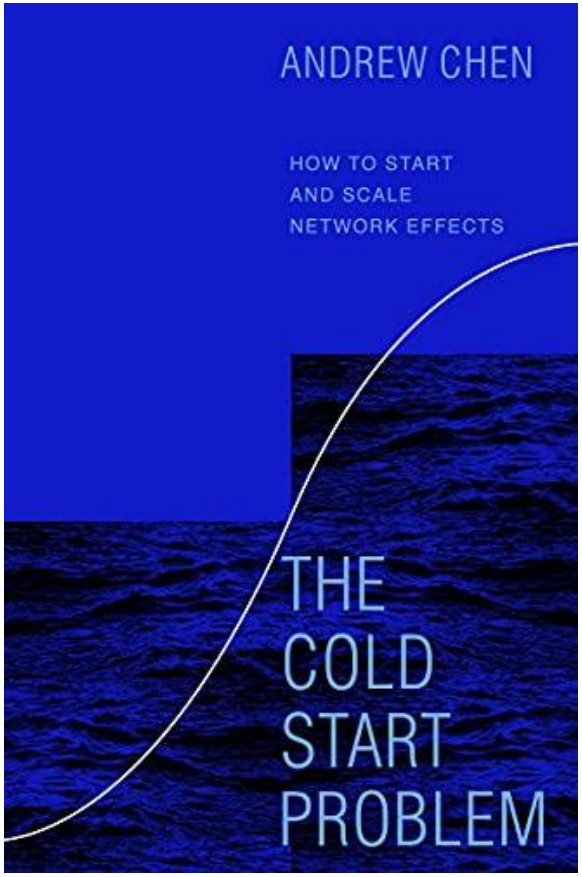
Another Example of Network Externality

- Economists from Adam Smith to Paul Krugman have noted that similar businesses tend to congregate geographically ("agglomerate")
  - Opening near similar companies attracts workers with skills in that business, which draws in more businesses seeking experienced employees.
  - There may have been no reasons to prefer one place to another before the industry developed, but as it concentrates geographically, participants elsewhere are at a disadvantage, and will tend to move into the hub, further increasing its relative efficiency.
  - This network effect follows a statistical power law in the idealized case, though negative feedback can occur (through rising local costs)

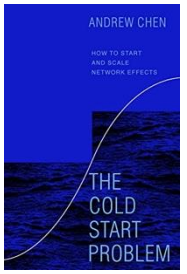
Cold-start Problem

- Although software has become easier to build, launching and scaling new products and services remains difficult. Startups face daunting challenges entering the technology ecosystem, including stiff competition, copycats, and ineffective marketing channels.
- Teams launching new products must consider the advantages of "the network effect," where a product or service's value increases as more users engage with it. Apple, Google, Microsoft, and other tech giants utilize network effects, and most tech products incorporate them, whether they're messaging apps, workplace collaboration tools, or marketplaces. Network effects provide a path for fledgling products to break through, attracting new users through viral growth and word of mouth.
- Yet most entrepreneurs lack the vocabulary and context to describe them—much less understand the fundamental principles that drive the effect. What exactly are network effects? How do teams create and build them into their products? How do products compete in a market where every player has them?





The Killer Product: Zoom



- "When I first started Zoom, people thought it was a terrible idea." (Eric Yuan, CEO of Zoom)
  - "Zoom was originally called Saasbee. When Saasbee was first getting started, I sent a pitch deck to my friends and angel investors asking them to invest. Many of them decided to fund me just because they knew me and didn't care much what I was working on. But if they looked at the deck, they always hated the idea and wouldn't fund it!"
- At the beginning, people didn't get the idea behind Zoom—why? According to Eric, it just seemed too simple, literally. An easier-to-use videoconferencing product wasn't an obvious idea when products like WebEx, GoToMeeting, Skype, and others had already conquered the market. Zoom didn't have more features per se, but in fact had the most important feature of all: the "it works" feature.
  - It allowed attendees to join with a single click of a link, rather than entering meeting codes and dialing numbers. (Simplicity)

INTERNET AND ECONOMY

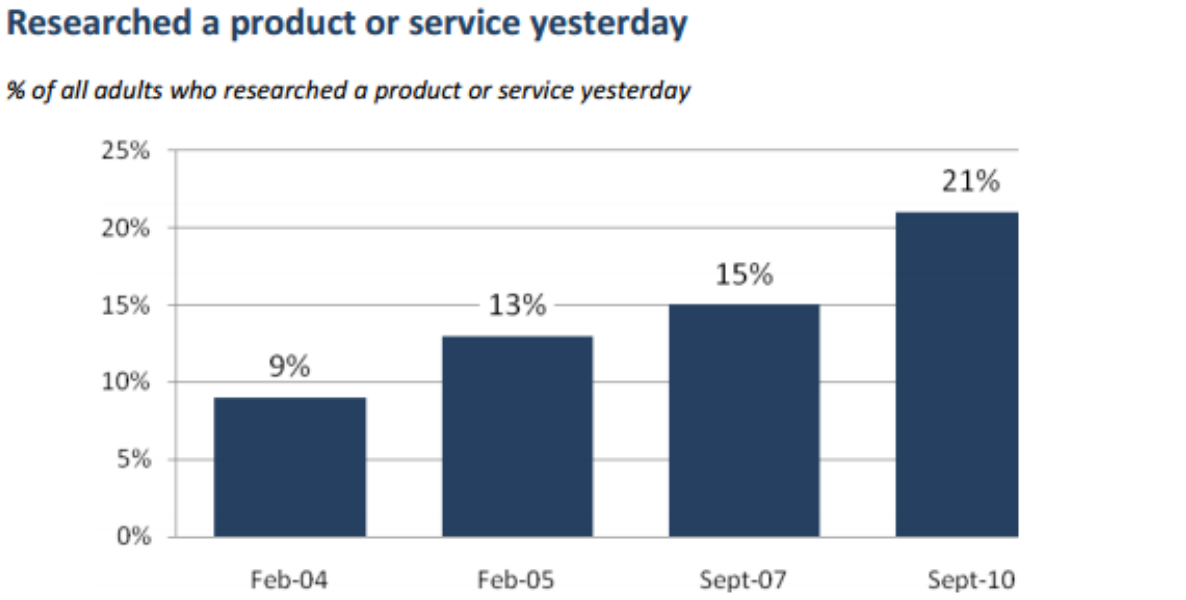
Paying on Internet

- 65% of internet users have paid to access or download some kind of digital content (among 755 users asked at the end of 2010)
    - 33% have paid for digital music online
    - 33% have paid for software
    - 21% have paid for apps for their cell phones or tablet computers
    - 19% have paid for digital games
    - 18% have paid for digital newspaper, magazine, or journal articles or reports
    - 16% have paid for videos, movies, or TV shows
    - 15% have paid for ringtones
    - 12% have paid for digital photos
    - 11% have paid for members-only premium content from a website that has other free material on it
    - 10% have paid for e-books
    - 7% have paid for podcasts
    - 5% have paid for tools or materials to use in video or computer games
    - 5% have paid for “cheats or codes” to help them in video games
    - 5% have paid to access particular websites such as online dating sites or services
    - 2% have paid for adult content

Pew Internet & American Life Project
http://pewinternet.org/Reports/2010/Paying-for-Content/Overview.aspx

Researching Products on Internet

- Nearly six-in-ten adults (58%) have done research online about the products and services they buy, and about a quarter (24%) have posted comments or reviews online about the things they buy (phone survey of 3k users over 18 years old in 2010)



Source: Pew Research Center's Internet & American Life Project, August 9-September 13, 2010 Tracking Survey. N=3,001 adults and the margin of error is +/- 2.5 percentage points.

Where People Get Information about Restaurants or other Businesses?

- 55% of adults get news and information about local restaurants, bars, and clubs (telephone survey of 1,087 adults >18 years old in 2010)
- When they seek such information, the sources they use are:
  - 51% turn to the Internet, including:
    - search engines - 38%
    - specialty websites - 17%
    - social media - 3% rely on social networking sites or Twitter
  - 31% rely on newspapers, including
    - printed copies - 26%
    - newspaper websites - 5%
  - 23% rely on word of mouth
  - 8% rely on local TV, either broadcasts or websites
  - …

http://www.pewinternet.org/~/media//Files/Reports/2011/PIP-Local-business.pdf

Examples of Fraud on the Web

http://www.japantoday.com/category/national/view/yahoo-restaurant-reviews-and-rankings-manipulated-by-fake-comment-companies
http://www.japantoday.com/category/crime/view/japanese-dating-site-busted-for-using-fake-profiles

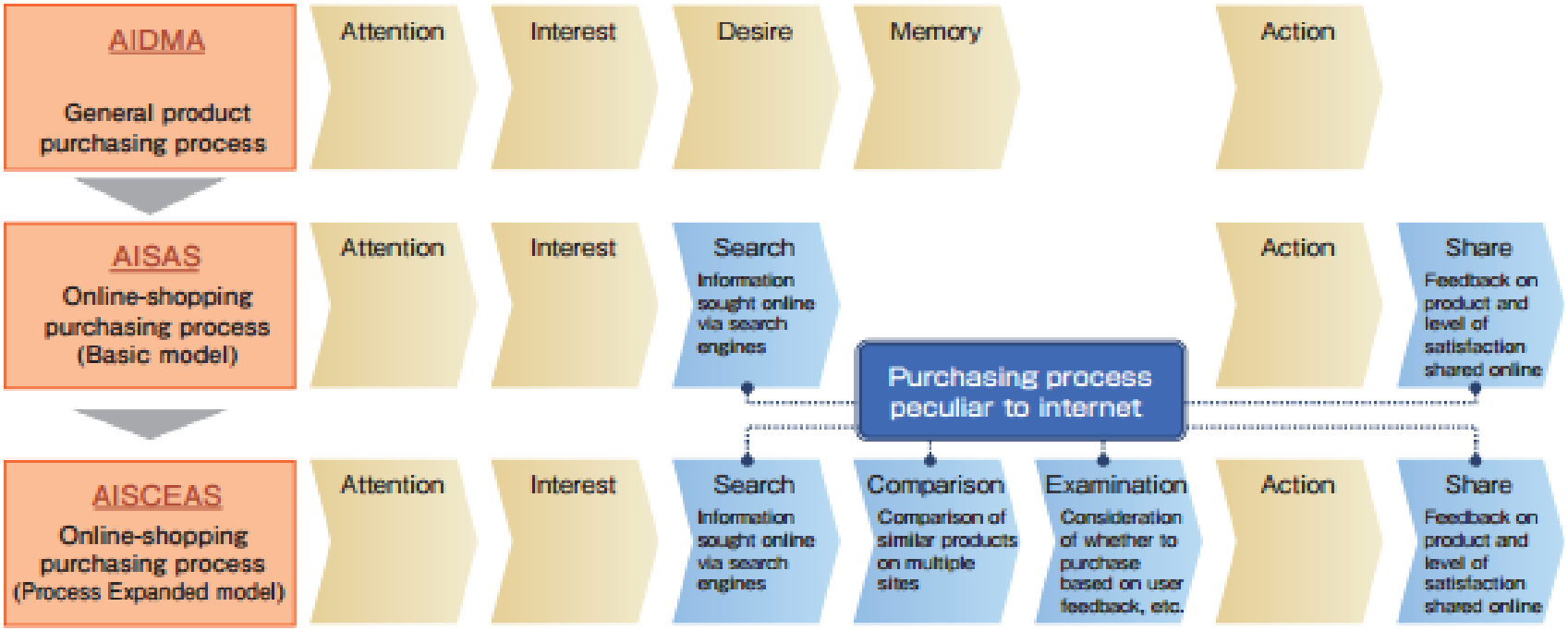
Internet Impact on Economy

- More **efficient allocation of goods and services**, for example, by enabling **auctions**, better matching of customers and sellers, extending markets
  - Despite the global nature of the economy, most consumers and businesses still are much better informed on the products available in their own country. As a result, many potentially useful trades go unmade
- **Long tail markets**
  - E.g. average large bookstore could have 40K-100K books stored while Amazon has over 3 millions
- "**Shipping services**" rather than goods
  - Turning large portions of the service sector into export industries, e.g. education

Internet Impact on Economy

- Saving money by consumers due to better choice and due to automatized operations (e.g. Amazon, Netflix, various price comparators putting pressure on prices, online brokers like E*TRADE)
- Faster diffusion of ideas make competition stronger and potential "reward" higher
  - With new ideas diffusing quickly, there is decreased chance of protecting a monopoly
- Increased quality of service and goods (e.g., eBay's seller rating system)
- Mass customization possible (e.g. Dell, Toyota, Nike)
  - Prosumers – consumers who share in production process when they consume

Online Shopping Changes Purchasing Process



(Source) Ministry of Internal Affairs and Communications "Survey on the Impact and Reciprocal Relationship of ICT Infrastructure Progress and Citizens' Lifestyles and the Social Environment" (2011)

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