

## Week 2 lecture A Introduction to technology innovation

Invention: It is the first occurrence of an idea for any product or process. – Jan Fagerberg.

Innovation: According to Schumpeter, is a new idea applied commercially.

Thus innovation is more than just coming up with a new idea, it involves combining a creative idea with resources and expertise for building new products, services, processes or business models.

### IMPORTANCE OF INNOVATION

#### - To a country:

1. It acts as a driving force for competition in an industry.
2. Leads to improvement in productivity
3. Improves the GDP of a country. (propels the economy)
4. Is linked to improving standard of living in a country by creating jobs, improvements in the field of education and health.
5. Innovation is also aimed at addressing national issues by improving the way we respond to disasters and in decreasing pollution.

(Innovation is a driver of productivity, growth, improvement in living conditions (health, education, reducing pollution etc.) )

#### - To a company:

According to an Australian Study,

1. More likely to report increased profitability; -
2. More likely to export and increase the number of export markets targeted;
3. More likely to increase the range of goods or services offered;
4. More likely to increase employment;
5. More likely to increase training for employees; and
6. More likely to increase social contributions such as community enhancement projects.

(Innovative companies usually have greater productivity, revenue, growth and social contributions )

**Creative Destruction:** waves that restructure entire industries and markets in favour of those who grasp and adapt to technological discontinuities faster. (It is a process of industrial mutation which incessantly destroying the old economic structure, incessantly creating a new one from within called by Schumpeter)

### IMPORTANCE OF IT INNOVATION

#### 1. IT as a General Purpose Technology (GPT)

---GPTs are pervasive (spreading to most sectors)

---GPTs continually improve in usefulness and lower in cost.

---GPTs spawn innovations in other areas by making it easier to invent or produce something.

2. IT (ICT), like electricity, is an enabler of innovation in other fields (IT as a horizontal has helped innovate in all the vertical fields such as health, transport, education, arts, etc.)  
(health: bio-informatics, computational genomics(SARS))  
(transport: Smart traffic control, Fleet logistics, Train schedule optimization, Automotive)

3. Software is now key to innovation in most industries.

Examples:

1. Software for analysing genomes

SARS coronavirus (SARS CoV), Cause of SARS (Severe Acute Respiratory Syndrome) illness

2. Software for fleet logistics

Saves cost, ensures timely delivery and tracking system, reduce emissions.

3. Softwares in Cars

Software development for cars amounts to a considerable amount of the time spent on the overall production. For modern cars, 80% of the innovations come from software development. They enable everything from Air-bags system, entertainment, navigation to engine ignition.

4. IT Innovation as Creative Destruction

1. Improvements in IT can change whole industries – e.g. Media industry

(the Online advertising revenue still increasing since 1999, while print Newspaper advertising revenue still decreasing since 2000) (Creation of one industry Destruction of another)

Another Example: Music industry – Home studios because of recording softwares, Bandcamp and Spotify affecting – Record Labels.

2. “software is eating the world” (2011)

考试

It means more and more major businesses or industries are being run on software and delivered as online services. In addition, technology required to transform industries through software finally works and can be delivered globally.

e.g. With billions of people using smartphones, services needed can be delivered conveniently via Internet.

For now, the sentence is almost 100% correspond to current conditions. For example, Google, as a software company, is still the largest direct marketing company, and Oracle, Microsoft, their softwares are popular and necessary for people's daily lives and working. In addition, using software to analyze a large amount of data, big data, are more and more popular as well as open source development in terms of software is becoming more popular. Examples mentioned above shows that software is still eating the world.(Online shopping(eBay,Amazon))

## TYPES OF INNOVATIONS

### 1. Type of thing being innovated

–Product/Service Innovation or Process Innovation or Business Model Innovation.

**Product/Service Innovation:** Product innovation is the creation and introduction of a product or service that is either new or a substantially improved version of an existing product or service from an organization.

e.g. Pix4d - Software to generate 3d imagery of a geography, new features in Facebook, (Video game, iPod)—product innovation, etc.

**Process Innovation:** involves the discovery and implementation of a new improved production or delivery method. It could be related to production/engineering or to business process.

e.g. The process for making a prototype product from injection moulding to 3D printing

**Relation between product and process innovations**

*Product innovations can enable process innovations*

– E.g. 3D printer enables cheaper prototyping

*Process innovations can enable product innovations*

– E.g. the A/B testing process can enable product innovation

*What is a product innovation for one organization might be a process innovation for another*

– E.g., a package delivery service creates a new distribution service (*product innovation*) that enables its customers to distribute their goods more widely or more easily (*process innovation*)

**Business Model Innovation:** is coming up with new and radical business models.

e.g. web-based innovations (Google, Groupon, Amazon Web Services, Uber, Airbnb) are built around business model innovations

one business model—canvas

### 2. How different is it from what's already available?

– Radical vs incremental innovation

**Radical Innovation:** The radicalness of an innovation is the degree to which it is new and different from existing products and processes. (totally different)

e.g. 3D Printer, 360 Cameras.

**Incremental Innovation:** Innovation that may involve a minor change from an existing product or process.

e.g. a new feature in Microsoft Word

### 3. What impact will it have on the consumer?

– Life-changing vs incidental innovation

### 4. What impact will it have on the market or industry?

– Disruptive vs sustaining

5. What scope of the product/service/process does it affect?

– Architectural vs component innovation

**Architectural Innovation:** involves changing the overall design of the system or the way components interact.

e.g. cloud computing, the system of allowing “signals” to be added to Google

**Component Innovation:** involves changes to one or more components of a system without significant change to the overall design.

e.g. Changing an algorithm for face recognition in a camera, adding a new “signal” in the Google search engine

(Most architectural innovations also require changes in the underlying components. )

6) What impact will the innovation have on the producers?

– Competence-enhancing vs competence-destroying innovation

**Competence-enhancing Innovation:** Innovations build on the company's existing knowledgebase.

e.g. Intel's Pentium 4 built on the technology for Pentium III.

**Competence-destroying:** Innovations render a firm's existing competencies obsolete.

e.g. Ex. Though Kodak invented the first digital camera, the company could not keep up with the transition from their existing competence in analog technology to digital photography as everything in the organization like the R&D and development teams were people with skill in analog photo technologies. While Sony or Canon did not struggle with it as they had expertise in microelectronics.

## Week 2 lecture B Digital Disruption and the Future of Jobs

### TECHNOLOGY TREANDS

1. Digital processing is smaller, cheaper, more powerful and everywhere
2. More data- better ways to handle product.
3. Disruption through automation (Automated mining)
4. Disruption due to new sources of data and new platforms (Uber)
5. Disruption due to new sources of data and new ways to process it (A/B testing)

### TREANDS IN SOCIETY

1. Changing employment markets  
—growth in peer-to-peer marketplaces(Freelancer, Airtasker, Kaggle, Innocentive, Ninesigma, Etsy)
2. More entrepreneurs

### INDUSTRY/JOB TRENDS

1. High-skilled (and not susceptible to automation) with high wages
2. Low-skilled (and susceptible to automation) with low wages

### NEW WAYS OF WORKING

- Work anywhere (eg co-working spaces)
- Freelancing (facilitated by digital platforms)

- Portfolio work (people try to diversify their career)
- Entrepreneurialism (people create their own jobs)

## **JOBs OF THE FUTURE**

- Existing business models disrupted
- Technology facilitates flexible working

## **SKILLS FOR THE FUTURE**

- Creativity
- Problem solving
- Advanced reasoning
- Complex judgment
- Social interaction
- Emotional intelligence

Overall, digital disruption will change many of the jobs people do. Many low-skilled jobs will go due to increasing automation but many high-skilled jobs will become available where automation is not feasible or practical. And new jobs will replace the old jobs, so there is no need to worry about no jobs. People can work more flexible but the requirements are higher which means people skills are more important and the essential one is digital literacy and for skills, some skills are likely to be important (creativity, problem solving, advanced reasoning, etc) and some skills are likely to be unimportant (eg routine and repetitive tasks) for new jobs.

## **Week 3: Industry dynamics of Technological Innovation**

### **Sources of innovation**

Transforming creativity into innovation

This transformation happens in:

1. Established companies
  - Technology or product development in R&D departments
  - Process innovation throughout the company
  - Business model innovation in business units
2. Startup companies
3. Universities
4. Research institutions
5. Individuals
6. Also thorough interactions among the entities listed above.

### **Diffusion of innovations through society**

1. DIFFUSION: Diffusion is the process in which (1) an innovation [A product innovation, process innovation, business model innovation] is (2) communicated through certain channels [By word-of-mouth, TV, trade journals, Internet] (3) over

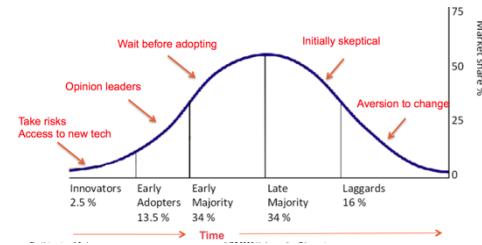
**time** [the rate of adoption of an innovation] among (4) **the members** [There are different types of people – some tend to adopt innovations early after initial availability, others later] of a (5) **social system** [A social system has external influencers (eg media, govt) and internal influencers (eg opinion leaders) ]

## 2. Stages in the Innovation-Development Process:

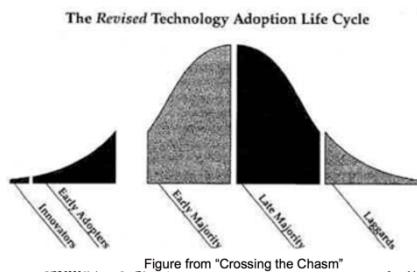
- Recognizing a problem or need
- Basic and applied research: Scientific investigation
- Development: Putting a new idea into a form to meet the needs of users
- Commercialization: Production, manufacture, packaging, marketing, distribution
- Diffusion and adoption: Spreading innovation through members of a social system
- Consequences

## 3. 5 types of adopters

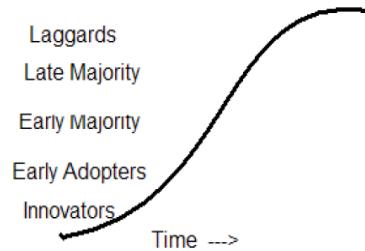
- Innovators (2.5%): take risks access to new tech
- Early Adopters (13.5%): opinion leaders
- Early Majority (34%): wait before adopting
- Late Majority (34%): Initially skeptical
- Laggards (16%): Aversion to change



## 4. The Chasm/S-Curve – the difficulty of moving from early adoption to mainstream



## 5. Technology adoption S-curve(Cumulative adoption curve)



## 6. The process of innovation adoption: Adoption by individuals/organizations

- The adoption of an innovation by an individual:
- The adoption of an innovation by an organisation:



## 7. The factors of rate of adoption of an innovation (Perceived attributes of innovations that determine rate of adoption)

**Relative advantage**—extent it is viewed as better than the idea it supersedes.

**Compatibility**—extent it is perceived as consistent with the existing values, past experiences, and needs of potential adopters.

**Simplicity (vs Complexity)**—extent it is perceived as simple to understand and use.

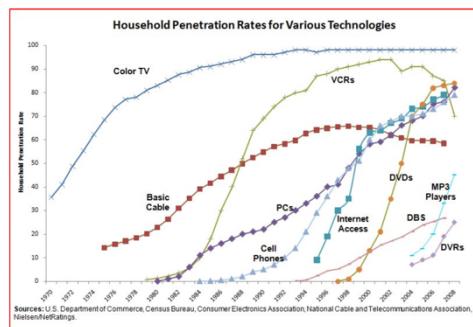
**Trial-ability**—degree it may be experimented with on a limited basis (low cost, “free trial offer”).

**Observe-ability**—extent to which results of an innovation are visible to others, who imitate.

Other factors:

Extent of Change Agents’ Promotion Efforts(e.g. marketing) (公司宣传力度等等)

## 8. Technologies get to 50% penetration more quickly but often don’t reach saturation due to other technologies replacing them (eg see VCRs). ----Factors leading to lack of adoption (Disruptive by other innovations or technologies)



## 9. Case study for lack adoption

### 9.1 QWERTY keyboard layout and Dvorak keyboard layout

The benefits of Dvorak keyboard layout: (1)Designed based on reducing finger movement (2) Trials showed significant improvements in speed

Reasons for why not widely adopted: From IBM Research Laboratory, there is no significant advantage of using Dvorak over the QWERTY for general purpose typing after at least a few months to adapt the new keyboard layout. And even if some arguments

about it really allows for faster and easier learning of typing, and faster typing for the experienced typist. The typists are small group of the whole society. (总的来说不适合大众)

## 9.2 Personal Digital Assistants & Tablets (PDAs)

Many Established companies (Apple, IBM etc.) and start-ups (e.g. GO Corporation) developed PDAs in 1990-1994. They had high expectation for sales but the result is the sales quite low.

Reasons: The enabling technologies for PDAs are not working very well.

- Handwriting recognition (needs to be accurate)  
{ X Only 95% accuracy or less}
- High performance functionality (need high processor power and memory)
- Effective connectivity (eg connect wirelessly to other devices)

X Wireless modems same size as PDA So most PDAs needed cables for syncing

- Support for lots of applications (needs to have widely used OS)

X Large number of operating systems – none had large number of applications

- Long battery life (while still being small form factor)

X Original Apple MessagePad took AAA nAnd had low battery life (later used 4 X AA so could get 24 hours but large and heavy)

(总的来说技术不够，用户体验不佳)

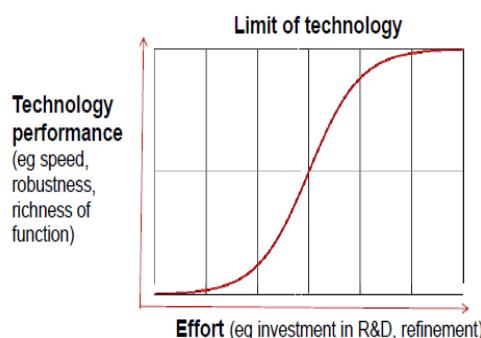
Overall reasons for lack of adoption:

1. Disrupted by other innovations(VCRs)
2. Not suitable for majority of people (Dvorak keyboard layout)
3. The supporting technologies for innovation are not work well, resulting not well customer experience.(PDAs in 1995)

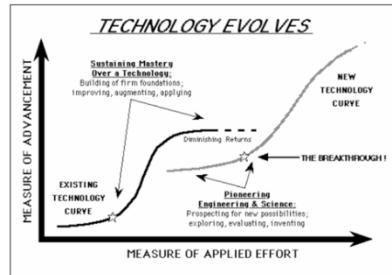
## Improvements in technology performance

1. Another use of the “S-curve”: the “technology performance S-curve”

- Used to show and predict performance improvement of a technology



2. Double S-Curve for technology evolves (existing technology curve and new technology curve [exponential line occurs after the breakthrough])



### 3. Relationship between technology adoption curve and technology performance curve

They're very inter-related in a sort of push-pull relation.

- As the technology gets better, the adoption increases.
  - As the adoption increases, the technology is more likely to get better.

(more adoption, more money in and more possible competition and the better technology)

## Modelling maturity and adoption of new technologies

## The Gartner Hype-Cycle

#### A. Uses:

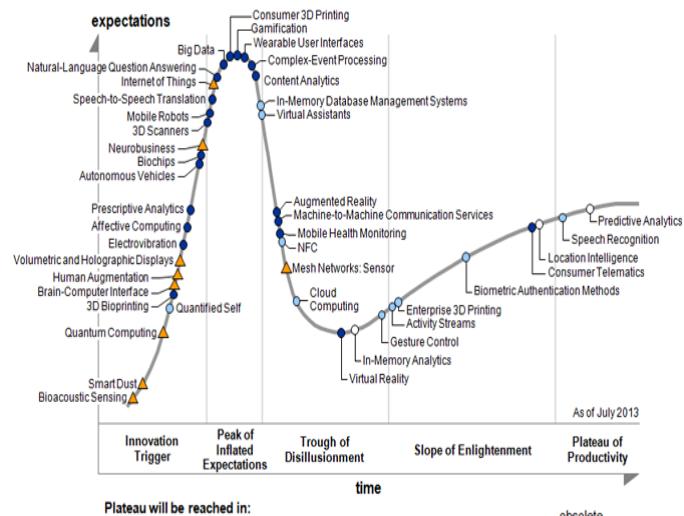
- Strategic planning of technology development
  - Companies considering adoption of a technology
  - Investors investing in technology

### B. Some criticisms

-Development of each Gartner Hype-Cycle is not done scientifically – it is the opinions of market analysts based on market information at a point in time

- Technologies may appear already on the slope of enlightenment or disappear
  - It only works for technologies that follow this model (eg it doesn't deal well with technologies that never succeed or are quickly superseded)
  - As it is widely-used, it is partly self-fulfilling (i.e. people may not adopt technologies as they don't appear mature in the hype-cycle)

### C. Summary: Useful but use with care



**Technology Trigger:** A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist and commercial viability is unproven. (就是理论技术，没有实际产品，商业价值也未知)

**Peak of Inflated Expectations:** Early publicity produces a number of success stories—often accompanied by scores of failures. Some companies take action; most don't. (宣传成功的案例，不管失败的经历，虚的)

**Trough of Disillusionment:** Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters. (兑现的时候失败了，优胜劣汰，幸存的继续努力)

**Slope of Enlightenment:** More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious. (稳定上升期，新产品好啊，产生利润)

**Plateau of Productivity:** Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off. (稳定期该技术的广阔市场适用性和相关性有明确回报。)

## The emergence of new product categories

### 1. Definition: Technology

- the practical application of knowledge especially in a particular area  
(e.g. medical technology)
- a manner of accomplishing a task especially using technical processes, methods, or knowledge (e.g. new technologies for information storage)

### 2. Definition: Product category

- A product category is all the products offering the same general functionality (相似的功能)
- A socially constructed partition of products that are perceived to be similar and in which firms choose to position their products (社会地位功能相同)

(Examples for emergence of product categories: Tablets, Smartphones, Fitness tracker, Smartwatch, UBER, Self-driving car)

### 3. Factors that lead to a “dominant category”

- Technological factors
- Firms attempts to claim advantageous market positions
- Stakeholders (eg customers, producers, critics, and regulators) making sense of emerging category

#### 3.1 Definition: dominant category(Pre-reding in Paper)

## Design dominance (Dominant Designs are not specific products, they are architectures)

### 1. The concept of Design Dominance

- "Dominant Design" is the design around which the industry settles.

### 2. The process by which Design Dominance happens

- 1. When a new product is first introduced, it is usually "made-to-order"
- 2. If the product attracts significant market share (through whatever path – technological superiority, good marketing etc), it forces imitation by competition
- 3. Competitive products are released
- 4. There is pressure to reduce costs in components leading to commoditization of components (for mass production)
- 5. This requires there to be a "dominant design" with components fitting within this design
- 6. The dominant design may be established by the first company to release a product, a later arrival or by a standards body
- 7. The dominant design becomes a base for the whole industry
- 8. This design may become a defacto standard or a de jure standard

(Why dominant design is needed?)

A: The dominant design is inevitable in industry evolution if there are competitors because once a product has been imitated by competition, there is pressure to reduce cost in components in order to gain greater market, thus it requires there to be a dominant design with components fitting within this cheaper design. In addition, the dominant design can reduce vicious competition to some extent. With this design could get higher exit rate because its cheaper price.)

### 3. The phases of reaching Design Dominance

- The fluid phase:
  - Uncertainty about the technology and its market
  - Firms experiment with different product designs
- The specific phase (i.e. innovations are specific to the dominant design):
  - There is a stable architecture (dominant design) for the technology
  - Firms focus on incremental innovations to improve components
  - Firms focus on process innovations to produce them efficiently and effectively

(Eg. Android, IOS)

### E.g. Dominant design in IT

IBM PC Architecture

WIMP (window, icon, menu, pointing device)

Internet protocol stack (TCP/IP)

The core web standards (HTML, HTTP, URL)

LAMP (Linux, Apache, MySQL and Perl/PHP/Python)

Relational Database Management Systems

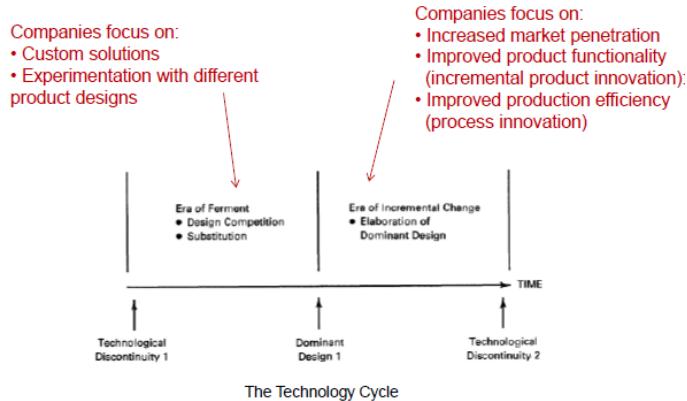
Apple iPhone application architecture

The Android architecture

modern virtual reality architectures, blockchain, smart phone architectures

#### 4. Design Dominance and Technology Cycles

- A new technology may cause a “technological discontinuity” in the industry leading to a new cycle
- They showed that technological discontinuities were competence-enhancing or competence-destroying for particular companies



Note: If time short between technological discontinuities, no dominant design emerges

- In the cases studied by Anderson and Tushman, they found that (features of dominant design):
  - The dominant design was never in the same form as the original innovation
  - The dominant design was not the leading edge of the technology(主导设计并非技术的前沿)
  - The dominant design had the features that met the needs of the majority of the market (Example: The IBM PC were not the most advanced or the cheapest technology at the time it rose to dominance.)

#### 5. The era of incremental change accounted for most of technological process

Anderson and Tushman found:

- That during the era of incremental change, firms:
  - stopped investing in learning about alternative designs; and
  - focused on developing competencies related to the dominant design.
- This helps explain why firms entrenched in a dominant design often don't recognize or react to discontinuous technologies: (Eg Microsoft's apparent slowness in identifying and acting on the importance of the Internet)

(Because firms devote much energy to era of incremental change)

#### 6. Standards for dominant designs

- Sometimes standards are used to encourage or maintain a dominant design in an industry
- Standards may be defined by:

- a formal standards organization (“**de jure
- (not formal standard)wide public acceptance or market forces (“**de facto
- Standards may be for controlling:
  - Quality (products/services have required characteristics);
  - Compatibility (products/services can be used with other products/services)
    - ◇ Compatibility standards can be:
      - + **Sponsored** (a party or parties hold a proprietary interest in a particular technology and in the adoption of it by others);(别人持有专利, 你用它)
      - + Non-sponsored****

## 7. Why do dominant designs get selected in a market?

- Market forces: Increasing returns to adoption  
For many technologies (especially in IT), the more a technology is adopted, the more valuable it becomes to the industry because of:
  - **Learning effects:** The industry gains knowledge in all aspects of the technology
    - › When a design is dominant, there is greater use of the technology.
    - › Greater use leads to greater knowledge accumulation about that technology
    - › Greater knowledge enables a fast rate of improvement of the technology
    - › Company structures and culture are based around the technology
  - **Network effects:**
    - The benefit of using a technology increases with the number of users.(用的人越多好处越多)
    - For technologies with network effects, the benefit from using a technology increases with the number of other users

### Rationale for buying network interface cards:

- Cost of cards = N
- Value of cards = N<sup>2</sup>
- Known as “Metcalfe’s Law” (买 card 的花费是 N,但是 card 的价值是 N 平方，所以买)

› Direct network effects: Increase in usage leads to direct increase in value (eg Email, Telephone, Twitter) (对产品的使用越多, 其价值越高)

› Indirect network effects: Increase in usage leads to increase in value of complementary goods leading to increase in value of the original technology (PC Architecture gained value from value of compatible software) (对辅助产品的使用增加其价值, 再增加原先产品的价值) A 的价值是通过, 对 B 的使用增加实现的, B 运用 AA

› Two-sided network effects: Increase in usage by one set of users increases

value to another set (eg marketplaces (such as eBay, Airbnb), reader/writer software)

两边 A,B, 对 A 使用的增加, 增加的 B 的价值

eBay 买家多了, 增加卖家的价值

› Local network effects: Increase in use of local networks (within a larger network) leads to increase in value (Eg Instant Messaging, Facebook)

› The self-reinforcing cycle:

----Developers would be interested in a technology that has a large installed base(many users) for development of complementary products.

-----A technology with wide range of complementary products attracts users.

-----An increase in the number of users is an increased installed base.

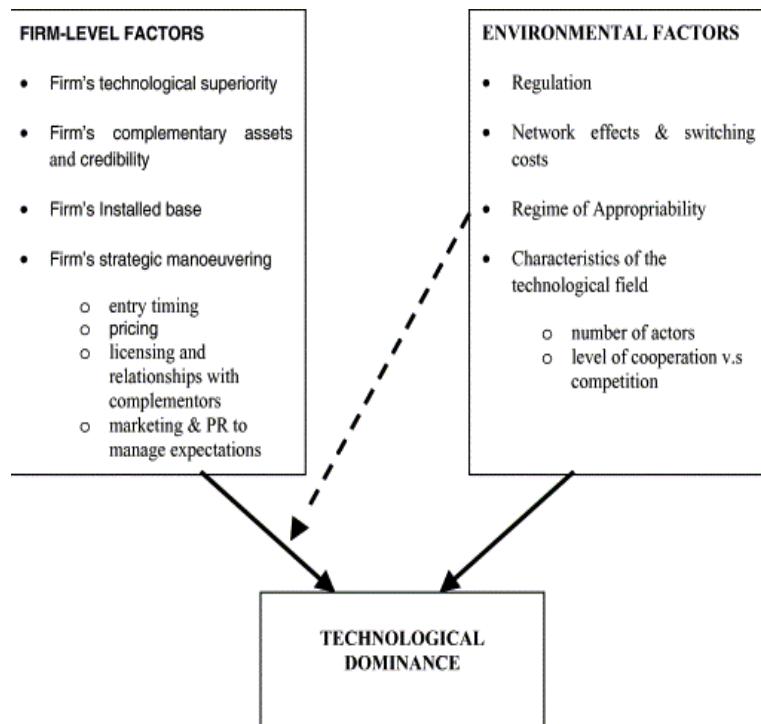
### Government regulations

Sometimes, the government sees the importance of a technology for a nation and regulates a specific dominant design (eg for TV, mobiles)

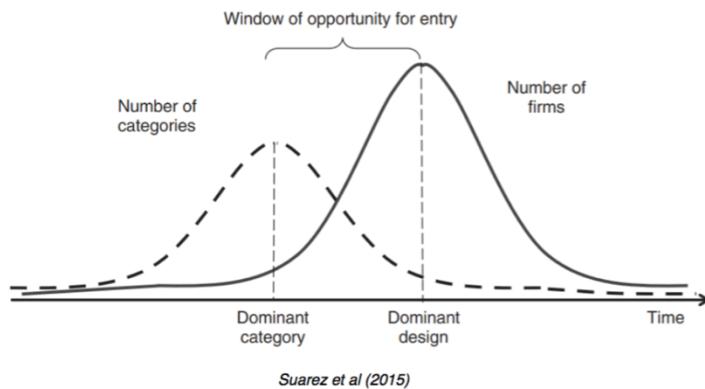
- There are often strong consumer or economy benefits of having a single dominant design
- Rather than wait for market forces, sometimes government organizations step in and impose a standard (Eg. GSM (General Standard for Mobile communications) for telecommunications, Digital TV in Australia (using the DVB-T standard) )

## 8. Frameworks for modelling design dominance

Firm- (installed base etc) and environment-level(regulations, network effects) factors influencing the outcome of technology battles



## 9. Relationship between dominant category and dominant design



Suarez et al (2015)

The time between these two things is the time which provides the opportunities for companies to entry.

Discusses how hard it is for companies making high-tech products to get from early adoption to mainstream and provides approaches to help

A: It is really hard if the well test products need much time to be achieved because the early adopters and early majority are different types of people. Simply, early adopters are willing to take high risk when they recognize the potential benefits of a new high tech product and want to tap into it. Pragmatists only want to buy what's been relatively established which give them strong sense of practicality and it will really help them.

Approaches (four step)

1. Commit to a point of attack – the market segment: First, the company need to choose a market segment of suitable size and try best to achieve the dominant leadership position in that segment (consider target customers, competitors, compelling reason to buy etc)---(定位市场)

2. Assemble the Invasion Force – the product offering

Create the whole product and make it as perfect as possible (lower cost, will satisfy customers etc)

3. Define the Battle and do it – the market

Through the competition to show how well the product is and then attract customer, but be careful to choose the object of competition. High-tech companies have to position the product in a favorable position within a buying category.

## Week 4: Disruptive Innovation

This is about technology improvement over time (with effort and with investment for that effort)

**Disruptive Innovation:** Innovations that disrupt the market by creating new markets or change the value system in an existing market. (technology will not disrupt the value

network of the market, unless putting the technology into use, which is innovation, could disrupt the market)

### Value chains, industry value chains and value networks

**Poter's Value chains:** value chains describe how value is added within different business units of a company. Value is added in each stage that a product passes through.(more suit for physical goods than IT)

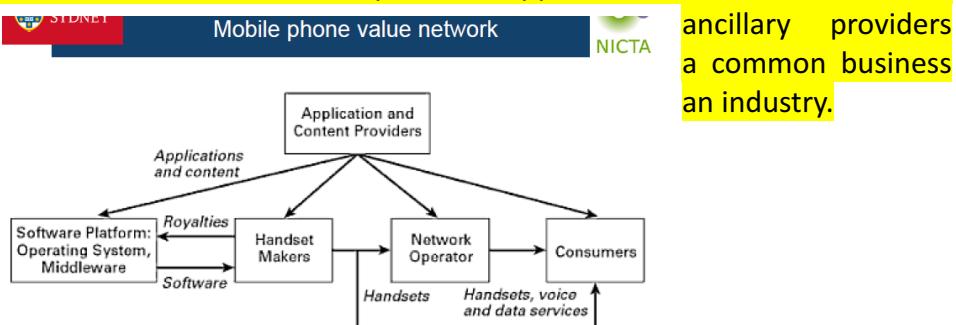
**Industry value chain:** is how value is created and passed on between participants in an industry. Values may be from licensing, selling a product, providing service, etc.  
(e.g. Mobile advertising , Smart grid, Microprocessors)

### Supply Chains vs Value Chains

Supply chain: “a channel of distribution beginning with the supplier of materials or components, extending through a manufacturing process to the distributor and retailer, and ultimately to the consumer”( 供应链是由物料获取并加工成中间件或成品，再将成品送到顾客手中的一些企业和部门构成的网络)

supply chain could have multiple companies but value chain only has one.

**Value System/Network:** The collection of upstream suppliers, downstream channels to market, and that support model within



### Typical results of disruption of a market

Change the value network, product categories, type of companies, actual companies, business models, relationships between companies, power relationships in the market

### Disruption innovation

1. “The Innovator’s Dilemma”(focus on high-end customers and pay little attention to low-end customers)
  - Effective established companies study the needs of their customers
  - The companies innovate to meet these customer needs
  - The companies sell new products/versions to their customers
  - The most important existing customers are the high-end ones who spend the most so

the focus is on them

- The dilemma is that the more a company focuses on the needs of their high-end customers, the more likely it is that they will miss opportunities in emerging technologies (e.g. Microsoft and the web browser (initially)) which could disrupt them (Ex: Intel and ARM. While Intel concentrated on the PC processors technology, ARM made it easier for lots of companies to license their designs initially for the lower spec devices that intel were not interested in. And at present ARM is one of the most successful companies with the number of smartphones in the market adopting their design for their processors. )

## 2. Disruptive Innovation

According to Christensen, innovations can be either disruptive or sustaining

- “Disruptive innovations” disrupt markets  
(i.e. they create new markets or change the value network in an existing market)
- “Sustaining innovations” sustain markets  
(i.e. there is no change to the value network in the market)

## 3. Types of disruptive innovation

Disruptive innovations create new markets or change the value systems within existing markets

- "low-end disruption" – there are customers who do not need the full functionality or performance of products already on the market so cheaper alternatives can take over. (e.g. Telephony- Voice over IP -Skype; Traditional encyclopedias-Wikipedia, Getty couldnt compete with iStockphoto, Traditional taxi system--Realtime ride-sharing(Uber))
- "new-market disruption" – there are customers who have needs that were not being addressed by existing products(e.g. 3D Printers)



### Other types of disruptive innovation



Type of Innovation	Type of Diffusion to which It Maps	Description
Sustaining Innovation	High-end encroachment	The new product first encroaches on the high end of the existing market and then diffuses downward.
Disruptive Innovation	Low-end encroachment	The new product first encroaches on the low end of the existing market and then diffuses upward.
New-Market Disruption	Fringe-market low-end encroachment	Before encroachment begins, the new product opens up a fringe market (where customer needs are incrementally different <sup>a</sup> from those of current low-end customers).
	Detached-market low-end encroachment	Before encroachment begins, the new product opens up a detached market (where customer needs are dramatically different <sup>a</sup> from those of current low-end customers).
Low-End Disruption	Immediate low-end encroachment	Low-end encroachment begins immediately upon introduction of the new product.

#### 4. Analyzing a value network

- Analyzing value chains/networks is useful for:
  - Understanding an industry (including relationships between companies)
  - Understanding your company's position within the market
  - Deciding where your company wants to be within that market
  - Looking for opportunities for disruptive innovations
  - Looking for threats for disrupting the market you are in
- Understanding value chains/networks is useful:
  - If you are an established company:
    - > In understanding emerging threats
    - > In designing a strategy to disrupt a market
  - If you are a startup:
    - > In disrupting a market
  - If you are in corporate IT:
    - > In understanding how products and solutions may change

#### 5. Disrupting value networks

Disrupting value networks can be done by:

- a) Analyzing the value network and attempting to change it:
  - “**Disintermediation**” = “cutting out the middleman”: Common using the Internet (eg book flights from the airline directly)
  - “**Reintermediation**” = adding in a new intermediary: Also common using the Internet (eg new types of travel agent – WebJet, Flightfox, etc)
- b) **Ignoring** the current value network and having it change around you  
e.g. Facebook – “move fast and break things”. It can either be very successfully or fail badly.

#### 6. The relevance of disruptive innovation to established companies and to startups

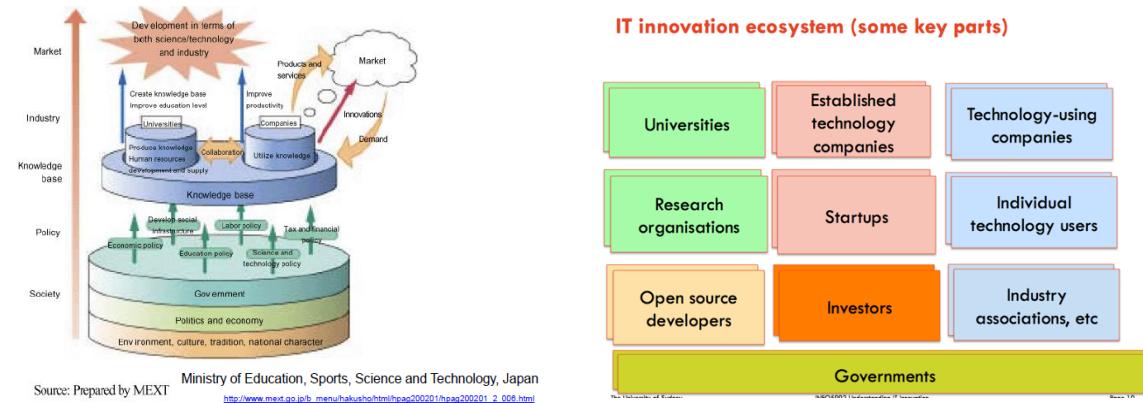
The similarity is both established companies and startups can use disruptive innovation to disrupt the market, and the difference is that start-ups are less likely to face disruptive innovations from others because they usually bring disruptive innovation into the market, while established companies are more likely to protect their own market from disruptive innovation and they usually ignore the coming innovation because innovator’s dilemma.

### Week 5: Distributed Innovation

#### Innovation systems

- Companies are continually innovating to stay competitive
- Entrepreneurs are continually looking for opportunities to change the value network
- Companies are being created and being destroyed
- Industries are being created and being destroyed
- This doesn’t happen in isolation – there is a system (or eco-system) in which innovation happens.

Innovation system models: Parties involved, framework conditions, government policy;



Example of participants that contribute:

- Government invests in research and innovation programs as they understand the importance of innovation (tender). (Health, education, standard of living, improving productivity).
- Angel investors and venture capitalists provide money which allows scaling.
- Companies partner with universities to get new ideas and technologies.

## Distributed Innovation

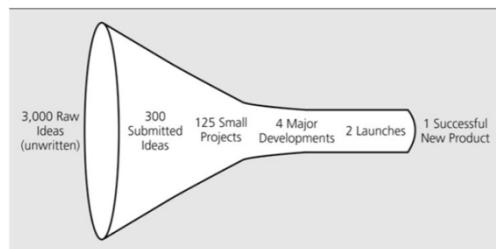
### 1. Definition of distributed innovation

According to Eric von Hippel, **A system where innovation emanates not only from the manufacturer of a product but from many sources including users and rivals.**

### 2. What led to the shift from traditional innovation to distributed innovation?

Most companies for a majority of the 20th century relied on in-house R&D and innovation. For their innovation to be successful they needed to ensure strict control but noticed that even with that kind of control they experienced spreading of innovation through "spillovers" of their innovations or ideas in that area because of people interacting with people from other companies and people joining other companies. This in a way encouraged capability building in that region.

Worked mostly in the traditional innovation funnel model.



This approach relied on everything happening in one company, was very linear and subject to a lot of control and not very fluid (no in-flows, no out-flows )

As people tend to switch companies more nowadays, they take their knowledge and capability with them. Globalization (cross different countries), better communication because of improvements in technology (web and email).

Better availability of venture capital funding allowing small company growth quickly, easier to create and build new tech companies owing to the installed base that smartphones and web offers.

So more opportunities for collaborative innovation

### 3. Modularity Enables distributed innovation

– Products may be modular at: – User level

e.g. Ikea shelving systems, Firefox add-ons, Microsoft Office plug-ins, Smartphone Apps

– Producer level e.g. Canon camera, Software products based on company platforms

– Industry level

e.g. each component of PC made by different company, etc.

– A standard interface enables components to be combined easily (e.g. by user, within company, between companies)

– **Modularity can enable many different configurations to be achieved from a given set of components.**

– Technology companies often design their structures around the product structure (eg with separate divisions developing “technology platforms”)

### 4. Open innovation(e.g. Cisco, SamsungAccelerator)

#### 4.1 Definition of open innovation

a distributed innovation process based on purposively managed knowledge flows(inflows and outflows) across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization’s business model (expand the markets for external use of innovation)

#### 4.2 types of open innovation

Outside-in process: “Enriching the company’s own knowledge base through the integration of suppliers, customers, and external knowledge sourcing”

Inside-out process: “Earning profits by bringing ideas to market, selling IP, and multiplying technology by transferring ideas to the outside environment.”

Coupled process: “co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures during which give and take are crucial for success.”

#### 4.3 benefits of open innovation

- Larger base of ideas to draw from for innovation: “Not all of the smart people work for us” (Bill Joy from Sun Microsystems)--(could have many intelligent people work for the innovation)
- Existing third-party technology can be used, reducing risk and cost of development (reduce time to market)
- Identification of new business opportunities with collaborators

- Share risks and pool resources with other companies
- Can be lower cost than large R&D departments

#### 4.4 Risks of open innovation (compared to closed innovation)

- Lack of control
  - Will usually not have as tight control of external resources as internal ones
- Higher complexity of managing innovation
  - Need to manage external relationship, intellectual property, confidentiality etc
- Higher coordination costs
  - May cost to coordinate external resources
- Possible loss of own capability over time
  - If are not using and building a capability but relying on others
- Possible loss of competitive advantage compared to others
  - If allow others to build skills in area important to your business, they can sell their expertise to your competitors (contracts can help address the risk)

Both traditional (“closed”) innovation and open innovation have benefits. Many companies do both and balance them.

(e.g. In 2002, P&G used mostly closed innovation. By 2007, P&G had moved to approximately 50/50 open and closed innovation)

#### 4.5 Some approaches to distributed innovation

- A. Product platforms
- B. Web APIs
- C. Releasing data sets
- D. Crowdsourcing innovation
- E. Platform ecosystems
- F. User innovation
- G. Free and Open Source Software
- H. Accelerators, investment and others

##### A. Product platforms

1. concept (known as “product family engineering”)

Concept became popular in the 90s – **used for reusable components or design frameworks**

(e.g. Canon digic chip which is used in multiple canon products, Nero video editing software which has different flavours with different functionality and price.)

could result in

- o The products often have different price-points
- o Different customer types.

##### 2. benefits:

For internal product platform: Reuse technology component in multiple products leading to(节省时间金钱, 一个组件到处用, 也方便在组件上革新升级)

- > Faster development time so gets to market sooner

- > Lower effective cost (as spread over multiple products)
- > Innovative aspects of the platform can benefit a range of products
- > Application development on platform can focus on innovative value-add

But also platform can be made available externally, leading to new businesses and new business models (eg Web API)

### 3. Product platforms in IT

Make source code available – innovators modify it for their own use.

e.g. Core Java platform. (给你源代码按自己要求改)

Provide toolkit – Lets external innovators to write software based on the toolkit.

e.g. SAP XML Toolkit for Java. (给你工具包方便开发)

Provide plug-in/add-on support in software – lets innovators customize software to their needs without access to source-code. (直接给产品, 你可以增加新功能)

e.g. Firefox extensions.

Provide full platform for external innovation—allows external innovators to write rich and varied applications on the platform

e.g. Android and iPhone app architectures (给你平台, 自己加东西)

Provide live data/functionality through APIs—allows external innovators to build new services using the data (给你数据, 自己加东西)

e.g. Facebook API, Flickr API.

### B. Web APIs (Becoming the underlying infrastructure for a lot of automation)

– Interfaces for web-based services to interact (usually RESTful APIs)

e.g. maps(google), payment(eBay(PayPal)), messaging(Facebook, Twitter)

通过接口调用其他人的功能。。。微信定位, 通过接口调用其他的软件

eBay generates 60% revenue through APIs

(最近几年 web-based APIs 增长迅速 因为：大家都离不开网, 需求增加)

### C. Releasing data sets

Many governments have opened up government data (“Open Data”)

Many communities and some companies are also doing it

-----Reason: They are encouraging users to develop websites and apps using the data:

The “Open Data” could be static data (eg tables of static data) or live data feed (eg an RSS feed or data service)

### D. Crowdsourcing innovation

1 Definition(在网上给出任务和奖励, 公开选拔的模式, 面向的人群对象类型清楚, 哪个公司 (crowdsourcer) 进行这个和进行这个的好处清楚)

—Crowd+outsourcing

—Crowdsourcing is an act of a company where the company or institution outsources a task online which was done by the employees of the company in an open call format to

an undefined network of people with the promise of a reward of some sort for their efforts.

- (a) there is a clearly defined crowd;
- (b) there exists a task with a clear goal;
- (c) the recompense received by the crowd is clear;
- (d) the crowdsourcer is clearly identified;
- (e) the compensation to be received by the crowdsourcer is clearly defined;
- (f) it is an online assigned process of participative type;
- (g) it uses an open call of variable extent;
- (h) it uses the internet.

## 2. Why do people engage with crowdsourcing?

Many varying reasons including (from Brabham reading):

- >the desire to earn money;
- >to develop one's creative skills;
- >to network with other creative professionals;
- >to build a portfolio for future employment;
- >to challenge oneself to solve a tough problem;
- >to socialize and make friends;
- >to pass the time when bored;
- >to contribute to a large project of common interest;
- >to share with others;
- >to have fun."

考试

## 3. types of crowdsourcing

### 1. Knowledge discovery and management( 规定格式找数据)

- o Company tasks the crowd to find and collect information into a common location and format.

e.g. Peertopatent.org, seeclickfix.com

### 2. Broadcast search approach(解决经验问题)

- o Organization tasks the crowd with solving empirical problems.

e.g. Innocentive.com

### 3. Peer-vetted creative production(创造和选择创新点子)

- o Organization tasks the crowd with creating and selecting creative ideas.

e.g. Threadless.com

### 4. Distributed Human Intelligence Tasking(分析大量数据)

- o Organization tasks the crowd with analysing large amount of information.

e.g. Amazon Mechanical Turk.

Identify and discuss 2 benefits that a company may gain and 2 risks that a company faces in using crowdsourcing as part of product innovation.

(1) Benefits gained by companies for using crowdsourcing as part of product innovation:

1. It has high possibility to receive valid and novel ideas from crowds to solve the problem with low cost because not all talent people work for one company, other people in crowd could provide better ideas and compared to hire many intelligent people to think the creative idea, this way is much cheaper.
2. It has high possibility to accelerate the innovation process because the solution could be appeared more quick from crowds than company own. Sometimes inspiration is important, the more people, the higher possibility of inspiration made

(2) Risks faced by companies for using crowdsourcing as part of product innovation:

1. It has risk to make competitors emerge earlier because other companies could guess what the company is going to do and if it is worth, other companies could do same thing with no cost for the idea.
2. It may have many good ideas from crowds which could cost much time for the companies to choose the best one even if it has voted by crowds, resulting in the delay of the innovation process.

## Week 9: User Innovation and Free and Open Source Software

Different modes of innovation: Who is doing the innovation?

Producer innovation VS user innovation VS open collaborative innovation

### Producer innovation

- “Producer innovation”:
  - Producer makes product/service for consumers
  - Designs for innovations come from producer companies
  - Producer innovators profit from many users of the same product/service
  - Assumption that a producer serving many customers can afford to invest more in innovation than a single user innovating for themselves
  - To encourage this investment, typical innovation policy allows producer to “protect” innovation through patents

### User innovation

Innovations made by users of a product to meet their own requirements. In other word, current product does not meet their requirements, so they innovate.

e.g.(In IT) The world wide web, Firefox add-ons, Apache server modules, MySQL, Slack(a game), Oculus Rift.

Why user innovation is important in IT? Why do so many IT innovations come from users (and not just from producers)?

Approx 80% of the most important scientific instrument innovations were by users (von Hippel, 1976) and many innovations in IT are innovations by users. Compared to user innovation, producer innovation is harder to get feedback from users to producers

because only they launch their products they can get as many feedback as possible even if they did research before the innovation the data is limited compare the market which could result in the innovation is not really suitable for majority people. Personally, the product is designed for improve people lives, so the user innovation could have high possibility to cross the chasm easily, while producer innovation could be lower.

### 1. Lead Users (early adoptors)

#### – Difference between lead users and typical users

Typical users are useful for some product categories (cleaning products), but for IT and other high tech industries, they are not so effective because they usually suffer from “functional fixedness” which is less likely to provide suggestion about view. However, lead users (may be individuals, companies or communities) will contribute to the innovation which could make it more effective.

#### – Characteristics of lead users

- Face the needs that will be general in the market, but months or years before the general marketplace realises the needs.
- Will benefit significantly by obtaining a solution to those needs, and...
- Spend resources trying to solve those needs
- Are at the leading edge of trends and so are very knowledgeable about “state of the art”
- Note: Lead users are not usually a company’s “lead customers” – they are usually not satisfied with current products so have had to create their own

#### – Why companies engage with lead users

Because involving lead users often leads to more effective innovation, they could provide concepts for products, services, processes and features to help companies innovate

### **Open collaborative innovation (especially free and open source software)**

1. Proprietary software: Traditionally most softwares were proprietary where an individual developer, an organization or a group of organizations own the intellectual property rights over the software and have control over how the software is used.  
(e.g. ios, Oracle Database)

2. Free and open source software:

- Source code is made available
- Source code can be changed and redistributed by others

(e.g. Android, Linux)

### 3. Definition of free software

Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. More precisely, it means that the program's users have the four essential freedoms:

- The freedom to run the program, for any purpose (freedom 0). (随便用)
- The freedom to study how the program works, and change it to make it do what you

wish (freedom 1). Access to the source code is a precondition for this.(随便改)

- The freedom to redistribute copies so you can help your neighbor (freedom 2).(随便给别人用)
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this. (随便把更改过的给别人用)

#### Why are free and open source software important?

Because the “Software is eating the world”, the software is becoming more and more critical in the whole society for people’s daily lives and companies’ working. Thus If that software is controlled by companies or governments, the software can be used to restrict or monitor people and a limited number of very powerful people would dominate computing

## 4. Open Source Software Definition

### 4.1 Copyleft

“Copyleft is a general method for making a program (or other work) free, and requiring all modified and extended versions of the program to be free as well.” (Free Software Foundation) (e.g. GNU Public License (GPL))

### 4.2 Definition

To be classified as OSS, the software must be (according to its licence):

- Freely redistributable
- Source code must be available for free or at reasonable reproduction cost
- Modifications and derived works must be allowed and be distributable under same terms(可以自己有修改和衍生新的)
- Can protect integrity of author’s source code as long as allow source code patches
- No discrimination against people/groups(不在乎谁用)
- No discrimination against fields of endeavor(不在乎哪个领域用)
- Must not be restricted to use with a specific product(不能限制只能在特定产品用)
- Must not place restrictions on other software distributed with it(在 copy 时不能有限制)
- Must be technology-neutral(技术中立)

### 4.3 Difference between Free Software and Open Source Software

- According to Stallman, "Open source is a development methodology; free software is a social movement."
- Open Source covers a wider range of license types
- More ability to mix Open Source software with proprietary software than is the case for free software
- The Open Source concept was developed to bring major software businesses and other high-tech industries into the mix.

- free software is ambiguous (eg confusion with freely downloadable binaries and shareware)
- When avoiding distinguishing between these, people use the terms:
- FOSS (Free and Open Source Software) or FLOSS (Free/Libre and Open Source Software)  
e.g.

**OSS and copyleft**  
(changes to the source must be made available to others)

- The Linux kernel
- MariaDB (database software based on MySQL codebase)
- Eucalyptus (for building private clouds – company bought by HP)

**OSS and not copyleft**  
(changes to the source do not need to be made available to others)

- Apache web server
- OpenCV (Computer Vision library originally by Intel)
- Chromium (the core of Google Chrome web browser)

#### 4.4 Open source hosting sites

- Offer hosting, version control, issue tracking, wikis, download support etc
- Some support code reviews etc

Eg. Github(jquery (JavaScript query engine) )

#### 5. Importance of FOSS for innovation

One factor leading to the high rate of IT innovation is the availability of open source software

For enterprise IT:

- Many companies use open source software such as for:
- > Internal IT infrastructure (eg Linux)
- > Building and running web services (eg Apache, Apache Tomcat, JBoss)
- > Building software for redistribution
- Open source software allows companies to rapidly innovate their infrastructure and services

For R&D and IT start-ups:

- Most infrastructure used in R&D and startups uses FOSS:
- > Operating systems (eg Linux)
- > Containers (eg Docker)
- > System configuration management (eg Puppet, Chef)
- Most new software is built using FOSS:
- > Software platforms (eg Java, Python, Ruby on Rails)
- > Software libraries/frameworks (eg Spring framework, glibc)
- > Software build and test automation (eg Jenkins, Cucumber)
- Most new software contains FOSS:

- > To reduce time and cost of development
  - > To reduce testing and maintenance costs (assuming using stable FOSS)
  - > To provide compatibility with other software
  - > To focus on the core differentiator of your own software
- e.g. Facebook has been developed from the ground up using open source software. Developers building with Platform scale their own applications using many of the same infrastructure technologies that power Facebook.  
 (Google, Amazon, Twitter)

## 6. FOSS licenses

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Different licenses have different obligations:

Public domain: Nothing but not commonly used for software (copyright doesn’t expire)

MIT license: they must make sure that the copyright of the original author is maintained and no warranty.

BSD: Similar to MIT Licence but, if redistribute software using it, must acknowledge that using it.

GPL: You can use the code and change it, but you must release all modified code under the same licence and any other code of yours that touches it

(Companies modifying source code and using this in hardware/software products had to make the modified source code available to others)

AGPL: if you are running code available to others through a network, you must make any source code changes available

(To address companies could use and modify free software and provide web-based

考试

applications without redistributing the code)

Becoming important due to large amount of software being cloud-based

## 7. Some open source business models(AND example)

- Sell support and services

Example: Canonical (with Ubuntu)

软件免费，服务收费模式

- Sell certified version (with support and services)

Example: Cloudera (with Hadoop)

- Sell “enterprise edition” (effectively proprietary software)

Example: MySQL “standard edition” (not “community edition”)

如 MySQL 产品就同时推出面向个人和企业的两种版本，即开源版本和专业版本，分别采用不同的授权方式。开源版本完全免费以便更好的推广，而从专业版的许可销售和支持服务获得收入。

- Dual licensing (copyleft so need commercial licence if modify source)

Example: Digia (with Qt)

如果一个厂商独立的完成一款开源软件，也就是说，这个厂商拥有这个软件所有的代码版权的话。那么它就可以采用双授权这种模式。这样他就可以针对不同的用途的用户签订不同的授权协议。这样就可以对用户收取授权费用。于此同时，产品仍可以融入开源社区这个生态系统中，获得改进信息，得到开发者的支持

- Cloud service using mostly open source

Examples: Facebook, Twitter

- Other advantage to the company

Example: Google (with Android)

Advertising-supported software

e.g. Mozilla through Google

1. 软件免费，服务收费模式 (只有原始版本，新增的功能收费)

2. 软件免费，培训收费模式 (叫人怎么用) JBoss

3 软件硬件一体化 操作系统 Linux， 销售硬件服务器

## 8. Open source lab model (eg Amplab at UC Berkeley)

for Amplab (sponsors: Google, Amazon, IBM, etc )(outcome: Spark (cluster computing framework))

- What do the companies get:

– Deep knowledge of technology as it is developed

– Influence technology direction and outcome

– Protection from disruption by other companies

– Access to university talent pool

- What does the university get:

- Clear focus for computer science research
- Additional income to fund activities
- Close interaction with market needs
- Incubation of new businesses
- Stronger innovation ecosystem

## 9. Managing the use of free and open source software

### 9.1 Challenges in using FOSS

1. Meeting obligations of software licences – ensuring appropriate notices
2. Possibility of accidentally “contaminating code”  
Ex: Accidental use of GPL code by a programmer in a company’s proprietary product could lead to legal issues as in that case the source code would need to be released.
3. Ensuring adequate quality in the final product, if it uses open source software of unknown quality
4. Avoiding security vulnerabilities in the underlying code as this may already be known by hackers.

### 9.2 To address this

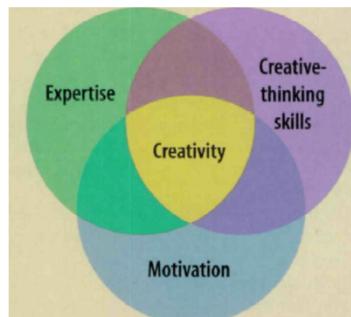
1. Companies using FOSS should have an open source governance policy to ensure good governance.
2. There are open source analysis tools available to check if open source software is used and check if usage conforms to a policy  
e.g. Black Duck Software, FOSSology – developed by HP.

## Week 10 lecture A

### Organizational culture, structure and management for innovation

#### Culture for innovation

- 1) **Innovation by networked individuals** (and implications for organizational culture)  
Work place needs to have places for people to interact.



- 2) Intrinsic motivation:

- Found workers far more likely to have new ideas on days when they felt happy
- Found the factor that most led to engagement of workers was:
- “Making progress in meaningful work”

- More important than bonuses, raises, etc  
More likely to lead to ideas/breakthroughs
- 3) “The smell of the place”—focus on right place empowering individuals
- Constraint -> Stretch  
Compliance -> Self-discipline  
Control -> Support  
Contract -> Trust
- 4) keys to a creative and innovative workplace:
- Workplaces have many opportunities for people to interact in their work
  - Staff work on meaningful work
  - Staff have visibility of their progress
  - Environment for stretch, self-discipline, support and trust

考试

### The Progress Principle:

#### Optimizing Inner Work Life to Create Value

The secret for business success and employee delight lies in creating the conditions for great inner work life: conditions that foster positive emotions, strong motivation and favourable perceptions of colleagues and the work itself.

-- people are more creative and productive when they are deeply engaged in their work, when they feel happy, and when they think highly of their co-workers, managers and organizations.

-- when people enjoy consistently-positive inner work lives, they are also more committed to their work and more likely to work well with colleagues.

In other words work related psychological benefits translate into performance benefits for the organization

### The dynamics of “Inner Work Life” (it goes on inside of each person)

Emotions:

- Sharply-defined reactions and more general feelings
- Joy, disappointment, pride, etc
- Vary by pleasantness and intensity

Perceptions:

- From immediate impressions to theories of what is happening and what it ‘means’
- e.g. perceptions of causes of actions in the work environment

Motivations:

- Extrinsic motivations

the motivation to do something in order to get something else

e.g. get promotion

- Intrinsic motivations (more important than extrinsic for creativity)

emerges from a love of the work it-self – wanting to do the work well because it is interesting, satisfying, engaging or personally challenging

e.g. Witness the phenomenon of open-source programming innovation, in which thousands of programmers collaborate online to create and improve computing platforms – with absolutely no tangible compensation.

- Relationship or altruistic motivations arises from the need to connect with and help others

### **Forces supporting “Inner Work Life”**

#### 1. “Making progress on meaningful work”

this sort of interaction a positive feedback loop or ‘cumulative causation’: progress enhances inner work life and positive inner work life leads to further progress, creating a virtuous cycle

#### 2. “Receiving catalysts (things that directly help get the timely, creative, high-quality completion of work done)”

**Setting clear goals.** People have better inner work lives when they know where their work is heading and why it matters.

**Allowing autonomy.** when employees have freedom in how to do their work, they are more creative because they are not restricted.

**Providing resources:** Access to necessary equipment, funding and personnel is a must

**Giving enough time – but not too much.** Although people become stressed and unmotivated if they have to work under extreme time pressure for weeks on end, they often feel excited, creative and productive after a single time-pressured day.

**Helping with the work.** Getting the right sort of help(provide needed information), from the right people at the right time, can give a significant boost to inner work life.

**Learning from problems and successes.** We have found that inner work life is much more positive when problems are faced squarely, analyzed, and met with plans to overcome or learn from them.

**Allowing ideas to flow.** The people in our study had some of their best days when ideas about their projects flowed freely within their team and across the organization.

#### 3. “Benefitting from nourishers (interpersonal events that uplift people as they work)”

Respect

Encouragement

Emotional support

Affiliation

Affiliation – actions that develop bonds of mutual trust, appreciation, and even affection with co-workers – is the most obvious way in which people feel the human connection at work.

### **Structure for innovation**

#### 1) Overview

- A company's size and structure impact its ability to innovate

- Some structures may foster creativity and experimentation
- Others may enhance efficiency of product development
- Some structures may enable both simultaneously
- Traditionally large companies have done most technological innovation in-house in R&D labs
- Trend towards more “open innovation”
  - involving other organizations and individuals in their innovation

## 2) Sizes

- a) Advantages of bigger companies
  - Better able to obtain financing
  - Better able to spread costs of R&D: As can spread over more products
  - Large size may also enable:
    - Greater economies of scale and learning effects
    - Taking on large scale or risky projects
- b) Disadvantages:
  - R&D efficiency may decrease due to loss of managerial control
  - Large companies can have more bureaucratic inertia
  - More commitments tie companies to current technologies
    - Learning effects (see Week 3); external commitments
    - Small firms are often more flexible and entrepreneurial;
    - Can change direction quickly based on changing circumstances or new observations
- c) Many big companies have found ways of “feeling small”
  - Break overall company into several subunits
  - Can utilize different culture and controls in different units

考试

## 3) Structural dimensions which influence innovation

- a) Formalization: The degree to which the company uses rules and procedures to structure the behavior of employees  
Standardization: The degree to which company activities are performed in a uniform manner.

Centralization: - Centralized authority: The degree to which decision-making authority is kept at top levels of the company; - Centralized activities: The degree to which activities are performed at a central location (This can affect innovation because, for innovation to happen, decision making authority needs to be at a level where the actual work is happening.)

- b) Mechanistic Structures: have high formalization and standardization.
  - Good for operational efficiency, reliability.
  - Minimizes variation -> may stifle creativity

Organic structures have low formalization and standardization; described as “free flowing”

- May encourage creativity and experimentation
- May yield low consistency and reliability.

- c) Approaches to organizing firms for innovation:

Combining the best of small and large companies (a small company in a large company)

If people in the organization understand the values of the company, they should be able to self organize to work on the most interesting problems. (when division happens)

- Some divisions (e.g., R&D, **new product lines**) may be **small and organic**.
- Other divisions (e.g., manufacturing, **mature product lines**) may be **larger and more mechanistic**
- Some organizations try to do both in different divisions:
- Can also alternate through different structures over time.
- Sometimes new product development can be quite independent of even the main R&D division (eg “skunk works”)

### Managing projects for innovation

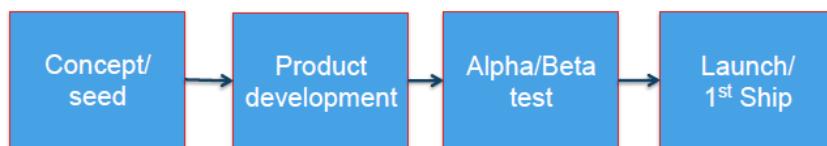
#### 1. Uncertainty is natural in all innovation

- Feasibility of idea may be unknown
- Product or process concept may be vague
- Target customers may be unknown
- The way to make revenue may be unknown

#### 2. Traditional waterfall approach (traditional model)

##### New Product Introduction model:

Works where customers are known, product features can be specified in advance, market well-defined, basis of competition understood



#### 3. Problem with traditional approaches

Impossible to know all requirements in advance

- The project takes time so the requirements at the time of capture may be different from those at the time of delivery
- Some requirements are only clear when users are using the product
- Too long to get customer validation of product

#### 4. “The Agile Manifesto” (2001)

**Individuals and interactions** over processes and tools

**Working software** over comprehensive documentation

**Customer collaboration** over contract negotiation

**Respond to change** over follow a plan

考试

Why agile methodologies (eg scrum) are well-suited to innovation rather than waterfall approach

innovations happen in a very uncertain environment with many uncertainties, so agile is better because it could deal uncertainty well compared with waterfall approach.

Specifically reasons:

(1) Using agile approach has higher customer satisfaction because it keeps customers involved and engaged throughout projects in order to get the new requirements rather than like waterfall approach the requirements at the time of capture may be different from those at the time of delivery which could make customer unsatisfied.

(2) Using agile approach could be more flexible which means it could incorporate new requirements at any point of the process, while waterfall is hard to do it because the design is fixed after the first requirements are captured

(3) Accelerate the innovation diffusion because it delivers products to market quicker and more often with every release not final version, while waterfall approach only release final version after a long time.

## Week 10 lecture B

### Innovation ecosystems and their culture

Q: Why is Silicon Valley a successful innovation ecosystem?

A: 1. Strong research-driven universities (with endowments)

--providing talent people and funds

2. Globally experienced repeat entrepreneurs

--Elon Musk (PayPal Tesla)

3. Sophisticated risk capital

4. Social capital (co-founder, adviser, investor.etc)

(relatively enough money)

5. Knowledge sharing

--Importance in startup accelerators (accelerate startups)

(e.g. Ycombinator)

6. Tolerance for risk taking

--entrepreneurs take risks by taking on ambitious missions

--Employees take risks by working for unproven startups

--Banks take risks by lending to unproven startups

7. creative destruction

--like to creating new businesses while destroying old ones

8. Constructive failure (the failed things help make other useful things)

9. Positive aggregate returns (Many failures so need large successes)

--eBay

10. Supportive government policy

--Tax incentives to encourage new ventures

--Flexible labor laws

## SYDNEY'S INNOVATION ECOSYSTEMS

- Co-working space – Ex. Fishburners - monthly fee to work in their space, do not ask for any part of the company or anything of that sort. Leads to knowledge sharing since people meet new people and that could lead to starting new companies.
- Accelerators: Ex. Incubate, Startmate.
- Tech business Incubators: More of a long term place where people can have a reasonable sized start up. Ex. ATP Innovations.
- Government programs: Ex. R&D tax incentives.
- Universities
- Established companies doing software product development.
- Government-funded research organisations e.g. CSIRO

## ~~Week 11 lecture A Innovations in the Healthcare~~

~~Q: Why is innovation important in Healthcare? (一句话花钱越来越多)~~

- ~~A:~~
- ~~1. Unsustainable costs (increasing pressure on GDP for healthcare expenditure)~~
  - ~~2. Aging population (more and more old people who need more healthcare)~~
  - ~~3. Technology (福利提升, 花钱变多)~~
- ~~-----~~ Wellbeing revolution  
~~-----~~ Patient empowerment

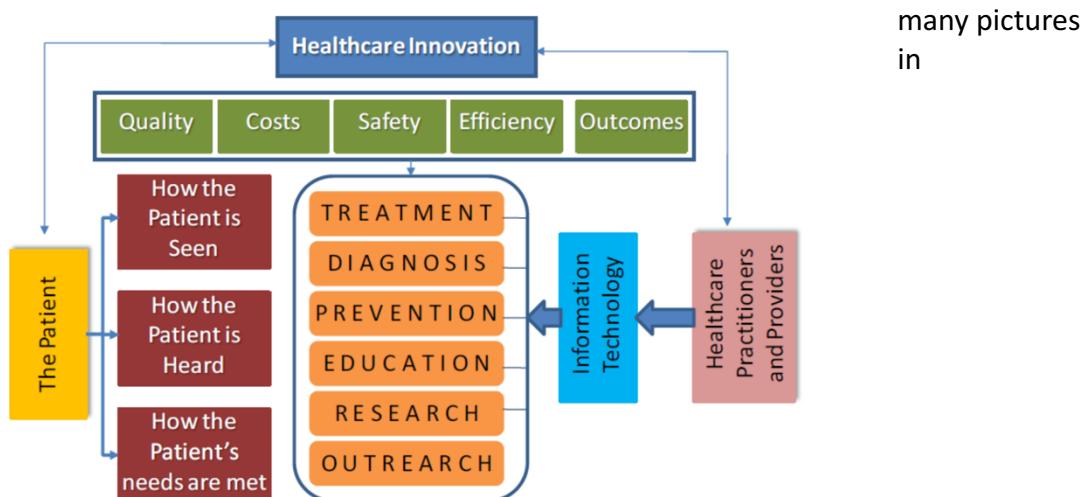


Figure 1: A Conceptual Framework for Innovation in Healthcare

PPT(framework)

考试

## **Enabling Healthcare Technology**

~~Wearables~~

~~PCeHR~~

~~Apple Health Kit and Care Kit~~

~~Google Home and Apple Home Kit~~

~~Communications through software and internet~~

## **~~Healthcare Innovations~~**

~~Example cases~~

~~1. Home Dialysis~~

~~It is one of the largest home dialysis therapy populations in Australia with 53% of all patients dialysing at home~~

~~Benefits~~

~~Simple and easy to view dialysis data and trends in real time resulting in improved clinical decision making assisted by the use of a mobile App~~

~~Efficient and easy record keeping through an App that has been developed with the patient, for the patient~~

~~Increased compliances and Frequency of reviews, Less travel time for patients and staff~~

~~- Best Practices (Security, Training and Documentation)~~

~~- Capture number of treatments per month for Activity Based Funding~~

~~-~~

~~-~~

## **~~Judging Criteria~~**

~~- - Relevance to your selected category~~

~~- - Aim, Nature and Extent of the Problem, Implementation~~

~~- - Outcomes~~

~~- - Sustaining change~~

~~- - Transferability and future scope~~

~~-~~

## **~~Proposal Pipeline~~**

~~- - Announcement and Briefing~~

~~- - CoE of Ideas~~

- - ~~1st Workshop present your idea!~~
- - ~~2nd Workshop present and critique proposal~~
- - ~~Submit the Proposal~~

## ~~Week 11 lecture B Tendering Process~~

### ~~Q: What is tendering and its process and its Selection Criteria ?~~

~~A: (1) Tendering is a bidding process for an individual customer where competing solution, usually unique and novel solutions about the project, providers bid to work on large projects for Governments or large private businesses. For public organizations, the process of tendering is required to be open, fair and transparent, depending on the law.~~

~~(2) The process: 1. Request for Tender / Invitation to Tender(招标, 给具体要求)~~

- ~~Formal invitation to solution providers to submit a bid~~
- ~~Specifies requirements~~
- ~~2. Interested solution providers prepare a tender~~
  - ~~Feasibility study~~
- ~~3. Submit tender~~
- ~~4. Tender analysis and selection~~
  - ~~Innovation~~
  - ~~Adequate requirements conformity / compliance~~
  - ~~Price~~
  - ~~Completion period~~
  - ~~Capability of the bidding company (references, financial and human resources)~~

### ~~Q: The impacts on innovation using tender process?~~

#### ~~A: Stimulate innovation:~~

~~1. from tenders : competition for win the tender could make better innovative solutions as well as in order to meet the requirements, could contribute to the innovative solutions.)~~

~~2. from requirements~~

- ~~Unique project requirements~~
- ~~Innovative features in a tender can be a competitive advantage~~
- ~~Requirements can push boundaries and therefore require innovative solutions~~

~~B:Hinder innovation: (要求可能太严格, 不自由 (不能按自己想法完成任务, 得在项目要求下 (第二, 四点)), 要求公开技术细节 (大多数估计不愿意))~~

- ~~Too rigid requirements~~
- ~~Request for tender insists on specific technical details(技术有要求, 必须用什么实现)~~
- ~~Conflict between innovation and compliance~~
- ~~Rigid process can be difficult to reconcile with agile development~~

~~EG: Bligh Street, Sydney (2011) for reducing the ecological footprint of high rise buildings (1. using gas and solar energy, it reduces the load on grid power by more than 27 percent 2. using blackwater recycling, predicted to save 100,000 liters per day)~~

~~EG: IT Innovation CCTV(closed circuit television)~~

~~Q: Innovation solutions derived from CCTV requirements?~~

~~A:~~

~~Quick random access of recordings –~~

~~Advanced multiplexing –~~

~~Live image / record / replay at the same time –~~

~~Tags that link recordings with events –~~

~~Digital network integration –~~

~~For example communication with alarm management software via LAN or internet~~

~~Digital image processing~~

~~For example motion detection~~

## Week 12 lecture Innovation by startup companies

It's easier for a small company to be agile than a large company, so is better for innovation because Innovation favours agility

(e.g. Facebook beats Myspace

facebook is small at first

Myspace is too large to change( failed))

### The importance of the entrepreneur

#### 1 Definition

the owner or manager of a business enterprise who, by risk and initiative, attempts to make profits

According to Schumpeter, it is leadership rather than ownership.

#### 2 Reasons

May be person who provides funding to set up a company and be a manager carrying out day-to-day management activities which could create new businesses and change social conditions.

According to Schumpeter, entrepreneurs inside new companies usually drive innovation causing creative destruction across markets

### Definitions of startups

1. Traditional approach: Treat start-up as small version of large company

This happens as founders who often are from business schools tend to use the techniques they learnt there, which may not apply to a dynamic and small innovation driven organization.

In this approach they come up with a Business plan for investments which focus on

- Identifying business opportunity (addressable market)

- Problem to be solved
- Planned solution to problem
- Forecast for income, profit, costs etc (eg for 5 years)

**however frequently unsuccessful for tech start-ups as:**

- For tech startups, there are many uncertainties
- The plan may have many untested assumptions
- Much of the plan may rely on these untested assumptions
- The business plan is often rigid and hard to change direction quickly

## 2. Definition

Most used for starting *technology* companies

- a temporary organization in search of a scalable, repeatable, profitable business model (Steve Blank)
- a human institution designed to deliver a new product or service under conditions of extreme uncertainty

### How to get startup ideas

Some start up ideas started with:

考试

When something the founders themselves wanted

Which they could build themselves

That few other people think is worth doing. e.g. Facebook, Microsoft, Apple, Google.

Points from Paul graham:

- Real problems:
  - Address real problems, not made-up problems (whacky idea for a startup)
- The “Well”
  - Build something a small number of people want a lot, rather than something a large number of people want a little
- Getting yourself ready
  - Be at the leading edge of a field (even if just a user)
  - “Live in the future, then build what’s missing”
  - External stimulus hitting a prepared mind

1. Knowing what’s out in the market so you have an idea of what is lacking.
2. Don’t try to just come up with ideas instead notice problems and build on those.
3. Gain knowledge of other domains which can lead you to identify problems in that domain which IT can solve.

### Established companies vs startups

While established companies execute a business model, start-ups search for a business model.

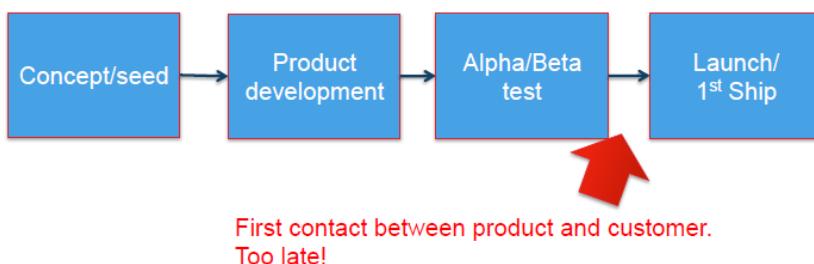
	Established companies	Start-up companies
Markets for products	Known	Mostly unknown (hypothesis only)
Customers	Known	Mostly unknown (hypothesis only)
Products	Known	Mostly unknown (hypothesis only)
Future product features	Learn from customers	Learn from potential customers and test hypotheses
Business model	Company executes the current business model	Company searches for the best business model
Product	Full specifications as needed by market	Minimum feature set (for speed to market and flexibility for change)
Product development	Smooth execution using proven methods	Pivots (until find market, customers, products, business model)
Structure	Relatively stable	Fluid

### Why traditional product processes are not suitable for startups

Traditional new product introduction processes are not suitable for situations of uncertainty (eg most startups) as not enough is known about customers, needed features, etc

#### - The 9 deadly sins of the New Product Introduction Model (traditional model)

- 1) Assuming “I know what the customer wants”
- 2) The “I know what features to build” flaw
- 3) Focus on Launch date
- 4) Emphasis on execution instead of hypotheses, testing, learning and iteration
- 5) Traditional business plans assume no trial and no errors
- 6) Confusing traditional job titles with what a startup needs to accomplish
- 7) Sales and marketing execute to a plan
- 8) Presumption of success leads to premature scaling
- 9) Management by crisis leads to a death spiral



“No business plan survives first contact with customers” – Steve Blank

### New approaches for startups

#### 1) Customer Development Process:

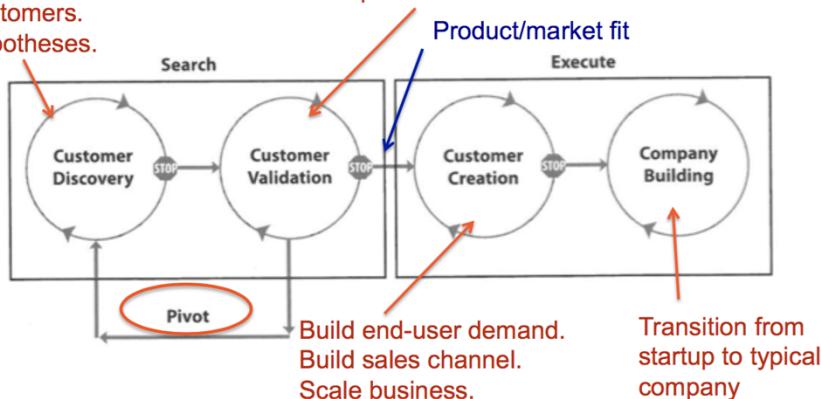
The Customer Development process has been designed to help scalable startups find a scalable business model

- Works where customers are unknown, product features unknown, market unknown,

basis of competition unknown – i.e. Designed to solve “the 9 deadly sins”

Capture vision and turn it into business model hypotheses.  
Develop plan to test hypotheses with customers.  
Test hypotheses.

Test whether related business model is repeatable and scalable



- The Customer Development Manifesto
- › Rule 1. There are no facts inside your building, so get outside
- › Rule 2. Pair Customer Development with Agile Development
- › Rule 3. Failure is an integral part of the search
- › Rule 4, Make continuous iterations and pivots
- › Rule 5. No business plan survives first contact with customers so use a business model canvas
- › Rule 6. Design experiments and test to validate your hypotheses
- › Rule 7. Agree on market type. It changes everything
  - Bringing a new product into an existing market
  - Bringing a new product into a new market
  - Bringing a new product into an existing market and trying to:
    - Re-segment that market as a low-cost entrant
    - Re-segment that market as a niche entrant
    - Cloning a business model that's successful in another country



- › Rule 8. Startup metrics differ from those in existing companies
- › Rule 9. Fast decision-making, cycle time, speed and tempo
- › Rule 10. It's all about passion

- › Rule 11. Startup job titles are very different from a large company
- › Rule 12. Preserve all cash until needed. Then spend
- › Rule 13. **Communicate and share learning**
- › Rule 14. Customer development success begins with buy-in

## 2) The Lean Startup

The Lean Startup approach provides a useful model for IT startups which combines

Customer Development Process and Agile Software Development

- Not every startup can be done lean, Big visions for short-term monopoly
- Focus on big vision rather than incremental niche-making by pivoting
- Focus on monopoly for a time in a market (e.g. Google) rather than continual competition

### 1. The Minimum Viable Product (MVP)

Eric Reis:

the minimum viable product is that version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort

### 2. Product Market Fit

Definition (Marc Andreessen): “Product/market fit means being in a good market with a product that can satisfy that market.”

### 3. Principles

- Entrepreneurship is everywhere
- Entrepreneurship is MANAGEMENT
- Validated learning
- Build – measure – learn
- Innovative accounting

Believes in start-up being an experiment where there is constant evaluation of a hypothesis to determine if we are on the path for a sustainable business.

Need a new kind of management, he refers to as Entrepreneurship management.

Emphasis on pivoting, changing directions i.e moving one foot in a new direction while being rooted to what they have learned.

Instead of building what not many people want – Rather than thinking can it be built we should think “should it be built?”

Learn, measure, build faster.

Innovative accounting – With a minimum feature product see how customers react,

experiment to see if metrics can be improved towards the ideal, if the experiments reach diminishing returns, it's time to pivot.

### 3) The Business Model Canvas

- Startup = the search for a business model
- Business model canvas = a representation of a business model
- A startup is the process of filling in a business model canvas

The Business Model Canvas:

- Good for representing what's known (results of hypothesis testing)
- What hypotheses still need to be tested

#### **Key Partners**

谁是关键的合作伙伴，供应商，技术提供者等

#### **Key Activities**

(要实现目标要做什么？建立渠道，使盈利，怎么实现设定的价值)

#### **Key Resources**

(实现行动的资源，人力物力（版权，资金）)

#### **Value Propositions**

What value do we drive to customers(我们能给顾客带来什么，解决了哪些顾客的哪些问题)

#### **Customer Segments**

a company must identify which customers it tries to serve

(Mass Market: 不具体限制对象 e.g. Car)

(Niche Market: 针对特定要求的人)

#### **Channels**

A company can deliver its value proposition to its targeted customers through different channels.

#### **Customer Relationships**

companies must identify the type of relationship they want to create with their customer segments

(Personal Assistance: Assistance in a form of employee-customer interaction. Such assistance is performed either during sales, after sales, and/or both.)

(Self Service: The type of relationship that translates from the indirect interaction between the company and the clients. Here, an organization provides the tools needed for the customers to serve themselves easily and effectively.)

#### **Cost Structure**

哪些地方需要花钱，并且哪些花费是很重要的

#### **Revenue Streams**

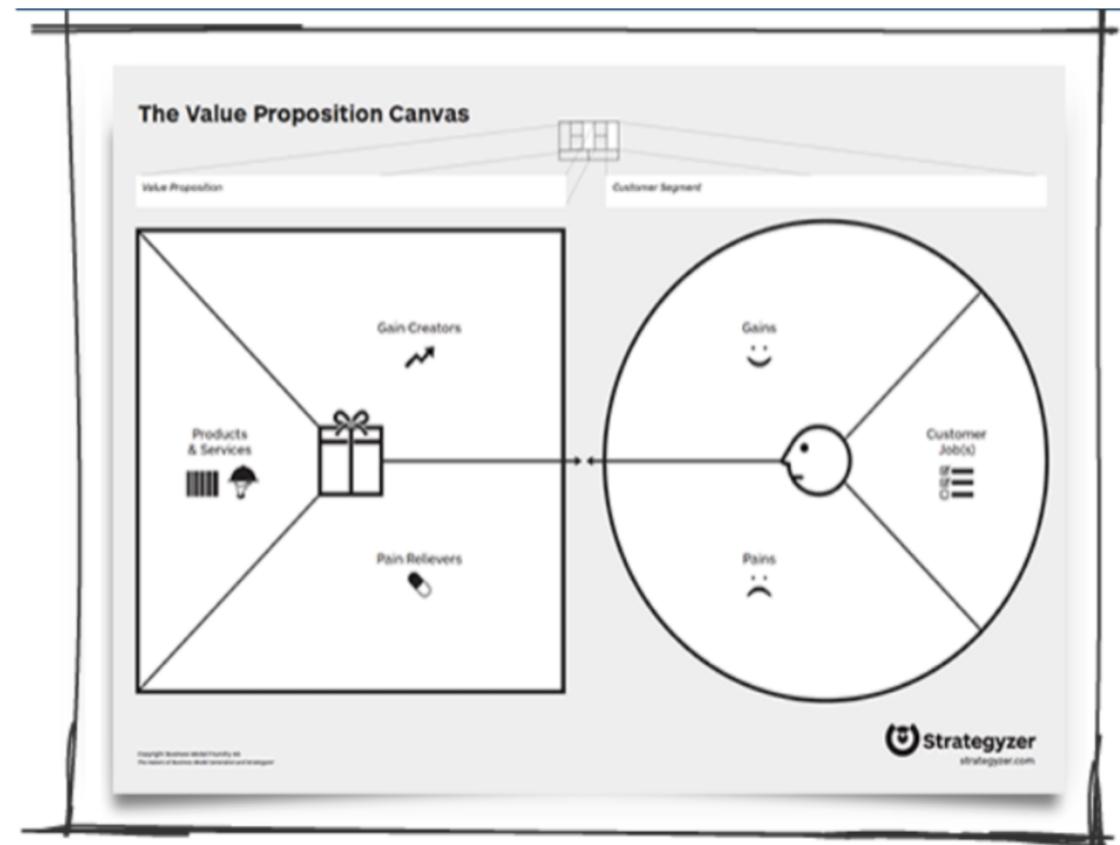
The way a company makes income from each customer segment. Several ways to generate a revenue stream(怎么赚钱)

(Asset Sale - (the most common type) Selling ownership rights to a physical good.

Usage Fee - Money generated from the use of a particular service e.g. UPS)

#### 4) Value Proposition Canvas

~~The Business Model Canvas and Value Proposition Canvas provide useful templates to help guide development of business models~~



ity of Sydney

~~Value Proposition:~~

INFO 5992 Understanding IT Innovation

~~Gain creator~~

~~Pain relievers~~

~~Products and Services~~

~~Customer Segment~~

~~Gains~~

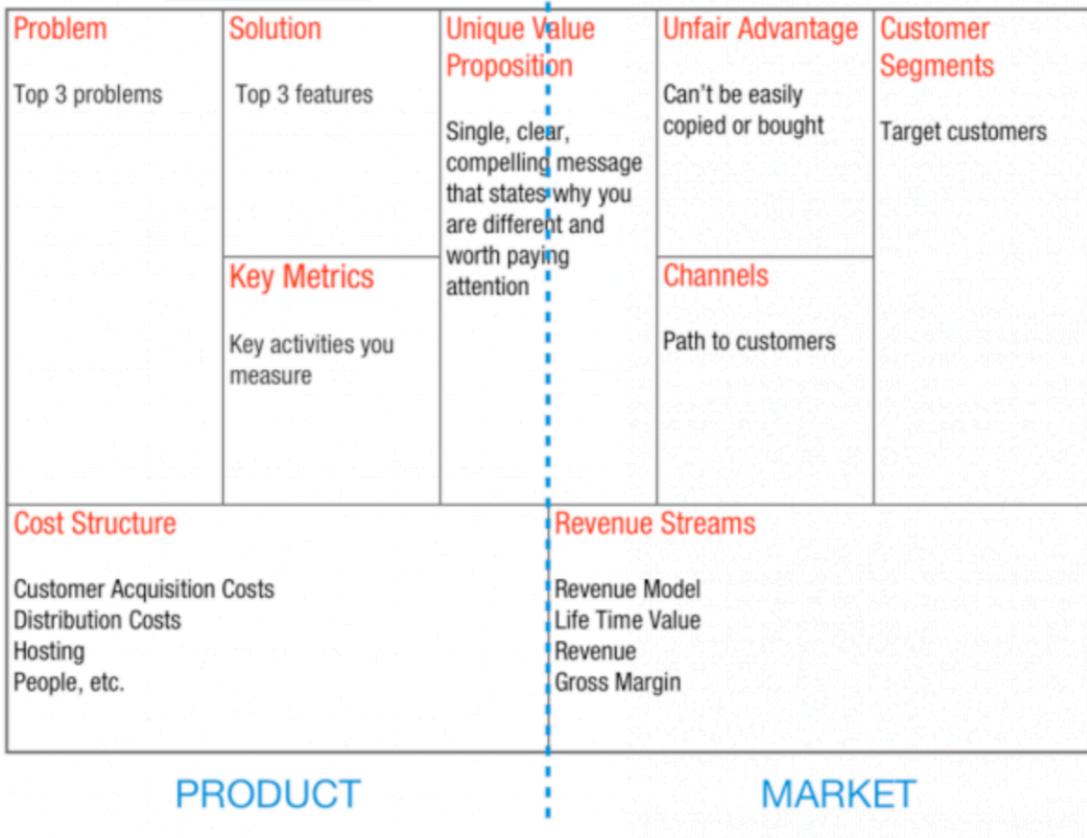
~~Pains~~

~~Customer Jobs~~

#### 5) The Lean Canvas (Ash Maurya)

~~Modified version of the Business Model Canvas that is designed specifically for startups~~

考试



The Business Model Canvas, Value Proposition Canvas and Lean Canvas provide useful templates to help guide development of businesses  
 These methods are not just for startups!! Any company can and should use them

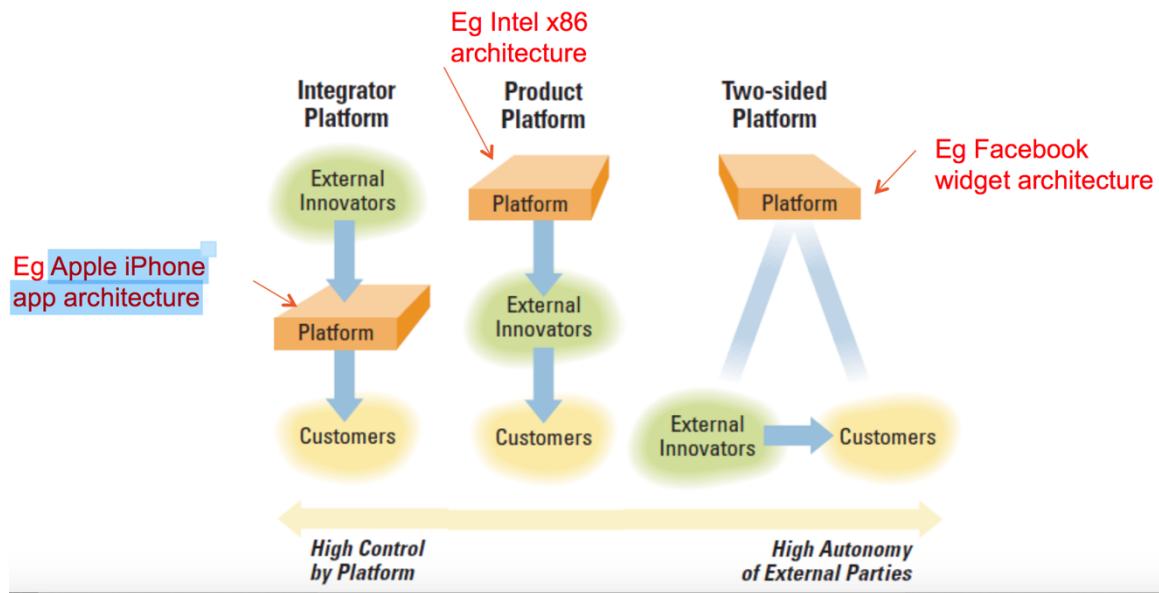
Differences between the Lean Startup approach and the traditional approach (for established companies)



## Week 12 lecture Platform ecosystems

Understanding how to build a platform ecosystem is key for many companies that are likely to be important in the future

### Different forms of platform businesses



### Roles in a platform ecosystem

- **Producers** create the platform's offerings (e.g. Uber, eBay)
- **Consumers** buy or use the platform's offerings
- **Platform providers** provide the interfaces to the platform
- **Platform owners** owns platform intellectual property (eg trademarks) and control who participates in the platform and how they participate

#### Benefits:

- “Platform businesses bring together producers and consumers in high-value exchanges.”
- “Their chief assets are information and interactions, which together are also the source of the value they create and their competitive advantage.”

#### Platform companies produce value in a different way from traditional “pipeline companies”

Pipelines (value in and value out, normally higher value, combine different value)  
Companies that take in resources, add value to them and then release products that are higher value

Platforms (some value in then create value-- information and interactions)

Companies that create value by controlling the interactions between producers and

consumers

**Approaches for running successful platform businesses are different from those for running pipeline businesses (eg for strategy, focus, measuring success)**

### 1. Strategy: From pipeline focus to platform focus

Many industries are being transformed by platform businesses

考试

1. From resource control to resource orchestration

– The main asset for platforms is the network of producers and consumers

2. From internal optimisation to external interaction

– Platforms focus on facilitating interactions in the network

3. From a focus on customer value to a focus on ecosystem value

– Platforms focus on the total value of the expanding network

### 2. Measuring a platform business

– Interaction failure: (建立联系是否成功)

– Failure of a key interaction between producers and consumers

– Engagement: (参与的人是否多)

– Level of participation enhancing network effects

– Match quality: (参与人的质量)

– Level of quality of an interaction between producer and consumer

– Negative network effects: (是否平衡的)

– Need to manage the platform carefully to avoid eg over-supply or over-demand