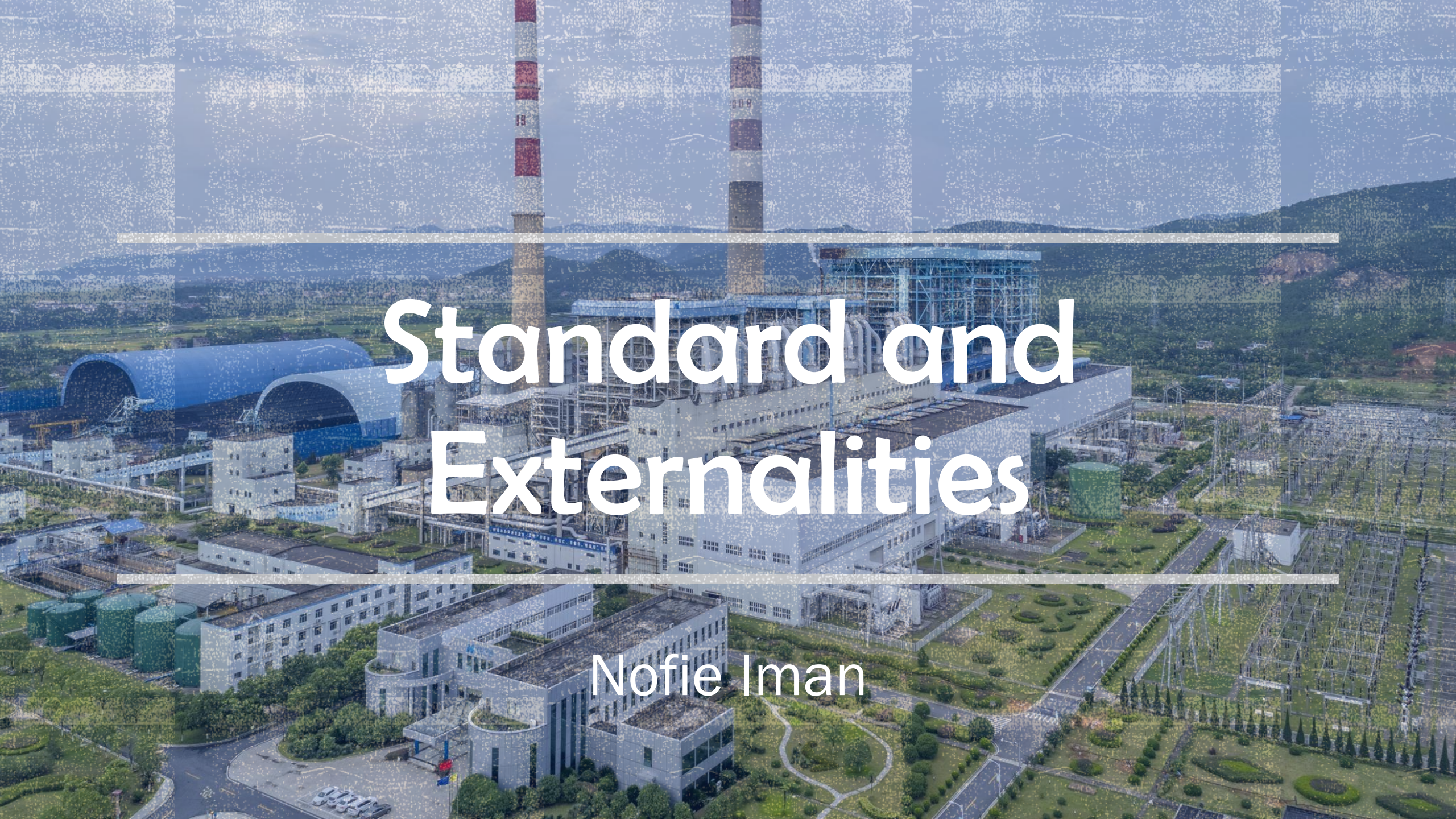

Standard and Externalities

Nofie Iman

Contents

Network

- A major driving force behind Internet commerce is the concept of '**network economy**' (Kelly, 1997).
  - The network economy is an economic system made up of millions of different types of networks.
  - A "network" per se can be anything; it might be users, a forum, subscribers, mailing list, businesses, computers, trucks, even fax machines (Kelly, 1997; Liebowitz, 2002).

Network

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  - The network economy is an economic system made up of millions of different types of networks.
  - A "network" per se can be anything; it might be users, a forum, subscribers, mailing list, businesses, computers, trucks, even fax machines (Kelly, 1997; Liebowitz, 2002).
- Internet (and the economy in general) **cannot exist without networks** of all shapes and sizes communicating and exchanging information with each other (Kelly, 1997)
  - One fax machine by itself is useless. However, many fax machines networked intelligently are very useful (Liebowitz, 2002).
  - Much like a network of fax machines, the Internet "embraces dumb power", where millions of computers are connected to each other via an intelligent network (Kelly, 1997).

Network Economy

- The concept of network economy is **not a new event.** However, with the Internet came many more opportunities to enhance a businesses network (Kelly, 1997).
- Businesses have always **relied on a network of sorts**, whether this be word of mouth advertising, or simply through the support of a business, to allow the owner to acquire more stock, which satisfies more consumers.
- As the number of 'nodes' in a network increases **the value of that network increases** (Kelly, 1997). The Internet facilitates this through its vast web of communication channels allowing an abundance of information to flow from its millions of access points (Kelly, 1997).
- From a business perspective, as the network grows, and more people participate and become part of it, it becomes **a more valid business.** The network becomes more relevant as more people are in it, and using it (Kelly, 1997).

Business and Network

- Liebowitz (2002) describes '**Winner-Takes-All**' where businesses 'share' with other businesses to increase their network capabilities. They achieve this by;
  - Pooling resources
  - Sharing financial, human resources, knowledge, expertise
  - Linking manufacturing, distribution and marketing
  - Forming technology cooperation networks (Rifkin, 2001).
- This is a drastic change from industrial economy where it was all about excluding competition (Rifkin, 2001).
- The concept of 'access' over 'ownership' relates a fundamental economic shift towards a knowledge economy where 'ideas, and intangible assets' creates revenue as apposed the ownership of physical assets (Rifkin, 2001).

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This is what digital platform are about.

In the digital economy, you cannot win the game by being exclusive and lone ranger, you have to cooperate and collaborate.

This is no longer about asset/ownership, but more about access/network.

In the new world its not the **big fish** which eats the **small fish**, it's the **fast fish** which eats the **slow fish.**

Klaus Schwab
Founder and Executive Chairman
World Economic Forum

Network Externality

- We are part of many networks. For example,
  - Network of same telephone service (Singtel, Axiata, Viettel, SK Telecom).
  - Network of people using same social network (Facebook, Twitter, Instagram).
- Demand for service depends on **the size of the network.**
- **Network externality** is a phenomenon in which entry of new user into the network, has either benefit or cost to the other user of the network.
  - If the entry costs something to other users, then it is **negative externality.**
  - If the other users are benefited, it is **positive externality.**

Network Externality

- In the networks showing network externality, the users have two separate sub part in the value he receives by being a part of the network.
  - **Autarky value**: The value from the product/service s/he is using (consumer has paid for it). User gets this even if there is no other person using the same product/service.
  - **Synchronization value**: The value from the network as the result of joining it (complementary but not optional).
- The **latter part** of the value decides whether it is positive externality or negative externality.

Autarky value = none
What is the use of a telephone if no one else is using it?

Synchronization value = yes
The more people are using the telephone, the higher the value of the telephone.

Autarky value = yes
You can still use the computer to write documents, make presentations, etc. even though it is not connected to the Internet.

Synchronization value = yes
The more people are getting their computers connected to the Internet, the higher the value of the Internet.

In many increasing returns industries (the rate of return from a product or process increases with the size of it's installed base), the value of a technology is strongly influenced by both **technology's standalone value** (autarky value) and **network externality value** (synchronization value).

What is

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it is not
net.

Synchronization

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Multiple Dimensions of Value

- **Technology's stand-alone value** (autarky value)
  - Includes such factors as:
    - The functions the technology enables customers to perform
    - Its aesthetic qualities
    - Its ease of use, etc.
- **Network externality value** (synchronization value)
  - The value of technological innovation to users will be a function not only of its stand-alone benefits and cost, but also of the value created by:
    - The size of the technology's installed base
    - The availability of complementary goods

Mul
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A new technology that has significantly more standalone functionality than the incumbent technology may offer **less overall value** because it has a smaller installed base or poor availability of complementary goods.

Value to customers of Windows OS is due to **stand-alone value** (makes it easy use computer), **the installed base** (number of users you can interact with), and **availability of compatible software.** This is what makes it difficult for OSs that are better than Windows to gain a foothold in the market

NeXT/Apple Computers were **extremely advanced technologically** but could not compete with the installed base value and complementary good value of Windows-based personal computers. They were **not compatible** with Wintel machines which had become the standard.

Positive Externality

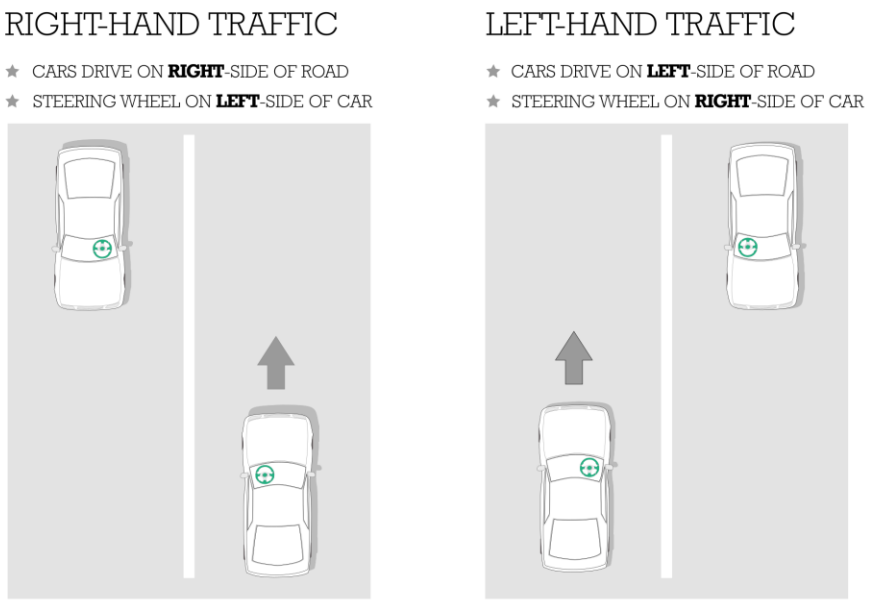
- If the other users are benefited by the entry of a new user into the network, then it is **positive externality** — the value of the service or product will increase as its installed base expands.
- Positive externality is known as **network effect**.
- A **technology spillover** is a type of positive externality that exists when a firm's innovation or design not only benefits the firm, but enters society's pool of technological knowledge and benefits society as a whole (e.g., the Internet).
- Though many networks have network effect initially, once they start facing resource crunch and once they scale above a level, they **might** start showing negative externality (e.g., too many users are joining the system could exceed the capacity and eventually slow down the system).

Negative Externality

- If the entry of a new user into the network costs something to other users of the network, then it is **negative externality** e.g., traffic congestion.
- The negative externalities can often be seen in the later stage of networks, where resources are **finite**.
- The government can **internalize an externality** and **avoid market failure** by imposing a tax on the producer to reduce the equilibrium quantity to the socially desirable quantity

Network Externalities and Standardization

- With network externalities, there will be a **few large networks** instead of several small ones.
- Will there be only **one**, or will there be **competing** networks?
  - With only **one** network, there is **less product differentiation**, so competition will be more intense.
  - But a larger network bestows more benefits on users, thus **increasing willingness to pay** and price.



Type A

Type B

Type C

Type D

Type E

Type F

Type G

Type H

Type I

Type J

Type K

Type L

Type M

Type N

Type O

Network Externalities and Standardization

- When introducing new technology, firms can adopt an "**evolutionary**" or "**revolutionary**" strategy.
  - **Evolutionary**: Make the technology "**backwards compatible**" so that people can easily switch from an older technology to your technology.
  - **Revolutionary**: Make the technology "**backwards incompatible**".

Network Externalities and Standardization

- When introducing new technology, firms can adopt an "**evolutionary**" or "**revolutionary**" strategy.
  - **Evolutionary**: Make the technology "**backwards compatible**" so that people can easily switch from an older technology to your technology.
  - **Revolutionary**: Make the technology "**backwards incompatible**".
- With two firms and two possible strategies, get three types of "**wars**".
  - **Rival Evolution**: Both firms have new technologies that are backward compatible, but not with each other (DVDs and DivX both play CDs but not each others' disks).
  - **Evolution** vs. **Revolution**: One technology is backwards compatible, the other is not.
  - **Rival Revolution**: Both new technologies are backwards incompatible (Nintendo vs. PlayStation).

Network Externalities and Standardization

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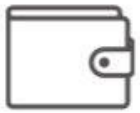
When you are about to launch new product/service/technology, think about current/existing technologies. Think about your competitors. Do you have enough resources to compete?

How to Overthrow the Incumbent?

- **Dramatic** technological improvement (e.g., in videogame consoles, it has taken 3X performance of incumbent)
  - Greater stand-alone value is not enough, needs greater overall value
- **Compatibility** with existing installed base and complements
  - Super Audio CD (SACD) from Sony and Philips is a new audio format based on Direct Stream Digital technology.
    - It is much better than standard CD technology but they made it backward compatible so that people would not have to throw out their existing CDs when they buy the new player and the new disks can be played on old CD players as well
    - Thus they maintained compatibility with the existing installed base and complementary goods

Network Effects as Economic Moat

	Sources of Moats	Description
	Switching Costs	Switching costs give a company pricing power by locking customers into its unique ecosystem. Beyond the expense of moving, they can also be measured by the effort, time, and psychological toll of switching to a competitor.
	Intangible Assets	Though not always easy to quantify, intangible assets may include brand recognition, patents, and regulatory licenses. They may prevent competitors from duplicating products or allow a company to charge premium pricing.
	Network Effect	A network effect is present when the value of a product or service grows as its user base expands. Each additional customer increases the product's or service's value exponentially.
	Cost Advantage	Companies that are able to produce products or services at lower costs than competitors are often able to sell at the same price as competition and gather excess profit, or have the option to undercut competition.
	Efficient Scale	In a market limited in size, potential new competitors have little incentive to enter because doing so would lower the industry's returns below the cost of capital.

Source: Morningstar

Value is created through innovation, but how much of that value accrues to the innovator partly depends on how quickly their competitors imitate the innovation. **Moats** are barriers to imitating innovation due to structural causes, as opposed to talent, vision and the likes.

Network Effects as Economic Moat

Network effects can act as a **powerful** competitive advantage. Network effects need to be **big enough** to matter, but creating a "better" network effect by a competitor is not easy, especially given the critical mass threshold.

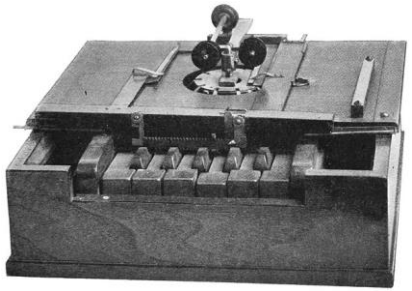
(1) Attract users with **value proposition** (e.g., photo filters on Instagram)

(2) Dominate **long-tail markets** and lever the network (e.g., Facebook with one campus at a time, LinkedIn with professional affiliation)

Source: Morningstar

Other Alternatives to Economic Moat

- **Barriers to entry** - Anything that makes it difficult for a new entrant to break into a market.
- **First mover advantage** - The competitive advantage that the first company to launch a new type of product should have over those that start later.
- **Natural monopoly** - A monopoly that arises from the nature of the industry, rather than being imposed by law or resulting from anti-competitive practices.
- **Product differentiation** - Making a product or service look different in the eyes of consumers.
- **Submarine patent** - A patent that is deliberately kept quite, in the hope of extracting money later from those who use an idea believing it not to be patented.



C. L. Sholes, a printer by trade, helped by his friends C. Glidden and S.W. Soule, built a primitive writing machine.

1867

1867

J. Densmore, the promoter-venture capitalist, struggled Sholes to perfect the machine. To reduce the frequency of typebar clashes, it was developed a four-row keyboard similar as the modern QWERTY.

QWERTY's evolution was completed by Remington's mechanics, a famous arms maker.

1873

1870's

Economic downturn of the 1870's was not the best times in which to launch a brand-new product of office equipment costing 125$.

Remington brought out its improved Model Two.

1878

1880's

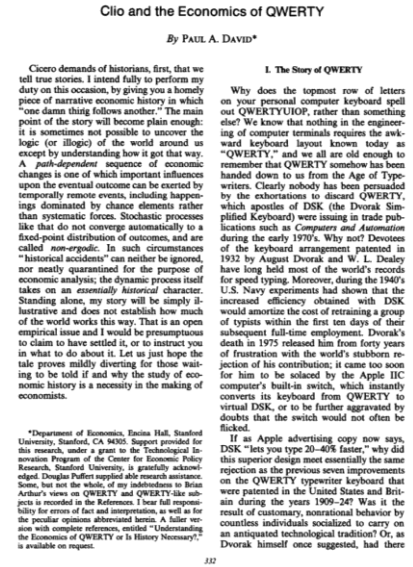
The typewriter boom begin.

Source: https://www.gutenberg.org/files/60794/60794-h/60794-h.htm

Crandall was the second inventor to reach the American market.

During this period, the main producers of typewriters offered the Universal as an option of the Ideal keyboard.

US Navy experiments had shown that the increased efficiency obtained with DSK would amortize the cost of retraining a group of typists within ten days.



Clio and the Economics of QWERTY

By Paul A. David*

I. The Story of QWERTY

Cicero demands of historians, first, that we tell true stories. I intend fully to perform my duty on this occasion, by giving you a homely piece of narrative economic history in which "one damn thing follows another." The main point of the story will become plain enough: it is sometimes not possible to uncover the logic (or illogic) of the world around us except by understanding how it got that way. A *path-dependent* sequence of economic changes is one of which important influences upon the eventual outcome can be exerted by temporally remote events, including happenings dominated by chance elements rather than systematic forces. Stochastic processes like that do not converge automatically to a fixed-point distribution of outcomes, and are called *non-ergodic*. In such circumstances "historical accidents" can neither be ignored, nor neatly quarantined for the purpose of economic analysis; the dynamic process itself takes on an *essentially historical* character. Standing alone, my story will be simply illustrative and does not establish how much of the world works this way. That is an open empirical issue and I would be presumptuous to claim to have settled it, or to instruct you in what to do about it. Let us just hope the tale proves mildly diverting for those waiting to be told if and why the study of economic history is a necessity in the making of economists.

Why does the topmost row of letters on your personal computer keyboard spell out QWERTYUIOP, rather than something else? We know that nothing in the engineering of computer terminals requires the awkward keyboard layout known today as "QWERTY," and we all are old enough to remember that QWERTY somehow has been handed down to us from the Age of Typewriters. Clearly nobody has been persuaded by the exhortations to discard QWERTY, which apostles of DSK (the Dvorak Simplified Keyboard) were issuing in trade publications such as *Computers and Automation* during the early 1970's. Why not? Devotees of the keyboard arrangement patented in 1932 by August Dvorak and W. L. Dealey have long held most of the world's records for speed typing. Moreover, during the 1940's U.S. Navy experiments had shown that the increased efficiency obtained with DSK would amortize the cost of retraining a group of typists within the first ten days of their subsequent full-time employment. Dvorak's death in 1975 released him from forty years of frustration with the world's stubborn rejection of his contribution; it came too soon for him to be solaced by the Apple IIC computer's built-in switch, which instantly converts its keyboard from QWERTY to virtual DSK, or to be further aggravated by doubts that the switch would not often be flicked.

If as Apple advertising copy now says, DSK "lets you type 20–40% faster," why did this superior design meet essentially the same rejection as the previous seven improvements on the QWERTY typewriter keyboard that were patented in the United States and Britain during the years 1909–24? Was it the result of customary, nonrational behavior by countless individuals socialized to carry on an antiquated technological tradition? Or, as Dvorak himself once suggested, had there

*Department of Economics, Encina Hall, Stanford University, Stanford, CA 94305. Support provided for this research, under a grant to the Technological Innovation Program of the Center for Economic Policy Research, Stanford University, is gratefully acknowledged. Douglas Puffert supplied able research assistance. Some, but not the whole, of my indebtedness to Brian Arthur's views on QWERTY and QWERTY-like subjects is recorded in the References. I bear full responsibility for errors of fact and interpretation, as well as for the peculiar opinions abbreviated herein. A fuller version with complete references, entitled "Understanding the Economics of QWERTY or Is History Necessary?," is available on request.

332

1879

1892

1895–1905

1936

1940

2005

Blickensderfer first sported a keyboard arrangement which was more sensible than qwerty. This “Ideal” keyboard placed in the bottom row the most used letters, DHIATENSOR

August Dvorak patented the Dvorak simplified keyboard (DSK).

Source: The Antikey Chop, Wikipedia

Barbara Blackburn earned the fastest typist Guinness World Record typing 150wpm for 50 minutes.

The Characteristics of DSK

- Better balance of hand loading
  - QWERTY: 57% left hand, 43% right hand; DSK: 44% left hand, 56% right — more appropriate for the right-handed people.
- Better balance of finger loading
- Better percentage loading of key rows
- Large home-row vocabulary
  - QWERTY: only 100 common words may be spelt by home row letters; DSK: 3,000 common words, or about 35% of words in normal text.
- Much less jumping around from row to row
  - The distance of finger travel on DSK is at least one-third of what is required on QWERTY — important to reduce typing fatigue.
- Much more of alternate hand keying
  - The separation of vowels to the left hand and high-frequency consonants to the right allows DSK much more in alternate sequencing — increase typing speed and reduce fatigue.
- Avoidance of awkward sequence fingering
  - The complete elimination of successive use of fingers of the same hand is obviously not possible. Among successive fingering sequences of one hand, there are those which are rather difficult to execute fast. They are known as awkward sequences.

Source: Okadome, T. (2007). A Performance Evaluation on DSK and Qwerty Keyboards. *International Journal of Computer Processing of Languages, 20(01)*, 15-35.

QWERTY vs. DSK

- **Easier to learn**: it usually takes one-third of the time compared with QWERTY to get up to the same level of competence at the early stage of learning.
- **More accurate**: the errors made by DSK users are approximately one-half of that by QWERTY users.
- **Fast to work with**: the DSK users type 15 to 20% faster for timed copy-typing of limited durations than the QWERTY users, and 25 to 50% faster in routine production typing of everyday work.
- **Less fatigue**: all typists who have switched from QWERTY to DSK attest that DSK leaves them much less tired at the end of the day's work.

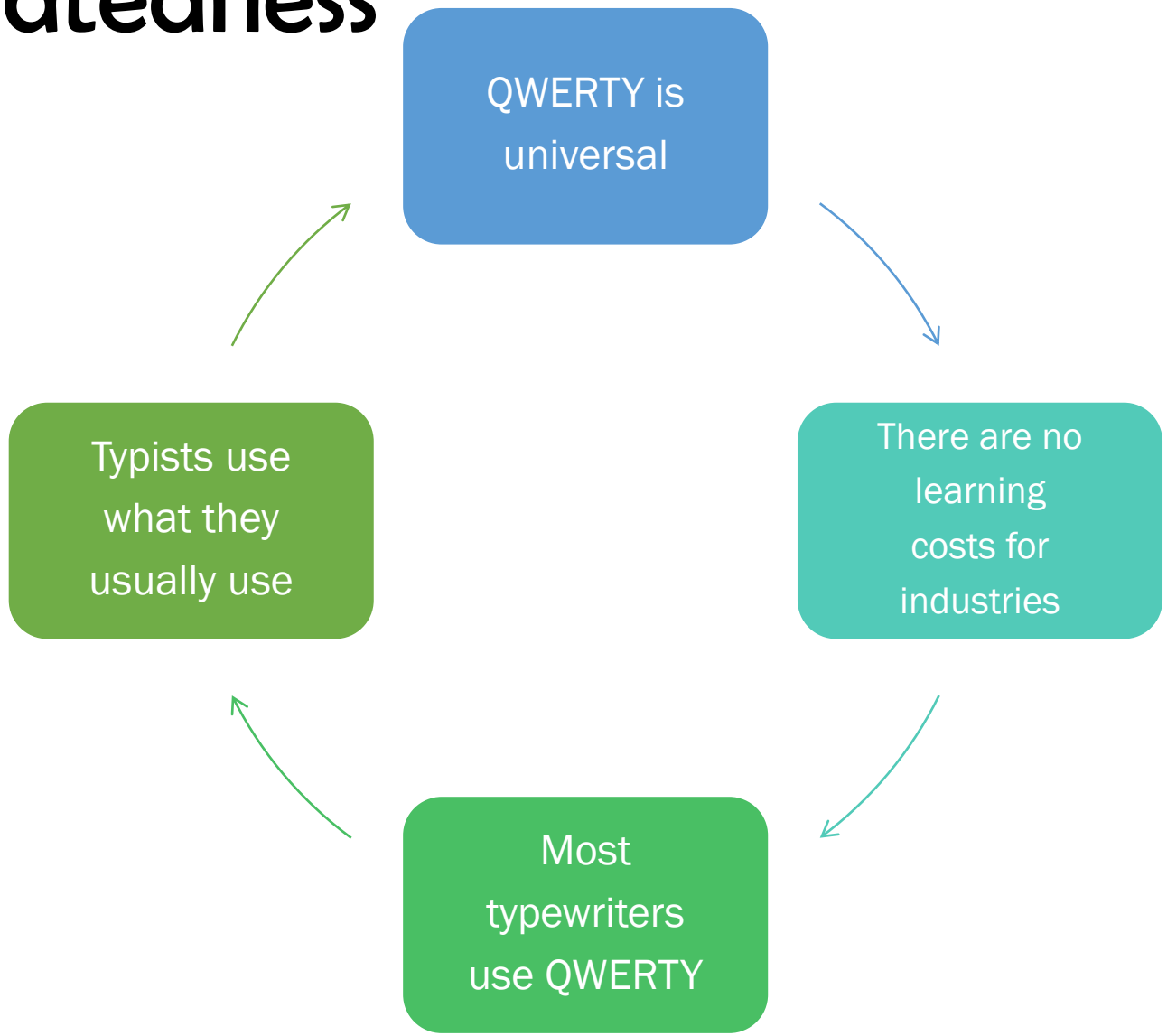
Source: Okadome, T. (2007). A Performance Evaluation on DSK and Qwerty Keyboards. *International Journal of Computer Processing of Languages, 20(01)*, 15-35.

The Big Question

- Why QWERTY and not something else?
- DSK broke the world records for speed typing
- US Navy showed that DSK is faster
- Seven other improvements between 1909-1924 were rejected
- Apple Computers equipped with switch from QWERTY to DSK
- Why does the entire world use the most inefficient keyboard?

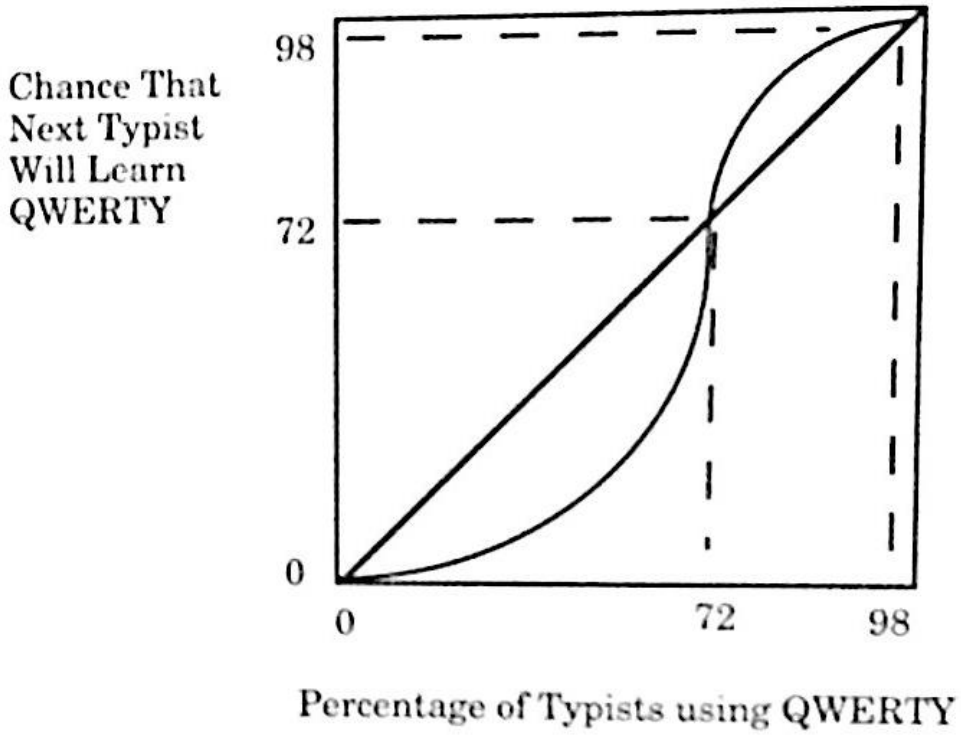
#1 Technical Interrelatedness

- Ensure **system compatibility** between **hardware** (physical layout of the keyboard) and **software** (memory of the typists).
- This will increase the likelihood that subsequent users will learn QWERTY.



#2 Economies of Scale

- In a world where typists have not any preference about which kind of keyboard to use and typewriter producers follow typist's preference, a typist will probably choose the same keyboard chosen by the precedent typist.
- QWERTY was widely used, de facto industry standard, hence the raise of QWERTY's users reduce production costs — **demand side economies of scale.**



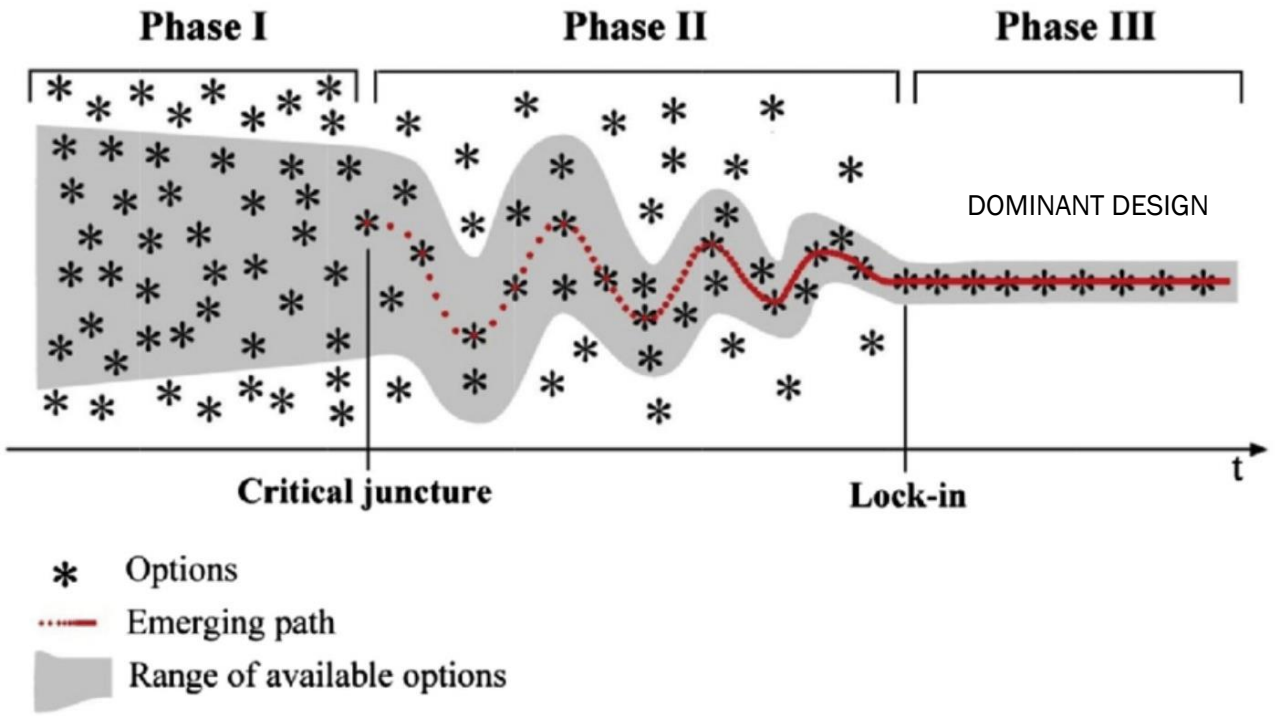
#3 Quasi-Irreversibility of Investment

- When the switching costs became extremely high, nobody will change his production to offer a typewriter with an alternative keyboard (**sunk cost investments** in QWERTY).
- Competitors found it beneficial to make hardware compatible with the installed based of QWERTY typists rather than the other way around
- Other examples: Britain's undersized railway wagons

"Excuse me, do you have a PC with DSK/AZERTY keyboard?"

"Sorry, we don't. Only QWERTY."

Path Dependence



A **path dependent** sequence of economic changes is one of which important influences upon the eventual outcome can be exerted by temporally remote events, including happenings dominated by chance elements rather then the systematic forces (David, 1985).

Sydow, Schreyögg, & Koch (2009). Organizational Path Dependence: Opening the Black Box. *Academy of Management Review, 34*, 689-709,

Path Dependence

- Path dependence gains added relevance because it is seen to attach to system that exhibit **network effects**.
- This could then be seen as a "**market failure**" — a failure of the market to unfailingly deliver the "best" standard.
- Technologically superior products **do not always win**.
- The lock-in may or may not be a problem. It is only a problem if we become locked-in to **an inferior standard**.
- Sometimes the consumer welfare benefits of having a single dominant design prompts **government to intervene**, imposing a standard.
  - In 1998, EU adopted the general standard for mobile communications (GSM) to avoid proliferation of incompatible standards and facilitate exchange within and between members countries

Key Takeaways

- We are living in a network economy — we have to pay attention to **network externalities/network effect.**
- In every digital innovation, think about **current/existing technologies**, think about your **competitors.** Do you have enough resources to compete?
- Network effects can act as a powerful competitive advantage — but it is **not easy.**
- Technical interrelatedness, economies of scale, and quasi irreversibility can caused a **lock-in** to the wrong/inferior standard.
- Lock-in (**path dependency**) is very common in the network economy.

Question to ponder

Does **network** really **matter**? How could we figure out how much it matters? Which do you think will be the **most spoken language** in the next centuries: English or Mandarin? Why?

The Men Who Were 'Supposed to Be' Bill Gates

- **Gary Kildall** was a math professor at Naval Post Graduate School in Monterey, California. In 1972, he completed his PhD in Computer Science and started consulting for Intel.
- He developed operating software for Intel 4004 microprocessor called it PL/M (Programming Language for Microcomputers). He then came up with **CP/M** (Control Programming for Microcomputers) which could help the microprocessor control a floppy drive.
- He offered CP/M to Intel but no response. Along with his wife Dorothy, He then decided to all out with CP/M. They started Intergalactic Digital Research in California. In 1977, they incorporated it as Digital Research Inc. (**DRI**).
- Before CP/M, every computer had to have a tailor-made software. Gary changed that. By 1979, CP/M was the most popular 8-bit operating system in the world. Microcomputer companies such as IMSAI 8080, North Star, Osborne were all running on CP/M. A little known company called Traf-O-Data run by Bill Gates and Paul Allen also used CP/M to collect data from the roadway traffic counters.
- Late-70s was the waves of change from microcomputers to personal computers. Steve Wozniak and co. hit the market with first Apple PC in 1976 and soon others followed. The PC market ballooned to $1 billion size. IBM took notice and decided to jump in.

Source: https://bookjelly.com/the-tragic-story-of-gary-kildall/

The Men Who Were 'Supposed to Be' Bill Gates

- In 1981, the IBM crack team tasked with creating the first IBM PC decided to buy off-the-shelf components along with software in order to expedite its entry to the PC market. IBM approached Gates who rightly pointed them to DRI citing that Microsoft had yet to build an operating system of its own.
- When IBM came knocking, Gary **left for a flying trip** in his private plane. Dorothy and a team of DRI lawyers met the IBM team and failed to inspire any confidence in them. IBM wanted a forever license for CP/M, Dorothy refused. Further, IBM wanted Dorothy to sign a unilateral NDA but they were not very comfortable with.
- By the time, Gary met the IBM team, a fair bit of damage was done. Gary wanted to sell CP/M on a royalty basis, IBM wanted to pay a one-time fee.
- IBM team stalked out and approached Bill Gates again. Microsoft still did not have an operating system. Bill scurried to Seattle Computers, a me-too manufacturer of CP/M clone called Q-DOS (Quick and Dirty Operating System). Microsoft rechristened it as **PC-DOS** and gave it to IBM. This upset Gary.

The Men Who Were ‘Supposed to Be’ Bill Gates

- IBM sensing a legal infringement approached Gary with a solution that it would license both PC-DOS and CP/M with IBM's line of PCs and let the market decide. Bill Gates had priced PC-DOS at $40 whereas Gary’s CP/M-86 sold for $240 (**6-to-1**).
- Some industry insiders later commented that IBM consciously priced CP/M six times higher than PC-DOS — no intention to honor the agreement with DRI.
- Microsoft went on to conquer the world. DRI suffered a major blow and started to slip off the industry’s radar. Gary’s life was not the same post-IBM-contract.
- In 1991, he sold DRI to Novell as a last ditch effort to put up a fight against Microsoft. Sadly, that **failed**, too. Everywhere he went, people would bring up IBM, Microsoft, and if he was really flying out on that day.
- He descended into alcoholism and severed his professional connections. In 1991, he stopped appearing in ‘The Computer Chronicles‘, a famous TV show which he co-hosted since 1985.
- In 1994, Gary got into a brawl at a Biker’s bar and later passed away due to head injuries.

Network Effect

- Gary Kildall and Bill Gates were both on a panel during a tech event. Gary made a point that this (operating systems) is a very large market and there is room for lots of companies. Bill Gates interjected, “No! There will always be **one company**.”

Thank You

See you anytime soon