



Network effects & Standards

Economics of Innovation

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Introduction

- In general economic theory of demand, it is assumed that the value a consumer obtains from consuming a product is independent of whether others also consume the same product, or indeed how many others consume it
- However in many settings these assumptions do not apply
 - The value of a product depends on how many others are consuming the same product
- Can you think of an example of such a product-market?

Network effects

- Network effects (or Network Externalities) characterise those situations in which the value of the consumption is not only a function of the intrinsic characteristics of the product itself but depends also on the number of others who consume the same product or service
- Usually network effects are of a positive nature, although there may also be negative network effects

Direct and indirect effects

- Network effects are direct or indirect
- Direct effects
 - The user benefits directly from the existence of a large network of other users (often arise because the user benefit by communication with other users)
- Indirect effects
 - The user benefits does not derive from other users directly (compatible software, car-parts, etc.)

Betamax vs VHS

- VCR: Market of videocassette recorders
- 1974: Sony launches Betamax, a videotape recording system
- Few years later a second type of videotape recording system was developed
 - 1976: JVC introduced its VHS (Video Home System) as an alternative and incompatible with Betamax VCR technology

Betamax vs VHS

- When JVC introduced VHS in September 1976, more than 100.000 Betamax machines had already been sold
 - Sony (Betamax) had the first mover advantage on the market
- It must be noted that many other machines were produced and brought to the market in those years, however the race took place only between these two systems
- This products/technologies needed to be adopted by partners (such as manufacturers or recording material distributors)

The VHS Family

- Initially VHS, compared to Betamax, had a longer recording time but lower picture quality
 - Differences that by mid 80s were already vanished
- JVC followed a more open policy for partners (open standard)
- Sony showed its machine six months before its launch on the market to various partners executives that remained a bit offended by the attitude of not having talked to them before the development of the technology/product (closed standard)
- By 1984, while Beta group numbered only a dozen firms, the VHS group included 40 companies (Grundig, Hitachi, Matsushita, Philips, Sharp, Mitsubishi, etc.)

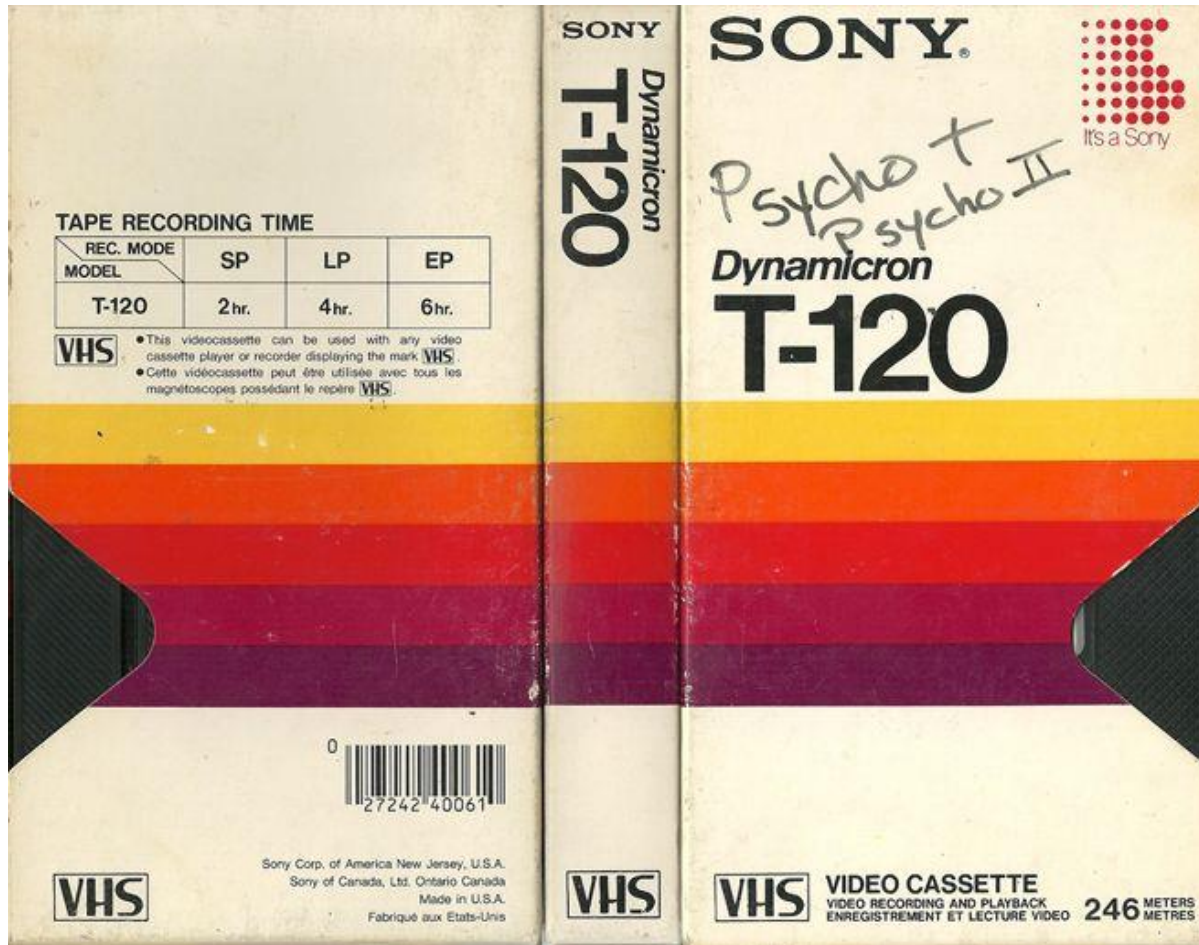
Supporting firms

- The bandwagon of supporting firms had two important effects.
 - First it gave VHS standard greater credibility. Consumers considering VHS might be reassured that the system had such broad support;
 - Second it introduced a faster pace of product improvement at precisely the moment when the market was choosing between the two systems, as partners contributed to the design and manufacture of VHS devices
- In 70s Betamax had technological advantages that was catch up by late 70s

And the winner is...

- In 1980 the total installed base of VCRs worldwide was less than 10 million units. Over the next decades the market expanded to more than 200 million.
 - To a large extent this growth resulted from consumers' shift from watching shows they recorded themselves to pre-recorded movies.
 - The sale and rental of these movies gave a strong advantage to the installed base, as video stores stocked movies in the format most used by their customers, namely VHS

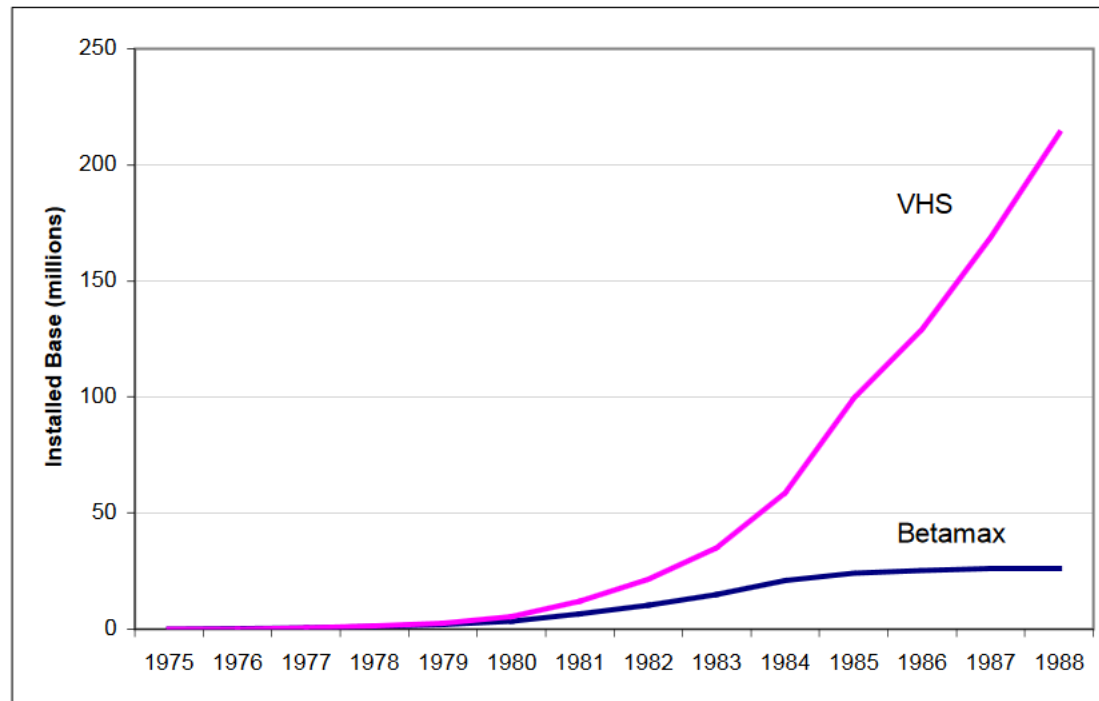
In 1988...



... Sony starts producing VHS recorders

Some figures...

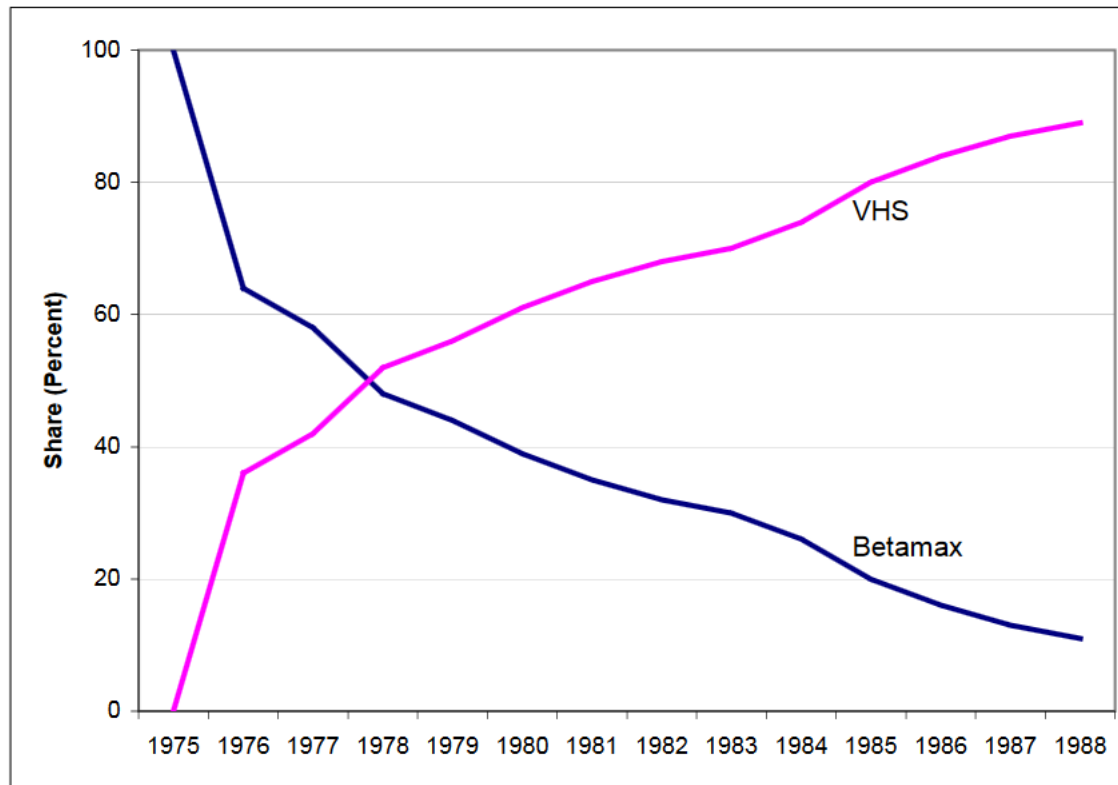
Exhibit 1
Cumulative Numbers of Units Sold



Source: Based on data from Cusumano et al., Table 1.

...continued

Exhibit 2
Share of VCR Market (VHS + Betamax)



Source: Based on data from Cusumano et al., Table 1.

Switching costs

- Costs the consumers face when switching supplier
 - In general theory of demand equal to zero
 - If the consumer identify a better product just switch to it with no costs
- In some contexts (products, market, technologies) switching costs are relevant and need to be accounted for

Switching costs

- Switching may have costs: think about changing electricity or internet supplier
- Costs of switching may also refer to learning costs: think about software or bank account (my bank knows and trust me)
- In both cases costs of switching may outweigh benefits gains

Switching costs and network effects

- The combination of switching costs and network effects may contribute to the establishment of a standard rather than another one
 - “Betamax keeps falling farther behind ... As consumers perceive Betamax faltering, they flock in even greater numbers to VHS, worried that those who produce movie cassettes for VCRs might desert Betamax” (Fortune magazine, 1985)
- Situations of technological lock-in

Network effects and theory of demand

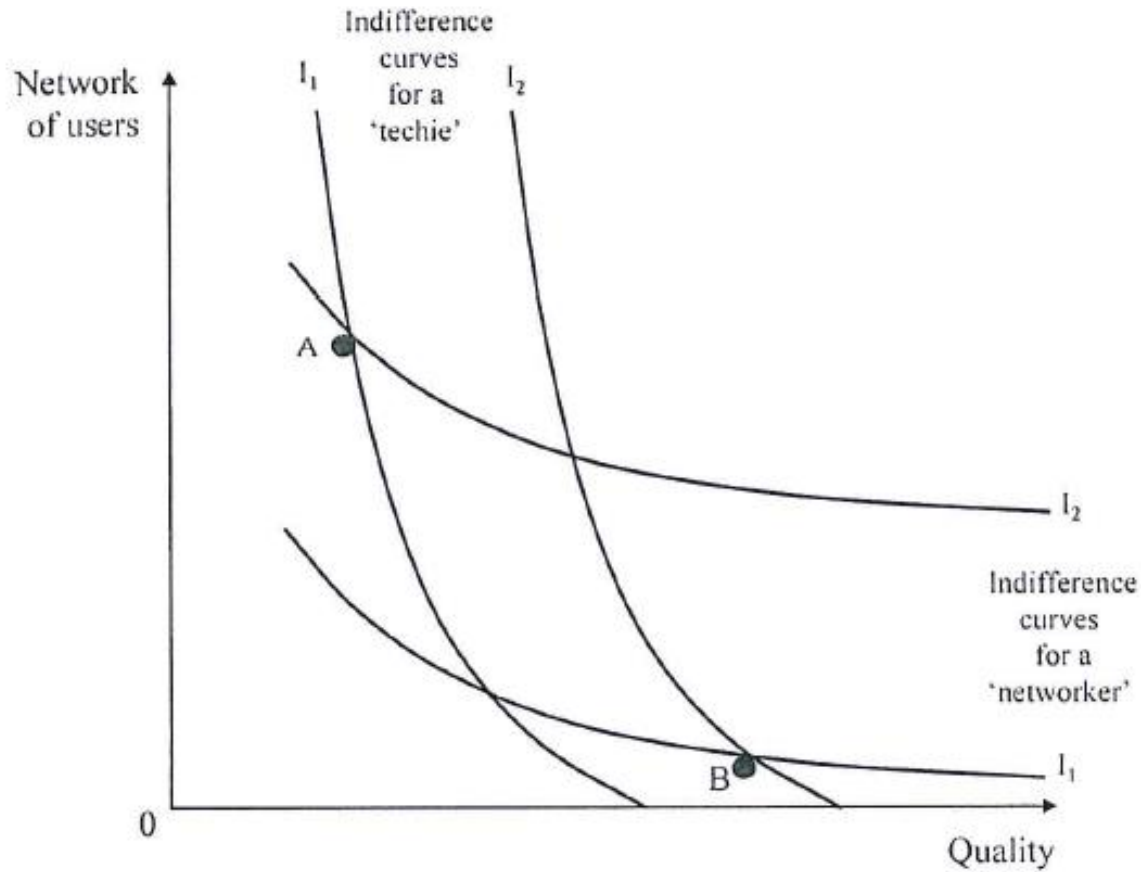


Figure 7.1 Consumer choice with network effects

Standard

- “An exact value, a physical entity, or an abstract concept, established and defined by authority, custom, or common consent to serve as a reference, model, or rule in measuring quantities or qualities, establishing practices or procedures, or evaluating results. A fixed quantity or quality.”

Standard

- Standards are all around ...
 - Measures (of length, weight, time, loudness, etc)
 - Language (and conventions in Mathematical expressions)
 - Railway Gauge; Clothing and Footwear sizes
 - Photographic Film; Plumbing fixtures; Electrical Plug
 - AC vs. DC; 230 Volt electricity in EU (110 Volts in US)
 - Batteries for electrical / electronic goods: AAA, AA, C, D, 9V
 - Driving on the Left or Right (e.g. Sweden switched in 1967)
 - Floppy discs; Compact cassettes, CD's, DVD's, etc.
 - Computer and Hi-Fi interconnection ports, etc.
 - ISO 9000

Network and standards

- Network effects and standard are often two related concepts (not always)
- Standards can be formal and informal, the latter also called dominant design, often emerged after market acceptance and race (if any)
- As a consequence they may be distinguished also for their open/public versus private nature

Standards ≠ Homogeneous Products

- ‘Standard products’ are not necessarily commodities ...
 - e.g., Duracell Batteries ...
 - ‘Duracell Bunny’ advertising is used to persuade consumers Duracell batteries are superior to ‘ordinary’ (zinc carbon) batteries
 - Much of Duracell’s competition is alkaline, not zinc carbon anyway
 - Similarly ‘blank’ Cassettes or CD’s
 - Advertising / packaging suggests significant quality differences
 - Consumers often don’t know if quality differences are real
- However, ‘Standard Products’ are Versatile / Flexible:
 - Can Interface effectively with other Products or Components in a Modular System ...
 - Provides Economies of Scope & Scale

Tuco's Revolver

- The Good, the Bad & The Ugly, have you seen it? It's a master piece
- https://www.youtube.com/watch?v=meP_Ufwj-FY

System decomposability and modularity

- Complex systems are often decomposable to modules ...
 - “A modular system is composed of units (or modules) that are designed independently but still function as an integrated whole. Designers achieve modularity by partitioning information into visible design rules and hidden design parameters. Modularity is beneficial only if the partition is precise, unambiguous and complete.” (Baldwin and Clarke, 1997, p.86)
- As a consequence:
 - The Architecture – i.e., configuration of system into modules
 - Interfaces – how modules interact (fit together, communicate)
 - Performance Standards – measures for testing the conformity of the module to the system ...
 - ... How well does module X perform in the system

Advantages of Modularity

- Modularity allows each component in a system to be designed and developed with significant independence
 - e.g., in Hi Fi, ‘speakers’ and ‘speaker technology’ can be developed essentially independently of amplifier and source technology.
 - New source devices can be introduced – e.g., DVD players, which are compatible with other existing components (i.e. amplifier & speakers)
 - Similarly with the PC – modular design allows progress with disc drive technologies to proceed independently of processor technology, etc.
- Competition often occurs at the level of the module (& the system)

Autonomous innovations

- Autonomous innovations (Teece, 1984) create improved products and processes that fit comfortably into existing systems.
- These innovations not only fit well within current industry standards, but they reinforce those standards.
 - An example would be the introduction of a faster microprocessor using the same architecture, such as the Intel 80x 86/Pentium family (or more recently intel core x)

Systemic innovations

- Systemic innovations change technological requirements so that the resulting configuration of both the innovation and its related technologies (which comprise a system of technology) are different;
- The potential from systemic innovations cannot be fully realized until adjustments are made throughout the system
- These innovations span current technology boundaries; complex coordination problem; require coordinated adjustment throughout the system to realize the gains from innovation
- Innovations of this type require that the design of the subsystems be coordinated in order for the gains from the innovation to be realized.
 - For example, audio CD plays require the abandonment of vinyl records and the manufacture of CD discs.

Public policy for standards

- Policies imposing some or other standards can reduce transaction costs (TC)
- Policies can impose open standards, again favouring innovation and reducing TC
- Policies can impose standards to direct all R&D efforts in one direction (think for example to a green-related standard)