



THE UNIVERSITY
OF AUCKLAND

BUSINESS SCHOOL

Department of Economics

09 Standards & Technology Adoption

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Introduction

- **Objectives of this lecture:** Understand what standards are, the benefits of standards, how they are made, how standards compete, and how new technologies get adopted over time.

What is a Standard?

- A standard is a set of rules, technologies or designs that precisely define the characteristics of a good or service.
- Examples:
 - DVD 1st and 2nd generation.
 - TV broadcast (PAL, NTSC).
 - Mobile phones (GSM, CDMA).
 - HTML, CSS, XML.
 - Data compression (MP3, JPEG).

Benefits of Standards

- A standard is a way to achieve competing compatible networks.
 - Maximise network benefits while supporting competition.
 - Example: Anyone can manufacture TV sets to receive broadcasts as long as they follow the relevant technical standard (eg PAL/NTSC).
- Helps to coordinate consumer decisions.
- Reduce complexity for network users.
 - Example: Only need to create content in one format (eg MP3 for music).

How Standards Get Made

- Somehow, the specifications of the standard need to be decided.
- Sometimes one firm invents a standard on its own and it is widely adopted by others.
 - Example: Adobe PDF.
- Sometimes different firms come together to form a *consortium* standard, often under the umbrella of a *standards-setting organisation*.
 - Examples: Various MPEG standards, HTML.

Standards and Patents

- Sometimes, standards are made by combining several patented technologies.
 - Examples: DVD, 3G mobile telephony.
- Users of the such standards usually must buy *licenses* from the patent owners.
- Sometimes, patent owners get together and license their patents for the standard jointly through a *patent pool*.
 - Example: MPEG-LA (www.mpegla.com).

Standards as Networks

- A standard defines a network.
- The more people or firms that use a standard, the more valuable it becomes.
- If we interpret standards as networks, all the previous insight we developed about networks also applies to standards and competition between standards.

Technology Adoption

- Suppose two alternative standards exist for a new product or technology.
 - Example: HD-DVD vs Blu-ray
- Due to network effects, users of the technology prefer to adopt the standard that has the most users.
- However, as with network effects, users may face a coordination problem.
- This may lead to *confusion*, *wait-and-see*, etc.

Example 1

- Consider the following standards adoption games with 2 players and 2 standards:

		Player 2	
		Adopt A	Adopt B
Player 1	Adopt A	4 , 4	-2 , -2
	Adopt B	-2 , -2	4 , 4

		Player 2	
		Adopt A	Adopt B
Player 1	Adopt A	4 , 4	-2 , -2
	Adopt B	-2 , -2	1 , 1

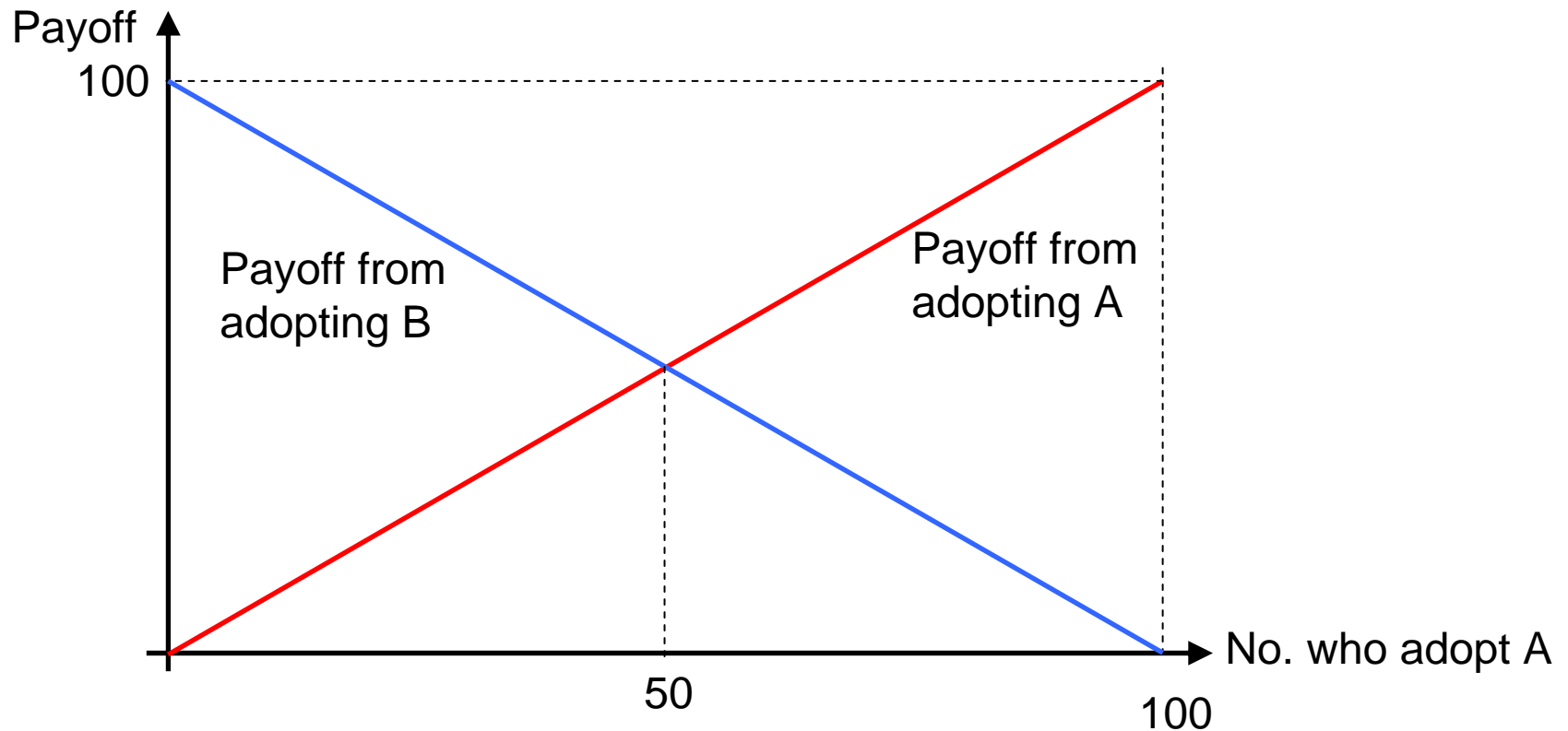
- Questions:
 - Find the equilibria of each game.
 - Compare and discuss.

Technology Adoption

- Consider again two standards, A and B.
- Suppose there are 100 people who can adopt each standard.
- If N people adopt a standard, suppose the value of that standard to its members is N .
- What are the equilibria if people choose one of the two standards independently?

Technology Adoption

- Illustration:



Technology Adoption

- There are three equilibria:
 - Everyone adopts A
 - Everyone adopts B
 - Half adopt A and half adopt B
- Note that the 50-50 equilibrium is *unstable*.
 - A slight movement away from this point will drive everyone to A or B.
- Again there could be a coordination problem.
 - How do people coordinate on adopting A or B?
 - Standard-setting organisations aim to resolve these problems.

Standards Wars

- Competition between rival standards is often called a 'standards war'.
 - Example: HD-DVD vs Blu-ray
- Rival standards are competing *for* the market.
- As with network competition, influencing consumers' *expectations* is important in a standards war.
- Being the *first* standard in the market can also be important.

Standards Wars

- Google searches for HD-DVD (blue) and Blu-ray (red):



- Blu-ray 'won' the war with HD-DVD by attracting more movie studios to its format.

Dynamic Standards Competition

- New standards often compete with existing standards based on similar technologies.
- Examples:
 - 2nd generation vs 1st generation DVD
 - 3G versus 2G mobile phones
- New standards are often technologically superior (higher quality) compared to older standards.
- But new standards lack the network size of old standards.
 - Backwards compatibility can help.

Excess Inertia

- Excess inertia refers to a situation where an inferior network technology persists longer than it otherwise would in the face of competition from a superior technology.
 - If consumers do not believe that enough others will adopt the new technology, many or all will remain with the old technology, even if the new technology is superior or even if it is cheaper.
 - This can occur even if consumers as a whole would be better off from adopting the new technology.
 - Coordination problems can prevent or delay switching to the new technology

Example 2

- Suppose player 1 and 2 are currently using the same standard and must independently choose whether to switch to a new superior standard. Compare the following two games:

		Player 2	
		Switch	Don't
Player 1	Switch	4 , 4	2 , 1
	Don't	1 , 2	3 , 3

		Player 2	
		Switch	Don't
Player 1	Switch	4 , 4	3 , 1
	Don't	1 , 3	2 , 2

- Questions:
 - Find the Nash equilibria of both games
 - Compare and interpret

Excess Momentum

- Consumers may adopt new technologies *too quickly* compared to sticking with old technologies.
- Existing consumers may prefer to stick with an old technology rather than pay the price of switching to a new one, but new consumers won't take this into account.

Example 3

- Suppose player 1 has already adopted an old technology and faces a cost to switch to a new (better) one.
- Player 2 is new and must choose to use the old technology or the new one, and doesn't face any cost of switching.

		Player 2	
		Old	New
Player 1	Switch	1 , 1	2 , 5
	Don't	5 , 3	1 , 4

- Find the equilibria and interpret.