



Technology strategies and standard competition – Comparative innovation cases of Apple and Microsoft

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ARTICLE INFO

Available online 19 June 2012

Keywords:

Technology strategy
Standard competition
Apple
Microsoft
Technology platform
Competitive advantage

ABSTRACT

This paper analyses the technology strategy and standard competition of the most outstanding innovation cases of Apple and Microsoft. The objective of the study is to understand innovators' pursuit of strategies in securing the benefits from an innovation, based on the innovation life cycle model. The study develops a new methodological framework of platform for analysing the case studies. It is argued that the ability to establish an industry standard and lock-in customers enables an innovator to create a competitive advantage. The study offers important lessons in strategic innovation management.

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1. Introduction

Competition to achieve competitive advantage often involves the ability to establish new standards for the interworking of products and services. The outstanding classic cases of standard battle are Sony Betamax and Matsushita VHS standards in the Videocassette Recorder (VCR) business, the standard competition among the powerful players of Visa Open Platform, MasterCard/Mondex Multos, Proton World's Proton, Microsoft Windows for Smart Cards in the smart card industry and the recent standard competition between HD-DVD and Blu Ray in the Digital Versatile Disc player (DVD) business. This study endeavours to understand the use of technology strategies and competition to establish technology standards in the most outstanding innovative companies of Apple and Microsoft. The comparative case study analyses using the new methodological framework of platform aim to contribute to the area of innovation management.

Following the introductory section, [Section 2](#) presents the literature review on innovation, innovation process, five forces Porter's approach, technology standards and platform and strategies in managing technological innovations. [Section 3](#) introduces the new methodology for analysing the technology platform creation process. [Section 4](#) analyses of the process of technological change in various industrial sectors in an attempt to provide a basis for better understanding the technological change of Apple and Microsoft, based on the innovation life cycle model. [Section 5](#) analyses the technology strategies of Apple and Microsoft for achieving competitive advantage. [Section 6](#) discusses the generalisable principles/abstract ideas synthesised from the case study analysis. [Section 7](#) concludes the paper by drawing lessons in strategic innovation management from the findings and suggests avenues for future research.

2. Theoretical framework

2.1. Innovation and innovation process

Innovation is a process of transforming the technology frontier into the commercialised product/process innovation in a competitive market (Daft, 1982; Rothwell & Gardiner, 1985; Schott, 1981). The innovation process characteristically exhibits an S

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pattern. The stages along the S-curve are characterised by the efforts of the innovator to adapt a technological development (invention) for transformation into an innovation (commercial product). The innovation process can be described by the forces of technology push (Schumpeter, 1939) and demand pull (Schmookler, 1962) or their interaction (Freeman, 1982) as triggers of innovation. Technology push views the innovation process as simple linear and sequential with emphasis on research and development. Demand pull views the innovation process as simple, linear and sequential with emphasis on the market (Brem & Voigt, 2009; Hung, 2010; Matthysens, Vandenbempt, & Berghman, 2006).

Given the competitive environment of the innovation/diffusion process in the industry, Utterback and Abernathy (1975) developed the innovation life cycle model to describe the process of innovation and the degree of technological change (Fig. 1). The analysis of the innovation process in this paper is based on the concept of innovation life cycle since the model provides a basis to understand a process of commercialisation. It is argued that the industry plays an important role in the innovation process since innovations are developed along with the markets for them. According to Fisher and Pry (1971), when a new innovation reaches about 5% penetration of the potential application market, it provides a reasonable base for forecasting the speed and ultimate penetration achievable.

Vernon (1966)'s Product Life Cycle (PLC) is a classical model explaining the development as a pattern of product substitution (the S-curve pattern). The phases along the PLC reflect innovation diffusion – the progress of product/process innovations along the stages of introduction, growth, maturity and decline. Vernon's PLC shows a progression of innovation from process innovation to product innovation (Fig. 2).

2.2. Five forces Porter's approach

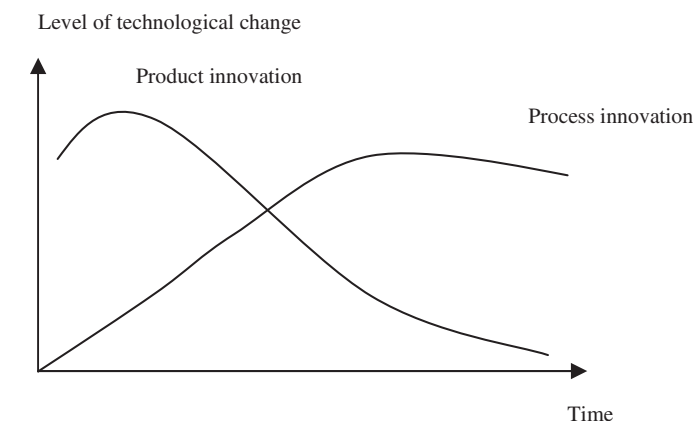
The influential work in innovation strategy is owed to Michael Porter (1980, 1985). Porter emphasised the use of competitive strategy as the way to achieve competitive advantage in the 1970s and 1980s. His notions are based on the resource-based approach by Barney (1986), Cool and Schendel (1988), Penrose (1959), and Wernerfelt (1984, 1989) who argue convincingly that strategies to cope with a changing competitive environment are associated with the firm's capabilities. The firm's capabilities have been described as amalgam of resources – technology, organisational capabilities, experiences and relationships (Fahy, 1996; Reed & DeFillippi, 1990).

Porter pioneered the 'Five Forces' approach for analysing the firms' strategic position. The five forces of competitive position model are: relations with suppliers; bargaining power of buyers; threats of new entrants; threats of substitute products or services; and rivalry amongst existing firms (Fig. 3). He argues that a firm's strategy is influenced by these forces and suggests the firm to find a position in an industry to defend itself against the forces or to influence them in its favour (Porter, 1980).

2.3. Technology standards and platform

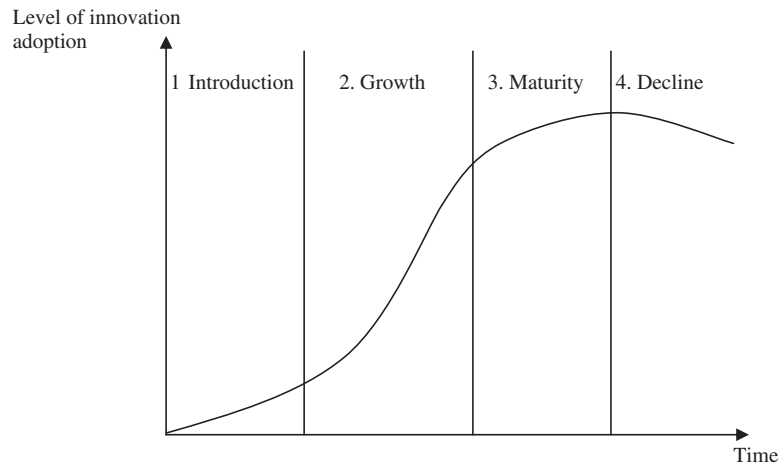
In the path of innovation diffusion, standards can affect the environment of competition (Hawkins, Mansell, & Skea, 1995; Wonglimpiyarat, 2005). The ability to establish standards could provide a technology platform allowing the innovation to progress from a firm level towards a country or even a global level. The level of innovation commercialisation suggests two patterns of development:

- (i) The pattern of development *with uniform standardisation*. The diffusion requires standardisation among multiplayers as in the case of credit cards, debit cards, mobile telephony, containerisation and electronic data interchange (EDI). Many players interacting with other system users on real time basis for low value transaction enforce standardisation.



Source: Utterback and Abernathy (1975)

Fig. 1. The innovation life cycle model. Source: Utterback and Abernathy (1975).



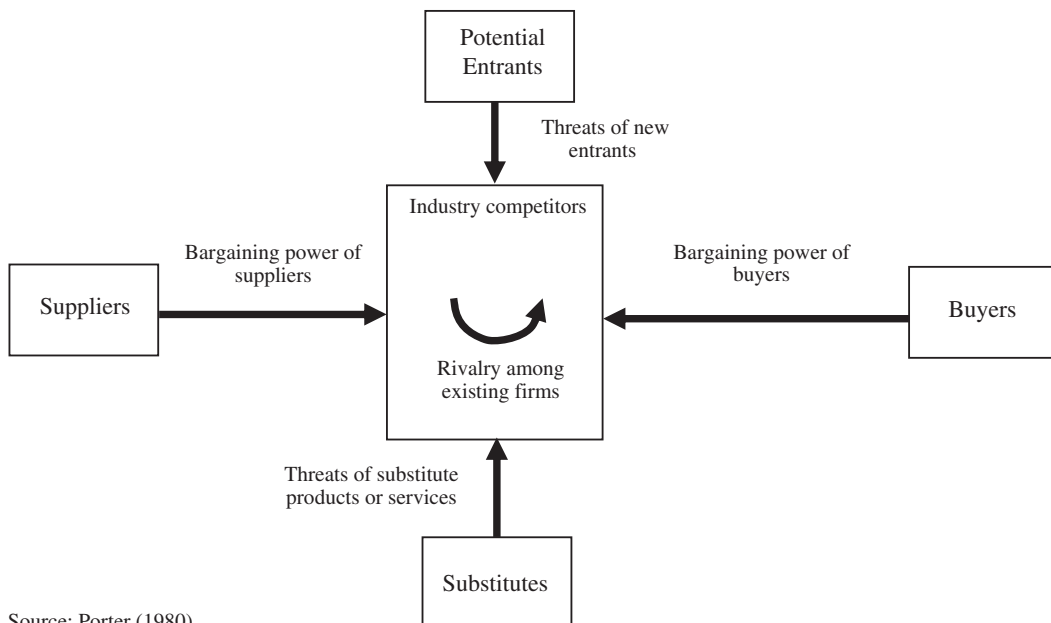
Source: Vernon (1966)

Fig. 2. The product life cycle (PLC) model. Source: Vernon (1966).

- (ii) The pattern of development *without uniform standardisation*. The diffusion does not require formal adoption of standards among multiplayers as in the case of Microsoft's de facto standard of Windows operating system in the PC market.

In the standard battle, the winner does not necessarily offer the lowest price or provide the best technology. In view of strategic management of innovation, effective competition could be enhanced if an innovator could establish its technology as an industry standard. The ability to establish the standard would attract more use of the innovation from its capability in interoperability, e.g. GSM standard in mobile telephony, Video Home System (VHS) and Betamax standard in video cassette recording.

The innovator's choice to carry out particular strategy may have implications for platform creation. Porter (1980) argues the use of technology platform as a resource to achieve a competitive advantage. Table 1 presents the platform concepts. Kim and Kogut (1996) define a technology platform as consisting of bundles of technologies that increase the likelihood of penetrating new markets. They provide empirical evidence, in the semiconductor industry, on the wide adoption of a memory based technology platform into diversified fields. The concept of platform also includes a set of subsystems functioning as a structure to produce a stream of derivative products according to Meyer and Selinger (1998), Aerts, Goossenaerts, Hammer, and Wortmann (2004), Economides and Katsamakos (2006). From their point of view, software (e.g. VISIO, Hewlett-Packard's Open View network management, Netscape Navigator, Microsoft Internet Explorer, Linux, Windows) provides technological platforms that



Source: Porter (1980)

Fig. 3. Five forces Porter's approach. Source: Porter (1980).

Table 1

Reviews of the platform concepts.

Concepts of platform	Studies by	Platform characterised as
1. Technology (technological component embedding in the system)	Kim and Kogut (1996)	Memory technology
2. Collection of subsystems for development of derivative products	Meyer and Selinger (1998), Aerts et al. (2004), Economides and Katsamakos (2006)	Software
3. Integration of capabilities from organisations	Downes and Mui (1998) Venkatraman and Henderson (1998) Taylor et al. (1999)	Internet Virtual organisation e.g. GM, Ford, Chrysler Integrated network e.g. FedEx, Lufthansa
4. Platform organisation	Ciborra (1996), Shim and Lee (2012)	Organisations (the combination of structures and strategies)

Source: The author's design.

allow the development of further plug in applications which gain from the existence of a compatible user base. A more general view of the term 'platform' is in respect of integrating business networks which leverage capabilities within and across organisations (Downes & Mui, 1998; Taylor et al., 1999; Venkatraman & Henderson, 1998). The term 'platform' according to Ciborra (1996), Shim and Lee (2012) is based on organisational science literature. They define platforms as arrangements or combinations of organisational structures and strategies that are created to meet the changing environment.

2.4. Strategies in managing technological innovations

Firms, according to the resource-based approach, compete according to their different capabilities. Strategies to cope with a changing competitive environment are associated with the firm's capabilities. Under the model of Schumpeterian competition, being the first mover or follower in the industry not only influences the extent of innovation adoption but also the benefits secured. According to Nelson and Winter (1982, pp. 280) and Schumpeter (1950, pp. 105), "...perfect competition was incompatible with innovation. As a matter of fact, perfect competition is and always has been temporarily suspended whenever anything new is being introduced..." implies the importance of timing and critical mass of use. Being first to the market can help firms to take advantage of benefits from initial demand in the market and enjoy an extra profit until competitors can respond. The pre-emptive move to capture the profit-making opportunities and to respond more accurately to the needs and responses of customers before a further move to launch other products may be more important and thus the innovation, from the outset, does not have to take off with the first best solutions to the market.

Porter (1980) argues that a firm's strategy is influenced by these forces and suggests the firm to find a position in an industry in order to defend itself against these forces or to influence them in its favour. As far as analysis of strategy is concerned, the adoption of strategies is important in managing innovations and in making the innovation happen (Hamel, 2007; Hamel & Prahalad, 1994; Porter, 1980, 1985). When the resources and capabilities required in the diffusion of innovation are not available within an economic entity, it is likely that innovators adopt collaborative strategy and vice versa. However, the innovatory strategies employed by innovators along the stages of innovation can change over time. The changes of the strategies of the innovator in the light of ever-changing market competition, in turn, influence the progress of innovation.

3. Methodology for analysing the platform creation process

In this study, the term 'platform' is used to describe a cluster of capabilities or competencies capable of creating competitive advantage for a firm in terms of subsequent innovations. Platforms involve an ability to excel at the innovation process itself by generating a continuity of commercially successful innovations. This study synthesises variables for use as indicators of technology platform as provided in Table 2. The technology platform variables are concerned with the mechanism of technology, which has influence on the development of continuing innovations. The new methodological approach of technology platform analysis allows the understanding of the way innovator builds up a technological capability to gain a competitive advantage.

4. Understanding the process of technological change in various industries

This section adopts the innovation life cycle model as an approach to analyse the process of technological change in various industrial sectors. The comparative analyses in different industry sectors provides a basis for better understanding the process of technological change in the innovation cases of Apple and Microsoft.

The process of technological change in the video recording industry represents a succession of S-curves. The period of innovation life cycle consists of technology substitutes to extend the life cycle of technology (Fig. 4). The envelope of S-curves describes the progress of innovation in the form of the improving video system over time. In other words, the successive S-curves represent the process of technological changes from magnetic recording technology to laser disc technology, compact disc technology and digital versatile disc (DVD)/high definition DVD (HD-DVD) technology and Blu Ray disc technology.

In the computer industry (Fig. 5), the technological change based on the theory of innovation life cycle represents a succession of S-curves. The technological improvement follows the S-curve to reflect technology progression from mainframe, minicomputer, PC,

Table 2

Technology platform variables.

Technology platform variables	Description of variables
1. High performance relative to existing practices in several dimensions of performance	Having high performance in applications engendered by technological capabilities
2. Variety of continuing applications	The potential of technological capabilities creates continuing arrays of new innovations and applications.
3. Intermediary serving multiple value chains	The technological capabilities are used in serving multiple networks e.g. suppliers, distributors, other businesses.
4. Subject to obsolescence from new technology	The technological capabilities are vulnerable to be substitutable by the new technology.
5. Mostly single ownership	The capabilities to innovate are provided by a single firm's resources, skills and knowledge bases.
6. Controls channel of supply to customers	The launch of innovation controls the supply delivery channel to the market.
7. Utilising numerically intensive analytic processing	The provision of solutions comes from extensively used communication lines, intensive analytic programming, integrated software, database and expert systems.

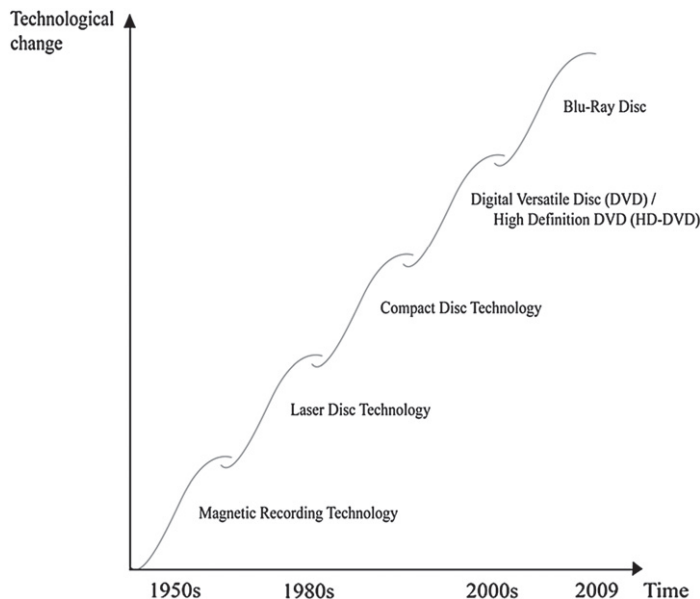
Source: The author's design.

client services, broadband, mobile web/WAP technology. The innovation process as shown in the figure also shows technology substitutes to extend the life cycle of the operating system.

In the energy sector, the process of technological change presents an envelope of S-curves – the progress from steam power, petroleum fuel, diesel, bensil, gasoline towards biofuel and electric/hybrid technology at present (Fig. 6). At present, many countries attempt to innovate new technology as a way to extend available energy in the context of increasing world demand for oil/petroleum fuel since the world cannot depend on Middle East OPEC nations to supply the oil needed to meet future demand – which is expected to grow to 110 million barrels per day by 2025 (DOE, 2006). It is high time that countries around the world attempt to find alternative energy technologies such as photovoltaics, wind turbines, biofuels, nuclear power, biomass, hydro electrical power and geothermal energy.

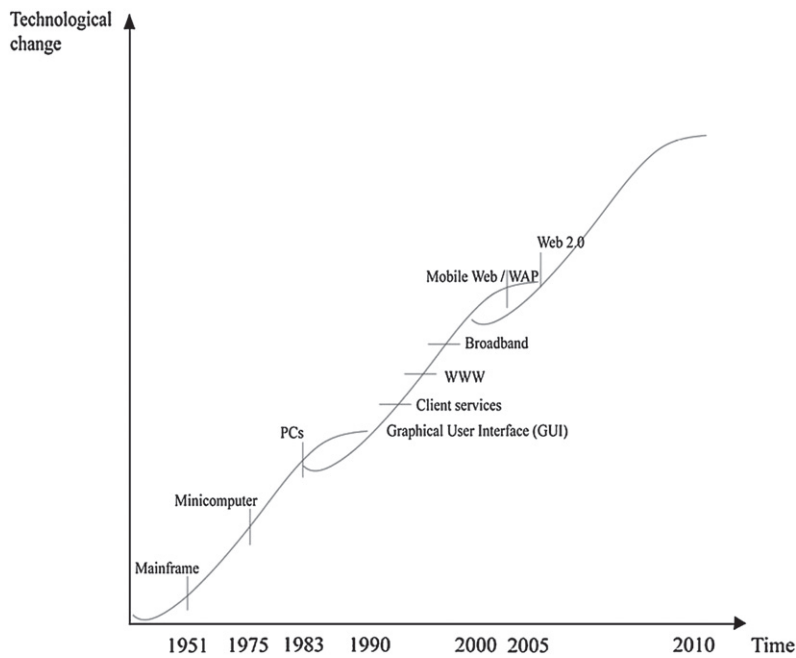
In the bank card industry, the innovation process, based on the theory of innovation life cycle, could be tracked by the pattern of technology substitution (the substitution of smart card technology for magnetic stripe technology) (Fig. 7). The process of technological change presents a progress from the magnetic stripe technology towards the smart card technology. The process of bank card innovation diffusion presents a parallel substitution of technology (the two technologies are not independent as the smart card technology has not yet taken over the existing magnetic stripe card technology).

In the mobile telephony industry, the innovation process, based on the theory of innovation life cycle, represents the generations of mobile system from 1G to 4G (Fig. 8). A succession of S-curves represents versions of mobile communication services with improving frequency limits.



Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

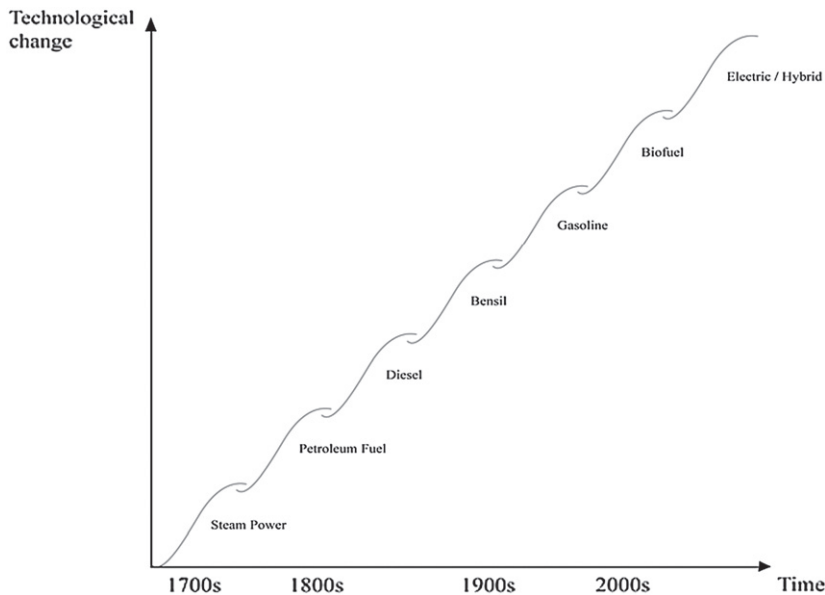
Fig. 4. Technological change in the video recording industry. Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).



Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

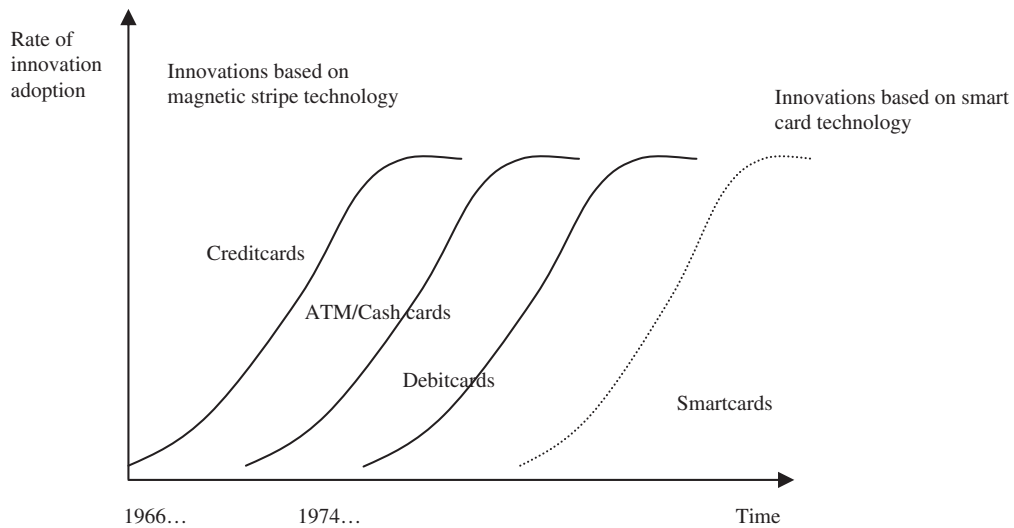
Fig. 5. Technological change in the computer industry. Source: The authors' design, based on [Utterback and Abernathy \(1975\)](#) and [Fisher and Pry \(1971\)](#).

Taking into account the technological evolution of these industries, it can be seen that the overlapping S-curves represent generations of new or improved technology (for product/process innovation). As the industry advances and technology evolves, the new S-curve represents the infant characteristics, altering the competitive landscape regarding competitors and industry



Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

Fig. 6. Technological change in the energy industry. Source: The authors' design, based on [Utterback and Abernathy \(1975\)](#) and [Fisher and Pry \(1971\)](#).



Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

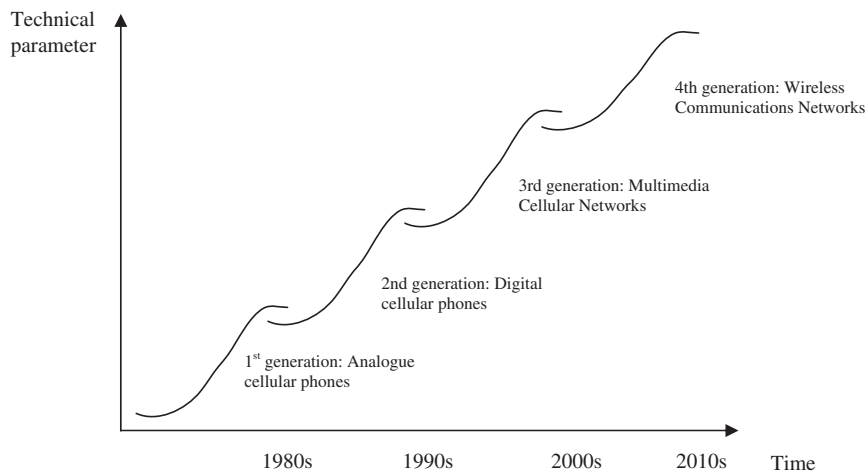
Fig. 7. Technological change in the bank card industry. Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

entrants. The process of technological change in various industries could provide a basis to understand the case study analyses of Apple and Microsoft in the next section.

5. Case study of Apple and Microsoft's technology strategies

The Apple and Microsoft case studies in this section will show how Apple and Microsoft employ the strategies to manage the innovation in coping with the changing competitive conditions.

In the early years of competition, Apple in its launch of Macintosh, continued the strategy of not licensing Mac OS to Original Equipment Manufacturer (OEM) hardware suppliers. Apple thought superior Macintosh technology would make it the industry standard, allowing Apple to gain proprietary benefits. However, Apple did not realise that Microsoft was a close follower who was ready to launch the Microsoft Windows which had similar characteristics to Mac OS and would reduce the point of differentiation of Apple's Graphical User Interface (GUI) that Apple intended to use for gaining superior benefits. The strategy of not licensing also showed that Apple overlooked the importance of speed in using other PC manufacturers' distribution capability to bring the



Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

Fig. 8. Technological change in the mobile telephony industry. Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

innovation to market. As a result, the Mac OS failed to take off as quickly as Microsoft Windows. The strategy of not licensing constrained the growth in the installed base of Apple machines, lowered Apple's capability to compete and limited the potential to create a business platform.

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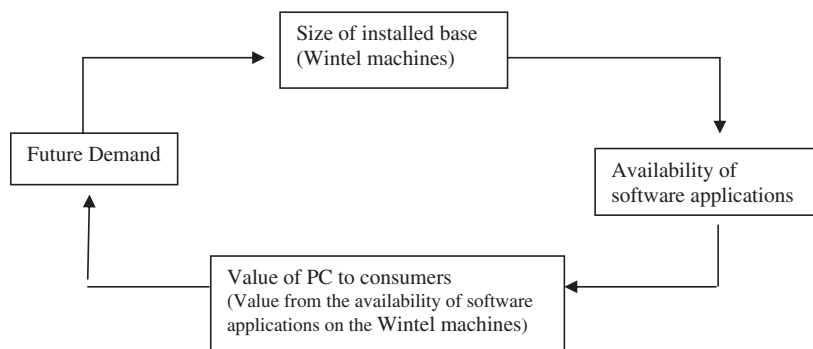
By pursuing a low-cost licensing strategy, Microsoft could license its Windows via OEM arrangements with the PC manufacturers. Microsoft also used a product bundling strategy to include software applications running on its operating system in the OEM deal which further increased the value of Microsoft Windows to PC users, increased the demand for its products and reduced the scope for competing suppliers. The distribution strength of global PC manufacturers and the value of application programmes running on Microsoft Windows enabled Microsoft Windows to reach wide adoption and become a de facto standard.

Fig. 9 shows the self-reinforcing standard creation of Microsoft Windows. Regarding this mechanism, Microsoft's pursuit of low price licensing strategy to the PC manufacturers led to the growing installed base of PCs running Microsoft Windows operating system. Since Microsoft Windows operating system and Intel microprocessor were mainly used in the PCs, this defined the PCs based on Microsoft's Windows and an Intel microprocessor as Wintel machines. A larger installed base of the Wintel machines leads to a greater availability of software applications since software developers place importance in writing applications programmes for the bigger market – users of Wintel machines. Since there were more applications available for Wintel machines, consumers increasingly placed greater value on Wintel machines, and purchased them in larger numbers. In turn, this results in the increase of the installed base of Wintel machines. The network externality effect shown by this mechanism enabled Microsoft Windows to become the de facto standard operating system in the PC industry. Microsoft could enjoy a continuing competitive advantage from its ability to dominate the PC industry with the extension of Windows standards.

In the case of Apple, the attempt to compete for potential platform creation began when Apple launched Apple Lisa. By tying the operating system to its own hardware, Apple expected to command a high price and establish proprietary business platforms. However, the price Apple set was regarded by the customers as too expensive (Apple Lisa \$10,000 comparing to a standalone PC \$2000). Moreover, as Apple Lisa ran as a closed system, this prevented software development firms from writing application programmes. Thus, the machines of Apple were not seen as valuable for the customers to purchase. The result was that Apple failed to establish a business platform even though Apple was an early mover in the PC Windows operating system market and might have established their technologies as standard.

Apple in its launch of Macintosh, continued the strategy of not licensing MacOS to OEM hardware suppliers. In other words, Apple thought superior Macintosh technology would make it the industry standard, allowing Apple to gain proprietary benefits. However, Apple did not realise that Microsoft was a close follower who was ready to launch the Microsoft Windows which had similar characteristics to MacOS and would reduce the point of differentiation of Apple's Graphical User Interface (GUI) that Apple intended to use for gaining superior benefits (Apple Macintosh was launched in 1984; Microsoft Windows was launched in 1985). The strategy of not licensing also showed that Apple overlooked the importance of speed in using other PC manufacturers' distribution capability to bring the innovation to market. As a result, the MacOS failed to take off as quickly as Microsoft Windows. The strategy of not licensing constrained the growth in the installed base of Apple machines, lowered Apple's capability to compete and limited the potential to create a successful platform.

Table 3 analyses the technology platforms of Apple and Microsoft. In the operating system market, Microsoft successfully established a *technology platform* which allows it to launch further related software products including scalable operating systems



Source: The author's design, based on Hill (1997)

Fig. 9. Self-reinforcing standard creation of Microsoft Windows. Source: The author's design, based on Hill (1997).

Table 3
Technology platform analysis of Apple and Microsoft.

Technology platform variables	Apple	Microsoft	Description
1 High performance relative to existing practices in several dimensions of performance	X	X	<ul style="list-style-type: none"> Multithreading – the running of programmes simultaneously Memory protection – the control of the areas of read/write of programmes so that programmes cannot interfere with each other Operating system based on the capacity of microprocessor technology e.g. from Intel's X86 series to MHz series, Itanium, Intel Core 2, Pentium Dual Core, Xeon.
2 Variety of continuing applications	X	X	<ul style="list-style-type: none"> Apple multi-touch gestures, mission controls, full-screen apps, launchpad Microsoft Windows 95, 97, 98, 2000, Windows NT, Windows ME, Windows XP, Windows Vista, Windows 7, Windows 8, Microsoft.Net, Windows.Net, WebTV product with each application focusing on different markets.
3 Intermediary serving multiple value chains	X	X	<ul style="list-style-type: none"> Apple's continuing innovations of PC, iPod, iPhone, iPad, iPad2 Windows operating system to serve PC and variety of devices Series of Apple Macintosh operating systems towards Apple Mac OS X, OS X Lion
4 Subject to obsolescence from new technology	X	X	<ul style="list-style-type: none"> Linux operating system and Sun's Java technology as a possible Windows NT alternative for the network operating system Symbian as a possible Windows CE alternative for the handheld markets Google Chrome OS, Android, iPhone OS, Windows Mobile, Sony Tablet S
5 Mostly single ownership	X	X	GUI Windows and OpenVPN GUI products by Microsoft, Apple, IBM
6 Controls channel of supply to customers	X	X	<ul style="list-style-type: none"> Microsoft controls channel of supplying Windows operating system through PC makers by pursuing the low price licensing and virtual desktop infrastructure (VDI) licensing strategies. Apple uses its iTunes channel to broaden its audiences. The launch of iOS devices – Mac iPods, iPhones and iPads is aimed at expanding Apple's customers base.
7 Utilising numerically intensive analytic processing	X	X	This applies in particular for the information highway

for intelligent devices, PCs and servers, software development tools and Internet and intranet software and technologies. Microsoft also established its business platform by pursuing a *low-cost licensing strategy* to license its Windows via Original Equipment Manufacturer (OEM) arrangements with the PC manufacturers. Microsoft's platform was reinforced by a *product bundling strategy* to include software applications running on its operating system in the OEM deal which further increased the value of Microsoft Windows to PC users, increased the demand for its products and reduced the scope for competing suppliers. The distribution strength of global PC manufacturers and the value of application programmes running on Microsoft Windows enabled Microsoft Windows to reach wide adoption and become a de facto standard. The *wide adoption* and the *de facto standard* of Microsoft Windows operating system then served as a strong platform that helped Microsoft to successfully launch subsequent Windows products such as Windows 95, 97, 98, 2000, Windows NT, Windows CE, Windows ME, Windows Media, Windows XP, Windows Vista, Windows 7, Windows 8, Microsoft.Net, Windows.Net and enter the new businesses such as the Internet browser, web TV business, computer game.

The SWOT analysis of Apple and Microsoft strategic position is shown in Table 4. At present, Microsoft Windows, Linux, Apple Mac OS X are the major competing operating systems. Linux has the advantage of providing higher security than Windows. The open source system of Linux makes it very competitive as the users do not have to pay license fee and thus could help reduce the

Table 4
SWOT analysis of the strategic position of Apple and Microsoft.

	Apple	Microsoft
Strengths	<ul style="list-style-type: none"> High-tech visionary CEO – Steve Jobs Apple is one of the most established and healthy IT brands Continuing product development iTunes music stores 	<ul style="list-style-type: none"> Ability to forecast technology trends Powerful technology leader in the operating system market Multi-function product bundling including Digital Media Player compatibility bundling
Weaknesses	<ul style="list-style-type: none"> Narrow product portfolio 	<ul style="list-style-type: none"> Software insecurity Unreliable and slow network connections and devices
Opportunities	<ul style="list-style-type: none"> Product Line Extension Product target on large population (Gen X&Y) Develop good relationship for joint ventures 	<ul style="list-style-type: none"> Cloud computing and software plus services Enhanced technology of Natural User Interfaces (NUI): voice, touch, face and beyond Natural Language Processing (NLP) technologies Technologies to enable new scenarios for viewing information online
Threats	<ul style="list-style-type: none"> Mobile phone vendors with global distribution channels such as Nokia, Motorola, Ericsson Software companies do not see Apple's products compatible with their software Free downloads of music from other online sources 	<ul style="list-style-type: none"> Free and open source software packages (e.g. Linux, Java) Software piracy

Source: The author's design.

organisation's costs. The analysis has shown that Microsoft achieved competitive advantage from its control over the technology platform and de facto standard for operating systems. The acquisition strategy to purchase software firms (acquiring software designers to work on specific Windows operating system industries) allows Microsoft to remain competitiveness in the operating system business. The ability to establish Windows OS as industry standards enables Microsoft to control the delivery channels, own the customers and enjoy a continuing advantage in the operating system market.

In the case of Apple, Apple Company, who was a market leader in the 1970s but lost its market share to IBM and Microsoft in the 1980s, has now regained its competitiveness. The strong technology platform of Apple enables it to successfully launch subsequent innovations of PC, iPod, iPhone, iPad. The success of the Apple's iPhone was based on its mobile Internet structure (the envisioning of mobile Internet). Apple, through its proprietary strategy, successfully established technology platform and brand strength. In the current market competition in the E ink market, Apple attempts to establish its own technology (tablet iOS) as industry standard. The accumulation and interaction of Apple with technology standards, technological capabilities and network externalities would increase its potential in launching new high-performance innovations.

6. Generalisable principles synthesised from the case study analysis

6.1. Technology push and demand pull

The case study analysis has shown that the level of innovation diffusion does not depend upon only conventional technology push or demand pull models. From the analysis, the delivery of mobile innovations launched by Apple and Microsoft reflects a result of dynamic interactions between the forces of technology push and demand pull (Freeman, 1982; Schmoekler, 1962; Schumpeter, 1939). The concept application is presented in Table 5. The complexities of mobile phone functions employing mobile telephony technology can be seen as technology push. However, Apple and Microsoft also emphasises the customer requirements (demand pull approach) by providing value-added solutions that satisfy the needs of the mobile Internet users with digital lifestyles. The high-speed 4G networks and the coming generation of 5G would provide an opportunity for the innovators to enhance functionality and improve consumer value in the future.

6.2. Technology S-curves

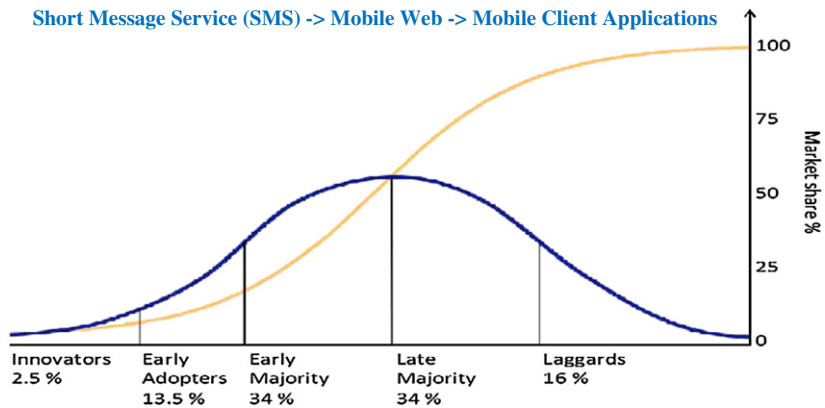
The level of technology adoption and diffusion can be seen as an S-curve. In other words, the technology S-curves reflect the adoption, diffusion and market acceptance of innovation (Fig. 10). With the improving technology from Short Message Service (SMS) to mobile Web (HTML and HXTML) and mobile client application, Apple and Microsoft compete to launch their mobile innovations which helps spur the mobile market adoption. In response to the customers' demand for web-based applications and third-party applications, the S-curve of technological innovation progresses from mobile e-market towards mobile banking to provide value-added web-based applications.

Table 5

Technology push and demand pull concepts of Apple and Microsoft case analysis.

		Apple	Microsoft	
Technology push concept	HTML5 support	Yes	No	
	Unifield inbox	Yes	No	
	Exchange support	Yes	Yes	
	Threaded email	Yes	No	
	Visual voicemail	Yes	No	
	Removable storage	No	No	
	Apps store	Yes	Yes	
	Widgets	No	Yes	
	Demand pull concept	Multitasking	Yes	Yes
		Flash support	No	No
Silverlight support		No	No	
Video calling		Yes	No	
Universal search		Yes	No	
Internet tethering		Yes	No	
Facebook integration		No	Yes	
Twitter integration		No	No	
Folder		Yes	Yes	
Apps organization		Yes	Yes	
Microsoft office support	Yes	Yes		
Media Sync	Yes	Yes		
X-Box live integration	Yes	Yes		

Source: The author's design (based on www.guardian.co.uk).

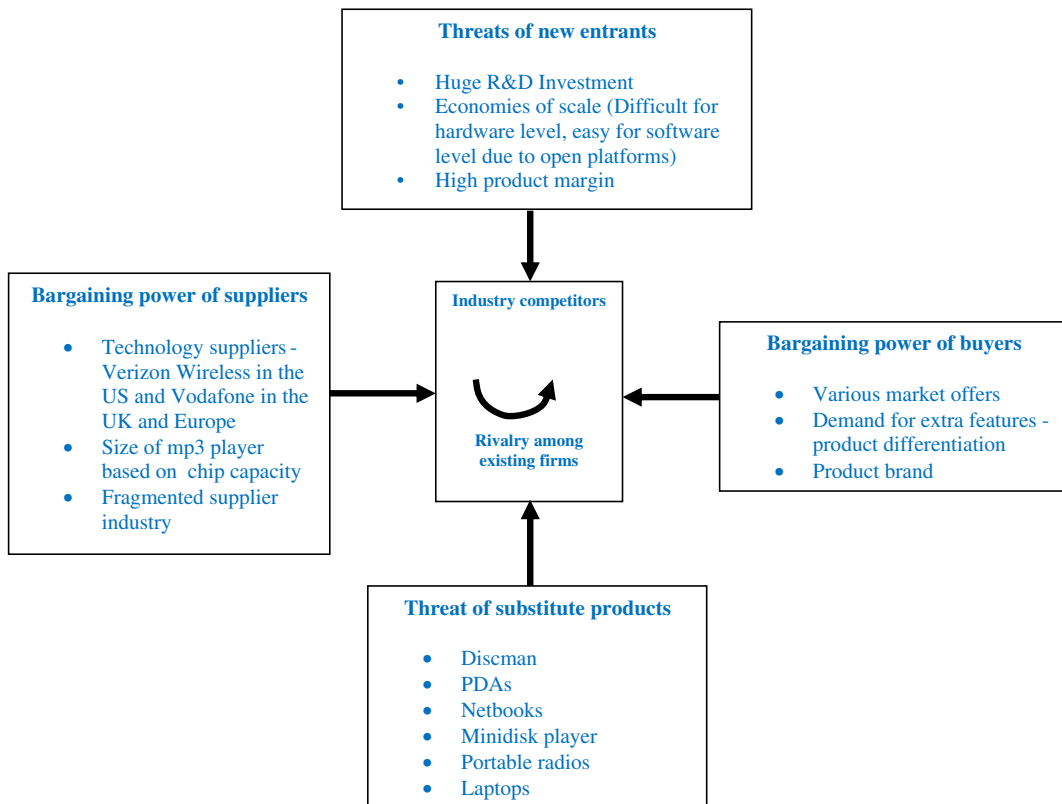


Source: The authors’ design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

Fig. 10. Technology S-curve concept of Apple and Microsoft case analysis. Source: The authors' design, based on Utterback and Abernathy (1975) and Fisher and Pry (1971).

6.3. Five forces Porter

The Five forces Porter application in the comparative innovation case analysis of Apple and Microsoft is shown in Fig. 11. The five forces driving industry competition are: Bargaining power of supplier, Bargaining power of customers, Threat of new entrants, Threats of substitute products or services, Rivalry among existing competitor (Porter, 1980, 1985). It is argued that the innovators'



Source: The authors’ design, based on Porter (1980)

Fig. 11. Five forces Porter concept of Apple and Microsoft case analysis. Source: The authors' design, based on Porter (1980).

strategies are influenced by these forces. Upon the innovator's awareness of the forces, Apple and Microsoft attempt to find their positions in operating system technology by targeting the mobile market. However, the market position of Apple and Microsoft is vulnerable to attacks from competing companies such as Google's Android, RIM's BlackBerry OS, Linux, Palm/HP's WebOS, Samsung's Bada, Nokia's Symbian, Maemo and Meego among many others. Porter's approach is helpful in its consideration of outside forces which cause innovators to be proactive in their selection of strategies, particularly the strategies of mobile Internet and mobile commerce.

6.4. Technology standards and platform

The case study analyses have shown that the ability to establish an industry standard enables an innovator to create competitive advantage. In other words, the ability to establish an industry standard provides a platform for an innovator to excel at the innovation process by generating a continuity of commercially successful innovations. In the current competition, Internet and mobile telephony can be seen as a technology platform. The mobile operating system empowers the processing capability of PCs providing a range of applications with greater levels of intelligence to the users. For example, Apple iOS, which is derived from Mac OS X, provides a technology platform for the launch of successive innovations of iPod, iPad and iPhone; Microsoft Windows Mobile provides a platform for the launch of successive versions of pocket PCs and smartphones. Apple standards of quality as well as its huge App store enable it to recreate the mobile phone innovations. Microsoft Windows Mobile standards with the integration features of the office suite, Outlook, Internet Explorer and Windows Media Player provide an effective technology platform to launch various mobile applications.

7. Conclusions and avenues for future research

This paper revisits the cases of Apple and Microsoft to analyse the technology strategy and standard competition. The study attempts to understand innovators' pursuit of strategies in securing the benefits from an innovation, based on the innovation life cycle model. From analysing the process of technology platform creation, a new methodological framework for the case study analyses, the results have shown that the innovators' use of strategies is consistent with the potential of platform creation. The following implications appear to be important in managing innovations.

The ability to establish the innovator's own technology as standard provides a route to competitive advantage. This is because standards can help create network externality effect through compatibility. Also, standards help tie in the customers since standards allow the creation of a base of compatible users, making it difficult for any competitors to capture on an individual or niche basis. For example, by owning the delivery channels through PC manufacturers, Microsoft effectively captured PC customers. The analysis has shown that the capability to own the customers can be seen as strategically important since it serves as a base enabling the innovator to offer further innovations. The ability to control the delivery channels as well as the customers enabled Microsoft to create a business platform and enjoy a continuing advantage.

The study has shown that technology platform emerges from a combination of strategies. The study suggests that the platform needs to be consistently upgraded/renewed to maintain a platform advantage. Microsoft consistently improves its technology platform and business platform by purchasing/acquiring software firms whose software applications could be bundled into the Windows operating system. Apple transferred the lessons learnt from the Lisa project to the Mac development projects to launch smaller, faster and much less expensive computers. Apple used the knowledge learnt from the earlier Mac projects to build the product champions (reconceptualising the personal computer and transforming it into new iPad tablet computer – Apple iPad).

It could be argued that technology could render competitive advantage to innovators. However, over time, the technology platform in competition tends to be open to allow plug-in of various applications which would create increased value to customers. At present, it is interesting to see Apple's step into the new standard competition in an attempt to lock-in E ink innovation through its technological platform in the operating system market and brand strength. However, it would be empirically observable in the long run to see the results of standard competition (standard competition among Apple iPad tablet, Amazon Kindle Fire tablet, Barnes and Noble Nook, Sony Reader).

7.1. Avenues for future research

The comparative innovation case analysis of Apple and Microsoft suggests some thoughts on strategic management of innovation. The issues of technology standards and platform are important to enable the operating system to run on any machine, processing the same applications as well as to achieve technical and data content compatibility. They also help accelerate the market development to achieve the level of innovation diffusion under the changing market circumstances. Given that competition in the future would involve competition to establish new standards for the interworking of products and services supplied by a number of different vendors such as Symbian OS, BlackBerry OS, Android OS, Palm web OS; further research in the area of technology strategy, particularly the strategies to establish industry standards and platform will thus be more useful in terms of market development. The players in the mobile market may use this empirical analysis to define strategic approach for their plan to compete in the mobile market launch.

Acknowledgements

This work was supported by the Higher Education Research Promotion and National Research University Project of Thailand, Office of Higher Education Commission.

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