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Hardware and Software Interdependencies for the Purpose of Standard Creation: the Microsoft case

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Abstract

In high technology and fast paced industries, the creation of standards has always been a pivotal element in every business strategy. The standard owner can capitalize its investments in terms of royalties and/or market share. In particular, this paper aims at reviewing a specific case about standard creation, demonstrating how it can stem from a precise, intentional longterm strategy. More specifically, this research will cover how Microsoft has been using its hardware product portfolio (Surface, Lumia, Xbox, Band, HoloLens) to a) either set (i.e. Surface and HoloLens) or adapt (Lumia, Band) to a physical product standard, and b) create the basis for a universal software environment called Windows 10, thereby imposing its standard of universal operating system. By using the Microsoft case, this study may show how innovation and strategy merge in a real, global, and fast-paced scenario, helping identify the major components of standard creation in the IT sector. In order to make such progress, this paper will use public information, market data and an interview to Luca Callegari, Microsoft Italia's Category Lead. The results will be compared to the literature framework provided in order to understand how does the strategy align to existing studies, and they will highlight new insights stemming from the analysis. In this way, it will be possible to understand major differences and novel elements brought by Microsoft.

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Chapter 1: Introduction

In the last decade, the IT industry has seen major disruption and evolution. Since the advent of the iPhone, devices have deeply changed and have become smarter and smarter. But while smart hardware devices are mostly based on existing standards for design and quality, there exists an historical fragmentation in the operating system market. Windows, Mac OS and Linux still compete for billions of potential devices, in different ways and with different value propositions. But what if a company managed to deploy a winner-take-all strategy? This research discusses how Microsoft's evolution towards a "devices and services" company favored its software by means of new, innovative and proprietary hardware. The latter is analyzed in order to understand both technical qualities and strategic roles. The portfolio comprehends brands as Surface, Xbox, Lumia, Band, and HoloLens, in order to respectively cover 2-in-1 hybrids, gaming consoles and entertainment, phones, fitness and health, and augmented reality. Such portfolio represents a significant sample for both current and future product segments, enabling the analysis of Microsoft's short and long term strategy. For each product, the research provides a history of major events and their evolution from concepts to final products. Additionally, the chapter provides the necessary context for every product, by using descriptive statistics and market data. While it is not shown any competitor analysis, the study highlights major competitors in the relevant categories, but it must be clear that the Microsoft case does not relate well to hardware competitors. In fact, the study shows that Microsoft's hardware portfolio is meant to be an innovation showcase for Original Equipment Manufacturers, additionally to successful products. Hence, I describe the portfolio as able to stimulate healthy competition, while at the same time create a market fully based on a universal operating system.

First of all, the research provides a literature framework comprehensive of the necessary concepts for readers. It provides a definition of IT and a description of market statistics, in order to build a context for the following analysis. Secondly, it reviews fundamental researches about IT industry's macro forces, i.e. price discrimination, search costs, switching costs, bundling, and network effects. In particular, the literature reviews focuses on standards,

which are the main contributor to thesis here showed. In fact, it is crucial to understand how standards are created, and what direct and indirect consequences are for both companies and consumers. Hence, the analysis is based on the concept of both product and nonproduct standard, alongside with most common strategies for mass adoption and therefore standard creation. The academic discussion about standard creation is quite prolific, and decades of research have showed the importance of this market force, due to its winner-take-all nature, able to shape the market itself. Hence, the objective of this research is to show interdependencies between hardware and software for the purpose of standard creation. In particular, I will leverage the Microsoft case to show how software and service adoption can be fostered and supported by the development of proprietary hardware, in particular Surface hybrids and Xbox gaming consoles. By pushing the market towards new path of innovation, Microsoft is also able to steer adoption towards its own products, effectively creating synergies between hardware and software. In this way, it is possible to create a universal operating system standard, whose name is Windows 10, and surround it with additional attached Microsoft's services. This research can therefore contribute to the standard framework by showing a real-case implementation of theoretical insights and at the same time providing a baseline for practical analysis.

The research is built through five chapters, whose first coincides with this introduction. In the second chapter, I analyzed the existing theoretical framework, from a broad definition and description of the industry to a deeper approach to macro forces and their implications for business and consumers. The third and the fourth chapter describe relatively the case and compares it to the theoretical concepts, thereby stacking real-case information to the literature framework, in order to provide a comprehensive understanding of the topic. Finally, in chapter five I conclude by overviewing the paper's logical process and results and by providing insights for future research. Chapters are divided into paragraphs to simplify notions and logic understanding.

Chapter 2: Literature Review

Information Technology can be defined as (CompTIA, 2016):

"The utilization of computing via hardware, software, services and infrastructure to create, store, exchange and leverage information in its various forms to accomplish any number of objectives. Additionally, the term encompasses the workers that develop, maintain and utilize information technology directly or indirectly"

As figure x shows, the wide scope within each single category does not manage to define precise borders for the IT sector, including consumer and business separation.



Figure 2.1 Elements defining IT. Source: CompTIA, 2016

In the last 20 years, the IT industry has massively grown in numbers, reaching \$3.7 trillion in 2016, and it is predicted to reach \$3.8 trillion in 2017, of which 28% concentrated in US (CompTIA, 2016). According to the same report, this is also due to how blurred are IT sector's borders, since incorporation of new technology waves in other industries (such as the Internet of Things) is increasingly transforming IT into a pervasive sector. Globally, hardware, software

and services make for 59% of total spending, while the remaining 41% relates to telecommunication. Local allocation can vary depending on market maturity of each segment, as for US hardware, software and services, which peak at 70% of the total share. This staggering growth is mirrored by employment data analysis: in fact, while US is facing 5% unemployment rate as of December 2015 (US Bureau of Labor Statistics), the same rate is halved in the IT sector, reaching 2.6% in the same time frame. This is a clear indicator of demand for both IT products on the business side and high-level skill specialization on the knowledge one. Moreover, the global industry is expected to grow overall at 4.9% rate, with upside scenario at 7.1% and downside at 2.7%.



Figure 2.2 IT Industry Consensus Growth Forecast. Source: CompTIA, 2016

Still, this industry is characterized by a fast, innovative pace, which causes continuous disruption for dominant firms, as the HP case clearly explains: Hewlett Packard, one of the most known brands in IT business, has split into two different enterprises in 2014 (HP Press Release): Hewlett Packard Enterprise and HP Inc. . The restructuring was needed in order to optimally address innovative product roadmaps (Hewlett Packard Enterprise), and at the

same time exploit the existing computing and printing businesses, which is the predominant source of cash flows (HP Inc.). And still, it is not just about legacy industry vendors. In fact, research from IDC and Forrester shows five key changes that are likely to happen in 2016 within the IT sector (CIO, 2015):

- 1. *Legacy vendors disruption*: as anticipated by the HP case, legacy players will face serious difficulties, with one-third expected to be out of business end of 2016. This is related to how the industry is changing, not to specific enterprises facing difficulties.
- Cloud providers' higher concentration: major providers are expected to grow even more and gain market presence, resulting in a smaller option for consumers and higher barriers to new entrants (increasing troubles for legacy vendors).
- 3. *Big Data pervasiveness:* while cognitive features are included in only 1% of today's apps, by 2018 (according to IDC) it will be 50 times more. Analytics will become pervasive, and major players are already preparing for this new technological wave, with the result of increasing industry concentration due to high storage costs.
- 4. Digital Transformation at the core: traditional enterprises are increasingly becoming software companies, exploiting open source mechanics and selling cloud services. IT has changed from a supporting role to a core one, evolving into the main driver for profitable business.
- 5. *Developers scarcity*: finally, revolutions require new skills, and companies will enter a job market quite scarce of the right talents. This is in line with BLS data analyzed above, confirming how the job market will change in the next years for IT companies.

It is then straightforward how the IT industry is fast-paced and innovative, where new technologies' disruptive action causes the phenomenon called "creative destruction", as defined by Schumpeter (1942). In fact, legacy players who fail to adapt are easily dethroned by new entrants or faster incumbents, in a continuous search for the right design and/or technological standard. In particular, every high-technology industry is influenced and shaped by a precise set of economic phenomenon described by Varian (2001), who reviewed the major forces acting within the industry. In this way, it is possible to deeply understand the context in which major IT enterprises as Microsoft operate on a daily basis. I will review the

most important macro forces, and integrate the analysis with additional literature and realworld cases.

- Price discrimination

Information technology allows for much finer product customization and personalization, which allows for higher, more tailored prices. At its best, it would be defined as "first-degree price discrimination": when firms manage to capture the totality of consumer surplus by setting the optimal price. In fact, online retailers are used to adjust their prices in much finer steps, and in a highly frequent pattern with respect to traditional retailers (Brynjolfsson et al., 1999). At the same time, Varian underlines how offline and online competition undermines this scenario, hence even online retailers cannot fully capture consumer surplus when using profiling and behavioral analysis. Still, purchasing histories from a single customer can increase the supplier's knowledge, thereby creating a different level of information between competitors in a single market. This allows for higher personalization, and more generically a competitive edge for surplus capture. Privacy has therefore become an important subject in order to understand how to create optimal transactions for both enterprises and consumers. Second-degree price discrimination happens in case of market segmentation, i.e. when prices of different products are fixed and widely available. In the IT sector, it can be exploited by "versioning" the information or product available, while striking a balance between high-end and low-end offering, in order to avoid cannibalization from potential customers. Finally, thirddegree discrimination coincides with selling to different groups at different prices, and it is the most common.

- Search costs and benefits

This is probably the most common advantage of Internet technology: searching costs have become much lower, while the activity per se results in higher consumer information and therefore optimal transactions. Still, companies can adapt and adjust their offering in order to charge a lower price to informed, searching consumers and higher price tags to uninformed customers. By using focus group interviews in behavioral analysis, it is possible to distinguish between knowledge and choice uncertainty in the process of consumers' search (Urbany et al., 1989): the first element refers to uncertainty about existence of product alternatives, while the second distinction happens when a choice must be made among the existing alternatives. It is straightforward that choice uncertainty leads to increased search, in order to understand what is the surplus maximizing choice. In this case, search costs and benefits are ambiguous depending on many different variables i.e. time, final output. In the case of knowledge uncertainty, the authors found that it had a weak negative correlation with searching behavior. While difficult to interpret, the answer could be related to the perception of search costs. In fact, in case of absolute uncertainty about whether a specific alternative does exist, perceived search costs could be higher than the choice uncertainty scenario. The relation between standards creation and search costs and benefits is complicated, since a new standard leads to both less market confusion (due to specific agreed requirements) and multiple similar alternatives, whose effect on buyers' search behavior is undetermined. The effect of standards will be further analyzed in the next sections.

- Bundling

Bundling happens when two goods are sold together at a single price. According to Varian, it is financially attractive for IT enterprises, since marginal costs are negligible (in case of pure information products). In the Microsoft case, bundling is used both for hardware and software platforms: in the first case, Xbox and game bundles are common, as well as Surface and accessories offers; in the second case, the most common is Office, which is marketed as a bundle of different tools, thereby capturing more surplus due to their negligible marginal cost (Bakos et al., 1999) and deterring new entrants, since market gaps are reduced (Nalebuff, 1999). This strategy can also explain the market dominance achieved by the Office suite against incumbents and new entrants when first introduced. Bundling strategies can also be explained by using microeconomics basic principles: in fact, customers have a reservation price for the goods they desire, and unbundled products would result in the purchase of goods whose price matches the reservation one. By bundling products, firms allow consumer surplus to be transferred from one good to another, thereby compensating higher-than-

reservation prices with lower ones (Skiera et al., 2000). Moreover, the same study observes how bundling can be profitable in case of products with different profitability rates, i.e. when it is strategically optimal to attach the most profitable product to the sale of the worse one.

- Switching costs and lock-in

Switching costs incur when a consumer changes supplier, product, and/or technology. In the IT sector, switching costs can easily cause the so-called "lock-in", which, as the name suggests, can lock the consumer (and large organizations as well) in a specific technology. Still, such phenomenon has an ambiguous effect on consumer surplus: in fact, while decreasing satisfaction when a switch is necessary, it can increase competition in the market and create valuable propositions. On the long-term, it can be argued that switching costs harm consumer surplus, by causing higher prices, and therefore deadweight loss (Klemperer, 1995). This is pivotal to understand the strategy behind a standard universal OS as in the Windows 10 case here discussed. In this sense, future compatibility determines switching costs magnitude. In fact, the higher those costs, the more profitable standard creation becomes (Marukawa, 2014).

- Network effects

Network externalities can be direct or indirect: the former indicates how consumer surplus deriving from a specific product (and therefore the demand for it) is positively correlated with the size of the installed base, while the latter happens when the adoption of a certain good critically affects another one, not being directly related. Practically, Windows 10 installed base can determine the number of contents developed for that platform (indirect network effect), and also increase Xbox and PC gamers' satisfaction by enlarging multiplayer base (direct network effect). Moreover, the higher the Office suite installed base, the easier the exchange of files (due to compatible formats). Hence, information technology is heavily influenced by network externalities. According to Varian, they easily relate to price discrimination, since early adopters can be attracted by offering "penetrative pricing", and to lock-in, since the

bigger the installed base, the easier is to adopt it for new customers (and the harder to not do so). Network effects also change the sustainability of pioneer radical products in an ambiguous way (Srinivasan et al., 2004). This kind of goods is defined as a new type incorporating novel core technologies and hence providing sensitively higher benefits to the final customer (Chandy et al.,1998). Radically innovative products can face inertia in market adoption, but according to Srinivan et al. (2004) the positive effects of network externalities can overcome the costs of inertia in early life stages of the new product. At the same time, later entrants will refine the technology and launch new market-ready offers that lower the value of pioneers' investments. In this case, the effects of network size is negative.

- Standards

Finally, the most important concept for this case: standardization and emergence of dominant designs. According to Varian, standardization is related to the concept of network externality, since value of networks depends on their size. In fact, standards can increase potential customer base and therefore market size, boosting profitability for both standard owners and standard adopters, who can offset reduced market share with larger market size. But what is a standard? It can be defined as the equilibrium between user needs, technology level and producers' costs, respecting public authorities' constraints (Germon, 1986). More practically, it is a set of fixed product specifications to be conformed with (Tassey, 2000). In the same study, Tassey highlights how standards allowed society to achieve higher levels of efficiency in the production area, facilitating transactions between different parties. The role of standards is now complex, facilitating both economies of scale of single, uniform goods and manufacturing of different variety of products. It is clear how R&D plays a leading part in standard development. By looking at Figure 2.1, it is possible to sense the complexity and the interdependencies between market forces and technology private development.



Figure 2.3 Technological and market forces in standard creation. Source: Tassey, 2000

Technically, the science base allows for the development of generic technologies, which can become market standards ("proprietary technologies") only if supporting infratechnologies are present, i.e. the necessary infrastructure that makes a market application feasible. Of course, R&D substantially differs from one area to another. The red flow instead represents market forces, where entrepreneurial activity and strategic planning lead to the production phase, while risk reduction facilitates market development, and eventually, value added. Regarding standards features, Tassey identifies four different types and two different subjects. The four types are (Tassey, 2000):

- "Quality/Reliability": the standard aims at specifying a basic level of performance, on which market players decide to compete at a level of price, while respecting the baseline, or quality, by differentiating the product.
- 2. *"Information"*: in this case, standards are useful to set tests, criteria, measurement methods, and information disclosure, whose scope is to reduce transaction costs. A

secondary, but equally important advantage is an increased R&D efficiency, since doubling of efforts phenomenon are less likely and research verification is less costly.

- 3. "Compatibility/Interoperability": this type specifies required dependencies for the product in order to be compatible with complementary goods. The most common case is interface standards between single systems' components, which is advantageous for both suppliers, who can innovate on both sides of the interface, and consumers, who can decide which components better suit their needs.
- 4. "Variety Reduction": one of the most common types, as it allows economies of scale. A clear, modern example can be identified in computer file formats. In this case, while standard agreement may happen through industry consensus, it is also the case for market wars, where the dominant winner sets its own standard, thereby automatically forcing the competition to adapt. Hence, as Tassey underlines, it can be a complex area, since this type of standards can either foster or harm innovation.

Secondly, standards can be divided into two other categories: product-element and nonproduct (Tassey, 2000). In the first case, one single product element is determined by a standard, and market forces are the most common creators in this sense. In fact, either gain of market presence or monopolistic position can determine what is adopted at an element level. This mechanism loops within the product's lifecycle: as product's life length increases, the more the industry standardizes single elements. Hence, in the long-term, this process usually leads to a shift from premium to commodity prices, and to service-focused businesses. Instead, nonproduct standards refer to technologies that are not linked to specific product attributes. More specifically, they include infratechnologies and basic standards set by public consensus, and they can be considered partially or totally public goods. According to Tassey, standards can have an impact on market structure: in fact, an higher degree of openness of systems in the market allows small and medium businesses to build competitive advantage and retain market share. On the opposite side, closed systems increase likelihood of market concentration, since the incumbents' market share play an important role in determining the available products.

Finally, the aim is to provide a clear understanding of standards' disadvantages and economic costs for society. In fact, both types are related to suboptimal scenarios, in which standard

solutions do not coincide with the best-case outcome. First, product-element standards are effective since they create "lock-in" spillovers, both on demand and supply sides. The demand side can be reluctant to switch to new standards due to sunk costs (learning costs for example), thereby maintaining a suboptimal technology. Similarly, incumbent firms on the supply side steer towards evolutionary innovation, instead of revolutionary, since there is no economic interest in moving to a new standard and not harvesting recent investments to their full extent. Non-product standards are not as dominant as product-element ones, but they can still induce subtle costs. According to the author, non-product standards do provoke economic costs in three specific cases:

- 1. "Multiple standards for the same technology": in this scenario, consumers face higher costs due to confusion for a different set of tests and metrics, while at the same time raising inaccuracy issues due to bonds with legacy infratechnologies.
- "Poorly designed standards": linking to point 1, standards heavily influenced by legacy elements can result in market inefficiencies. In such case, industry consensus represents a possible solution, despite being unlikely.
- 3. "Poorly timed standards": delays can increase transaction costs, especially for small firms, which need standard interfaces in order to supply single elements or simply enter the market.

Hence, standardization in itself needs proper designing in order to outweigh possible costs. After defining the concept of standard and its consequences, it is useful to analyze how firms interrelate in the process of setting it. In general, we can identify three different events: standard war, negotiation and leadership (Varian, 2001). In the first case, companies compete by using different and more or less aggressive market strategies in order to achieve the critical mass threshold for standard adoption. Common strategies are:

 Penetration pricing aimed at the creation of an early base (Besen et al., 1991). The most extreme form is probably the open architecture strategy, when a firm values ubiquity more than exclusivity (BSR, 2005). In fact, by adopting a free architecture, the company can achieve higher engagement of "complementors" and rapid spread, which becomes an even stronger argument if disadvantages of patents are considered: it is difficult to set the right boundaries inside the patent document, and competitors can perform reverse engineering. If the company struggles to define the correct patent and/or faces enforceability issues, it should also determine potential benefits of delivering an open architecture in the market.

- Licensing agreements (Hill, 1997): by licensing a specific technology to existing firms, including competitors, it is possible to increase the installed base and earn market approval. In fact, it enables wide distribution, which fastens economic returns (as they are increasing depending on installed base). Secondly, it increases investment costs for competitors that are focused on different, competing technologies, thereby creating a co-opting mechanism. Finally, it increases development of complementary goods. On the other side, risks for this strategy are related to subsequent technology development: in fact, competitors can develop improved in-house versions of the licensed technology, thereby avoiding to pay royalties. Moreover, licensing agreements increase the number of suppliers, which results in higher offer and competition, i.e. lower prices.
- Alliances with suppliers focused on complementary goods creation: Hill (1997) defines an alliance as "a cooperative agreement between a firm and one or more actual or potential competitors to jointly sponsor a technological standard". In this case, the focus is on coordination between different players. According to Hill, this strategy is particularly effective, as it brings specific advantages in common with the previously described licensing strategy: wide technology distribution, competitors co-option, and public commitment to the technology (therefore building expectations). This option is especially valuable when competitors are already ahead in terms of product development. An alliance differs from a licensing agreement, since by combining two committed standards into one, the alliance is able to capture the industry's attention better than a pure licensing agreement, thereby attracting at the same time customers and other potential business partners, in particular complementary goods suppliers (who rely on industry-wide adopted technology). From an industry point of view, the creation of such supportive network provides momentum to achieve critical mass and convince other important players to join (BSR, 2005). Complementary goods creation

is also fostered by commitment of alliance partners to diversify already in such goods. Finally, the combination of two well-developed technologies can give birth to a superior standard, increasing economic welfare (Hill, 1997).

- Public expectations management, i.e. announcements (Besen et al., 1991).
- Promise of competitive prices (Besen et al., 1991): it is worth mentioning how it was used by Microsoft in the Netscape-Internet Explorer war. It began in late 1997, when Microsoft released Internet Explorer 4 embedded into its own operating system. At that time, Netscape had achieved 72% of market share and it was enjoying the dotcom bubble era. By controlling the gateway to the internet's information, the winner could rip massive economic benefits, as online web owners would have paid to be highlighted inside the browser interface. While market share favored Netscape, Microsoft had two important advantages (Internet History Project, 2004): it was a financial giant with access to infinitely more resources than Netscape; it owned the market dominant operating system, which could be used as leverage for fast IE penetration among users. Microsoft also executed licensing strategies with major industry players, to favor IE against Netscape in many different ways. Notably, the most important is the "attack" on the server side. In fact, Netscape finance was based on selling server software. Microsoft bundled web server software into its already developed server Windows release, which contributed over time to the erosion of Netscape sales and profits. In late 1998, Internet Explorer achieved 98% of market share, winning the browser war. As of 2016, it stays at 21.4% (netmarketshare.com), on par to Chrome by Google, stressing how the IT industry is fast moving and how disruption forces change the economic scenario quickly.

Moreover, companies must try to invest more and better than its competitors (BSR, 2005), and this basic strategy applies to almost every scenario. Huawei probably represents the most fitting real case for this purpose: in 2012, the company invested 13.7% of its revenues into R&D. Did its strategy compensate the effort? Yes, as the company grew by 37% in 2015 and by an expected rate of 23% in 2016 (Reuters.com, 2016), becoming the first Chinese handset vendor (outperforming Lenovo and Xiaomi) and increasing its profits by 32%. Hence, Huawei truly managed to leverage its R&D investments compared to competitors.

Instead, in the case of negotiation, different players do agree on the necessity of standards, while pushing their own in the negotiation. While the process can be supervised by official bodies, mistrust between parties is the most common enemy, since disclosure of proprietary technologies does not always happen in a transparent and complete pattern. Finally, standard leaders are incumbent enterprises that develop proprietary standards, while smaller players seek compatibility and interconnection. A common solution is represented by adapters (Farrell et al., 1992), which can induce ambiguous economic effects. In fact, the higher the need for compatibility, the worse the economic costs of adapters, since the real degree of compatibility is lower. It is also important to enable increasing returns, for both the company and the final customer (BSR, 2005). By being compatible, it is more likely for a new technology to become a market standard. Moreover, the likelihood is influenced by production costs (BSR, 2005), since low marginal costs will ease the process of market penetration from one side, and increase the returns from a marginally wider market share, making the technology more attractive. In fact, it is obvious to state that every firm is recommended to build global reach, for both reasons quoted above (higher chances of standard creation and boost in profitability).

At core of Varian's framework lies the fact that strategic options for succeeding in industries highly sensitive to standards are and must be all aimed at one, single purpose: achieve a critical mass of adopters. Quoting Hill (1997):

"Three guidelines for success in industries where standards are important and increasing returns exist are: maximize installed base, maximize installed base, and maximize installed base."

There exists a real case for this guideline, which managed to fully represent the concept of embracing installed base: Tesla. This company, as quoted on its website, produces electric vehicles, whose first was launched in 2008 (Tesla Roadster). But why does it fully represent Hill's imperative quote? First, and probably most importantly, the concept of installed base is at the core of the company's mission:

"Tesla's mission is to accelerate the world's transition to sustainable energy".

Hence, by focusing on the transition from fossil energy to sustainable technologies, it aims at increasing the installed base of sustainable products (electric vehicles and batteries). Still, it could be argued that every enterprise agrees on increasing its own products' installed base. But Tesla's mission brought in 2014 a drastic novelty in corporate strategy, directly embodying the company's core values and business scopes: it made available its intellectual property to third parties for free, likewise to open source goods (Tesla Press Release, 2014). In fact, while patents are by definition a monopoly over a certain technology and therefore a crucial tool for business success, they incarnate at the same time the concept of a concentrated market: competitors are not able to produce what the incumbent can. Instead, Tesla sought a strategy that could easily foster electric innovation in the car industry. Quoting the press release (2014):

"Tesla Motors was created to accelerate the advent of sustainable transport. If we clear a path to the creation of compelling electric vehicles, but then lay intellectual property landmines behind us to inhibit others, we are acting in a manner contrary to that goal. Tesla will not initiate patent lawsuits against anyone who, in good faith, wants to use our technology."

Hill would probably agree with Tesla in this case. While patents are one of the most important tools for innovation and market sustainability, they harmed electric vehicles' installed base growth. This strategy has obviously resulted in loss of royalties, but it will help in achieving critical mass and therefore increase market size. Proper evaluation of costs and benefits is therefore needed also for traditionally successful strategies.

A second real-life case can show how companies that aimed at installing a sufficient base of their products, managed to achieve critical mass in spite of more traditional strategies. This case is PayPal, whose value proposition coincides with transferring money through emails, by leveraging existing financial infrastructures in real time (as stated on the company's website). In 1999-2000, PayPal was facing the most common issue for modern startups: how to achieve fast growth before new, better entrants could do. The answer was as contradictory as simple: give money to customers (Thiel, 2012). The company credited 10\$ to new customers, and the same amount for a successful referral from existing users. Obviously, viral growth

was achieved exponentially, with a substantial cost attached. Still, by executing such strategy, PayPal managed to both create a sufficient installed base and generate market rumor around it, finally attracting investments that enabled the company to switch to a different growth campaign. Also in this case, it is clear how the "installed base" mantra was at the core of daily strategies. It is worth highlighting the clear link between Tesla and PayPal: they were founded by the very same person, Elon Musk (currently CEO of Tesla, among others). Hence, it is acceptable to state that setting a market standard is also about the correct company mindset, by understanding the compromise between profits and base growth.

In the next chapter, I will show the Microsoft case, while the fourth chapter will explain how it relates to the theoretical framework here provided.

Chapter 3: Case Description

This research aims at describing the events that forged Microsoft as it is now, in order to explain its recent change of strategy and how it relates to the existing theoretical frameworks. This section will introduce Microsoft history, underlining major positive and negative events. In particular, this study aims at suggesting that Microsoft's market entrance into consumer hardware products was not due to a business opportunity per se, but as a chance to create synergies and increase returns of its Windows 10 platform. Moreover, this section will highlight how the vision of Windows 10 at the core of Microsoft's environment was fostered by the advent of the new CEO, Satya Nadella, in 2014.

As quoted on Microsoft's Windows website (windows.microsoft.com), the company was founded in 1975 by Bill Gates and Paul Allen, and it started selling a computer language product for PCs called BASIC. In 1978, sales exceeded 1 million dollars. The company entered a new age in 1980, when Steve Ballmer, former colleague of Gates in Harvard, joined Microsoft. IBM approached the company in order to develop an operating system, novelty at that time, in order to deploy a software base on which run other applications. It was called MS-DOS, which stands for "Microsoft Disk Operating System". It was still lacking a User Interface, or UI, and every command had to be typed in the famous format "C:...". The company started working from this precise flaw, and announced in 1983 Microsoft Windows based on MS-DOS, in which users could use the mouse to point and click objects of interest and interact with them. The first retailed version was sold only in 1985. It came bundled with other first-party software (Paint, Notepad, and Calculator among the others). Microsoft upgraded MS-DOS at the end of 1985 through the release of Windows 1.0, which added a graphical interface to the operating system. At the end of the financial year of 1985, the company had already reached 140 million dollars in revenues. It was only a matter of time before the company went public, event that happened in March 13th, 1986. Stocks were sold at \$21, closing at \$28, starting the public era of Microsoft. Just a few days before, the company had moved to Redmond, Washington, where it is still located exactly 30 years later, in 2016. In 1988-1989, two major events are worth mentioning: first, in 1988 Microsoft became the largest PC software company throughout the world, as Personal Computers

where starting to integrate with humans' everyday life; secondly, in 1989 it released its signature software, Office, a bundle of productivity applications, among which Word and Excel. Windows 3.0 was released in 1990, which together with version 3.1 retailed in 1992 sold 2 million copies in two years. The operating system even started to include famous games like Solitaire, exploiting advancement in graphic technology.

But the Internet wave had started, and Microsoft embraced it releasing Windows 95 in 1995, selling 7 million units in 35 days. It had built-in internet support, and it featured one of the most famous icons of the last decades: the Start button. Moreover, as already mentioned in the literature framework, the first version of Internet Explorer was released and bundled to the operating system from late November 1995, entering a browser war that it subsequently won, as described above. At the end of 1995, Microsoft's shares were traded at a close price (adjusted for dividends and splits) of \$3.8, in volumes of dozens of million shares. In 1998, there is a neat shift in strategy, as the release of Windows 98 in June aimed directly at the consumer market. In fact, computers are quite more common among average customers and cities' internet cafes. Among the new features, it included version 4.0 of Internet Explorer, showing the renewed efforts for the Internet network wave. Under Steve Ballmer lead as president and CEO, starting in 2000, the company released one of its most successful products, Windows XP, a 45 million code lines product. Among its improvements, the most famous one is the refreshed User Interface. To understand the magnitude of its mainstream penetration, after 15 years it is still installed on 10.63% of the existing customer base, 5 percentage points below Windows 10's market share (netmarketshare.com). Its success also started the exponential growth of viruses and malicious software, with Microsoft forced to release periodical security updates to limit external threats and to increase consumer awareness of such dangers.

The first sign of Microsoft's strategic shift towards a fully integrated entertainment environment became clear in 2005, when the company released the second version of its gaming console Xbox, the Xbox 360. While the first iteration lagged behind Sony's PlayStation 2 (venturebeat.com), selling around 24 million units, the Xbox 360 managed to sell 84 million machines, beating Sony's PlayStation 3 of a small margin. The installed base, together with Xbox Live online services, gave Microsoft a strong presence in gaming, both on PCs and on consoles.

In 2007, Microsoft announced Windows Vista and its focus on security and design. Still, the operating system required higher-than-average computing resources and it caused many users to skip the upgrade cycle in favor of Windows XP (and Windows 7 later). In the same year, Office Suite 2007 made its entrance. After only two years, Microsoft released Windows 7 after a beta test involving 8 million users, in a time where laptops had become the new desktops in terms of market growth and availability. Together with the new operating system, it entered the market of search engines by developing Bing, which will be better analyzed in the following paragraphs. Moreover, it launched Office 365 in 2011, a product specifically aimed at exploiting cloud technical advantages and able to switch between different personal devices.

Starting from 2009, it may seem that market accelerated in terms of quality and technology demand. In fact, the average Windows upgrade cycle changed from 5-6 to 2-3 years. As a matter of fact, Windows 8 was released in 2012, and revised by the Windows 8.1 Update as early as 2013. In this time frame, touch devices had already become the standard in mobile computing thanks to Apple's iPhone disruption. Microsoft tries to revamp its operating system. overhauling the user interface in order to best fit the experience for touchscreen-equipped devices. Windows 8.1 also bring a new feature called Cortana, a digital personal assistant that leverages consumer behavior and preferences to provide a tailored service (and hence higher value) to the final user. Microsoft has entered a hectic new era, both in software and hardware. In 2012, it launched the Surface line, a new 2-in-1 hybrid device designed to both provide a Windows complete experience and boost mobility usage through its touchscreen device and small size. In this way, the company created the guideline for a new industry segment, which will be further analyzed later in this section. In 2013, Microsoft launched the second version of Surface and the new gaming console "Xbox One", competing with Sony's PlayStation 4. While it may seem a minor feature in the Windows context, the announcement of Windows 10 stated very clear that Cortana would have played a major role both for the end user and the company. In 2014, Microsoft appointed Satya Nadella as new CEO, who brought a radically different strategy, which is Windows 10-centric and aimed at accelerating the installed base (in this year, Office for iPad and Android were released). In fact, this new version of Microsoft's operating system, which was released in late 2015, was launched with one, difficult to ignore difference: it was free. In one month, the installed base spiked to 75

million users. This version also ended the vision of Windows as a standalone product. In fact, as it has now become a service (theverge.com, 2015), it implies frequent major updates instead of new releases every few years. Finally, in October 2015 Microsoft launched the last version of the Surface line, two new phones using Windows 10 Mobile as operating system and the second iteration of its fitness band. In this way, the company has built a comprehensive hardware platform for Windows 10 wide stream penetration in the consumer market.

By reviewing Microsoft history, it is possible to understand how the company shifted from a pure software company to something completely different. In fact, the production of in-house hardware products for different market segments has started a deeper phase of vertical integration within the company. While it first relied on partners to achieve the right physical platform for its software, it has moved towards proprietary development and industry leadership.

The following paragraphs will focus on pivotal events, as the substitution of Ballmer with Nadella as company CEO, and new hardware products in order to describe the structural innovation that has shaped Microsoft in the recent years. In the next chapter, I will analyze how such elements form a comprehensive long-term strategy and how it relates to the theoretical framework previously provided.

- Steve Ballmer to Satya Nadella: the new Microsoft.

It was the 13th of January 2000 when Steve Ballmer became CEO of Microsoft, when the IT industry was on the edge of the dotcom bubble burst. In fact, the NASDAQ market index was going to reach its highest peak on the 10th of March, at 5132.52. Between 2000 and 2002, the stock market crashed and burnt around \$5 trillion (Gaither et al., 2006), causing a consistent number of firms to file for bankruptcy. When Ballmer was appointed, Microsoft had already enjoyed the highest stock price ever reached by the company, \$59.56 (Google Finance), achieved on the 27th of December 1999. On the 13th of January, it was already \$53.91, and after only two years it would have slumped under \$30. As shown in the graph below (Fig. 3.1, Yahoo Finance), only in recent years the company managed to recover from a long stagnation period.



Figure 3.1 Microsoft Stock Price. Source: Yahoo Finance

Obviously, the company survived the tidal wave of the bubble burst and kept focusing on software development. While the launch of Xbox, a gaming console, in 2001 was the first sign of a new devices and software strategy for Microsoft future (and the first, in-house hardware product), the company was still Windows-centric. The hardware business remained a marginal part of Microsoft's plan for many years, as the company was heavily focused on its operating system. And while the company grew, its vision stood uncertain. Promising projects were killed in favor of Windows-related resources (Weinberger, 2016), while business units were becoming increasingly independent, fighting for more resources with each other. Projects started to lose consistent vision, and the first Xbox is a clear example (Weinberger, 2015): it was supposed to be based on Windows 95 at first, then on Windows 98. The Xbox team convinced the management that they would have created a slimmer version of Windows exclusively for Xbox, and then include the changes in the PC version, in order to ease the coding process for third party developers. In that way, there would have been seamless integration between the two platforms, and Xbox would have greatly contributed to an operating system that was starting to face some critiques (long boot times and the infamously famous "Blue Screens Of Death"). After receiving \$500 million dollars' investment and a oneyear window, the team developed an isolated system. It was smooth and efficient, but did not provide anything to Windows, and it never did (the operating system reached the Xbox One

only in November 2015, through a system update). And it is pretty interesting to analyze how the core lying into Microsoft changed from Ballmer to Nadella. The first made the company coincide with Windows, with a whole universe of differently important products gravitating around the operating system, from Office suite to Windows Server. Xbox introduced a shift towards the vision of a "devices and services company" (McCracken, 2014), which was consolidated when Surface and Windows 8 made their appearances in October 2012, together with Windows Phone 8, and Xbox One only a year later. The strategy of vertically integrating devices in order to increase adoption and quality of proprietary services is a clear reference to Apple, according to the new CEO Satya Nadella (McCracken, 2014). In fact, when Ballmer resigned from his position as Chief Executive Officer, the company needed first of all a coherent vision and brutal steer with the past. The market demanded a new version of Microsoft, more connected between its parts and focused on innovation, rather than cash flows. Nadella addressed these problematics by highlighting what is Microsoft about: productivity and innovation. And their combination creates the new company identity in terms of products and services, as Nadella himself stated (McCracken, 2014):

"I just think about three things: there is Windows, there is Office 365, and there is Azure. That's it. Everything else to me, you can call it features"

This has some direct consequences:

- While Windows is still core, it shares its importance with two much younger entrants in the portfolio. In this case, as previously described, this research will focus on Windows, while Azure and Office 365 case studies will be material for future scholars.
- The vision of a "devices and services company" is now shortened to "productivity services". Devices are just "features". As this study claims, devices play a complementary role in Windows market lead under Nadella's vision.
- The company is now heavily focused on cloud integration and computing: in fact, Azure represents the cloud platform for businesses, unlocking integration for multiple additional services and several benefits for consumers.

It is fairly obvious how the market positively received Nadella steer in Microsoft strategy. Recalling figure 3.1, the stock price has surged from its long-time stagnating neighborhood of \$35 to \$51, increasing by a magnitude of 50% and almost reaching the all-time high of early 2000. Moreover, the market realized how the new company was addressing future topics as Big Data, Internet of Things (recently the acquisition of the Italian company Solair specialized in IoT solutions, as per Microsoft press release), cloud solutions (Azure), and augmented reality (HoloLens). In this context, it may seem that Microsoft's devices do not deserve any spotlight. Instead, while being just "features", they still figure as top-notch hardware in their own categories, with some units in particular - i.e. Surface Book - earning the press favor due to their great execution and innovation (Forbes, 2016). Hence, I will now describe each hardware product that fits Windows 10 universal strategy, in order to discuss the underlying strategy and its comparison to the literature here provided in the next chapter.

- Surface: a new, productive hybrid.

As briefly mentioned, the first version of Surface launched in October 2012 alongside Windows 8, in a time when there was only one truth about mobile productivity: the iPad. Apple sold its tablet product around 58.3 million times throughout the year (CNET, 2012), dominating the tablet market (IDC, 2012). At that time, December 2012, Windows 8 earned a 2.9% market share against a staggering 96.5% aggregate by Apple iOS and Google Android.

Tablet OS	2012 Market Share	2016 Market Share	CAGR 2012 - 2016 (%)
iOS	53.8%	49.7%	20.9%
Android	42.7%	39.7%	21.0%
Windows	2.9%	10.3%	69.2%
Other	0.6%	0.3%	7.7%
Grand Total	100.0%	100.0%	23.3%

Tablet Operating Systems, Market Shar	re Forecast and CAGR 2012-2016
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Source: IDC Worldwide Quarterly Tablet Tracker, December 5, 2012

Figure 3.2 Tablet Operating Systems Market Share and CAGR. Source: IDC, 2012

Still, such industries are sensitive to disruptive force. In fact, Windows tablets grew by 59% on a year-over-year basis (Nofuente, 2016), whose magnitude is even more important when compared to Android and iOS, who decreased by 7 and 22 percent respectively. This difference is mainly due to a new category of devices called 2-in-1, crossover tablets, or hybrids, that grew by 379% in 2015. Surface started the evolution of desktop productivity in 2012, and since then has seen 4 iterations (in the moment this research was written, the newest version was the Surface Pro 4). The product did not enjoy immediate success. In fact, the Surface RT, which was the cheapest version equipped with a underwhelming Windows RT distribution, caused Microsoft to pay a 900 million dollars charge for unsold goods (Fiegerman, 2015). Doubts were shattered in fiscal year 2015, when the second quarter (ending in December 2014) reported a 1.1 billion dollars' revenue from the Surface division, officially establishing the 2-in-1 business. The last Microsoft earning release in April 2016 showed a revenue of 9.5 billion from the Surface line, an average of 2.4 billion dollars per quarter.

It does not come as a surprise if many competitors have risen since October 2012. All major Original Equipment Manufacturers like Asus, Lenovo, HP, Dell, Toshiba, and Vaio have launched competing products, ranging from as cheap as 250\$ to more premium pricings (Lacoma, 2015). Surface formula convinced Apple eventually, which released the iPad Pro. This research does not aim at specifically comparing products from a technical point of view, but the iPad Pro and the Surface Pro can be considered comparable due to their similar screen size, nature, and scope: they both incentivize the use of smart pen for work, while having the option to attach an external keyboard-cover to maximize productivity. According to IDC (2016), the iPad Pro sold 2 million units against 1.6 million of Surface sales. Still, it is a clear sign of a market that is now educated to larger screen sizes and touch, hybrid productivity. This is the most important effect of the Surface line on the consumer market. As a matter of fact, it is no coincidence that it was launched together with Windows 8, stressing the importance of touchscreen devices. The 2-in-1 tablet fitted two precise functions: first, show the new Windows version as perfect for new trends as smart working, mobility, and touch experience; secondly, lead the industry. I will analyze this scope deeply in the next chapter.

- Xbox One: the high-potential underdog.

Xbox One is an interesting product and topic for research. In fact, it is at the same time three different things: most importantly, a gaming console; a hub for home entertainment, by connecting to it the TV cable (and a Kinect sensor for vocal commands); a PC extension, as it runs Windows 10 at its core together with Microsoft universal apps. Its main competitor, the PlayStation 4, is only a gaming console. If only this information was known, it would have been straightforward to predict the success of Xbox One. But as VHS famous story tells us, the best product on the specification sheet does not always win the battle. In fact, the PlayStation 4 has sold over 40 million units worldwide (Figure 3.3), surpassing the previous record held by PlayStation 2. And while Microsoft does not reveal Xbox One sales, it is possible to provide fair statistical estimates. As we can see in the graph, Xbox One has managed to retain 28.5% of market share compared to a gigantic 54.5% of PlayStation 4 (I will exclude Wii U from the analysis, as it was launched in a different time frame and with different characteristics). The market share coincides with around 21.1 million units estimated.



Figure 3.3 Gaming Consoles Market Share. Source: Vgchartz.com, 2016

Is it a pure matter of casual consumer behavior? Of course not. There are key variables that affected Xbox One sales and favored Sony's console. I identify four different areas: targeting, pricing, performance and expectations.

- Targeting: the mantra of PlayStation 4 was straightforward and simple, as it aimed at gamers in a crystal-clear fashion. The Xbox One instead focused on TV integration and the concept of entertainment hub (Peckham, 2013), subtly stating that it would have been a great product, with or without the gaming part of the experience. Of course, Microsoft described the product as a complete, 360-degrees living room console, but in this study I assume that such broad targeting actually created confusion, which is supported by the repeated changes in strategy made in the following years, one of which is described in the next point.
- Pricing: Xbox One was launched at \$499 in a bundle including the Kinect 2.0 sensor, an innovative natural user interface device for gesture and voice recognition, among others. Consumers could not choose to exclude the sensor from the bundle and buy the console separately. Instead, PlayStation 4 was a console-only, similar product at \$399, 20% less than its direct competitor. Only six months after the launch, Microsoft announced that it would have separated Xbox One and Kinect, and that it would have started selling a console-only bundle, therefore reducing the price from \$499 to \$399, aligning to Sony's offer (Balestriere, 2014). It is clear how this late move had an impact on Xbox One market penetration and adoption.
- Performance: history tells us that the most performing product is not necessarily the one adopted eventually by the market. Still, I assume it can have a significant effect on power users, whose influence on other buyers may be significant as well. One month after the launch, PlayStation 4 and Xbox One were both being tested in every possible way to test possible differences in performance. As a matter of fact, the PlayStation 4 was found to be faster than the Xbox One by an order of 15% in terms of raw megabytes per second processed by the CPU (Sinha, 2013). Additionally, the faster memory of Sony's product (a GDDR5 V-RAM versus an older DDR3 sported in the

Xbox One architecture) increased the discussion between power users and technical tests.

Expectations: with "expectations" I refer to the announcement of a Windows 10 based console, promising complete support to universal apps and smooth transition from the desktop/laptop to the console. Instead, the Xbox One used at its core Windows 8, and received Windows 10 and Universal Windows Apps support only two years later, as already mentioned before. I assume this failure in matching announcements and expectations led to mistrust by a small, but significant part of the consumer market.

In the next chapter, I will analyze how did these four areas negatively impacted the adoption of Xbox One, and which actions were taken by Microsoft to address the issues and increase the installed base, of which the most notable is the availability of Windows 10 Universal Apps.

- Hololens: introducing Augmented Reality

Virtual reality attracted the attention of many important players in the IT industry, when in 2012 9522 backers pledged around \$2,5 million dollars to invest in a project called "Oculus Rift" on Kickstarter.com, a crowdsourcing site. The new company was acquired by Facebook in 2014 after two year of product development (Orland, 2014), which valued the company at \$1,6 billion dollars. The first consumer edition was released on the 28th of March, 2016, and it is already competing against two other strong competitors as HTC and Sony. The first has produced the HTC Vive, a virtual reality headset based on a different technology (and selling at a higher price tag), while Sony is launching its PlayStation VR in October (House, 2016), planning on leveraging the existing PlayStation 4 customer base.

Is HoloLens a competitor? Actually, no. As described on Microsoft product page, It is the first augmented reality headset, a device capable of computing real-time holographic objects, which are perceived as part of the reality in front of the user. Hence, it does not involve an immersion in a completely different environment, it aims at *augmenting* the existing one. Moreover, it is a standalone device equipped with Windows Holographic, an operating system based on Windows 10, which differentiates this product from the previously cited Virtual

Reality competitors. In fact, the Vive and the Oculus Rift need a fairly powerful desktop machine, since the required graphic card cannot be equipped on traditional laptops, and the PlayStation VR needs a PlayStation 4 connection - obviously. It is then clear how HoloLens is leading an entirely new market segment, creating a unique opportunity for Windows innovation and adoption. In fact, proprietary holographic environments would push Windows 10 penetration in the market. Still, as of now it has been released only the development kit on the 30th of March, 2016 (Warren, 2016), while the consumer version has no release date yet, and it is no coincidence. Microsoft is aiming at businesses and enterprises from one side (as quoted on the company's website), counting on important partners, especially in the designing industry (Volvo, Autodesk, Trimble, NASA among the others) and education from the other side (Pot, 2016). About the latter, it is worth mentioning the ongoing project at Case Western Reserve University and Cleveland Clinic, where HoloLens is currently used to teach using interactive 3D holograms, especially for anatomy and medicine classes. It is clear then how HoloLens represents Microsoft's long-term, future-proof strategy, and I will describe how solid it is in the next chapter.

- Windows Phones: a significant 1%.

As the title suggests, Windows Phones represent a strong contradiction: a great potential for PC substitution, by using a feature called "Continuum", which projects Windows 10 on bigger screens directly from Windows 10 phones and allows keyboard and mouse support; secondly, a terribly small market share, i.e. 0,7% (Warren, 2016). In the same article, Warren dramatically states that: "Windows Phone is dead.", since Microsoft managed to sell only 2.5 million phones, losing market share against an overall market growth of 4% (Gartner, 2016). Strategy has changed from three different devices for three well-separated segments (enterprise, low-cost, flagship) to a much vaguer "great devices" (Warren, 2016), while on the software side Microsoft has changed from exclusivity to compatibility, by releasing great apps for iOS and Android. These two elements together create a scenario where developers do not have any new hardware to work with, while consumers can enjoy Microsoft's software on their operating systems, be they either Google or Apple's one. Microsoft's reaction is clear: cost-

reduction and layoffs. In fact, as the mobile division stays lackluster, the Redmond-based company is laying off 1850 employees, which cumulate with the 7800 jobs already cut last year (Warren, 2016). Human resource reduction coincided with a total write-off of \$8.55 billion, of which \$7.6 billion in the first tranche, and an additional \$950 million in May 2016. Microsoft also streamlined Nokia's feature phone business to the Chinese manufacturer FIH Mobile for \$350 million. What does remain of the original Nokia? A small engineering team focused on research and development, and the Finnish subsidiary.

Still, as the Surface case shows, Microsoft is able to innovate in many different ways, both hardware and software. Hence, the new hardware will play a key role, together with new synergies with Windows 10 (in particular Continuum's evolution).

- Microsoft Band: Health and Cortana.

Finally, the "devices and services" strategy theorized by Ballmer could not miss one of the most growing sectors for consumer technology: smart wearables. According to Gartner (2016), wearable electronic devices shipments will increase by 18.4 percent in 2016, reaching 274.6 million units. Overall, the market will generate \$28.7 billion revenues, of which \$17.5 billion stemming from smartwatches. By knowing this data, it is clear the rationale behind the Microsoft Band. In fact, it can be defined as both smartwatch and fitness tracker, as highlighted on Microsoft product's website. About the first, the Band can stay synced with customers' calendar and preview emails and texts, interacting with Cortana-equipped phones in different ways. In this way, the Band empower people to be more productive and achieve more, as Microsoft's long term vision states. Secondly, it can be defined as fitness tracker since it is able to constantly measure heart rates, while tracking sleep quality, sports, UV exposure and fitness activities (especially running and biking) through an array of sensors, as the GPS and the barometer.

In the next chapter, I will leverage the theoretical framework to explain how are these products going towards the creation of a universal operating system, which strategies were optimal and which were excessively business-driven. By doing so, this study aims at showing

how Microsoft has built an hardware environment mainly for software adoption and market penetration.

Chapter 4: Case interpretation based on theoretical contributions

In chapter 2, I described the case of a company that has managed to achieve great financial results, despite an incredible organization restructuring during the last years, when it moved from a stagnating position to a tight and consistent vision focused on future challenges. But how is the "devices and services company strategy" performing against the existing theoretical literature? Is it possible to study failure and success of it by understanding the rationale and comparing it to existing studies? In this chapter, I will merge the literature framework previously provided to the actual strategy, highlighting major alignments to and shifts from the economic theory, and their consequences.

First, it is interesting to analyze how Figure 2.1 applies to the Microsoft case. In fact, I previously stated how blurry the borderline between IT components has become, and this case is no exception. In fact, first of all Microsoft has built a complex net of hardware (Surface, Xbox, Phones, etc.), software (Windows 10 as operating system, Office), services (Windows as per Nadella's vision), and infrastructure for information and computation (Azure Suite), aiming at both the consumer and the business segments. It is clear how every physical product represents not only a hardware good, but a shaded mix of different categories. For example, a Surface Pro 4 includes hardware, software, services, and information at the least. In this way, the company has managed to create an incredible, interdependent environment, built on the core concept of Digital Transformation (CIO, 2015). Side by side with hardware development, which strategies did Microsoft exploit in order to boost Windows 10's adoption? It is not difficult to see a clear link between theory and practice. In fact, as Besen et al. described (1991), Microsoft adopted an incredibly aggressive penetration price by releasing the update for free for one year. It does not imply a steer towards open source software, but a signal to the industry that the business efforts are focused more on reaching customers and on their satisfaction than on cash flows. The initial exponential growth can be probably considered mainly, if not entirely, due to the correct penetrative price. While it could be described as an extreme measure, the PayPal case showed in Chapter 2 demonstrates that firms in the IT industry are able to deploy much more extreme strategies in order to achieve critical mass. Secondly, Microsoft managed to leverage a complex web of Original Equipment Manufactures as partners and customers. In fact, it is a two-sided business: from one side,

Microsoft licenses Windows to OEMs, in order to be bundled on new machines. From the other side, it strictly collaborates with partners in order to optimize Microsoft's services on their hardware products, even in case of competing products. One example is the Italian presentation of the Galaxy TabPro S by Samsung, a 2-in-1 Windows-based device, able to compete with the Surface Pro 4. Still, Samsung's event has seen the participation of both companies (hdworld.it, 2016). This fact proves the double-sided business relationship of Microsoft with OEMs, and how hardware products are not tied to business opportunities per se, but more precisely on software penetration. Finally, the Redmond-based company used public announcements to build future expectations about its products, and in particular about Windows 10. In fact, by announcing new updates' content months before (the Anniversary Update was announced in March 2016 on the official Windows blog, around three months before the release), it can achieve both existing customers' retention and potential customers acquisition.

In the next paragraphs, I will briefly review the relationship between Microsoft's products and the most relevant industry's macro forces described in the second chapter, while subsequently focus on how the company is achieving a universal operating system standard.

- Microsoft portfolio and IT's forces

The forces described throughout the second chapter are pivotal in the IT industry, and Microsoft makes no exception. The most commonly used across all Microsoft's products is probably price discrimination by means of *product versioning*, as it is the case for hardware consumer electronics. This term refers to the deployment of different product versions in the market, in order to be able to capture a higher consumer surplus by addressing more reservation prices (recalling chapter 2). Practically, Microsoft has launched different SKUs, or Stock Keeping Units, for Surface, Xbox, and Phones. The most common is the differentiation in storage memory, i.e. Surface 128/256/512 Gigabytes, Xbox 500 Gigabytes/1 Terabytes, etc.. Still, Surface products show a deeper customization. In fact, they offer increasingly powerful processors and core accessories such as keyboard covers, ranging from \$899 up to over \$2000. By offering a wide spectrum of prices, Microsoft is able to earn higher profits by

optimally capturing the available consumer surplus, while at the same time satisfying the most demanding customers like power users and enterprises. But versioning alone is still suboptimal. In fact, there is another macro-force heavily related to surplus capturing: bundling. The borderline between bundling and price discrimination can result blurred in some case. As a matter of fact, both allow improved targeting and the addressing of different reservation prices, increasing both profitability and customer satisfaction. Moreover, both techniques achieve such advantages by implying an active choice between different options from the buyer. Still, there are theoretical and practical differences, as previously described. Related to Microsoft's hardware portfolio, and therefore excluding the well-known Office bundle, this macro-force is exploited mainly in Surface and Xbox. Both present bundles with highly-profitable accessories: in the first case, the most common is Surface + Keyboard bundle, which increases productivity and overall flexibility of the device, while attaching a high margin product to the core device; secondly, Xbox One was first launched together with Kinect, and then sold separately, fact that made the Xbox + Kinect offer a bundle, exploiting the same mechanics described for Surface (additional features for the consumer side and higher margins for the business side).

Still, while product versioning and bundling can increase customer satisfaction and therefore Windows adoption, their contribution to Windows 10 penetration is fairly indirect. In this research, I assume that two macro-forces in particular build towards a universal standard: first, switching costs and lock-in phenomenon; secondly, network effects. In fact, from customers' perspective, adopting a standard coincides with a voluntary technological lock-in and the appropriation of network benefits. Switching costs are an important component for mass adoption, as they are inversely related with profitability of standards, i.e. the more customers feel comfortable with changing operating system, the lower the return on investment for standard creation. By comparing different operating systems, it is clear how many different factors sum together and account for total switching costs. Three particular elements are worth mentioning: the User Interface, the applications' compatibility and the synchronization across devices. The first element is directly related to consumers' costs, as inherently different User Interfaces require learning a potentially complex scheme. Enterprises need to strike a balance, since incredibly difficult systems will not be widely adopted, while extremely friendly User Interfaces will also present low switching costs. Windows

differentiates from Mac OS while retaining a friendly glance, achieving a compromise. The compatibility plays a major role, since the two competing operating systems do have different architectures (Germain, 2009): Windows is based on Dynamic Link Libraries that enables it to support a wide range of applications, while Mac OS is technically based on Unix technology and applications availability is lower. Hence, since users expect a different set of compatible applications, difference that also increases search costs, they will face higher costs. In this case, Windows wider app compatibility and higher market share increases its odds in the switching costs war. Finally, since 2008 personal devices has exponentially grown, from a desktop computer and/or a laptop, to a set of products, such as 2-in-1, laptops, desktops, phones, consoles, etc.. As described on the official Windows website, Microsoft's operating system is able to synchronize the majority of the device settings with other Windows 10 powered electronics, increasing likelihood of lock-in phenomenon for consumers. Moreover, as previously described, the Redmond-based company is steering towards a strategy based on Universal Windows Apps, which are able to work no matter the device, if Windows 10 is its operating system. In this way, by knowing that each personal device will have both preferred settings synced and universal app, the final customer will face a steeper learning curve when considering different operating systems to adopt, and as a result a significant increase in switching costs.

Windows 10 also makes the case for interesting network effects, both direct and indirect. Recalling chapter 2, network effects are directly related to the size of the network, usually in an exponential pattern. I identify two major direct effects that create positive spillovers across the network for consumers: the gaming community and the format compatibility. The first element is becoming more and more relevant alongside the process of Windows 10 porting to Xbox One. In fact, a Windows-based gaming console allows for an incredible single and multiplayer cross-play between Windows machines, no matter if they are fully operational computers or plain gaming devices. In an industry that grew by 5% in 2015 reaching \$23.5 billion revenues in U.S. only (Morris, 2016), the cross-play between different Windows devices can significantly influence the adoption of the operating system by both casual and power gamers. It is not difficult to imagine a scenario where cross-play happens smoothly from a specific device to a very different one, especially when cloud computing will take place into the gaming services (one clear example is Nvidia). Secondly, a widespread adoption of

Windows 10 across personal devices will directly affect the easiness of file compatibility and therefore sharing. It could be argued that such success would also exponentially increase the threats stemming from malwares, but it is an inevitable consequence of market share dominance. At the same time, we can identify a direct network effect for Microsoft, for which the adoption of Windows devices increase visibility of Microsoft's software and services, thereby increasing attach rate of high-margin products. Nonetheless, indirect effects can be equally important, and as an operating system developer Microsoft is particularly sensitive to one precise community: developers. At the BUILD event in March 2016, Microsoft focused on developers and announced the built-in support for the famous shell Bash, previously tied to Ubuntu by Canonical, a so-called "distro" (or distribution) of Linux (Welch, 2016). As the author highlights, it is not only a direct focus on developers for Windows, but also a commitment to open-source development. Indirectly, the growth of Windows 10's network size attracts more content, both in terms of quantity and quality. By combining size growth and commitment, Microsoft aims at winning the race for developers' attention. If we add another element to this scenario, it becomes clear why I defined it "race", and it was described in chapter 2. Recalling CIO's report (2015), IDC and Forrester projected a future where developers are a scarce resource, working in a market where demand is significantly higher than supply. Knowing the talent war to come, Microsoft has transformed, and it aims at gaining more content thanks to both Windows 10's customer pool and friendly development environment.

But how does Microsoft, and in particular Windows 10, create a standard? I will answer this question in the next paragraph, by comparing Microsoft's strategy to the ones described in the literature framework. Moreover, I will complement the analysis by including the interview with Luca Callegari, Category Manager of Microsoft Italy (Switzerland starting from July 2016), who provided a broad as well as detailed picture of how has Microsoft designed its "devices and services" strategy.

- Windows 10: a software standard by means of hardware standards.

In 2012, Microsoft launches the Surface Pro, whose promising concept has now been deployed four times, reaching the present Surface Pro 4. Surface division surpassed the \$1

billion guarter revenue objective, and 2-in-1 are now a standard, enjoying double-digit growth on a yearly basis. Does it mean Microsoft's core competencies have changed? As Callegari states: "Microsoft is a mobile-first, cloud-first company". Is there a conflict? How does hardware relate to this statement? Actually, it is simple. Surface Pro was meant to be a showcase, to drive the lackluster innovation the PC industry had suffered for years, reaching the state of commodity market. Low prices, and cheap, good-enough machines. The Surface Pro not only increased the expectations from Windows devices, but also brought a completely different approach to innovation. The message was two-sided: premium Windows machines did have market, and Original Equipment Manufacturers did have a new path for innovation. Callegari describes what was the rationale behind such move: "We believed that introducing Surface as a Premium 2-in-1 device would have showed the Original Equipment Manufacturers and Retailers a new market, and we are leveraging the same strategy with Surface Book at a global level". The Book is still not available in many countries around the world, fostering the point of a showcase, more than a mass-market product. The numbers show it was the right bet, meaning that customers would love to choose premium Windows devices, if available. As a matter of fact, Surface has become a standard of quality and design, creating the 2-in-1 market and enabling competition in the premium segment, previously dominated by Apple's devices. Was the purpose purely about hardware? Of course not. Quoting Callegari: "Surface was meant to both increase the threshold of reference design for Windows computers and show how great Microsoft's services can be on precisely built machines. The product is a showcase." Now, Surface Pros face intense competition, but it would be a mistake to consider it a downside. On the opposite, it shows that Surface actually managed to set the hardware standard for 2-in-1 hybrid devices, and more in general for premium experiences on Windows computers. Moreover, the deployment of additional services for this new segment is a considerable value-added for Microsoft's business, as "the motion of attached products completely changes".

Throughout the interview, Callegari also explained how gaming consoles have changed, and why Microsoft has tried to stress the importance of the Xbox One as the main entertainment hub: "Consoles are perceived as commodities, where the value-added is completely stemming from games. This is the reason we aimed at producing something innovative and future-oriented. Still, this perception caused PlayStation 4's lower price to beat the market.".

Hence, Microsoft did try to set a new standard for consoles, shifting the focus from pure gaming to broad entertainment. And it is still the vision behind the business. In fact, "the Xbox One is a multimedia console, focused on delivering a great Xbox Live service together with classic entertainment, while introducing innovative cloud computing solutions for gaming", which implies that the change in pricing strategy has not affected the underlying commitment to innovation and to Windows 10 synergies. Xbox One can also enable cross-playing, reassuring customers that buying Windows 10 devices coincides with joining a massive gaming community and with compatibility across machines. In Callegari's vision, the machine "will become a tool specialized for easy access to cloud services, while Xbox Live will become the center of multimedia, thanks to Windows 10". In this way, the Xbox is aimed at setting a new standard for gaming consoles, on a scale that no competitor has managed to reach. By merging the PC and the Xbox community and enabling cross-play, the Xbox will vehicle customers towards Microsoft's services, and in particular Windows 10, which will become more and more central under the console's hood. This innovation is compulsory, since "the market is shifting from buying products to service consumption".

Instead, the Band is the gateway to fitness data. The hardware's scope is to establish Microsoft Health and Cortana, in order to be able not only to monitor, but also "to predict health issues and warn the consumer before illness takes place", in Callegari's words. As per Surface Book, the Band is sold in a limited set of countries around the world, demonstrating that it is about what can be created, instead of what can be sold by Microsoft itself. It is no coincidence that the device showed great potential, as previously described.

Finally, HoloLens represents the long-term strategy of Microsoft, as the company is selling only the developer edition for enthusiast partners. As of now, the project's main focus and consequence is the increased attention of developers towards Windows Holographics and in general Windows 10's environment, according to Callegari. HoloLens is therefore meant to attract the scarce available developing talents toward the new frontier of augmented reality, at least in the short-term. It is difficult to predict how the product is going to evolve, and how will Microsoft foster adoption, or even if the company will leverage other OEMs' augmented reality propositions instead of its proprietary hardware. Hence, future research will be able to understand if and how the company will evolve in the next years. Therefore, it is clear how Microsoft's hardware portfolio as a whole aims at boosting software and services adoption, either from the development or the consumer side. Recalling Hill (1997), there is only one mantra in IT: maximize installed base. Microsoft is leveraging internal core competencies to create interdependencies between hardware and software. In particular, the introduction of proprietary hardware aims at showing both new path for innovation and proprietary software and services, among which Windows 10, the last version of Windows. The latter is proposed as universal platform for a vast spectrum of devices, thereby proving how a standard universal operating system can be achieved by means of proprietary hardware.

Chapter 5: Conclusions

In the last decade, the IT industry has seen major disruption and evolution. Since the advent of the iPhone, companies have deeply changed and new business models entered the market. In particular, IT shifted from being hardware-centric to service-based, since the real value added is now created on software and cloud services. Hence, smart hardware devices have evolved as well, from pivotal elements to gateways. As they are mostly based on existing standards for design and quality, there is no absolute harmony. In fact, there exists an historical fragmentation in the operating system market. Windows, Mac OS and Linux still compete for billions of potential devices, in different ways and with different value propositions. This research shows how a single operating system can aim at a universal value proposition across different devices of different sizes and scopes by analyzing the Microsoft case. By diving into the last decade of strategic moves of the Redmond-based company, it is possible to extract a pattern about the creation of a hardware platform on which attach a universal proposition: the ecosystem of Microsoft's products. In particular, this study focuses on Windows 10, which is the clearest example of universality. Microsoft is trying to create an operating system able to run no matter the device nature, and in order to accomplish such goal, the company is creating a massive portfolio of hardware products, aiming at setting new standards and creating new market segments. In this way, the company can accomplish two achievements at the same time: Windows leadership in the market; new hardware innovation, which equals higher profits for market incumbents and higher consumer satisfaction due to tailored premium devices.

Recalling how the industry is phasing to new business models and new challenges, it can be understood how this topic can raise interest and contribute to the existing research. In fact, the analysis of a real business case of an innovative giant such as Microsoft can spur new studies about how major brands in the IT industry are competing. Hence, I chose this topic for both its current relationship with market developments and consumer proposition, and its long-term vision of a standardized ecosystem of devices exploiting full compatibility and seamless portability. This is the main reason that required a wide literature review of standards. To understand how Microsoft is executing the strategy of a universal operating system supported by a hardware portfolio it is necessary to understand how standards are established. With respect to the existing literature framework, this research aims at understanding how firms actually implement theoretical notions in practice. By analyzing the Microsoft case, it is possible to immediately see a either a correspondence or a misalignment with the existing studies, and understand the rationale behind both scenarios. Still, the study also aims at answering precise questions: is there evidence of a long-term standard creation strategy in Microsoft history? How is it executed? How does hardware synergize and create interdependencies with a universal software platform? In order to answer these questions, I employed both an analytical study of current strategy based on publicly available information and tech-focused journalists and researchers, and an interview to Luca Callegari, Category Lead at Microsoft Italy (Microsoft Switzerland starting from July, 2016). In this way, it was possible to compare the public opinion and research to an expert analysis of Microsoft's strategy since the start of the "devices and services" new mantra. Moreover, I stressed the organizational change due to the advent of Nadella, who replaced Steve Ballmer as new Microsoft CEO in 2014. Nadella declared that Microsoft is a "mobile-first, cloud-first company", and the research showed the consequences of the organization structure and business approach.

The results mostly confirmed the hypothesis of a comprehensive approach towards hardware and software, but they also show additional insights that contribute to the analysis of Microsoft actions, and therefore of successful IT strategies. By studying the history of Microsoft's hardware portfolio, it was possible to identify successes and failures of single products, but most of all the rationale behind the product design. In particular, Surface Pro was built as a concept, whose aim was to show existing players that new path for innovation were possible, and that most of all they could be highly profitable. Surface started a new market segment, now famously known as 2-in-1 hybrid devices, that is able to achieve massive growth, especially when compared to sales decline of notebooks and fall of desktop computers. Customers desired premium Windows devices and demanded radical innovation in computers' design, elements that fostered the explosion of new price points. This strategy has been replicated with the Surface Book, which aims at repeating the process for classic notebooks, instead of tablet form-factors. By selling a highly innovative machine for an extremely premium price tag, Microsoft managed to raise the bar for new devices. More interestingly, from the analysis of Surface's history we can understand that not only Microsoft aimed at fostering the adoption of Windows 8 (and subsequently 10) and therefore create a software standard, but also establish a hardware standard for quality and design, thereby successfully creating a product division that is now worth more than \$1 billion per fiscal quarter. We could define it as standard creation for the purpose of standard adoption, but aside from definitions it is an exciting case for future research.

Still, the analysis also found major failures in Microsoft's strategy, of which the most prominent examples are Xbox and Lumia. First of all, Xbox failed at accomplishing the "maximize installed base" mantra by missing the correct pricing and value proposition, bundling the gaming console with an accessory that was *ex post* clearly not desired by price sensitive consumers. While Callegari stated that Xbox value was not completely understood, as it shifted from pure gaming to complete entertainment hub, it still had major consequences, especially on market share (and therefore growth of high-margin cloud services such as Xbox Live). Sony's PlayStation 4 is now leading, but I found that it is not clear how the market will evolve. In fact, Xbox One is now running Windows 10 under the metal hood, and Universal Windows Apps together with merge of PC and Xbox gaming communities will bring new interesting developments. Still, contrary to Surface, the establishment of a hardware standard has failed since now, which makes the case for future research to track new moves from Microsoft in this sector. Secondly, Windows Phones, i.e. Lumias, are the worst failure within this strategy. The Redmond-based company acquired Nokia in a massive financial operation, only to achieve 1% market share and an incredibly poor product portfolio. While Microsoft confirms its commitment to the industry and to both consumers and enterprises, it is not clear how will Windows 10 penetrate this market in the next years. The introduction of the Continuum feature, which enables to scale from smartphone to regular computer capabilities through an external hub, is innovative and a step towards device universality, but the insignificant market share and the lack of new flagship devices for enthusiasts creates great uncertainty. The latter was confirmed by Microsoft itself when it wrote off Nokia's acquisition twice following poor performance in the smartphone market. Hence, Microsoft has faced both incredible success, setting new market segments and driving incredible innovation, and expensive business failures, either due to wrong marketing (for Xbox) or inconsistent business efforts (Nokia). In the next five years, we will be able to see how HoloLens will evolve and contribute to the penetration of augmented reality in daily routines. As of now, it is a revolutionary approach to teaching and designing, but how it will establish Windows in the holographic/virtual reality/augmented reality industry is still unknown. In fact, Microsoft is selling the development kit, while there is no confirmed release date for the final version, which is meant to create a new market segment, as it does not compete with incumbents' products such as Oculus Rift and HTC Vive. Finally, the introduction of Band coincides with Microsoft's move towards health analysis and prediction, imposing Windows (together with Cortana) as a hub for personal data.

Analyzing the design, the market and the technical development of Surface, Xbox, Lumia, Band, and HoloLens, it is possible to create a clear context for Windows universal value proposition and to understand how this product is aiming at establishing a new standard for universal operating systems across different devices. By defining the strategy in its complex set of links between different elements, new companies can understand how to improve similar strategies and how to avoid the market failures described above.

Hence, this research shows actual implementation of theoretical notions about standard creation and IT market forces, while at the same time raising interesting questions for future research. In fact, the analysis of single brand is not sufficient. One possibility is to widen the study to important competitors such as Google and Apple, who are implementing similar strategies, but in important different ways. By employing a broader approach, it would be possible to identify new drivers for successful strategies in the IT industry and the process behind the creation of hardware-software interdependencies.

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Riassunto

This research discusses how Microsoft's evolution towards a "devices and services" company favored its software by means of new, innovative and proprietary hardware. The latter is analyzed in order to understand both technical qualities and strategic roles. The portfolio comprehends brands as Surface, Xbox, Lumia, Band, and HoloLens, in order to respectively cover 2-in-1 hybrids, gaming consoles and entertainment, phones, fitness and health, and augmented reality. Such portfolio represents a significant sample for both current and future product segments, enabling the analysis of Microsoft's short and long term strategy. The study shows that Microsoft's hardware portfolio is meant to be an innovation showcase for Original Equipment Manufacturers, additionally to successful products. Hence, I describe the portfolio as able to stimulate healthy competition, while at the same time create a market fully based on a universal operating system. It is then straightforward how the IT industry is fastpaced and innovative, where new technologies' disruptive action causes the phenomenon called "creative destruction", as defined by Schumpeter (1942). In fact, legacy players who fail to adapt are easily dethroned by new entrants or faster incumbents, in a continuous search for the right design and/or technological standard. In particular, every high-technology industry is influenced and shaped by a precise set of economic phenomenon described by Varian (2001), who reviewed the major forces acting within the industry. In this way, it is possible to deeply understand the context in which major IT enterprises as Microsoft operate on a daily basis. I will review the most important macro forces, and integrate the analysis with additional literature and real-world cases.

Price Discrimination: Information technology allows for much finer product customization and personalization, which allows for higher, more tailored prices. At its best, it would be defined as "first-degree price discrimination": when firms manage to capture the totality of consumer surplus by setting the optimal price. In fact, online retailers are used to adjust their prices in much finer steps, and in a highly frequent pattern with respect to traditional retailers (Brynjolfsson et al., 1999).

Search costs and benefits: This is probably the most common advantage of Internet technology: searching costs have become much lower, while the activity per se results in higher consumer information and therefore optimal transactions. Still, companies can adapt and adjust their offering in order to charge a lower price to informed, searching consumers and higher price tags to uninformed customers.

Bundling: when two goods are sold together at a single price. According to Varian, it is financially attractive for IT enterprises, since marginal costs are negligible (in case of pure information products). In the Microsoft case, bundling is used both for hardware and software platforms: in the first case, Xbox and game bundles are common, as well as Surface and accessories offers; in the second case, the most common is Office, which is marketed as a bundle of different tools, thereby capturing more surplus due to their negligible marginal cost (Bakos et al., 1999) and deterring new entrants, since market gaps are reduced (Nalebuff, 1999).

Switching costs: they incur when a consumer changes supplier, product, and/or technology. In the IT sector, switching costs can easily cause the so-called "lock-in", which, as the name suggests, can lock the consumer (and large organizations as well) in a specific technology. Still, such phenomenon has an ambiguous effect on consumer surplus: in fact, while decreasing satisfaction when a switch is necessary, it can increase competition in the market and create valuable propositions.

Network externalities: they can be direct or indirect: the former indicates how consumer surplus deriving from a specific product (and therefore the demand for it) is positively correlated with the size of the installed base, while the latter happens when the adoption of a certain good critically affects another one, not being directly related. Practically, Windows 10 installed base can determine the number of contents developed for that platform (indirect network effect), and also increase Xbox and PC gamers' satisfaction by enlarging multiplayer base (direct network effect).

Finally, the most important concept for this case: standardization and emergence of dominant designs. According to Varian, standardization is related to the concept of network externality, since value of networks depends on their size. In fact, standards can increase potential customer base and therefore market size, boosting profitability for both standard owners and standard adopters, who can offset reduced market share with larger market size. But what is a standard? It can be defined as the equilibrium between user needs, technology level and producers' costs, respecting public authorities' constraints (Germon, 1986). More practically, it is a set of fixed product specifications to be conformed with (Tassey, 2000).

Tassey identifies four different types and two different subjects. The four types are (Tassey, 2000):

- "Quality/Reliability": the standard aims at specifying a basic level of performance.
- *"Information"*: in this case, standards are useful to set tests, criteria, measurement methods, and information disclosure, whose scope is to reduce transaction costs.
- *"Compatibility/Interoperability"*: this type specifies required dependencies for the product in order to be compatible with complementary goods.
- *"Variety Reduction"*: one of the most common types, as it allows economies of scale. A clear, modern example can be identified in computer file formats.

Secondly, standards can be divided into two other categories: product-element and nonproduct (Tassey, 2000). In the first case, one single product element is determined by a standard, and market forces are the most common creators in this sense. In fact, either gain of market presence or monopolistic position can determine what is adopted at an element level. This mechanism loops within the product's lifecycle: as product's life length increases, the more the industry standardizes single elements. Hence, in the long-term, this process usually leads to a shift from premium to commodity prices, and to service-focused businesses. Instead, nonproduct standards refer to technologies that are not linked to specific product attributes. More specifically, they include infratechnologies and basic standards set by public consensus, and they can be considered partially or totally public goods.

Finally, the aim is to provide a clear understanding of standards' disadvantages and economic costs for society. In fact, both types are related to suboptimal scenarios, in which standard

solutions do not coincide with the best-case outcome. First, product-element standards are effective since they create "lock-in" spillovers, both on demand and supply sides. The demand side can be reluctant to switch to new standards due to sunk costs (learning costs for example), thereby maintaining a suboptimal technology. Similarly, incumbent firms on the supply side steer towards evolutionary innovation, instead of revolutionary, since there is no economic interest in moving to a new standard and not harvesting recent investments to their full extent. Non-product standards are not as dominant as product-element ones, but they can still induce subtle costs. According to the author, non-product standards do provoke economic costs in three specific cases:

- 1. "Multiple standards for the same technology": in this scenario, consumers face higher costs due to confusion for a different set of tests and metrics, while at the same time raising inaccuracy issues due to bonds with legacy infratechnologies.
- "Poorly designed standards": linking to point 1, standards heavily influenced by legacy elements can result in market inefficiencies. In such case, industry consensus represents a possible solution, despite being unlikely.
- 3. "Poorly timed standards": delays can increase transaction costs, especially for small firms, which need standard interfaces in order to supply single elements or simply enter the market.

Hence, standardization in itself needs proper designing in order to outweigh possible costs. After defining the concept of standard and its consequences, it is useful to analyze how firms interrelate in the process of setting it. In general, we can identify three different events: standard war, negotiation and leadership (Varian, 2001). In the first case, companies compete by using different and more or less aggressive market strategies in order to achieve the critical mass threshold for standard adoption. Common strategies are:

- Penetration pricing aimed at the creation of an early base (Besen et al., 1991). The most extreme form is probably the open architecture strategy.
- Licensing agreements (Hill, 1997): by licensing a specific technology to existing firms, including competitors, it is possible to increase the installed base and earn market

approval. In fact, it enables wide distribution, which fastens economic returns (as they are increasing depending on installed base). Secondly, it increases investment costs for competitors that are focused on different, competing technologies, thereby creating a co-opting mechanism. Finally, it increases development of complementary goods.

- Alliances with suppliers focused on complementary goods creation: Hill (1997) defines an alliance as "a cooperative agreement between a firm and one or more actual or potential competitors to jointly sponsor a technological standard". In this case, the focus is on coordination between different players. According to Hill, this strategy is particularly effective, as it brings specific advantages in common with the previously described licensing strategy: wide technology distribution, competitors co-option, and public commitment to the technology (therefore building expectations).
- Public expectations management, i.e. announcements (Besen et al., 1991).
- Promise of competitive prices (Besen et al., 1991)

Moreover, companies must try to invest more and better than its competitors (BSR, 2005), and this basic strategy applies to almost every scenario.

Strategic options for succeeding in industries highly sensitive to standards are and must be all aimed at one, single purpose: achieve a critical mass of adopters. Quoting Hill (1997):

"Three guidelines for success in industries where standards are important and increasing returns exist are: maximize installed base, maximize installed base, and maximize installed base."

Case description

It was the 13th of January 2000 when Steve Ballmer became CEO of Microsoft, when the IT industry was on the edge of the dotcom bubble burst. In fact, the NASDAQ market index was going to reach its highest peak on the 10th of March, at 5132.52. Between 2000 and 2002, the stock market crashed and burnt around \$5 trillion (Gaither et al., 2006), causing a consistent number of firms to file for bankruptcy. When Ballmer was appointed, Microsoft had already enjoyed the highest stock price ever reached by the company, \$59.56 (Google

Finance), achieved on the 27th of December 1999. On the 13th of January, it was already \$53.91, and after only two years it would have slumped under \$30. Only in recent years the company managed to recover from a long stagnation period.

Obviously, the company survived the tidal wave of the bubble burst and kept focusing on software development. While the launch of Xbox, a gaming console, in 2001 was the first sign of a new devices and software strategy for Microsoft future (and the first, in-house hardware product), the company was still Windows-centric. The hardware business remained a marginal part of Microsoft's plan for many years, as the company was heavily focused on its operating system. And while the company grew, its vision stood uncertain. Promising projects were killed in favor of Windows-related resources (Weinberger, 2016), while business units were becoming increasingly independent, fighting for more resources with each other. Projects started to lose consistent vision, and the first Xbox is a clear example (Weinberger, 2015): it was supposed to be based on Windows 95 at first, then on Windows 98. The Xbox team convinced the management that they would have created a slimmer version of Windows exclusively for Xbox, and then include the changes in the PC version, in order to ease the coding process for third party developers. In that way, there would have been seamless integration between the two platforms, and Xbox would have greatly contributed to an operating system that was starting to face some critiques (long boot times and the infamously famous "Blue Screens Of Death"). After receiving \$500 million dollars' investment and a oneyear window, the team developed an isolated system. It was smooth and efficient, but did not provide anything to Windows, and it never did (the operating system reached the Xbox One only in November 2015, through a system update). And it is pretty interesting to analyze how the core lying into Microsoft changed from Ballmer to Nadella. The first made the company coincide with Windows, with a whole universe of differently important products gravitating around the operating system, from Office suite to Windows Server. Xbox introduced a shift towards the vision of a "devices and services company" (McCracken, 2014), which was consolidated when Surface and Windows 8 made their appearances in October 2012, together with Windows Phone 8, and Xbox One only a year later. The strategy of vertically integrating devices in order to increase adoption and quality of proprietary services is a clear reference to Apple, according to the new CEO Satya Nadella (McCracken, 2014). In fact, when Ballmer resigned from his position as Chief Executive Officer, the company needed first

of all a coherent vision and brutal steer with the past. The market demanded a new version of Microsoft, more connected between its parts and focused on innovation, rather than cash flows. Nadella addressed these problematics by highlighting what is Microsoft about: productivity and innovation. And their combination creates the new company identity in terms of products and services, as Nadella himself stated (McCracken, 2014):

"I just think about three things: there is Windows, there is Office 365, and there is Azure. That's it. Everything else to me, you can call it features"

This has some direct consequences:

1. While Windows is still core, it shares its importance with two much younger entrants in the portfolio. In this case, as previously described, this research will focus on Windows, while Azure and Office 365 case studies will be material for future scholars.

2. The vision of a "devices and services company" is now shortened to "productivity services". Devices are just "features". As this study claims, devices play a complementary role in Windows market lead under Nadella's vision.

3. The company is now heavily focused on cloud integration and computing: in fact, Azure represents the cloud platform for businesses, unlocking integration for multiple additional services and several benefits for consumers.

It is fairly obvious how the market positively received Nadella steer in Microsoft strategy. The stock price has surged from its long-time stagnating neighborhood of \$35 to \$51, increasing by a magnitude of 50% and almost reaching the all-time high of early 2000. Moreover, the market realized how the new company was addressing future topics as Big Data, Internet of Things (recently the acquisition of the Italian company Solair specialized in IoT solutions, as per Microsoft press release), cloud solutions (Azure), and augmented reality (HoloLens).

- Surface: a new, productive hybrid.

Windows tablets grew by 59% on a year-over-year basis (Nofuente, 2016), whose magnitude is even more important when compared to Android and iOS, who decreased by 7 and 22 percent respectively. This difference is mainly due to a new category of devices called 2-in-1, crossover tablets, or hybrids, that grew by 379% in 2015. Surface started the evolution of desktop productivity in 2012, and since then has seen 4 iterations (in the moment this research was written, the newest version was the Surface Pro 4). The product did not enjoy immediate success. In fact, the Surface RT, which was the cheapest version equipped with a underwhelming Windows RT distribution, caused Microsoft to pay a 900 million dollars charge for unsold goods (Fiegerman, 2015). Doubts were shattered in fiscal year 2015, when the second quarter (ending in December 2014) reported a 1.1 billion dollars' revenue from the Surface division, officially establishing the 2-in-1 business. The last Microsoft earning release in April 2016 showed a revenue of 9.5 billion from the Surface line, an average of 2.4 billion dollars per quarter.

- Xbox One: the high-potential underdog.

Xbox One is an interesting product and topic for research. In fact, it is at the same time three different things: most importantly, a gaming console; a hub for home entertainment, by connecting to it the TV cable (and a Kinect sensor for vocal commands); a PC extension, as it runs Windows 10 at its core together with Microsoft universal apps. Its main competitor, the PlayStation 4, is only a gaming console. The PlayStation 4 has sold over 40 million units worldwide, surpassing the previous record held by PlayStation 2. The market share of Xbox One coincides with around 21.1 million units estimated.

Is it a pure matter of casual consumer behavior? Of course not. There are key variables that affected Xbox One sales and favored Sony's console. I identify four different areas: targeting, pricing, performance and expectations.

• Targeting: the mantra of PlayStation 4 was straightforward and simple, as it aimed at gamers in a crystal-clear fashion. The Xbox One instead focused on TV integration and

the concept of entertainment hub (Peckham, 2013), subtly stating that it would have been a great product, with or without the gaming part of the experience.

- Pricing: Xbox One was launched at \$499 in a bundle including the Kinect 2.0 sensor, an innovative natural user interface device for gesture and voice recognition, among others. Consumers could not choose to exclude the sensor from the bundle and buy the console separately. Instead, PlayStation 4 was a console-only, similar product at \$399, 20% less than its direct competitor.
- Performance: the PlayStation 4 was found to be faster than the Xbox One by an order of 15% in terms of raw megabytes per second processed by the CPU (Sinha, 2013). Additionally, the faster memory of Sony's product (a GDDR5 V-RAM versus an older DDR3 sported in the Xbox One architecture) increased the discussion between power users and technical tests.
- Expectations: with "expectations" I refer to the announcement of a Windows 10 based console, promising complete support to universal apps and smooth transition from the desktop/laptop to the console. Instead, the Xbox One used at its core Windows 8, and received Windows 10 and Universal Windows Apps support only two years later.

- Hololens: introducing Augmented Reality

Virtual reality attracted the attention of many important players in the IT industry, when in 2012 9522 backers pledged around \$2,5 million dollars to invest in a project called "Oculus Rift" on Kickstarter.com, a crowdsourcing site. The new company was acquired by Facebook in 2014 after two year of product development (Orland, 2014), which valued the company at \$1,6 billion dollars. The first consumer edition was released on the 28th of March, 2016, and it is already competing against two other strong competitors as HTC and Sony. The first has produced the HTC Vive, a virtual reality headset based on a different technology (and selling at a higher price tag), while Sony is launching its PlayStation VR in October (House, 2016), planning on leveraging the existing PlayStation 4 customer base.

Is HoloLens a competitor? Actually, no. As described on Microsoft product page, It is the first augmented reality headset, a device capable of computing real-time holographic objects, which are perceived as part of the reality in front of the user. Hence, it does not involve an

immersion in a completely different environment, it aims at *augmenting* the existing one. Moreover, it is a standalone device equipped with Windows Holographic, an operating system based on Windows 10, which differentiates this product from the previously cited Virtual Reality competitors. It is then clear how HoloLens is leading an entirely new market segment, creating a unique opportunity for Windows innovation and adoption. In fact, proprietary holographic environments would push Windows 10 penetration in the market. Still, as of now it has been released only the development kit on the 30th of March, 2016 (Warren, 2016), while the consumer version has no release date yet, and it is no coincidence.

- Windows Phones: a significant 1%.

As the title suggests, Windows Phones represent a strong contradiction: a great potential for PC substitution, by using a feature called "Continuum", which projects Windows 10 on bigger screens directly from Windows 10 phones and allows keyboard and mouse support; secondly, a terribly small market share, i.e. 0,7% (Warren, 2016). In the same article, Warren dramatically states that: "Windows Phone is dead.", since Microsoft managed to sell only 2.5 million phones, losing market share against an overall market growth of 4% (Gartner, 2016). Strategy has changed from three different devices for three well-separated segments (enterprise, low-cost, flagship) to a much vaguer "great devices" (Warren, 2016), while on the software side Microsoft has changed from exclusivity to compatibility, by releasing great apps for iOS and Android. These two elements together create a scenario where developers do not have any new hardware to work with, while consumers can enjoy Microsoft's software on their operating systems, be they either Google or Apple's one. Still, as the Surface case shows, Microsoft is able to innovate in many different ways, both hardware and software. Hence, the new hardware will play a key role, together with new synergies with Windows 10 (in particular Continuum's evolution).

- Microsoft Band: Health and Cortana.

It is clear the rationale behind the Microsoft Band. In fact, it can be defined as both smartwatch and fitness tracker, as highlighted on Microsoft product's website. About the first,

the Band can stay synced with customers' calendar and preview emails and texts, interacting with Cortana-equipped phones in different ways. In this way, the Band empower people to be more productive and achieve more, as Microsoft's long term vision states. Secondly, it can be defined as fitness tracker due to its wide range of sensors able to track fitness activities.

Findings

Alongside the theoretical analysis, I interviewed the Category Lead of Microsoft Italia, Luca Callegari. As Callegari states: "Microsoft is a mobile-first, cloud-first company". Is there a conflict? How does hardware relate to this statement? Actually, it is simple. Surface Pro was meant to be a showcase, to drive the lackluster innovation the PC industry had suffered for years, reaching the state of commodity market. The message was two-sided: premium Windows machines did have market, and Original Equipment Manufacturers did have a new path for innovation. Callegari describes what was the rationale behind such move: "We believed that introducing Surface as a Premium 2-in-1 device would have showed the Original Equipment Manufacturers and Retailers a new market, and we are leveraging the same strategy with Surface Book at a global level". The Book is still not available in many countries around the world, fostering the point of a showcase, more than a mass-market product. Surface has become a standard of guality and design, creating the 2-in-1 market and enabling competition in the premium segment, previously dominated by Apple's devices. Now, Surface Pros face intense competition, but it would be a mistake to consider it a downside. On the opposite, it shows that Surface actually managed to set the hardware standard for 2-in-1 hybrid devices, and more in general for premium experiences on Windows computers. Moreover, "the motion of attached products completely changes".

Throughout the interview, Callegari also explained how gaming consoles have changed, and why Microsoft has tried to stress the importance of the Xbox One as the main entertainment hub: "Consoles are perceived as commodities, where the value-added is completely stemming from games. This is the reason we aimed at producing something innovative and future-oriented. Still, this perception caused PlayStation 4's lower price to beat the market.". Hence, Microsoft did try to set a new standard for consoles, shifting the focus from pure gaming to broad entertainment. And it is still the vision behind the business. Xbox One can

enable cross-playing. In Callegari's vision, the machine "will become a tool specialized for easy access to cloud services, while Xbox Live will become the center of multimedia, thanks to Windows 10". This innovation is compulsory, since "the market is shifting from buying products to service consumption".

Instead, the Band is the gateway to fitness data. The hardware's scope is to establish Microsoft Health and Cortana, in order to be able not only to monitor, but also "to predict health issues and warn the consumer before illness takes place", in Callegari's words.

Finally, HoloLens represents the long-term strategy of Microsoft, as the company is selling only the developer edition for enthusiast partners. As of now, the project's main focus and consequence is the increased attention of developers towards Windows Holographics and in general Windows 10's environment, according to Callegari. HoloLens is therefore meant to attract the scarce available developing talents toward the new frontier of augmented reality, at least in the short-term.

Therefore, it is clear how Microsoft's hardware portfolio as a whole aims at boosting software and services adoption, either from the development or the consumer side. Recalling Hill (1997), there is only one mantra in IT: maximize installed base. Microsoft is leveraging internal core competencies to create interdependencies between hardware and software. In particular, the introduction of proprietary hardware aims at showing both new path for innovation and proprietary software and services, among which Windows 10, the last version of Windows. The latter is proposed as universal platform for a vast spectrum of devices, thereby proving how a standard universal operating system can be achieved by means of proprietary hardware.