Titel: Apple Inc. - Solving the Innovator's Dilemma

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Apple Inc.

Solving the Innovator's Dilemma

Abstract

We analyze Apple Inc. using the theoretical concepts of Clayton Christensen's disruptive innovation theory and find it differs significantly from the predictions of the theory. We trace the theoretical origins back to the dichotomy in capitalism between Knightian uncertainty taking entrepreneurs, who fight in a Schumpeterian creative destruction sense against monopolistic bureaucracies. Apple has sought to organize itself to avoid excessive process bureaucracy while maintaining a high degree of centralization.

We lay out Apple's internal organization and analyze its ability to innovate on both sustaining and disruptive paths. We find that its interdependent architecture is a natural fit to its objective of controlling the entire user experience to the furthest extent possible. Apple wants to disintermediate other distribution networks of content, communication and software. It incorporates this value added in its own distribution channels. It creates moats around its interdependent architecture through its proprietary software lock-ins, its physical retail, marketing & public relations and by running an extremely efficient internal market with hundreds of suppliers.

Apple's cultural DNA has shown itself prepared for low-end disruptions by leveraging both the quality of its products and the network effects of its ecosystem as well as its efficient cost structure to close off potential low-end price umbrella strategies. It has also shown itself to disrupt its own products, cannibalizing immediate profit optimization for long-term monopoly volumes.

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Introduction

All corporations eventually fail. Most never get off the ground and grow sufficient value networks that can sustain them. Those that do innovate and create exponential growth eventually slow down only to fail later. The physicist Geoffrey West (West 2011) has shown through statistical analysis of 10,000 US public companies a consistent S shape pattern of growth, that tells a remarkably consistent tale of limits to corporate innovation. His thesis being that initial innovative growth becomes unsustainable as corporations grow in size and complexity.

Innovation has become a prolific term in both business and politics. Few words are as revered in society. Perhaps because most companies stop truly innovating. Perhaps because we understand that it has become essential for corporate and perhaps even societal survival. Of course innovation does not occur in a vacuum. There is competition for value creation.

In an evolutionary sense companies can be understood to be continually competing for human capital, and the attention of potential investors and consumers. Of course in a crucial sense we are not dealing with evolution, as we are not confronted with an entirely random process of selection. Companies are deliberate creations. And competitors adapt through deliberate actions. Companies are one another's fitness landscapes. They local optimize their operations due to competitive action.

Economists tend to describe markets as either being in perfect competition or being dominated by one or a select few companies. Of course what may be beneficial for consumers is far from perfect from the viewpoint of corporations. Corporations want to avoid competing in markets in which they are price takers, instead preferring to set prices. To accomplish this corporations build moats around their business models. This notion of moats comes from the legendary investor Warren Buffett (Cunningham 2009), who mostly avoids investing in technology companies. To him the cash flows are too unpredictable going into the future. He seeks companies that have defensive moats around their businesses. Whether brands, intellectual property or long-term value networks with customers, he looks for companies that have business models that are prohibitively expensive to replicate. Only a limited amount of competitors can compete for market share making it a symmetrical battle of large companies. Innovation can be said to be sustaining to the few symmetrical competitors. In this sense Warren Buffett can be said to be short technology disruption.

In industries with rapid change such as information technology moats are often temporary but their specific weaknesses hard to assess or predict. Moats can be said to be nullified or *disrupted*, as business or technology innovation dislocates the cash flows travelling between the buyers and sellers of goods and services. These *disruptive innovations* are a key topic of this thesis.

Disruptive innovation is by its nature *asymmetrical*. Marginally sized innovators can threaten established corporations by circumventing or potentially even turning their moats with legacy costs against them. This dynamic asymmetrical fight of defending or attacking established

moats was the topic of Harvard Business School professor Clayton Christensen's seminal book *The Innovator's Dilemma* (1997). In it he introduced the theory of disruptive innovation that seeks to explain the failure of formerly successful corporations that follow best practices, innovate and build successful businesses that cater to customers wishes. Despite following best practices the moats they built ultimately failed them.

Purpose and Relevancy

"It's important that we make this transformation, because of what Clayton Christensen calls "the innovator's dilemma," where people who invent something are usually the last ones to see past it, and we certainly don't want to be left behind."
- Steve Jobs, CEO of Apple in conversation with biographer Walter Isaacson.
(Isaacson 2011, Kindle: 8813)

Steve Jobs is well known to have despised MBAs and the business school general management approach. According to his biographer the only business book that caught the interest of Steve Jobs was *The Innovator's Dilemma*. Maybe he recognized the dilemma of small marginal companies overtaking larger dominant ones, only to repeat the experience as they in turn are disrupted.

Our interest in Apple as a disruptor stems in part from Christensen's persistent criticism of Apple's business model. He was critical of Apple's integrated business model and predicted several times during the 2000s that it would fail. Competitors would soon imitate its products and diminish any advantage it had. He questioned whether the company would be able to create further disruptions. This we now know they did which raises three questions. How did they accomplish the rare feat of disrupting an industry more than once? Does Christensen's disruptive innovation theory contain a flaw? And can other corporations imitate Apple's organizing decision making processes?

Our interest also originates in Jaron Lanier's ideas regarding how the captains of Silicon Valley are shaping the future of the Internet and in so doing our global economy. Moats in technology are often those of network effects such as proprietary lock-in. To comprehend Apple or its competitors we must not confine ourselves to the past.

"There's an old Wayne Gretzky quote that I love. 'I skate to where the puck is going to be, not where it has been.' And we've always tried to do that at Apple. Since the very, very beginning. And we always will."
Steve Jobs, launching the iPhone at Macworld Expo 2007 (Jobs, iPhone launch at Macworld Expo 2007 2007)

The decisions of the industry leaders are highly deliberate. They are positioning their business models, their value networks and brands to secure long-term success in an industry prone to rapid rise and declines. We are not only interested in understanding how they try to disrupt markets and avoid themselves being disrupted. We also want to understand and possibly learn from their decision making processes. This may contain valuable knowledge for other corporations, either to imitate pieces of their business models or as inspiration for organizational change.

Apple's organization is unlike any other major corporation without divisions nor divided profits & loss statements. Its cohesion, focus and strong alignment of incentives are often overlooked

while its brand and design choices are superficially emulated. Are any of its deep organizational convictions applicable to other corporations? Is Apple itself imitable?

Apple's remarkable success at vertical integration questions the received wisdom that conglomerates are inefficient and unable to stay ahead in continually innovating industries. Apple may not always dominate in volume but its three disruptions starting with the iPod have all captured the majority of industry profits. Two of these disruptions include volume dominance. Why did some disruptions work better than others and why has Apple made little progress with its Mac business? How has it managed its innovation process? And how has it kept both commodity competitors as well as talented software competitors from disrupting its businesses?

All of these questions strike at the core of how corporations should organize, process innovate and communicate with stakeholders and customers. Information Technology is a rapidly developing industry. As with researchers who change one variable at the time in fruit flies, IT gives us more pieces of the puzzle of what determines success and failure. The theory of disruptive innovation started with the fast changing hard disk drive storage industry (Christensen, The Rigid Disk Drive Industry: A History of Commercial and Technological Turbulence 1993). The disruptions of the PC, mobile phone and consumer electronics industries by Apple are therefore powerful cases from which to draw business lessons.

Software is furthermore in some ways a unique industry with almost non-existent marginal costs and is extremely favored by network effects such as customer lock-ins. Software can be said to affect most other industries and increasingly so as it becomes ever cheaper to store, process and communicate information on an ever increasing amount of devices.[1] The high-end of software is an important sector for the rest of the economy and for this reason alone deserves our attention. For software will help shape the sustaining evolution or possible disruptions of other industries.

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[1] From storage on RFID chips to processing on billion dollar server centers running clouds.

Thesis Statement

"If the hardware is the brain and the sinew of our products, the software in them is their soul."
Steve Jobs (WWDC Keynote, 2011)

Throughout this thesis we will take the view that Apple is a software company that has chosen to distribute its software products through an integrated value chain that includes hardware products.

Often Apple is conceived of as a hardware company but this overlooks the fact that the company is one of a few to ever successfully develop, launch and sustain an ecosystem surrounding a personal computer operating system. This is not a trivial task.

Software is a highly volatile business where only a few have successfully built long term businesses with strong moats. None of these besides Apple have been successful in integrating large parts of their value chain from hardware to software to distribution.

Disruption theory posits that an interdependent strategy only works temporarily before competitors imitate and collaborate across the value chain, undercutting an interdependent architecture on price and customization. Apple has avoiding this fate for a long time and this will be our thesis question:

How did Apple Inc. solve *'The Innovator's Dilemma'* by avoiding *low-end disruption*, i.e. commoditization of its premium priced products, or by being made qualitatively obsolete by *new market disruption*?

Any integrated company must be able to create higher value and/or lower cost than the market place that in combinations create competing products or services. There is always an economic tradeoff between control and complexity. At its most extreme a planned economy offers perfect control but the informational complexity and divergence of incentives far outweigh any benefits to control.

To answer our question we will have to understand both how Apple organizes itself to drive innovation, and how it builds defensive moats to make imitation costly.

Methodology

A choice must always be made between focusing on the quantitative or the qualitative aspect in analysis. One does not exclude the other but it does shape the analysis. We will focus on the qualitative because Apple is a closely followed stock with a wide range of opinions and they are all based on storytelling. We make sense of data before we acquire it and our cognitive abilities are flawed when it comes to understanding complex causal systems. Further a lot of money is involved including from professor Christensen as he works as a consultant and goes on highly lucrative speaking tours in corporate America. Further his interests now include disruptions in health care and education both of which are very profitable industries to have opinions about. This doesn't degrade his theory but we will entertain a healthy dose of skepticism.

Common Financial Biases

Countless research analysts, journalists, academics and bloggers pore over the minutest details in any official filing or rumor that follow Apple and its main competitors. As is now well proven, equity analysts are worse than random at predicting future discounted cash flows and stock price movements. In fact quite a few amateur bloggers have a better track record in predicting quarterly returns than financial analysts. Perhaps this is because Apple does not supply whisper numbers. Or it may be due to the tradition of Steve Jobs rarely engaging with investors. This has somewhat changed with Tim Cook.

We do not believe a quantitative discounted cash flow analysis would bring anything new to this discussion. Apple's stock (AAPL:NASDAQ) has advanced roughly 85 times since September 2002, and the present market chatter on AAPL risk centers around the law of large numbers and the eventual mean-reversion. More prudently it also discusses the disruptive threat of Android. The first is a bell curve argument of returns though past returns should contain no knowledge of future returns according to academics. The second is a qualitative argument that goes back to the experience of the 1980s and 1990s when Microsoft's DOS/Windows operating systems won decisively over Apple and other non-server operating systems by selling the license freely. There are some parallels to todays computing world but as we will show much has changed including Apple.

Market Research Biases

Other quantitative analysis that is of doubtful quality comes from the market research companies. Because of litigation we know that Gartner were paid by Microsoft in the 1990s to form opinions about markets that were in favor of Microsoft products. While we do not know whether this is still the case, companies such as Gartner have terrible predictive track records that make equity analysts look prescient (Bott 2012).

Besides market share analysis we also find this problem when we analyze Apple's pricing strategy. Tear downs of its products by iSupply seem dubious when they could not possible know Apple's arrangements with hundreds of suppliers, in particular in some cases before Apple has even launched their product.

These are all problems that a quantitative analysis wouldn't circumvent. The data is of a generally poor quality, in particular when one understands how they are shaped by market categories determined by market researchers who have monetary interests in outcomes. In many ways they depict the past instead of explaining disruptions already underway.

Another issue is that Apple releases sales numbers whereas its competitors state shipments. These could be unsellable channel stuffing units that will become accounting losses without corresponding adjustments to prior market research reports on shipments. This is mostly a problem when assessing newly forming markets such as tablets.

Apple's Secrecy
Apple is a highly secretive company that finds nothing to gain from disclosure of its business practices. Its public relations is firmly focused on its products, not its organization or employees. To understand its culture we will rely on marketing executive Ken Segall's book Insanely Simple describing what he has learned from working with Apple and Steve Jobs. Inside Apple is the second book we will use to understand Apple's organization and DNA. It is written by senior editor at Forbes Adam Lashinsky. Thirdly we use Walter Isaacson's biography Steve Jobs.

We will include interviews with Steve Jobs and other executives both former and present at Apple. These are obviously part of Apple's PR. Nothing at Apple is left to chance including its public brand. They do however clearly express its DNA and some of the choices it has made when it comes to strategy.

Apple's accounting is of a very high quality and it helps us understand its business decisions. Unfortunately its competitors especially Google and Samsung are less forthcoming. We can therefore only make some general conclusions from their accounting regarding specific strategic business decisions.

Quality of Other Sources
We will incorporate some ideas of Jaron Lanier on networks and the future of the Internet as Google, Apple, Facebook and others are shaping it. He is a researcher at Microsoft but we judge him credible.

Analysis Framework

We split our analysis into four parts.

The first part is a concise introduction to Clayton Christensen's disruptive innovation theory including the concepts of modular / interdependent architecture, job to be done and sustaining / disruptive innovation. We cover the crucial issue of whether or not a company should open up its value chain to partners in a modular architecture. We explain The Innovator's Dilemma as being an organizational challenge, driven by best practices and optimization. Established organizations rich in resources are well prepared for symmetrical fights, but are poor at recognizing and responding to asymmetrical business and technological innovation.

The second part of our analysis questions the predictive ability of disruption theory in the face of Apple's success despite Clayton Christensen's numerous predictions of imminent failure. We concisely analyze the non-disruption of the Mac and the three disruptions of the iPod, iPhone and iPad. We will argue that the widespread misunderstanding of a disruption is in fact a telltale sign of a disruption. We find that the dichotomy between sustaining and disruptive innovation is indeed a very old one and show some of their roots in economic thought. From this we develop the idea that the dichotomy is based in the conflicting incentives of entrepreneurs and bureaucracies.

The third part builds on this knowledge in exploring how Apple was built by Steve Jobs to avoid stagnation and disruption by competitors. We argue that Apple was shaped by a cohesive vision of what a corporation should and should not be. We see that Jobs had a clear view of corporate failure as a result of incentive structures and bureaucracy. For Apple to remain a disruptive company he had to find a signature job to be done that was not encapsulated in a specific product or service. We then analyze how Apple is organized to remain focused and motivated in solving this job. Apple's ability to balance disruptive and sustaining innovation derives from its unique organization.

The fourth part is focused around the issue of the costs and benefits to Apple's interdependent architecture. An integrated company is to a large extent an internal market with greater complexity costs than a group of specialized competitors organized in a modular architecture. Success or failure is determined by whether its parts as a whole add value at a greater rate than its competitors. We analyze its five moats separately to determine their effectiveness and cost of imitation versus its modular competitors: Brand, Distribution, Scaling, Proprietary Technologies and Network Effects.

Disruption Theory

Clayton Christensen's disruption theory has evolved quite significantly since first being sketched out in 1995. At its core is an attempt to frame business and technology innovation as asymmetric corporate warfare.

In this section we will introduce the central concepts and show how they've evolved. These begin with the question of how to avoid commoditization by choosing to compete with the correct corporate architecture. Companies must choose along the value chain to either control the processes themselves or let other companies compete for position. The most successful companies are those that control the key nodes while the others are mostly commoditized. We will use the example of the Microsoft-Intel architecture as it pertains to Apple directly.

Christensen argues that an interdependent architecture works as long as the speed of innovation is high. When it slows price competition sets in. This is possible because consumers can become over served. Customers buy products or services because of a job to be done which can be difficult to determine, as it is inherently a qualitative judgment. Inferior products or services may therefore compete on price and qualitatively new products or services may create niche markets that potentially can conquer well-established core markets. We will treat the issues of low-end disruption and new market disruption separately. We will use Christensen's examples of mini steel mills and milk shakes to cover low-end disruption and job to be done respectively. New market disruptions pose the question of judgment. What may appear to offer significant value to one may to another be inferior. How to judge Apple revolves around the question of what they offer customer and whether this is defendable. Brands on their own are not.

Finally we discuss the innovator's dilemma. If companies were able to absorb and act on market information to innovate aggressively when prudent then we would have no dilemma. In the real world organizational politics and misaligned incentive structures create organizations that with age are ripe for disruption. Even corporations created through disruption eventually fail because they disregard inferior competitors and insignificant markets until they no longer are neither inferior nor insignificant. At that point their response is inadequate and their failure a given. The innovator's dilemma is first and foremost internal.

We discuss Christensen's solution to the dilemma before we in the next chapter will see how Apple has structured itself to avoid both price – and worse – new market disruptions.

Architecture

In capitalism a dichotomy exists between the price-performance optimization of perfectly competitive markets and the profitability of corporations. As a culture we want to see the normative good of perfectly competitive markets with minimal profits. But as employees and investors we want monopoly and price setting. As Peter Thiel puts it weak companies signal that they are price setters whereas market dominating companies describe themselves as

competing in much larger markets of which they have no control (Masters 2012). No one wants to admit it but success comes from control over key non-imitable economic resources from which rents can be extracted. Corporations therefore seek to avoid commoditization as these markets are far more difficult, more risky and success is measured in far smaller margins.

The question of value chain architecture is only to be decided by strong corporations or new disruptors who control the key nodes of value.

Interdependent architectures vertically integrate parts of the value chain making them dependent for final sale. Christensen describes these as common in new and fast developing industries where time to market and continued innovation is valued by customers as products and services are yet to over serve customer needs. Interdependent architecture competes on the dimensions of improving functionality and reliability. (Christensen 2003, Kindle: 2421)

Modular architectures are part interdependent architectures where a single or a few companies control key nodes of value creation. The remaining nodes are deliberately kept open to markets for competition. According to Christensen they meet where the interdependent architecture is optimized to meet the sub-optimized third party service. Modular approaches compete by improving speed, responsiveness and customization.

As industries mature and the speed of innovation slows companies dependent upon an interdependent architecture face competitors who specialize on specific parts of the value chain. These competitors can optimize their cost structure to fit these specific operations. They also add value by responding to niche markets and customizing their services. The company controlling the key node to be optimized reaps all of these benefits without the corresponding investments.

The classic example is that of the personal computer. Apple and many other computer makers initially had great success in solving both hardware, firmware and software jobs to be done. As the pace of innovation slowed they became vulnerable to the modular architecture of Microsoft-Intel (Wintel). IBM had initially been shortsighted by the move from minicomputers to personal computers giving space to Apple and others. To get quickly into the PC market they licensed their operating system from Microsoft but made the mistake of not being the sole licensee, since they could not foresee that the part to be optimized was no longer hardware but software and microprocessors. Cost competition and customization from a large field of hardware manufacturers made Apple and other interdependent architectures uncompetitive in the still booming PC market. Microsoft and Intel with their x86 instruction set architecture benefitted tremendously from owning and controlling the direction of innovation without manufacturing a single PC.

Let us for now accept the premise of this story, that Apple's failure was a failure of interdependence. In that case the point of debate would be what constitutes the pace of innovation. Disruption theory takes both a macro view and a micro view. The macro explains the motivation of corporations competing in markets. How their innovation either sustains or

disrupts competition. The micro defines the boundaries of these markets by what motivates customers, their job to be done.

Sustaining Innovation and Disruptive Innovation

"In sustaining circumstances—when the race entails making better products that can be sold for more money to attractive customers—we found that incumbents almost always prevail. In disruptive circumstances—when the challenge is to commercialize a simpler, more convenient product that sells for less money and appeals to a new or unattractive customer set—the entrants are likely to beat the incumbents." (Christensen 2003, Kindle: 701)

Exhibit 1 & 2 show Clayton Christensen's figures that explains the relationship beetwen sustaining and disruptive innovation.

Sustaining innovation occurs in well established markets where competition centers around incrementally improving products and services. Customers are on average satisfied and the pace at which they can absorb improved products is limited. Corporations target their best customers, the most demanding with the highest margins. The speed varies greatly between industries but within industries companies are awarded for keeping up with the sustaining pace of the industry. The pace is in turn set by how fast their best customers can absorb change. Recent research has shown that this is true across a wide range of industries. In 62 different technologies from semiconductors to beer production, a consistent pattern of incremental yearly price-performance improvements was found (Nagy, et al. 2012). With well defined business models and technology, incumbents almost always win symmetrical fights as they hold more resources and have established moats around their value networks.

Disruptive innovation is asymmetrical competition for profits that initially escapes the notice or interest of corporations competing for the highest margin business of their best customers.

Disruptive innovation is predominantly business innovation whearas sustaining innovation is typically incremental technology innovation.

Entrants amost always win asymmetrical fights.

Christensen divides disruptive innovation into low-end disruption and new market disruption. The simplest to understand is the low-end disruption. As industries with sustaining innovation improve their products to fit the needs of their best customers, they overshoot the needs of lower-end customers. A disruptor can win a foothold in a market by targeting low-end customers with a simpler, inferior product that sells at a lower price. From this position they can gradually improve upon their product and move up market taking away market share from incumbents. For incumbents to let a lower price position remain open is refered to as a price umbrella, something Apple is conscious about.

The classic example is that of steel minimills. Traditional integrated steel mills are capital intensive but produce a high quality of steel. Minimills have small electric furnaces producing lower quality steel at 20% below the cost of integrated steel mills. The case story begins in the 1960s (exhibit 2) when minimill technology first became viable in the lowest quality steel market, the concrete reinforcing bar (rebar) market. From this position they made sustaining improvements to their technology and moved up market over the course of 30 years. Their 20% cost advantage led to high margins until the moment when the minimills dominated a subsector of the steel market when profitability would collapse. This want of profits motivated the minimills to innovate, moving them upmarket towards high margins steels. From the perspective of the integrated steel mills, managements were happy to stop competing for unprofitable business. Their margins increased as they focused on their best customers. After 30 years of fleeing up market the integrated steel mills became marginal players or bankrupt. (Christensen 2003, Kindle: 809)

Once a price umbrella is established low-end disruption eventually leads to market dominance as high-end incumbents flee upmarket.

Price is an easy to measure and understand competitive differentiation. Rational customers such as those who purchase steel, want steel that is good enough for less. New market disruptions are more ambiguous. They occur when entrants are able to simplify a product sufficiently to open up a market that was previously unserved. Christensen also refers to this as competing for non-consumption.

”New-market disruptors' challenge is to create a new value network, where it is nonconsumption, not the incumbent, that must be overcome.” (Christensen 2003, Kindle: 928)

When the qualities of a product are not easily compared to what preexists, the boundaries of a market is set by what it is hired to do.

Job to be Done

To discover the boundaries of new markets Christensen focuses on what motivates the purchasing decisions of customers. He developed this insight in his second book The Innovator's Solution:

"[Customer] thought processes originate with an awareness of needing to get something done, and then they set out to hire something or someone to do the job as effectively, conveniently, and inexpensively as possible. The functional, emotional, and social dimensions of the jobs that customers need to get done constitute the circumstances in which they buy. … Companies that target their products at the circumstances in which customers find themselves, rather than at the customers themselves, are those that can launch predictably successful products. Put another way, the critical unit of analysis is the circumstance and not the customer." (Christensen 2003, Kindle: 1526)

Asking customers want they want is unlikely to explain why they purchase. The circumstances that lead to purchases are in large part due to externalities that are in constant social flux. It is too easy to divide customers along functional lines as if they were rational consumers who have access to their inner preferences. But it is difficult to successfully launch new products based on customer wants. Christensen is prone to use the case of selling new milkshakes (Christensen 2011) to explain what customers hire a product to do. A fast-food restaurant wanted to sell more milkshakes and did a top down profiling of their customers, and then asked those who fit the demographic to list the qualities of an ideal milkshake. The resulting products did not succeed. Instead success was found when doing an in store investigation of shoppers behaviors throughout a day. This lead to the realization that the primary customers were morning shoppers whose job to be done was to pass time in commuting to work, constricted to using one hand and only requiring enough substance to satisfy hunger for a couple hours before lunch. The company was then successful in making milkshakes that took longer to ingest by increasing the amount of fruit chunks and launching a children's milkshake that did the opposite, making it quicker for parents to commute with children.

Without explicitly stating it, Christensen is advocating a bottoms-up anthropological analysis rather than a top-down statistical approach in defining the boundaries of markets. Looking at market data is by its nature looking at the past. At the edges of new markets past categorizations may be harmful to analysis. To define what customers are hiring a product or service to do can be very difficult. The weakness of disruption theory lies in this ambiguity. It requires judgment to assess the functional, emotional and social circumstances from which customers hire products.

New markets disruptors build critical mass away from the attention of established interests. They appear marginal and outside the scope of incumbents. With time they create new value out of customers who were not able to make use of a technology. This is due to simplification. Simpler, cheaper products may quickly improve and eventually threaten nearby markets. This is the path Apple has taken several times over the past decade and a half.

The Innovator's Dilemma

We have been describing the three avenues of innovation and corresponding corporate failures. Sustaining innovation is incremental to industries and a failure to keep up with the slow but certain evolving demands of customers leads to failure. Focusing on the best customer can lead to a price umbrella developing from below. Disruptive entrants can gain footholds with cheaper inferior goods from which they can force incumbents to flee upmarket. The same fleeing is seen with new market disruptions though what constitutes a new market is always contentious. As we argued earlier, corporations have vested interests in either exaggerating or understating their price setting power, to appear strong versus competitors but weak from a regulatory view of monopolies. They accomplish this by changing the competitive comparison. Incumbents very often deny they're being disrupted.

"There's no chance that the iPhone is going to get any significant market share. No chance. It's a $500 subsidized item. They may make a lot of money. But if you actually take a look at the 1.3 billion phones that get sold, I'd prefer to have our software in 60% or 70% or 80% of them, than I would to have 2% or 3%, which is what Apple might get."
Steve Ballmer, Microsoft CEO, 30 April 2007 (iPhone Death Watch u.d.)

This was a common response from those with vested interests in mobile phone manufacturing and OS licensing. Unfortunately for them their denial was also internal causing them to waste valuable time while the entrant improved upon the product, reduced the price and gained a significant foothold from which to expand.

Failure is commonly blamed on bad management. After the fact it is clear to all that management should have acted differently. This may be true when management fails to keep up the pace of incremental sustaining innovation. But what is best practice in sustaining innovation is often detrimental to an organizations ability to disrupt or avoid being disrupted. Christensen is vehement in denying this common sense belief. To him it is those who follow best practices that fail to react timely to disruption. They listen to their best customers, and focus their resources on staying relevant to those who demand and pay the most. When disrupted from below it is rational to flee upmarket, as the overhead of a higher-end company cannot compete on low-end cost terms. It is attractive to flee upmarket.

New and potentially interesting disruptive opportunities are ignored. To divert resources to new and untried markets is not condoned by either customers or investors. The best customers want full attention and investors often complain about small new businesses that are hard to put a value on. Even if successful these marginal markets simply do not move the needle of large corporations. Worse, career paths rarely benefit from taking chances in large corporations. Incentives also exist on the divisional level where silos fight for resources and influence, making it difficult to break with the past. Doing things as they've always been done is deeply ingrained in many organizations. They are the antibodies fighting change.

Focusing on sustaining innovation – improving products and profitability – all too often leads to ignoring disruptive threats and opportunities. It is simply much more attractive for everyone involved until it is too late to change course. This is the innovator's dilemma.

Conversely a company cannot ignore sustaining innovation, as its profitability remains with improving its products and reducing costs.

So how do companies stay focused on sustaining their core markets, while avoiding having antibodies kill off any potential disruptive opportunity, and how can they stay motivated in fighting off low-end disruptors?

Christensen's solution is size. Startups are where we naturally find potential disruptors. The solution is therefore to setup small divisions with their own profit & loss far away from corporate headquarters. These will be motivated even if markets are small and distance will cure the antibodies. He uses the example of IBM, who set up a division far away from corporate headquarters to avoid having its minicomputer division kill off the PC. Some companies deliberate buy up disruptive startups and integrate them into their distribution. Johnson & Johnson, Proctor & Gamble and Hewlett-Packard are mentioned.

Separating the profit & loss is very important. Disruptions may be exponential but it can take years for them to become meaningful to the corporate P&L. In the mean time they are always at risk of being starved for resources if the organization changes priorities or needs the resources to defend its core business. For this reason he advocates leading from the top if necessary, because success depends more on resources than process to begin with. It is likewise best to start early before pressure for immediate action leads to mistakes being made.

Sub-Conclusion

Let us sum up disruption theory. Corporations want to avoid commoditization and for a few this may be accomplished by controlling the key nodes of technology that add value to customers. When markets are young, an interdependent approach allows companies to quicker improve functionality and reliability. As they mature companies that open up parts of their value chain to competitors gain the advantage of speed, responsiveness and customization. Young markets move from under-serving to over-serving the average customer, and change slows to sustaining innovation where incremental performance and cost improvements are targeted at their best customers. Customers hire products to do jobs that in some industries are simple and easy to understand while in others require judgment on human insights. Companies competing in industries with sustaining innovation are incentivized to ignore disruptive threats and opportunities. Obstacles to disruptive innovation and fighting low-end disruptors are internal. Organizational processes and resources are biased towards easy to recognize gains and losses.

The challenge of recognition and response to asymmetrical threats is internal. Christensen's solution entails splitting disruptive opportunities into separate divisions physically located far away from headquarters. Top-down resource allocation may be necessary in early years but it is best for disruptions to quickly focus on profits however small they may appear to top management.

Part Two: The Dilemma in Action

"The trick is to manage the transition. [As standards take over], the products always become much lower in cost and much more broadly available [from more suppliers]. So if you're the incumbent, it appears you're facing a huge threat, even though you're really at the cusp of a great new opportunity. But it's usually new companies that grab that opportunity.

So it really is a fork in the road for Apple. If they do not open up the architecture and begin trying to be the iTunes inside all MP3 players, they're going to have to keep coming up with the next cool thing."

Clayton Christensen interviewed by Business Week (Christensen 2006)

"Q: In a 2006 interview with BusinessWeek magazine, you predicted the decline of Apple within three years.

A: I wouldn't say I predicted Apple's decline. I think a better characterization of my statement regarding Apple would be that I was concerned that it would keep its hardware and software products interdependent, even as the performance of its products began to outstrip the performance levels that mainstream consumers needed. And I think that we're seeing that [now].

Apple has continued to keep its product architectures tightly interdependent, which has allowed it to make really incredible products that are constantly pushing the performance envelope. At the same time, the consummately modular Android platform has seen explosive growth, and for most people, the performance of Android products is good enough for what they need a handheld device to do. Android has seen explosive growth, by many measures outstripping growth in iPhone units. I think that Apple has the talent and culture to continue to make amazing products. But I think that the decision not to break up the interdependence of their hardware and software is a mistake that will ultimately end up costing them."

Clayton Christensen interviewed by The Daily Beast (Christensen 2010)

"The salvation for Apple may be that they can find a sequence of exciting new products whose proprietary architecture is demanded by the marketplace, and they can keep going from one product to another so that they will not have to confront this dilemma."
Clayton Christensen interviewed by Horace Dediu (Christensen 2012)

For the better part of a decade Clayton Christensen has been advocating that Apple should license its software or be forced to reinvent itself. As its success has become undeniable he has become less critical. His initial predictions of Apple's imminent failure have been toned down to the statement that it has to 'keep going'. We want to understand why he failed to predict in the first instance, and whether this questions disruption theory as a predictive

theory. Rarely do we find conclusive evidence in the social sciences that can falsify a theory. This may be one of those instances.

We first need to understand why Christensen failed to understand Apple's disruptions. Disruptions are very often difficult to assess as they happen, especially when they create entirely new markets. We will argue that the widespread misunderstanding of a disruption is in fact a telltale sign of a disruption. It can take years for disruptions to be recognized by participants and outsiders such as journalists. Eventually they become obvious and they are no longer 'new'. We explore this hindsight bias with examples taken from Apple's Mac, iPod, iPhone and iPad businesses, assessing their disruptive and sustaining innovations.

The narrative of The Innovator's Dilemma is that failure to recognize and respond to disruptions is due to a paradoxical challenge for organizations. Organizations optimize to solve profitable problems, since no one benefits from taking unprofitable risks. Incremental sustaining innovation involves listening to ones best customers. Bureaucratic process oriented organizations are well suited for solving these long-term cost and improvement challenges, but are ill-suited to make decisions that jeopardizes cash flows from their best customers. New and unproven opportunities are the territory of entrepreneurs. This dichotomy between sustaining and disruptive innovation is a very old one. We trace its roots in economic history and explore the consequences for disruption theory.

We will use these insights in part three of our analysis, when we to analyze how Steve Jobs created Apple to focus on continual disruption yet have just enough process bureaucracy to drive sustaining innovation as well.

The Mac and the iPod

The Mac is the case in which Christensen was completely right. It never could disrupt the Windows-Intel modular PC industry. When Steve Jobs returned to Apple its excessively large portfolio of computers offered no compelling reason to switch from Windows. Its operating system obsolete and third party developers leaving the platform, it had to remake its operating system, get Microsoft to guarantee Office for Mac, hedge this risk with its own office package and make its own compelling applications for multimedia (iLife) and the internet (Safari and Mail). This took the better of five years after which the company could compete for high-end customers. A gradual switch from Windows to the new Mac OS X began to be noticed by 2004 (exhibit 7).

The modular approach of Wintel had all of the same moats around it that Apple is now creating around its iOS ecosystem: Brand, Distribution, Scaling, Proprietary Technologies and Network Effects. The PC manufacturers produced 20 times or more units with fierce price competition between them. Their price competition well suited for the by new dominance of Internet and big box retailing. Chain stores and big box retailing staffed with salespeople on commission, were replacing the knowledgeable enthusiast stores. Apple was now competing on hardware specifications and price. Intel's proprietary x86 architecture was winning against

Motorola and IBM eventually causing Apple to switch to x86 by 2006. But worse of all the lock-in of customers and developers to the Windows platform could not be overcome by developing a few great applications.

On its own the Mac could not disrupt the Wintel ecosystem. It could only hope to take over the high-end which after fifteen years it has mostly done. We spot this from average selling prices and volume of the top manufacturers. From 1997 to 1999 the ASP of Apple's Macs were in free-fall dropping 25% from $2000. By 1999 the new strategy of having just four models was in place and the ASP of a Mac remained steady until 2008 while the average ASP of a PC fell year on year. Exhibit 7 graphs gradually declining ASPs while its market share decreased from roughly 3.6% to 1.7% by 2004. It is currently around 4.5%. Though we are comparing sales and shipments it is fair to say that OS X has not disrupted Windows. The global market grew from about 80 million units in 1997 to roughly 350 million by 2010-11. Exhibit shows that Apple moved to prioritize portables before the rest of the industry, even though it was promoting its iMac line of desktops. In 1997 a portable computer was luxurious. The enterprise targeted Apple Powerbook 3400c/180 had a starting price of $4500 or about $6500 in 2012 dollars. The importance of portables grew as Apple was able to drop prices. In 1999 10% of Mac units were portables, 50% by 2004 and now 70% of units. According to the research group NPD the ASPs of U.S. laptops were in the $500 range from 2010 to 2012 (Piltch 2012). The ASP of Mac portables has dropped incrementally to $1211 in the most recent quarter. The Mac has outgrown the PC market for the last 25 quarters without significantly prices declines suggesting that Apple now dominates the high-end.

It took the better part of a decade of sustained innovation to mitigate all the technical weaknesses of the Mac platform. None of this was disruptive as the mass market is still captured by the network effects of Microsoft's Windows platform. Apple cannot compete with $500 laptops and so is satisfied with the high margins at the top. It is very difficult to assess the effect that the Mac business had from investments in retail and the halo effect of the iPod and iPhone. What is clear is that these disruptions drove the profits, miniaturization expertise and retail distribution from which the Mac could incrementally innovate. The Mac Air with its miniaturization simplicity would be unthinkable without the iPod. The Mac Air in turn lowers ASPs without sacrificing margins nor the many important jobs to be done of portables.

The iPod was the first disruption but had a slow start. Launched in October 2001 it was a high-end portable music player that sold reasonable well in the hundreds of thousands a quarter. Its competitive advantage being its ease of use, due to removing all software complexity from the device and placing it in iTunes on the Mac. Infamously Jobs was against making iTunes available for Windows but senior management changed his mind. This decision to port iTunes to Windows and the integrated music store were carried out by October 2003. This laid the foundation for the true disruption that began in 2004 three years after it was first launched. Apple quickly reiterated the iPod line to stay competitive. In 2004 they were on the 4th generation of the classic when they launched the mini. The miniaturization was made possible by the move from harddisks to flash memory. The iPod ASP dropped from $350-400 level of late 2001 – mid 2004 to $150-200 range with the help of the mini. Sales took off by the 4th quarter of 2004 selling 2 million units compared to 336 thousand a year earlier. During Q4

2005 they sold 6 million and during the 4th quarter of 2006 they sold 21 million units (see exhibit 8).

It was the first time Apple had a mass-market disruption due to its interdependent business model. When it offered customers its high-end product that integrated the whole experience from music listening to the purchase of music it became disruptive. The competition could only offer pieces of this experience and rarely very well. There was no easier way to purchase and listen to music on the go and competitors could not compete on price.[2] Napster and the piracy it symbolized made music into bits. Apple solved music's job to be done in the Internet age, for those interested in picking their own music. The delivery and enjoyment of purchased music had become software driven, no longer confined to physical media distribution.[3] But it took Apple three years in the market to get all the pieces right.

The iPhone and the iPad

A telltale sign of a disruption is that the affected are slow to recognize and respond to it. Low-end disruptions take place in the same market and are easier to recognize though often corporations flee upmarket rather than fight for what is unprofitable business. New market disruptions are much more difficult to assess as we have seen. Steve Jobs presented the iPhone at launch as "an iPod, a Phone and an Internet Communicator" (Jobs, Keynote at MacWorld 2007 2007), which high-end customers immediately understood but most of its competitors did with the exception of Google. The job to be done was no longer centered on mobile voice and Short Message Service, technologies that had become good enough by the late 1990s.

The iPhone was a computing device that had a voice application. The iPhone was a software product, driven by a slimmed down version of Mac OS X, itself based on Unix. The iPhone was the first "mobile phone" that both ran a "real" operating system and without technical insights was immediately useful to the general public. The iPhone sustained the jobs that were already good enough. It did not improve significantly improve upon voice or SMS to warrant a purchase. The inclusion of an iPod was an improvement but not truly disruptive. The disruption was to open its user platform to third party software and content experiences. At first this was limited to the browser and the limited capabilities of WWW/HTML at the time.

After a year it introduced a software market place that made it easy, cheap and safe for customers to add third party software applications. In this crucial respect Apple made its platform modular. Software had to suboptimize to Apple's requirements, but no such thing had

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[2] A topic we will discuss when we analyze Apple's scaling moat and the price umbrella.

[3] Music is again changing because of software. This time the ubiquity of mobile bandwidth is enabling subscription services that sell content using a rental model. The iPod represented a time when Internet bandwidth was intermittent.

existed on a mobile platform before.[4] Apple low-end disrupted quick and always on hand email[5] and mobile Internet browsing[6] taking away some of the jobs to be done from desktops and portables. The development of its third party distribution platform, the App Store, has low-end disrupted casual gaming[7], photography[8] and both taken away and added to the uses of software formerly limited to users sitting with a portable or desktop computer. Apple's hardware has improved to incorporate more ways for software to interact with the physical world. Camera, gyroscope, GPS, mobile bandwidth and the new input method of touch rather than the mouse or trackpad, all expand the possibilities of software on its platform. The software and hardware together enable jobs that are still not good enough, and most of which probably are yet to be invented.

Google and Samsung immediately understood this. In the case of Google we know this from the recent litigation with Oracle over Google's copying of IP[9] (Ionescu 2012). In the case of Samsung we have a RIM Blackberry imitation smartly titled the Samsung Blackjack (Samsung 2006). This led to litigation by RIM over its trademark which was settled out of court. Google was preparing a mobile OS system inspired by RIM's secure communication and full QWERTY keypad hardware. Search being a service in the browser, Google was fortunate on the desktop to have government regulators monitoring Microsoft's use of its monopoly of the OS market to dictate the innovation of the browser and by extension the Internet. They could not depend on government intervention in the yet to be formed mobile computing market, and were therefore preparing an OS. When the iPhone launched they wisely let Android be inspired by iOS. As far as we are aware it took Christensen five years to state in public that he understood that the iPhone was not a phone but a mobile computing device (MacFarquhar 2012).

What constitutes a new market disruption can be very difficult to assess. The handset manufacturers did not believe that a software company could quickly make a phone that consumers trusted. The software companies understood better what was going on and Microsoft, Palm and Google refocused their efforts. In this case with hindsight it is clear that two software companies, Apple as first mover and Google as second mover, completely obliterated the mobile phone handset manufacturers. The business model built around voice was swallowed up and expanded upon by a software model. Exhibit 16 graphs the evolution

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[4] Or arguably at this scale on any platform when one considers ease of purchase, price and security.

[5] RIM did this first, but Apple eventually did it just as well or better. To the other OS' it was disruptive.

[6] Disrupted with the cumulative effect of technologies such as Multi-Touch, tap to zoom and the sheer rendering speed of its browser.

[7] Nintendo and Sony are being disrupted in the handheld space. IPOs such as that of social and mobile game maker Zynga have raised billions of dollars from investors.

[8] The two most popular cameras on Flickr are all iPhones. The photoapp Instagram disrupted social media and was purchased by Facebook for $1b a mere 16 months after launch.

[9] Oracle lost the case but is appealing.

of profits in the mobile phone industry sine 2007. It took two years for iOS and Android to accumulate half of industry profits. Today no other software platform is profitable.

Another telltale sign of a new market disruption is that the combined profitability of the industry has increased. Consumers are paying for more value added. Exhibit 18 shows that about half of the U.S. install base of mobile phones is now 'smart'. Of that roughly half is Android and a third is iOS according to comScore (2012) and Nielsen (2012) (exhibit 17). Worldwide Android dominates with a 64.1% share of shipments while Apple sold 18.8% in Q2 2012 according to Gartner (S. Knight 2012). Q2 was a weak quarter for Apple. We will discuss the significance of these numbers when we look at the network effects of Android and iOS. Here it is sufficient to conclude that both platforms are clearly solving new jobs. Customers are rewarding the winners with expanding the profitability of the industry, of which Apple captures the majority of profits.[10]

Many of the same arguments can be said for the iPad. Its mobile hardware and sensors enable new ways of interacting with software. As of writing two and a half years have passed since it was launched, and a common sentiment is still that it is not for real work and that it cannot compete with a real computer. It may be true that it cannot compete with a laptop for typing or running complex intensive applications. But this overlooks the fact that the laptop in its complexity never did any of the many jobs that consumers and enterprises are now using iPads for. An asymmetry in input and output of data exists in many jobs that make the iPhone and iPad competitive with larger computers. It is already successfully solving new jobs in retail, in education and corporate life. It is also low-end disrupting many simple PC tasks such as search, social, email as well as media consumption. Users and developers are making up new jobs to be done as they are discovered. This process is inherently unknowable. We can only conclude that PC sales have stagnated since late 2010 though the world economy is possibly affecting this. What is clear is that the iPad is Apple's most successful product launch. Exhibit 12 compares the launches of the iPod, iPhone and iPad, each growing faster than the last suggesting that they benefit cumulatively as Apple's interdependent architecture is strengthened. Exhibits 13-15 tells us that the iPad has expanded the PC market and now comprises roughly 15% of PC sales, making Apple the largest PC manufacturer.

Though we cannot know where these disruptions are taking us, it seems clear at this point to conclude, that the role of the traditional PC is in decline as smartphones and tablets erode its monopoly of personal computation.

The Roots of the Terms Disruptive and Sustaining Innovation

Some would deny that a tablet is a PC. Defining new market disruptions requires judgments that are often times only clear after the fact. The act of defining is never a neutral act.

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[10] Note: We do not know the profitability of Chinese manufacturers who mostly supply Android phones for their home market. We do not suspect it alters the conclusion that Apple earns the majority of profits.

Organizations and careers are built on careful delimitations. In the following we make the argument that bureaucratic organizations thrive on incremental sustainable innovation over long time periods. Entrepreneurs in turn attempt to disrupt bureaucracies by making their moats obsolete.

Christensen presents the choice between modular or interdependent architectures as a temporal one exogenous to the firm, determined by customers' ability to absorb innovations. In new markets where customers are underserved, interdependent corporations are quicker to improve upon what the customers are hiring the corporation to do for them. What is unstated is that interdependent companies have larger costs in some form of complexity. These complexity costs outrun the benefits of specialization as innovation slows to a sustaining pace.

There is a straight line from the absorption rate of customers' jobs to be done to whether firms are innovating at disruptive or sustaining rates to the optimal firm size.

This is an incredible statement. The boundaries of corporations are determined by the boundaries of markets that in turn are formed by the how quickly customers are able to utilize changes to technology and business models.

When customers no longer will pay for disruptive change the benefits to a general-purpose interdependent entrepreneurial organization diminishes. In its place a process driven bureaucracy takes over. Its specialty is in avoiding failure through process. Inventors are more certain of outcomes; career paths and decision-making are navigated through processes. Competing bureaucracies cause specialization with some owning better moats than others in a modular value chain.

That customers and speed of innovation should determine the boundaries of corporations is by no means a given. The boundaries of firms have been studied by microeconomists as the theory of the firm. Coase (1937) and Williamson (1981) described corporate boundaries as determined by where agency costs (misaligned incentives) and bureaucracy costs are greater than external transaction costs. Hart & Grossman (Hart & Grossman 1986) combined the two into an explanation deriving from residual rights of control. Because of incompleteness of contracts companies have limited control over resources that are outsourced beyond what is explicitly agreed upon. In case of contingencies they may lose the flexibilities afforded ownership or pay dearly for them.

In short costs to insourcing and outsourcing can be said to determine the boundaries of the firm, i.e. whether it is in the long-term competitive to be vertically integrated or specialized. This is an equilibrium view of economics, one that goes back at least to Ricardo. Specialization, which are firms optimizing to an environment, drive down costs to the benefit of all economic actors at the sacrifice of individual profits.

In a perfectly competitive market there is no place for entrepreneurship. Every economics actor optimizes to fit a specific role. To quote Frank Knight (F. Knight, Profit and Entrepreneurial Functions 1942, 128):

"To begin with a general abstract answer, it will be evident to anyone with a rudimentary understanding of economic processes and analysis that profit (always in the sense of pure profit) would be absent under the conditions of equilibrium with "perfect competition," (which may be defined in more than one way). The "tendency" of the competitive processes of buying and selling and the control of production is to impute the whole product to the productive agencies which create it, leaving nothing for entrepreneurship as a distinct function (except for monopoly gain, referred to below). This means that under the conditions of ideal equilibrium (stationary or moving) the function of entrepreneurship itself is entirely absent from the economy…

In the theory of competition, all adjustments "tend" to be made correctly, through the correction of errors on the basis of experience, and pure profit accordingly tends to be temporary. While it exists, in a positive form, it may obviously be regarded as a phenomenon of monopoly, and some distinction, which can never be clear, must be made between temporary profit and permanent monopoly revenue."

Only with the idea that entrepreneurship is irrational does it have a place in economics. To create what has never existed is outside the scope of empirical experience —statistics. The risks involved are incalculable hence the entrepreneur makes decisions under uncertainty.

Joseph Schumpeter[11] expanded upon this point when he proposed that entrepreneurs commit creative destruction. He claimed that innovation is driven by entrepreneurs rather than by established corporations. Bureaucracies are not interested in innovation if it threatens their current business. Capitalism evolves because of the pressure of entrepreneurs on bureaucratic organizations. If not by their success, then by the threat of it.

Another unstated theory underpinning disruption theory is the principal-agent problem. The problem is one of influence and motivation on behavior. The asymmetry of information and the uncertainty of outcomes cause behavior that limits risk taking to the detriment of the organization. We understand The Innovator's Dilemma as the failure of an organization to recognize and respond to disruption. Because most attempts at disruptions fail, and those that succeed start out very slow and have little effect on the overall profitability, careers rarely benefit from straying from the well-trodden path. Shareholders and employees are in theory collectively interested in the long-term survival of their corporation. In reality we have a cascade of principal-agent problems. Since disruptions require qualitative judgments by middle management who can choose to punish low-level employees or claim responsibility for success with their superiors, there is little to gain for low-level employees when taking such uncertain decisions. The same is true between top management and middle management. Investors likewise prefer to judge top management on their well known specialized business. It is better to mimic competitors than risk standing out negatively. Often disruptions are targeted at ones own established business. In this scenario the skills of some employees might become redundant and middle managers with budgets might lose their power. The asymmetry is even worse in this scenario.

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[11] Who infamously borrowed the term from Karl Marx (Schumpeter 1942). They shared the belief that capitalism would end, in the case of Schumpeter when bureaucratic capitalism would be so refined that it would render entrepreneurship impossible.

Christensen's solution is essentially to create a startup in which the entrepreneurs are distanced from the concerns and meddling of corporate headquarters. Small entrepreneurial organizations are aligned to the success of their innovations. If they fail they have no fall back position. His suggestion to go for profits early, is in effect another instance of the principal-agent problem. A distant sub-organization may want to overestimate future success in the hope of a continuous stream of resources. Headquarters may not have the same tacit knowledge of the actual prospects.

Sub-Conclusion

It is impossible to know exactly why Christensen failed to foresee that Apple would continue to disrupt itself and the industry. We find it likely that he believed Apple to be a large bureaucratic organization with many obstacles including a still important core Mac business that would determine its available options. It was clear that the Mac was unable to compete on price or customization against the modular Windows-Intel architecture. The iPod would follow the same path as its job to be done became good enough, and therefore ripe for low-end disruption with the resulting commoditization by modular competitors. Instead of waiting to be disrupted by Google, Microsoft or any other mobile handset innovator, Apple chose to disrupt its own iPod business with the iPhone.

"There's no chance that the iPhone is going to get any significant market share. No chance," said Ballmer. "It's a $500 subsidized item. They may make a lot of money. But if you actually take a look at the 1.3 billion phones that get sold, I'd prefer to have our software in 60% or 70% or 80% of them, than I would to have 2% or 3%, which is what Apple might get."
Steve Ballmer, CEO of Microsoft on April 30th 2007. (Ballmer 2007)

Disruptions are very difficult to assess as they happen, the extent of their further success is debatable. Quantitative analysis looks backwards by the nature of how data is assembled to fit preconceived categories of meaning. Qualitative judgments are narratives that solidify as data begins to convince. The issue is further muddied by the fact that the disruptor will exaggerate the strength and potential while the disrupted will ignore or deny its effect until the position becomes untenable.

The lack of a physical keyboard was what initially set the iPhone apart. To the detractors at Microsoft and RIM it took a long time to comprehend the significance of what a handheld computer with a touch-screen interface would do to the mobile phone business. Google and Samsung immediately understood and switched away from imitating RIM's Blackberry.

The logic of disruption theory flows in a straight line from the absorption rate of customers' jobs to be done to whether firms are innovating at disruptive or sustaining rates to the optimal firm size. When innovation slows the success of the modular architecture becomes inevitable due to price commoditization. These competitors innovate on a sustaining path potentially vulnerable to disruption.

The two ideas of jobs to be done and the innovator's dilemma are powerful ideas. They are simple to explain and comprehend. They lend themselves to easy analysis, being able to be used in many situations. Now they are being used outside business to advocate change in education and healthcare. Since 1997 they have become well known if often misinterpreted in the mainstream. The dilemma draws upon a long history of economic thought that gives it its power. The dichotomy between bureaucracy and entrepreneur are as much theory as politics. They are useful constructs but it is prudent to know their history and limitations.

Most crucially we find that the theory poorly describes the processes underlying market change. Customers' jobs to be done define market structure but how these jobs are determined and acted upon is left mostly to a loose set of anthropological ideas of observing human action. This assumes that disruptions are observable if not from the conscious wants of customers, then from their actions. How this is observable is left to the reader. Innovation is hard, but it is too easy to place its origins at the feet of customers.

The example of Apple suggests that customers may have multifaceted relationships with the company and its products. The innovation that it gives customers may be across many different dimensions. The failure of its interdependent architecture does not seem imminent despite the low-end disruption of Android. We will in the next two parts of our analysis concentrate on what jobs Apple solve for its customers, how it keeps on disrupting and why the interdependent architecture may be a permanent benefit.

Part Three: Organizing Innovation at Apple

"Apple is a company of paradoxes. Its people and institutional bearing are off-the-charts arrogant, yet at the same time they are genuinely fearful of what would happen if their big bets go bad. The creative side of the business that was dominated by Steve Jobs is made up of lifers or near lifers who value only an Apple way of doing things—hardly the typical creative mind-set. The operations side of Apple runs like any company in America, but better, and is led by a cadre of ex-IBMers, the cultural antithesis of Apple. Apple has an entrepreneurial flair yet keeps its people in a tightly controlled box, following time-tested procedures. Its public image, at least through its advertising, is whimsical and fun, yet its internal demeanor is cheerless and nose-to-the-grindstone."
- Adam Lashinsky, author of Inside Apple (kindle 2060)

As we've argued organizations are in the business of making decisions. An original business model that works cannot be predicted from statistics and its risk diversified as with a portfolio of securities. It is in the domain of uncertainty that the entrepreneur experiments and a domain that the bureaucratic organization cannot subsume.

Apple has built a successful organization that represents the benevolent liberal arts of progressive thinking. But behind making this happen is a ruthless and cunning corporation that plays hardball with its suppliers, competitors and temporary allies. It is as much a creative business that invents and thrills the world, as it is a believer in meticulously cutting out pennies from its cost structure. It sees itself as a startup but is the worlds most valuable company with a workforce in excess of 75,000 and through suppliers control the workforce of hundreds of thousands.

Adam Lashinsky calls this paradoxical but we will argue it is driven by a clear cohesive vision of how a corporation should be run. Its want of control naturally leads it to create an internal market, though one that no longer relies exclusively on ownership.

We split our analysis of Apple's organization into three pieces. First we want to understand what sort of organization Steve Jobs feared Apple could turn into in his absence. We see that he had a clear historic understanding of why innovative companies become stagnant and weak. Second we want to understand what Apple's purpose is, its signature job to be done. Thirdly we explore how such a large organization can avoid becoming a bureaucracy and stay focused on solving this signature job.

A Fear of Stagnation

It is well known that Steve Jobs built Apple in his own image, to be a company that would change the world, to put a dent in the universe. As we have seen products are only advantageous in the short run, especially in the fast moving consumer electronics industry. The jobs to be done by consumers are not always transparent and organizations may with

time lose touch with what their customers are actually purchasing. Products are not on their own a competitive advantage in the long run.

Steve Jobs was inspired by innovator's who had operated at what he saw as the intersection of the humanities and science. Walt Disney and Edwin Land of Polaroid in particular were an inspiration. Both companies had trouble keeping innovative after their founders had left. Disney had valuable intellectual property and could live off the derivative works of old creative ideas. Polaroid had to rely on their products, which in the long run was no moat.

To build an organization that would change the world he also had to avoid it failing after his departure.

 "One of the things that happens in organizations as well as with people is that they settle into ways of looking at the world and become satisfied with things and the world changes and keeps evolving and new potential arises but these people who are settled in do not see it. That's what gives start-up companies their greatest advantage. The sedentary point of view is that of most large companies. In addition to that, large companies do not usually have efficient communication paths from the people closest to some of these changes at the bottom of the company to the top of the company which are the people making the big decisions. There may be people at lower levels of the company that see these changes coming but by the time the word ripples up to the highest levels where they can do something about it, it sometimes takes ten years. Even in the case where part of the company does the right thing at the lower levels, usually the upper levels screw it up somehow. I mean IBM and the personal computer business is a good example of that. I think as long as humans do not solve this human nature trait of sort of settling into a world view after a while, there will always be opportunity for young companies, young people to innovate. As it should be."
- Steve Jobs in Smithsonian interview (Jobs 1995a)

This is the innovator's dilemma explained. Change is the enemy of bureaucracies and their established ways enabling startups despite their lack of resources. Corporate communication with its many layers and incentives discards anecdotal evidence from the bottom. But he also hints at a problem at the top.

"What happens is, like with John Sculley. John came from PepsiCo. And they at most would change their product once every ten years. To them a new product was a new sized bottle. So if you were a product person, you couldn't change the course of that company very much. So who influenced the success of PepsiCo? The sales and marketing people. Therefore they were the ones who got promoted and therefore they were the ones who ran the company. For PepsiCo that might have been okay but it turns out the same thing can happen in technology companies that get monopolies. Like IBM and Xerox. If you are a product person in IBM or Xerox, so you make a better copier or computer. So what when you have a monopoly market share, the company is not anymore successful. So the people who can make the company more successful are sales and marketing people and they end up running the companies. And the product people get driven out of decision making forums. And the companies forget what it means to make great products. It means the product genius that brought them to that monopolistic position gets rotted out by people who are running these companies who have

no conception of a good product versus a bad product. They have no conception of the craftsmanship that is required to take a good idea and turn it into a good product. And they really have no feeling in their hearts usually about wanting to really help their customers."
- Steve Jobs in The Lost Interview (Jobs 1995b)

The argument here is that companies are both shaped by their customers and by internal incentives. If a company secures a monopoly it no longer needs to concern itself with its customers best interests and can concentrate on maximizing profits. The incentives are to sell not to innovate gradually weakening a company from within. Obviously the pace of technology and impact of social change is uneven across industries. What worked at PepsiCo was almost fatal at Apple though it took more than a decade.

"If that's so, then why is the Mac market share, even after Apple's recent revival, sputtering at a measly 5 percent? Jobs has a theory about that, too. Once a company devises a great product, he says, it has a monopoly in that realm, and concentrates less on innovation than protecting its turf. "The Mac-user interface was a 10-year monopoly," says Jobs. "Who ended up running the company? Sales guys. At the critical juncture in the late '80s, when they should have gone for market share, they went for profits. They made obscene profits for several years. And their products became mediocre. And then their monopoly ended with Windows 95. They behaved like a monopoly, and it came back to bite them, which always happens."
- Steve Jobs in Newsweek (Levy 2004)

What is mostly unsaid in disruption theory is here expressed clearly. Companies are social structures with norms and behavior that continually must be kept healthy. Incentive structures that favor short-term profitability give power to sales people over engineers and designers. With time they completely lose the ability to innovate, only familiar with sales and marketing as instruments. The disagreement with John Sculley that led to his departure from Apple in 1985 was on this exact point (BBC 2012). Sculley wanted to profit maximize, Jobs to lower prices through lower profits and scale advantages to volume production. Higher prices made the platform uncompetitive in the long run against the Wintel modular architecture. The technological advantage of its proprietary technology was a temporary moat.
"Sculley destroyed Apple by bringing in corrupt people and corrupt values, Jobs later lamented. They cared about making money—for themselves mainly, and also for Apple—rather than making great products." (Isaacson, Kindle: 5039)

Whether such a view of a corrupting[12] process explains business failure or not is probably not provable. What is clear is that it was a favorite pejorative of his, a fear of everything that Apple could become. (Lashinsky, Inside Apple: How America's Most Admired--and Secretive--Company Really Works 2012, Kindle: 870)

To create a lasting business he could not rely on the profit motive. Nor could he expect customers to drive innovation on their own. As with Henry Ford's statement: "If I'd asked customers what they wanted, they would have told me, 'A faster horse.'", customers are not

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[12] To be understood as a decaying practice, not as an illegal act.

able to articulate disruptive jobs to be done before they become possible. (Isaacson, Kindle: 9377)

The Job to be Done

To create a lasting business, a product or a service is no more than a temporary fix for a job to be done. There would have to be a more fundamental service rendered, for a technology company to keep reinventing itself and not fall back into dependence on a monopoly revenue stream.

An idea that would both inspire its products and have Apple stay focused long after he would leave. That idea is simplicity.

The world is a complex place. New technology is built on top of the old. When customers purchase a technology product they are confronted with a multitude of choices. There are literally thousands of hardware configurations available from a large number of practically undifferentiated manufacturers who promote customization as a good. Software is rarely any better having functions many users will never use not to mention the numerous security and privacy pitfalls that are hard to decode and navigate.

Apple's job to be done is simple: Selling technology in which customers expect and trust Apple to make the right choices on the countless variables take make up its ecosystem.

"People pay us to integrate things for them, because they don't have the time to think about this stuff 24/7. If you have an extreme passion for producing great products, it pushes you to be integrated, to connect your hardware and your software and content management. You want to break new ground, so you have to do it yourself. If you want to allow your products to be open to other hardware or software, you have to give up some of your vision"
- Steve Jobs (Isaacson, Kindle: 9390)

Apple is not perfect at this but if their hit rate is sufficiently better than the modular architecture of its competitors, then it will at a minimum win over the high-end. Most customers are unable to understand all the issues, no less utilize the stock version of a hardware-software device. This is why trust is so essential. It is always being tested to find areas of doubt. This is why the exclusion of Adobe's Flash in iOS and the treatment of workers by subcontractors in China receive the scrutiny they do. Apple sets the bar extraordinarily high by assuming responsibility for making the right choices when its finished products hide away all the complexities of technology. Removing what is unnecessary is the primary objective. Only then will customers trust and more fully absorb the potential of new technology. Good products signal 'care' to consumers. (Lashinsky, Inside Apple: How America's Most Admired--and Secretive--Company Really Works 2012, Kindle: 590)

"Why do we assume that simple is good? Because with physical products, we have to feel we can dominate them. As you bring order to complexity, you find a way to make the product

defer to you. Simplicity isn't just a visual style. It's not just minimalism or the absence of clutter. It involves digging through the depth of the complexity. To be truly simple, you have to go really deep. For example, to have no screws on something, you can end up having a product that is so convoluted and so complex. The better way is to go deeper with the simplicity, to understand everything about it and how it's manufactured. You have to deeply understand the essence of a product in order to be able to get rid of the parts that are not essential."
- Jonathan Ive, Senior VP of Industrial Design at Apple (Isaacson, Kindle: 5819)
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The objection here would be to call this form of talk public relations. And that is of course true, but it overlooks the fact that they are communicating a very costly signal to the customer. Their speech, the products, physical stores and marketing all communicate simplicity at great cost. They promise to hide the complexities of technology and consequently have to deliver. To be able to do this they have to organize to foster product innovation. It is not enough to have a great idea. Execution is everything.

Execution

"We are the most focused company that I know of or have read of or have any knowledge of. We say no to good ideas every day. We say no to great ideas in order to keep the amount of things we focus on very small in number so that we can put enormous energy behind the ones we do choose. The table each of you are sitting at today, you could probably put every product on it that Apple makes, yet Apple's revenue last year was $40 billion."
- Timothy Cook at Goldman Sachs Investment Conference (Frommer 2010)

Lashinsky's view of Apple as a paradox is perhaps most pronounced when it comes to how it executes its ideas. Apple is a strict top-down organization that is run in the spirit of a startup. Top management can direct the company quickly because there is just one layer between it and its many productive cells. A twelve member executive team runs the company assisted by less than 100 vice presidents. But rank is not synonymous with power. Steve Jobs always joked that he had a list of the 100 people he would leave the company with to start anew. Old distinguished engineers, scientists, technologists carried power without title as long as Steve Jobs were alive. Power was with those who did the important work of the time. As the iPod was developed in secret they took away the best talent from the Mac. The same happened with the iPhone.

The lack of codification of the power structure may be on purpose. Microsoft proves the point. The company has struggled with excess politicking instead of innovating. Kurt Eichenwald writing for Vanity Fair (Eichenwald 2012) argues that Microsoft's troubles began when its stock stopped climbing. When equity no longer presented itself as an incentive, the only way to be rewarded was politics. An excess middle management layer of VPs distanced top management from any innovation below. Related to this was what the performance review of stack ranking that every single interviewee for his article cited as damaging. Every six months all employees would be evaluated by comparison to a bell curve of group performance.

Bonuses were tied to relative performance and the bottom 20% or so would be fired. This meant no one would willingly share information in group work, and the best talent would not work together or gather new followers for ideas. Employee energy was spent on politicking as a class of middle management had to be impressed continually.

Microsoft may be an extreme example but all too often the measurement of qualitative output by quantitative means are counterproductive. The layers in-between production and management introduces politics, endless discussions and a lack of focus. Dell is another good example. Its many different divisions have their own products, marketing budgets, expertise, and goals, and because their profit & loss are separated they have no concern for the overall health of the company.

"A company like Dell is consumed by these numbers. There are goals attached to every project, and if the clicks don't match the goals, somebody's in trouble. It's not hard to appreciate why Dell's managers place so much emphasis on performance metrics. Quite a few get bonuses based on these hard numbers.
…
Steve Jobs was one of the most forward-thinking people on this planet, yet he was refreshingly old-fashioned when it came to the use of analytics. He demanded all the information he could get, and he would digest every bit of it—but he took it all in context." (Segall 2012, Kindle: 2974)

This is not to say that quantitative methods are without use, but they become counterproductive without context and understanding of their limitations, including their use to 'game the system'. This is common sense but seemingly not to Dell or Microsoft.

To minimize politicking Apple is run on a need to know basis. There is a degree of paranoia to the whole organization. Divulging secrets even to other Apple employees leads to termination and lawsuits. A classic anecdote has it that security listens in on conversations at the local bar. The truth of this is irrelevant. Employees are kept in the dark only to see the full picture at the same time as the rest of the world. Lashinsky describes this as running the organization as a terrorist organization with splinter cells. More benevolently we may remember that intelligence organizations are run in the exact same manor.
Every Monday the executive team assesses the work and sets the direction. The work being done by groups is no more than two Monday meetings away from being commented on. Even new employees sense an influence through their work.

The company is built on the backs of specialists not generalists. The best people in their given fields are hired and there is rarely any promotion or movement away from these positions. The welfare of the company is always prioritized openly. There is no space for tenured placements in middle management. It is "what one recruiter calls 'a replacement culture versus a development culture.' Said an executive who worked at Apple twice: 'I have way more examples of people being demoted than promoted.'" (Lashinsky, Inside Apple: How America's Most Admired--and Secretive--Company Really Works 2012, Kindle: 911)

The obsession with keeping the best minds focused on their specialty under an intense workload enables the disruptive process: "'Dates are set well in advance,' said Mike Janes, who ran Apples online store in the early 2000s. 'Things get accomplished. There are no questions. The Innovator's Dilemma doesn't exist at Apple.'" (Lashinsky 2012, Kindle: 877)

The ethos of Apple is that it only hires the best: "A players hire A players, and B players hire C players. We want only A players here", is attributed to Jobs (Lashinsky, Inside Apple: How America's Most Admired--and Secretive--Company Really Works 2012, Kindle: 902). The company sets strict goals with corresponding heavy workloads. Hiring only the best, having them work on a need to know basis, direct involvement of top management and ensuring there is never a quiet moment are all ways of managing employees to stay focused on work and not politicking. Employees have no knowledge or time to play politics. The twelve member executive team knows in much finer detail than at comparable companies, what happens at the bottom, and it has the ability to influence processes at much greater speed.

To stay focused on making technology feel under the control of customers, it internally focuses on the work process. It has codified the process of creating products with a handbook called the 'Apple New Product Process'. "The goal is to automate the science part so you can focus on the art" (Lashinsky, Inside Apple: How America's Most Admired--and Secretive--Company Really Works 2012, Kindle: 649). Responsibilities are always specified on the individual level even for the minutest details. Only those with responsibilities are invited to decision making meetings, further limiting any loss of focus. There is always a 'Directly Responsible Individual'. This is a remarkably simple management tool yet it is rarely seen at other companies.

Responsibility grows with power:
"Difference Between the Janitor and the Vice President," and it's a sermon Jobs delivers every time an executive reaches the VP level. Jobs imagines his garbage regularly not being emptied in his office, and when he asks the janitor why, he gets an excuse: The locks have been changed, and the janitor doesn't have a key. This is an acceptable excuse coming from someone who empties trash bins for a living. The janitor gets to explain why something went wrong. Senior people do not. "When you're the janitor," Jobs has repeatedly told incoming VPs, "reasons matter." He continues: "Somewhere between the janitor and the CEO, reasons stop mattering." That "Rubicon," he has said, "is crossed when you become a VP." (Lashinsky 2011)

Apple's attention to detail begins with its organization. The best people are hired in their respective fields to do their best work. The enemies of perfect are politicking and the corruption of work with unnecessary processes. Time is the essential asset of a disruptive innovator. Being too late and the market is already on a path determined by sustaining innovation where resources determine winners. Being too early and the innovation fails to satisfy sufficient jobs to be done at an attractive price. This plagued Apple repeatedly in the early 1980s. Lisa was remarkable for its graphical user interface but far too slow and expensive to create a new market from which to sustainably innovate. It could not create the necessary jobs to be done with developer support as it had too few customers. The other side of the coin of time is the chicken-and-egg problem. Jobs defended his Mac launch when it in

hindsight had the same problems, as being the result of then CEO John Sculley setting the price too high. Sculley went for short-term profits rather than volume, which meant that Microsoft and Intel gained the volume advantage and could bring costs down and improve technology along a sustainable innovative path.

The Innovator's Dilemma and the thinking of Steve Jobs meet at the fear of stagnation. As customers become satisfied with what they have innovation slows and it becomes difficult to acquire market share from already consuming customers. In the case of the early Mac, high prices made it inevitable that it would be low-end disrupted by a large group of commoditized competitors. Once this had happened it would be an uphill struggle to win back market share.

The way in which this stagnation could be overcome sets Jobs apart. He did not believe that customers could know in advance what they wanted. Apple's cell like structure enables hundreds and now thousands of teams to work on projects well before they may be obvious to the market. At the top a small group are up-to-date with the progress of these projects, and can make the timing decisions as to what to integrate and when to launch. All along the way secrecy and focus ensure that Apple operate like a large startup. The limited time and cognitive bandwidth at the top further forces the need to focus on a few projects at a time:

"'Apple is not set up to do twenty amazing things a year,' said a former executive. 'At most its three projects that can get a ton of attention at the executive level. It is about editing down. The executive team is always looking at picking technologies at just the right time. The minute you're doing a hundred things, you can't possibly do things the Apple way. Most companies don't want to focus on one thing because they could fail. Winnowing ideas from twenty-five to four is horrifyingly scary.'" (Lashinsky 2012, Kindle: 720)

Secrecy, focus, clear responsibilities and the intense workloads are all part of the same overall idea: To keep innovating and avoid cultural stagnation.

Apple's DNA

All these methods of creating a focused work culture would be futile without the goal of creating the best products. Employees would not want to work at Apple if it was not for the chance to do the best work of their careers. Without feeling that their work has a positive impact on the world. It is this privilege that keeps employees at Apple.

It sees itself as being at the intersection of the liberal arts and technology. Tellingly status within Apple is given to designers, then less so engineers and much further down the status list we find support staff that has virtually no say. This is unusual in an industry dominated by engineers such as at Google or Facebook. At Microsoft committees of engineers develop products after management have analyzed profitable markets using quantitative market analysis. As the lowest status job, designers are merely to fit an outward appearance to the

high status technical specifications. At Apple this relationship is reversed. Power and status resides with the designers not the engineers.

"In most people's vocabularies, design means veneer. It's interior decorating. It's the fabric of the curtains and the sofa. But to me, nothing could be further from the meaning of design. Design is the fundamental soul of a man-made creation that ends up expressing itself in successive outer layers of the product or service."
- Steve Jobs Fortune Interview (Jobs 2000)

It is by taking the consequences of their choices seriously, that they attract the best talent. Apple has always attracted those who believe that the world contains mostly stuff that is crap and too few things that are insanely great. This black and white view of the world has like a magnate either attracted or repulsed people.

Likewise it attracts and repulses a core audience of people with a technology interest. The minutest details are immediately scrutinized by its core audience which take part in its course correction mechanism. Apple is an arrogant company that is fearful of hubris. It listens to customers selectively. On issues where it feels it is leading the industry, like not supporting Adobe's flash, it will state its position with in public and not cave in to pressure. It missed the music burning to CD job to be done but quickly learned from customers. No company can avoid listening to its customers and Apple is no exception. However everything is put in the same context as all of its decisions: "[if] it's the right thing for the product" (Lashinsky 2012, Kindle: 656).

The company is obsessed with the word product. They take center stage in its marketing and in its public relations. Its stores are built to nudge new customers to experience its products unobstructed by the rest of the world. But the obsession begins on the inside. The compulsive attention to detail has shown itself from the very beginning with the 1976 Apple I. The aesthetic preoccupation of Jobs lent itself well to the engineering obsession of Steve Wozniak who made the personal computer possible by getting rid of superfluous parts. The Apple I reached a size and price point that led to disbelief that it was a computer upon launch. The same feeling that the iPhone was met with.

Getting rid of as many screws as possible and then only using the prettiest screws, on the inside of products where no customer would ever look. This is part of the Apple mythology –its brand. It communicates subliminally with the consumer that the company cares about its choices. The powerful emotions that this myth creates are a double-edged sword. When the obsession went unchecked it led to the much too expensive G4 Cube, and the loss of focus when it came to repainting its robot factory over and over again to get it right in the 1980s.

But that overlooks that employees do not work at Apple for the money or the cozy work environment. It is entirely for the privilege to work on insanely great products (Jobs 1989).

Lashinsky sees a paradox between its liberal arts values and it playing hardball business. But there is no paradox. The motivation at Apple is to create the best possible products at the edge of technology, keeping focused on its niche of integrating advanced software with

hardware. There is no reason to disbelieve them. Any sane person would immediately cut corners the minute they stopped believing this myth.

The motivation to put in the hours and never stand still does not come from the profit motive. The hiring of "musicians and poets and artists and zoologists and historians, who just also happened to be the best computer scientists in the world" (Jobs 1995b) is a reflection of the multitude of possible jobs to be done and the need to make them ever simpler and more accessible. A vision for a company that never really ends:

"To me the spark of that was that there was something beyond sort of what you see every day. There is something going on here in life beyond just a job, and a family and two cars in the garage and a career. There is something more going on. There is another side of the coin that we don't talk about very much. And we experience it when there are gaps, when everything is not ordered and perfect. And a lot of people have set off throughout history to find out what that was. Whether that was Theroux or some Indian mystic or who ever that might be. And the hippie movement got a little bit of that and they wanted to find out what that was about. And that life wasn't about what they saw their parents doing. And of course the pendulum swung too far the other way and it became crazy, but there was a germ of something there. And it's the same thing that causes people to want to be poets instead of bankers. And I think that's a wonderful thing. And I think that same spirit can be put into products and those products can be manufactured and given to people and they can sense that spirit… I don't think that most of the really best people that I have worked with, have worked with computers for the sake of working with computers, they have worked with computers because they are the medium that is best capable of transmitting some feeling that you have, that you want to share with other people. And before they invented these things, these people would have done other things. But computers were invented... and [they] said hey this is the medium that I think I can say something in." - Steve Jobs in The Lost Interview (Jobs 1995b)

Sub-Conclusion

Long before the Innovator's Dilemma was written Steve Jobs had his own understanding of why corporations fail. Monopolies tend to believe their success is permanent turning to sales and marketing for quick improvements to profitability. When disruption occurs the monopoly is no longer able to respond as its product-making ethos has left its DNA. Whether this is true or not is beside the point. Jobs said out to ensure that no such thing would occur at Apple. Hence the result of which is a unique organization stressing continual entrepreneurial innovation.

We live in a complex world and the choices computers presents us with are incomprehensibly overwhelming. Apple's job to be done is simple: Selling technology in which customers expect and trust Apple to make the right choices on the countless variables take make up its ecosystem. While an easy to comprehend idea, it is deceptively simple to execute. The ability

of Apple to disrupt and keep innovating lies in its intense focus, motivated by a belief in the meaningfulness of creating insanely great products.

Technology moves quickly enabling new jobs to be done. The products at any given time are representations of its motivation towards excellence, no product in itself being the end point. As it has grown into the largest purchaser of semiconductors and many other key technologies, its influence on shaping technological and business innovation has increased proportionally. The chicken-and-egg problem of investing heavily in unproven technologies that in a few years will become commoditized by the entire industry has not been solved. It never will. This cheapening of technologies enables their use in new disruptive business innovations that are unpredictable for the first mover innovator. Christensen's disruptive innovation theory is not disproven by the example of Apple. Defending against disruption with technologies and products that are currently good enough remains doubtful against unknowable asymmetrical threats.

Apple's defense against disruption lies in its DNA, in its mythology of never being satisfied. Its obsessions have led it astray at times, but it has never strayed from eating its own products before anyone had the chance to do it to them. Its cannibalism is deeply ingrained in its DNA. It does this by having an obsession with excellence trump the profit motive. Designers have the highest status and decisions are made based on what is right for the product. This is why there is no innovator's dilemma at Apple.

It manages its vast number of employees without incurring most of the costs of a process bureaucracy. Decisions are highly centralized with an opportunistic entrepreneurial culture below. The small executive team is only capable of focusing on a few major products at a time. This focus is an advantage because they are fed from below with an understanding of the soon to be technological possibilities. The distance between executive team and the work being done below it is remarkably short and focused. Apple's many entrepreneurial cells benefit from ample resources and the executive team can direct this energy into a few focused products a year. The objective is to create insanely great products and get them right the first time.

The threat of stagnation and wasted resources by misalignment of interest and politicking is cured with secrecy, paranoia and a call to excellence through strenuous work. It shows by hiring the best specialists in their given fields and leading them clueless to the big picture. Its motivation shows in its obsessive focus with getting rid of the superfluous and touting their products as revolutionary.

Apple's obsession with control naturally leads it to an interdependent architecture. In the next part of our analysis we focus on the value and cost to imitation that its architecture brings.

Part Four: Apple's Interdependent Architecture

Apple's obsession with perfecting its products naturally leads it to want to control the entire value chain that supplies the building blocks that make up its ecosystem of third party value adders. This introduces conflicts with competitors for resources and with suppliers and third parties for control over their future autonomy. The extent of Apple's interdependent architecture is now of a scale and depth that makes it impossible to describe in detail. Hundreds of suppliers, thousands of distributors and potentially millions of developers are all interdependent with Apple's autonomous architecture. Apple does not have equal partners; its obsession with products is too great as we have argued. This has at times caused it to become isolated in a software industry dependent upon third party value added.

To make sense of its choices we will remind the reader of disruption theory's assumption that the form of company interdependence – their architecture – are determined by consumers' absorption rate of innovation. As we wrote in part two:

"Christensen presents the choice between modular or interdependent architectures as a temporal one exogenous to the firm, determined by customers' ability to absorb innovations. In new markets where customers are underserved, interdependent corporations are quicker to improve upon what the customers are hiring the corporation to do for them. What is unstated is that interdependent companies have larger costs in some form of complexity. These complexity costs outrun the benefits of specialization as innovation slows to a sustaining pace."

Apple has clearly not treated its interdependent architecture as temporary. It has modified it as we shall argue, but it remains mostly the same as in the late 1990s.

Our analysis of Apple's DNA showed that the company has a sense of mission of excellence that keeps disruptive and sustaining innovation at a high pace. But this does not in itself solve the problem of convincing potential customers that they have new or somewhat better jobs to be done. Neither does it solve the issue of imitation. Innovation requires resources of talent, time and capital to create advances. Imitation is the act of copying, a very simple task that requires less and less resources with scale and experience. Intellectual property laws were invented to help protect against immediate imitation in the belief that there exists for society as a whole, an unhealthy asymmetry between innovation and imitation. But IP laws are not on their own sufficient to deter imitation. Since money and honor are involved these are contentious issues but it is well known that Apple learned of the graphical user interface from Xerox, and that Microsoft in term learned from both. The change from the command line interface to the graphical user interface was one of the most significant technological disruptions of the personal computing era, and yet no law could protect its innovator.

The ability to acquire customers with new jobs to be done and then make it difficult for competitors to imitate and acquire customers comes down to the execution of a consistent business model architecture.

We are therefore interested in the interdependence of its architecture in solving a range of issues relating to customer acquisition and retainment. It needs both be able to launch new disruptive products and compete symmetrically against large resource rich competitors in established markets. Apple is faced with competition for attention and mindshare with a wide variety of direct and indirect competitors making it costly to acquire customers on the basis of unique and premium priced products.

Our analysis will focus on the five moats that optimally should enable faster business innovation than its modular architecture competitors and make imitation costly. Imitation both by simple low-end disruptions targeting the least demanding customers, as well as by symmetrical specification rich competitors with comparable cost structures. These moats are its Brand, Distribution, Scaling, Proprietary Technologies and Network Effects.

It further needs to open up its architecture and compromise on its control obsession to create a sufficiently large ecosystem that adds most of the value to its products.

The Network Effects of Software

"People who are really serious about software should make their own hardware."
- Alan Kay, one of the fathers of the graphical user interface at Xerox PARC (Kay 1982)

We begin our analysis of Apple's architecture by examining how software differs from physical products. This is important since Apple competes primarily with software companies and it sees itself as being a software driven company.

Software is unique in that its copying is virtually without cost and once it is in use it creates high switching costs. From the point of view of the users, the use of software is a form of human capital investment. To switch software requires costly investments of time and effort to master new software. From the point of view of investors, software creates lock-ins through the incomprehensible complexity of its interdependencies. Once lock-in has occurred it becomes very costly to rewrite software, as it must retain compatibility with decisions made far back in time.

The software programmer Jaron Lanier describes software lock-in by comparing it to science:

"We can compare lock-in to scientific method. The philosopher Karl Popper was correct when he claimed that science is a process that disqualifies thoughts as it proceeds—one can, for example, no longer reasonably believe in a flat Earth that sprang into being some thousands of years ago. Science removes ideas from play empirically, for good reason.

Lock-in, however, removes design options based on what is easiest to program, what is politically feasible, what is fashionable, or what is created by chance."
- Jaron Lanier in his book 'You Are Not A Gadget' (Lanier 2010, 10)

The low copying cost of software makes it in the words of Steve Jobs "like printing money" (Lashinsky 2012, Kindle: 902). The difficult part is getting the software into the hands of customers who find a use for it and by using it create lock-in. This is why we have the business model of giving away software for free in the hope that the lock-in can be monetized in another fashion. With the advent of the Internet network effects have strengthened since users in real time can communicate and give away their data services that offer free computation in exchange. Google was the first significant success story. It offered users a way to make sense of the vast uncoordinated data that we refer to as the World Wide Web. It offers these search computations for free in exchange for knowing more about its users and personalizing advertisement for when a user is searching products or services. Microsoft has spent the better part of a decade and billions of dollars trying to fight this symmetrically without any success. Since Google has much better data on its users and their searches, it offers a better product to both users and its real customers, its advertisers. Google occupies a strong software niche that can only really have one profitable enterprise.

Facebook and Twitter likewise offer free computation to its users in exchange for the valuable data they supply and the ability to monetize this data through advertisement or real time marketing insights. Another potential revenue stream for a network is to create a store for content or third party software applications. So far this has mostly been to sell traditional media such as music and movies, and simple programs such as games. But the potential is to create viable ecosystems that can monetize data without being dependent on the once all-mighty gatekeepers of the operating systems. This is where we find Microsoft and Apple. For the Internet software companies to be successful they must expand to the widest extent with free software services, create lock-ins with these customers and keep this data closed-off and secret from the rest of the Internet. This is why Facebook and Twitter do not let Google read its data, and why Google is responding by changing from a strictly search company to social, commerce and other services. Lock-in is hugely dependent on successful distribution and the disruptive effect of its originality. Once this has occurred a software company can essentially print money from behinds its network effect moats. (Lanier 2011)

Because of this dynamic between virtually no cost to replication and very costly moats the traditional expectation of commoditization does not occur. There is no way to commoditize Facebook or Google by offering the same service cheaper. Only asymmetrical strategies have a chance and these are limited. Twitter created a disruption by limiting messages to 140 characters, opening up the protocol to third party clients that vastly improved the service making it practical for hundreds of millions of users and letting these messages be visible to all. Only later when the network effects were present did they close off the data from search engines and started to limit third party clients to control the data completely. Another asymmetrical disruption came from Instagram a social service centered on the use of the iPhone's high quality camera and its always-on high capacity mobile bandwidth. The simplicity of pictures for social quickly created a network that was purchased by Facebook. Even in the case of an asymmetrical disruption such as Instagram, with a fast growing mobile social network, did the owners not think it profitable to compete instead choosing to be acquired by the established social network Facebook. Once a software niche has been occupied it becomes almost impossible to usurp. (Lanier 2011)

The monopoly of the operating system and the core productivity applications markets by Microsoft has long proven a strong moat. There have been disruptive attempts at making the operating system and the core applications on top free and open source without much market success. Lately Google has tried to move the computation into the cloud and offering it for free. The proprietary technologies behind Windows and the Office document standard made compatibility with its architecture impossible for enough time to pass to create network lock-ins.

Networks receive their value from the users and developers who make use of its technology. The hardware manufacturers, the users and developers are all dependent upon the architecture they conduct their business on. With Internet services the price of software can be offer for free in return for the exclusive right to the data of its users and the ability to offer access to these users for other content or software owners. The network owner is a powerful gatekeeper that benefits from owning the architecture in which value is exchanged.

The software that creates network effects can be said to have asymmetrical qualities that makes commoditization impossible and successful disruption rare. Christensen oversees the fact that Apple creates software with lock-ins through proprietary technologies that create network effects. This creates high switching costs to consumers increasing the implicit price of competitors with commoditizing products. Apple is unlike Christensen's favored example of the steel business or any other market with clearly defined jobs to be done and no lock-in costs.

Apple has several proprietary network technologies that create lock-in. The success of the iPod came from having the PC or Mac be a hub for its advanced software. On top of this free software Apple built a content shop that sold music and subsequently movies and TV series. The necessity of being on the Windows platform has since diminished and several of its new technologies are only present on iOS and OS X. The App Store is the primary lock-in network that differentiates it from its competitors. It is the most successful third party software application store creating a positive feedback loop between ever more users and developers. Lesser moats are found around its communication technologies. Facetime video chat and iMessage text and images communication are proprietary technologies that make communication between iOS devices easier because of their deep integration with the hardware and operating system. Competitors Google and Microsoft have their own systems but the lack of deep integration with iOS makes it more of a hassle to change technology.

Airplay technology is creating a new moat for the job of streaming music, video or applications to other devices including TVs and music equipment. As this only works with Apple sanctioned devices, it creates an ecosystem of audio/video equipment that predominantly is made for Apple devices.

The newest moat could potentially be the most significant in the long-term. Apple's iCloud is at the moment a place to store application and user documents. But it shows promise of far deeper integration in its iTunes Match and Photostream cloud services. Both services push data, either music or user created pictures, into Apple's proprietary cloud. The promise is that

more and more data will be in proprietary clouds making customers dependent on subscription services to maintain use of their data. Many companies are competing in this space, but Apple's advantage lies in its supplying the software for its popular hardware. The deep integration makes it a hassle to use other services when Apple supplies tailored solutions for its devices. Fully online services such as Amazon are dependent upon the operating system layer to not discriminate between various competitive cloud solutions. This is why Apple, Google and Microsoft[13] are all their back-end cloud into the front-end of their respective operating systems. The value of integration is obvious in this case, and it raises the cost of not having a successful mobile operating system.

What is common of the moats is that the interoperability of Apple's devices and the data on them makes switching costs higher as users spend more time using them. Purchased software in the App Store and the data in the cloud are either impossible or difficult to transfer to other ecosystems. Likewise the interdependence of the hardware ecosystem of Airplay devices and other proprietary standards, make Apple's products more valuable and increases switching costs.

As time passes more users, developers and data will become tied up in Apple's proprietary technologies, the result of its deep integration of hardware and software.

Control versus Spread

"[At Apple] we think as a software driven company, we think about the software strategies first." (Jobs 2010)

Apple has chosen never to license their software.[14] They consider it their most valuable asset. Since DOS/Windows became dominant the conventional wisdom has held that licensing is the most efficient way of spreading software. The modular architecture of Wintel lets hardware manufacturers compete on price and customization to drive down prices and reach as many niche markets as possible. This then led to lock-in. Many expect the same to happen today with Android. It is currently not good enough but will rapidly improve from a lower cost structure and will become a low-end disruption of Apple's iOS ecosystem.

When consumers and developers buy into a new ecosystem they must do so on the expectations that others will do the same. The value of an ecosystem arises from the number of users who buy in. When an ecosystem is well established on a sustaining path such as Windows, it is only rational of users and developers to continue to divert resources into it. Android and iOS represent disruptions that create new potential ecosystems with strong lock-ins. In this situation users and especially developers try to determine what other users and developers will choose. This is not a completely rational choice as effect determines cause in

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[13] When Windows 8 launches this fall.

[14] They tried licensing in the 1990s but it was too late. Clones did not expand the market but took away margins instead.

a reflexive loop. The quality and potential of a disruptive innovation, the resources backing the innovation and the marketing and public relations ability to convince customers all play a part.

Again let us compare to the early days of personal computing. Apple and many other smaller companies had the early market for themselves before IBM introduced their PC with Microsoft's DOS. It was an inferior product but they had resources to fix this if they could convince customers to buy in and wait for the products to improve. In this reflexive competition of convincing customers, IBM held a unique advantage. Their sales organization had decades of experience with selling computers to corporate America. Since personal computers were still expensive machines, corporations held the key to volume success. With its measurable resources and long-term enterprise relations came the proverb: "No one ever got fired for buying IBM" (Rawsthorn 2011).

Enterprises may have been the determinant of the future direction of the personal computer, but today consumer electronics shape the industry. Prices have dropped to the level where most households have one. Android and iOS are targeted at even cheaper and more mobile personal computers that will expand the market beyond 400 million units a year (as we saw in part 3). Already half of the mobile phones in use in the United States are smartphones and we would expect this to occur in most markets within a few years. Smartphone sales have recently surpassed feature phone sales in China (Yee 2012). It is becoming more common to see corporations allow their employees to bring their own devices (Savitz 2012).

This time consumers not corporations will determine the success of these new ecosystems. Steve Jobs always lamented the fact that Apple was no good at selling to enterprises. He could not deal with the middlemen of the Fortune 500 CTOs.

The objective now is to convince consumers and create massive lock-in on a scale far larger than the Windows PC. Or as Bill Gates put it in 2007 long before the success of Android and iOS:

"Technology is letting us put more things in there but then again you really want to tune it so people know what to expect … I think those are natural form factors [tablet and phone], and we will have the evolution of the portable machine and evolution of the phone be both extremely high volume and complementary. If you own one you're more likely to own the other."
Bill Gates at the D5 Conference (Gates 2007)

Brand

Next to its proprietary software the Apple brand may be its most valuable asset. Brands are notoriously difficult to assess or value. The Apple brand has recently been judged the most valuable brand at $182 billion (MilwardBrownOptimor 2012). More importantly the brand is closely integrated with the rest of its corporate strategy. It takes its brand very seriously;

neither employees nor suppliers are allowed to use it. The brand is exclusive to Apple and its operations.

Christensen describes brands as communicating to the circumstances in which the customers finds jobs to be done. In this case the circumstances are the many situations in which a form of computing is necessary for use of content, communication and other software services. But the brand also has an aspirational side to it that is equally valuable. We argued in part three when we looked at Apple's DNA, that the company has a clear sense of purpose in simplifying technology. This comes across in its brand as giving customers the feel of dominating otherwise complex technology.

At its core the brand is nearly synonymous with its charismatic founder. The aspirational nature of its brand comes from its belief in changing the world for the better. That the importance of the computer revolution is too important to be left to corporations who only master the profit motive. The mainstream of its audience is more interested in how the products solve jobs to be done whether these are outwardly aesthetic or to be more productive.

Upon the return of Steve Jobs as CEO in 1997 he took the decision to drastically cut employment and simplify the product portfolio. The company then spent generously on an aspirational branding campaign – think different – the last and only one they needed. Apple had to convince its core that the company would resume its aspirational role of changing the world, before it could launch products that spoke to the circumstances of mainstream jobs to be done.

"I think that more than anything right now, PR is influencing purchase consideration in this category. Not advertising… And I believe strongly that Apple really needs to talk about it's great products, and it's great customers and it's great applications. And the best way for it to do that is in print in a very straightforward way. And I also believe very strongly that the high order bit of any marketing campaign is profitability. We send a boatload of money in any quarter marketing ourselves. If we lose money in that quarter, any positive momentum that we've created is completely erased. Profitability to me is the high order bit of marketing for Apple at this point in time."
- Steve Jobs at WWDC 1997 (Jobs 1997)

Without any proof in the market that they are successful in their aspirational goals, no degree of marketing would have an impact. Once the core audience of Apple faithful and journalists were convinced that the company would survive they could begin to build on top of this foundation by talking about 'it's great products, and it's great customers and it's great applications'. Once the foundation is laid the company can concentrate on marketing products that in turn function add value to its aspirational brand as more and more use its products. A strategy that continues to this day.

The company uses marketing and PR to stay focused on its message of product. It knows that communicating with customers is very low bandwidth through media. It can only communicate a few messages across. This is one of the primary reasons why it chooses to launch products throughout the year. It can concentrate its message on one product making its communication

far stronger. It also ensures that there is a continuous interest throughout the year from its core audience and from the media since they know that any Apple story leads to viewers. Competitors have tried to emulate the keynote formula of launching products to get media attention, often by introducing products in the weeks just prior to Apple's keynotes. Apple's dominating brand now shapes the launch schedule of its competitors.

An example of PR as a weapon was recently seen when Google's first significant Android tablet, the 7" Nexus 7 was announced on June 27th 2012. This poses a potential low-end disruption to Apple because of its $199/249 price points versus Apple's entry iPad 2 at $399. Apple most likely leaked to Bloomberg (Burrows & Satariano 2012) and WSJ (WSJ 2012) on July 4th that they would soon cannibalize their iPad lineup with their own low-end tablet. Rumors are common on the tech blogs, but leaks to investment media makes Apple's intentions known. The domination of Apple's brand makes competitors vulnerable for strategies in which it preempts their moves with superior products at compelling price points.

A brand on its own is not valuable. It is only in combination with the rest of the architecture that it becomes a potent moat. Its role is to both defend against price commoditization and any potential disruptions that may arise. With its mindshare consumers are likely to consider it when the circumstances arise for a compatible job to be done. The idea that Apple's products lets consumers dominate technology differentiates it from its competitors.

Distribution

"All our competitors sell the same product. They're all designed by the same company in Taiwan…At the point of distribution you don't have to know very much to sell them. You don't have to be able to explain them because they're all the same. And you just have to be able to point to the one where your company gets a point more of gross margin that week. And we can't thrive in that environment. We innovate and lets say we have a dozen breakthroughs in a year. We can advertise three or four of them or otherwise if we do more the customer thinks we're a little nuts. And so the rest of them will have to be delivered at the point of sale. And we looked at the point of sale and it's eroding. It's going to be Best Buy and other people like that. The competence level is getting less at the point of sale, even if you train them they turn over every 120 days, so it's impossible to get any knowledge at the point of sale. And we wanted to make the best buying experience in the world because this was at the beginning of the digital hub revolution that we saw … and we thought people are going to need to know more about this stuff."
- Steve Jobs at D2 Conference (Jobs 2004)

As we argued above distribution worked against Apple when the sales channel was dependent upon large corporations. Apple has never been good at selling through middlemen. It has always wanted to remove these and interact directly with its customers. When they launched their own retail it was met with disbelief. Retailing is hard. It is capital intensive and requires a lot of employees. Without moving a lot of goods with decent margins it would be an expensive error.

The objective of Apple Retail was to grab the attention of mainstream customers and earn their trust to walk into a store and try out its premium products. It would work as a physical manifestation of its brand to break the control of distribution from specialized resellers. In the view of computer resellers the job was to move inventory as quickly as possible, and for its employees to make commissions not necessarily educate and guide customers towards the right product for their jobs to be done. Even worse in the case of carriers, where they control both the network technology and the primary distribution of mobile phones through network branded phone shops. Especially in the United States carriers control distribution to the extent that phones carry their brands. The carriers can guide customer choice towards the phones that do not threaten their monopoly over the brand experience of mobile communication. Consequently the large preorders for their branded shops made them the actual primary customer of the mobile phone industry. Carriers dictated industry innovation so that it would not threaten voice, SMS and MMS services.

When asked in 2003 why Apple did not enter the phone industry, Steve Jobs cited distribution: "We didn't think we were going to be successful in the cellphone business because of the carriers." (Jobs 2003)

Retail takes years to build out with a consistent quality of experience. To do so requires a product portfolio that makes enough revenues to finance the expansion. The Mac and iPod supplied the resources to make Apple Retail ready for the iPhone launch. It could not negate the moat carriers have because of the regulation of wavelengths of bandwidth. Apple had to cooperate with one or more carriers to launch the iPhone. Relying on wifi technology was investigated but it proved untenable. Apple could not in the mid-2000s circumvent the laws of physics and had to go through the regulated bandwidth despite the wishes of Jobs to get rid of the carriers (Gohring 2011). But its own distribution channel did give it enough power to retain the exclusivity of its brand in negotiations with smaller upcoming carries, who took the bargain of having the best phone for an uncertain future in which they might lose control over the customer experience including their brand. Apple has patents for a virtual SIM system that in theory could be used to continually auction off customer data usage to the lowest network bidder. This would make networks completely commoditized, retaining the customer experience exclusively with Apple (Purcher 2011).

Apple is strengthened every time it deflates away a customer cost or middlemen margin. These add up cumulatively in much the same manner that cheap software and content deflates consumer prices and adds value to its products. Currently media corporations as diverse as Hollywood, the TV/Cable Networks and book publishers are all fighting this loss of control with distribution and the resulting price deflation.

Apple Retail revenues may not consistently be more than 15-20% of revenues but they supply a physical manifestation of its brand and a place to learn about Apple's products and start a relationship with the brand. Apple does not need to sell through this channel. It just needs the channel to be visible enough to shape the dialogue with consumers.

Visibility starts with its attention to detail. Located in both high-end shopping malls and prominent world-class locations it aims both to be present where shopping takes place, as

well as benefit from the iconic locations of its high-end brand stores. It has 19 of these costing it about $25 million a quarter. The success of these stores is part of the 'cool' feeling that is meant to grab the attention of new potential customers. The stores are meant to represent the brand, build trust and then educate customers on how to use Apple's technology. This is why it hires enthusiastic believers in technology not sales men, and it pays them a fixed wage avoiding the incentive problems commissions create. Commissions motivate quick sales and highlighting products with the highest commissions, not on building trust and listening to customer wishes. "The soft sales touch accomplishes the same result as the seemingly organic—but thoroughly planned—corporate marketing message: The customers feel good, but they've been told exactly what Apple wants them to hear." (Lashinsky 2012, Kindle: 1758).

Apple Retail plays a key role in its interdependent architecture. With control over a sizable part of its distribution, it aids its brand and makes disruptive product launches simpler. With the power of distribution weakened, middlemen in the eyes of Apple have less power to dictate the speed of innovation. This present an enormous advantage versus Google who has a limited online retail presence and otherwise depend upon hardware manufacturers. The same is true of Microsoft. Distributing disruptive software has proven to be distribution constrained as disruptive software technologies are fought by vested interests, many of which control distribution networks. Even when there are no vested interests it is difficult to depend on third party resellers to attract and educate customers. A soft sales approach has proven more efficient at building trust and opening customers to new jobs to be done.

Creating such a successful retail operation with its attention to detail has taken Apple ten years and about $6.3b in capital expenditure and lease commitments. With only 367 stores its physical presence in markets is not yet saturated, especially outside the United States where it only has 112 stores. These time and resource costs make it unlikely that others will follow this strategy and create hundreds if not thousands of stores. Microsoft, HTC and Samsung have all experimented with opening a few stores of their own. However they act more as experiments into branding strategy rather than a vision of a completely independent distribution system. It would require a long-term commitment to an interdependent architecture that is not present outside of Apple in the software industry. This makes Apple Retail a prominent physical moat around its distribution.

Scaling the Interdependent Architecture

"…one thing we'll make sure is that we don't leave a price umbrella for people."
- Tim Cook on Q2 2009 Earnings Call (Krazit 2009)

The advantage of a modular architecture is that the market place works to the advantage of the holder of a monopoly to drive down the cost structure and have the product reach as many niche markets as possible through customization and third party distribution. We have above described Apple's product and message focus as well as its want to control distribution.

Cost is a significant concern for an interdependent corporation. The cost structure is assumed to be higher as it cannot efficiently optimize all aspects of production. Apple integrates to the extent that it exclusively sources a high quality bauxite from a specific mine in Australia to get a particularly distinct aluminum for its products (Wingfield 2012). The obsession with details has haunted the company in earlier times as we argued earlier.

Hiring operations expert Tim Cook and his staff of ex-IBM was meant to create an internal market that was just as efficient as the market place if not more so, and have the flexibility to create new products growing at exponentially year on year. The price umbrella is letting a competitor gain a foothold below Apple's portfolio of products. It includes the cost structure of Apple's sales and the strategic decisions on market positioning to set adequate margins to fund expansion. We begin by assessing Apple's cost structure.

The threat from an inefficient internal market is two fold. From common commodity competition that lets a modular competitor such as Google or Microsoft control a market with its software while others drive down costs. This would be when an industry is on a sustaining path such as the Windows-Mac PC market. Worse would be letting a low-end disruption take hold at the bottom of the market, rapidly improving in quality and price until Apple's medium and later high-end customers find better value below. We have described how Apple's public relations deal with low-end disruptions by preempting them. However without the operational skills of the supply chain organization, these would soon be empty threats.

Apple used to own its own factories but gave up on this in the late 1990s. Instead it does contract assembly in China mostly using the services of Foxconn. Foxconn in turn employs hundreds of thousands of workers to work on Apple's assembly lines. This is a very close relationship with little ability of Apple to divert its business elsewhere as the other OEMs are too small. It is estimated that roughly 40% of Foxconn's 2012 revenues will come from Apple (Dignan 2012). It generally wants control meaning it is not looking for partners. But in the case of Foxconn there seems to be a unique symbiosis.

Apple is now the largest purchaser of semiconductors and many other hardware technologies, which means that there are relatively few companies that can guarantee volume and yields for core technologies. Apple is Samsung's largest customer at 8.8% of revenues though this understates their importance (King & Satariano 2012). Samsung semiconductor represents about half of Samsung's group profits. Apple takes up about 85% of Samsung's sales to third parties, in turn making Samsung the fastest growing semiconductor manufacturer for the second year in a row (McGrath 2012). Apple can only source part of its needs from other suppliers of semiconductors and LCD screens such as from Korean LG and Japanese Sharp.

Its dependence on Samsung is a weakness that it is trying to avert by trying to keep Sharp alive with an equity investment from Foxconn owner Terry Gou (SHIMBUN 2012) and getting exclusive access to medium sized foundry TSMC (King, Culpan & Satariano 2012). Its favorite position to be in is when it can source from many different suppliers. In less critical products it uses in excess of 150 different suppliers.

Apple loves to play hardball with its suppliers. Like Wal-Mart it demands to know every detail of its suppliers cost structure and then it decides the appropriate profit margin. To become an Apple supplier you have to be among the best in an industry category. It often stipulates what technologies should be acquired before Apple will source requiring large capital investments. But it also invests large amounts itself, which is shown by its increasingly large capital expenditures that are now larger than Google's (exhibit 25).[15] This machinery is exclusively for the use of Apple, meaning it can commercialize new expensive technologies, drive down costs through volume and the experience curve and retain exclusive production for a crucial time period in marketing terms.

Through its sheer size and involvement with large parts of the industry it gains several of the advantages of an internal market while keeping incentives aligned to drive down costs. Suppliers are incentivized to produce at a high quality for remain an Apple supplier, but because of stringent cost structure oversight, they are as in the market place incentivized to optimize the process and cut costs. Apple presumably understands that suppliers will want to skimp on quality and makes sure to test sufficient quantities and ban transgressors to ensure standards are kept. Suppliers that choose to work with Apple do so because of the volume and the reputation of being an Apple supplier.

Apple gains control over the quality process, with deep insights into cost structures, and because of its large volume and diverse tier one supplier network, it potentially knows the present location of its competitors cost structures and technological abilities. This knowledge gives it an advantage in determining its pricing strategies. Its insights into the industry also shows itself in the case of emerging technologies, where it can purchase IP and invest capital to exclusive commercialize unproven technologies giving it temporary advantages as they arise.

Let us turn to how it uses its manufacturing to optimize its pricing strategy. By keeping a very simple portfolio of products it can reuse many of its resources across product lines. The same semiconductors, screen and basic materials make up several of its product lines. As products age yield improvements and machinery depreciation leads to higher margins or lower prices letting Apple go down market with older products. The iPhone 3GS began its life three years ago at about $650. The design was superseded by the iPhone 4 and later the 4S models making it not directly competitive. Today it can be found on eBay in the United States, in a model with half the flash storage, for about $160 used / $220 new (Ebay.com 2012). In India it is being offered for roughly $181 on a two year contract with a $52 deposit (Ritchie 2012). By updating its software three years after launch, Apple is using its older products to move into lower income markets, and to offer an alternative to low-end Android phones.

The success of Apple supply chain manufacturing is best seen when judging the iPad market. Phones receive carrier subsidies in the U.S. making their upfront costs small compared to the total cost of contract over two years. Consequently Apple's average selling price of its iPhones has remained steady throughout (exhibit 9). The iPad however is not subsidized and it has shown signs of moving down market preempting low-end disruptions by Android tablets

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[15] Note: A large part of CAPEX is driven by investments in cloud infrastructure. Apple Retail leaseholds excluded.

(exhibit 10). Recent data from Samsung released during its patent trial with Apple shows that its Android tablet have yet to gain market share. Their unit sales are essentially zero while Apple is growing consistently in region of 100 percent year on year. Samsung's is finding it hard to compete below the iPad on price (exhibit 21 & 22). Likewise high-end sales of Samsung's direct iPhone competitors the Galaxy series, are not gaining revenues year on year and their ASPs are dropping significantly (exhibit 19 & 20) in an otherwise booming smartphone market. Though the data is somewhat thin, it suggests that in the U.S. market Samsung may be having success at the low and medium-end of the market, but is vulnerable to Apple moving down market as it did with the iPod (exhibit 8) and is now doing with the iPad.

Another way of judging Apple's supply chain management is to compare it to Dell who is generally considered to have a tier one supply chain manager. Exhibits 23 and 24 show that Apple under Tim Cook has improved considerably and is now somewhat better than Dell at managing inventory, accounts outstanding and payable.

Sub-Conclusion

"We don't want to get into something unless we can invent or control the core technologies. Because we'll get slammed if we don't. And the more we look at it, the more and more consumer devices, the core technology in them is going to be software. If you really look at the iPod, I mean from the very beginning we looked at them and said "the ultimate competitive barrier is going to be software in this thing." We are pretty clever at hardware but ultimate people will copy us and do other things but the competitive barrier will be software. And the more consumer products evolve the more they look like software in a box."
- Steve Jobs at D2 Conference (Jobs 2004)

Apple's interdependent architecture can be seen to be a comprehensive structure with many distinct parts. They are interdependent and add value collectively. Consequently the moats become cumulatively stronger as each moat is strengthened.

The objective is to spread its software and lock-in customers to its architecture, making it difficult for others to challenge it either symmetrically or asymmetrically. A few large software companies are competing to be the gatekeeper of the coming digital age in which software swallows up more and more of the economy.

The value accruing to the gatekeeper and the powerful network effects that keeps it protected from symmetrical makes it a highly coveted position. As we wrote above:

The network owner is a powerful gatekeeper that benefits from owning the architecture in which value is exchanged.

The software that creates network effects can be said to have asymmetrical qualities that makes commoditization impossible and successful disruption rare.

Apple believes in selling its software integrated into its hardware. This becomes a problem of distribution that has haunted the company in the past. Apple now benefits from the point of gravity of the industry moving to consumer electronics. It is far better at selling to individuals than the gatekeepers of corporate purchases or the carriers who control the key technology of wireless communication. To break their monopolies and enter a dialogue with consumers it had to create its own physical retail presence. This is a very costly and long-term process that is still in its early stages on a global basis. It has built a remarkable strong brand that dominates the mindshare of consumers and industry, as shown by its competitors launching products just prior to Apple's own keynotes. By controlling a large part of its own distribution, aided by its almost quarterly product keynotes, it sets the tone of the industry.

It is now building scale advantages between its two iOS devices, the iPhone and the iPad. The reuse software and hardware components and the simplicity of its designs as well as its intense surveillance of supplier cost structures, makes its products very cost competitive against its modular competitors such as Samsung. Bill Gates expressed this fact in 2007: "If you own one you're more likely to own the other." (Gates 2007)

Apple has shown a willingness to cannibalize its own profits with the iPod. It is presumably about to do the same with the iPad to preempt a low-end Android disruption. Its public relations and supply chain advantages suggests that its interdependent architecture is prepared and not threatened by this attempt at a price disruption. Its ability to focus and understand which key technologies to own and commercialize, it can quickly update and launch new products with sustaining and disruptive technologies ahead of its modular competitors.

By controlling the entire value chain from sourcing to sales it can leverage its parts to keep a quicker pace and minimize its cost structure.

Discussion & Conclusion

We set out to answer the following question:

How did Apple Inc. solve 'The Innovator's Dilemma' by avoiding low-end disruption, i.e. commoditization of its premium priced products, or by being made qualitatively obsolete by new market disruption?

Our interest in this question came from the competitive nature of capitalism. Most corporations fail and yet innovation increases social welfare by improving products and services while consistently driving down costs. However what is good for social welfare is bad for corporate profits. It is always in the interest of corporations to avoid competition. The best businesses create moats that make their competitive advantages expensive or impossible to imitate.

Disruptive innovation theory describes a world in which technological and business innovation at times makes it possible for organizations to defeat much larger entrenched interests. We found that the theory has roots in economic thought going back to the dichotomous relationship of failure obsessed rule-based bureaucracies and entrepreneurs who try to overcome failure by experimenting with new uncertain business models.

In this worldview no moat is truly permanent. Changes to technology or social structures may render moats redundant. The issue at the center of competition then becomes one of culture. Industries innovating at a sustaining pace reward companies for listening to their best most profitable customers. Internally employees are incentivized to minimize risk taking and to fight organizational change that might jeopardize their careers. In this form organizational processes and resources are biased towards easy to recognize gains and losses.

Disruptions are very difficult to assess as they happen because we have to rely on qualitative judgment. Quantitative data is only available after the fact as disruptions begin on the margins before eventually taking off in an exponential fashion. By the time of takeoff it is often too late to respond. The ability to recognize and motivate a disruptive defense is a crucial competence of a contemporary corporation. The Innovator's Dilemma can be understood in an evolutionary sense as one of excessive optimization to an external environment that suddenly changes. The fitness landscape rewards optimizations until the landscape itself changes.

We argue that disruption theory is poor at describing the underlying changes to technology and market structures that create the new jobs to be done by customers. The pace of innovation in the theory is determined by customer needs, but the process that leads to the fulfillment of those needs is a loose set of anthropological ideas on investigating human action. Disruption theory merely suggests that the innovative process is best nurtured in smaller entrepreneurial organizations, and therefore large organizations should create small secluded startups located far away from headquarters to avoid corporate antibodies killing them off.

Our interest in Apple comes from its many deviations from the recommendations of disruption theory and the obvious success of its organization. Apple represents a cohesive worldview of how to organize, innovate and defend on both disruptive and sustaining paths. Disruption theory recommends modular specialization and letting the market place optimize around key interface moats. The Microsoft-Intel success story of DOS/Windows on the x86 microprocessor architecture looms large in the mind behind disruption theory. Clayton Christensen has often suggested that Apple would face increasing competitive pressure if they did not change to a modular architecture, by licensing their software and letting the market place compete in the low margin hardware business.

Apple was founded on the idea of having complete control over the entire value chain. The issues of complexity costs and misaligned corporate incentives are organizational challenges that can be overcome. Long before the Innovator's Dilemma was written Steve Jobs had his own understanding of why corporations fail. Monopolies tend to believe their success is permanent turning to sales and marketing for quick improvements to profitability. When disruption occurs the monopoly is no longer able to respond as its product-making ethos has left its DNA. Whether this is true or not is beside the point. Jobs said out to ensure that no such thing would occur at Apple.

The solution to The Innovator's Dilemma is to be found in its organizational DNA. At its core we find an arrogant organization that is terrified of hubris.

The organization goes in the opposite direction of disruption theory by centralizing power, causing permanent focused micromanagement. Decisions are highly centralized with an opportunistic entrepreneurial culture below. The small executive team is only capable of focusing on a few major products at a time. This focus is an advantage because they are fed from below with an understanding of the soon to be technological possibilities. The distance between executive team and the work being done below it is remarkably short and focused.

The threat of stagnation and wasted resources by misalignment of interest and politicking is cured with secrecy, paranoia and a call to excellence through strenuous work. It shows by hiring the best specialists in their given fields and leading them clueless to the big picture. Its motivation shows in its obsessive focus with getting rid of the superfluous and touting their products as revolutionary.

At its core is an organization that is motivated by the belief that it is changing the world, making the hard work and paranoia worthwhile tradeoffs.

The jobs to be done that it solves are not its products or even the abstract notion of computing. Apple sells the promise of simplicity in a complex world. The promise of taking the best possible choices in the interest of consumers, who do not have the insight to comprehend the long-term ramifications. Apple's want of simplicity naturally leads it to hardware-software integration and to as much control of the consumer experience as possible. Apple is a software driven company that stands to gain from the rising importance of software. Software by its nature creates strong network effects and proprietary technology moats that increases in value depending on the volume of users and services offered. Apple

competes with a few other powerful software companies to create these ecosystems that assimilate more and more value from physical domains such as content and communication.

Its interdependent architecture creates numerous moats that help it diminish the importance and power of third parties. Central to its architecture is its control over a significant portion of its physical distribution. The strategy of Apple is heavily tilted towards disintermediation of third party value added, whilst working in the long-term to create physical and software customer lock-ins.

A further advantage is its ability to quickly leverage new technologies to advance the pace of innovation both sustaining and disruptive. Companies located in modular architectures may not be incentivized to invest sufficiently in innovation to improve products that mostly benefit parts outside its ownership in the value chain. The chicken-and-egg or collective coordination problem is solved by integration.

Disruption theory would predict that as innovation slows to a sustaining pace in mobile computing, that price and customization would be favored by consumers, benefitting a modular architecture. There is reason to be skeptical because of the strong moats and Apple's ability to dominate volume and thereby produce cost effectively. The iPod was neither weakened by commoditized competition nor was it low-end disrupted. Though the data is inconclusive we tentatively conclude that the iPhone is not being affected by Android at this point in time when we assess its yearly volume growth and consistent average selling prices. In fact there is some data that suggests that its main competitor Samsung is not increasing its market share of the high-end smartphone market in the United States. Apple is showing signs of moving down market to preempt low-end disruption. This is especially clear in the tablet market where it is preempting a low-end disruption by Google.

Will Apple be able to preempt other low-end disruptions in the future? Will it be able to recognize new market disruptions and react?

The history of the iPod suggests that Apple will disrupt its own markets before anyone else. Apple's cannibalism is deeply ingrained in its DNA. It seemed clear at the time that the iPod music software would eventually be assimilated by mobile phones. Instead Apple assimilated the mobile phone and the music player in a mobile computing device.

Whether Apple will be able to dominate the mobile computing market, as with the music player market is less certain. The sheer size and profitability not to speak of its multiple and as of yet unknown jobs to be done, all suggest that the market will have many different successful approaches. Google, Samsung and Microsoft are to different degrees experimenting with imitating Apple's distribution, marketing and public relations and the look and feel of its products. It is unlikely that they will entirely imitate Apple as they lack the motivation to commit to an interdependent architecture. But they are moving quickly to create their own software-hardware ecosystems with content, communication and third party software tightly integrated.

The strength and weaknesses of Apple lies in its motivation to stay faithful to its DNA but also to renew itself as necessary. Many companies founded by charismatic leaders have since failed in their absence. Apple has opened Apple University in an attempt to codify its DNA. However no amount of books and teaching guarantee that the corrupting processes Steve Jobs abhorred will be kept at bay forever.

Apple has shown that the interdependent architecture is competitive in the modern software dominated world. The revolution in specialization and global supply chain sourcing beginning with the end of the conglomerates of the 1960s is not over. *The Innovator's Dilemma* remains. Instead the example of Apple suggests that these can be internalized efficiently with information technology and a focused centralized organization. Integration solves collective action problems and misaligned incentives including those of vested interests, giving the interdependent architecture a valuable ability to set the pace of industry innovation. It also suggests that specialization in physical retail may still hold surprising value.

Other companies will surely learn from the example of Apple and try to imitate its interdependent approach in other frontiers of technology and business innovation. Controlling the entire customer experience is now feasible and lends itself to profitable monopoly business.

Bibliography

Ballmer, Steve, interview by David Lieberman. *CEO Forum: Microsoft's Ballmer having a 'great time'* (April 30, 2007).

BBC. *Ex-Apple boss Sculley sets record straight on Jobs* . January 13, 2012. http://www.bbc.com/news/technology-16538745 (accessed August 12, 2012).

Bott, Ed. *Why does the IT industry continue to listen to Gartner?* . July 23, 2012. http://www.zdnet.com/why-does-the-it-industry-continue-to-listen-to-gartner-7000001394/ (accessed August 20, 2012).

Burrows, Peter, and Adam Satariano. *Apple Said To Plan Smaller Ipad To Vie With Google Nexus* . July 4, 2012. http://www.bloomberg.com/news/2012-07-03/here-comes-nexus-7-nightmare-the-ipad-mini.html (accessed August 27, 2012).

Christensen, Clayton M. "The Rigid Disk Drive Industry: A History of Commercial and Technological Turbulence." *Business History Review*, Winter 1993: 531-589.

—. *Clay Christensen's Milkshake Marketing* . February 14, 2011. http://hbswk.hbs.edu/item/6496.html (accessed August 5, 2012).

Christensen, Clayton M., interview by Peter Burrows. *How Apple Could Mess Up, Again* (January 9, 2006).

Christensen, Clayton M., interview by McKay Coppins. *Predicting Innovation Winners and Losers* (August 18, 2010).

Christensen, Clayton M., interview by Horace Dediu. *The Critical Path: An Interview with Clayton Christensen* (May 2, 2012).

—. *The Innovator's Dilemma.* 2nd Edition. Boston: HarperCollins, 2000.

—. *The Innovator's Solution.* Harvard Business School Press, 2003.

Coase, Ronald. "The nature of the firm." *Economica*, 1937: 386-405.

comScore. *comScore Reports June 2012 U.S. Mobile Subscriber Market Share* . August 1, 2012. http://www.comscore.com/Press_Events/Press_Releases/2012/8/comScore_Reports_June_2012_U.S._Mobile_Subscriber_Market_Share (accessed August 3, 2012).

Cunningham, Lawrence A. *The Essays of Warren Buffett: Lessons for Investors and Managers.* Third Edition. Unknown City: John Wiley & Sons (Asia), 2009.

Dignan, Larry. *Apple-Foxconn tale goes well beyond Apple, and tech* . January 27, 2012. http://news.cnet.com/8301-13579_3-57367320-37/apple-foxconn-tale-goes-well-beyond-apple-and-tech/ (accessed August 27, 2012).

Ebay.com. *Ebay Search for iPhone 3GS.* August 29, 2012. http://www.ebay.com/ctg/Apple-iPhone-3GS-8GB-Black-ATT-Smartphone-MC555LL-A-/100012593?_refkw=iphone+3gs&_pcatid=801&_pcategid=9355&_dmpt=Cell_Phones (accessed August 29, 2012).

Eichenwald, Kurt. *Microsoft's Lost Decade.* August 2012. http://www.vanityfair.com/business/2012/08/microsoft-lost-mojo-steve-ballmer (accessed August 15, 2012).

Frommer, Dan. *Apple COO Tim Cook: 'We Have No Interest In Being In The TV Market'* . February 23, 2010. http://www.businessinsider.com/live-apple-coo-tim-cook-at-the-goldman-tech-conference-2010-2 (accessed August 15, 2012).

Gates, Bill, interview by Kara Swisher and Walt Mossberg. *Bill Gates Interview at the D5 Conference* (May 30, 2007).

Gohring, Nancy. *Jobs wanted own network with unlicensed spectrum .* November 15, 2011. h t t p : / / w w w . c o m p u t e r w o r l d . c o m / s / a r t i c l e / 9 2 2 1 8 5 4 / Jobs_wanted_own_network_with_unlicensed_spectrum (accessed August 27, 2012).

Hart, Oliver D., and Sanford J. Grossman. "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy*, 1986: 691-719.

Ionescu, Daniel. *Original Android Prototype Revealed During Google, Oracle Trial .* April 26, 2 0 1 2 . h t t p : / / w w w . p c w o r l d . c o m / a r t i c l e / 2 5 4 5 3 9 / original_android_prototype_revealed_during_google_oracle_trial.html (accessed August 20, 2012).

iPhone Death Watch. http://aaplinvestors.net/stats/iphone/iphonedeathwatch/ (accessed August 7, 2012).

Isaacson, Walter. *Steve Jobs.* Simon & Schuster, 2011.

Jobs, Steve. *Apple Q4 2010 Earnings Call* (October 18, 2010).

Jobs, Steve. *Apple's One-Dollar-a-Year Man* (January 24, 2000).

Jobs, Steve, interview by Daniel Morrow. *Excerpts from an Oral History Interview with Steve Jobs* (April 20, 1995a).

Jobs, Steve. *iPhone launch at Macworld Expo 2007.* San Francisco, CA, January 8, 2007.

—. "Keynote at MacWorld 2007." January 9, 2007.

Jobs, Steve, interview by Walt Mossberg. *Steve Jobs at the D1 Conference* (May 28, 2003).

Jobs, Steve, interview by Walt Mossberg. *Steve Jobs at the D2 Conference* (june 7, 2004).

Jobs, Steve, interview by Robert X. Cringeley. *Steve Jobs - The Lost Interview* (1995b).

Jobs, Steve, interview by Bo Burlingham and George Gendron. *The Entrepreneur of the Decade* (April 1, 1989).

Jobs, Steve. *WWDC Keynote.* San Francisco, CA, June 6, 2011.

Jobs, Steve. *WWDC Keynote 1997.* May 13, 1997.

Kay, Alan. *Creative Think Seminar.* July 20, 1982.

King, Ian, and Adam Satariano. *Apple Ties To Samsung In Sharp Contrast To Courtoom Clash .* August 7, 2012. http://www.bloomberg.com/news/2012-08-07/apple-ties-to-samsung-in-sharp-contrast-to-courtoom-clash.html (accessed August 27, 2012).

King, Ian, Tim Culpan, and Adam Satariano. *Apple, Qualcomm Bids Spurned For Exclusive Tsmc Supplies.* August 30, 2012. http://www.bloomberg.com/news/2012-08-29/apple-qualcomm-spurned-in-bids-for-exclusive-tsmc-chip-supply.html (accessed August 30, 2012).

Knight, Frank. "Profit and Entrepreneurial Functions." *The Journal of Economic History*, 1942.

—. *Risk, Uncertainty and Profit.* Boston, MA: Hart, Schaffner & Marx, 1921.

Knight, Shawn. *Gartner: Smartphone adoption up 43%, buyers waiting for new iPhone.* August 15, 2012. http://www.techspot.com/news/49771-gartner-smartphone-adoption-up-43-buyers-waiting-for-new-iphone.html (accessed August 20, 2012).

Krazit, Tom. *Apple's Cook determined to stay the course .* April 22, 2009. http://news.cnet.com/8301-13579_3-10225484-37.html (accessed August 27, 2012).

Lanier, Jaron. *The Local-Global Flip, or, "The Lanier Effect".* August 29, 2011. http://edge.org/conversation/the-local-global-flip (accessed July 19, 2012).

—. *You Are Not A Gadget: A Manifesto.* New York: Alfred A. Knopf, 2010.

Lashinsky, Adam. *How Apple works: Inside the world's biggest startup.* August 25, 2011. http://tech.fortune.cnn.com/2011/08/25/how-apple-works-inside-the-worlds-biggest-startup/ (accessed August 16, 2012).

—. *Inside Apple: How America's Most Admired--and Secretive--Company Really Works.* Business Plus , 2012.

Levy, Steven. "OK, Mac, Make a Wish ." *Newsweek*, February 2, 2004: 53-.

MacFarquhar, Larissa. "When Giants Fail: What business has learned from Clayton Christensen. ." *The New Yorker*, May 14, 2012.

Masters, Blake. *Peter Thiel's CS183: Startup - Class 4 Notes Essay .* April 11, 2012. CS183: Startup—Notes Essay—April 11—The Last Mover Advantage (accessed August 10, 2012).

McGrath, Dylan. *Thanks to Apple, Samsung foundry sales to surge again .* August 21, 2012. http://www.eetimes.com/electronics-news/4394486/Thanks-to-Apple--Samsung-s-foundry-sales-to-surge-again-in-2012 (accessed August 27, 2012).

MilwardBrownOptimor. "BrandZ Top 100 Most Valuable Global Brands 2012." *MilwardBrownOptimor.* May 22, 2012. http://www.wpp.com/NR/rdonlyres/4B44C834-AEA8-4951-871A-A5B937EBFD3E/0/brandz_2012_top_100.pdf (accessed August 27, 2012).

Nagy, Béla, J. Doyne Farmer, Quan M. Bui, and Jessica E. Trancik. "Statistical Basis for Predicting Technological Progress." *arXiv.org* (Cornell University), 2012: 1-12.

Nielsen. *Two Thirds of New Mobile Buyers Now Opting For Smartphones.* July 12, 2012. http://blog.nielsen.com/nielsenwire/online_mobile/two-thirds-of-new-mobile-buyers-now-opting-for-smartphones/ (accessed August 3, 2012).

Piltch, Avram. *Laptop Mag.* March 13, 2012. http://blog.laptopmag.com/the-average-pc-laptop-cost-513-in-february (accessed August 8, 2012).

Purcher, Jack. *Apple introduces us to the Virtual SIM Card .* November 3, 2011. http://www.patentlyapple.com/patently-apple/2011/11/apple-introduces-us-to-the-virtual-sim-card.html (accessed August 27, 2012).

Rawsthorn, Alice. *The Clunky PC That Started It All .* July 31, 2011. http://www.nytimes.com/2011/08/01/arts/the-clunky-pc-that-started-it-all.html?pagewanted=all (accessed August 26, 2012).

Ritchie, Rene. *iPhone 3GS now available for $180 on Aircel India, and what that tells us about the budget iPhone future .* July 21, 2012. http://www.imore.com/iphone-3gs-now-available-180-aircel-india-and-what-tells-us-about-budget-iphone-future (accessed August 27, 2012).

Samsung. *Samsung Blackjack II™ Windows Smartphone.* 2006. http://www.samsung.com/us/mobile/cell-phones/SGH-I617TIAATT (accessed August 20, 2012).

Savitz, Eric. *Averting IT Civil War Over 'Bring Your Own Device' .* July 3, 2012. http://www.forbes.com/sites/ciocentral/2012/07/03/averting-it-civil-war-over-bring-your-own-device/ (accessed August 27, 2012).

Schumpeter, Joseph. *Capitalism, Socialism and Democracy.* New York: Harper, 1942.

Segall, Kenneth. *Insane Simple: The Obsession That Drives Apple's Success.* Portfolio / Penguin, 2012.

SHIMBUN, THE ASAHI. *Hon Hai underscores pledge to help Sharp reverse heavy losses .* August 28, 2012. http://ajw.asahi.com/article/economy/business/AJ201208280066 (accessed August 29, 2012).

Taleb, Nassim N. "The A Priori Problem of Observed Probabilities." 2007.

West, Geoffrey B. *Why Cities Keep Growing, Corporations and People Always Die, and Life Gets Faster* . May 23, 2011. http://edge.org/conversation/geoffrey-west/ (accessed July 28, 2012).

Williamson, Oliver E. "The economics of organization: The transaction cost approach." *American Journal of Sociology*, 1981: 548-77.

Wingfield, Nick. *With Tablet, Microsoft Takes Aim at Hardware Missteps* . June 24, 2012. http://www.nytimes.com/2012/06/25/technology/companies/with-tablet-microsoft-takes-aim-at-hardware-missteps.html?pagewanted=all (accessed August 27, 2012).

WSJ. *Apple Prepares Mass Production of Smaller Tablet -Sources* . July 4, 2012. http://online.wsj.com/article/BT-CO-20120704-703673.html (accessed August 27, 2012).

Yee, Lee Chyen. *CORRECTED-UPDATE 1-Apple share of China smartphone mkt almost halved in Q2 - IDC* . August 24, 2012. http://www.reuters.com/article/2012/08/24/china-smartphones-idUSL4E8JO13G20120824 (accessed August 27, 2012).

Appendix: Electronic Data

PDF and NUMBERS on DVD

Appendix: Exhibits

Exhibit 1 & 2
Source: Clayton Christensen
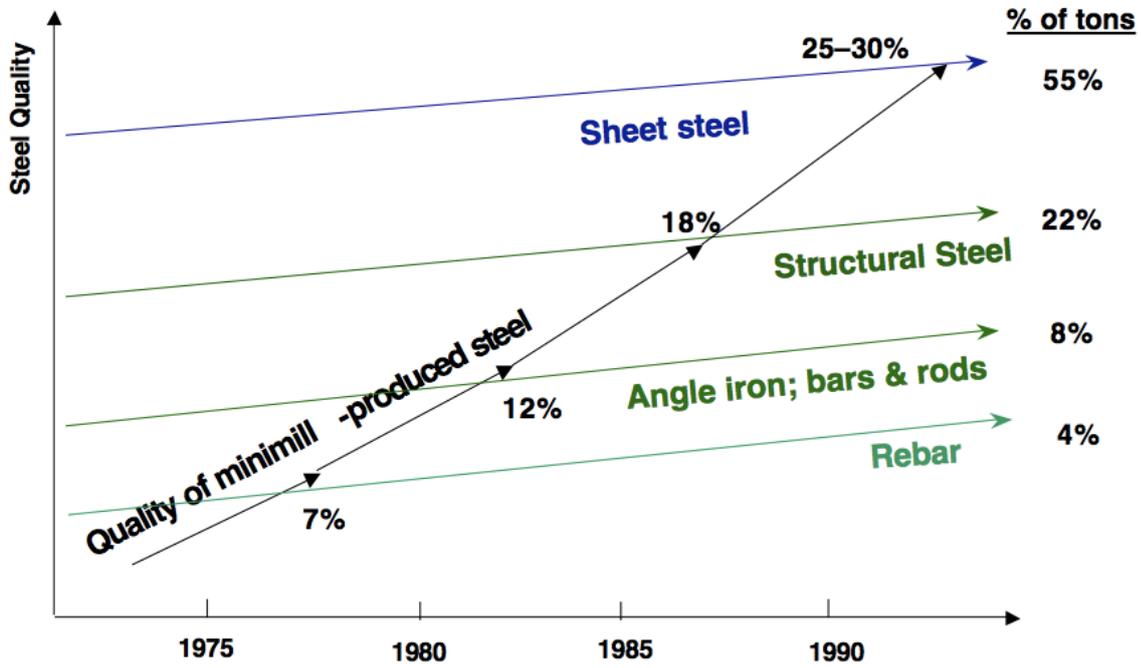
Exhibit 3: Revenue by Segment
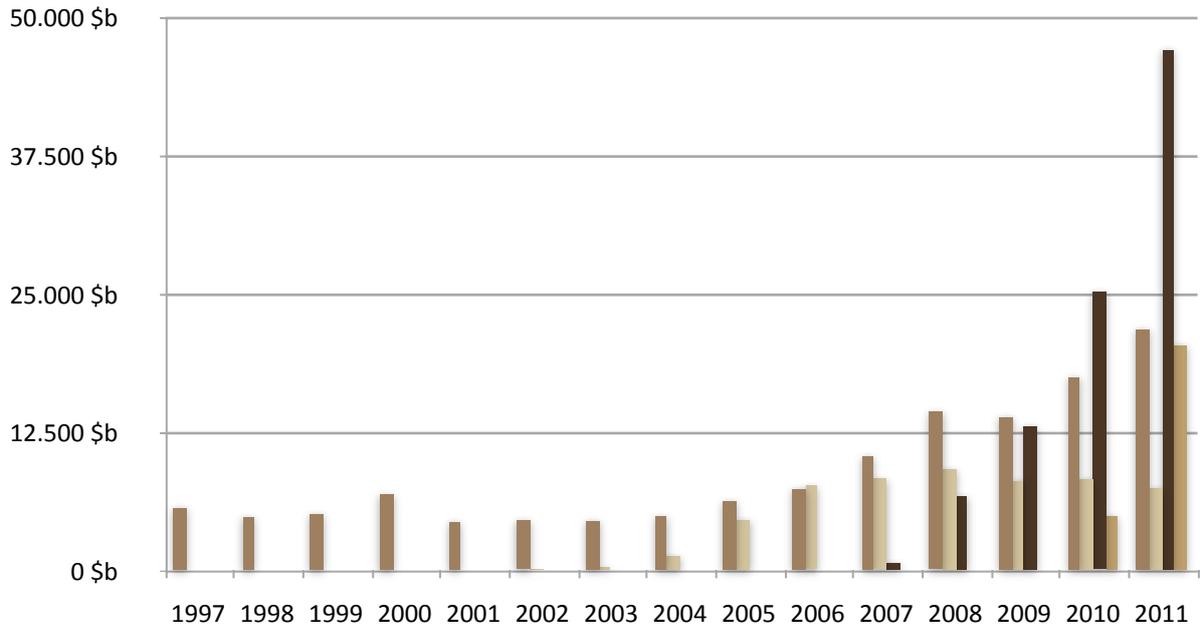
Exhibit 4: Operating Income by Region

Americas: Retail US   Retail ex-US   Japan: Europe:
Other: Asia-Pacific:
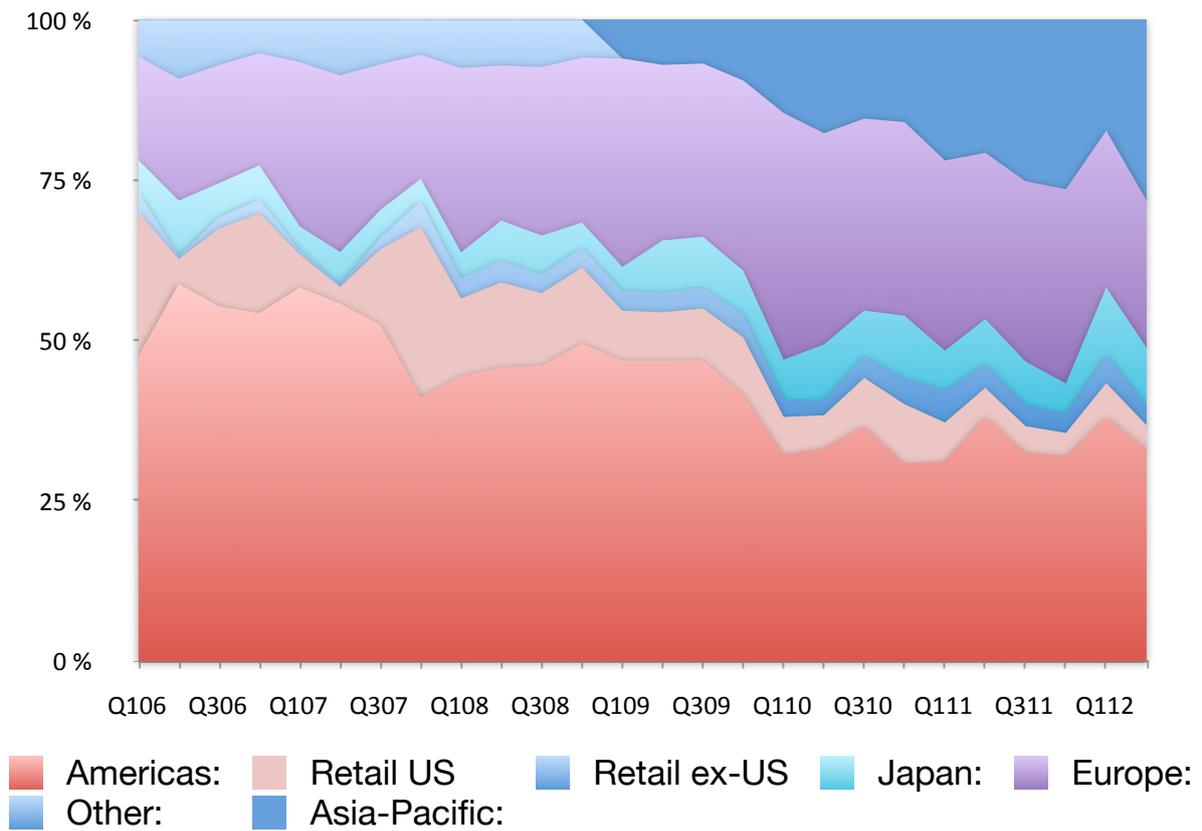
Exhibit 5: R&D Spend % of Revenues
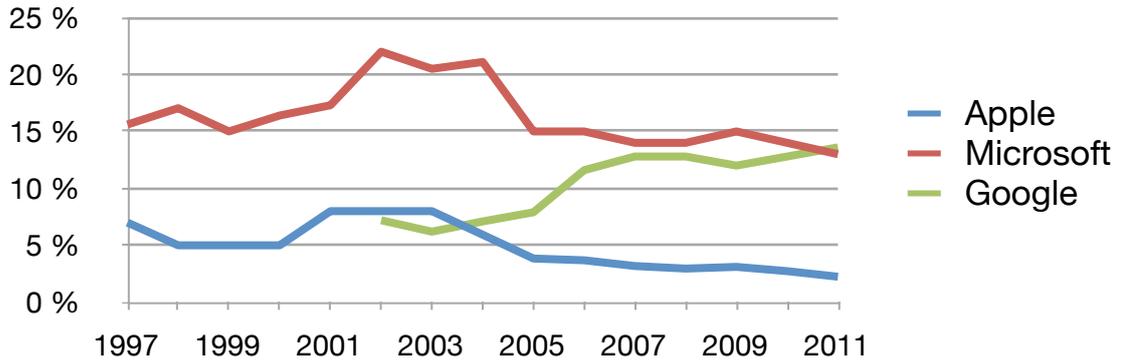
Exhibit 6: The Move to Portables
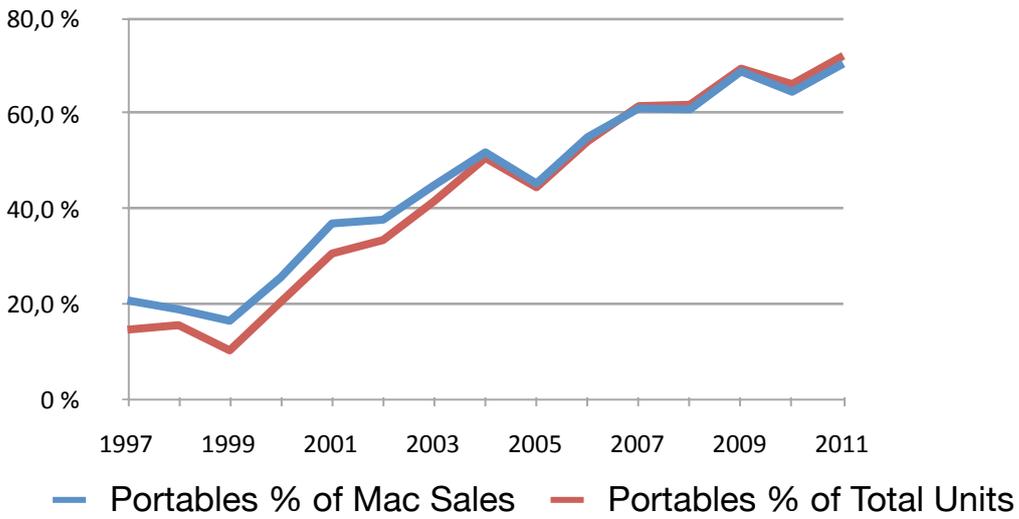
Exhibit 7: Mac Pricing Strategy
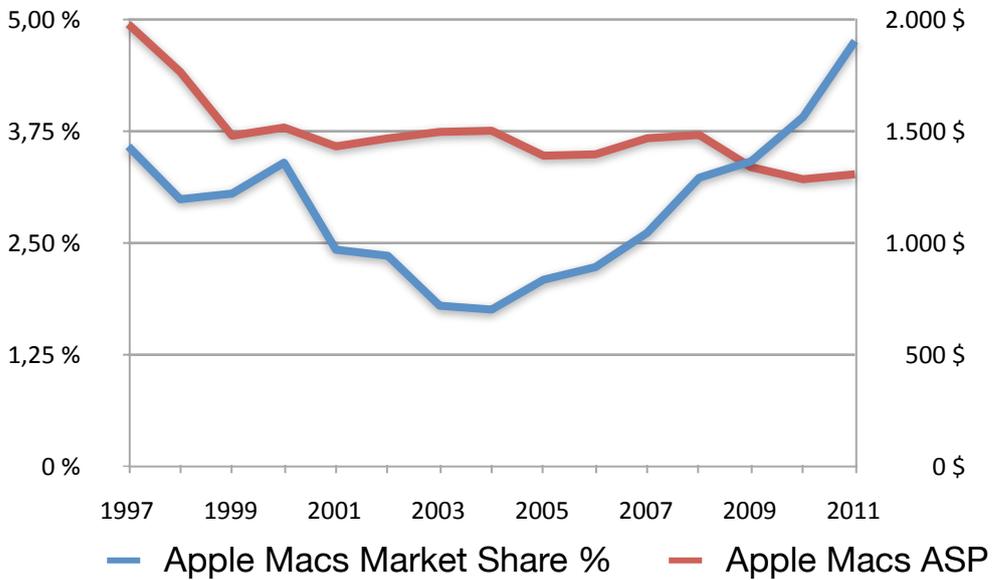
Exhibit 8: iPod Pricing Strategy

— Average Selling Price   ▮ iPod units
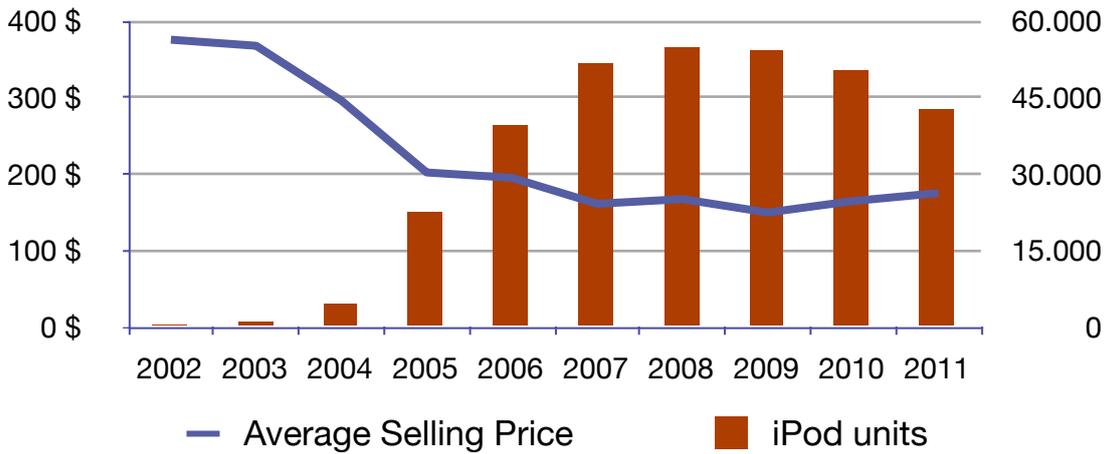
Exhibit 9: iPhone Pricing Strategy

— Average Selling Price   ▮ iPhone unit sales
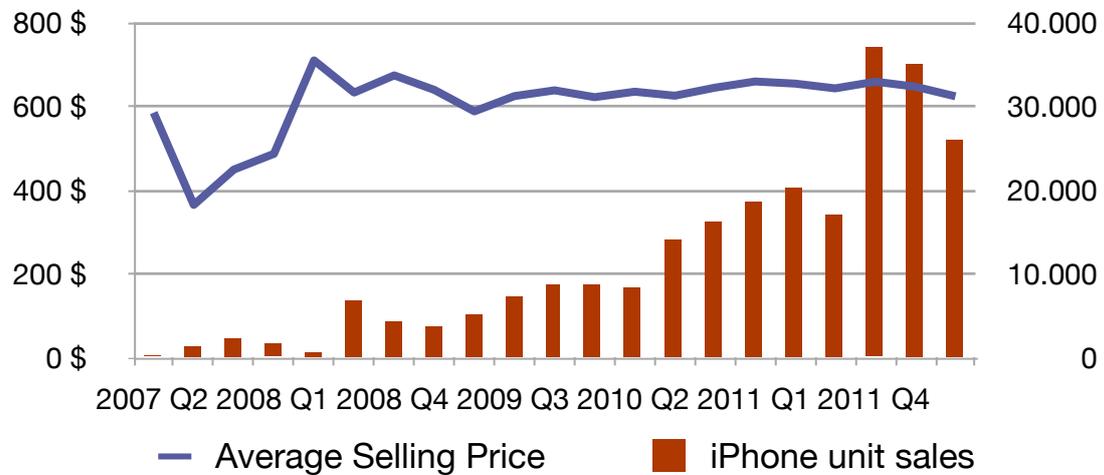
Exhibit 10: iPad Pricing Strategy

— Average Selling Price   ▮ iPad unit sales
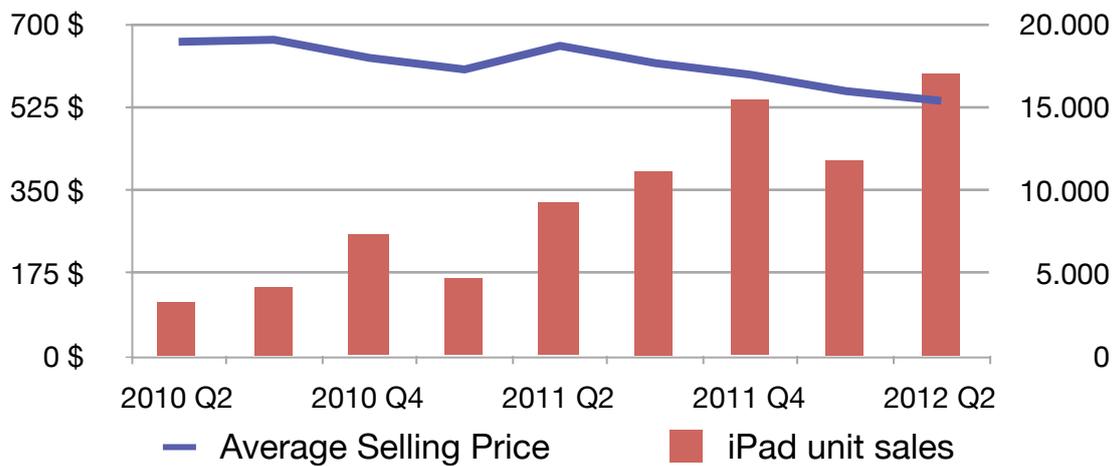
Exhibit 11: Quarterly Unit Sales Since Launch of iPod

Total Mac unit sales — iPod unit sales — iPhone unit sales — iPad unit sales
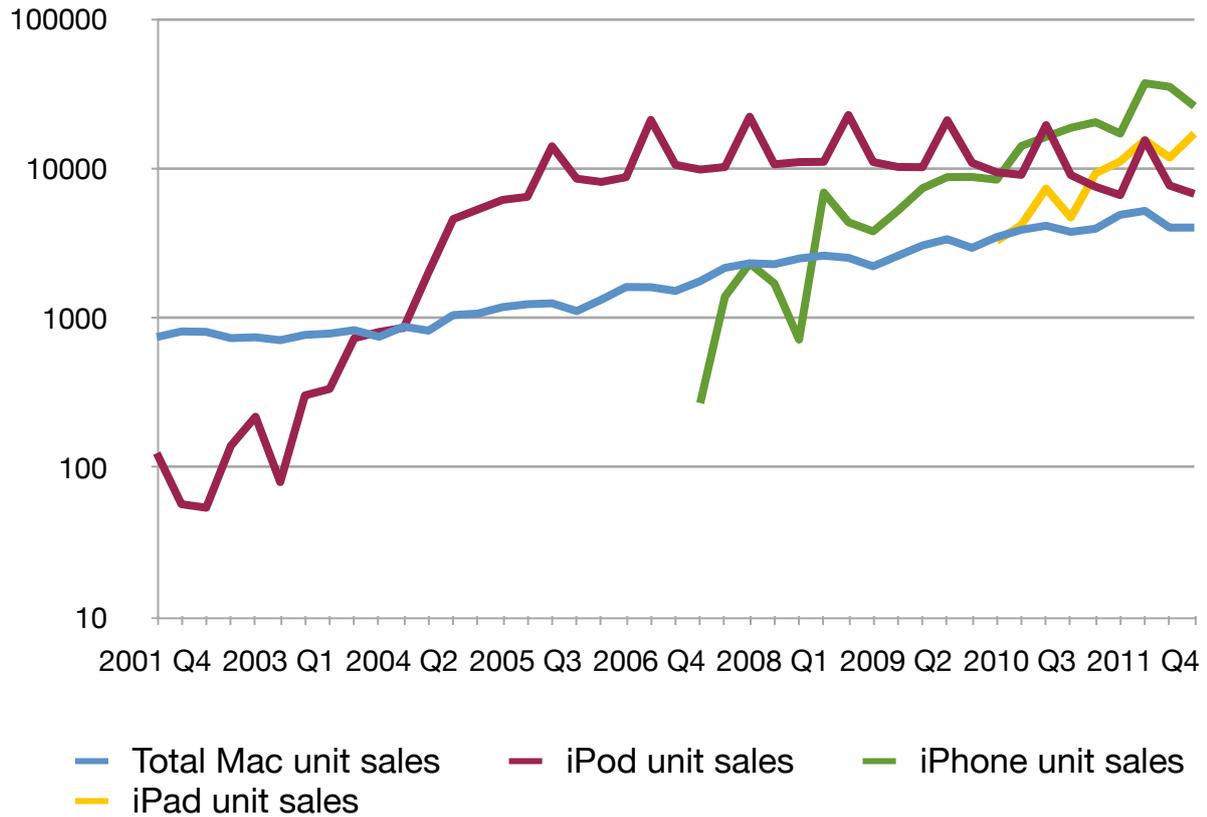
Exhibit 12: Sales Since Launch Quarter

iPod unit sales — iPhones — iPad
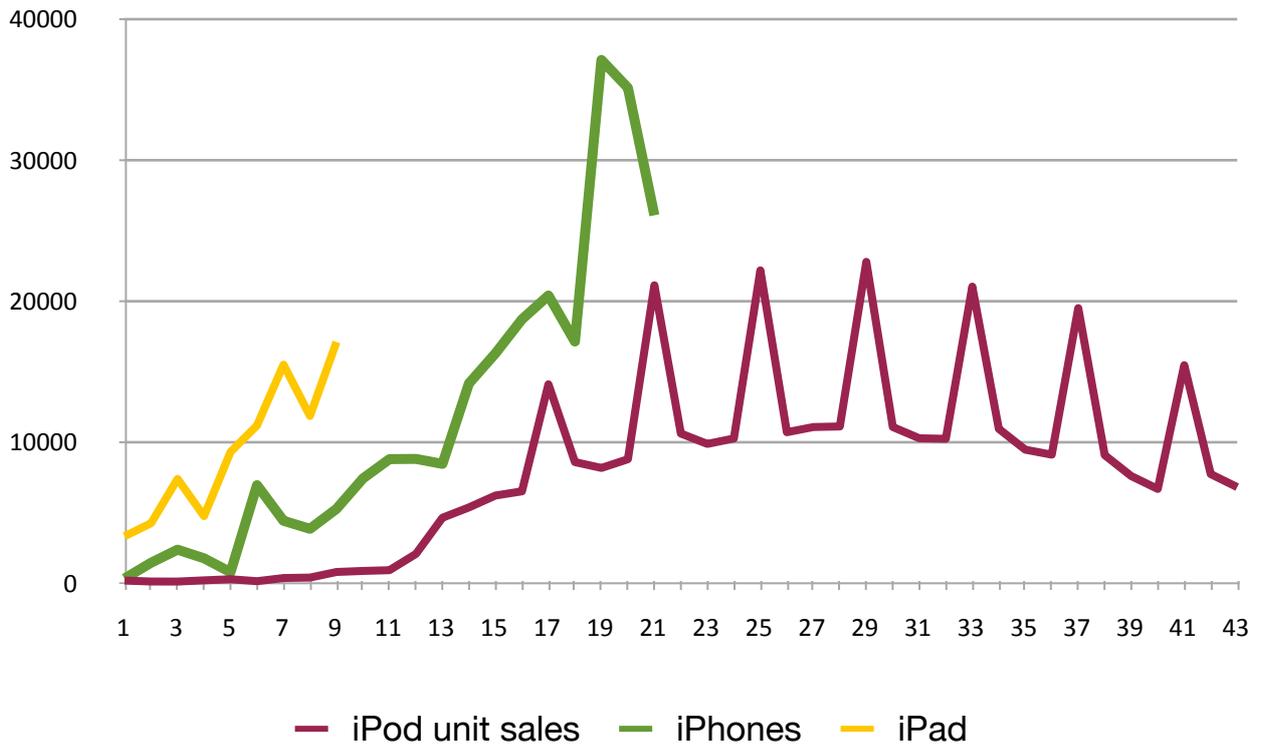
Exhibit 13: PC Market Share

Legend: OS X | Tablets (iPad) | Tablets (Android) | Windows PC
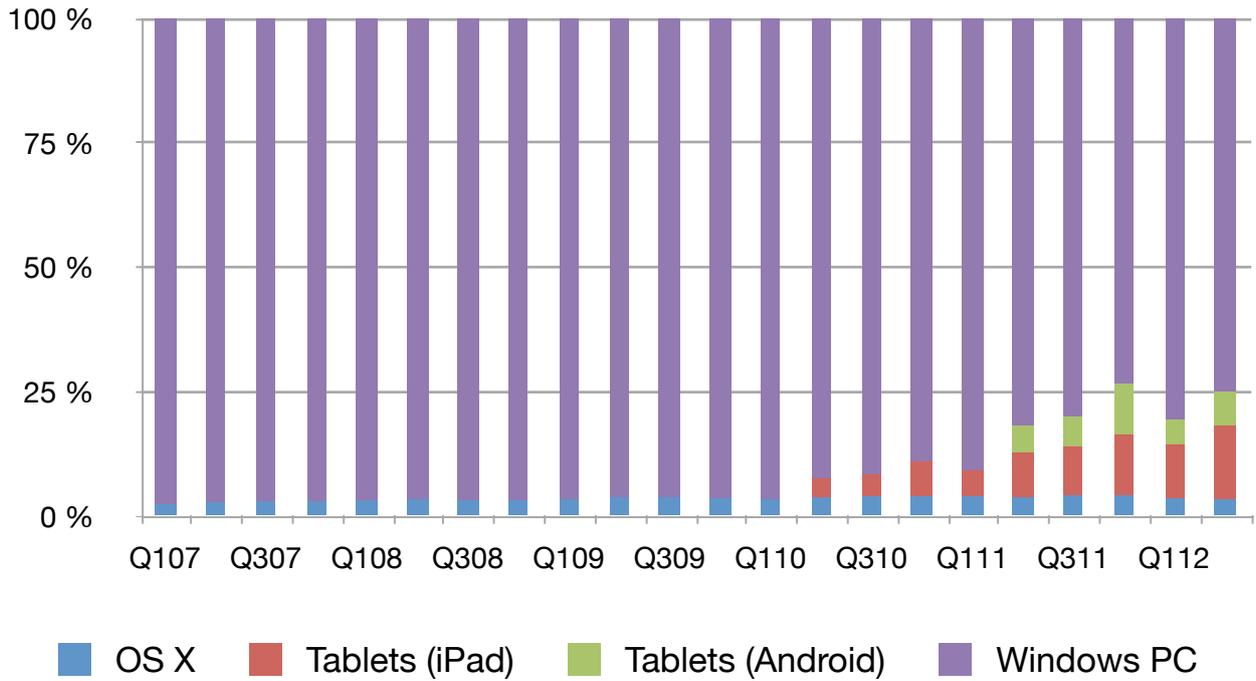
Exhibit 14: Windows, OS X and iOS Growth Rates (Y-o-Y)

Legend: Windows | Mac OS X | iOS (iPad)
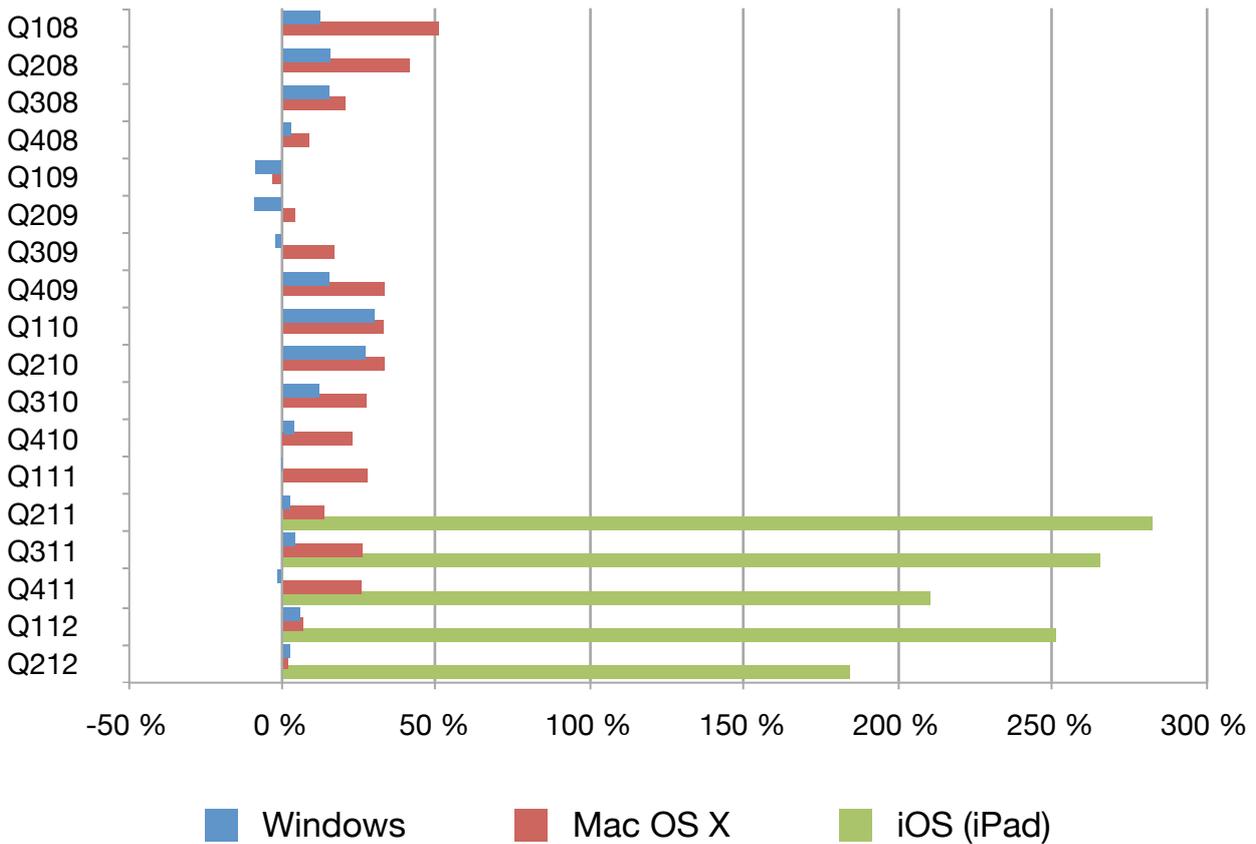
Exhibit 15: Apple (OS X + iOS) and Top 5 PC Unit Sales (millions)

Legend: Q209, Q210, Q211, Q212

Categories: Apple, HP, Asus, Lenovo, Dell, Acer
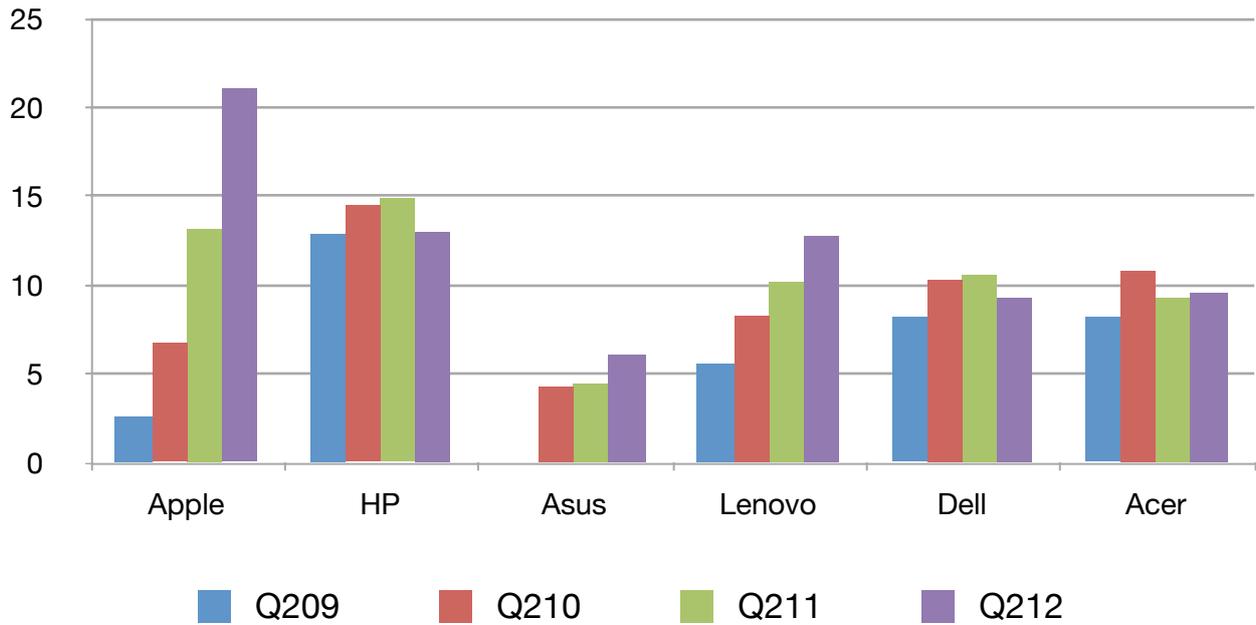
Exhibit 16: Mobile Phone Industry Profits

Legend: RIM, LG, HTC, Sony Ericsson, Nokia, Samsung, Apple
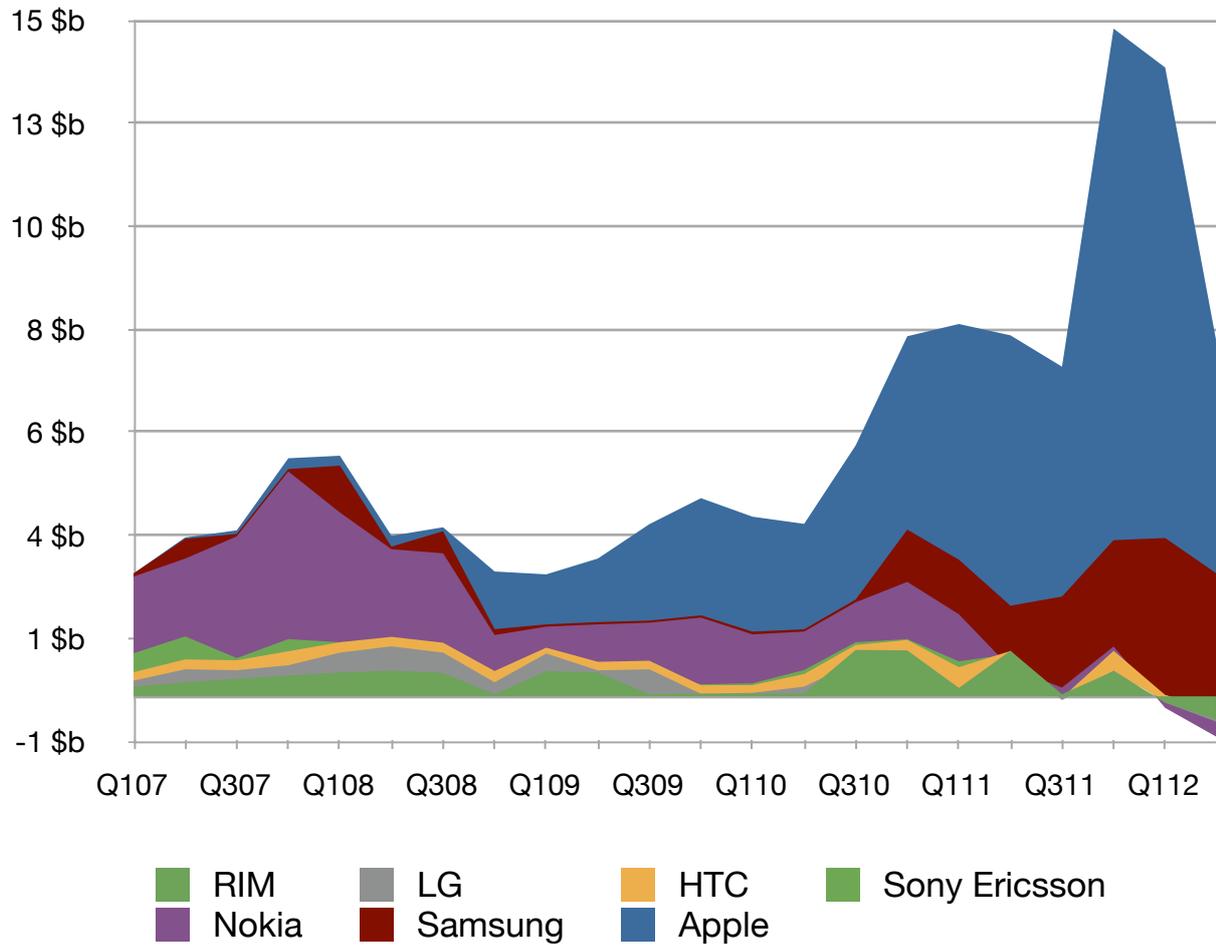
Exhibit 17: Market Share in U.S. Smartphone Market

Legend: Apple, RIM, Microsoft, Palm, Symbian, Others, Google
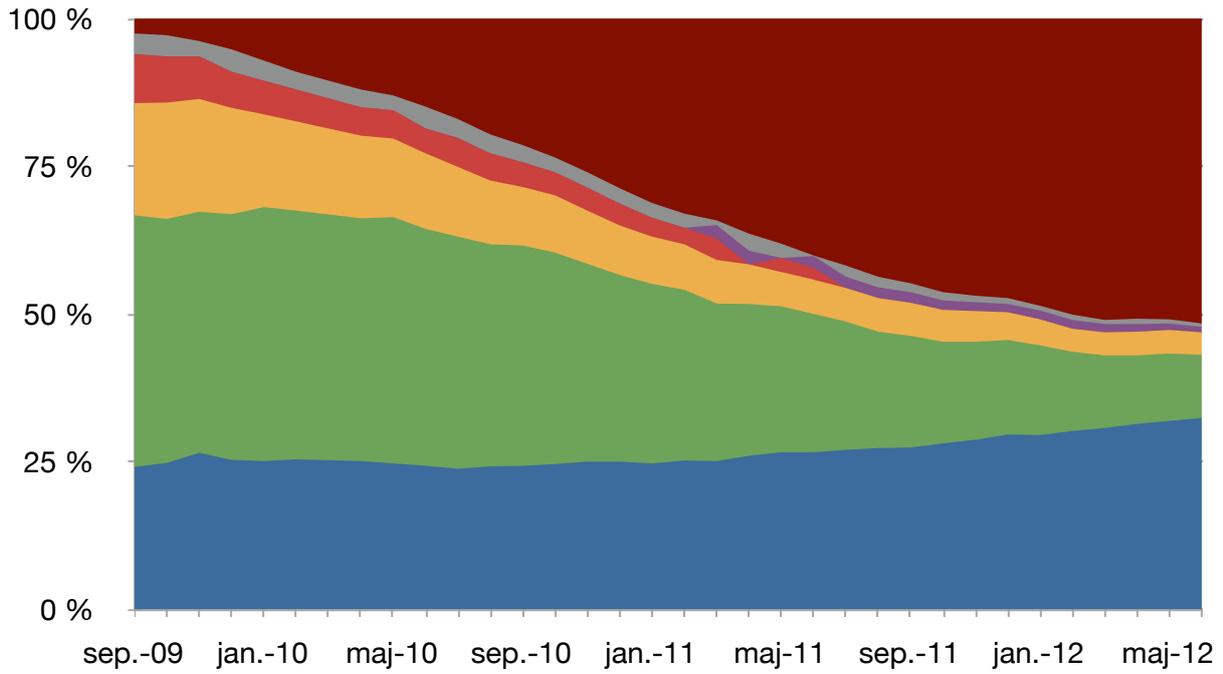
Exhibit 18: Market Share in Total U.S. Phone Market

Legend: Apple, RIM, Microsoft, Palm, Symbian, Others, Google, Non-Smart
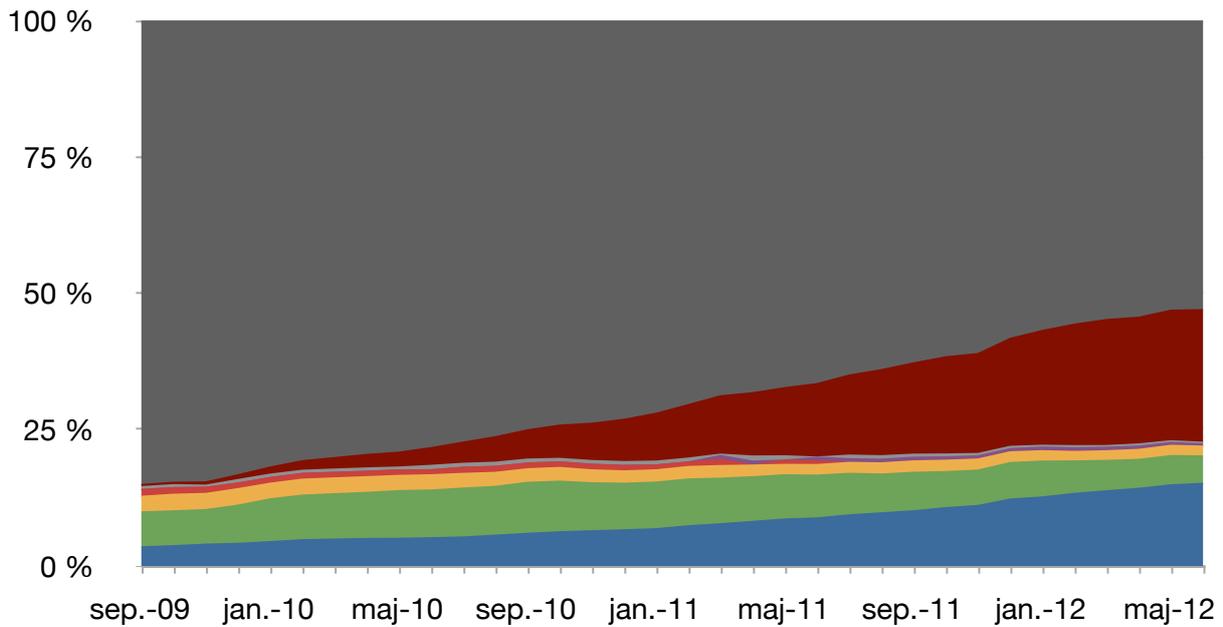
Exhibit 19: ASPs Samsung Smartphones and iPhones

Legend: Samsung Galaxy 1+2, Samsung Other, Apple iPhone

Y-axis: 700 $, 525 $, 350 $, 175 $, 0 $
X-axis: 2010 Q2, 2010 Q4, 2011 Q2, 2011 Q4, 2012 Q2
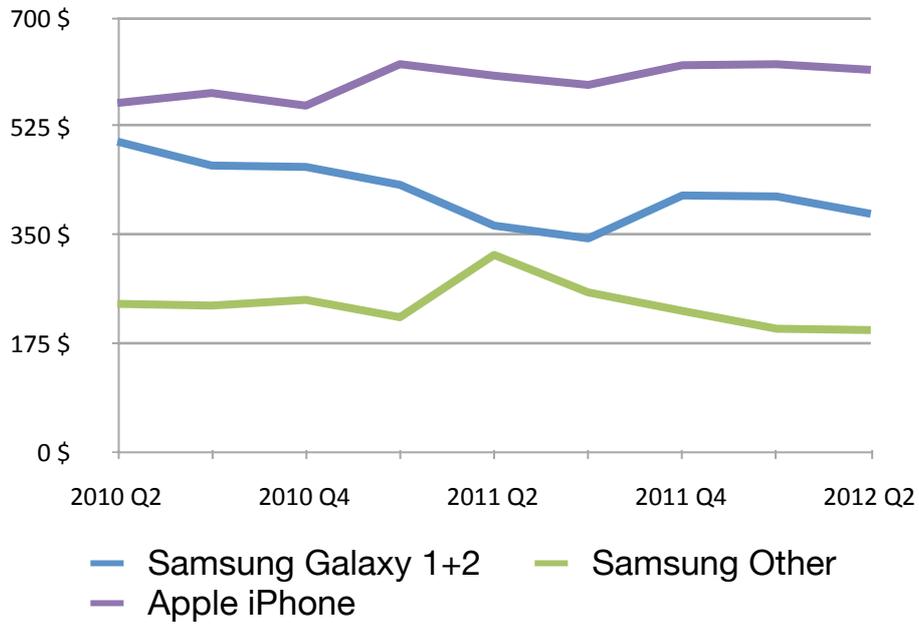
Exhibit 20: ASPs Samsung Smartphones and iPhones

Legend: Samsung Galaxy 1+2, Samsung Other, Apple iPhone

Y-axis: 700 $, 525 $, 350 $, 175 $, 0 $
X-axis: 2010 Q2, 2010 Q4, 2011 Q2, 2011 Q4, 2012 Q2
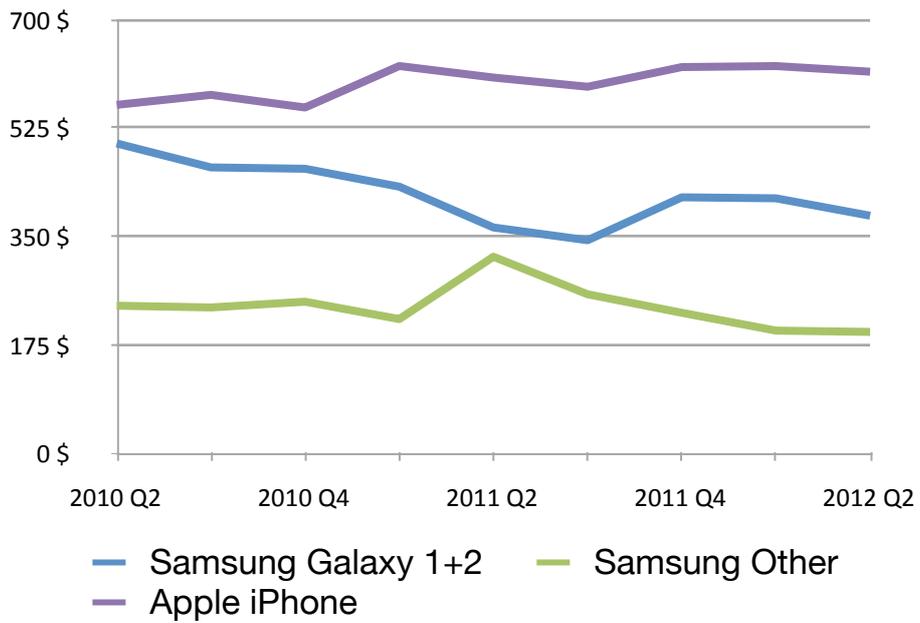
Exhibit 21: Unit Sales of iPads and Galaxy Tabs

Legend: Galaxy Tab Total — iPad Total
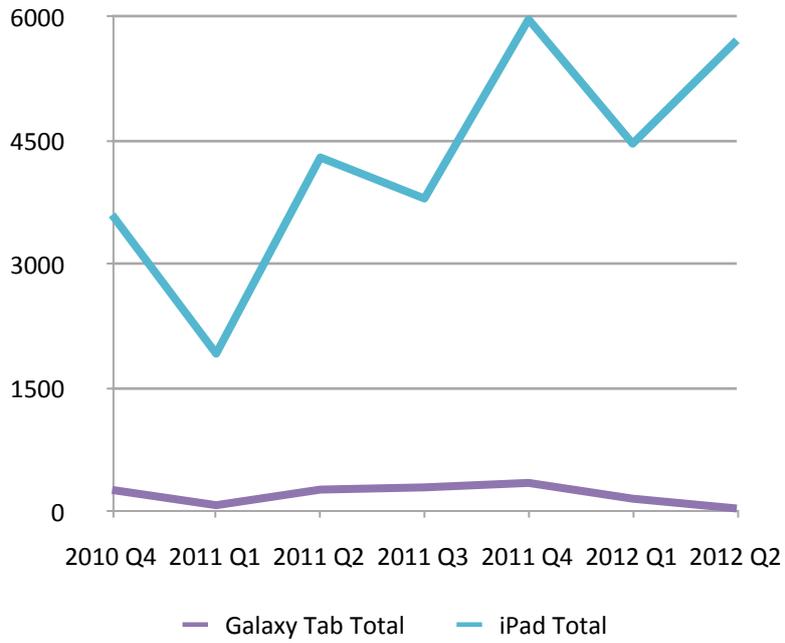
Exhibit 22: ASPs of Galaxy Tabs and iPad

Legend: Galaxy Tab — Galaxy Tab 10.1 — Galaxy Tab 10.1 LTE — Galaxy Tab Total — iPad Total
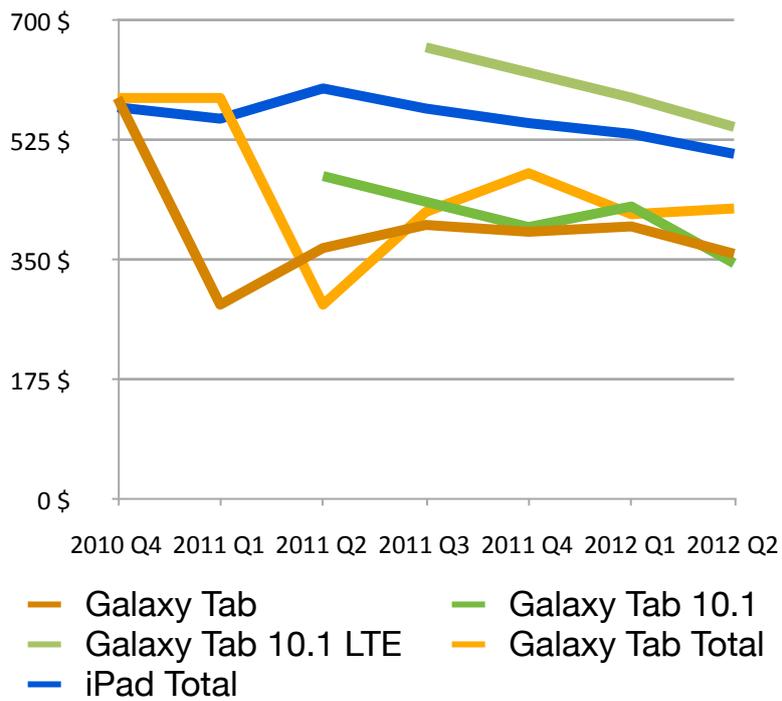
Exhibit 23: Ratio of Payable Outstanding/Sales Outstanding (higher is better)

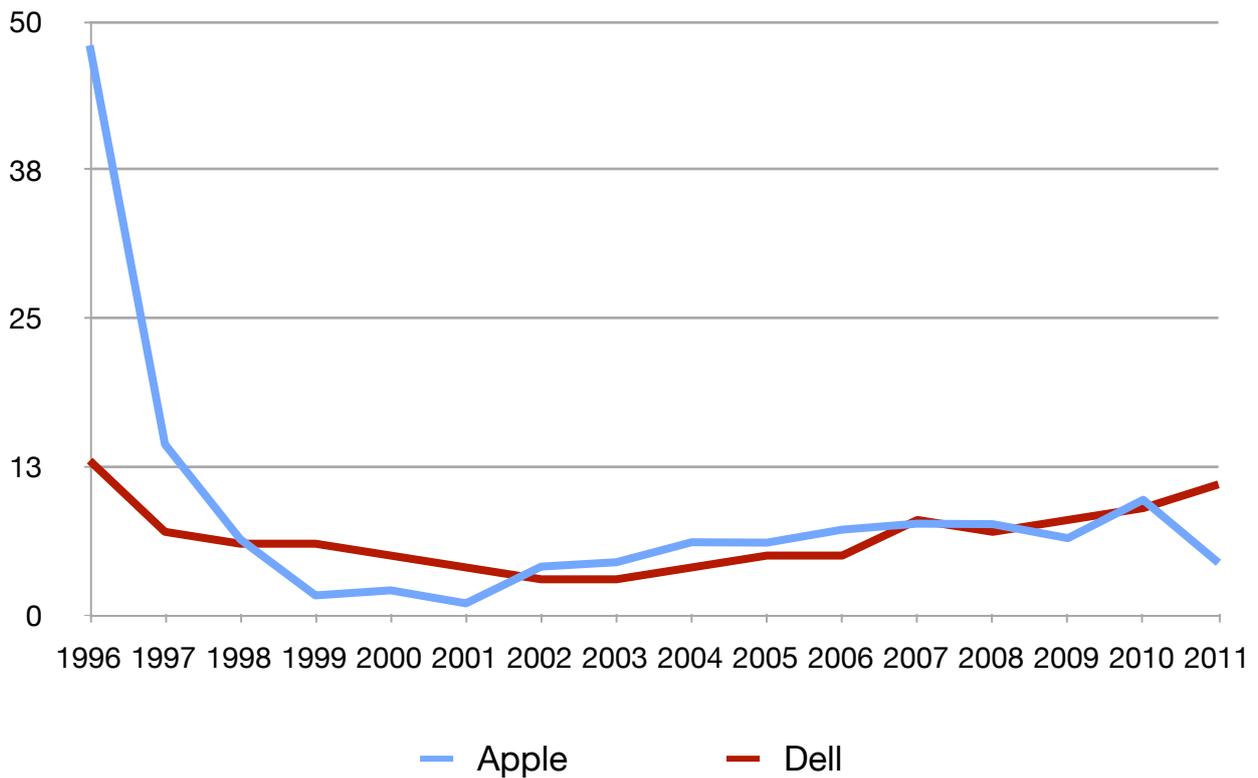— Apple   — Dell
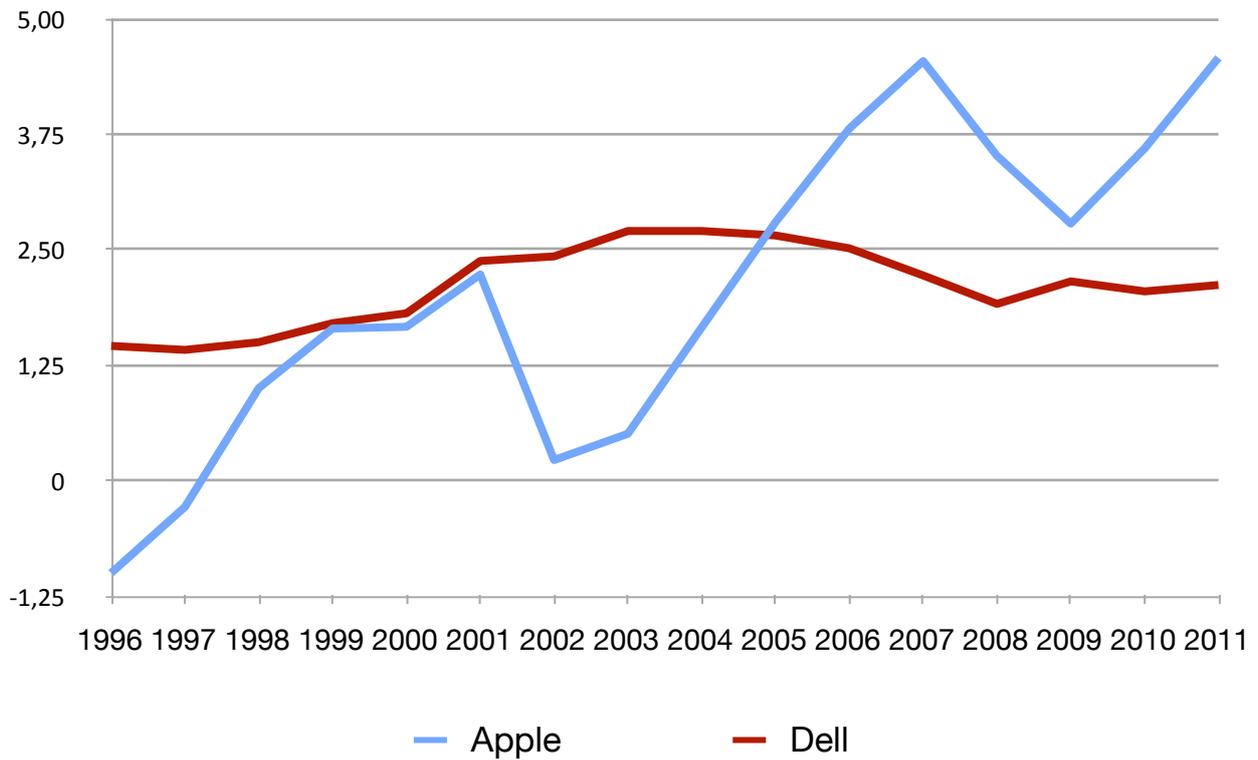
Exhibit 24: Days in Inventory (lower is better)

— Apple   — Dell

Exhibit 25: Capital Expenditure ($ millions)

Legend: Apple, Google