Innovator's Dilemma in the Computer Operating Systems Market – *Strategies for the High Technology Market Space*

Abstract

High Technology Products follow a distinct Development and Usage Cycle from Innovators to Laggards. According to Moore the passage from one phase to another is not a smooth movement but is marked by gaps that need to be crossed. A big chasm needs to be crossed before a product is accepted by the majority. Christensen has introduced the concept the Innovator's Dilemma in the face of disruptive technological innovations which have the potential to drive out dominant companies that depend only on sustaining technological innovation. The ongoing confrontation between the high tech giants Google and Microsoft in the Computer Operating System market space provides an interesting study in competitive strategy and this paper presents a framework for evaluating the rationale and consequences of their strategies.

Key Words: Cloud Computing, Innovator's Dilemma, Disruptive Technologies, Google Android.

Basically, our goal is to organize the world's information and to make it universally accessible and useful.—Larry Page, Google[1]

Introduction – Important Insights on Strategy

In the decade following the publication of Michaels Porter's ideas on strategy and competitive advantage, a number of insights were published by leading researchers of strategy that made a major impact on strategic thinking viz. Christensen (1997)[2], Moore (1995)[3], Norman (1999)[4], Hamel & Prahlad (1994)[5], and Kim & Mauborgne(1997)[6]. The first three of these hypotheses were especially directed towards the High Technology Industry and deal with the classic problem technology companies' face in sustaining or expanding their market. However, the collapse of the dotcom bubble in 2000 led to rethinking among corporations as to the extent of their relevance in the actual market space. This paper analyses the strategies being adopted my Google and Microsoft in their attempts to gain dominance in the share of the future market in computing in light of the above mentioned hypothesis.

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[1] Retrieved from http://www.woopidoo.com/business_quotes/authors/larry-page-quotes.htm

[2] Christensen, Clayton M., (1997). *The Innovator's Dilemma*. Harvard Business School Press.

[3] Moore, Geoffrey., (1995). *Crossing the Chasm*. HarperCollins.

[4] Norman, Donald A., (1999)*The Invisible Computer*. M.I.T. Press

[5] Hamel, G. & Prahlad, C.K., (1994). *Competing for the Future*. Harvard Business School Press.

[6] Kim, W. Chan & Mauborgne R., *Value Innovation: The Strategic Logic of High Growth*. Harvard Business Review (Harvard Business School Press): 103–112. January - February 1997

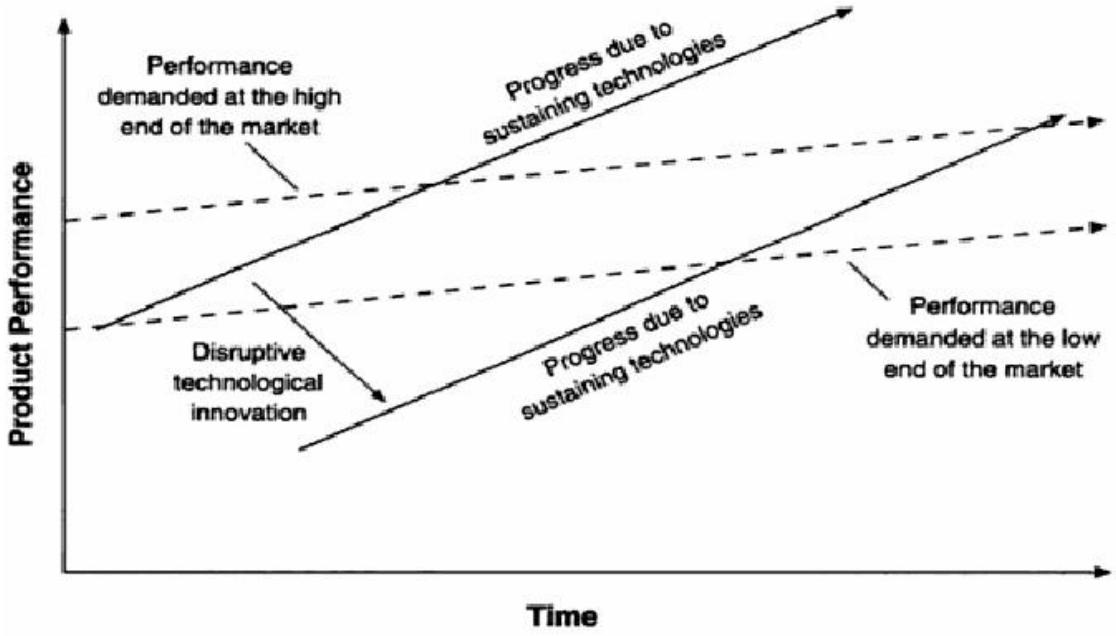
Innovator's Dilemma (Christensen)

Christensen deals with the challenge of balancing the needs of existing customers for sustaining technological improvement, on the one hand, with the threat of disruptive innovation on the other. According to his research "the logical, competent decisions of management that are critical to the success of their companies are also the reasons why they lose their positions of leadership" (Christensen, 1997)[7]. This "failure framework" is built upon three findings of his study:

1. Sustaining versus Disruptive technologies: Normally technical innovation focuses on improving the performance and features of a product. These improvements can be incremental (kaizen) or major but as long as they pertain to improving the performance of an existing product or need, they are "sustaining technologies" because they cater to an identified, pre-existing need. In this respect they rarely cause the demise of leading companies because of the latter's ability to retaliate, (we shall revisit the issue of retaliation later in the paper). A good example is the case of Netscape's web browser that captured almost the entire browser market before Microsoft stepped in with its Internet Explorer and all but destroyed the challenger. In fact companies such as IBM and Microsoft, undisputed leaders in theirs fields, have been known to be followers in the technology arena and have prospered because technological innovations have been improvements in existing product/service ("sustaining technologies") in nature, allowing them to strike back at the challenger with all their financial and organizational might. "Disruptive technologies" on the other hand are innovations that result in a product with *degraded* or *worse* features or performance than existing technologies at least in the near term. However they bring a different value proposition to the market that addresses a different need, albeit a small and insignificant one, and, more importantly, of little or no interest to the market leader and its mass customer base. It is this "Trojan horse" that could suddenly capture mass appeal, leaving the leader caught unawares.

Figure 1. The Impact of Sustaining and Disruptive Technological change (From Christensen - "The Innovator's Dilemma")

[7] Christensen, Clayton M., (1997)., *The Innovator's Dilemma*. Harvard Business School Press.



2. The growth paths of market need versus technological improvement: The flow of product/technology improvement over time follows the path shown in Figure 1. It starts at the lower end of the performance demanded by the market, progress to the higher end of market expectations of performance and then surpasses it ("overshoot") as sustaining technological innovations continue to throw up better product features. Consequently customers are forced to pay ("overpay") for more than what they generally use, e.g. according to some estimates 90% of MS Excel users utilise less than 10% of its features[8]. A disruptive technological innovation however follows a different path as shown by the lower line in the figure. Initially it compares poorly with the existing technology and therefore may attract only the fringe players in the market (diehard "techies", innovators, early adopters etc). However they soon catch up on the performance requirement and, due to lower price or better appeal can unseat the leader. Retaliation by the leader is difficult, as borne out by the tribulations of IBM as it struggled with the demise of mainframe computer brought about by powerful desktops and "client-server" architecture.

3. Investment Dilemma: Even if leaders have identified or are aware of disruptive technologies on the horizon, investing major resources or aggressively backing them may be a difficult decision at best because a) since disruptive products are simpler and cheaper and generally provide less attractive margins; b) disruptive products initially cater only to the fringe market, i.e. emerging or insignificant markets; c) The

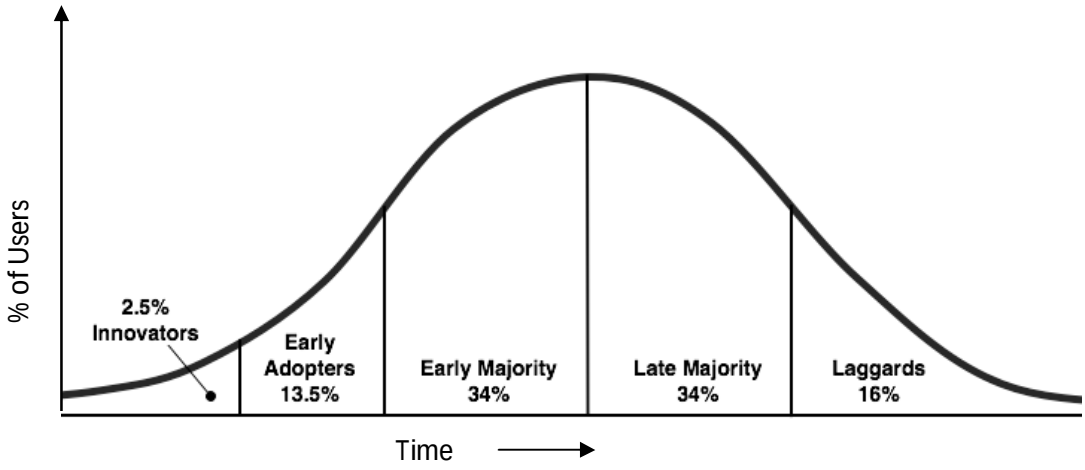
[8] Jelen, B & Syrstad, T., (2007). *VBA and Macros for Microsoft Office Excel 2007* (p.3). Que Publishing. Also retrieved form http://www.kickstartnews.com/reviews/books/speced_usingmsword2003.html

existing customers of the market leaders, who constitute the highest value, would not have any use for the product. Therefore investing in disruptive products would be viewed as a gamble.

Technology Adoption Lifecycle Model (Rogers)

The adoption of new technology by a society was studied by Bohlen & Beal[9] in relation to the adoption of new techniques by corn growers. Rogers[10] expanded it further to cover the technology in general. According to the Rogers model the adoption of any new technology by a society follows a bell curve (Fig 2), starting with diehard innovators who are willing to embrace a new technological concept even though it may not be tested or proven. Rogers (1964, p. 134) defined the rate of adoption as the relative speed with which members of a social system adopt an innovation, measured by the length of time required for a certain percentage of the members of a social system to adopt an innovation. Fig 2 gives a depiction of the Rogers model.

Figure 2. A graph of Rogers Technology Adoption Lifecycle model.



Crossing the Chasm (Moore)

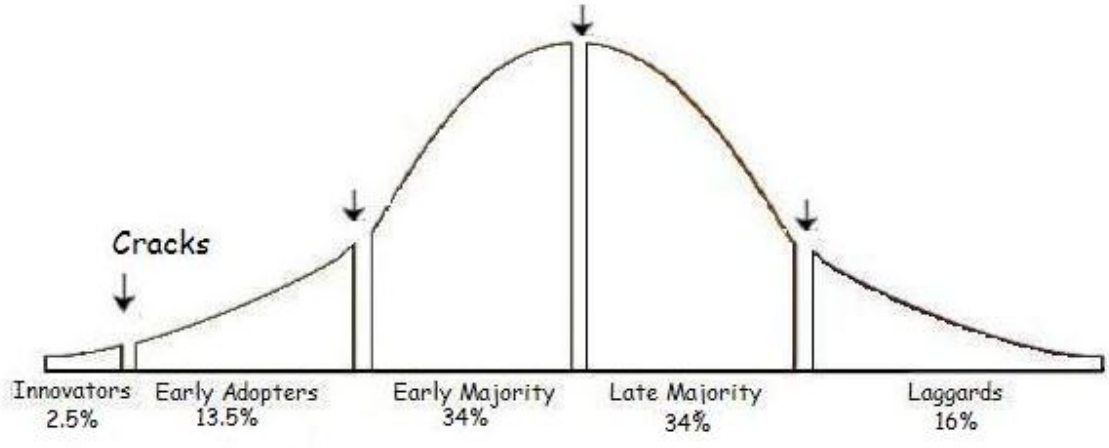
Let us examine this concept a bit further. The traditional Technology Adoption Life Cycle (Fig 2) is a smooth bell curve of (high tech) customers that progresses from Innovators, to Early Adopters, to Early Majority, to Late Majority, and finally ending with the Laggards. Most marketing models for high-tech products are based on this concept which says that the way to develop a market is to work the curve from left to right, progressively winning each group of users, using each "captured" group as a reference for the next. Moore (1995) postulated that the transition from one stage to another was not smooth and there were obstacles (“cracks”) to be crossed at each stage, leading to the problem of bridging the divide between early adoption of an innovative product and its universal

[9] Bohlen, Joe M. & Beal, George M., (May 1957), "The Diffusion Process", *Special Report No. 18* (Agriculture Extension Service, Iowa State College) **1**: 56–77

[10] Rogers, Everett M. (1964)., *Diffusion of Innovations*. Glencoe: Free Press

usage. According to him "the notion that part of what defines a high-tech market is the tendency of its members to reference each other when making buying decisions-- is absolutely key to successful high-tech marketing"[11]. He redraws the traditional product adoption cycle (Fig 3) by introducing cracks between each phase of the cycle, denoting a disassociation between any two groups, representing, in other words, "the difficulty any group will have in accepting a new product if it is presented the same way as it was to the group to its immediate left."

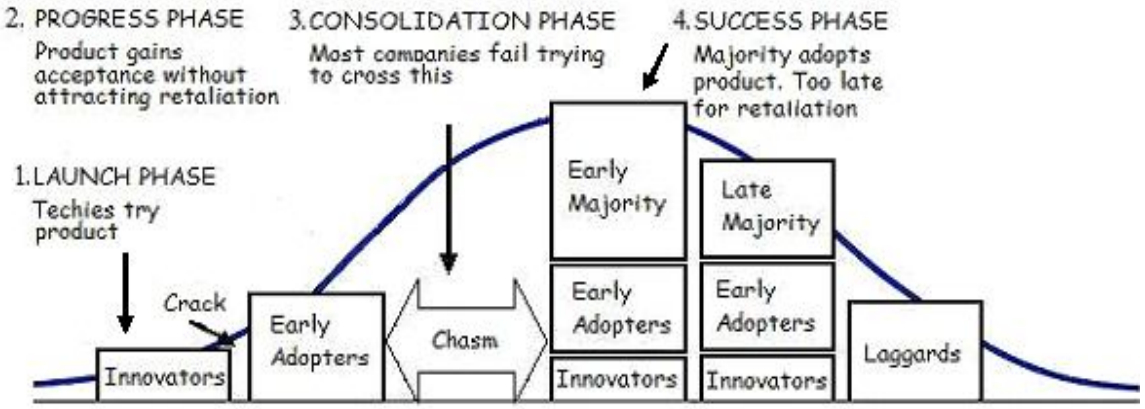
Figure 3. Moore's adaptation of the Technology Adoption Model



Moore went on further to state that there is a major hurdle to cross before a new technology becomes accepted by the majority. In his terminology the gap between the Early Adopters and the Early Majority is the largest crack, which Moore calls "the Chasm" (Fig 4). Many, if not most, high tech ventures fail trying to cross this chasm.

Figure 4 The "Chasm" between early adoption and universal acceptance (Moore, Crossing the Chasm)

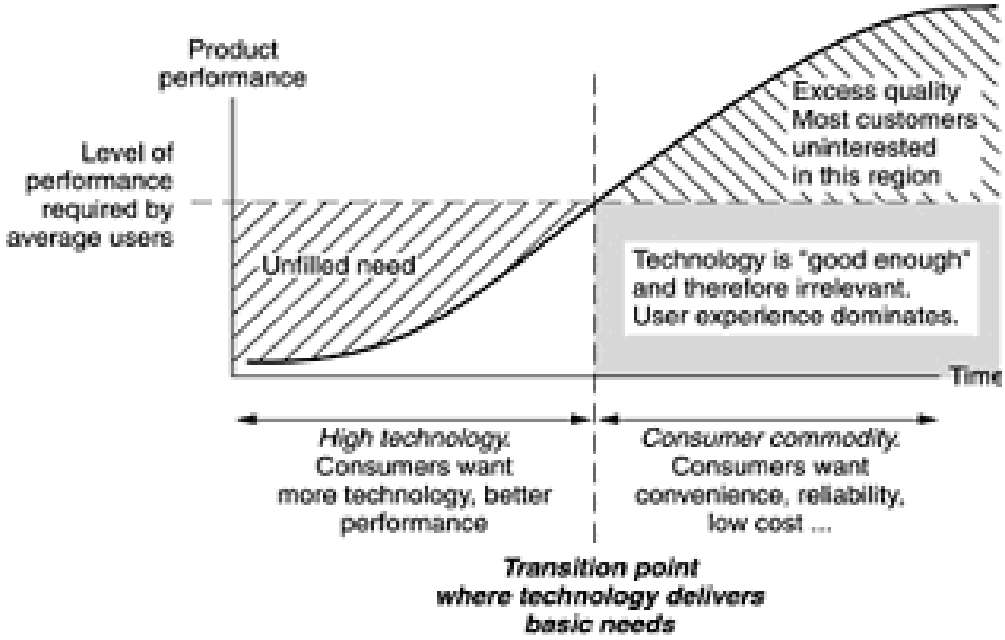
[11] Moore, Geoffrey, (1995)., *Crossing the Chasm*. HarperCollins.



Human-Centered Design (Norman)

Norman[12], has added another dimension to the theories of Christensen and Moore. According to him the Innovator's Dilemma shows that products only need a limited amount of performance to be successful in the market before they need to focus on issues such as human-centred design. This human centred design is exactly what businesses need in the tornado phase of the Chasm theory, as they push to simplify their product, i.e. make it more user-friendly, and distribute it to the mass market. Norman sees an interaction between the two theories but only sees this as further justification for his theories of human centred design being critical to serving mass markets. However he does not acknowledge broader possible synergies between the two theories (Figs 5a, 5b, 5c).

Figure 5a. Norman's perspective on the Innovator's Dilemma



[12] Norman, Donald A., (1999)*The Invisible Computer.* (chapter 2). M.I.T. Press

Figure 5b. Norman's perspective on the Crossing the Chasm

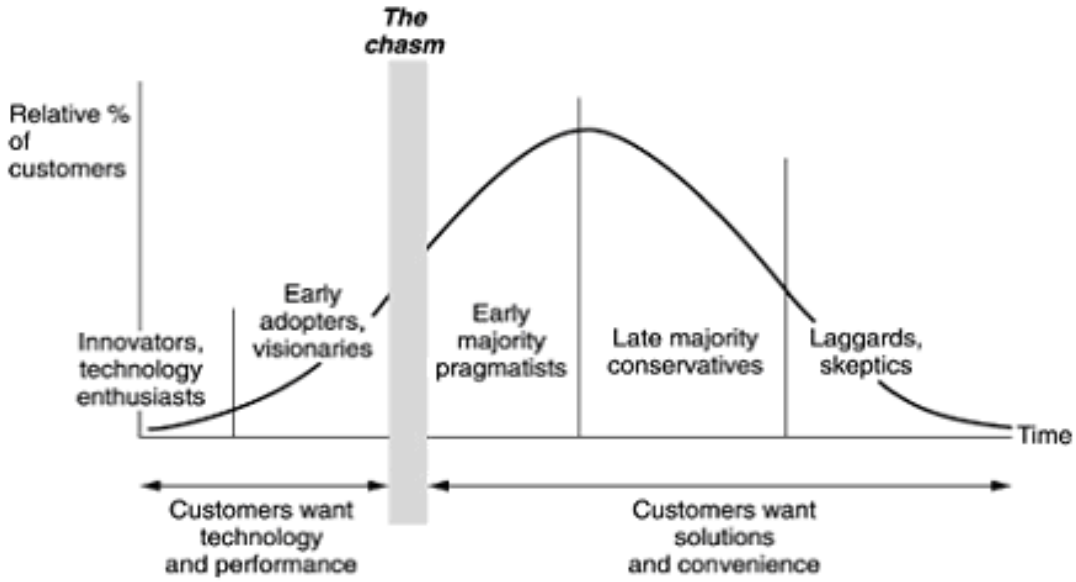
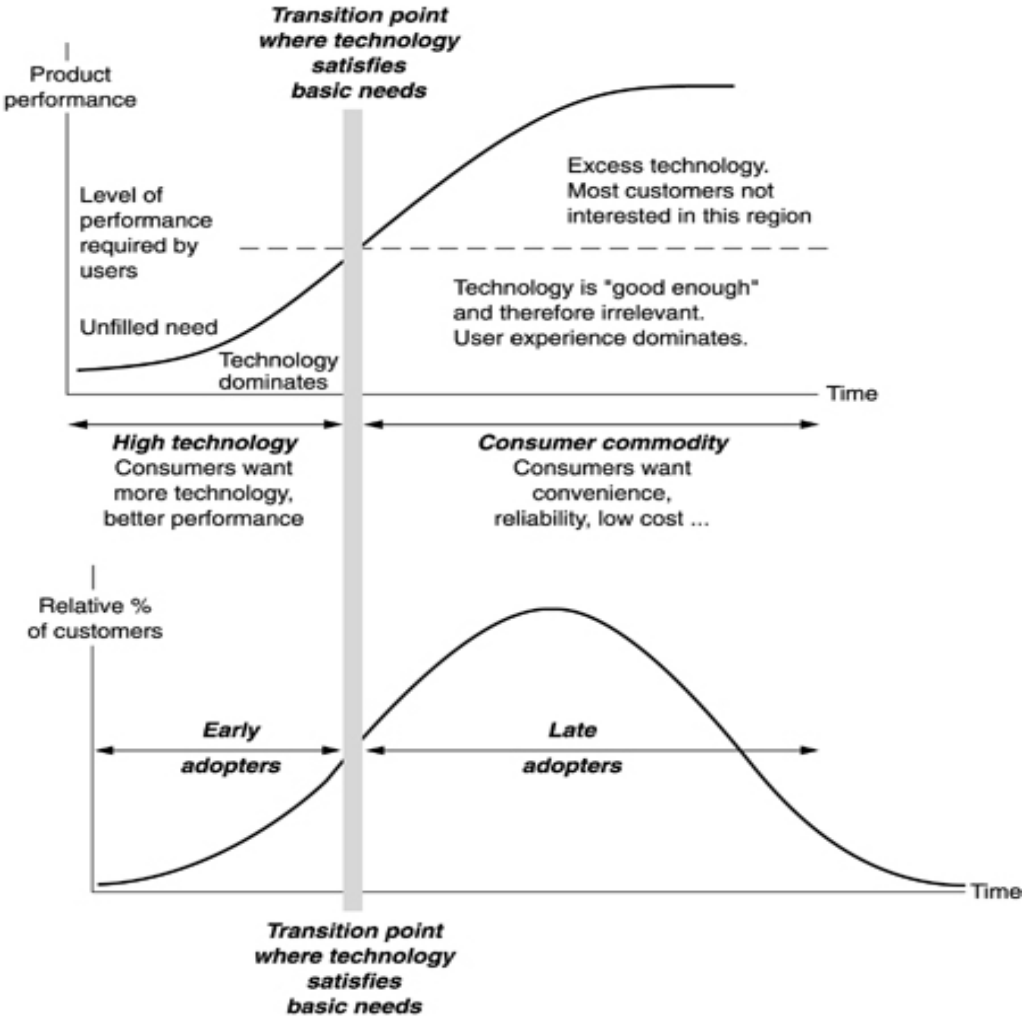


Figure 6 The Interaction of the Innovator's Dilemma and Crossing the Chasm (Norman 1999)



Determining the path by which a firm can navigate to a critical mass of customers and achieve mainstream market acceptance is the single most important task facing any technological product introduction. This paper examines the strategies of Google and Microsoft in the Operating System market from the perspectives of Christensen, Moore and Norman. It will attempt to look at how Google intends to cross the chasm and the response of the market leader, Microsoft, which is the dominant market leader with more than 92% share of market (Table 1).

Table 1. Segment-wise Market share of Google & Microsoft[13] [14] [15]

[13] Net Applications Inc. *October 2009., OS, Browser and Search Engine Market Share*. Retrieved on 23/11/09 from http://marketshare.hitslink.com/report.aspx?qprid=8&qptimeframe=M&qpsp=124

[14] Business Week – July 3 2009. MS Office. Retrieved on 23/11/09 from http://www.businessweek.com/magazine/content/06_27/b3991412.htm

[15] Campaign Monitor.com. June 2009. Email. Retrieved on 24/11/09 from http://www.campaignmonitor.com/stats/email-clients/

	OS	SOM	Browser	SOM	Applications*	SOM	Search Engine	SOM	Email	SOM
Google	Chrome OS/Android	~ 0%	Chrome	3.6%	Google Apps	>1%	Google	84.5%	Gmail	5.5%
Microsoft	Windows	92.5%	Internet Explorer	64.6%	MS Office	95%	Bing	3.5%	Hotmail	15.4%
Others	Linux	1%	Firefox	24.0%	Open Office	>1%	Yahoo	6.7%	Yahoo	15.7%

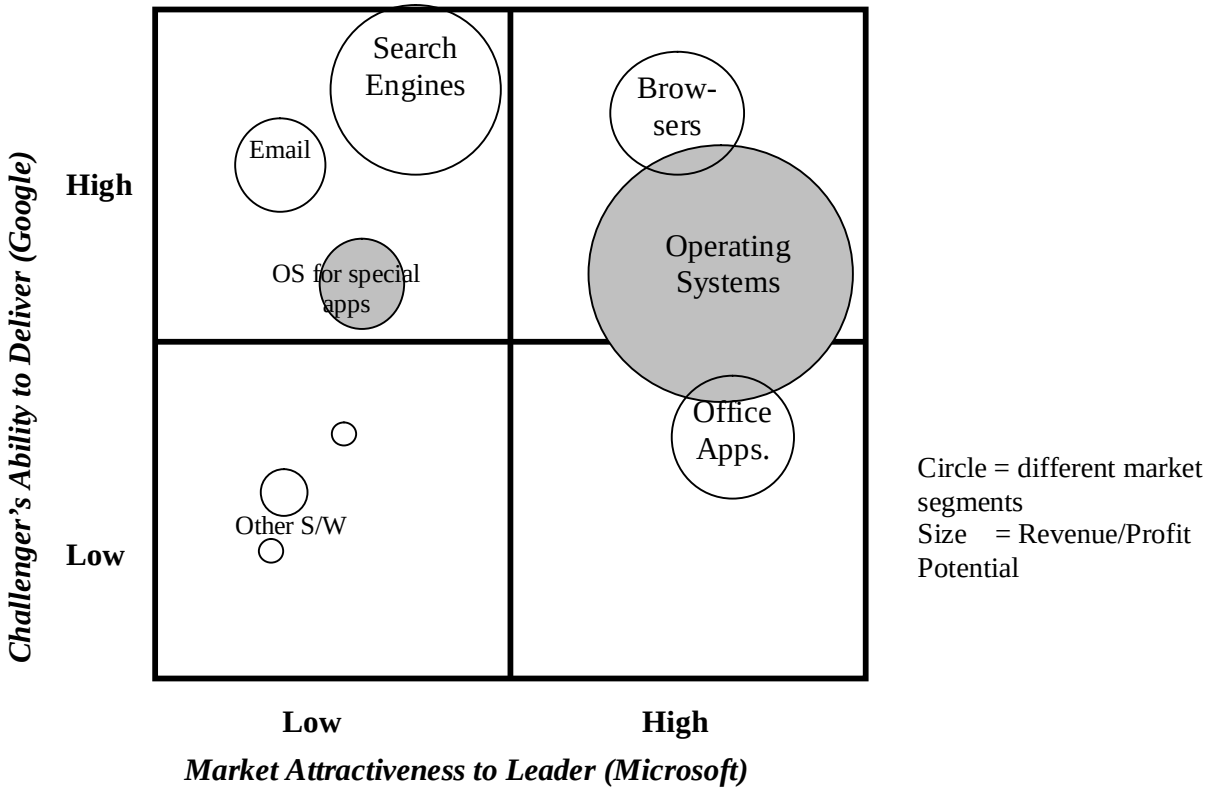
* Figures based on Email clients. MS Outlook family (SOM 34.5%) not considered as it is not an email service

This article examines the Google Operating Systems strategy from the point of view of established thinking on marketing and management strategy for technological products.

Competitive Response (CR) Matrix

Here it is pertinent to note that the response of a market leader would not be the same for every action of the challenger. Netscape's browser faced a strong response from Microsoft but Google's Chrome browser has not evoked any substantive response. Fig 6 shows a matrix relating the ability of the Challenger (disruptive innovator) to meet the expectations of the customer, with the Market Attractiveness of that segment to the Market Leader (sustaining innovator). The assumption here is that the more attractive a particular market is to the leader, the more intense will be its response. Microsoft is the current Market Leader and Google the Challenger in the OS market (Table 1). If we plot different market segments (shown as circles) on this matrix, where each segment represents a different software segment, we get the diagram in Fig 6. The size of the circle represents the value of the market in terms of revenue or profitability the leader derives from that market.

Figure 6. The Competitive Response (CR) Matrix



In this framework the OS segment (Operating Systems) is the most valuable for the Microsoft and it also represents a fairly high degree of capability of Google to deliver a competing product, given its size and resources. Since the market size is also the most attractive, the natural reaction of a challenger would be to compete in this market space. However such an action would also bring about the most intense retaliation by the market leader, in effect widening the "chasm" that the challenger will need to cross in order to succeed, and making it very difficult to succeed. On the other hand a market segment located in the top left square of the matrix presents a much better entry strategy because it bases itself on the strengths of the challenger in an area which is of little interest to the leader and hence exposed to lesser degree of retaliation. Once established in that segment the challenger can then plan to move to the next phase of the Moore's framework, i.e. targeting the early majority of users (Fig 3).

Microsoft's (Market Leader) Position

In the early 1980's the dominant market leader in Data Processing was IBM with its mainframe computers which ran on the OS360 Operating System. Microsoft entered the computer market with a disruptive technology – the DOS operating system for the Personal Computer. It then entered into a sustaining innovation path (Fig 1) with newer and newer and improved versions of their OS culminating with the Windows Vista Operating System (January 2007)[16]

[16] Microsoft Press Release January 2009. Retrieved on 30/11/2009 from http://www.microsoft.com/nz/presscentre/articles/2007/jan07_windowsvistalaunch.mspx

and recently, the Windows 7 OS (2009)[17]. Due to its aggressive and highly effective strategies, by the 1990's it had become the dominant market leader in PC operating systems and even IBM, with their OS2 failed to dislodge them. In the browser market they announced improved versions of their browser, Internet Explorer 7 (2006) and Internet Explorer 8 (2009)[18]. In the Applications segment Microsoft announced the next version of its MS Office suite the MS Office 2007 (2007)[19]. In the Search engine segment it unsuccessfully launched it MSN search engine and has recently (2009) launched its new search engine Bing and remains a challenger to Google which is the clear leader in this segment. Acknowledging the significant shift in computing trends they released the Windows Azure Operating System in 2008[20] for cloud computing and the Windows Mobile OS for mobile computing.

In the framework of this article Microsoft's strategy closely resembles the sustaining technological innovation path in the classic Christensen mould i.e., of announcing improvements in its existing products. This is a direct consequence of the Microsoft mindset about that computer software has to reside in hardware boxes, i.e. sold as a "shrink-wrapped" product[21]. This concept has paid them handsome dividends ever since they were established almost three decades ago. Let us examine this in light of the three findings of Christensen mentioned at the beginning of this paper:

1. Sustaining versus Disruptive technologies: Sustaining technological innovations cater to a pre-existing need. In the OS, Office Applications and Browser markets Microsoft has consistently focussed on improving the performance of an existing product, i.e. sustaining technological innovations aimed at providing better features to their established markets. No one has been able to challenge their dominant position in any of these segments, including Google Apps and Chrome browser. Disruptive innovation brings a different value proposition to the market that addresses a different need, different from mass customer base of the market leader. In the Operating System segment Google has adopted this disruptive technology route: first by announcing Android which was aimed at the mobile handset market and then the Chrome OS aimed at the mobile computing market e.g. the netbook computers. Both these introductions fall in the top left square of the CR Matrix (Fig 3.). Since Microsoft's main customer base is in the desktop and laptop segments these products address a different and non-competing need – mobile and networked computing.

2. The growth paths of market need versus technological improvement: Sustaining technological innovations throw up better product features along the path shown in Fig 1 and eventually overshooting the market expectations. As mentioned earlier less than 10% of the features of MS Excel are used by the

[17] The Windows Blog July 22 2009. Retrieved on 30/11/2009 from http://windowsteamblog.com/blogs/windows7/archive/2009/07/22/windows-7-has-been-released-to-manufacturing.aspx
[18] Microsoft Press Release March 2009. Retrieved on 30/11/2009 from http://www.microsoft.com/presspass/newsroom/windows/factsheets/IE8FS.mspx
[19] Retrieved on 30/11/2009 from http://blogs.msdn.com/microsoft_office_word/archive/2007/01.aspx
[20] Retrieved on 02/12/2009 from http://www.microsoft.com/presspass/press/2008/oct08/10-27PDCDay1PR.mspx
[21] Wharton, University of Pennsylvania. *Why Software Business Models of the Future Probably Won't Come in a Box.* Knowledge@Wharton February 2007. Retrieved on 8/12/2009 from http://knowledge.wharton.upenn.edu/article.cfm?articleid=1651

average user and it would be safe to assume the same for Microsoft Operating Systems – Windows 7 and Windows XP. By contrast, both Android and Chrome OS from Google are much inferior to the features of their Microsoft rivals but the are targeted at an audience that did not exist five years ago and for whom the Windows Operating System would be too cumbersome to adopt.

3. Investment Dilemma: Even if leaders have identified disruptive technologies investing major resources or aggressively backing them may be a difficult decision at best because margins are small, the market is miniscule and caters to the non-mainstream customer base. Microsoft's response to the disruptive technology of Internet in the late 1990s and early 2000s was very bold and decisive. Here is one account of the massive corporate commitment Microsoft had to make in order to address the then disruptive technology called the Internet:

> "On the day of the management announcement, Gates sent (an email) to all employees. He explained that Microsoft's success is built upon its commitment to the graphical user interfaces, or GUIs, in its Windows operating system and the Office applications that work with it. Then he added: "Today we must make a similar bet on using software to improve the way people experience the Internet--an even more important revolution than the GUI." His new title is chief software architect, and he'll guide the technical and strategic transition."[22]

The full import of the Microsoft's decision can be appreciated by the fact that in the quarter ending December 1999 their quarterly net earnings rose 22% from a year ago, to $2.4 billion, on $6.1 billion revenues[23] almost entirely from their existing non-Internet products. In the very next quarter (March 2000), the Internet boom had started unravelling causing a number of Internet companies to close, possibly causing Porter (2001)[24] to state that:

"The time has come to take a clearer view of the Internet. We need to move away from the rhetoric about "Internet industries", "e-business strategies", and a "new economy" …"

Furthermore, a similar technology called ISDN, introduced by the telecom companies in the 1980's, was predicted to be the next standard in networking, but it just did not take hold. In this scenario it would have been understandable for Microsoft to focus on its existing base rather than back the new (internet-oriented) focus that had the potential of destabilising its well-entrenched market position. As Christensen has noted, well-managed market leaders, paying close attention to the needs of their customer base, would generally do exactly that. However it is a testimony of Microsoft's Bill Gates foresight to persist with his decision to continue to back the new disruptive technology.

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[22] Kirkpatrick D., (2000). *The New Face of Microsoft.* Fortune Magazine. Retrieved on 1/12/2009 from http://money.cnn.com/magazines/fortune/fortune_archive/2000/02/07/272829/index.htm

[23] *ibid*.

[24] Porter, Michael E. *Strategy and the Internet.* Harvard Business Review March 2001.

Once Microsoft took the decision to embrace the Internet, that market space became their sphere of interest, i.e. it shifted to the right of the CR matrix (Fig 3). Any challenge in this space therefore faced the retaliatory force of the market leader as evident in the browser segment where Netscape's browser, Navigator, was the victim of Microsoft's retaliation. In the conventional Operating Systems market the Linux OS challenged Microsoft by addressing the niche server segment but has never managed any significant market share because of the latter's dominant position. Therefore, as of 2006 Microsoft's dominant position remained invincible despite the growth of the Internet because of its decision to adopt that disruptive technology.

Internet and Disruptive Innovation

If Microsoft had ignored the disruptive potential of the Internet it would have seriously exposed its vulnerability as Internet usage exploded. However by re-engineering their products they have been able to prevent any "Trojan Horse" from eroding its customer base. But has disruptive innovation ended with the Internet 2000? In other words, by addressing the Internet issue has Microsoft weathered the storm? It is the contention of this paper that the Internet has spawned, and continues to spawn, new disruptive innovations – a fact that Microsoft has not fully addressed, thereby exposing itself to potential Trojan Horses.

In the past few years two disruptive technologies have surfaced in the computing scene – 3G mobile connectivity and cloud computing, both of which have evolved around the Internet and identified among the top 10 technology trends according to Gartner's[25], the premier technology tracking company. Mobile phones, which began as communication devices, have gradually morphed into virtual mobile computing devices with the introduction of 3G networks which allow easy and continuous connectivity to the Internet. The 3G devices (hardware) run on a number of different proprietary Operating Systems – a segment largely ignored by Microsoft because it lies in the bottom left side of the CR Matrix ("OS for special apps" in Fig 3). The other disruptive innovation that is gaining ground is cloud computing – a technology identified as the topmost strategic technology for 2010 by Gartner[26]. The recently introduced "Netbook" computers geared to operate with the Internet point towards the gaining importance of cloud computing. Both these technologies break away from the traditional concept of "shrink-wrapped" products in a box, where Microsoft is the undisputed leader.

Microsoft's Current situation

It is the contention of this paper that Microsoft's response to disruptive innovation of Internet was successful in the case of the Browser market. However, its strategic position with respect to the Operating Systems market, where it enjoys more than 90% market share, suffers from the innovator's dilemma. It is therefore susceptible to a "Trojan Horse" strategy of a challenger. Let us examine this further.

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[25] Barnard, P. (2009). *Cloud Computing tops Gartner's "Top 10 Strategic Technologies for 2010"*. Retrieved on 02/12/2009 from http://www.tmcnet.com/channels/call-center/articles/70143-cloud-computing-tops-gartners-top-10-strategic-technologies.htm

[26] *ibid*

It has been shown earlier in the paper that the Windows OS offerings of Microsoft have followed the path of sustaining technological innovation typical of the dominant market leader. It's performance has overshot that demanded by the market (Fig 1), and so, as per Norman (Fig 5c), user experience dominates over these additional features, and further technological innovation would produce diminishing returns in terms of customer preference. In Moore's framework, this product has already crossed the chasm and has won mass adoption. Therefore in the computer operating systems market, its traditional base, Microsoft has managed its strategy well and is in no imminent danger.

However, when we examine closely Microsoft's strategy in the disruptive technological environment of cloud computing and mobile applications, we see a typical market leader's approach (dilemma) so well documented by Christensen. In the mobile computing market Microsoft entered as early as 2000 with their Pocket PC and followed it up with newer versions, the latest being Windows Mobile 6.5 introduced in October 2009[27]. However, even after being in the market for nine years it is only fourth in market share[28]. More significantly, Windows Mobile market share declined by 20% in the third quarter of 2009 despite the fact the sale of smartphones increased by 13%[29]. Table 2 gives the market shares in the Mobile market.

Table 2. Market share in Mobile OS for smartphones[30]

Symbian (Nokia)	44.6%
Blackberry OS	20.8%
iPhone	17.1%
Windows Mobile	7.9%
Google Android	3.5%
Others	6.1%

Google's Challenge

Ever since its founding in 1998 Google had been announcing a slew of innovative products primarily connected with its stated goal of organising web content and search engine based Internet advertising. However from 2006 onwards

[27] Hamblen, M. *Windows Mobile smartphone sales plunge 20% in Q3*. Computerworld (November 2009). Quoting Gartner's figures. Retrieved on 02/12/2009 from http://www.computerworld.com/s/article/9140761/Windows_Mobile_smartphone_sales_plunge_20_in_Q3?taxonomyId=15&pageNumber=2

[28] *ibid*

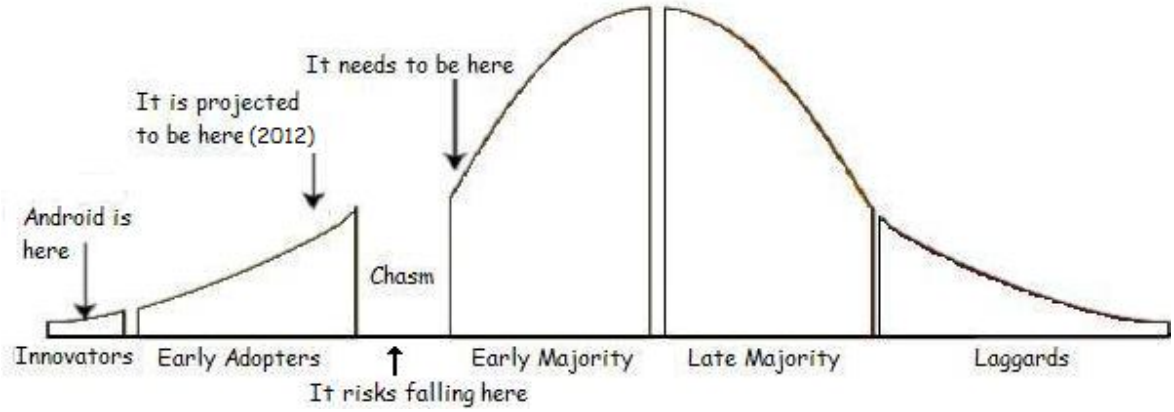
[29] *ibid*

[30] *ibid*

Google, after years of scrupulously avoiding any direct confrontation with Microsoft, began announcing products that directly encroached on the latter's domain. In 2006 it announced the Gmail service and then Google Apps – a direct challenge to the Microsoft Office suite. The same year, without any publicity, it acquired Android Inc. a start-up engaged in making software for mobile applications. In 2007 Google announced through a press release[31] an "Open Handset Alliance" that would use the Android OS for developing applications for mobile phones. The Android, though it could run on netbook computers, was primarily meant to be utilized across a host of devices, from smart phones to set top boxes. In 2008 The Google Chrome browser was officially launched[32] followed by the Google Chrome Operating system (in 2009) primarily aimed at the Internet based computing market[33].

The Android OS has still to gain widespread usage in the OS market. Google's position, in terms of Moore's framework, is depicted in Fig 7. Both Chrome OS and Android target a fast growing but fairly recent segment – Cloud Computing and Mobile Applications. In the CR matrix these products lie in the top left square (OS for Special Apps), i.e. distinct from the main existing markets for Microsoft.

Figure 7 The Google Android Strategy in terms of Crossing the Chasm



[31] Google official website. *Industry Leaders Announce Open Platform for Mobile Devices* . Retrieved on 30/11/2009 from http://www.google.com/intl/en/press/pressrel/20071105_mobile_open.html

[32] McCracken, H. *Chrome vs. the World - So Google is now a browser company. What does that mean for the rest of the industry?* PCWorld Tuesday, September 02, 2008. Retrieved on 06/12/2009 from http://www.pcworld.com/article/150586/chrome_vs_the_world.html

[33] Google Official Blog July 07, 2009. *Introducing the Google Chrome OS*, Retrieved from http://googleblog.blogspot.com/2009/07/introducing-google-chrome-os.html.

Analysis of Google Strategy

Google's Applications software (Google Apps) and Browser (Chrome) present a challenge to Microsoft in the "OS for Special Apps" category (Fig 6). It lies in the upper left square of the CR Matrix and hence not in the main market space of the market leader. Given Microsoft's vast resources and dominance in the traditional OS segment, what could be the reason for its inability to dominate this market? One indicator could be the fact that this market segment lies in the left side of the CR Matrix (OS for special apps). In fact it has been commented that Microsoft would want to focus on their MS Office software rather than Windows mobile because it is far more profitable[34]. Therefore it should not come as a surprise that Windows Mobile is based on an existing Microsoft product – the Windows CE operating system. In the new and fast growing market for netbooks also Microsoft does not have any specific Operating System, only a watered down version of their Windows XP since Windows Vista is to unwieldy to be installed on netbooks[35]. In the cloud computing segment Microsoft has introduced the Azure (2008)[36] environment, but unlike Google it has chosen to charge for this product[37], which puts it at a disadvantage. Considering that these products (mobile and netbooks) are a precursor to the widespread usage of cloud computing, this is a major weak spot in Microsoft's strategy.

In light of the above it appears that Google has chosen its strategy well. Firstly, it has chosen a segment that lies in the left of the CR matrix hence not in direct competition with the market leader's key markets. Secondly, it has chosen to enter a market segment that is fragmented (Table 2) and fast changing. Therefore there is ample scope for expansion. In fact Gartner's has projected that Android's share will be 18% in 2012[38] from the current 3.5% making it the fastest growing in its segment. It is also an classic disruptive technology in Christensen's framework because:

a. Android does not address a pre-existing need, i.e. the existing OS market for PC's where Windows is dominant

b. The market segment it is aimed at is miniscule as compared to the total OS market and is also very unattractive profitability-wise.

c. It has limited functionality compared to systems such as the Windows Vista and Windows 7.

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d. In due course, if smartphone technology converges with netbooks and further with the current functionality offered by portable computing (laptops), then it enters the mainstream mode of computing, i.e. it attains the Early Majority Phase. It would then it quickly bring about the demise of the PC based Windows OS.

The scenario of point (d) above is not as futuristic as it seems. Already companies such as Acer, a leader in mobile computing, are using their expertise in netbooks to build better smartphones[39]. For this purpose Acer has acquired a smartphone company and its stated policy is[40]:

> "The company took an 'unpopular' decision -- to stake everything on mobility -- and then organised itself to make this decision work …"

If the above scenario plays out, i.e. smartphones converge with netbooks and replace laptops, Google's decision to position Chrome OS as a cloud computing platform aimed at netbooks provides a reinforcement of its mobile computing strategy. Two other components of Google's strategy aim to cross Moore's chasm and quickly gain majority adoption. The first is their decision to make Android an "open source" product so that it is freely available to application developers without charge and the second is strengthening their ties with mobile phone manufacturers and developers[41].

The most brilliant aspect of Google's strategy however, is the fact that its business model is based on controlling data and since all other computer companies offer products that process data, Google essentially controls the medium that is the core of the rest of the industry. If the future is cloud computing then even the proprietary databases that companies other entities own would reside in the cloud, which Google is attempting to dominate. What Google is actually doing is addressing the future i.e. the post PC era where computing would be online, a market space that is still in its early infancy i.e. phase 1 in Moore's framework. When Google announced its Chrome OS it outlined its product philosophy as follows[42]:

> "….the operating systems that browsers run on were designed in an era where there was no web. So today, we're announcing a new project that's a natural extension of Google Chrome — the Google Chrome Operating System. It's our attempt to re-think what operating systems should be…."

This is a disruptive shift in the path of sustaining technological innovation (fig 1).

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The Innovator's Dilemma

Microsoft's dilemma therefore is whether is should place its bets on a future based on cloud computing (disruptive technology) or continue to cater to its existing customer base (sustaining technology). Whatever path it adopts, it faces a difficult choice. If it shifts focus away from its present customer base and the technological future evolves differently then it would have needlessly diverted attention and resources away from its core strength and customer base. After all, notwithstanding industry projections, the Android system, (as well as Chrome OS) has till now proved to be only a minor irritant not a major threat. On the other hand, if it stays the course and the future actually unfolds as per current projections, it would be forced into a market space (online computing) where Google is the undisputed leader. Even if neither of these scenarios plays out, and Microsoft is able to attain dominance over Google in the OS marketspace, it would be at a disadvantage. This is because of Google's dominance of the web through its search engine and control off data on the net, and therefore it would be the main beneficiary of anything that makes the web more useful. Therein lies the brilliance of Google's strategy

Microsoft's has products that address all the three segments – Windows 7 for the conventional OS market, Windows Mobile for the mobile market and Azure platform for the cloud computing segment. While its dominance in the first segment is undisputed, it has not shown signs of aggressively attaining dominance in the other segments. If future lies in these two latter segments, then it is faced with a classic innovator's dilemma.

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