

Industry Analysis

Attractiveness of the Personal Computer Manufacturing Industry in the United States

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Overall Attractiveness of the Industry

The overall attractiveness of the PC manufacturing business is affected by several factors. These include general macroeconomic conditions as well as industry specific factors such as the unique economic features of the industry, competitive forces, forces of change, the market position and expected behavior of the various competitors already in the industry, and the industry's key success factors. This report examines each of these factors in turn to arrive at an overall assessment of the attractiveness of the industry, and the types of companies that would, or would not be, attracted to it. The analysis starts with an assessment of the macroeconomic conditions affecting the market.

Macroeconomic Conditions (Details in Appendix A)

The world is currently in the grips of one of the longest-lasting recessions in modern times. This economic contraction has lasted 21 months and there is no consensus on whether the end is in sight. This makes the attractiveness of many industries questionable at this time.

Additionally, not all industries are affected equally. The PC market has probably reached its maximum penetration in terms of households and businesses. At this point, replacement due to failure and obsolescence due to increasingly demanding applications are the primary drivers of new PC purchase (see Pace of Technological Change – page 15). Replacement accounts for 80% of U.S. PC purchases. Since many of these demanding applications are in the home-computer market demand is subject to disposable income which has been curtailed by the recession. The purchase of computers by businesses has also fallen sharply (see General Economic Conditions – page 7). **This has negative implications for the short-term attractiveness of the market.**

In terms of legislation and regulation there are no pending significant developments. The Internet Tax was postponed a few years ago and is not looming at this time.

In terms of demographics and lifestyle changes, the segment most interested in buying a new computer in the near term are in the 18-34 year old range, and are more interested in buying laptops than desktop computers (see Population Demographics and Lifestyle – page 8).

The pace of technological change has been historically high in this market, with both Moore's law and Convergence being two forces driving the technological changes. One factor, Moore's law when coupled with the convergence of other electronic devices into the computer is creating a market where mobile devices could become a major competitor to traditional PC functionality. Additionally, convergence is driving the computer into the television's general arena. The consensus is that the market is moving towards highly-capable mobile devices and away from PCs. **This has very negative implications for the long-term attractiveness of this market.**

Dominant Economic Features (Details in Appendix B)

The market for PCs in the home has reached its maximum and growth has largely stagnated. As noted earlier the market is primarily driven by replacement. There is an upward trend to having multiple PCs in each household, but the trend is probably not enough to spur market growth. It

may be that people are simply keeping them around for minor functions such as checking email or surfing the news (see Market Size and Growth Rate – page 11). **This has very negative implications for the attractiveness of this market.**

Analysis shows that the market is highly concentrated with most of the revenue (90%) coming from half of the approximately 1,500 companies (see Number of Rivals – page 11). Further analysis identifies only five major players (Dell, Hewlett-Packard, Acer, Apple and Lenovo) accounting for the lion's share of the market. The fact that there are so few large competitors with the remaining market share divided by over 1,000 other companies indicates that anyone can enter, but few can grow. **This has negative implications for the attractiveness of this market.**

The number of buyers in this market is relatively stable and growing only with population. The market is fully penetrated with every one of the estimated 111 million households already fully served. This is also reflected above in the analysis of market growth rate. Also as noted earlier, the replacement market is driven by technological change (see Pace of Technological Change – page 15). **This has very negative implications for this attractiveness of this market.**

This industry is strongly affected by both experience curve effects and large economies of scale. Companies entering this industry would require significant experience in large-scale electronics manufacturing in order to have a chance at competing. **This has negative implications for the attractiveness of this market to most companies.**

From a financial perspective, standard measures of company performance, such as profitability and liquidity ratios, as well as economic efficiency measures such as ROA, are low for the major players in this market. It seems that in order to achieve a large market share a company must compete primarily on the basis of price and efficiency. **This has extremely negative implications for the attractiveness of this market.**

Porter's Five-Forces Analysis (See Appendix C for details)

As would be expected from the previous discussion of the economic characteristics of this market, this market is strongly competitive. The rivalry is fierce with two groups of similarly-sized rivals launching fresh market actions in attempts to take market share. When coupled with the market's slow growth this leads to a zero-sum game where each player can only grow at another's expense. This fierce competition is driven by low switching costs, commoditization of almost all inputs, and minor to non-existent differentiation among market offerings.

Pressure from Rivalry: Fierce

The threat of new entrants to this market must be examined in two lights. There are an extremely large number of small competitors which intuition and experience would lead one to expect to be competing on price in tiny and geographically distinct markets. While there is great likelihood of new entrants on this level, they offer significant risk with small returns and almost no growth opportunity. Large-scale new entrants are much less likely for the same reasons. This means that the threat of significant new entrants is normal.

Threat of New Entrants: Normal

Pressure from substitutes comes primarily from the growing capabilities of mobile devices. As devices such as the Blackberry® and iPhone® grow in capability they are expected to grow in popularity and displace PCs from many of their traditional roles (see Forces Driving Change – page 20).

Pressure from Substitutes: Normal

Competitive pressures from supplies are almost non-existent in this market. Most of the inputs are commodity items, and the remainder (CPU / GPU) are facing their own competitive pressures to sell as many units as possible. The only pressure that may come from suppliers is preferential treatment of important PC manufacturers in times of shortage, such as during the release of new items. In recent years this has been mitigated by the fact that most of the cutting-edge chips are aimed at high-performance computing which does not represent a large market segment. This allows the chip makers time to ramp up production without facing market shortages.

Pressure from Suppliers: Weak

Buyers are in the driver's seat in this market. With the commoditization of computer hardware, the lack of differentiation due to the standardization of the operating system, and the high-level of performance that is normal with most hardware on the market today, there is almost no switching cost for the buyer. This has led to an erosion of brand loyalty and extreme price sensitivity.

Pressure from Buyers: Fierce

In total, the five forces average around 2.1 on a 0-4 scale indicating a moderate level of competitive pressure. Moderate competitive pressure is common in many industries.

This is neutral with respect to the attractiveness of this market.

Forces Driving Change (See Appendix D for Details)

There are a variety of forces driving change in this industry. These include the rapid development and increasing capabilities of Smart Phones to perform some of the duties once handled by PCs. Additionally, Cloud computing is removing much of the driving force for increasing speed and memory requirements that characterized the PC market in the past. Finally, Internet sales have been able to bypass many aspects of the historical 'bricks and mortar' distribution channel. This allows any manufacturer, anywhere in the world, to sell within the U.S. without having to start a distribution channel.

In total, the above forces are changing the PC industry by reducing its future growth opportunities while increasing price competition.

This has negative implications for the attractiveness of this market.

Market Positions of Competitors (See Appendix E for Details)

The market positions of the various major competitors, with the exception of Apple, are easily characterized as linear with market share correlating with high return on assets. This correlation

between market share and efficiency provides further strength for the argument that competition is primarily on the basis of price. The two strategic group maps, Market Share and ROA (on page 22) and ROA and Customer Support (on page 23) offer additional insight on the fact that price is the only significant driver of market share. Since this is a low-margin industry with almost no growth opportunities it is worthwhile to anticipate the various strategic moves that the various competitors will make.

Probable Strategic Moves by Competitors (See Appendix F for Details)

The five primary competitors can easily be grouped into three groups with similar strategic options. The first group, comprised of Dell and HP, has high ROAs, moderate operating margins, and the two largest market shares. Both of these companies have responded to conditions in the PC manufacturing industry by seeking to diversify into related businesses with higher margins. In both cases they have purchased the remains of earlier Ross Perot companies (EDS and Perot Systems). It would not be a surprise to see both of them follow IBM's lead and outsource their PC manufacturing to an overseas company, probably in China, and probably one of the companies in our second group.

The second group, comprised of Acer and Lenovo, has abysmal financial characteristics that reflect their deep involvement in a commoditized industry. While Acer is approximately seven times as large as Lenovo in terms of market share, it does not seem to have any better long-term growth opportunities. Given the larger market share and financial strength of Acer relative to Lenovo, it should be expected that Acer will acquire Lenovo as part of a consolidation in the Chinese PC manufacturing industry.

The third 'group' is comprised only of Apple. Apple has done a fantastic job of maintaining its market niche in what might be called luxury computing while expanding into consumer electronics with the iPod, and into the mobile devices market with the iPhone. Apple's long-term growth prospects are excellent, and Apple has the strongest balance sheet and financial ratios of any of the companies in the analysis set. Apple will continue to do what it has been doing.

The fact that the players with the strongest financial health are diversifying outside of the PC manufacturing industry, while the ones with the weakest financial health are heading into a consolidation has very negative implications for the attractiveness of this industry.

Key Success Factors (See Appendix G for Details)

The key success factors for the PC manufacturing industry are few, simple, and strangely irrelevant. This is because they are necessary but not sufficient for financial success.

Establishing a strong brand – Establishing a strong brand, as Dell and HP have done, allows a company to gain market share. Still, with the paper-thin margins, large economies of scale, and total lack of brand loyalty relative to price this does not confer and worthwhile advantage.

Producing market-favored goods – This factor is necessary in order to sell anything at all. The problem is that there is, and probably cannot be, any product differentiation. This means that if a

company is smart enough to product market-favored goods, their product will look like every other PC on the market. This leaves price as the only competitive driver.

Economies of Scale and Competitive Pricing – These two success factors must be treated together because price is the sales driver, and the price level is set by minimizing the margin of production costs. Ultimately, this means that until a company reaches the high economies of scale while cutting its margin it cannot compete in the marketplace. If the company does achieve these success factors then the margin will not offer enough return to justify the risks.

Collectively, the key success factors are necessary but not sufficient to achieve a financially sound business. **This has very negative implications for the attractiveness of this market.**

Conclusion

In almost every category of analysis this market has shown to be very unattractive. The more successful players have either exited the market (IBM) or are diversifying to related businesses that offer a better margin (Dell and HP). The ones that are staying in the market (Acer and Lenovo) are probably heading for some form of shake-up and consolidation. The player with the healthiest financial ratios, Apple, probably has more in common with Sony or Samsung that it does with the companies in the PC market.

The inescapable conclusion is that this is a very unattractive market.

Appendix A - Macroeconomic Environment

General Economic Conditions

According to the National Bureau of Economic Research (NBER), the United States economy entered into a recession in December 2007 (National Bureau of Economic Research 2008). As of now, September 2009, the recession continues. The contraction has lasted 21 months so far, and there is no consensus on whether or not we have reached the trough and begun an expansion. Again, according to the NBER, there have been 10 economic cycles since 1945, with an average contraction of 10 months (National Bureau of Economic Research 2008). The current retraction is putting stress on consumer spending and, by extension, industries that depend on consumer spending. The NBER's Economic Report for the President notes:

Real consumer spending stagnated in the first half of 2008 and then fell sharply in the third quarter in what was the largest quarterly decline since 1980. This was a major deceleration after the 2.8 percent average annual rate during the 2001–07 expansion. (National Bureau of Economic Research 2009, 33)

This does not bode well for the near-term revenue for companies such as PC makers that target the consumer market. Unfortunately, the outlook for business customers is no better. Quoting again from the Economic Report for the President.

During the first three quarters of 2008, real business investment in equipment and software fell 4.4 percent at an annual rate, down from 2.8 percent growth in 2007. Growing categories included software (2.4 percent), communication equipment (5.2 percent), and agricultural equipment (27 percent), while investment in industrial equipment fell 4.0 percent. (National Bureau of Economic Research 2009, 41)

This outlook is further supported by the **Mintel Oxygen** report Market Re-forecasts: Technology - US - April 2009, which notes the following points:

- In light of current macroeconomics as well as rapid developments in the market, Mintel has created a new forecast for its Home Personal Computers – US, December 2008 report. Previously, Mintel had forecast 8% growth from 2008-12 for the market as a whole. Sales are now projected to decline by 14% for the same period.
- In terms of macroeconomics, consumers are likely to be more willing to make do with current PCs owned, and households without a PC are likely to continue to make do as well, or turn to used equipment or low-end netbooks.
- Regardless of macroeconomic trends, the desktop category has seen its peak and is headed into permanent decline; household penetration hasn't risen in years, standing at 63-65%. (Mintel Oxygen 2009)

In summary, overall economic conditions are poor and will probably remain so for the next several months.

Appendix A - Macroeconomic Environment

Legislation and Regulation

Detailed searching at the United States House of Representatives reveals that H.RES.558, a bill creating a “National Computer Science Education Week” was moved into committee on 6/18/2009¹. There does not seem to be any other current legislation affecting the computer industry.

Population Demographics and Lifestyle

The **Mintel Oxygen** report Consumer Electronics Holiday Shopping - US - September 2009, notes a variety of demographic and lifestyle information that is pertinent to the PC industry.

As part of surveying 2,091 adults (aged 18+) with Internet access, the following findings are reported.

When asked “which of the following PC and PC-related products are you interested in purchasing between now and January 2010, either for yourself or as a gift for others?” the subjects responded as follows: (Intel Oxygen 2009)

	Any consideration for purchase:	Thinking about buying as gift by January 2010	Thinking about buying for self by January 2010	I am not sure what this is
	%	%	%	%
Laptop PC	34	7	27	1
Desktop PC	21	5	17	1
A "Netbook" (such as the HP Mini or ASUS Eee)	15	4	11	8

The subjects responding to the previous question have the following age distribution.

Figure 40: Interest in purchasing PCs before January 2010, by age, June 2009							
Any consideration for purchase:	All	18-24	25-34	35-44	45-54	55-64	65+
	%	%	%	%	%	%	%
Laptop PC	34	45	44	39	31	24	17
Desktop PC	21	29	28	22	20	15	10

¹ <http://thomas.loc.gov/cgi-bin/bdquery/D?d111:2:./temp/~bdKqi1:./bss/111search.html>, accessed 9/29/2009 7:53 PM

Appendix A - Macroeconomic Environment

A "Netbook" (such as the HP Mini or ASUS Eee)	15	20	26	13	15	11	2
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The report authors note that the age range interested in purchasing new computers is skewed towards the 'under 35' group. This may have implications for the marketing strategies of companies hoping to sell PCs this holiday season.

In terms of lifestyle and usage patterns, the **Mintel Oxygen** report Home Personal Computers - US - December 2008 indicates the following usage patterns broken down by age group. (Intel Oxygen 2008)

	Total	18-24	25-34	35-44	45-54	55-64	65+
	%	%	%	%	%	%	%
Internet/e-mail	82	77	86	86	82	83	74
Computer games	55	60	55	63	55	50	44
Digital music	48	59	60	59	49	34	17
Digital photo editing	47	46	56	53	45	44	32
Digital video	24	30	33	31	23	16	10
Networking devices	10	13	11	12	9	7	4

Technology

The pace of technological change in the Personal Computer arena is both cliché and complex. There are several factors that drive this change. Two of these factors are the well-known 'Moore's Law', and the somewhat familiar concept of 'Convergence.'

Moore's Law: "Moore's Law describes a long-term trend in the history of computing hardware, in which the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years.[1]. Rather than being a naturally-occurring "law" that cannot be controlled, however, Moore's Law is effectively a business practice in which the advancement of transistor counts occurs at a fixed rate."²

The implication of Moore's law is that computers become faster and less expensive with great frequency. This allows for broader application of the computer to activities that were previously too computationally expensive. Moore's law is, ultimately, the driving force behind 'Convergence.'

In his Telephony article "When TVs and PCs collide," Ed Gubbins examines some of the concepts and issues facing the convergence of the Personal Computer with the Television. He notes that "with the rise of IPTV and online video, among other trends, TVs and PCs increasingly are crowding each other's turf, posing plenty of questions about how the roles played by these devices will shift over time..." (Gubbins 2008). The convergence issues are also

² http://en.wikipedia.org/wiki/Moore%27s_law, accessed 9/29/2009 9:03 PM

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being addressed by Microsoft® with the **Microsoft Media Center**. On the Microsoft Media Center website, Microsoft invites us to:

Enjoy your entire digital entertainment library in full glory on your PC or even on your TV with Windows Media Center.^M View your photos in a cinematic slide show, browse your music collection by cover art, easily play DVDs, watch and record TV shows, download movies, and project your home videos—then pass the remote to let friends and family join in the fun! (Microsoft 2009)

In addition to the technological issues raised by convergence, the rise of mobile computing is also acting as a force for change in the Personal Computer industry.

In his article “Disruptive Innovation”, in **Wireless Week**, Keith Mallinson asserts “PC industry be warned. Mobile devices are taking computing to everyone, everywhere and all of the time.” (Mallinson 2008)

He goes on to note that “disruptive technologies tend to be cheaper, more flexible with wider applicability and outsell what they displace. They succeed despite initially providing lower performance than incumbent technologies.” This leads him to conclude that with the increases in computing power inherent in the development of mobile telephone (and computer) technology that “**mobiles will become the primary and most pervasively used or only computing devices for most of the world’s population.**” (Mallinson 2008)

Mr. Mallinson is not the only one to make assertions along this line. This position is supported by the now flat market growth in the PC industry. This is explored further in the **Dominant Economic Features** section of this report.

Appendix B - Dominant Economic Features

Market Size and Growth Rate

As noted earlier, the **Mintel Oxygen** group has provided an update to the forecasts in the Home Personal Computers – US, December 2008 report. In that re-forecast, Mintel expects that the Home PC market will **decline by 14% in the period from 2008-2014** (see page 7). Additionally, “the desktop category has seen its peak and is headed into permanent decline; household penetration hasn’t risen in years, standing at 63-65%. (Mintel Oxygen 2009)”

Mintel provides the following data table to emphasize the declining sales expectation for the home computer market.

Total U.S. supplier sales and forecast of home computers at current prices, 2003-12				
Year			Index	Index
	\$million	% change	2003 = 100	2008 = 100
2003	15,579	-	100	74
2004	18,233	17.0	117	87
2005	19,399	6.4	125	93
2006	19,553	0.8	126	93
2007	21,156	8.2	136	101
2008 (est)	20,931	-1.1	134	100
2009 (fore)	19,242	-8.1	124	92
2010 (fore)	18,595	-3.4	119	89
2011 (fore)	18,183	-2.2	117	87
2012 (fore)	18,089	-0.5	116	86

Source: (Mintel Oxygen 2009)

While the forecast is dour, it is at least directionally consistent with other sources. An article in EDN covers some of the details of a Gartner Group report forecasting PC sales in 2009. According to the article:

The market-research company projects that worldwide PC shipments will reach 274 million units in 2009, a 6% decline from 2008 shipments of 292 million units. The fourth quarter should see growth, setting the stage for a healthy market recovery in 2010 with unit shipments forecast to increase 10.3%.” (EDN 2009)

Number of Rivals

The PC manufacturing market is characterized by having a few large players in competition with each other, and a large number of smaller players (sometimes individuals) engaged in local personal selling and consultancy. Hoovers describes the industry as follows:

The US computer manufacturing industry includes about 1,500 companies with combined annual revenue of \$70 billion. Major companies include Dell, Hewlett-

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Packard, IBM, and Sun Microsystems. The industry is highly **concentrated**: the top 50 companies generate about 90 percent of revenue. (Hoovers n.d.)

The Mintel Oxygen report Home Personal Computers - US - December 2008 describes the market participants as follows:

For many years, PCs have been an unusually commoditized product. With the notable exception of Apple, most PC makers sell boxes that contain components (such as processors and graphic and sound systems) and software that are produced by the same third-party vendors—and are often put together in the same factories. Furthermore, component-level vendors are often heavily featured in advertising and product packaging due to co-op advertising arrangements. (Mintel Oxygen 2008)

The Mintel report also summarizes recent purchases by brand and recentness of purchase.

Home Personal Computers - US - December 2008 - Brand Qualities							
Brand of PC most recently acquired, by date of purchase, April 2007-June 2008							
	Total	Less than 1 year ago	1 year to less than 2 years ago	2 years to less than 3 years ago	3 years to less than 4 years ago	4 years to less than 5 years ago	5 years ago or more
	%	%	%	%	%	%	%
Dell	38	31	41	42	43	47	32
Hewlett Packard	16	19	15	15	15	13	14
Compaq	10	9	10	9	8	8	15
Gateway	8	6	7	7	8	9	12
Apple	5	9	5	4	3	2	3
eMachines	4	3	4	5	6	2	2
Toshiba	3	5	3	3	2	2	1
Sony Vaio	2	2	3	2	3	2	2
Acer	2	4	2	1	1	1	2
IBM	2	2	1	2	2	2	2
Other	9	7	8	9	11	11	7

(Mintel Oxygen 2008)

It is worth noting a peculiarity about this brand list. According to the Acer Group web site³, “the Acer Group family of brands -- **Acer, Gateway, Packard Bell and eMachines** -- and their respective sub-brands offer products with distinguished brand characteristics that target different customer needs in the global PC market.” Additionally, Hewlett-Packard and Compaq merged on May 3, 2002. This is significant for a number of reasons. First it implies consolidation in the industry, and secondly, it points out that the above list is based on **brand** but not on

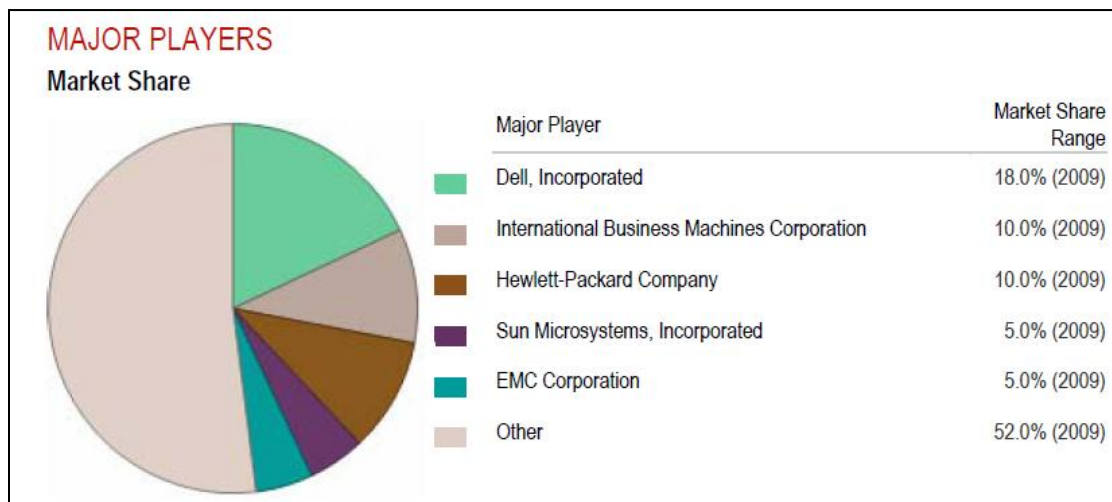
³ http://www.acer-group.com/public/The_Brands/index.htm, accessed 9/29/2009 11:02 PM

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manufacturer. Reformatting the table, accounting for brand consolidation, and sorting by market share shows a clearer picture of the competitive group.

	Total	Less than 1 year ago	1 year to less than 2 years ago	2 years to less than 3 years ago	3 years to less than 4 years ago	4 years to less than 5 years ago	5 years ago or more
	%	%	%	%	%	%	%
Dell	38	31	41	42	43	47	32
Hewlett Packard + Compaq	26	28	25	24	23	21	29
Acer Group	14	13	13	13	15	12	16
Other	9	7	8	9	11	11	7
Apple	5	9	5	4	3	2	3
Toshiba	3	5	3	3	2	2	1
Sony Vaio	2	2	3	2	3	2	2
IBM	2	2	1	2	2	2	2
Total	99	97	99	99	102	99	92

Here we see that the primary players in the market are Dell, HP, and the Acer Group. Ranking along these lines is supported by the **IBISWorld 33411 - Computer & Peripheral Manufacturing in the US - Industry Report**. The following graphic from the IBISWorld report shows the key competitors identified by IBISWorld.



(IBISWorld 2009, 25)

While this chart supports the inclusion of Dell, HP, and possibly IBM in the competitive group, it is important to understand that the market definition here includes the manufacture of peripheral equipment. For example, EMC does not manufacture ‘Personal Computers’.

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Additionally, the report goes on to note that from 2002 through 2007 IBM removed itself from most of this market.

In 2002 IBM sold its hard drive manufacturing business to **Hitachi, Ltd**, and its European desktop computer business to Sanmina-SCI. In 2005 IBM sold its personal computer business to the Lenovo group based in China. In 2007 IBM sold its stake in the printer manufacturing joint venture InfoPrint to the other Stakeholder, **Ricoh**.

IBM explains these moves in their 2008 annual report as follows:

IBM has divested commoditizing businesses like personal computers and hard disk drives, and strengthened its position through strategic investments and acquisitions in higher-value segments like business intelligence and analytics, virtualization and green solutions.⁴

For the above reasons, it seems reasonable to cite Dell, HP, Acer, Apple and possibly the Lenovo group as the dominant players in the industry although a significant share of the market is scattered among a very large number of small to tiny players. A further note would be that since Acer manufacturers motherboards, and many of their motherboards are used in computers provided by the ‘others,’ any analysis is likely to understate the size of the financial share of the market owned by Acer.

Scope of Competitive Rivalry

This market is almost completely globalized, with the major players having significant representation throughout the developed world.

Number of Buyers

With some caveats, the number of buyers approximates the number of U.S. households. There are demographic considerations with certain brands being preferred by lower or higher income segments (Mintel Oxygen 2008), market penetration estimates are around 63-65% of households (Mintel Oxygen 2009). While the penetration in number of households is stagnating, it is interesting to note that multiple-computer ownership is common. When Mintel asked their subjects “What is the number of personal computers your household owns?” they gleaned the following data:

Number of home computers owned, June 2002-June 2008						
	June 02- May 03	May 03- Apr04	May 04- May 05	May 05- Jun 06	May 06- Jun 07	Apr 07- Jun 08
	#	#	#	#	#	#
One PC	59	57	58	55	54	52
Two PCs	23	25	24	25	25	26

⁴ ftp://ftp.software.ibm.com/annualreport/2008/2008_ibm_annual.pdf, accessed 9/29/2009 11:47 PM

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Three or more PCs	12	12	13	15	16	17
Average number of PCs owned	1.55	1.56	1.58	1.63	1.66	1.71

This shows that the number of computers owned per household is increasing, although probably not at a rate that could drive industry-wide growth. It seems reasonable to conclude that with the high household penetration rate and the more than 1.5X multiplier of computers per household, it is reasonable to use the number of households as the number of buyers. ($0.63 \times 1.71 = 1.08$).

According to the U.S. Census, the estimate for the number of households is **111,609,629** (+/- 103,102).⁵

Pace of Technological Change

It is relatively common knowledge that the pace of technological change in the PC industry is very rapid. According to the IBISWorld report 33411 - Computer & Peripheral Manufacturing, “There is a rapid introduction of new products, due to a rapid rate of technological change. There is rapid growth in customer acceptance of new products, and a rapid growth in household and business demand. (IBISWorld 2009, 17)”

Nevertheless, there are interesting developments that affect both the rate of change and the adoption of new technologies in this market. One of the most important factors that drives demand is the need (or desire) to replace existing computers as they age. The IBISWorld report makes the following observation.

Replacement demand can change over time. Replacement accounts for nearly 80% of U.S. PC shipments and 60% of worldwide PC shipments. Western Digital Corporation stated in its 2003 annual report that it believed that the cycle time in which existing PC owners replaced their PCs had lengthened from two to three years to approximately three to five years. This may be due to a number of factors including improvements in products quality, an increase in the capacity of computer equipment, more scrutiny on technology budgets, and slower release of new applications. (IBISWorld 2009, 14)

This means that the pace of technological change in the PC world can influence demand, but does not (currently) drive it. There are other factors, such as the rise of mobile computing devices (non-PC) that also affect the pace of technological change in this market.

Economies of Scale

There are significant economies of scale in this industry. IBISWorld notes that “the fall in computer prices was promoted by a rise in economies of scale and productivity improvements in

⁵ http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2007_3YR_G00_S2504&-ds_name=ACS_2007_3YR_G00 accessed 9/30/2009 12:20 AM

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input industries (e.g., semi-conductors), and by rising productivity of computer manufacturers. (IBISWorld 2009, 45)” Additionally, “economies of scale can represent a major factor in competitiveness by reducing component and other costs. (IBISWorld 2009, 24)” These economies of scale have significant impact on the competitive landscape, both in costs and in barriers to entry. These effects are examined in the five-forces analysis.

Experience Curve Effects

Experience-curve effects, like economies of scale are related to production volume and have significant impact on costs. These effects are present in this industry, and are responsible for the increases in productivity that, in conjunction with the economies of scale, caused the ongoing reduction in costs (IBISWorld 2009, 45).

Industry Ratios

Analysis of financial statements of the major players indicates the following industry averages and rates of change.

Industry Averages	2006	2007	2008	Average	3-year Slope
Financial Ratios					
Revenue					14.46%
Gross Margin (Higher is Better)	65.4%	63.6%	64.5%	64.5%	-0.5%
Operating Margin (Higher is Better)	5.7%	7.5%	6.8%	6.7%	0.6%
Net Margin (Higher is Better)	5.1%	6.4%	5.3%	5.6%	0.1%
ROA (Higher is Better)	7.5%	8.9%	6.0%	7.5%	-0.7%
Current Ratio (Higher is Better)	1.41	1.41	1.39	1.40	-0.01
Quick Ratio (Higher is Better)	1.13	1.09	0.99	1.07	-0.07

While these averages and rates of change will serve as benchmarks for other parts of the analysis, a few words are in order about them.

It is interesting to note that while industry revenues are growing by a compound annual rate of 14.5%; both gross margin and return of assets are trending downward. These numbers alone could indicate that this is an unattractive industry.

Appendix C – Porter’s Five-Forces Analysis

Porter’s Five-Forces Analysis

Rivalry

- **Fresh Market Actions** – There are on-going actions by all of the major players as they work to increase market share. There seems to be two approaches here, depending on the attributes of the company. The U.S. companies (Dell and HP) are launching efforts to diversify into higher-margin operations. The Chinese competitors (Acer and Lenovo) seem to be willing to compete on a low-cost basis.
There is almost no hope of differentiating the products as they all (but Apple) have to run the current Microsoft OS. Additionally, there is full penetration in all dealer networks by almost all brands, and significant Internet sales as well.
Apple seems more forward-looking and is working maintain its niche (high-quality) while expanding into the mobile market.
Force Rating: 4
- **Similarly-Sized Competitors** – There are essentially four players in the market, as Apple is subject to significantly different forces. Again, the U.S. companies are of related size, and are both significantly larger, in terms of market share, than the Chinese companies. Each contingent seems to be competing in its own way. Dell and HP are diversifying, while Acer and Lenovo go head-to-head in manufacturing.
Force Rating: 4
- **Rivalry Due to Slow Market Growth** – This market is completely saturated, and market growth, in terms of units sold, is almost stagnate. The players now face a zero-sum game. This explains why IBM chose to exit the field, while Dell and HP diversify.
Force Rating: 4
- **Low Switching Costs** – There is no switching cost except between the PC variants and the Apple Macintosh variants. Among the PC makers, this leads to extreme rivalry.
Force Rating: 4

Threat of New Entrants

- **Economies of Scale Effects** – There are great economies of scale in this industry, and the effects of this fact make it both expensive and risky for a new entrant. With an industry average ROA of 7.5% shrinking at a compound annual rate of -0.7%, there is little in the way of risk-adjusted rate of return to entice new entrants.
Attractiveness Rating: 0
- **Brand Loyalty** – There is almost no brand loyalty in this largely commoditized market. This means that anyone can enter and make a convincing marketing pitch. They will have to understand that this pitch will be primarily on the basis of price.
Attractiveness Rating: 4
- **High Capital Requirements** – To actually manufacture PCs requires a significant amount of capital investment. When coupled with the low net margins and high risks inherent in this industry, raising such capital in the equity market seems unlikely. This is further exacerbated by the slow industry growth.
Attractiveness Rating: 0

Appendix C – Porter’s Five-Forces Analysis

- **Regulatory or Tariff issues** – There are some regulatory issues with respect to pollution that discourage electronics manufacturing in the U.S. These are not factors for overseas manufacturers, and there are no trade regulations or tariffs.

Attractiveness Rating: 3

- **Ability of Incumbents to Block New Entrants** – There are certain manufacturer-supplier relationships that may be leveraged to block new entrants. It would be simple for a company like Dell to simply buy most of Intel’s or AMD’s processor chips for a short time thus preventing a new entrant from bringing systems to market. While there would likely be anti-trust suits filed over the infraction, it would be worth the fines to the incumbents to keep another loss-leader out of an already competitive market.

Attractiveness Rating: 0

Pressure from Substitutes

- If there is an Achilles’ heel in this industry, this is it. The growing capabilities of mobile devices have been documented in other sections of this report. IBISWorld summarizes it nicely.

Finally, substitute products are also key demand determinants. Products not classified to this industry can incorporate functions that provide computing applications (e.g. mobile phones, digital TVs), and therefore can potentially adversely or positively affect demand for industry products. The network computer and on-demand computing, which use central servers to provide functionality, could reduce demand in value terms. (IBISWorld 2009, 14)

For the time being, PCs will continue to have significant application in word-processing and business functions. The primary challenge is in the home (non-business) market.

Force Rating: 1 (but growing in the future)

Pressure from Suppliers

- **Supplier Bargaining Power** – The suppliers in this industry are in an interesting position. There are only two major players in the processor market, Intel and AMD, and all manufacturers support both brands. Additionally, there are no major functional differences between them. This leaves the PC manufacturer agnostic with respect to processors. The other components of the PC are largely commodity items, so there can be no pressure from these suppliers either.

Force Rating: 0

Pressure from Buyers

- **Buyer Bargaining Power** – Since the PC has become a largely commoditized item with almost no switching cost or brand loyalty, the buyers tend to buy based on price. While there were times when poor manufacturing standards affected the so-called ‘clone’ makers, those days are gone. Now, buyers will buy almost any brand that matches their price point.

Force Rating: 4

Appendix C – Porter’s Five-Forces Analysis

Summary of Competitive Forces

Force	Elements	Average
Rivalry	4,4,4,4	4 - Fierce
Threat of New Entrants	0,4,0,3,0	1.4 - Weak
Pressure from Substitutes	1	1 - Weak
Supplier Bargaining Power	0	0 - Weak
Buyer Bargaining Power	4	4 - Fierce
Grand Average		2.1 - Moderate

In total, the five forces analysis reveals that there moderate competitive forces in this industry. This hardly comes as a surprise given the financial analysis indicating that the basis of competition is almost entirely on price.

Appendix D - Forces Driving Change

Forces Driving Change

There are a variety of forces driving change in this industry. Some of these factors are from within the industry itself, while others originate within competing product categories.

- Smart Phones - The rapid pace of change in smart phones, emphasized to consumers by massive ad spending, provides cross-category competition from sleek, new devices that surf the internet. Mintel expects computing speed and screen size to continue to rise in smart phones; with cell phone costs often subsidized by carriers, consumers eyeing budgetary constraints may prefer to upgrade the phone, and leave the PC be. (Mintel Oxygen 2009)

This is perhaps the most significant long-term force in the industry. Keith Mallinson of Wireless Week makes a strong case:

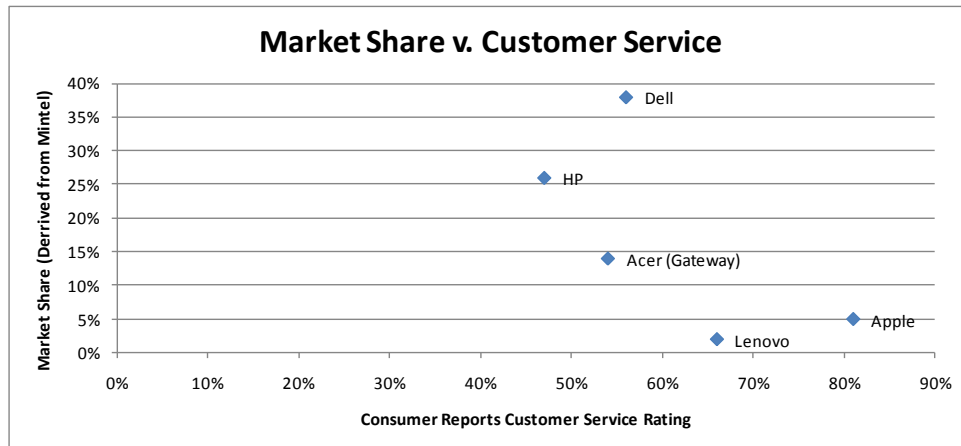
Mobiles will become the primary and most pervasively used or only computing devices for most of the world's population. Much of that population hasn't had a phone for long. More have not yet used or rarely used a computer or Internet connection. (Mallinson 2008)

- Cloud Computing - Cloud computing is clearly gaining ground among consumers, even if the term itself is relatively unknown. Most e-mail software exists in the cloud. Further developments in cloud computing are likely to ensure that processor speed and RAM will not continue to be the driving force for sales in the future that they have been in the past. (Mintel Oxygen 2009)
- Internet Sales - Computer manufacturers have become more dependent on Internet sales over the last decade. Many companies sell directly to consumers through their own Web sites, or through retailers. (Hoovers n.d.)

Appendix E - Market Positions of Competitors

Market Positions of Competitors

The Personal Computer manufacturing market is highly commoditized with little differentiation in product capabilities. This leads to competition on other factors. With respect to *home* computers, customer service seems a reasonable measure. However, **research indicates a negative correlation between customer service (as rated by consumer reports) and market share**. The following scatter chart shows the lack of relationship between market share and customer service.



Also, there does not seem to be a strong relationship between market share and any standard profitability or performance ratio. The following table demonstrates this conundrum.

Industry Averages	2006	2007	2008	Average	3-year Slope				
Financial Ratios									
Revenue									14.46%
Gross Margin (Higher is Better)	65.4%	63.6%	64.5%	64.5%	-0.5%				
Operating Margin (Higher is Better)	5.7%	7.5%	6.8%	6.7%	0.6%				
Net Margin (Higher is Better)	5.1%	6.4%	5.3%	5.6%	0.1%				
ROA (Higher is Better)	7.5%	8.9%	6.0%	7.5%	-0.7%				
Current Ratio (Higher is Better)	1.41	1.41	1.39	1.40	-0.01				
Quick Ratio (Higher is Better)	1.13	1.09	0.99	1.07	-0.07				
Manufacturer	Market Share (Derived from Mintel)	Average Gross Margin	Average Operating Margin	Average Net Margin	Average ROA	Average Current Ratio	Average Quick Ratio	Consumer Reports Customer Service Rating	
Dell	38%	82.1%	5.4%	4.5%	10.0%	1.18	0.85	56%	
HP	26%	75.8%	8.1%	6.9%	7.7%	1.18	0.77	47%	
Acer (Gateway)	14%	10.5%	2.1%	2.6%	5.2%	1.35	1.11	54%	
Apple	5%	67.6%	16.8%	13.2%	12.5%	2.35	1.94	81%	
Lenovo	2%	86.5%	1.0%	0.9%	2.0%	0.95	0.68	66%	
Other	15%								
Correlation to Market Share		0.14	-0.10	-0.08	0.34	-0.33	-0.39	-0.66	

Note: the red-highlighted items indicate a measure below the industry average.

The strongest positive correlation to market share is average return on assets, but there is no theoretical financial model that would explain why companies with a higher ROA would also

Appendix E - Market Positions of Competitors

have greater market share. One might **speculate** that the higher ROA implies lower capital intensity and may free-up cash for advertising and sales promotion.

An exhaustive correlation analysis shows the following characteristics of the industry:

Correlation	Market Share	Average Gross Margin	Average Operating Margin	Average Net Margin	Average ROA	Average Current Ratio	Average Quick Ratio	Customer Service Rating
Market Share		0.14	-0.10	-0.08	0.34	-0.33	-0.39	-0.66
Average Gross Margin			0.19	0.13	0.13	-0.16	-0.24	0.19
Average Operating Margin				1.00	0.87	0.89	0.83	0.58
Average Net Margin					0.87	0.90	0.83	0.54
Average ROA						0.75	0.69	0.34
Average Current Ratio							0.99	0.74
Average Quick Ratio								0.76
Customer Service Rating								

There are strong correlations between the margins but this is to be expected. **The strangest correlation is between the customer service rating and the liquidity ratios.**

Speculation leads to the following question: Since Apple is NOT subject to the same rules as the commoditized PC makers, it may sell its hardware at a premium if people want the operating system, **perhaps Apple should be removed from the analysis.**

The following table shows the correlations between the various factors without including apple in the data set.

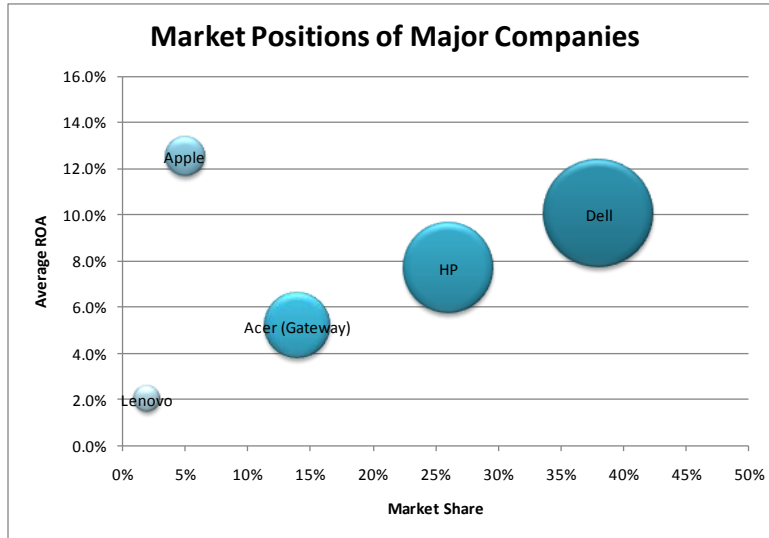
Correlation (w/o Apple)	Market Share	Average Gross Margin	Average Operating Margin	Average Net Margin	Average ROA	Average Current Ratio	Average Quick Ratio	Customer Service Rating
Market Share		0.19	0.77	0.75	1.00	0.42	0.12	-0.61
Average Gross Margin			0.31	0.16	0.13	-0.81	-0.94	0.27
Average Operating Margin				0.99	0.78	0.23	-0.19	-0.83
Average Net Margin					0.77	0.37	-0.05	-0.90
Average ROA						0.47	0.17	-0.66
Average Current Ratio							0.91	-0.68
Average Quick Ratio								-0.33
Customer Service Rating								

Now we see a strong positive correlation (1.00) between average ROA and market share. ROA is calculated as Net Income divided by total assets, and is a measure of how efficiently a company is using its assets. High efficiency implies low operating costs. This is further supported by the low correlation to average gross margin (everyone is buying the same inputs), and the high correlation to average operating margin, as the operations of the companies with the highest market share are also the most efficient. All of this implies that the PC market, with the exception of Apple's niche, is driven primarily by price, and other factors, such as customer service, are secondary.

Market Share and ROA

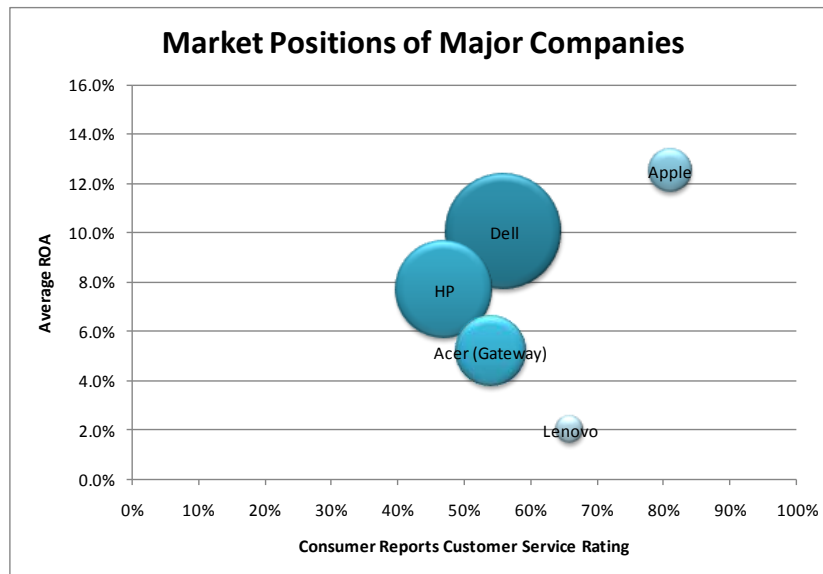
The following strategic group map shows the relationship between ROA and market share.

Appendix E - Market Positions of Competitors



The strong correlation between efficiency and market share implies a market with paper-thin margins, and this is supported by the financial ratios of both the industry and the individual players shown earlier. This is further supported by the following strategic group map.

ROA and Customer Support



From the above group map clearly shows that ROA is a primary driver of market size (bubble size), while the larger players hover around mediocre customer service ratings. This means that there is no financial incentive to differentiate one brand from another by offering better customer support.

Appendix F - Probable Strategic Moves by Competitors

Probable Strategic Moves by Competitors

This section attempts to predict strategic moves by the various major players in this industry. These predictions are a mixture of new items, financial analysis, and conjecture. The following tables, derived from company financial statements provide the basis of the financial analysis.

Manufacturer	Market Share (Derived from Mintel)	Average Gross Margin	Average Operating Margin	Average Net Margin	Average ROA	Average Current Ratio	Average Quick Ratio	Consumer Reports Customer Service Rating
Dell	38%	82.1%	5.4%	4.5%	10.0%	1.18	0.85	56%
HP	26%	75.8%	8.1%	6.9%	7.7%	1.18	0.77	47%
Acer (Gateway)	14%	10.5%	2.1%	2.6%	5.2%	1.35	1.11	54%
Apple	5%	67.6%	16.8%	13.2%	12.5%	2.35	1.94	81%
Lenovo	2%	86.5%	1.0%	0.9%	2.0%	0.95	0.68	66%
Other	15%							
Correlation to Market Share		0.14	-0.10	-0.08	0.34	-0.33	-0.39	-0.66

Dell

Dell	2006	2007	2008	Average	3-year Slope
Financial Ratios					
Revenue	57,420	61,133	61,101	59,885	3.16%
Gross Margin (Higher is Better)	83.4%	80.9%	82.1%	82.1%	-0.7%
Operating Margin (Higher is Better)	5.3%	5.6%	5.2%	5.4%	-0.1%
Net Margin (Higher is Better)	4.5%	4.8%	4.1%	4.5%	-0.2%
ROA (Higher is Better)	10.1%	10.7%	9.4%	10.0%	-0.4%
Current Ratio (Higher is Better)	1.12	1.07	1.36	1.18	0.12
Quick Ratio (Higher is Better)	0.90	0.78	0.87	0.85	-0.02

In terms of market share, Dell is the largest player in this analysis. Yet, like the other players (except Apple) the three-year trend in ROA is downward. When coupled with Dell's lack-luster revenue growth, 11.3% below the industry average, Dell is likely to diversify into related opportunities that may offer a higher margin than hardware. This would be consistent with IBM's exit from the market to focus services such as consulting. With this in mind, the following excerpt from a Dell press release should come as no surprise.

ROUND ROCK and PLANO, Texas, Sept. 21, 2009 — Dell and Perot Systems have entered a definitive agreement for Dell to acquire Perot Systems in a transaction valued at approximately \$3.9 billion. Terms of the agreement were approved yesterday by the boards of directors of both companies.

Appendix F - Probable Strategic Moves by Competitors

The acquisition will result in a compelling combination of two iconic information-technology brands. The expanded Dell will be even better positioned for immediate and long-term growth and efficiency driven by:

- Providing a broader range of IT services and solutions and optimizing how they're delivered;
- Extending the reach of Perot Systems' capabilities, including in the most dynamic customer segments, around the world; and,
- Supplying leading Dell computer systems to even more Perot Systems customers.⁶

At some point, Dell will probably outsource its PC manufacturing to China.

Hewlett-Packard

HP	2006	2007	2008	Average	3-year Slope
Financial Ratios					
Revenue	91,658	104,286	118,364	104,769	13.64%
Gross Margin (Higher is Better)	75.7%	75.6%	76.0%	75.8%	0.1%
Operating Margin (Higher is Better)	7.2%	8.4%	8.8%	8.1%	0.8%
Net Margin (Higher is Better)	6.8%	7.0%	7.0%	6.9%	0.1%
ROA (Higher is Better)	7.6%	8.2%	7.3%	7.7%	-0.1%
Current Ratio (Higher is Better)	1.35	1.21	0.98	1.18	-0.18
Quick Ratio (Higher is Better)	0.92	0.78	0.59	0.77	-0.17

Like Dell, Hewlett-Packard has also diversified into consulting and IT outsourcing. In the 2008 annual report, the CEO Mark V. Hurd writes of the recent (August 2008) acquisition of EDS:

The EDS Acquisition—Disciplined Execution of a Multi-year Strategy In August, HP completed its acquisition of EDS, a global technology services, outsourcing and consulting leader, for a purchase price of \$13 billion. The EDS integration is at or ahead of the operational plans we announced in September, and customer response to the acquisition remains very positive. (Hewlett-Packard 2008)

In terms of strategic moves, HP seems likely to simply focus on expanding market share in the consulting industry. It would not be surprising if at some point HP outsources its PC manufacturing to China.

⁶ <http://content.dell.com/us/en/corp/d/secure/2009-09-21-Perot-Systems.aspx>, accessed 9/30/2009 8:45 PM

Appendix F - Probable Strategic Moves by Competitors

It is entertaining to note that EDS (Electronic Data Systems Corp.) was founded in 1962 by Ross Perot, formerly of IBM. As noted above, Dell recently purchased Perot systems, founded in 1988 by Ross Perot, formerly of IBM.

Acer Group

Acer	2006	2007	2008	Average	3-year Slope	
Financial Ratios						HK\$/US
Revenue (HK\$)	44,976	59,239	70,035	58,084	24.79%	7.8
Gross Margin (Higher is Better)	10.9%	10.3%	10.5%	10.5%	-0.2%	
Operating Margin (Higher is Better)	1.8%	2.2%	2.2%	2.1%	0.2%	
Net Margin (Higher is Better)	2.9%	2.8%	2.1%	2.6%	-0.4%	
ROA (Higher is Better)	5.4%	5.3%	4.8%	5.2%	-0.3%	
Current Ratio (Higher is Better)	1.47	1.34	1.25	1.35	-0.04	
Quick Ratio (Higher is Better)	1.23	1.10	0.98	1.11	-0.04	

While Acer has growing revenues and a significant 14% market share, there are almost no positive aspects to its financial ratios. There could be two options at play here.

- Acer may be operating as a loss leader in order to grow market share
- Acer may be poorly managed and simple a bad company. This seems unlikely with their high quick ratio indicating a strong cash position.

Between the two, I would suspect the former. It would also not be a surprise to see Acer acquire Lenovo.

Apple

Apple	2006	2007	2008	Average	3-year Slope
Financial Ratios					
Revenue	19,315	24,006	32,479	25,267	29.67%
Gross Margin (Higher is Better)	71.0%	66.0%	65.7%	67.6%	-2.7%
Operating Margin (Higher is Better)	12.7%	18.4%	19.3%	16.8%	3.3%
Net Margin (Higher is Better)	10.3%	14.6%	14.9%	13.2%	2.3%
ROA (Higher is Better)	11.6%	13.8%	12.2%	12.5%	0.3%
Current Ratio (Higher is Better)	2.24	2.36	2.46	2.35	0.11
Quick Ratio (Higher is Better)	1.97	2.00	1.84	1.94	-0.06

Appendix F - Probable Strategic Moves by Competitors

Apple is going to continue to grow in consumer electronics and telephony. Microsoft does not dominate the operating system environment for mobile devices, and Apple has a strong position in mobile devices, and mobile devices are the most likely candidate for the future of computing platforms. These facts would lead one to believe that Apple is well positioned for the future. This is also supported by the fact that of all of the companies in this analysis, Apple is the only one that is above industry averages in every financial ratio considered by this analysis. They also top the list in consumer service.

Watch for Apple to continue doing what it has been doing.

Lenovo

Lenovo	2006	2007	2008	Average	3-year Slope
Financial Ratios					
Revenue	14,590	16,352	14,901	15,281	1.06%
Gross Margin (Higher is Better)	86.0%	85.0%	88.3%	86.5%	1.1%
Operating Margin (Higher is Better)	1.3%	3.1%	-1.4%	1.0%	-1.4%
Net Margin (Higher is Better)	1.1%	3.0%	-1.5%	0.9%	-1.3%
ROA (Higher is Better)	3.0%	6.7%	-3.6%	2.0%	-3.3%
Current Ratio (Higher is Better)	0.87	1.05	0.92	0.95	0.03
Quick Ratio (Higher is Better)	0.63	0.76	0.67	0.68	0.02

Between the two Chinese manufacturers, Lenovo has the highest gross margin, and the lowest operating margin. With these inefficiencies, low liquidity ratios, and the lowest ROA of any of the companies examined here, it seems likely that Acer will acquire Lenovo.

Appendix G - Key Success Factors

Key Success Factors

There are certain activities and attributes that a company must engage in and attain in order to be successful in this industry. According to IBISWorld, the key success factors in this industry include:

- Establishing brand names
- Production of goods currently favored by the market
- Economies of scale
- Ensuring pricing policy is appropriate

Establishing brand names and associated reputations for quality are critical for success. Brands that have a reputation for low quality, incompatibility, and other negative aspects tend to disappear from the market fairly quickly.

The second two factors, Economies of Scale and appropriate pricing policy are interrelated and synergistic. This means that large firms with significant economies of scale are also able to reduce costs and, by extension, prices while maintaining an acceptable margin.

The other KSFs cited by IBISWorld include supplier relations, distribution systems, and innovation. These factors are also important but perhaps not actually 'key,' and are thus noted in the five-forces analysis but not analyzed in any depth here.

It is interesting to note that the key success factors are also responsible for the commoditization that caused IBM to exit the market. This observation bears significantly in the five-forces analysis above.

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