June 11, 2007

Worldwide PC Adoption Forecast, 2007 To 2015

by Simon Yates
for Market Research Professional

Includes market sizing forecast

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It's Time To Focus On Emerging Markets For Future Growth

by Simon Yates
with Ellen Daley, Benjamin Gray, J.P. Gownder, and Rachel Batiancila

EXECUTIVE SUMMARY

Forrester's 2007 worldwide PC adoption forecast shows that there will be more than a billion PCs in use by the end of 2008 and more than 2 billion by 2015 — a 12.3% compound annual growth rate (CAGR) between 2003 and 2015. It took more than a quarter of a century to reach the first billion users, but with advancing technology, lower prices, and global demand for a technology-aware population, it will take only seven years to reach the next billion. Today, efforts like the Intel World Ahead Program, Microsoft Unlimited Potential, and One Laptop per Child (OLPC) are the driving forces behind creating a market to include another billion and more. However, for PC technology suppliers, the biggest challenges will be scaling production with enough volume to drive down prices to meet affordability requirements, and effectively planning and executing in a market that no one really understands yet.

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Forrester interviewed vendor companies, including AMD, Intel, One Laptop per Child, and Microsoft. Data sources include *The Economist*, the International Monetary Fund, and The World Bank.

Related Research Documents

"Designing PCs For The Third World"
May 22, 2007

"The Rise Of Globally Adaptive Organizations"
December 13, 2006

"Sizing The Emerging-Nation PC Market"
December 10, 2004

PC USAGE WORLDWIDE WILL TOP 1 BILLION IN 2008 AND 2 BILLION BY 2015

When Forrester first published its perspective on the adoption of PCs in emerging markets in 2004, the industry debate focused on whether or not there would be a billion PC users by the end of the decade.[1] More than a quarter of a century after IBM released the first personal computer, Forrester's 2007 forecast shows that there will be more than a billion PCs in use by the end of 2008 and more than 2.25 billion by 2015 — a 12.3% compound annual growth rate (CAGR) between 2003 and 2015 (see Figure 1).[2] It will have taken 25 years to reach the first billion, but only 10 years to reach the next billion. Our research shows that:

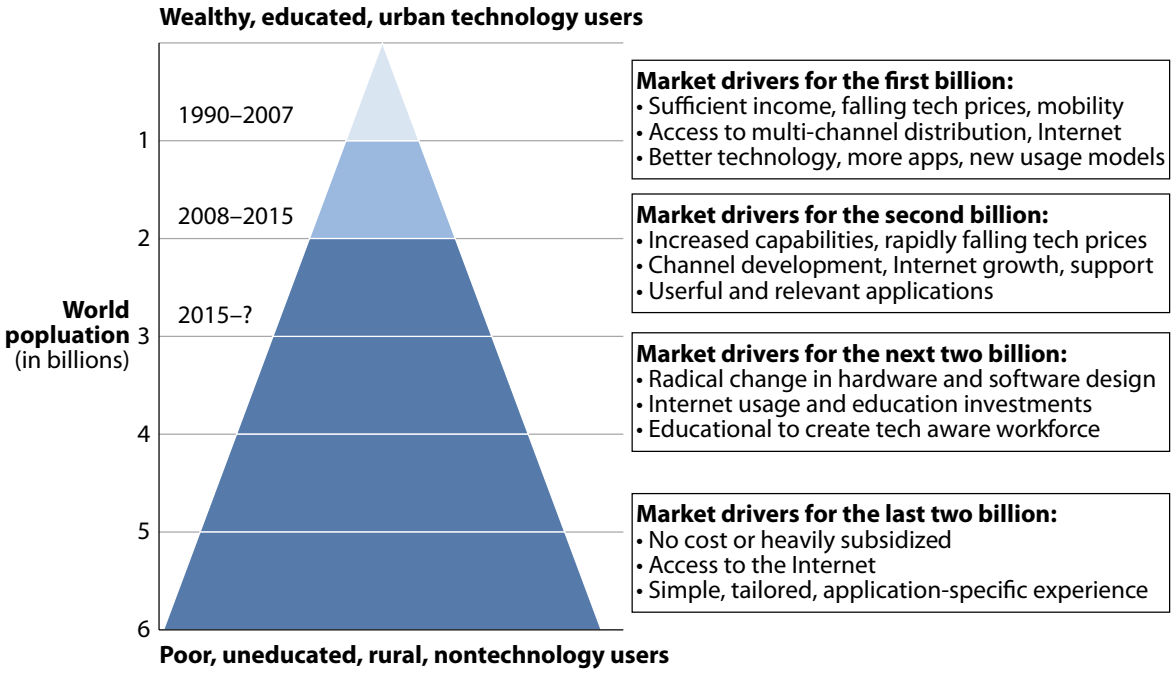
- **PC use rose from almost 500 million to 755 million between 2003 and 2007.** In 2003, there were about 496 million PCs in use in the largest 67 countries in the world — dominated by the 178 million in the United States and followed by Japan at a distant second with almost 45 million. Mature Western European countries like Germany, France, and the United Kingdom had 27 million, 20 million, and 22 million, respectively. By the end of 2006, the total number of PCs in use had risen to more than 755 million, an 11% CAGR from 2003 to 2007 as the PC penetrated deeper into these mature markets.

- **Fast-growing emerging markets will lead the way during the next five years.** The vast majority of the future growth during the next decade will come from countries like Brazil, Russia, India, and China (BRIC), accounting for the more than 800 million new PCs between them by 2015.[3] In each of these countries, Forrester expects to see CAGRs of 25% or more as access to PC technology increases, the build-out of network infrastructure continues, technology prices fall, and personal incomes increase enough to bring millions of new users into the market.

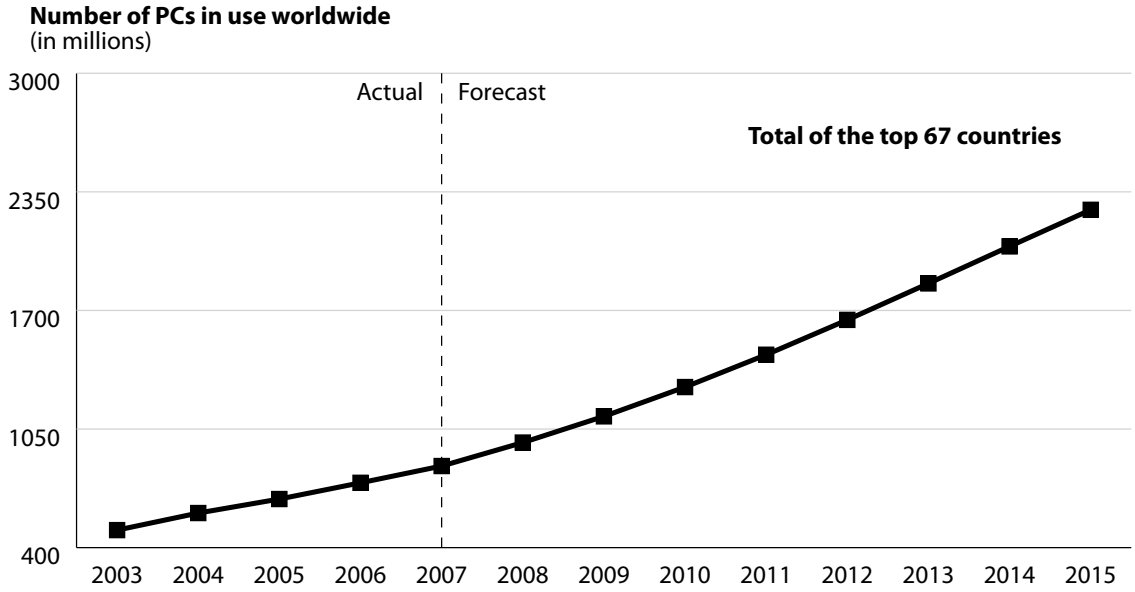
- **Reaching people without technology access will define the PC industry in the long-term.** While reaching the next billion users is mostly dependent on rising incomes and falling technology prices, several high-profile efforts — such as One Laptop per Child (OLPC) and Microsoft Unlimited Potential — are underway to serve the poorest and least educated of the world's population. Reaching these users in a cost-effective manner with technology that is relevant to their lives requires a fundamental shift in the way computer hardware and software is designed, assembled, financed, and distributed.[4]

Figure 1 Forecast: Worldwide PC Adoption, 2003–2015

1-1 The PC adoption pyramid



1-2 Worldwide PC adoption forecast



Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

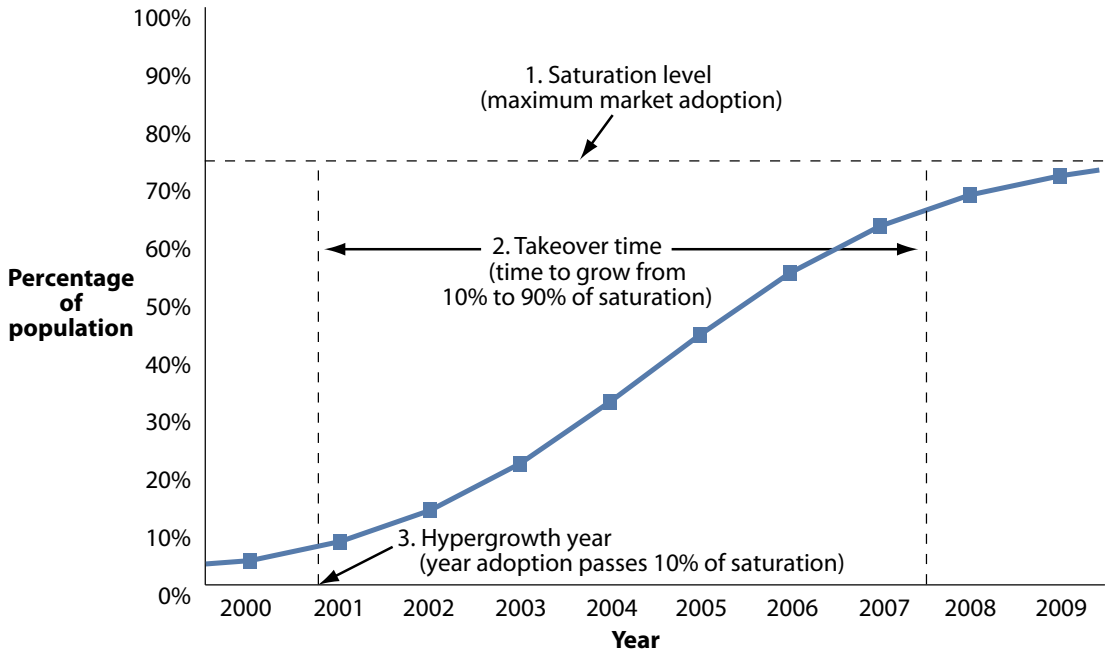
Which Factors Drive PC Adoption?

Our 2007 PC adoption forecast uses the same time-tested S-curve modeling technique that Forrester uses in its Consumer Technographics® research.[5] This model employs three growth parameters: saturation, takeover time, and the hypergrowth year (see Figure 2). The 2007 model includes the top 67 countries based on the size of their population. This significantly expands the scope of our original 2004 forecast — which focused only on emerging PC markets — to include mature markets in Western Europe, Asia, and North America, as well many more new countries in the Middle East, Africa, and Eastern Europe. The model now covers approximately 90% of the world's population, up from 62% in the 2004 report.[6] Readers should note that this forecast does not distinguish between consumer and business use but is simply the number of PCs in use relative to the population.

To ensure that the model was equally applicable and accurate across markets, we used six adoption factors, each based on a combination of multiple data points:

- **Demographics.** The demographic component combines population growth, urbanization levels, and adult literacy rates. Countries with large urban populations are more likely to have an industrial and consumer base with greater access to and demand for PC technology; urban, educated citizens are more likely to have the means and motivation to own a PC. At the same time, countries with strong primary and secondary educational systems generally have higher adult literacy rates. A low level of literacy can severely impede the economic development of a country in a technology-driven world.[7]

Figure 2 Modified S-Curve Modeling Graphic With Factors



42496 Source: Forrester Research, Inc.

- **Macroeconomics.** Income distribution plays a major role in determining the available market. Emerging markets taking a more significant role in the world economy tend to have the fastest economic growth, but if the income generated by that growth is concentrated in a small percentage of the population, then personal incomes levels at the consumer level might not be enough to drive PC adoption. A relatively equal distribution of wealth — a low Gini Index score relative to other countries — indicates that more of the income generated by gross domestic product (GDP) is ending up in the hands of the population.[8] This transfer of wealth leads to the growth of the middle class, higher personal income levels, and ultimately a larger total available market of consumers and businesses with the means to buy technology products and services.

- **Microeconomics.** Microeconomic factors such as personal income levels and ready access to communication, computing technology, and support services have an important effect on the growth of markets for technology products. We combine personal income level data with current PC usage levels to determine whether the income of the citizen has at least supported early growth of the PC market.

- **Pace of economic development.** We use two economic indicators to calculate the pace of economic development in the context of PC growth: public and private investment in infrastructure and fixed assets such as factories, machinery, roads, railways, and communications and public expenditure on education at the primary, secondary, and higher education level. Together, these investments provide the basis for future production and, in theory, future GDP generation. In mature economies, fixed asset and educational investments tend to settle into a fairly consistent pattern because countries continually reinvest in future productivity as their economy grows. In the United States, for example, fixed asset investments are between 15% and 20% of GDP and educational investments are between 5% and 8% of GDP.

- **Pace of technology adoption.** Technology use leads to ownership over time. The pace at which countries have adopted other technologies and services is a proxy for PC adoption, although today's PCs are larger financial investments than cell phones or Internet access service. However, as hardware and software prices fall or new services such as subsidized hardware with Internet service accounts become available, adoption will grow. We use a combination of mobile phone subscriber growth, Internet usage and the growth of Internet hosts, and the current ratio between Internet and PC users to determine the pace of technology adoption.

- **Affordability and access.** It sounds simple, but potential users must have the financial means, motivation, and access to distribution channels to adopt any new technology. In any market, the success of a new technology product is dependent on the relevance of the product in the daily lives of the buyer, the scale of the investment required by that buyer to acquire the technology, and the availability of sales channels (retail, reseller, online) to make that product readily available. For emerging markets, this is the "X factor" that most often leads to failure. Another aspect of PC affordability is the cost to consumers relative to their personal income.

If consumers in emerging markets were willing to spend between 3% and 5% of their annual income on a PC, the price tag would fall somewhere between $125 and $250 in most countries.[9] While manufacturers will certainly develop products aimed at the more prosperous citizens first, developing PC solutions that are in line with the much lower personal income levels will be required to reach a broader swath of the overall population.[10]

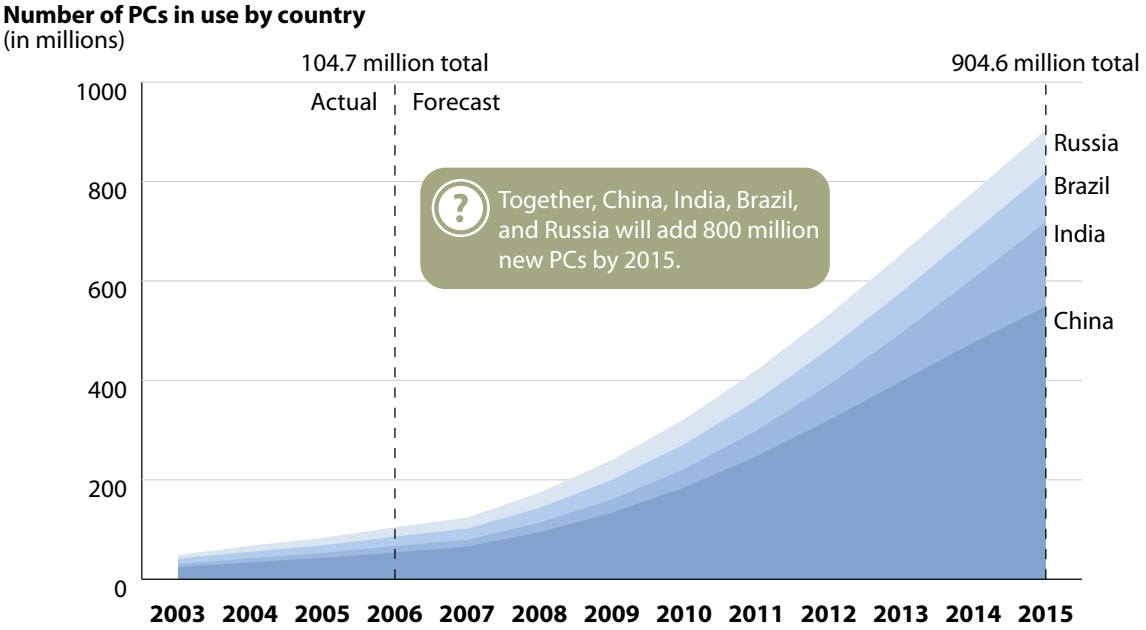
WHERE WILL THE NEXT BILLION PC USERS COME FROM?

From a technology adoption perspective, there are significant differences between developing, emerging, and mature markets**.** In mature PC markets like the United States and Japan where PC usage is high, vendors focus on attracting buyers to the latest hardware and software innovations, driving more frequent technology upgrades and encouraging the growth of multi-PC households.[11] But in emerging technology markets like China and India where there are less than five PCs for every 100 people, the long-term growth opportunity is in introducing the billions of people untouched by technology to computers, the Internet, and useful applications. Forrester forecasts that there will be 432 million new PCs in use by 2010 and 1.4 billion by 2015. Specifically, our forecast shows that:

- **Almost 500 million new PCs will be in use in China alone.** China is clearly the leading market opportunity, with about 54 million PCs in use today and almost 550 million in use by 2015 — a CAGR of 27% (see Figure 3). The pace of economic development and technology adoption has been rapid in China during the past five years as major population centers (tier 1 and tier 2 cities) have undergone an amazing transformation.[12] Personal income levels are rising, and investments in infrastructure are starting to pay off. But China's economy faces plenty of risks. The country spends the equivalent of 45% of GDP on infrastructure and fixed assets — the highest of all the countries we looked at — but only about 2% on education — one of the lowest. With its rapidly aging population, China needs to invest much more in education to ensure that it has a well-educated, technology-aware workforce that can support the country's rapid growth plans.

- **Close to 300 million new PCs in India, Brazil, and Russia.** India will add another 157 million (CAGR 29%); Brazil, 81 million (19% CAGR); and Russia, 67 million (21% CAGR) by 2015. Despite an enormous population of more than 1 billion and rapid economic growth in recent years, India today still has a ratio of only 1.2 PCs for every 100 people, due in large part to its heavily rural population (72%), low adult literacy (60%), low investment in education (3.3% of GDP), and very low personal income level (US $720 GNI, 2005). Brazil faces several issues that limit its potential for the adoption of technology. For example, income distribution is quite problematic in Brazil, as it has one of the highest Gini Index scores in the world. On the positive side, though, the large urban population, personal income levels in the middle of the pack, and strong historical adoption of technology are characteristics that make Brazil an appealing market. Russia's robust GDP growth began in 1995, peaked in 2005 at 7%, and is expected to settle into a stable 5% range for the rest of the decade.

Figure 3 Forecast: BRIC Nations PC Adoption, 2003–2015



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
China	24.4	34.0	42.8	53.9	65.8	94.6	133.7	184.5	247.2	319.8	398.1	476.3	548.9
India	6.2	8.0	10.1	12.9	13.5	19.1	26.8	37.4	51.9	71.3	96.9	129.5	169.9
Brazil	10.8	13.4	15.1	19.1	22.5	30.1	39.3	49.7	60.8	72.0	82.6	92.1	100.4
Russia	7.2	12.2	15.1	18.8	22.3	30.5	40.2	50.5	60.5	69.3	76.4	81.7	85.4

(numbers have been rounded)

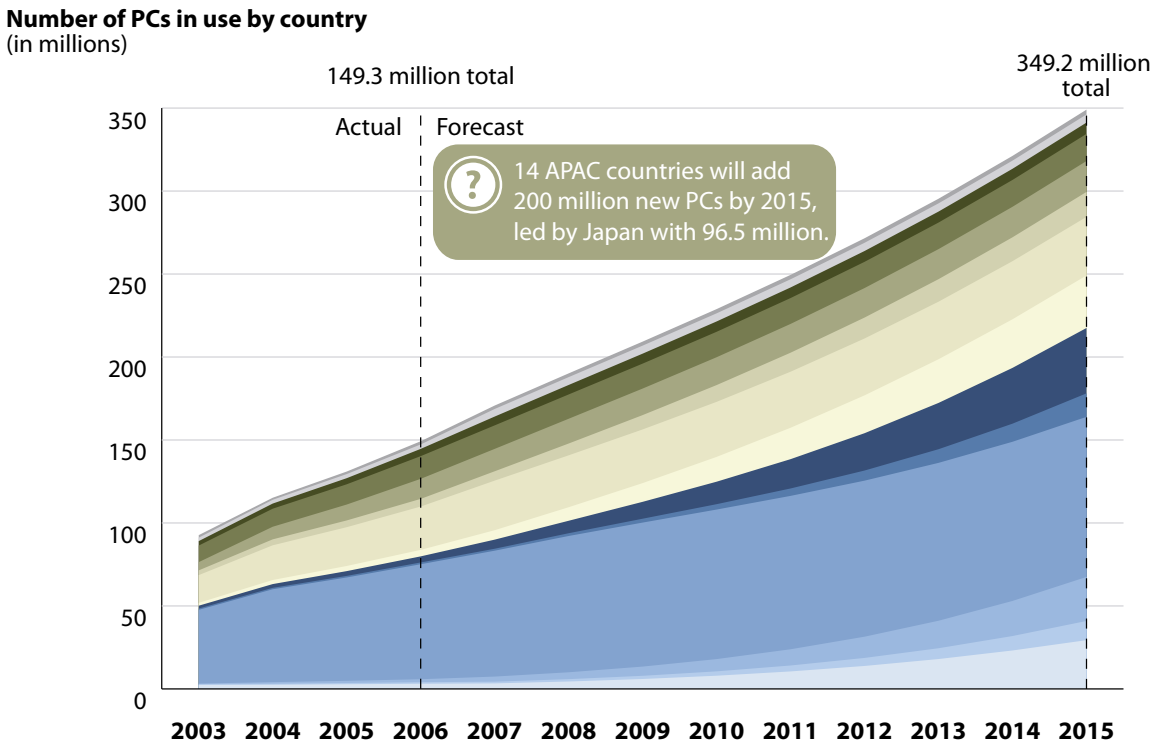
Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

- **The other 14 Asia-Pacific countries will add about 200 million additional PC users by 2015.** Vietnam, Philippines, Pakistan, and Bangladesh will all experience CAGR north of 24% through 2015, although, admittedly, they are all growing from a small base (see Figure 4). Vietnam's PC use will grow from almost 1 million today to 14 million in 2015, while the Philippines will grow from 3.7 million today to more than 39 million in 2015. Both countries have populations that are more than 80 million, but that's where the similarities end. Seventy-four percent of Vietnam's population is rural, versus 39% in the Philippines, and Vietnam is investing about 37% of GDP in infrastructure, compared with the Philippines at a 17% investment rate. Vietnam's economy is growing much faster, but personal income is about half. Vietnam — and other countries in the region — hope to benefit from rising labor costs in China and become the next destination for low-cost manufacturing. Vietnam's entry into the World Trade Organization earlier this year, plus a threefold increase in foreign direct investment (FDI) in 2006 over 2005, suggests that while near-term banking, tax, and governance reforms could be painful, the long-

term outlook for the country is good.[13] Bangladesh and Pakistan will both try to ride India's coattails but have annual population growth rates between 2% and 2.5%, severely underfunded educational systems, and large-scale poverty problems, despite strong GDP growth rates. Indonesia is on the road to recovery after the tsunami of 2005, but the tragedy set the country back many years. Nevertheless, PC usage will grow at a 24% clip — rising from about 3 million today to almost 30 million by 2015.

Figure 4 Forecast: APAC PC Adoption, 2003–2015



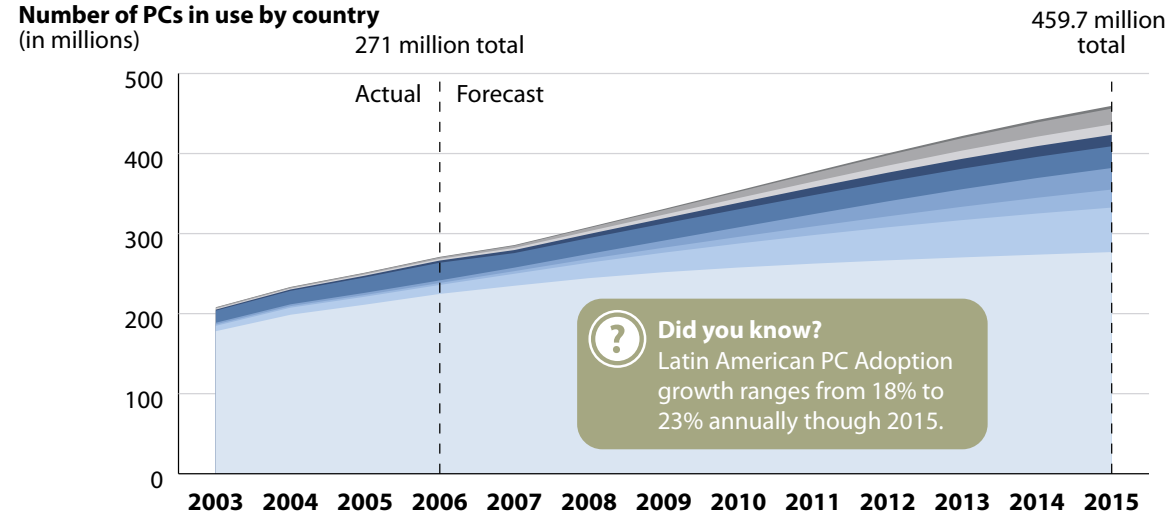
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
New Zealand	1.5	1.2	1.5	1.9	2.1	2.3	2.4	2.6	2.7	2.7	2.8	2.8	2.9
Singapore	2.1	2.3	2.5	2.7	4.6	4.7	4.8	4.9	4.9	5.0	5.0	4.9	4.9
Hong Kong	2.7	3.1	3.7	4.4	5.3	5.7	6.0	6.2	6.4	6.5	6.6	6.7	6.8
Australia	10.0	10.9	12.2	13.7	14.2	14.7	15.0	15.3	15.6	15.8	16.0	16.2	16.4
Taiwan	5.0	7.6	9.6	12.1	13.5	14.9	16.0	16.8	17.4	17.8	18.1	18.4	18.6
Malaysia	2.9	3.6	4.1	4.6	5.6	7.1	8.6	10.1	11.5	12.6	13.6	14.4	15.1
South Korea	16.7	20.9	23.4	26.1	29.9	31.3	32.3	33.2	33.8	34.3	34.7	35.0	35.3
Thailand	1.7	2.5	3.1	3.9	5.7	8.2	11.3	15.0	18.9	22.8	26.3	29.3	31.7
Philippines	1.7	2.3	2.9	3.7	5.5	7.5	10.2	13.5	17.7	22.5	27.9	33.6	39.4
Vietnam	0.8	0.9	1.0	1.1	1.2	1.7	2.3	3.2	4.5	6.1	8.2	10.9	14.2
Japan	44.4	56.0	62.3	69.3	75.9	82.1	86.8	90.1	92.4	94.0	95.1	95.9	96.5
Bangladesh	0.3	1.0	1.3	1.8	3.1	4.1	5.6	7.4	9.8	12.8	16.6	21.1	26.5
Pakistan	0.6	0.6	0.7	0.9	1.0	1.4	1.9	2.6	3.6	4.8	6.5	8.7	11.6
Indonesia	2.4	2.5	2.8	3.1	3.3	4.5	6.0	8.0	10.6	13.8	18.0	23.2	29.4

Source: *The Economist Pocket World In Figures* (2004,2005,2006, and 2007 editions) and Profile Books (2003,2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

- **The Americas will add 189 million new PCs.** With the United States and Canada chipping in about 57 million new PC users, Latin American countries — excluding Brazil — will add about 120 million new PC users by 2015 (see Figure 5). Chile will lead the way with 23% CAGR — rising from less than 2 million PCs in use today to almost 20 million in use in 2015. Colombia and Argentina both have PC growth rates of around 22%, followed by Peru at 21%, Venezuela at 19.5%, and Mexico and Bolivia both at 18%. Latin America as whole is experiencing a period of stability and, as a region, is plodding along at between 3% and 4% GDP growth after years of financial mismanagement and hyperinflation. Wealth concentration across the continent is the highest in the world, with every country in our model having Gini scores ranging from 49 in Bolivia to 57 in Brazil. With its rich natural resources and growing prominence in the bio-fuel craze, Latin America's economic future looks promising, but in order to hang on to political power, leaders baulk at reforms that would fuel growth and sustain lavish entitlement programs and arcane labor laws to keep poorer voters happy.

Figure 5 Forecast: North And South American PC Adoption, 2003–2015



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bolivia	0.4	0.5	0.5	0.6	0.9	1.1	1.4	1.7	2.0	2.4	2.7	3.1	3.4
Chile	1.3	1.4	1.6	1.9	2.7	4.0	5.7	7.8	10.3	13.0	15.5	17.8	19.7
Venezuela	1.3	1.3	1.7	2.1	2.7	3.5	4.6	5.9	7.3	8.8	10.3	11.8	13.2
Peru	1.3	1.7	2.2	2.7	3.8	5.1	6.5	8.1	9.6	11.1	12.3	13.4	14.3
Canada	15.1	16.8	19.3	22.1	18.2	19.8	21.3	22.6	23.7	24.7	25.6	26.4	27.2
Argentina	2.0	2.3	2.7	3.2	4.4	6.3	8.9	11.9	15.3	18.7	21.9	24.7	26.9
Colombia	1.8	1.9	2.2	2.5	3.3	4.6	6.2	8.3	10.8	13.7	16.7	19.7	22.5
Mexico	6.7	8.8	10.0	11.2	15.0	19.4	24.4	29.9	35.7	41.3	46.6	51.4	55.6
United States	178.1	198.6	211.3	224.7	234.8	244.4	251.8	257.6	262.5	266.6	270.3	273.7	276.9

(numbers have been rounded)

Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

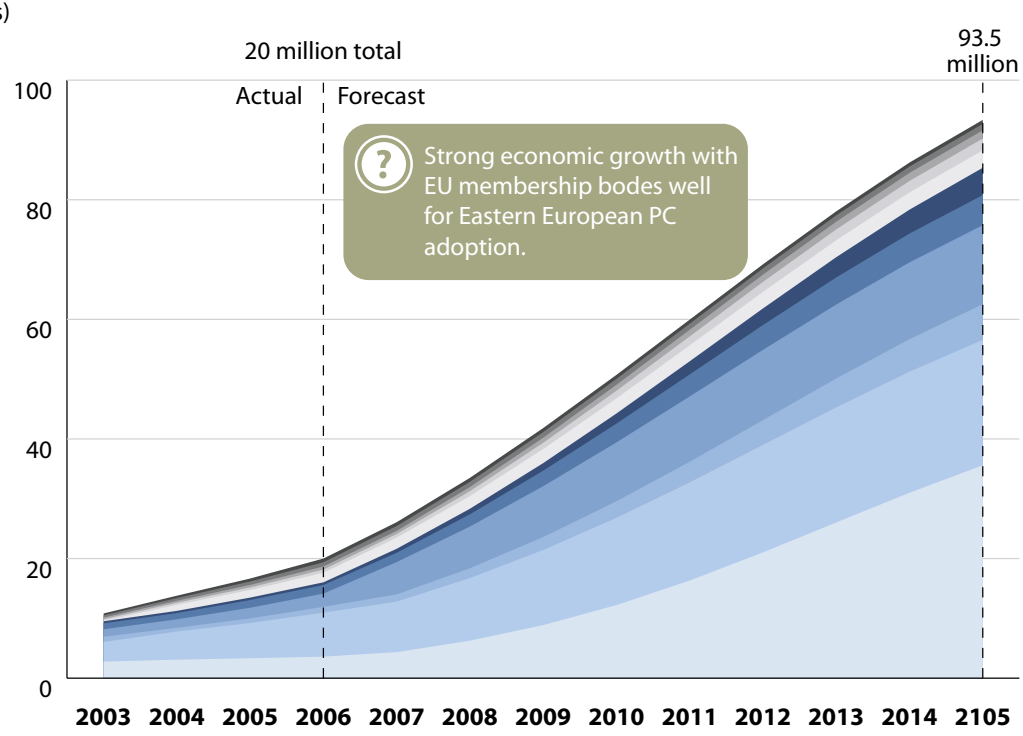
- **The rising economies of Eastern Europe will add 74 million PC users.** Some countries in Eastern Europe look promising to PC technology vendors, but with varying levels of economic development and technology adoption, the region is characterized by more differences than similarities (see Figure 6). In May 2004, when the European Union (EU) welcomed eight Central and Eastern European countries into the fold, most of these countries had GDPs per capita that were half that of the legacy EU-15 countries and unemployment rates of more than 10% in five of the eight countries.[14] Some headway has been made in the intervening years, though, with unemployment cut in half or more in some countries and a doubling of GDP per capita in others. PC adoption has been mixed overall, too. The Czech Republic almost doubled the number of PCs in use between 2003 and 2006 and Poland achieved even higher PC growth on the back of foreign investment that exceeded $10 billion in 2006 and GDP growth north of 3.7%.[15] Lithuania, Estonia, and Latvia continue to languish despite relatively strong growth. One bright spot for these countries, however, is the public investment in education that is on par or better than their legacy EU-15 partners. Bulgaria is rising too — as an ex-pat destination for upper-middle-class Western Europeans with money to invest and spend in the country.

- **Western Europe — still not saturated — has room for growth in certain countries.** There is still room for growth in the mature PC markets of Western Europe — which will add another 97 million PCs in use — although the CAGR is expected to be in the 1% to 4% range through 2015 for the region as a whole (see Figure 7). While many countries such as the United Kingdom, Switzerland, and the Netherlands are reaching the tail end of their new PC growth cycles, countries like Spain, Italy, France, Belgium, and Germany are still at the midpoint or a little beyond their ultimate saturation levels. Germany's economy, for example, is starting to pick up speed again after a long period of stagnation in the 1990s brought on by chronic unemployment issues; falling investments in infrastructure and education; high interest rates; flat domestic consumption; inefficient public enterprises; and rigid, labor-friendly laws. There is no doubt that similar structural issues have held back France, Italy, and Spain as well.

- **Middle East and Africa will add 118 million new PCs.** Our forecast includes 13 countries from the Middle East and Africa that will account for more than 118 million new PC users by 2015 (see Figure 8). The four largest African nations by population — Nigeria, Egypt, South Africa, and Kenya, with a total population of about 276 million — will see CAGR in PC use of 47%, 26.5%, 14.5%, and 29%, respectively, and account for more than 50 million new PCs. In the Middle East, Iran boasts about 7.8 million PCs today — up from 5 million in 2003 — and is entering the early hypergrowth period that will drive adoption up to almost 40 million by 2015, a CAGR of almost 17.3%. Saudi Arabia's PC growth of 14% will take PC usage from nearly 8 million today to more than 19 million in 2015. The good news for Saudi students is that the country spends more than 8% of its GDP on education, giving technology vendors an excellent opportunity to support institutional programs designed to introduce more students to technology at an early age.[16]

Figure 6 Forecast: Eastern European PC Adoption, 2003–2015

Number of PCs in use by country
(in millions)



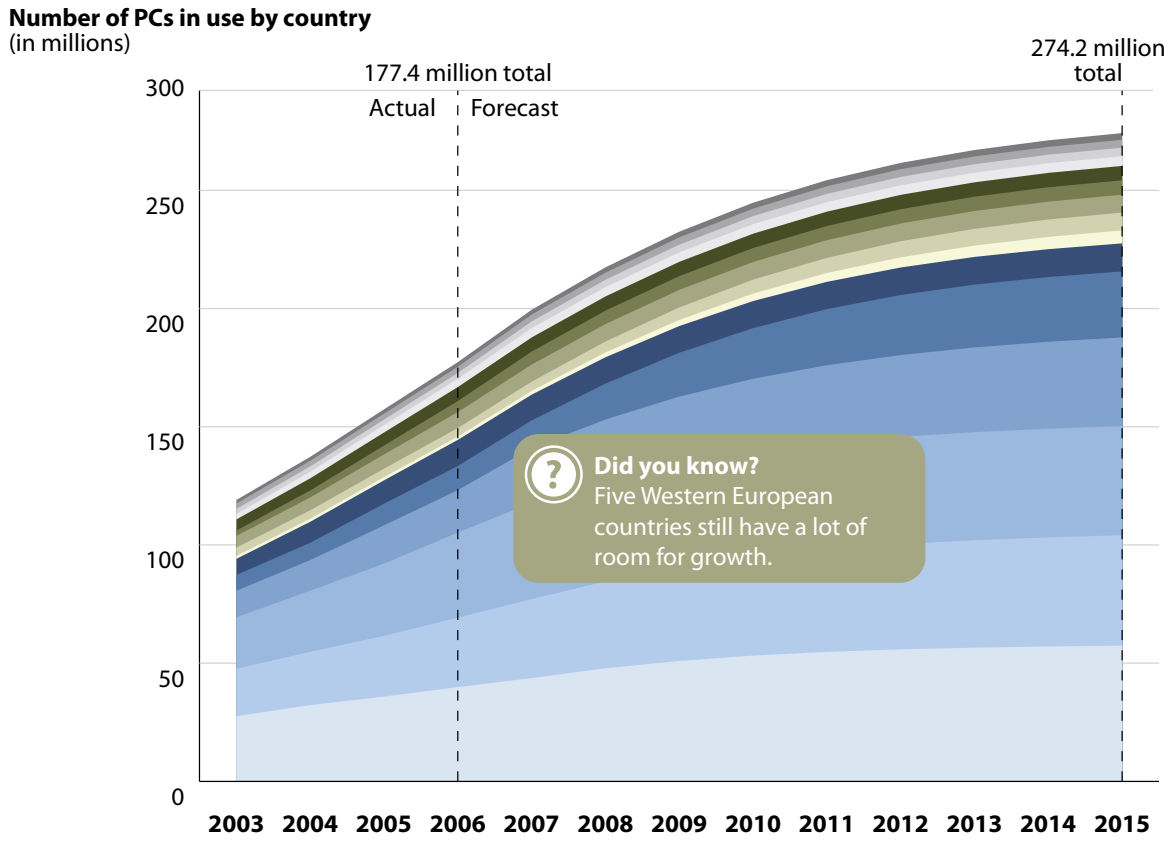
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2105
Estonia	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Slovenia	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
Latvia	0.3	0.3	0.4	0.5	0.5	0.7	0.9	1.0	1.1	1.2	1.3	1.3	1.4
Lithuania	0.3	0.3	0.4	0.5	0.6	0.8	1.0	1.3	1.5	1.7	1.8	1.9	2.0
Slovakia	0.1	1.0	1.3	1.6	1.9	2.1	2.4	2.5	2.7	2.8	2.8	2.9	2.9
Bulgaria	0.4	0.4	0.4	0.5	0.7	0.9	1.3	1.7	2.2	2.8	3.4	4.0	4.6
Hungary	1.0	1.0	1.3	1.4	1.6	2.1	2.6	3.2	3.7	4.2	4.5	4.8	5.0
Czech Republic	1.3	1.4	1.8	2.2	5.4	7.0	8.5	9.8	10.9	11.8	12.4	12.8	13.2
Greece	0.9	0.6	0.8	1.0	1.2	1.6	2.2	2.8	3.5	4.1	4.8	5.4	6.0
Poland	3.3	4.7	5.9	7.4	8.4	10.5	12.6	14.6	16.4	18.0	19.3	20.2	21.0
Turkey	2.8	3.1	3.3	3.6	4.4	6.3	8.9	12.2	16.3	21.0	26.0	31.0	35.6

(numbers have been rounded)

Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

Figure 7 Forecast: Western European PC Adoption, 2003–2015v



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Ireland	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.8
Norway	2.3	2.4	2.5	2.6	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.3	3.3
Finland	2.2	2.2	2.4	2.5	2.9	3.1	3.3	3.4	3.5	3.5	3.6	3.6	3.6
Denmark	2.3	2.8	3.1	3.5	3.9	4.0	4.0	4.0	4.1	4.1	4.1	4.1	4.1
Switzerland	4.7	5.1	5.5	5.9	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.1
Austria	2.3	3.0	3.7	4.7	5.5	5.7	5.8	5.9	6.0	6.0	6.1	6.1	6.1
Sweden	4.9	5.4	6.0	6.7	7.3	7.4	7.4	7.5	7.5	7.5	7.5	7.6	7.6
Belgium	3.6	3.6	3.6	3.6	3.9	4.6	5.3	5.9	6.4	6.8	7.1	7.4	7.5
Portugal	1.2	1.3	1.3	1.4	1.6	2.1	2.6	3.2	3.8	4.3	4.8	5.2	5.5
Netherlands	6.8	8.9	9.9	11.1	10.9	11.1	11.3	11.4	11.6	11.6	11.7	11.8	11.9
Spain	6.7	7.3	9.2	10.2	11.7	15.2	18.5	21.4	23.7	25.4	26.6	27.4	27.9
Italy	11.2	13.0	16.2	17.9	23.1	26.1	28.8	31.1	33.0	34.6	35.8	36.8	37.5
United Kingdom	21.8	25.9	30.5	36.0	40.8	42.4	43.5	44.4	44.9	45.4	45.7	46.0	46.2
France	20.1	22.5	25.7	29.4	33.4	36.8	39.6	41.7	43.3	44.5	45.5	46.2	46.7
Germany	27.6	32.2	35.8	39.9	43.7	47.8	50.9	53.2	54.8	55.8	56.6	57.0	57.4

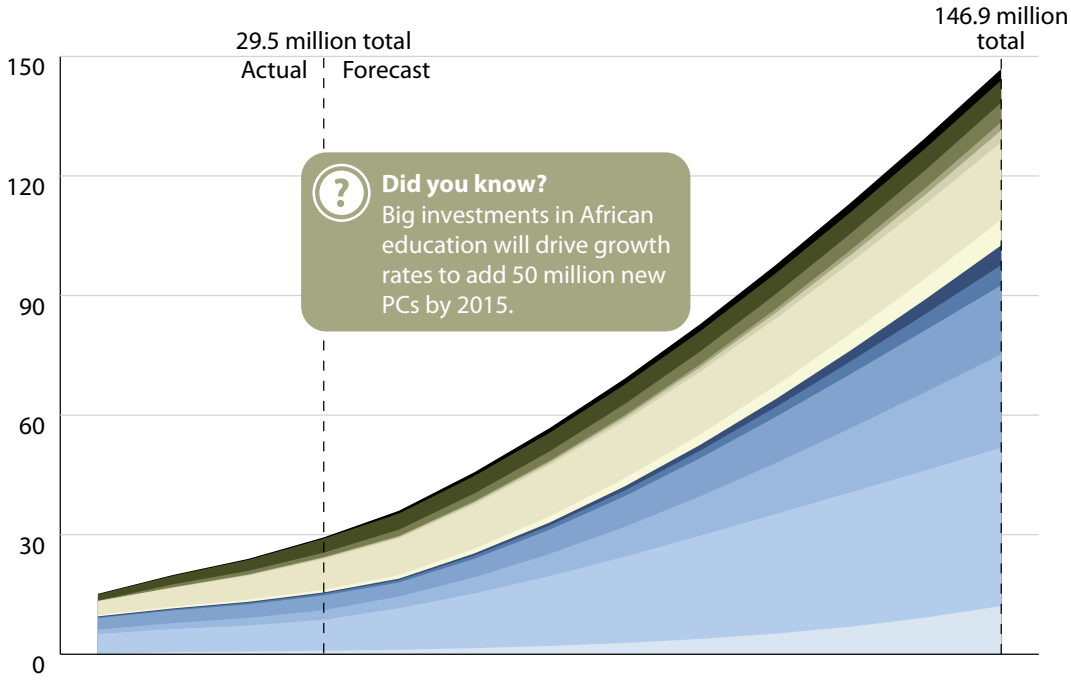
(numbers have been rounded)

Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

Figure 8 Forecast: Middle East And African PC Adoption, 2003–2015

Number of PCs in use by country
(in millions)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
United Arab Emirates	0.2	0.2	0.3	0.3	0.7	0.9	1.2	1.5	1.8	2.1	2.4	2.6	2.8
Israel	1.5	2.2	2.8	3.5	4.1	4.4	4.7	4.9	5.1	5.2	5.4	5.5	5.6
Zimbabwe	0.2	0.7	0.9	1.1	1.6	1.9	2.4	2.8	3.3	3.7	4.1	4.5	4.9
Cameroon	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.7	1.0	1.3	1.6	2.1
Cote d'Ivoire	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.1	1.4	1.9	2.4	3.0
Saudi Arabia	3.4	4.7	6.1	7.8	9.3	11.2	12.9	14.5	15.8	16.9	17.8	18.7	19.4
Morocco	0.4	0.5	0.6	0.7	0.9	1.2	1.6	2.0	2.6	3.3	4.2	5.3	6.5
Algeria	0.2	0.2	0.3	0.3	0.4	0.5	0.7	1.0	1.4	2.0	2.7	3.7	4.9
Kenya	0.2	0.3	0.4	0.5	0.6	0.8	1.1	1.4	1.9	2.5	3.2	4.1	5.1
South Africa	2.9	3.2	3.4	3.7	3.5	4.6	6.1	7.7	9.6	11.6	13.6	15.5	17.3
Egypt	1.1	1.5	1.9	2.4	2.9	4.1	5.6	7.5	9.9	12.8	16.1	19.7	23.5
Iran	5.0	5.8	6.5	7.8	10.4	13.7	17.5	21.7	25.9	30.0	33.7	37.0	39.7
Nigeria	0.1	0.5	0.7	0.9	1.1	1.5	2.1	2.8	3.8	5.2	6.9	9.2	12.1

(numbers have been rounded)

Source: *The Economist Pocket World In Figures* (2004, 2005, 2006, and 2007 editions) and Profile Books (2003, 2004, 2005, and 2006)

42496 Source: Forrester Research, Inc.

THE TIME IS RIGHT FOR A WAVE OF PC ADOPTION IN EMERGING MARKETS

Forecasting the adoption of a current platform too far into the future is always risky business. The pace of technology change, particularly in personal computing, is very fast and can have a radical impact on product design and on the cost of computing. Emerging PC markets — those countries with less than 10% overall adoption — now have the chance to leapfrog the quarter of a century of technology development that the mature computing markets had to endure to get the right computing tools for their people at dramatically lower cost.

New Technology Will Help Emerging Markets . . .

Today's PC platform was designed for the developed market based on a quarter of a century of in-the-field testing, and this platform will serve the next billion users just fine — as long as PC prices continue to fall, income levels rise to justify the investment, and distribution channels are strong enough to support the growth. However, the ecosystem of PC technology suppliers will need to develop:

- **New hardware form factors, custom-built for emerging PC markets.** PCs that would have cost $1000 or more a few years ago, or weren't even possible due to the economics of the PC industry, will soon be offered in emerging markets for one-tenth of the cost and will be purpose-built to address the power and infrastructure challenges that many regions face. New approaches to hardware — like Intel's Classmate PC and the One Laptop per Child (OLPC) XO laptop — continuously push hardware designs to new levels of relevance for the next billion users and will push hardware prices to as low as $100 over time.

- **Low-cost, relevant software packages that will redefine education.** Schools can take the educational tools and methodologies developed for the first billion users and overhaul their current teaching methods and curriculums quickly to create a better educated and more technology-aware population. Software packages like the Microsoft Student Innovation Suite, which includes Windows Starter Edition, Microsoft Office, and math and email programs, is available for $3 to governments and educational institutions in emerging markets.

- **Partnerships to build connectivity infrastructure in disconnected regions.** Partnerships between technology suppliers, communications providers, and government agencies can drive broader availability of wireless Internet access and connectivity to remote regions of the world at a fraction of the cost. In 2006, Intel, the United States Agency for International Development (USAID), and Vietnam Data Communication Company joined forces to install WiMAX in Lao Cai, a city in the mountainous, rural north of Vietnam, to provide broadband Internet and voice over IP (VoIP) telephony to the city's disconnected citizens.

. . . But New Markets Will Be Challenging And Volatile

Reaching the first billion PC users took a quarter of a century of technology investment and development, plus a lot of in-the-field testing by buyers whose expectations of the platform

increased with each incremental generation of technology. If they liked what they saw, they'd go out and buy a new one every few years. If they wanted to be the first to have it, they would pay a premium. This dynamic gave the whole PC industry valuable insight into capabilities that drove replacement behavior and pretty accurate timelines about when we could expect it to happen. From now on, things will get much harder to predict. Why?

- **High-volume launches into unpredictable markets are risky.** To reach new potential PC users in emerging markets, vendors won't have the luxury of introducing products on a small scale to test the market before going into full production. The economics will force suppliers to focus on bringing volume to market quickly at a much greater risk. As an example, a September 2006 coup threw out the prime minister of Thailand and installed a new government with less interest in the OLPC project. Next, a production delay announcement — unrelated to the Thai announcement — pushed off production of the systems until late 2007, and investors are skeptical of the program's ability to scale. A Merrill Lynch report states that "some research institutions . . . predict that the sub-$200 market will pick up 68 million units in 2010 from 7 million in 2007 . . . We expect the market to start realizing the difficulty of ramping up the OLPC project and to start cutting shipment forecasts in the 2H07."[17] Clearly, the challenges around planning and execution in this kind of market are totally different than the way we currently think about the PC industry.

- **Long life cycles mean a limited replacement market for the first 10 years.** PC refresh cycles in mature markets average between four and five years for desktops and a little less for laptops. This allows vendors to introduce new technologies and capabilities on a fairly regular cycle, knowing that, for the most part, they can introduce new products and sell them with strong demand for at least a few years before they reach the tail end of the growth cycle. How long will new PC users in emerging markets hold onto to their machines before replacing them? No one really knows the answer, but it is probably safe to assume that refresh cycles will start out long and shorten gradually in the following years. The long life cycles may make it easier to optimize supply chains around specific systems, but it won't help suppliers sustain revenue growth through sales.

- **System vendors with the capital to sustain production aren't involved yet.** Despite the efforts of Microsoft Unlimited Potential, the Intel World Ahead Program, AMD 50x15, and OLPC, major system vendors like HP, Dell, Lenovo, Acer, and Toshiba also need to step up. It is these firms that have the infrastructure and the access to capital needed to scale production enough to ship five times the number of systems at one-fifth of the cost. Contract manufacturers like Quanta in Taiwan — the manufacturer for OLPC — are perhaps better equipped to deal with long-life-cycle and high-volume production, but they also won't want to tie up their factories for long periods at the expense of other potential deals. The major system vendors need to get on board, but investors may not place enough value on corporate citizenship to support the effort.

WHAT IT MEANS

VENDORS IN THE PC MARKET NEED A REAL PLAN FOR EMERGING MARKETS

There is nothing more important to the long-term health of the ecosystem of personal computing hardware and software vendors than a successful strategy for emerging markets. Why?

- **Business opportunity.** The vast majority of the growth of new PC use in the PC industry during the next 10 years will come from emerging markets where PC adoption is low, but the use of other computing and communication devices is growing. The industry can continue to sell incrementally better hardware and software to people who already have technology in their lives, but the real opportunity is in reaching new users. It took 25 years to get to the first billion, but it will take less than 10 years to reach the next billion.
- **Self-preservation.** The competitive nature of the personal computing industry means that if vendors don't find a way to reach out to new users in emerging markets, someone else will. Competitors can spring up in local markets, build a reasonable distribution channel, and use their local connections to put up barriers to entry to foreign players moving into that market. If Microsoft doesn't get Windows onto the majority of PCs in China, for example, local players like Red Flag Linux, or aggressive multinationals like Novell and Red Hat, could move in.
- **Corporate citizenship.** Big vendors like Microsoft, Intel, and Dell want to present themselves as kinder, gentler companies with the best interests of the people in the country in mind. Efforts like the Intel World Ahead Program, Microsoft Unlimited Potential, and AMD 50x15 need to be seen as more than efforts to lock users into their platforms.

Forrester believes that industry players need a healthy balance of all of the above. An effort too focused on self-preservation will be reactive, but one focused primarily on the business opportunity will lead to major investments that can take years to reap any rewards. A program that is purely based on corporate citizenship will turn off investors and put the long-term commitment of partners in the process at risk.

SUPPLEMENTAL MATERIAL

Online Resource

The underlying spreadsheet detailing the forecast in Figures 1-8 is available online.

Methodology

In this model, Forrester forecasts the PC adoption in emerging and mature nations using macroeconomic analysis of the 67 largest markets based on population. The adoption factors used to build the forecast are urbanization, education, income distribution, per capita personal income, and use of Internet and other technologies. We forecast adoption using a time-tested approach: logistic growth curves. Each country receives a score for each adoption factor — which generates the growth curve. Adjustments are made in some cases to address country-specific issues and these adjustments are called out in the Adjusted Growth Factors tab on the model spreadsheet.

Companies Interviewed For This Document

AMD

Intel

Microsoft

One Laptop per Child (OLPC)

ENDNOTES

[1] In 2004, Forrester said that there were 575 million PCs in use and that the mature markets in North America, Europe, and Asia would add an additional 150 million PCs in use by the end of the decade. Forrester also predicted that more than half a billion PCs would come from the 16 emerging markets we looked at a CAGR of about 31% between 2003 and 2010. See the December 10, 2004, "Sizing The Emerging-Nation PC Market" report.

[2] In this report, PC adoption is the ratio of PCs in use relative to the population. As a result, the forecast does not distinguish between consumer and business use, and we use the terms "PCs in use" and "PC users" interchangeably.

[3] For the purposes of this report, Forrester defines the "PC platform" as a system that includes the complete PC technology stack, including a central processing unit (CPU) running a 16-bit or greater processor, internal or attached local storage, a full PC operating system like Windows XP or Novell SUSE Linux, a keyboard, and a display of at least 7 inches.

[4] Finicky customers, ruthless competition, and stringent regulations are accelerating demand for technology-enabled innovation. But supply-side deficiency and ineffectiveness hamper firms' ability to convert inventions into profitable innovations. The result? A new market ecosystem called Innovation Networks will emerge to match global demand for innovation with worldwide supply. Innovation Networks will

let firms fluidly weave internally and externally available invention and innovation services to optimize the profitability of their products, services, and business models. Innovation Networks will deconstruct vertically integrated invention-to-innovation cycles in software, finance, and CPG industries, and will reinvent the formula for success in regional, national, and global markets. See the June 17, 2004, Forrester "Innovation Networks" report.

[5] Forrester's logistic, or S-curve modeling, technique, provides a clear analytic framework that product planners, marketers, and investors can download and adapt to gain confidence in their consumer technology forecasts. Forrester uses S-curve modeling as a foundation for its US forecast of 14 consumer technologies. See the October 18, 2004, "How To Forecast Consumer Technology Adoption" report.

[6] In the first report, we used a single year, 2003, as the baseline for the "actuals." *The Economist* provides the most credible, publicly available data that we have found for all 67 countries in the model. We pulled population data from The World Bank statistics to calculate the number of PCs in use by country.

[7] There are no universal standards for adult literacy, as different countries use their own standards. For the purposes of this study, we define "adult literacy" as the ability of people at a specific age (generally 15 years and above) to read and write. Detailing the standards that different countries use to define "adult literacy" is beyond the scope of this report but is based on literacy statistics in at least two sources, such as the CIA's The World Fact Book 2007 and The World Bank. Source: Central Intelligence Agency (https://www.cia.gov/cia/publications/factbook/index.html)

[8] The Gini Index, published by The World Bank, measures income distribution among individuals within a country to determine to what degree income distribution deviates from a perfectly even distribution among the entire population. A 0 Gini Index score would indicate perfect equality — everyone earns the same. A 100 Gini Index indicates perfect inequality — that one person controls all the wealth.

[9] Sixty-nine percent of US consumers plan to spend less than $1250 on their next PC. With personal per-capita income in the US at $37,500, a $1250 PC would cost the equivalent of 3.1% of annual personal income. Today, a low-end Windows-based PC in the US costs more than $500 with a monitor, but even a barebones PC built from recycled parts is still out of reach for a large portion of the population in emerging markets. See the September 24, 2004, "'Black Box' PCs Won't Halt Commodization" report.

[10] Personal income per capita is calculated using the purchasing power parity (PPP) method that measures the relative purchasing power of different countries' currencies over the same types of goods and services. Because goods and services may cost more in one country than in another, PPP allows for a more accurate comparison of standards of living across countries. PPP estimates use price comparisons of comparable items, but since not all items can be matched exactly across countries and time, the estimates are not always "robust." Source: World Development Indicators database, The World Bank, July 2004.

[11] This Data Overview is a graphical analysis of Forrester's NACTAS 2006 Benchmark Survey. It is our annual guide to technology adoption and forecasts, demographics, attitudes, and online behavior based on a mail survey of 66,707 households. See the July 27, 2006, "The State Of Consumers And Technology: Benchmark 2006" report.

[12] Fueled by rising personal incomes and high literacy rates, Forrester expects Chinese PC adoption to break the 200-million-user barrier by 2010 — a CAGR of 28%. AMD, Dell, Intel, and Microsoft have established a strong foothold in the early market as Chinese buyers gravitate toward Western brands, but local manufacturers like Lenovo are expanding into previously untapped markets within China with lower-cost desktops and notebooks. See the December 13, 2004, "Trends In The Chinese PC Market" report.

[13] Source: The World Bank, Database of Statistics

[14] The former Eastern Bloc countries that have joined the EU are years behind Western Europe — both in their general economic situation and their ability to invest in communications services. The Central and Eastern European (CEE) region is far behind Western Europe economically. Most CEE countries have a per capita GDP — in purchasing power standards — that is half that of the legacy EU-15; unemployment rates are higher in most CEE countries, too. Poland's total GDP, for example, matches that of Austria, but Poland has a population five times the size of Austria. Poland has been hit particularly hard by the economic downturn, and, as a result of its strong economic ties with Germany, Poland seems to have suffered the most during the recession. Annual GDP growth slowed to 1%, and unemployment increased to almost 20% during 2001 and 2002. See the June 24, 2004, "Central And Eastern Europe: Go Wireless" report.

[15] Source: The World Bank, Database of Statistics

[16] Only Hong Kong, Switzerland, and Denmark spend more than 8% of their GDP on education.

[17] Merrill Lynch is raising concerns about the risks associated with OLPC and advising its clients to lower their expectations. Source: "OLPC — Another Blue Sea Or A Bubble?" Merrill Lynch, March 2007.

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