

## Chapter 6

### **Globalization Of Wireless Markets**

#### *From Original Demand to Replacement Demand*

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In the wireless industry, sustaining developments have boosted incumbent leaders through successive waves of wireless innovation.<sup>1</sup> In turn, disruptive change has allowed challengers and new entrants to redefine competitive rules, even if the disruptive moments have been relatively rare and brief.<sup>2</sup> Concurrently, functionalities have been upgraded from the primitive pre-cellular technologies to analog, digital, and multimedia cellular, which will be followed by broadband platforms. Overall, wireless evolution has progressed over several transitions:<sup>3</sup>

#### *Wireless Telegraphy*

- 1 On the full role and historical function of R&D in the globalizing wireless business, see Steinbock, D., 2002, *Wireless horizon* (Amacom Books, New York), Chapter 10; Steinbock, D., 2001, *The Nokia revolution* (Amacom Books, New York). See also Steinbock, D. (2002) "Globalization of Wireless R&D", INFO, [Forthcoming].
- 2 Here disruption is defined broadly, in terms of disruptive business models. The latter are discontinuous and radical, and offer a new and different value proposition. They are not confined to technology development alone, but can affect any activity or set of activities in the value chain. For a narrower, technology-driven definition of sustaining and disruptive business models, see Christensen (1997).
- 3 On wireless innovation through ages, see Steinbock, D., 2002, *Wireless Horizon* (Amacom Books, New York), Chapter 2.

- Marconi’s commercial innovation (wireless telegraphy)

#### *Pre-Cellular Phase*

- Emergence of AM wireless communications (U.S. police departments)
- Transition to FM communications (defense forces) and the subsequent MTS and IMTS (consumer test markets) in America

#### *Cellular Phase (Dominant Platforms)*

- 1G Era: Analog Cellular (AMPS)
- 2G Era: Digital Cellular (GSM)
- 3G Era: Multimedia Cellular (W-CDMA)
- 4G Era: Broadband Cellular

In the wireless business, it is this interplay of technology change and market evolution that has driven the industry from the early market creation of the pre-cellular era to the regional penetration of the cellular era. From 2000 to 2002, the birth pains of the 3G transition were not due to technology issues alone. The problems were in the opposite direction. Over time, the thrust of change has shifted from upstream activities (technology) to downstream activities (markets), as original demand has been replaced by replacement demand.

## **1. EARLY MARKET CREATION**

Initially, customers were not wedded to any specific design or company, and industry standards were rudimentary. After the market launch, vendors and operators have sought first to *create* the customers, then to *retain* them, and finally – prior to the shift to next-generation services – *renew* their customer base. These phases have characterized the pre-cellular era (naval communication, police wireless pioneers, FM wireless during World War II, MTS, and IMTS), as well as the 1G and 2G eras.

### **1.1 Wireless Telegraphy: Naval Communication**

In the pre-World War I era, all early radio pioneers built their business models on navy contracts. Through the 1910s, primary opportunities and clients were in the shipping and maritime segments. Marconi’s first order was from Lloyds of London for communication to lightships. In 1900, it was followed by the Royal Navy’s order for 32 wireless sets for a total cost of £6,000 with a continuing royalty payment of £3,200 annually. This business

model – an initial payment for equipment and an ongoing revenue flow – became central to Marconi's wireless strategy, which he replicated in his dealings with the French government and shipping firms worldwide.<sup>4</sup>

## 1.2 AM Communications: Police Pioneers

The earliest use of electronic communications in law enforcement may have occurred in 1845 by the New York Police Department, which used a telegraph system to link signal boxes for patrolmen with their station houses. In 1920, a radio station was issued to the NYPD. A year later, Detroit's police began pioneering experiments in wireless communications. The earliest efforts toward wireless communications among people and vehicles were taken by the police departments in Britain and the United States. Until the 1920s, wireless radio communications used the Morse code. Even Marconi had not been able to extend the maritime properties on ground. The pioneers of the ground wireless did not test their equipment through learning-by-doing, but through learning-by-using. They were cops. Indeed, the first land mobile systems were used by public safety agencies, mainly police departments. In these pursuits, Detroit's department became a pioneer of wireless communications as a result of motorization and Prohibition.

## 1.3 FM Communications: The Impact of World War II

In 1940 and 1941, Bell Labs and Western Electric were commissioned to undertake the development of wireless communications systems for military vehicles, including tanks and military aircraft. As the U.S. defense forces opted for the FM, great advances were made in size, cost, performance, and reliability. In late 1940, a Motorola engineering team produced prototypes of the five-pound *Handie-Talkie* radio, an AM unit with a range of one mile. The shortcomings of the SCR-536 *Handie-Talkie* radio, especially short range and static interference, led the company to continue R&D of another product early in the war. Beating the rival manufacturers, the Galvin SCR-300, a high-frequency FM unit, proved the superior entry. With its 35-pound backpack, and a range of 10 miles or more, it could be tuned to various frequencies and had stable frequency calibration. These *Walkie-Talkies* were used throughout Europe and the Pacific and provided critical radio links at Anzio, Guadalcanal, Iwo Jima, and Normandy.

4 See Garrard, G.A. (1998) *Cellular Communications: Worldwide Market Development* (Boston: Artech House), Chapter 1.

## 1.4 Commercialization of Mobile Services: From MTS to IMTS

By 1945, the Federal Communications Commission began to explore spectrum allocations for a variety of uses in industrial services: police and fire departments, forestry services, electric, gas and water utilities, as well as transportation services, including taxis, railroads, buses, streetcars, and trucks. On June 17, 1946, in Saint Louis, Missouri, AT&T and Southwestern Bell introduced the first American commercial mobile radio-telephone service to private customers. These systems were based on FM transmission and used a wide-area architecture, with a single powerful transmitter offering coverage to 50 miles or more.

Through incremental advancements, the MTS evolved into the *improved* Mobile Telephone Service (IMTS), which was tested in field trials in Harrisburg, Pennsylvania, from 1962 to 1964. A commercial service was introduced in many metropolitan centers, forcing the FCC to engage in substantial spectrum allocation.<sup>5</sup> As soon as the wireless was launched in major U.S. cities, waiting lists proliferated and the systems became oversubscribed. In 1976, just 545 subscribers in New York City had Bell System mobiles, while 3,700 remained on a waiting list. More than 20 million people had only 12 available channels.<sup>6</sup> By 1983, there were some 150,000 mobile telephones in the U.S., but they used low-technology systems and could not expand, due to a lack of available frequency channels. The few privileged users had a very poor service.

## 2. REGIONAL PENETRATION

Since the early 1990s, the wireless revolution has proceeded rapidly in North America, Western Europe, and Asia Pacific (**Figure 1**).

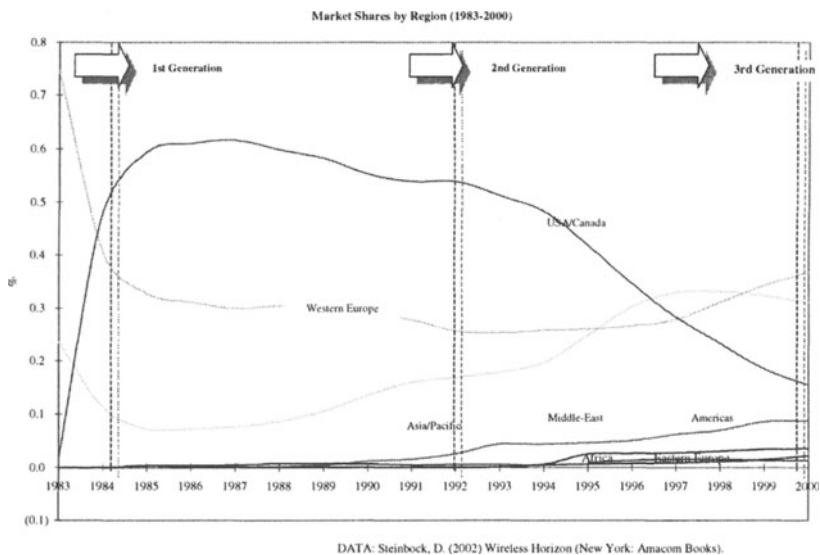
### 2.1 The Pre-Cellular Era: U.S. Superiority

Due to the limited distribution, the U.S. advantages in nascent wireless communications enabled little appropriation. Without thriving markets, the business meant investments and expenditures rather than cash flow and profitability. Moreover, as U.S. regulators stumbled, rivals were rapidly

<sup>5</sup> As reflected by its name, the IMTS was an enhanced version of the original MTS. Indeed, this concept represented the peak of three decades of pioneering developments. It relied on a narrowband FM channel, automatic trunking, direct dialing, full-duplex service, and other critical "modern" features. These were the intrinsic technologies of the pre-cellular era.

<sup>6</sup> Lee, W.C.Y. (1982) *Mobile Communications Engineering* (New York: McGraw-Hill).

catching up in Japan and Western Europe, particularly in Nordic countries. By the mid-1960s, Swedish telecom authorities began to outline a joint Nordic standard, which was defined by the end of the decade. Meanwhile, U.S. players opted for technology solutions, which built upon closed and proprietary models that made national roaming impossible, whereas Nordic players chose open specifications that built upon interdependence across northern Europe. During this era, Japanese developments were not that different strategically from those in the United States. Through substantial technology investments, NTT and its family of suppliers tried to catch up with U.S. players in order to introduce their own closed and proprietary models.



*Figure 1*

Because of their corporate mission, the Nordic PTTs sought technology solutions that would match the egalitarian culture of their mixed economies. In practice, this meant low-cost strategies that boosted rapid penetration. In the United States, a lucrative and large country market favored domestic strategies by the central wireless players. As long as foreign markets remained regulated, they did not attract U.S. players. In the Nordic countries, these competitive circumstances were almost the reverse. The home markets were small, became saturated rapidly, and allowed for little volume. Access to worldwide markets was a precondition of success. The early deregulated foreign markets (the U.K., the United States) provided the greatest pull motive. Strategic advantages could be created only by focusing *outside* the home base. Nordic players needed scope to achieve scale. To U.S. wireless players, worldwide markets were an afterthought at best. Strategic advantages were created *inside* the home base. These players achieved scope via scale.

## 2.2 The 1G Era: U.S. Leadership

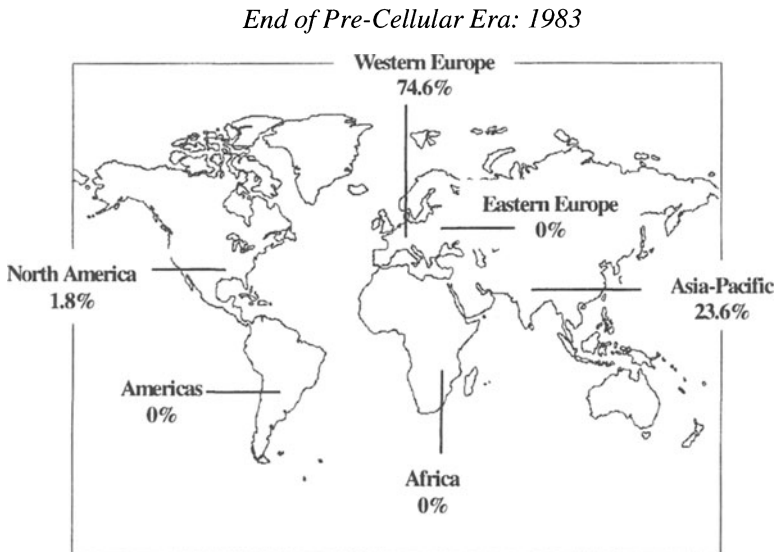
Around 1983, at the end of the pre-cellular period and amidst the transition to the 1G era, the United States continued to dominate wireless communications. Through the analog phase, a single standard (AMPS) reigned in the most lucrative country market in the world. However, the United States no longer enjoyed monopoly leadership in technology, development, or commercialization. Since the late 1960s, the Nordic countries had cooperated in the development of a common standard (NMT). In Japan, NTT launched its 1G network prior to U.S. operators, but a proprietary platform confined the standard to the national market. Due to the initially relatively high but absolutely declining Nordic numbers, Western Europe still enjoyed the highest worldwide penetration (74.6%), against Asia-Pacific, primarily Japan (23.6%), and the United States (1.8%) in 1983 (**Figure 2**). A year later, when AMPS was introduced in the United States, it soon achieved the highest relative penetration worldwide (48.3%), against Western Europe (40.5%) and Japan (11.1%). During these early years of the wireless industry, some small countries (Nordic countries in Europe, Puerto Rico near the United States, Hungary in Eastern Europe) still achieved extraordinary market shares due to relatively small penetration worldwide.

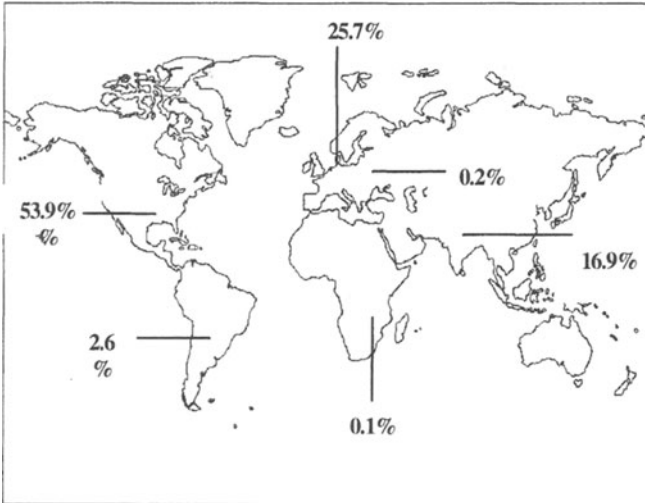
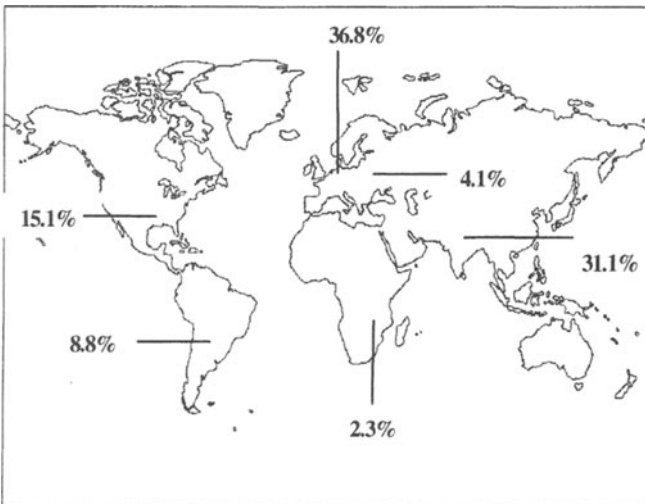
In the Americas, the United States was leader. Brief relative expansions took place in Canada, Puerto Rico, and Chile. In Western Europe, Nordic countries enjoyed magnificent market shares amidst the transition to the 1G era, but in every case – in Sweden, Norway, Denmark, and Finland – these

shares shrank rapidly toward the end of the phase. By the mid-1980s, the U.K. possessed the highest relative share in Western Europe, not least because of the early deregulation of British telecommunications. In Asia-Pacific, Japan's early lead quickly eroded. NTT favored proprietary technologies rather than open specifications and it was not allowed to compete in foreign markets, due to esoteric Japanese regulations. Toward the end of the 1G era, Australia's relative penetration rose rapidly. In Eastern Europe, absolute penetration was low until the end of the Cold War. As a result, Hungary's activity in wireless communications translated to a substantial lead until the rise of digital cellular.

Although the Nordic countries had been able to launch 1G networks *before* U.S. rivals, the powerful national PTTs in continental Europe opted for proprietary standards. The failure to achieve a unified regional standard fragmented the marketplace in Europe. After the mid-1980s, the European Commission noted the sources of the AMPS success in the United States and the potential of the Nordic specifications for the 2G era.

Figure 2. Regions and Market Shares: Worldwide Penetration\*



*Analog Cellular (1G): 1991**Digital Cellular (2G): 2000*

\*Africa, Asia-Pacific, Eastern Europe, Western Europe, United States, and Canada  
 Source: Steinbock, D. (2002) *Wireless Horizon* (New York: Amacom Books).



### 2.3 The 2G Era: Western European Leadership

Amidst the transition to the 2G era in 1992, the United States was the most lucrative country market and had the largest worldwide penetration. With digitalization, rapid growth migrated first to Nordic countries, then to Western Europe. As the European Commission made GSM mandatory in Europe, the regional wireless leaders – the Nordic vendors as well as a new generation of aggressive operators that were eager to challenge national PTTs – seized GSM to extend their domestic advantages on a global basis. In the United States, these developments initially went unnoticed because Motorola, the leading vendor of the 1G era, enjoyed high profitability until the mid-1990s. When the “American Samurai” finally awakened, it had lost its Samurai. Motorola would spend the second half of the 1990s to catch up with the Nordic vendors – with little success.

With the popularity of analog cellular rapidly declining, European countries accelerated the transition to GSM. The United States failed to lead the developments because its multiple standards fragmented the marketplace. In the 1G era, Western Europe witnessed the proliferation of a slate of standards, which splintered the market. Now the old continent had learned from its mistakes, whereas the United States repeated European mistakes. At the end of the 2G era, the Triad regions of the worldwide wireless competition – North America, Europe, and Asia and the Pacific Rim – grew to include China. By the end of 2000, Western Europe had the most substantial worldwide penetration (36.8%) versus Asia-Pacific (31.1%), and the United States (15.5%). In regional market shares, 1997 was a milestone year: North America lost its penetration leadership to Western Europe. Unsurprisingly, Motorola’s growth years had ended a year before.

### 2.4 The 3G Era: Triad Leadership

In 1999, Western Europe surged past North America in terms of population penetration with an extraordinary 16 point gain, bringing total penetration to more than 40% (**Figure 3**). Penetration was expected to shift the composition of subscribers worldwide by 2005. If the United States reigned in the 1G era and Western Europe dominated the 2G era, the 3G transition belonged to Japan and Western Europe. The convergence of mobility and the Internet meant new opportunities for American players, but lingering problems – lack of adequate spectrum, fragmented markets, legacy technologies–constrained the catch-up.

The future of the business belonged to China. At the end of July 2001, this vast nation had 120.6 million wireless phone users compared with 120.1 million in the United States. The growth translated to a surge of 42% in the

first half of 2001. It also meant that China overtook the United States as the largest cellular market worldwide, a significant and symbolic event. With only one wireless phone for every 10 of China's 1.3 billion people, and tariffs falling by an estimated fifth that year, China was likely to sustain the pace of growth for some time. By contrast, four in ten Americans and half of Europeans were already using mobile phones. These factors heightened China's allure for mobile vendors, such as Nokia, Ericsson, and Motorola, which faced flat sales in Europe and North America.<sup>7</sup>

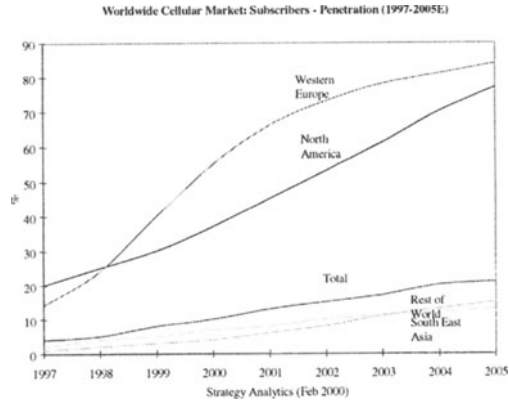
### 3. LEAD MARKETS

In the global chessboard, different regional markets have played different roles in the course of the wireless evolution. In different phases, certain markets have moved to center stage while others have been left in the background. In the early 1980s, small-country markets, especially the Nordic countries in Western Europe, played a critical role in wireless evolution. Since the 2G era, they can no longer occupy center stage in global *market* strategy, even if some remain critical in terms of global *R&D* strategy.

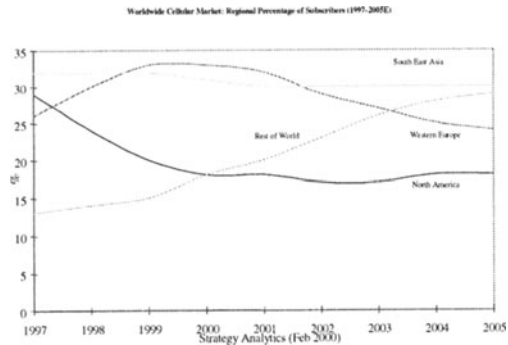
7 Forsythe, M. (2001) "China Overtakes U.S. as Largest Cell Phone Market," Bloomberg News, August 14, 2001. Sales estimates in China from the Ministry of Information Industry; sales estimates in the U.S. from the Cellular Telecommunications and Internet Association.

Figure 3. Worldwide Cellular Market (1997-2005E)

Western Europe surged past North America in terms of population penetration in 1999 with an extraordinary 16 point gain, bringing total penetration to over 40%. By 2005, penetration rates in excess of 84% were expected in Western Europe. North American cellular penetration was forecast to reach 77% by 2005 compared with 30% at the end of 1999. South East Asia and rest of world (ROW), despite impressive subscriber additions throughout the forecast period, were expected to trail with penetration levels of 13% and 15%, respectively, in 2005.



The penetration rates were anticipated to shift the composition of subscriber population worldwide. In 1997, North American subscribers accounted for 29% of the total, but this portion was expected to decline to 18% by 2005. The role of Western European subscribers would climb from 26% to 33% in 2000, but decline thereafter to 24%. Finally, the portion of South East Asian subscribers was expected to decrease gradually from 32% to 30%. At the same time, growth would migrate to the ROW regions.



In the analysis of worldwide markets, a key issue is the value and number of countries required for an effective global strategy. Not all markets are equal; some are more valuable than others. According to the idea of global chessboard, the point is to invade and win over those markets that truly count – i.e., the lead markets.<sup>8</sup> In the wireless business, lead markets represent locations whose pivotal role mirrors the basic generic strategies and rests on the stage of technological development (innovation), perceived quality (differentiation) and size or volume (cost structure).

### 3.1 The Americas: U.S. Leadership and Emerging Markets

Through the 1G era, from 1983 to 1991, North America was the center of mobile competition worldwide. In the 2G era, the United States lost its regional leadership in the industry due to delays in implementing the digital transition. But even as America's mobile cluster splintered, the country *market* remained the most populous worldwide – until mid-August 2001, when China overtook the United States as the largest global cell market, in terms of the number of mobile subscribers. Even thereafter, America remained the most lucrative country market *per capita*. China provided a massive population base (high volume in unit shipments and service provision) but lower returns (lower profitability).

In the early 1980s, small but developed country markets held substantial market shares in the Americas. In 1989, Puerto Rico still had more than 41% of the regional market. By the mid-1980s, Mexico enjoyed superior regional leadership (60%), which eroded with the eclipse of the 1G era. In the late 1990s, market-share leadership was captured by large regional economies, particularly Brazil (35.5% in 2000), where telecommunications had been thoroughly transformed after extensive privatization. Brazil was followed by Mexico (22.5%), Argentina (10.5%), Venezuela (8.5%) and Chile (5.6%). Without the requisite macroeconomic and institutional stability, substantial country markets, such as Colombia (2.8% in 2000), Peru (2.1%), Paraguay (1.3%), Uruguay (0.7%), and Panama (0.6%) remained well behind.

By 2000, the top four country markets in the region (Brazil, Mexico, Argentina, and Venezuela) had a 77% share of the aggregate marketplace. In fact, just two country markets – Brazil and Mexico – accounted for some 58% of the Latin America's share.

<sup>8</sup> The lead market serves the function of a bellweather. See Jeannet, J-P. and Hennessey, H.D. (1998) *Global Marketing Strategies*, 4th Ed. (New York: Houghton Mifflin Company 1998), p. 254. For the development of the concept, see Jeannet, J-P. (1986), "Lead Markets: A Concept for Designing Global Business Strategies," Working Paper, IMEDE, May 1986.

### **3.2 Western and Eastern Europe: Developed and Undeveloped Markets**

With the 2G era, the momentum in the wireless markets shifted to Western Europe, particularly Nordic countries. The European market comprised large countries (Germany, the U.K., France, Italy), emerging markets (Spain), and several small country markets. Many of these are relatively advanced in wireless communications.

In 1983, the tiny Nordic countries enjoyed superior positions in Western Europe. Together, Sweden (39.4%), Norway (29.3%), Denmark (20%) and Finland (10.8%) accounted for 99.5% of the entire Western European marketplace. After explosive absolute growth, the rising curve in these countries began a rapid decline in 1984. Only two years later, new market-driven public policies (privatization, liberalization, deregulation) turned the U.K. into the European leader in wireless communications. The share of the country market peaked at 37% in 1989 in the U.K. After the mid-1990s, the British lost their leadership to Italy, which retained a dominant position in the latter half of the 2G era – until it was overtaken by Germany in 1999.

By 2000, the market shares in Western Europe had been “normalized.” While the four Nordic markets – Sweden (2.4%), Finland (1.5%), Denmark (1.3%), and Norway (1.2%) – now accounted for less than 7% of the total, the top four Western European markets – Germany (18.5%), Italy (16.3%), the U.K. (15.4%), France (11.2%) – held more than 61% of the total marketplace. Add two substantial emerging wireless markets – Spain (9.4%) and Turkey (6.2%) – and the top six markets controlled 77% of the aggregate market. These were the critical markets of Western Europe. Nordic markets could not provide size or scale, but they played an important role in terms of technology development; they served as R&D laboratories for worldwide wireless players.

Wireless business arrived in Eastern Europe only in the aftermath of the Cold War. After the collapse of Soviet Union, the unification of Germany precipitated the painful reintegration of Europe. In the long term, the largest, most stable, and most technologically progressive Eastern European countries were expected to evolve into new emerging markets, following the footsteps of Spain and Turkey. By the end of 1990, Hungary (81%), Slovenia (19%), and soon thereafter Croatia dominated the early years of “mobilization” in the former Socialist Europe. At the end of the decade, however, these pioneers had been overthrown and the market composition looked quite different. Four countries – Poland (23.4%), Czech Republic (15.1%), Russia (11.1%), Hungary (10.7%), and Romania (8.3%) – controlled almost 69% of the entire Eastern European market.

### 3.3 Asia-Pacific: From Japan to China

In August 2001, the number of subscribers in China exceeded that in the United States. The shift of the world's most populous country market from North America to Asia-Pacific illustrated the move of the wireless market momentum from West to East. Furthermore, a pro-competitive stance has brought about rapid development of mobile communications in the "tiger economies" of Asia Pacific.<sup>9</sup>

With the advent of the 1G era, the Asian market *was* synonymous with Japan, which held 100% of the wireless marketplace. Like the Nordic leadership in Western Europe, this superiority was not sustainable, even if it was solid because of the sizable population base. At the end of the analog era in 1991, Japan still had 46.6% of the Asia-Pacific market, against Australia (13.6%), Taiwan (7%), Hong Kong (6.9%), Korea (5.9%), Thailand (5.8%), and Malaysia (5.1%). These country markets, however, had already been passed by China's rapid-growth market. After the reform-minded Communist leaders opened Chinese borders to foreign companies in 1979, foreign direct investment in general, and mobile expansion in particular, took off during the latter half of the 1980s. By 1987, China's share of the entire Asia-Pacific market had soared from a base of zero to 8.2%. By the end of 1991, it had climbed to 13.6%. In 1999, China overtook Japan as the leading country market in Asia Pacific and, a year later, it overtook the United States as the leading country market worldwide. At the end of 2000, China enjoyed a 33.8% market share, against Japan (26.4%), Korea (12.2%), and Thailand (7.6%). No other country in Asia Pacific had more than 5% of the subscriber base. These four market leaders accounted for 80% of the total market and were the lead markets of the region.

In China and Thailand, economies of scale and critical mass made the markets important; in addition to size factors, Japan and Korea were strategic in other ways. In Japan, the technological infrastructure was highly advanced and NTT DoCoMo had pioneered the first thriving 3G products and services worldwide. Qualcomm's close partnership with Korean research organizations, contractors, and operators had made this country a critical CDMA cluster worldwide, along with San Diego, the U.S. company's headquarters.

By the end of the 1990s, U.S. industry practitioners believed that U.S. competitive advantage was eroding even in its traditional footholds, including Asia Pacific. This erosion was attributed to the skillful government relations of Euro-Nordic rivals. As one industry representative noted,

9 Compare Yan, X. (2001), "Return of the Tigers: Asian-Pacific Innovation in Mobile Communications," *Info*, Vol. 3, No 3, June, pp. 231-242.

In Asia among the U.S. companies, Motorola and Lucent really dominate. The companies have invested a lot of money in the region, and have a lot of resources there. They are looked upon as being more world-class than are other U.S. suppliers. In terms of the competition, Ericsson and Nokia are extremely strong in the region. One thing with Ericsson that continually impresses me with is their ability to develop incredible relationships with government and ministry people all over the world. They are incredibly tied in, much more than Lucent and Motorola are to those people. Ericsson and Nokia have greater access to people making a lot of the regulatory decisions. I can cite a handful of countries where the regulatory decisions have come down on the wrong side for U.S. manufacturers because of that, including Thailand and a handful of other countries.<sup>10</sup>

### **3.4 Africa: South Africa and Fragmented Markets**

Wireless business arrived in Africa through two central locations: the North African *Maghreb* countries, which were situated close to the advanced Western European markets, and South Africa, the economic center of the southern part of the continent. In 1985, Tunisia “owned” the African market. Only a year and a half later, South Africa overtook the market leadership, which it has retained despite erosion and instability. At the end of 2000, South Africa still held almost half of the market (47.2%), against Morocco (18.2%) and Egypt (13.9%). All other country markets had less than 5% of the market. In this highly fragmented region, these three countries accounted for more than 79% of the entire market pie.

### **3.5 Middle East: From Saudis to Israel**

At the turn of the 1980s, Saudi Arabia pioneered the earliest 1G markets worldwide with Ericsson’s wireless systems. At the end of 1985, the Saudi kingdom’s market share in the Middle East soared from a base of zero to 87%, while Oman held the remaining 13% of the market. These two pioneers were followed by Kuwait and United Arab Emirates (UAE). At the end of the 2G era, the market looked different. Israel dominated the Middle Eastern market (41.6%) against UAE (13.9%), Saudi Arabia (12.2%), and Iran (9.7%). Regionally, however, Israel’s leadership had been eroding since the mid-1990s. Despite its tiny population base, Israel’s relatively high penetration stemmed from the undeveloped nature of the wireless markets in

<sup>10</sup> See International Technology Consultants (1998), Global Wireless Competitiveness Study, June 14, 1998.

the Middle East, particularly political and military instability and the absence of appropriate infrastructure. When the large Arab countries embraced modernization, Israel's regional leadership suffered the same fate as that of Nordic countries in Europe, due to the small population base.

Since the early 1990s, then, the wireless revolution has proceeded rapidly in North America, Western Europe, and Asia Pacific – through rapid growth in regional penetration and increasing differentiation vis-à-vis lead markets. The wireless industry, however, has always evolved through the *interplay* of markets and technology, not through market evolution *or* technology evolution. As markets have expanded, the technologies have grown increasingly complex with novel innovations. Concurrently, commodification has swept through the industry as original demand has been taken over by replacement demand.

#### **4. FROM ORIGINAL DEMAND TO REPLACEMENT DEMAND**

At the peak of the 2G era, and reflecting a wide industry consensus, Nokia's CEO Jorma Ollila argued that the best was yet to come. "I firmly believe that Nokia is ideally placed to bring the benefits of the convergence of Internet and mobility to the markets."<sup>11</sup> For the third consecutive year, the vendor exceeded its overall growth and profitability targets. As Ollila and Nokia President Pekka Ala-Pietilä noted in 2000, the company was determined to play *the* leading role in the emerging mobile Internet era:

We are at the beginning of something very significant. Not just for our company. Not just for our industry. But for everyone. And for all aspects of our lives. We are using the twin drivers of the Internet and mobility to break through the limits of time and place. These are very powerful forces... This is what we mean by the Mobile Information Society... We know that there are no limits to what can be achieved with will, vision and determination. And we have all three in abundance.<sup>12</sup>

With U.S. consolidation and European downturn, the tone was quite different only a year later. After the technology consolidation and 3G slowdown, the dream of the "twin drivers of the Internet and mobility" was suppressed. The talk about "no limits" was over. Business was no longer

11 Jorma Ollila, "To Our Shareholders," Nokia's Annual Report 1998, pp. 6-7.

12 Jorma Ollila and Pekka Ala-Pietilä, "Letter to Our Shareholders," 1999 Annual Report, pp. 6-7.



about bold dreams, but about demanding realities and execution. Why did it prove so difficult for the vendors, operators and enablers to sell the early 3G infrastructure and handsets? The problem was that many industry practitioners still thought like engineers, even though *markets* now drove industry developments. In Japan, NTT DoCoMo focused on services rather than selling technology, but, in Western Europe, the leading vendors and operators pushed technology rather than developing viable service propositions. This mistake proved particularly detrimental as market drivers shifted from *original demand* to *replacement demand*.

## 4.1 Handsets and Demand Shifts

By the end of the 1990s, the global wireless market for handsets – a useful indicator of demand shifts – was rapidly expanding, while the composition of sales was changing. An increasing number of people were buying their first phones, and the upgrade market was growing. A third evolving market was multiple handset ownership. In 1999, upgrades accounted for some 40% of unit sales. Their share was likely to rise to about 50% in 2000 and to around 70% to 80% in the next few years.<sup>13</sup>

In Western Europe, the cellular market grew at a phenomenal pace through the 1990s; this pace was expected to continue from 1999 to 2004. Prior to industry slowdown, the overall penetration rate in the region increased by 16 percentage points during 1999, while handset sales rocketed to 113 million units. According to Strategy Analytics forecasts, further strong growth should continue to 2004, with penetration rising to more than 80%, service revenues approaching \$200 billion, and handset sales reaching 210 million units per annum. In order to understand better the shifting nature of market demand, it is instructive to pay attention to growth and

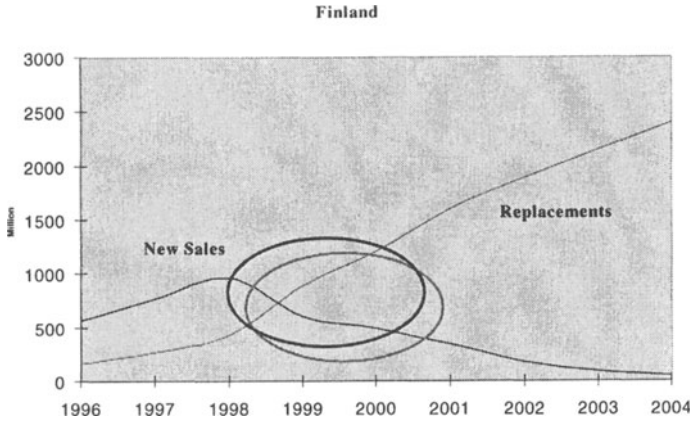
13 Equipment manufacturers were struggling to design handsets for all actual consumer segments, from hiking enthusiasts' water-repellent, shock-resistant Gore-Tex phone with rubber gaskets, to colorful, snappable plastic covers for fashion-conscious teens, and easy-to-use toy-like models for the 12-year-old set. Precipitating the trend, Nokia had introduced its colorful snap-on covers for mobile phones in the mid-1990s. By the end of the decade, its phone covers were available in a rainbow assortment of bright colors, with names like meteor yellow and zircon green. After colors came graphic design. Again, Nokia anticipated the future by hiring a group of emerging young artists to design its latest batch of snap-on jackets. However, needs were different in different segments. While snap-on covers could contribute to the purchase decision of consumers, business users required functionality. For maximum flexibility, the front and back panels of a new Nokia model could be snapped off and replaced for a different look. Compare Amanda Kaiser, "Express Yourself: Why phone makers offer something 'special' for you," Wall Street Journal, October 11, 1999.

penetration, new sales and replacements, average handset price and monthly average revenue per user (ARPU), replacements of total, and market segmentation. In each case, developments in Finland's Wireless Valley have foreshadowed those in Western Europe at large (**Figure 4**).

**New Sales and Replacements.** In Finland, the number of new sales peaked at 963,000 in 1998, and was estimated to decline to 44,000 by 2004 (CAGR -40.9%). Meanwhile, the number of replacements was expected to increase from 163,000 to 2.4 million by 2004 (CAGR 21.9%). A milestone was passed in the middle of 1998, when the number of replacements exceeded that of new sales. In Western Europe, the number of new sales peaked at 83.8 million in 1999, and was estimated to decline to 18.4 million by 2004 (CAGR -26.4%). Meanwhile, the number of replacements was expected to soar from 4.1 million to 192.8 million by 2004 (CAGR 45.9%). A milestone was passed in the middle of 2000 (some two years later than in Finland), when the number of replacements exceeded that of new sales.

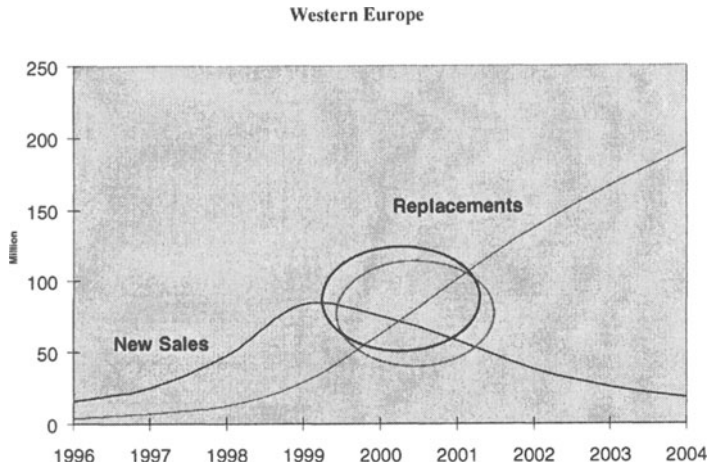
**Replacements of Total Sales.** In Finland, the percentage of replacements of total sales climbed from 23% to 59% in 1999 and was expected to reach 98% by 2004 (CAGR 10.6%). In Western Europe, replacements of total sales climbed from 20% in 1996 to 26% in 1999; this figure expected to reach 91% by 2004 (CAGR 28.8%). In Finland, this percentage exceeded 50% by the end of 1998; in Western Europe, by the middle of 2000.

Figure 4. From Original Demand to Replacement Demand

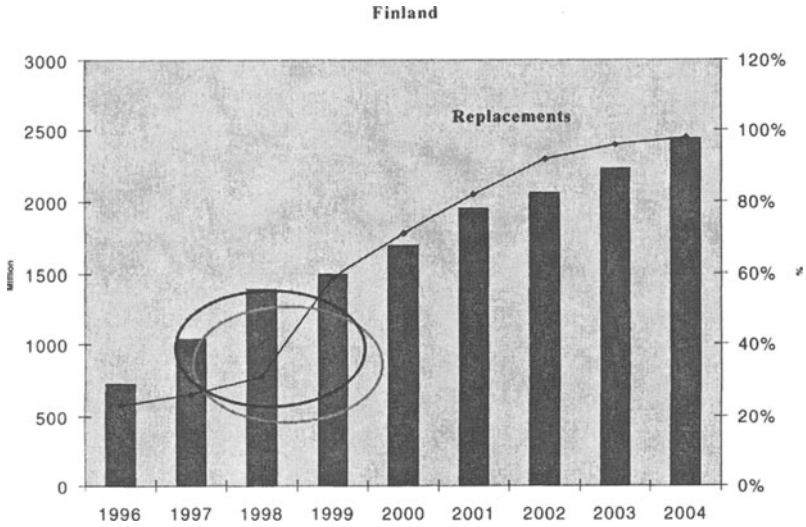


As sales decline,  
replacements soar...

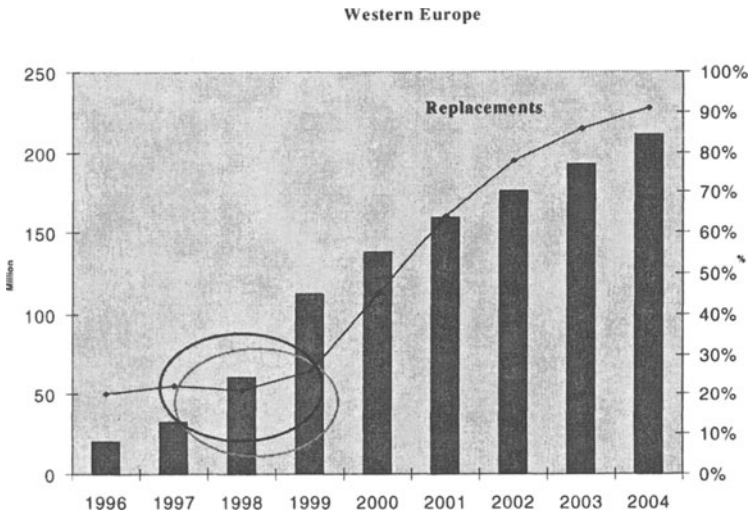
*Handset Shipments in Western Europe and Finland: New Sales and Replacements*



**Handset Shipments in Western Europe and Finland: Replacements of Total**



Replacements dominate competition...



## 4.2 Industry Drivers: From Innovation to Diffusion

At the beginning of the 1G era, the wireless marketplace had been high-cost and low-volume by nature. By the end of the 2G era, it was low-cost and high volume. In the process, the industry had shifted from national industrial services to global consumer mass markets. Toward the end of the 2G era, the cumbersome SMS (short message service) had sold the idea of data messaging to early adopters in the most developed markets. At the beginning of a new era, MMS (multimedia messaging services) were likely to serve as the “killer apps” of the wireless Internet – a bit like email had sold the pioneering Internet services to American consumers in the latter half of the 1990s. But by 2001, the new environment was far more difficult, complex, novel, and dynamic than the early 2G phase around 1991 and 1992, for several reasons.

By the latter half of the 1990s, the dynamics of wireless competition shifted from technology-driven high-growth rivalry to market-driven slow-growth rivalry, first in the most advanced markets and later in less developed markets;

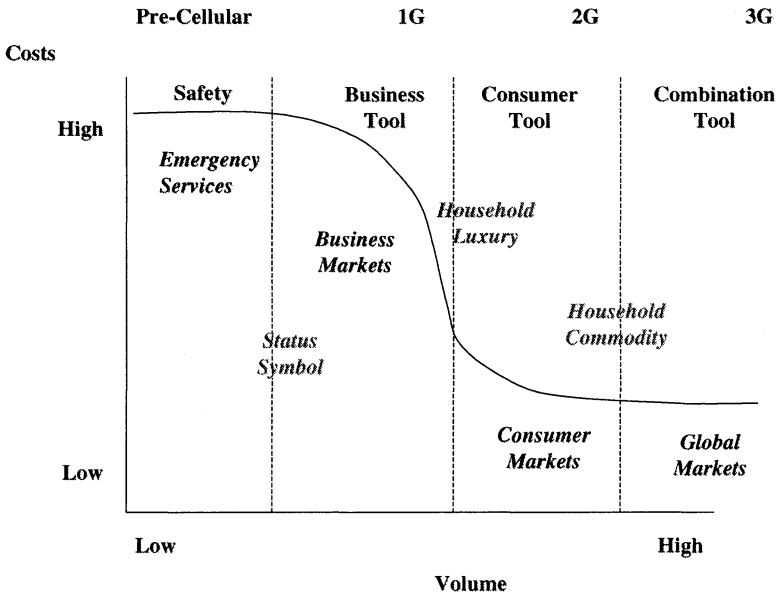
- In this rivalry, the very nature of demand shifted as well, from new demand to replacement demand, between 1998 and 2000;
- In the most developed markets, the stagnation of the monthly ARPU had ended by the mid-1990s, while the average handset price continued to decline relatively rapidly;
- Consequently, the very composition of the market demand shifted as well, from the dominance of business users (the most important market of the 1G and the early 2G phases) to consumers, and more slowly toward combination users.

At the end of the 2G era, industry competition was market- rather than technology-driven. The high-growth years were behind; industry consolidation evolved in maturing markets. In the developed and most lucrative markets, penetration was rapidly saturating. Original demand faded into history. Replacement demand dictated the new competitive pressures, from extensive product portfolio, and technology agnosticism to pricing pressures and ever-shorter product cycles. While ARPU no longer stagnated, vendors and operators had to boost usage to increase it. Meanwhile, consumers – particularly innovators and early adopters – were proving increasingly critical in the marketing economies.

In the pre-cellular era, a wireless phone had been confined to emergency services. Its function was safety. In the 1G era, the cell phone – more precisely the car phone – had penetrated the business markets, but remained a household luxury. In the 2G era, the cell had become a consumer tool; it

was now a household commodity. Through these phases, an emergency function had turned into a business tool, and finally into a mass consumer device. Meanwhile, its significance had shifted from safety to basic needs, instrumental uses, and finally expressive functions (**Figure 5**). In *this* environment, one of the worst possible mistakes was to sell the next-generation services through technology (think of the failure of the early WAP in Western Europe). Because the market is now driven by customers and replacement demand, new and attractive value propositions rather than new technology per se make or break new technologies. Interestingly, only NTT DoCoMo, in the late 1990s, has been able to draw the right conclusion – it’s the service, stupid – even if its solution has weaknesses as a *global* strategy (e.g., difficult to export, imitation potential, geographically limited developer community, operator’s high market share).

Figure 5. Wireless Infrastructure and Handsets: Market Evolution



With 3G technologies proper, users will enjoy still higher-speed and even better always-on capabilities, just as operators will exploit even greater pricing flexibility and still better capacity. From the standpoint of *customer* value, these are incremental enhancements; in terms of *perceptions*, it is the

2.5G transition that was critical. Such insights on market development build less on technology innovation than marketing innovation. They are also highly reminiscent of those in other maturing fields. Take, for example, the detergent battles of the 1950s, when Procter & Gamble and its rivals vied to make a product that would produce the “cleanest” clothes.<sup>14</sup> Although the clothes were as clean as they could ever get, they often had a gray, dingy look, which the consumer associated with dirt. This gray, in effect, was caused by torn and frayed fibers, but the consumer’s gaze missed this technical detail. Because “the customer is always right,” P&G decided to capitalize on the misperception and added “optical brighteners” to the detergent. These chemicals reflect light. So when they were added to the detergent and retained on the clothes, they gave the clothes a seemingly brighter and thus cleaner look. The consumers bought the idea and fell in love with Tide. To further capitalize on the idea, P&G had the clothes made even brighter. And, again, more detergent was sold. But soon a new kind of limit was encountered, not that of optical brightness but the limit of the *perception* of optical brightness and cleanliness. More was no longer better; the consumer could no longer perceive the difference.

At the end of 2001, the wireless business found itself at a crossroads that P&G had discovered in the 1950s. The business was still far from its physical limits. The 3G technologies would offer a *perceptibly* better customer experience than the 2.5G technologies, thought not without significant cost. However, when an industry moves from high-cost, low-growth markets to low-cost, high-growth markets, innovation shifts from the upstream side of the value chain to its downstream side – essentially, from technology to marketing. Then 3G services must be marketed as handsets or wearables in global consumer and corporate markets, as personalized tools. As technologies, they no longer sell; as services, their value-added must be justified. Disruption is defined by consumers, not by technologies. Brighter is not always better or even desirable.

14 On the P&G experiences and other examples of innovation, see Foster, Richard (1986), *Innovation: Attackers’ Advantage* (New York: Summit Books), see especially Chapter Three.