

Chapter 5

Vectors of Diffusion: The Mobile Phone

“[T]he great engine powering us into the new wireless age is, of all things, the good old cell phone.” (Needleman *et al.*, 2003)

Introduction

To understand the growth and diffusion potential for mobile phone applications such as retail LBS, one must first establish the availability of a diffusion vector. Mobile phone use has grown rapidly over the last few years and ‘mobiles’ are emerging in all aspects of life, whether for entertainment, for business, or simply for gathering information. Some studies suggest that by the year 2004, “more than 40% of all e-commerce transactions will be initiated from a handheld device” (Wareham and Levy, 2002, p 161), such as a mobile phone. Research also indicates that mobile phones will soon overtake landlines in Europe (cellular-news, 2003; Needleman *et al.*, 2003). This is not surprising since globally, mobile phone sales amounted to 114.9 million units during the second quarter of 2003, an increase of two percent over the previous quarter according to market research firm Gartner Inc. (Pruitt, 2003).

This chapter is set out as follows: first, is a brief history of wireless telecommunications and mobile phone diffusion into US and EU¹ societies. A discussion of mobile phone growth, in terms of numbers of phones and numbers of subscribers in the US and Germany, follows. The chapter concludes with a discussion of estimated future LBS revenue in both the US and EU.

Brief History of Mobile Phones

In the US

When cellular telecommunications began in the US, the Federal Communications Commission (FCC) initially gave away radio spectrum² licenses for cellular communications (Christensen *et al.*, 2001, p 19; Murray, 2001). AT&T, the inventor of cellular technology, lobbied heavily for exclusive use of a large portion of the spectrum (Murray, 2001, p 21). However, because of the politics surrounding monopoly ownership at that time, the FCC allowed non-telephone companies to compete with AT&T for licenses (Murray, 2001, p 22). In the meantime, other companies, including

¹ The discussions concerning mobile phone growth and LBS revenue compare the US and EU, as specific figures were not available for individual EU member countries, such as Germany.

² The radio spectrum is used by a number of technologies to transmit information through space, e.g. garage door openers, and is also the basic resource for wireless telecommunication (Mallick, 2003; Murray, 2001). A particular frequency, or segment of the spectrum, can be used by only one device at a time in one place, so that ‘spectrum’ is a geographically restricted resource (Murray, 2001, p 20-21; Pelton, 1995, p 5).
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Motorola, were working on cellular technology. This technology began to move from the laboratory into the hands of the public and the first mobile phone call was made by Motorola executive Martin Cooper in 1973 (Murray, 2001, p 22).

After deciding that cellular should be *competitive*, the FCC, on June 7, 1982, stated that it would accept applications for spectrum licenses to run the mobile phone systems for the 30 largest US cities (Murray, 2001, p 7). The 40 MHz spectrum was divided in two: one-half for the local telephone company and the other for non-telephone companies (Christensen *et al.*, 2001; Kim and Litman, 1999; Murray, 2001, p 25). A diverse group of companies and entrepreneurs sought to become a part of the new industry and applied for the non-telephone company licenses, including MCI, Graphic Scanning (a communications company), and Western Union (Murray, 2001). In October 1983 the first system went on-line in Chicago, which began the cellular revolution in the US (Murray, 2001, p 69).

In the following ten years, 13 million mobile telephones were sold to US consumers (Rogers, 1995, p 244), with many early adopters being male executives who received mobile phones through their companies (Rogers, 1995, p 245). By the year 2000, the US had 100 million mobile subscribers (Murray, 2001, p 313). This statistic was a surprise to many analysts; it was more than 100 times what AT&T predicted in 1980 and two and a half times what Donaldson, Lufkin, Jenrette, a major investment banking and securities firm, predicted as late as 1990 (Murray, 2001, p 313).

In the EU

The development of digital wireless technology proceeded more smoothly in Europe (Christensen *et al.*, 2001, p 21) and contributed to the steady increase in mobile phone penetration in the EU. Wireless market penetration rates were increasing by 1.5 percent every *month* during 2000 in Europe (Murray, 2001, p 313). Penetration rates³ in 2000, particularly in Scandinavia, were twice those of the US: Finland was at 73 percent, Norway at 81 percent, and Sweden at 76 percent (Murray, 2001, p 313). The high percentages in these countries, however, may come as no surprise. Scandinavia,

³ Penetration rates are measured as the percentage of the total population owning a mobile phone.
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specifically Denmark, Finland, Norway, and Sweden, was the region in which mobile service was first introduced in 1981 by the Nordic Mobile Telephone System (Farley, 2000 to 2004). This was followed by systems in Great Britain, West Germany, France, and Italy, each using a different frequency range (Farley, 2000 to 2004). Due to the national systems' incompatibility with one another, plans were underway in the early 1980s to build an all-digital mobile service to allow 'roaming' between countries and other advanced features (Farley, 2000 to 2004). A year later, the development of GSM (Global System for Mobile communication) was begun by twenty-six European national phone companies (Christensen *et al.*, 2001, p 21; Farley, 2000 to 2004). The European Telecommunication Standards Institute (ETSI) eventually took over the planning of GSM and commercial GSM networks began operating in the early 1990s (Christensen *et al.*, 2001, p 21; Farley, 2000 to 2004).

In addition to Europe's GSM standardization, the evolution of its wireless industry and geography contributed to Europe's earlier advances in wireless technology relative to the US. In Europe, the evolution of cellular systems was first initiated by monopoly telephone companies owned or subsidized by the government (Murray, 2001, p 286). Technology standards were therefore dictated by government agencies, which aided in the adoption of new innovations (Murray, 2001). Additionally, geography played a role in Europe's rapid advances in the cellular industry (Goodchild, 2001). During the advancement of wireless telecommunications, the US contained many geographically distinct markets licensed to different operators using incompatible technologies, like Europe prior to GSM standardization (Murray, 2001, p 286). In contrast, Europe's compact boundaries and large population density allowed for easier standardization within its national markets (Murray, 2001, p 286). However, despite these differences in the history and growth of the mobile industry, both the US and EU currently boast enhancements in mobile communication that are important for future mobile phone applications, including retail LBS.

In the present transition stage between 2G (Second Generation mobile network) and 3G (Third Generation mobile network), the focus is on a change from pure voice traffic to additional multimedia services for the mobile phone (Christensen *et al.*, 2001;

Mallick, 2003; Prasad and Ruggieri, 2003). Upcoming 3G systems promise to provide faster data transfer rates than earlier generations, as a result offering a wide range of new services for users including email, fax, video, Internet access, and audio services (Mallick, 2003, p 73; Prasad and Ruggieri, 2003, p 7). In addition to these services in a 3G network, LBSs will improve to more accurately determine a mobile user's location (Bossert, 2002; Mallick, 2003, p 404). Research suggests that future LBSs will be "feature-rich and user-friendly," while also allowing for mapping and routing at the street level (Mallick, 2003, p 405). Currently the LBS market is in its second generation and is moving toward the next generation with these innovative features (Mallick, 2003, p 404). It seems that the motive for this move is an interest in m-commerce in Europe and Asia (Mallick, 2003; Oliva, 2002), while the primary force driving the LBS market in the US is the FCC E911 mandate (Mallick, 2003, p 404). Both motives however, provide the same outcome – the potential for retail LBS diffusion. To demonstrate that a new 'third generation' LBS, i.e. retail LBS, has the opportunity to diffuse into the US and Germany, the number of diffusion vectors are established and compared below.

Mobile Phone Statistics

Between 1991 and 2001, "wireless communications [was] the fastest growing segment of telecommunications" (Beaubrun and Pierre, 2001). Universal wireless coverage is almost complete in developed countries, while in developing countries wireless is becoming an inexpensive alternative to landlines (Beaubrun and Pierre, 2001). There were 1.2 billion mobile phones in the world by 2003, one for every five people, and by 2006, there will be an estimated 2 billion (Needleman *et al.*, 2003). The global wireless economy as a whole, including revenues from services, handsets, accessories (e.g. faceplates, hands-free sets, phone protector covers, etc.), applications, and infrastructure, totaled 500 billion dollars in 2002 (Needleman *et al.*, 2003). In addition, a steady increase in wireless technology use is forecasted for the future. According to Analysis Research Consultancy (ARC) Group, an IT consulting company based in London, the penetration rate of mobile data users in the US will increase from 7 percent in 2000 to 44 percent in 2003 and is

expected to reach 83 percent by the year 2005, while an even higher rate of 91 percent is expected in Western Europe by 2005 (Oliva, 2002).

Current and Future Trends in Mobile Phones

As mentioned in the methodology, three datasets were used to compare statistics of mobile phone use in the US and Germany – mobile subscriber data from *Telecommunications Database 2003* of the Organization for Economic Co-operation and Development (OECD) (OECD, 2003b), comprehensive US mobile subscriber statistics from the Cellular Telecommunications and Internet Association (CTIA) semi-annual wireless industry survey (CTIA, 2003b), and mobile subscription data from the Research Room (The Research Room, 2003c).

The OECD is an organization of 30 member countries with democratic governments, including the US and Germany (OECD, 2004). The OECD provides many statistical databases, which cover economic and social issues, including science and innovation (OECD, 2004). Statistics relevant to this research were found in the *Telecommunications Database 2003*, which provided major market indicators of the telecommunications sector including network infrastructure, revenues, mobile subscribers, operator expenses, etc. for the years 1980 to 2001 (OECD, 2003b). The telecommunications data assembled by the OECD includes mobile subscriber numbers collected from member countries, including the US and Germany. According to the OECD Directorate for Science, Technology, and Industry, the data are cross-referenced with annual reports from individual mobile carriers (Bourassa, 2004, email communication). Data in the *Telecommunications Database* include the total number of mobile phone subscribers. These include subscribers of an automatic public mobile telephone service, which provides access to the Public Switched Telephone Network (PSTN) (Bourassa, 2004, email communication). Subscribers to “public mobile data services, private trunked mobile radio, telepoint or radio paging services” are not included (Bourassa, 2004, email communication). Data was available for the years 1985 – 2001 (OECD, 2003b).

The CTIA is an industry association calling itself “the voice of the wireless industry” (CTIA, 2003a). It represents members in discussions with the US government, Birgit Muehlenhaus (May 2004) – www.birgitm.com/thesis.htm

such as policy makers in the Executive Branch, in the Federal Communications Commission (FCC), and in Congress (CTIA, 2003a). Members of the organization include wireless carriers such as AT&T, Cingular, T-Mobile US, etc. Since 1985, it has conducted a semi-annual wireless survey with data collected from member and non-member wireless carriers (CTIA, 2003b). From this data the CTIA estimates the total number of subscribers in the US, accounting for the fact that since it is a voluntary survey not all carriers respond (CTIA, 2003b). Estimates are compiled by determining the nature of the non-responding market and using surrogate diffusion rates to similar known systems (CTIA, 2003b). Despite the fact that the survey is voluntary, the response rate is very high. For the June 30, 2003 survey, CTIA received an 86 percent response rate – 2,444 of 2,840 systems responded in the US (CTIA, 2003b, p 1).

The Research Room is a research, consulting, and analysis organization concentrating on the global telecommunications market, specifically mobile and wireless communications (The Research Room, 2003a). Clients include Vodafone, Siemens, Nortel, Motorola, Ericsson, Nokia, and Virgin Mobile (The Research Room, 2003d), some of the leading firms in the wireless industry. The Research Room's free, online data tallies mobile subscriptions, not actual mobile subscribers, and therefore diffusion rates may differ from other data, such as that of the OECD and CTIA (The Research Room, 2003b). The Research Room's data is synthesized from various sources, including Telecommunication Union, Global Mobile, CTIA, mobile operators, country regulators, and other news and research Web sites (The Research Room, 2003b). The Research Room has developed its own forecast model and methodology and states, "when forecasting the future, it is necessary to make many assumptions" (The Research Room, 2003b). This forecast "contains hundreds if not thousands of assumptions" (The Research Room, 2003b). However, the forecasts represent the course mobile phones may follow in the future and are typical projections. Data utilized in this thesis is from the Research Room's second edition of the mobile forecasts, which range from 1991-2007. When comparing forecasts from the end of 2002 with actual numbers, "the total subscriber number for all 77 countries was out by only 0.28%" (The Research Room, 2003c).

All three datasets used in this chapter were ultimately converted from pure subscriber or subscription numbers to penetration rates, i.e. number of mobile subscribers or subscriptions divided by population and multiplied by 100. Population data from the OECD (OECD, 2003a) was used to calculate these percentages for each dataset. The conversion of raw numbers to penetration rates was completed to easily compare mobile phone diffusion rates between the US and Germany. Comparisons show that all three datasets illustrate fairly constant and steady increases in mobile numbers over the past years, both for the US and Germany (Table 5.1).

Table 5.1. Mobile Subscriber and Subscription Numbers

The table illustrates mobile numbers (in thousands) for both Germany and the US. OECD and CTIA data represent mobile subscribers (CTIA, 2003b; OECD, 2003b), while data from the Research Room represents mobile subscriptions (The Research Room, 2003c). Dashes indicate unavailable data.

	GERMANY	GERMANY	US	US	US
Year	OECD	Research Room	OECD	Research Room	CTIA
1984	–	–	92	–	–
1985	1	–	340	–	204
1986	24	–	682	–	500
1987	49	–	1,231	–	884
1988	99	–	2,069	–	1,609
1989	164	–	3,509	–	2,692
1990	273	–	5,283	–	4,369
1991	532	532	7,557	7,557	6,380
1992	975	982	11,033	11,033	8,893
1993	1,768	1,795	14,712	16,009	13,067
1994	2,466	2,476	22,550	24,134	19,283
1995	3,733	3,724	31,400	33,737	28,154
1996	5,782	5,816	44,043	44,043	38,195
1997	8,176	8,280	55,312	55,312	48,706
1998	13,913	13,980	69,209	67,312	60,831
1999	23,446	23,482	86,047	84,716	76,285
2000	48,202	47,984	109,500	108,211	97,036
2001	56,245	53,930	128,500	127,537	118,398
2002	–	56,722	–	139,217	134,561
2003	–	60,308	–	157,094	148,066
2004	–	62,815	–	168,718	–
2005	–	64,701	–	179,863	–
2006	–	66,826	–	186,526	–
2007	–	67,615	–	189,076	–

Table 5.1 demonstrates that figures remain relatively consistent regardless of data source. For example, CTIA data for 2000 shows that there were fewer than 100 million mobile subscribers, while both OECD and Research Room data show numbers just above 100 million for the US. Similarly, OECD and Research Room data for Germany indicate that in 2000, there were just less than 50 million mobile subscribers and subscriptions, respectively. Whereas the OECD database contains actual numbers only up to the year 2001, Research Room data extends to 2002 and CTIA data continues to 2003. The most recently available data from the CTIA in June 2003, illustrates that the US had over 148 million wireless subscribers, a 10 percent increase from the previous year. Beyond 2003, Research Room data is the only source providing mobile subscriber forecasts. It projects mobile subscriber numbers up to 2007, with the US at approximately 189 million subscribers and Germany at approximately 67 million subscribers.

Comparing Mobile Numbers in the US and Germany

Using these data, we can compare mobile phone trends in the US and Germany. While Table 5.1 illustrates steady increases in mobile numbers in both the US and Germany, the figures do not provide a comprehensive indication of mobile phone diffusion due to population variability between the two nations. Therefore, the raw data in Table 5.1 was converted from numbers of mobile subscribers or subscriptions to represent a percentage of the total population in Figures 5.1 and 5.2. Population data are OECD estimates (OECD, 2003a). Figure 5.1 compares mobile subscriber percentages from CTIA and OECD data. The Research Room data is plotted separately in Figure 5.2, as it represents mobile subscription percentages.

Diffusion of Mobile Subscribers

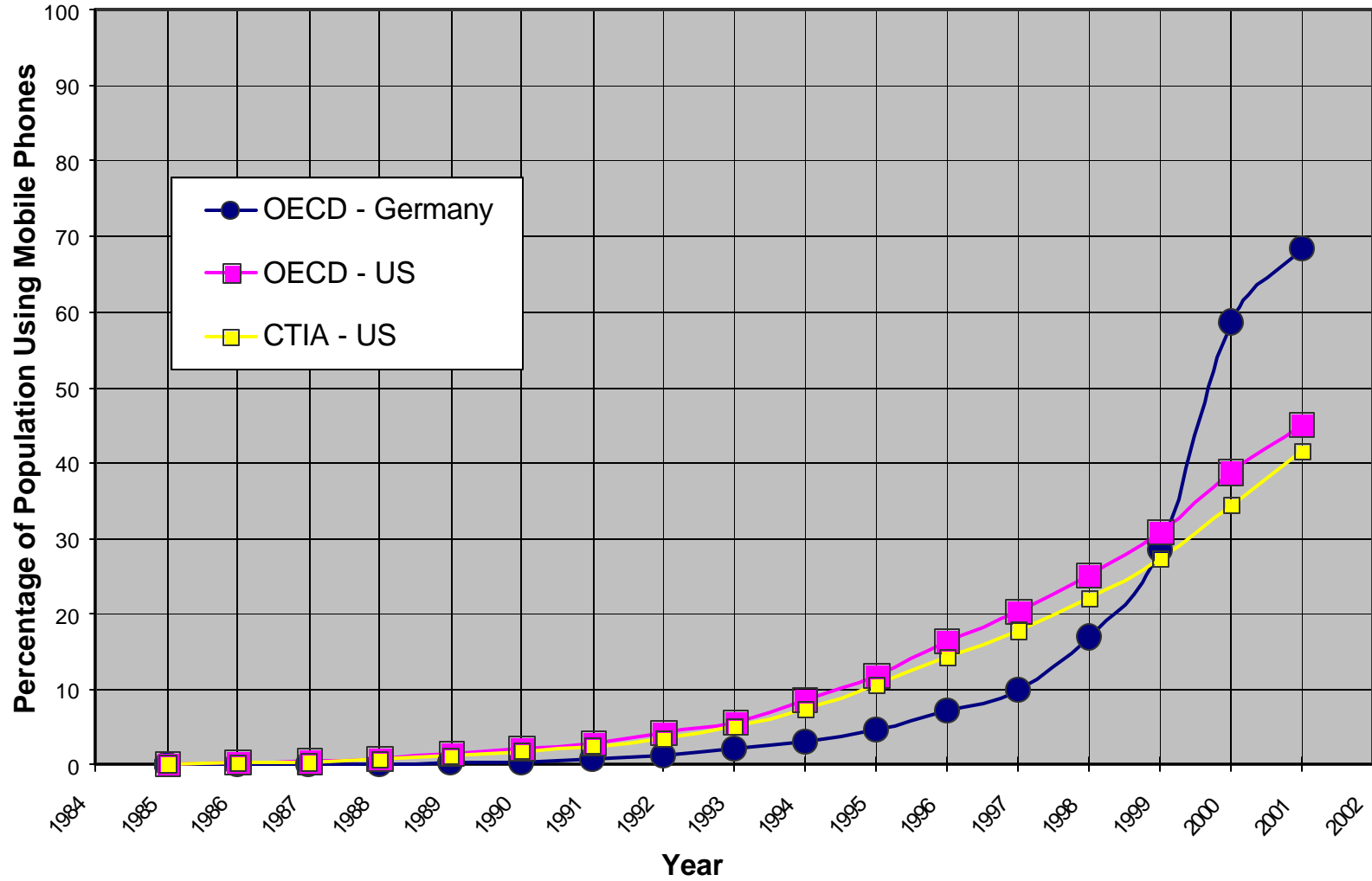


Figure 5.1. Mobile subscriber numbers (from (CTIA, 2003b) and (OECD, 2003b))

Diffusion of Mobile Subscriptions

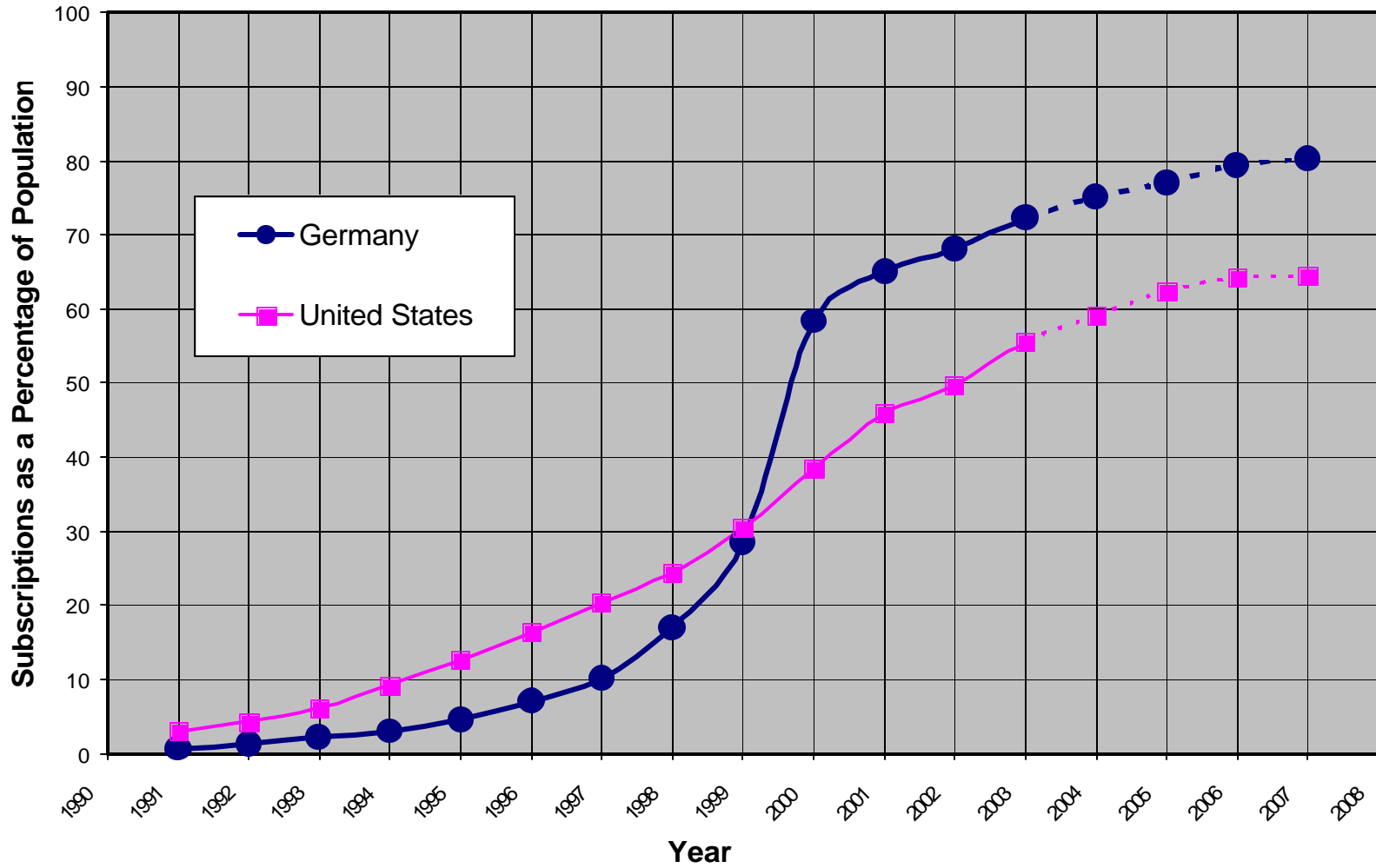


Figure 5.2. Mobile subscription numbers (from (The Research Room, 2003c))

Note: The percentage may exceed 100, as individuals may have more than one subscription. Dotted portions of lines are projected.

In both figures, data represented by circles refers to Germany's mobile statistics while data represented by squares refers to US mobile statistics. It is clear from both Figure 5.1 and Figure 5.2 that since 2000, Germany has had a higher percentage of mobile subscribers than the US. Most recent data from 2001 illustrates that Germany exceeded the US's mobile penetration rate by approximately 20 percent – both for mobile subscribers (Figure 5.1) and subscriptions (Figure 5.2). The Research Room data (Figure 5.2), projects that this difference will persist into 2007, by which time Germany is estimated to have an approximately 80 percent mobile penetration rate compared with around 65 percent in the US. Figure 5.2 also illustrates that mobile subscription percentages will begin to stabilize near 2007.

A visual and qualitative comparison of the logistic curve, or S-curve, as described in Chapter 3 (see Figure 3.1 on page 49), and Figure 5.2 can roughly estimate the current stage of diffusion. Figure 5.2 depicts that technology growth took off slowly between 1991 and 1998; percentages began to climb more rapidly between 1998 and 2002; and increases in percentage slow down to reach a plateau near 2007. A similar path can be illustrated using various adopter categories: innovators (~1991), early adopters (~1993), early majority (~1996), late majority (~1999), and laggards (~2007) (see Figure 3.4 on page 58). Yet, the problem in using a logistic curve in predictions, i.e. the likelihood of error in forecasting the final height of the curve discussed in Chapter 3 (page 50), must be taken into account and applied to the Research Room projections in Figure 5.2. The visual comparison of the curves in Figure 5.2 with the logistic curve from Figure 3.1, suggest that German and US mobile subscriber percentages begin to level off in 2007, albeit with Germany at a higher percentage than the US, 80 percent versus 65 percent, respectively; essentially reaching saturation by that time. Yet, the projected 65 percent saturation level for the US seems quite low. Because the Research Room's forecast model includes numerous assumptions as mentioned in the methodology, it seems likely that the S-curve has been used, as it is typically used in determining the course of diffusion (Gould, 1969, p 19). Therefore, it may be that the Research Room projections are vulnerable to the curve-fitting problem pointed out previously - the difficulty in estimating a final saturation level, which can only truly be determined in retrospect.

While the future may be unknown, analyzing these statistics and coordinating these numbers with the previous discussion, it is apparent that Germany currently boasts more wireless subscribers than the US. Forecasts suggest that this is likely to remain the case for some years to come. Europe's commitment and coordination in creating one universal standard gave it an edge over the US mobile phone market (Gruber, 2001; Walters and Kritizinger, 2000). In addition, European producers of telecommunications equipment "have proven to be more successful when there is also a regulatory element" (Gruber, 2001, p 424). This is partially due to the regulatory element, which Gruber alleges, is the act of coordinating GSM implementation across the EU, offering a crucial incentive for making GSM the most extensive digital mobile communications technology (Gruber, 2001, p 424). But whatever the reason for Europe's advantages over the US, the crucial point is that "Europe is definitely leading in the diffusion of mobile telecommunications" (Gruber, 2001, p 429).

Comparing the US and EU: LBS Statistics

Such rapid growth in the mobile phone market ultimately has an impact on the diffusion of mobile applications. Thomas Geitner, a board member of the British-based wireless carrier Vodafone, states, "Technology alone doesn't sell [...] what the mobile industry needs to continue growing are compelling, easy-to-use and attractively priced services" (Blau, 2003). To increase growth in the mobile market, Geitner claims that new services offering customers benefits that they are willing to pay for will create new demand, and hence growth (Blau, 2003). In the mid 1990's, location information, provided in a variety of formats, became a fundamental part of mobility since commercial uses of the Global Positioning System (GPS) began to thrive (Smyth, 2000). Linking information with location has become a "traveler's friend" as well as an increasingly "important differentiator for mobile multimedia" (Smyth, 2000, p 60). As Rob Sanderson, senior equity analyst with Bank of America put it, "Who doesn't want to know where their friends are?" (Cleary, 2001), implying that LBSs, such as AT&T's *Find Friends* service, will be a natural and obvious choice for most mobile users. LBS companies are of course hoping that Mr. Sanderson's prediction is true. The prediction may slowly be coming

true since the proliferation of the mobile phone has spurred the LBS industry. Certain location-based services (LBSs) are already available, as discussed in Chapter 2. This coupled with the ever increasing rate of mobile phone diffusion will likely contribute to an increase in new LBSs and applications, such as retail LBS.

Global LBS Statistics

LBS statistics from mobile operators project that over 40 percent of operators' mobile data services revenues will come from LBSs by 2007 (PR Newswire, 2002). This statistic from the marketing research firm Analysis Research Consultancy (ARC) Group was published in a strategic outlook report in August 2002 concerning the LBS industry (ARC Group, 2002). The report also suggests that consumer-oriented applications, which are already deployed, will produce more revenue than business-oriented applications, while both will contribute to an estimated 15 billion dollars worldwide revenues by the year 2007 (PR Newswire, 2002).

Research conducted in February 2002 by Ovum Research (Ovum Research, 2002), a major European research firm, indicated that 55 percent of mobile subscribers will subscribe to LBSs generating revenues of "on the order of \$20 billion worldwide" (Leite and Pereira, 2002). In North America, the potential revenue for LBSs in 2005 is over ½ billion US dollars, whereas in Europe, that number is over 1 billion dollars (Figure 5.3) (Leite and Pereira, 2002). Though Europe's potential in 2005 is almost twice that of North America, Ovum Research's forecasts suggest that by 2010, North America will exceed LBS revenue in Europe by approximately ½ billion US dollars (Figure 5.3).

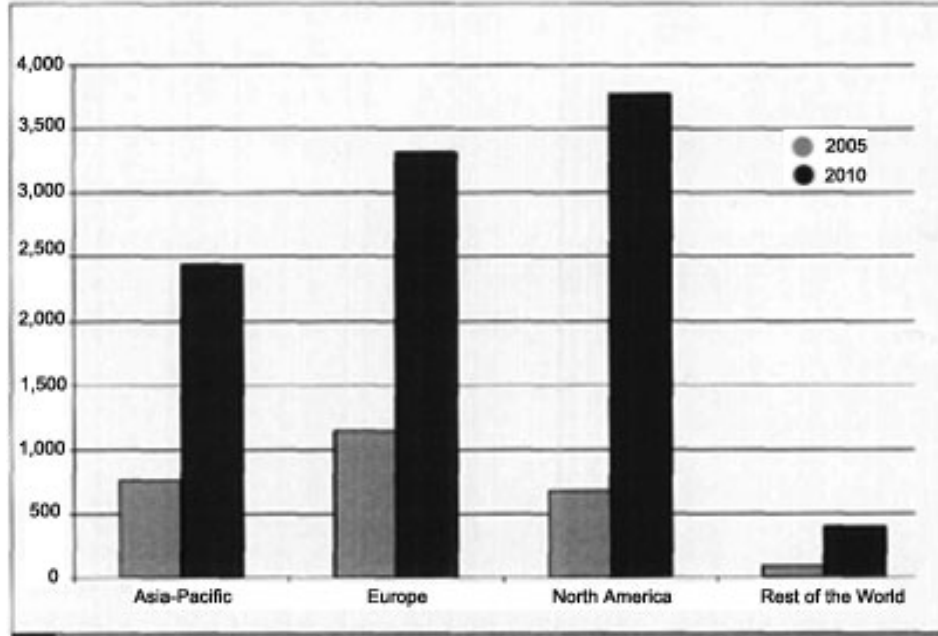


Figure 5.3. Predicted LBS revenues (in millions of US dollars) (data from Ovum Research, chart obtained from (Leite and Pereira, 2002))

Similar conclusions were drawn by the UMTS (Universal Mobile Telecommunications System)⁴ Forum, an international organization promoting the global use of UMTS 3G mobile systems and services, in a forecast report less than a year earlier. Its report entitled *The UMTS Third Generation Market, Phase II - Structuring the Service Revenue Opportunities* published in April 2001, included worldwide and regional forecasts for LBSs (UMTS Forum, 2001b). The Executive Summary states that “North America provides the greatest revenue opportunity for [...] Location-Based Services” (UMTS Forum, 2001a, p 2). On a global scale, revenue from LBSs retained by the 3G service providers will be an estimated 10 billion USD by 2010 (UMTS Forum, 2001a, p 3), a much lower estimate than the figure previously mentioned from Ovum Research.

In the US

US consumer interest in LBS is a hot topic for many marketing research firms. A Driscoll-Wolfe Marketing and Research Consulting study completed in May 2002 asked consumers to comment on their interest in LBSs (Driscoll-Wolfe, 2002). Research

⁴ UMTS is one alternative of the various third generation (3G) mobile technologies. Essentially, it is the 3G version of GSM.

demonstrated that many US consumers are most interested in safety-related LBSs; 44 percent of subjects were interested in roadside assistance services, 36 percent in emergency notification services, and 26 percent in stolen vehicle tracking services (Driscoll, 2002). Many subjects also responded that they would “accept some advertising from nearby retailers [i.e. retail LBS], if it is not intrusive, in exchange for a discount on services or airtime” (Driscoll-Wolfe, 2002). These and other LBSs are estimated to contribute six billion dollars in annual LBS revenue in the US by 2005 (Cleary, 2001). However, this set of forecasts constitutes only one of many predictions. Other figures have claimed that the LBS revenue will increase from six million in 2002 to 828 million dollars by 2005 (Pfeiffer *et al.*, 2003).

In the EU

While there is excitement about the *promise* of LBS in the US, the LBS situation in the EU contrasts slightly. According to Concise Insight, a technology consulting firm, a majority of Western European cellular operators were *already* offering commercial location-based services by early 2003 (Moss, 2003). One hundred thirty-three individual commercial services were available at the end of the fourth quarter in 2002 (Concise Insight, 2003). This, in addition to a larger percentage of Europe’s population using mobile phones, accounts for the region’s label as “a primary market for location-service businesses” (Cleary, 2001). The LBS market, is estimated to “generate 6.37 billion dollars in incremental annual revenue for mobile phone providers across Western Europe by 2005” according to Yankee Group research firm (Cleary, 2001). This forecast, when compared with the US six billion dollar forecast made above, is oddly similar. However, when comparing the EU prediction with other predictions to the US market (828 million dollars in LBS revenue (Pfeiffer *et al.*, 2003)), the numbers are quite distinct.

Discrepancies in the forecasts used in this chapter demonstrate the need for caution, as illustrated by AT&T’s early expectations of mobile phone forecasts being out by a factor of 100. However, discrepancies may be explained by a variety of factors. Whether estimated LBS revenues miss, meet, or exceed projections involves a variety of factors, such as location infrastructure and technology, user experience, and service infrastructure (Northridge, 2003). These same factors were offered as potential factors

affecting the success of retail LBS in survey question number 11 (Appendix A). Location infrastructure, i.e. location technologies described in detail in Chapter 2, are able to more or less accurately determine the location of a mobile user (Table 2.1). Europe, relying mostly on Cell ID technology (Moss, 2003; Northridge, 2003; Staff, 2003), will therefore only be able to offer certain services through this method. In contrast, more precise location technologies, as required in the US by the FCC E911 mandate, will be able to offer more ubiquitous and more personalized LBS applications, increasing a user's potential and reliance (Northridge, 2003). This in turn should increase diffusion of services, i.e. an increase in LBS revenue (Northridge, 2003). However, a user's privacy will be a major factor in LBS adoption (Interviewee-2, 2003; Northridge, 2003), a factor also mentioned by a majority of survey respondents. Considerable concern over privacy could therefore decrease use of LBSs, hence reducing revenue. A third factor affecting the true outcome of LBS revenues includes service infrastructure. Service infrastructure constitutes directing a mobile user's location information to an LBS service provider "within and outside the boundaries of the wireless network operator" (Northridge, 2003). Twelve of 29 survey respondents claimed this to be the number one factor attributing to the potential diffusion and adoption of retail LBS. Hence, if the services infrastructure is inadequate, LBS revenues will likely stagnate. Regardless of the reasons for discrepancy, only time will tell if these large expectations can be met.

Conclusion

Though comparisons of mobile phone percentages in the US and Germany, as well as LBS revenue predictions, cannot be determined by exact numbers, these comparisons and predictions demonstrate the existing potential for new and advanced LBSs, particularly retail LBS. The analysis of mobile numbers and LBS revenue projections has shown that 1) growth within the mobile sector will likely continue over the next few years, 2) a large number of retail LBS diffusion vectors are available in both the US and Germany, with a slightly larger percentage existing in Germany, and 3) these vectors offer significant growth potential for future LBS applications.

Nevertheless, the diffusion of retail LBS can occur only as long as the vectors, i.e. mobile phones, encounter no barriers. And just as the social informatics framework asserts, the tangible technologies and statistics surrounding mobile phones are not the only components necessary to determine whether or not diffusion will take place. The societal context of retail LBS technology is a vital component in determining its diffusion and adoption. The following chapter highlights an important social aspect of retail LBS, namely privacy.