

# **STRATEGY IN THE GLOBAL MOBILE PHONE INDUSTRY**

**By**

**F.A.Hashim Raza**

**THESIS**

Submitted to  
School of Public Policy and Management, KDI  
In partial fulfillment of the requirements  
for the degree of

**MASTER OF BUSINESS ADMINISTRATION**

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## **ABSTRACT**

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The global mobile phone industry has emerged as an extremely competitive yet attractive industry, characterized by a blend of high technology, intense competition and attractive markets. Particularly in the last decade, it has gone through remarkable advancements simultaneously in technology, competitiveness and customer orientation, leaving its strategy makers completely mesmerized. This dynamic transformation is an outcome of a multi dimensional journey performed by the industry in the last twenty years. On the technology dimension, the journey from 1<sup>st</sup> to 3<sup>rd</sup> generation phones and from a variety of un compatible technical standards to a single universal wireless standard, on the competitiveness dimension, the journey from close to monopolistic competition to a cutting-edge competitive environment with a vast array of players and on the customer dimension, the industry leaped from hundreds of them to 900 million in 2001. During the course of this transformation, companies like Nokia ascended the growth ladder to #1 in the wireless world from nowhere, whereas a number of other companies even lost their existence in the process. These extremes amongst the industry players are peculiar of any competitive industry, but in case of wireless industry this environment has emerged in less than 20 years, which is so far unprecedented. Lately, with the advent of the 3<sup>rd</sup> generation phones, the industry entered into an entirely new dimension, convergence with other industries like computers, software, Internet solutions etc. This convergence has posed serious implications for the industry managers. The global mobile phone industry, at the moment, presents an ideal case study for the strategy makers in a truly global and competitive industry. An endeavor has, therefore, been made, in this thesis; to identify the challenges faced by the industry, to define the present opportunities and to analyze the strategies of the major players of the industry, followed by a summary of the key findings from the global mobile phone industry.

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## **ACKNOWLEDGEMENTS**

I am grateful to a number of individuals who devoted their precious time and efforts, in one way or the other, towards the completion of this work.

I owe the basis of my research interest in the mobile phone industry to Professor Seung-Joo Lee, with whom I worked as a Research Assistant during my KDI School duration. My especial gratitude goes to him; he gave his valuable time not only in guiding me about the thesis contents but also in outlining the basic issues, which should be highlighted during the course of research. He kept a constant watch on the progress of my research and kept contributing through guiding points and sources.

Where the academic sources helped me in maintaining a gradual pace in conducting research towards the completion of my thesis, there was a personality who kept motivating me, to do even better by helping me in every thing, typing, cooking, living etc as well as aspiring my inner self and consoling my soul during my stay at KDI School. She is my beloved wife, Ayeshah.

Last but not the least, I acknowledge the co-operative and helping attitude of every member of the KDI School family, who always try to extend every sort of help and assistance.

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# INTRODUCTION

## Background and Objective of the Research

Mobile telecommunications is one of the most tenacious and cutting edge fields in today's competitive era, which encompasses new challenges faced by the world on the turnover of the new millennium. In spite of a remarkable advancement, which is already achieved in this sector, a competitive journey towards an unknown destination is still going on. With each new technological advancement in the industry something even better appear in the pipeline. As a thoughtful spectator in such a dynamic period, I have made an endeavor to outline the evolution of the global mobile phone industry through different stages, the pitfalls, which have been dictating its competitive environment leading to the present trends and the emerging future challenges.

Towards the later half of the twentieth century, some successful businesses exclusively attracted the attention of global audience by virtue of their successful strategies. Efficient managers, through their farsighted visions and strategic foresight, evolved such successful strategies for the companies, which made them prosper with leaps and bounds. But one thing was common in all such strategies adopted by the successful companies of today in their ladder of success i.e. their strategies was, to some degree, dependent on substantial prediction of their future

challenges, against whom the strategists of 20<sup>th</sup> century formulated the strategies and succeeded.

Unlike them, the leaders and strategists of the mobile phone companies are rather handicapped in formulating the future strategies for their companies because of the mere fact that the future of global mobile phone industry is somewhat vague at the moment. Obviously its technology has to advance, but to what extent? This is the question which no one seems to answer. In the last decade even a mobile phone, enabling its user to talk on move, was considered to be a great advancement, today the transmission of voice only, is considered antique and exchange of video and data signals has become common. What is going to happen tomorrow on the forefront of mobile phone technology, nobody knows.

Strategy making in such uncertain conditions is a real challenge. Hitherto everyone has seen, analyzed and basing on their knowledge and understandings, either criticized or applauded, previous strategists and their strategies in conditions which were, if not fully than to some extent predictable. But the point to ponder is that how to evolve an implement able strategy in uncertain conditions, when the future can neither be foreseen nor predicted.

With the above mentioned background, I come to the objective of my research, to analyze the trends of the global mobile phone industry, carrying out critical analysis of its market characteristics, technology

standards vis-à-vis geographical compatibility, identifying the future challenges in the industry and deduce strategic conclusions, which can be derived from its emerging trends. The research will help us visualize the present trends and how they are being molded into the future challenges for the key players of the mobile phone industry.

## Research Methodology

Prior to embarking on the research for writing the thesis on the global mobile phone industry, deliberate research was carried out on the leading player of the industry i.e., Nokia, resulting into an academic case study on the strategic transformation and growth of Nokia<sup>1</sup>. Soon after the case study was finalized, it was thought essential to expand the scope from one player of the industry to the entire global industry. Lot of issues were needed to be dealt with in order to widen the horizon of research, some of which are as follows:

- a. Deliberation on the trends of the industry, in order to pinpoint, the key issues towards which, the research should be directed.
- b. Identification of informative sources.
- c. Going back to the roots of the mobile phone industry.
- d. Gathering information from the identified sources; Web journals<sup>2</sup>, magazines<sup>3</sup>, companies<sup>4</sup>, universities<sup>5</sup>, case studies<sup>6</sup>, friends, articles etc.

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<sup>1</sup> KDI School Case Study, Nokia Strategic Transformation and Growth, co-authored by Prof Seung Joo-Lee and myself, December, 2000.

<sup>2</sup> Web Journals: M for mobile, wow-com, B2B Analyst, Gartner insight for the connected world, Wapland, Business week online, world cellular review etc

<sup>3</sup> Business week, Forbes weekly, Time, Newsweek, Economist, Fortune, Harvard Business Review, Asia Business News etc

<sup>4</sup> Nokia, Ericsson, Motorola, Samsung, NTT DoCoMo, Gartner, Qualcomm, Microsoft, AT&T, Ariba, LG Electronics, Alcatel, Lucent Technologies etc

<sup>5</sup> Harvard University Database, KDI School, NYU, KDI Library, Quaid-e-Azam University, Punjab University etc

<sup>6</sup> Case Studies from Harvard University, IMD, University of Helsinki, INSEAD etc

- e. Perusal, sifting and organization of the collected material.
- f. Making an outline of the research and its tentative issues/subjects.
- g. Reading and marking the relevant material.
- h. Writing the thesis based on the collected material.
- i. Organizing the written material into one coherent and interlinked document.
- j. Carrying out in-depth scrutiny of the document and deleting the undesirable parts.
- k. Final check on the latest news regarding the research subject so that if there are any new additions, they may also be incorporated in the research.
- l. Printing the final draft and submitting it to the supervisor for approval.

## **Organization of the Paper**

This research has been organized into four parts, as follows:

### **I. Introduction:**

- a. Background and objective of the research
- b. Research methodology
- c. Organization of the paper

### **II. Global Overview of the Mobile Phone Industry:**

- a. Evolution of products and technologies
- b. Market characteristics
- c. 3G and its strategic implications

### **III. Strategy of Key Players:**

- a. Nokia
- b. Motorola
- c. Ericsson
- d. Samsung
- e. NTT Do Co Mo
- f. Others

### **IV. Conclusion:**

Summary of key findings

# GLOBAL OVERVIEW OF THE MOBILE PHONE

## INDUSTRY

### Evolution of Products and Technologies

#### Origin of Mobile Phones

In 1876, Alexander Graham bell patented a wire telephone<sup>7</sup>, which marked a technological breakthrough in the world. The invention of telephone made it possible for two individuals to communicate with one another irrespective of geographical distances between them, only if there is a network of telephone wires and services at those places. At that time, nobody could have thought that someday people will be able to communicate from anywhere in the world, may it be in the center of an ocean or the top of a mountain or in aircraft flying at 10,000 meters altitude. The mobile phones made it possible to do so.

Historically, the first mobile radio service started in the 1940' s in USA and UK. Prior to 1940' s, the radio transmitters and receivers were used as separate gadgets but in 1946<sup>8</sup>, AT&T interconnected both of them with Public Switched Telephone Network (PSTN)<sup>9</sup> and introduced its Mobile Telephone Communication service (MTC) in the New York City (NYC) in USA. That was more of a wireless set than a telephone. The

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<sup>7</sup> Source: Encyclopedia Britannica

<sup>8</sup> Source: AT&T

<sup>9</sup> For all the abbreviations see Appendix P



mobile user had to look for a free frequency channel before trying to place a call. Even after the call was placed, the radio connection was one way. It means that like the wireless sets transmission, only one person could talk at a time. The speaker used to press a button to talk, and while one person talked the other could only listen and vice versa.

Interestingly enough, there are some sources who claim that the world's first ever Mobile Telephone System (MTS) was introduced and developed by the telecommunications company of Sweden by the name of "S.Lauhren"<sup>10</sup>, where as no clues of the same have been found in any research work. AT&T and South Western Bell originated the world's first MTS, according to all the publicly available sources, in 1946.

AT&T launched an improved version of mobile telephones in 1964, known as Improved Mobile Telephone Service (IMTS). This was much better than the earlier ones in the sense that they provided full-duplex operation, automatic dialing and automatic channel searching. Soon after this, AT&T and Motorola jointly developed a new system for American cellular telephones known as Advanced Mobile Phone System (AMPS). Even after the development of AMPS, the same was not publicly put to use. In the meantime, Japan became the first country to launch the first cellular system in 1979, known as the Japanese system.

In close pursuit of the Japanese system, the Nordic countries, i.e. Finland, Sweden, Norway and Denmark also launched a cellular telephone system known as Nordic Mobile Telephone (NMT) system in

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<sup>10</sup> Source: "Mobile Phone History" by Tom Farley

1981 followed by TACS of the UK in 1983<sup>11</sup>. It was only then i.e. 1983, that the AMPS was publicly introduced in Chicago<sup>12</sup>. Thus the mobile phone became a reality for a common man around the world by the middle of 1980' s.

### **Product development history and subsequent technology standards**

Mobile radios were first used in 1921 by a police department of Detroit, Michigan in USA. Those mobile radios, were operated at 92 MHz, which is almost the same as the A.M radio frequency broadcast band of today. Those mobile radio services were more of experimental in nature. There weren' t any significant contributions in the mobile phone industry for the subsequent two and a half decades. Though an official organization by the name of Federal Communications Commission (FCC) was created by the US congress in 1934 to regulate the communication companies and their services.

Then on the 17<sup>th</sup> day of July in 1946, AT&T and South Western Bell jointly introduced the first American Commercial Mobile Telephone Service (MTS). In the same year a “Public Correspondence System” was declared by FCC as a “Domestic Public Land Mobile Radio Service” (DPLMRS). This was given the frequency band of 35-44 MHz<sup>13</sup>. Basically these newly introduced commercial mobile radio telephones used the vehicle radiotelephone licenses issued by FCC. A centrally located

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<sup>11</sup> Source: British Telecom

<sup>12</sup> Source: Mobile Phone History by Tom Farley

<sup>13</sup> Source: Mobile Phone History by Tom Farley

antenna, which was installed high above the South Western Bell's headquarters, transmitted signals to mobiles. This was a straightforward communication process. The telephone customer used to dial "long distance" and got connected with the mobile services operator to whom he gave the telephone number of the vehicle he wanted to call. The operator on getting the number sent out a signal from the radio control terminal, which switched on a light and rang a bell in the mobile unit of the receiver. The receiver answered his telephone and voice traveled by radio to the nearest receiver and then through the telephone wire. In this way the two-way communication was managed in the "MTS".

All of these mobile radio systems were PTT (push to talk) systems and only one party could talk at a time. The talking party used to push a button and release it as soon as the talk is finished to let the other party push and talk. Nevertheless, the police departments, fire departments and other emergency services, mostly used this MTS.

However, the commercial use of MTS was limited and it really lacked the characteristics of a consumer mobile phone. In 1956 the mobile telephone system introduced by South Western Bell, known as Bell system, started providing manual radio talk service. Other telephone companies such as Richmond Radiotelephone Company etc, made similar advances to mobile telephony throughout the 1950's and 1960's<sup>14</sup>. But it was not till 1964, that the first such consumer friendly mobile phone

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<sup>14</sup> Source: Affordable phones official web site.

system was introduced which is known as Improved Mobile Telephone Service (IMTS) by the South Western Bell System.

This system eliminated the PTT (push to talk) and for the first time in the history of mobile phones, made it possible for the users to talk and listen at the same time and also do their own dialing. Though IMTS facilitated the mobile communications to a greater extent yet there were certain inherent weaknesses in the system. There were very few channel spaces or frequencies available for the consumers and almost every time there was saturation stage at every place. In every city where the MTS was introduced waiting lists developed which grew every year. For instance, by 1976, there were 545 mobile phone customers in New York City against 3700 customers on waiting list. More than 20,000 customers were on 5-10 years waiting list across the country. IMTS was used by all circles of the society till the end of 1970' s.

#### **a. First Generation Phones**

##### **AMPS:**

In 1979, the Bell telephone again made a technological advancement in the global mobile telephone industry by introducing the advanced mobile phone service. Later developed by AT&T and Motorola, AMPS was based on 666 paired voice channels with a much broader frequency range and available channels to its subscribers. It used analog modulation (AM) as well as frequency modulation (FM). From its very outset AMPS was

designed and developed to work efficiently with the mobile and portable subscriber units.

The subscribers of AMPS used Frequency Division Multiple Access (FDMA) as the technical standard. In this system, the callers use separate frequency slots via FDMA. When one telephone call is completed, a network, managing computer at the cellular base station, reassigns the released frequency slot to a new caller. Typically AMPS reuses the frequency slots whenever possible to accommodate the maximum number of callers. Although designed and developed much earlier, AMPS was publicly launched in 1983 in Chicago, USA. AMPS was a great success, in its first year, it had 200,000 subscribers and after five years the figure leaped to 2 Million, only in USA.

### **Other Cellular Communication Systems:**

Chronologically AMPS or the advanced mobile phone service was the first ever cellular system to be developed yet it was not the first one to be launched and put to use. By 1977, AT&T Bell Labs constructed and operated the prototype cellular phone system<sup>15</sup>. A year later public trials of the new cellular system were started in Chicago yet its public usage wasn't started. In the meantime, when further research and experimentation was being done on AMPS, the Japanese introduced a Japanese cellular system in Tokyo in 1979, which is invariably regarded as the first commercial cellular phone system in the world. Following the

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<sup>15</sup> Source: AT&T, USA

Japanese, the Norwegian or Nordic countries, including Denmark, Finland, Norway and Sweden not only developed but deployed also their own cellular phone system by the name of Nordic Mobile Telephone (NMT) system in 1981 all across the Nordic countries. United Kingdom begged the next place in chronological order in introducing a cellular system of its own i.e. Total Access Communications System (TACS)<sup>16</sup> in 1983. In this way this fact can be deduced from the historical chronology of events that Europe made a comparatively swifter and more sophisticated advancements in the global cellular phone industry.

Although developed in a close chronological proximity, yet all of these cellular telephone systems were incompatible with one another, therefore it was not possible to use a telephone set, working on one system, in another country.

## **b. Second Generation Cellular Phones**

### **GSM:**

Due to chronological proximity and overlap of common interests, the countries of the European community needed a common telephone system by which they could make effective use of one telephone in all the countries. This led to some research by the group of government owned public telephone bodies within the European community, on the cellular telephone systems. Finally in 1988 the group announced a digital Global System for Mobile communications (GSM), the first cellular system ever,

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<sup>16</sup> Source: British Telecom

which would make it possible for a mobile phone subscriber in one GSM country to operate his own personal mobile phone in another GSM country.

In other words, GSM marked the culmination of geographical parameters for the international cellular phone technology. Henceforth, all GSM cellular users could use their telephone sets throughout Europe and could receive and send telephone calls from their hand phones, irrespective of geographical frontiers<sup>17</sup>. With the introduction of GSM in Europe all the earlier cellular communication systems being used in the European countries at that time e.g. NMT (Nordic), TACS (Total access communication system) etc, were quickly replaced by the new European digital standard GSM (**See Appendix F**).

GSM operates in 900 MHz or 1800 MHz band. The digital processing uses phase modulation that again results in only very small and essentially random changes in the amplitude of the carrier wave. The channels are distributed across the cells in a way that allows neighboring cells to operate at different frequencies to avoid interference. These characteristics allowed more space wave, freedom and minimum interference to its subscribers.

### **Second Generation AMPS:**

With the launch of GSM, the American cellular industry also developed new approach to its existing cellular standard AMPS. AMPS, was hitherto functioning on FDMA technology. As a part of its advancement, one

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<sup>17</sup> Source: European union countries official web site i.e. Euroforum.com

analog FM approach, proposed by Motorola in 1991, was NAMPS (Narrow band AMPS). NAMPS offered additional channels and other extra features in the existing AMPS. Another approach, developed by committee of the Telecommunications Industry Association (TIA) in 1998, employed digital modulation and digital voice compression through TDMA method. This also expanded the existing AMPS channels by three times.

### **Other Second Generation technology standards:**

Yet another approach, developed by USA based company 'Qualcomm' in 1994, used a form of spread spectrum multiple access known as Code Division Multiple Access (CDMA), a technique that, like the original TIA approach combined digital voice compression with digital modulation<sup>18</sup>. All of these second-generation mobile phone technology standards are given below in detail (**See Appendix C for Global Technology Standards**):

### **CDMA:**

This system has been used in mobile military communication for the past 40 years. It is digital in nature. Its process starts with the breaking up of the digitized conversation into bundles, and then it compresses the bundles and sends them. On reaching the receiver, the bundles are decompressed and are converted back into analog. During the course of this process it has been found out that CDMA is susceptible to interference, though very rare. The interference results in packet

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<sup>18</sup> Source: Qualcomm's official website i.e. Qualcomm.com



retransmissions and often delays in the communications. The delays are so brief that they are not ordinarily noticed during a call.

CDMA is sometimes referred to as Spread-Spectrum Multiple Access (SSMA) also because the process of multiplying the signal by the code sequence causes the power of the transmitted signal to spread over a larger bandwidth<sup>19</sup>. Frequency management, which hitherto was a mandatory and often troubling feature of communication channel, has been eliminated in CDMA. When another user wishes to use the communications channel, it is assigned a code and immediately transmits, unlike FDMA and TDMA, where the subject user is being stored until a frequency slot opens.

**TDMA:**

In TDMA, the time is divided into different smaller slots. Placing them in already divided time slots also separates the signals of individual users. So the requests to use the communication channels keep coming at random and therefore there are occasions when the number of requests for the time slots exceeds the separate time slots. In such cases, information has to be delayed by being buffered or stored in the memory until any time slot becomes available to cater for the request. With TDMA,

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<sup>19</sup> Source: Qualcomm

calls are simultaneously held on the same channels, but are multiplexed<sup>20</sup> between pauses in the conversation.

These pauses occur in the way people talk and think and the cellular services provider company also injects short delays during the course of conversations to accommodate maximum traffic on that channel. TDMA is mostly used in the AMPS system in the second-generation mobile phones.

Currently TDMA is in the process of enabling worldwide roaming installing a massive base of GSM network<sup>21</sup>. Both systems can technically combine to provide roaming to each other. In June 2000, the Universal Wireless Communications Consortium (UWCC), which represent TDMA interests, announced that by June of 2000 there were 50 million subscribers of TDMA.

### **Third Generation Mobile Phones**

#### **3 G Phones/ WAP:**

Wireless Application Protocol (WAP) provides a universal open standard for bringing Internet content and advanced value added services to mobile phones and other wireless devices in the form of 3<sup>rd</sup> generation phones. WAP would enable users to access web based interactive information services and applications from the screen of the mobile phones. These

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<sup>20</sup> Multiplexing is the sharing of a communication channel through local combining of signals at a common point. Two types of multiplexing are commonly employed:

- Frequency division multiplexing
- Time division multiplexing

<sup>21</sup> Source: TDMA' s web site i.e. TDMA-edge.com

include both consumer and corporate solutions, like e-mail, corporate data, news, sports, entertainment and information services. According to the Nokia Mobile phones, WAP is at the heart of Total Connectivity Usage.

There is, however, a big drawback in the bridge from second generation phones to 3<sup>rd</sup> generation phones. All the existing technologies in the 2<sup>nd</sup> generation phones, except CDMA, are circuit switched, a system that is good for voice but unsuitable for data transmission. There is a way to upgrade most of the existing technologies in order to enable them to support the packet-switched data, the technology standard of 3<sup>rd</sup> generation phones<sup>22</sup>. A need was therefore felt to develop the bridging technologies from the 2G to 3G systems. These bridging technologies are collectively known as 2.5 G solutions, since they are developed on second-generation networks using the same transmission frequencies and much of the same equipment.

In Europe, this bridging technology or 2.5 G took the form of a data standard called General Packet Radio Service (GPRS)<sup>23</sup>. GPRS can give GPRS-enabled hand phones access to always-on data connections at up to 28 kilobits per second initially and eventually 56 kilobits per second, the speed of a conventional landline modem.

In USA, the TDMA networks used a relatively more advanced technology known as Enhanced Data Rates for Global Evolution (EDGE). Rather than simply adding a packet-switched stream to the existing signal,

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<sup>22</sup> Source: Mobile Communications International

<sup>23</sup> Source: Euroforum.com

EDGE uses a different signal, modulated at a far higher speed to make better use of the available spectrum.

### **3G cellular technology standard**

#### **IMT-2000/UMTS:**

A third generation of mobile telecommunications technology has now been agreed and will be introduced in the next few years. It is globally known as IMT-2000 (International Mobile Telecommunications 2000). In Europe, It is also known as UMTS (Universal Mobile Telecommunication System). The frequency bands identified for this system are 1885-2010 MHz and 2110-2200 MHz and the need for additional frequency spectrum to meet future expected demand for capacity has also been recognized and is being debated at the World Radio Communication Conferences, held from time to time around the world<sup>24</sup>. The specifications allow some choice in the modulation to be used but it is expected that the main choice will be CDMA (Code Division Multiple Access). The frequency channels will have 5MHz bandwidths and, as in GSM, each can be used by a number of users at the same time. However, in CDMA, a transmission is “labeled” by a coding scheme that is different for each user. Since all the transmissions occur at the same time, the changes in amplitude of the carrier waves are essentially random (noise-like).

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<sup>24</sup>Source: Mobile Communications International

Two types of CDMA are likely to be implemented<sup>25</sup>: FDD (Frequency Division Duplex), where separate 5MHz channels are used for two directions (to and from the mobile phone), and TDD (Time Division Duplex), where the same channel is used but in different time slots. Both types lead to pulse modulation because of the need to send regular commands from the base station to change the power level. In FDD the pulse frequency is 1600 Hz, while for TDD it can vary between 100 Hz and 800 Hz<sup>26</sup>.

The expected demand for the use of UMTS both for speech and for data and internet services is such that systems may be expected to employ macrocells and microcells, and also short-range picocells, to meet the various requirements for mobility and wide bandwidth services- for example, in the office environment.

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<sup>25</sup> Source: Encyclopedia Britannica

<sup>26</sup> Source: Pederson and Anderson, 1999

## **Market Characteristics**

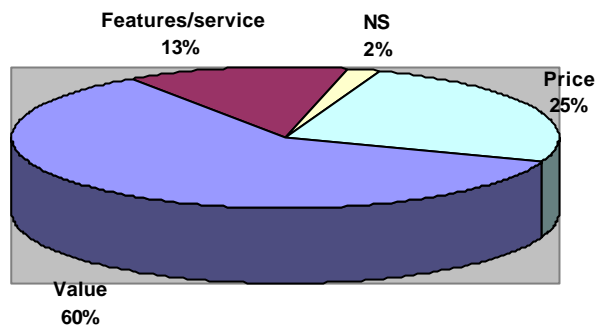
The global mobile phone industry has its peculiar market characteristics, unlike any other industry, which differ from region to region. First of all this industry started as a luxury, moving to a facility and then gradually transformed into a necessity but only for a particular class<sup>27</sup>. This fact particularly holds true for developed countries like USA, Europe, Japan, Korea etc **(See Appendices B & E for subscribers by region)**.

Although the technological aspects of the mobile phone industry may differ from region to region, yet the consumer related characteristics remain the same irrespective of the geographical regions. Normally those mobile phone consumers who are value shoppers, always looking for the middle ground, dominate the global wireless market. They care more about getting the best value for the money than about getting the lowest price for the best features and services.

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<sup>27</sup> Source: Survey conducted by Peter D. Hart Associates, Washington D.C. in February 2000.

**Segmenting The Market:  
Price, Value, Features**  
*Most important factors in shopping  
for wireless phones & service*



**Source:** *The Wireless Market Place in 2000, Peter D. Hart Research Associates*

The value shoppers are normally middle aged, middle-income users and most of the time they are long time users<sup>28</sup>. On the other hand, the price-sensitive shoppers are normally light users (39%), personal safety users (37%), older women (32%) and lower income households (31%). Features and services shoppers comprise of young generation (20%), upper income class (20%), heavy users (18%) and business users (17%).

Presently the global wireless industry is going through an era of strong competition with consumer comparison shopping, switching providers and experiencing the benefits of competition. More than 56% of present wireless users say that they have had at least two different

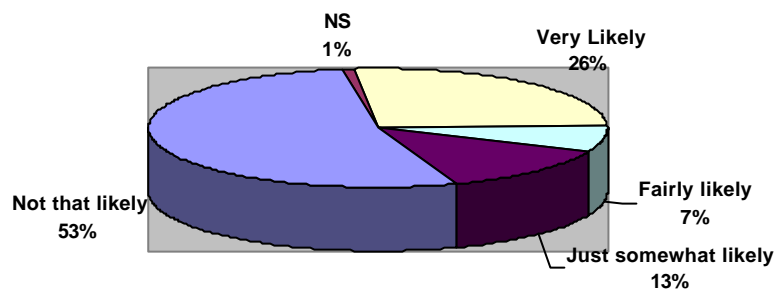
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<sup>28</sup> Source: Survey conducted by Peter D. Hart Associates, Washington D.C. in February 2000

phones. Every one user in four users states that he is likely to replace his phone within this year. This indicates that there is a strong opportunity for growth even among the current users.

**Opportunities For Growth  
Among Current Users**

*How likely are you to replace/upgrade your current wireless phone in the next year?*



**Source:** *The Wireless Market Place in 2000, Peter D. Hart Research Associates*



## **Market Characteristics by Region**

### **Europe:**

The wireless mania basically started from Europe and till today the names of key mobile phone players, except Motorola, are linked with European market. Presently there were only two telecom companies in the world who have market capitalization in the top ten companies of the world, Vodafone and Nokia, both being European. The brand name of Nokia is 5<sup>th</sup> in the world<sup>29</sup>. The most widely used digital system, GSM, is also a European system, basically designed by the European countries to facilitate one another. So unlike in most other industries, in mobile phone industry, Europe has played a vital role in its identity, development, innovation and growth.

At the end of 2000, there were 212 million subscribers in Western Europe only, which shows a penetration rate of 47% (**See Appendix A for market penetration**). Eastern Europe had 27 million with 11% penetration rate<sup>30</sup>. Some of the European countries have very high penetration rates, e.g. Finland 70%, Iceland 78%, Italy 62%, Norway 68%, Sweden 64% etc.

Since the market penetration has become very high in Western Europe, the mobile phone markets have become close to saturated. The higher the penetration rate, the lower its growth prospects. For example, Finland with a market penetration of 70% just grew by 16%, in year 1999-2000, whereas Spain with a market penetration of 50% in 2000

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<sup>29</sup> Source: Citibank, Interbrand

<sup>30</sup> Source: EMC-World Cellular Database

experienced a growth of 100% in 1999-2000. Obviously when the penetration increases, like in case of Spain, which has reached 50% in 2000, unlike in the last year now Spain will not grow at a dynamic 100% growth, rather its growth rate will be marked by decline as it is moving towards saturation stage. A detailed list of the growth rates and the penetration of mobile phones in the European markets is given in **Appendix H**.

Eastern Europe, on the other hand, is less saturated and so the growth prospects in the East European countries are brighter. For instance, Ukraine with a 0.91% penetration experienced a 140% growth rate, Moldova with a 0.94% penetration grew by 258%, Siberia with 6% penetration showed a growth of 160%, Croatia with a 15% penetration rate, experienced 195% growth and similarly Kazakhstan with a mere 0.69% penetration underwent a tremendous 198% growth in 1999-2000.

In the past, visualizing the remarkable future growth opportunities in the mobile phone industry, the key players of the industry concentrated their endeavors on Europe but now the situation is different. The European markets are nearing saturation and so the cushion of growth is comparatively lesser in Europe as against in Asia or America. Another factor, which has in a way, contributed to the advancement of Europe in the mobile phone industry is the presence of key players in the European countries; Ericsson, Nokia and Vodafone; all of them are Europe based<sup>31</sup>.

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<sup>31</sup> Source: Euroforum.com

Technologically also, Europe had been ahead of others in introducing new cellular standards one after the other. Initially Nordic countries in Europe introduced Nordic mobile telephone system (NMT) in 1981. Then TACS was introduced in UK in 1983, then in 1988, GSM was declared as the global system for mobile communications, jointly by a group of representatives from all the European countries. GSM is still leading the global mobile phone industry with maximum subscriber ship<sup>32</sup>**(See Appendix C for Global Technical Standards).**

The key players of the European market, till the middle of 1990' s, followed a regionalist strategy by which they mostly concentrated on expanding their market shares inside Europe. This strategy led to a state of saturation inside Europe. For instance, Nokia initially concentrated on Finland so much so that the number of mobile phones in Finland exceeded that of the line phones, only than Nokia thought of expanding into other countries. Same had been the case, with Ericsson and other European players. It was only in the later half of the nineties when the major players like Nokia and Ericsson realized that even the European market is nearing the saturation stage and the global market is still lying unexplored and then they followed the strategy of globalization. Presently in Europe, Nokia is the market leader in the industry with Ericsson following.

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<sup>32</sup> Sources: EMC World Cellular Database, GSMworld.com

At the end of 2000, Europe enjoyed the maximum share i.e. 38% in the world mobile phone market<sup>33</sup>. Whether it maintains its ascend in the industry or not is open to anyone' s guess.

### **North America:**

North America hasn' t enjoyed a good reputation in the mobile phone players in the history of the industry. Nevertheless it continues to be the world' s richest "Cellular back water"<sup>34</sup>. North America with a subscriber base of almost 110 million (end of 2000) has a penetration rate of 31%, still presenting a huge room for growth. In spite of being the biggest capitalist economy in the world, it only has 18% share in the global mobile phone market **(See Appendix B for market shares)**. Thus a lot of potential in the US market is yet to be explored by the mobile phone companies.

But USA is a market where no customer can travel from New York to LA with one cell phone. There are three different technologies in the US market and to be successful in penetrating the market, one has to master all the three and this comes out to be a very costly project. That is the obvious reason why most of the cellular companies avoid the US market considering it as a white elephant and rightly so. Ericsson, which had also invested a lot in the United States, suffered a great blow in just last year when its market share declined from 19% of the market to 11.5%. So the

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<sup>33</sup> Sources: EMC World Cellular Database, Dataquest

<sup>34</sup> Source: Commentary on Nokias costly stumble by Stephan baker, Business Week Aug 14, 2000

US market presents serious consequences for the companies too in spite of the apparently lucrative opportunities.

Motorola is the biggest and oldest mobile phone company in USA. A number of small companies have recently started their operations in USA like Skytel, Worldcom etc, besides global player Nokia which enjoys 38% share in US market and Ericsson with 12% share<sup>35</sup>. In USA, the subscribership is growing at a rate of 67,082 new wireless subscribers everyday, about one subscriber every two seconds<sup>36</sup>. From 1983 to 1992, the subscriber base grew by 10 million customers. From 1993 to 2000, it went up by 20 million and presently it is experiencing a hike at an even faster pace in USA.

The mobile phone industry in USA initially started with the Improved Mobile Telephone Service (IMTS) in 1964. But it was far short of a technology standard sufficient for a proper two-way mobile phone conversation. However with the launch of Advanced Mobile Phone System (AMPS), USA had its first generation of mobile phones based on AMPS. Later, TDMA was used in the second-generation mobile phones in the US market. Today there are almost 77 million digital subscribers and 33 million analog subscribers in USA. Similarly there are a number of technology standards being followed in North America, 8 million subscribers on GSM, 28 million on CDMA and than 50 million on TDMA.

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<sup>35</sup> Source: Gartner Dataquest

<sup>36</sup> Source: EMC-World Cellular Database

Ironically, apart from Motorola there had been only small scale mobile phone companies in USA with the telephone coverage only in small areas, therefore there was never a compatibility of the technology standards between all the mobile phone users across USA. Even today a large number of companies in USA follow strategies of localism. For example; an east coast mobile phone provider offers some technical standard whereas the west coast company offers yet another. This multiplicity in the technology standards has created disparity amongst the North American subscribers. With the advent of WAP, lately Qualcomm, the founder of CDMA is playing a critical role in propagating the 3rd generation technology across the entire USA so that the transfer of data is made possible. During the course of propagation of the 3<sup>d</sup> generation technology, uniformity of technological standards is also expected to be achieved.

Most of the North American mobile phone companies which were not using the second generation CDMA, plan to use the CDMA modes designed by Qualcomm, USA because they have been designated by the international telecommunications union in the IMT-2000 standard for their 3G offerings<sup>37</sup>. Each of these modes including CDMA 2000, WCDMA and TD-SCDMA are based on, and require many Qualcomm patented inventions.

Thus, CDMA technology has presented positive implications for the US mobile phone industry because if uniformity in technology standard is

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<sup>37</sup> Source: EMC-World Cellular Database

once achieved for the entire North America, then there would be no one stopping the rapid growth in the mobile phone penetration.

### **Asia-Pacific:**

Asia offers a “tremendous green field opportunity”<sup>38</sup> for the mobile phone companies. Many countries in Asia lack an extensive wireline infrastructure and are presently undergoing major changes in their existing wireline communications to extract possible uses for the mobile phone companies. Currently 5% of Asians have wireless phones, compared to 46% of Europeans, but the numbers are expected to double over the next three years (**See Appendix E for the number of subscribers**). There are 202 million subscribers with a 14% penetration rate in Asia (end of 2000) and are expected to reach 400 million with 25% penetration by 2004 (**See Appendix A for market penetration**). Presently Asia Pacific enjoys the second largest market share i.e. 32% in the global mobile phone industry.

There are some prospective markets, which play an important role in the future of mobile phone industry in Asia Pacific e.g. China, India etc (**See Appendix G for Asian markets**). In China, there are 64 million cellular phone subscribers presently and are expected to grow by 160 million by 2003, when the new 3G mobile phones will begin to hit the market. China's ambition is to develop a home grown 3G standard with a western partner. Last February, China Unicom Ltd., the country's second

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<sup>38</sup> Extract from the speech of Mr Stephan Yap, Iamasia's director of marketing and communications.

largest telecom company, signed a deal to build a nationwide CDMA network with Qualcomm's support. Now the Chinese Government has put that deal on hold: it may switch to a different 3G standard, known as TD-SCDMA, that China jointly developed with Siemens of Germany. With a fast-growing market of more than 65 million mobile phone users, China plans to nurture its own domestic industry so that it should be able to compete with other market leaders.

“China is a big market. It has the potential to establish CDMA as a world standard”

(Barry Naughton)<sup>39</sup>

Another bright market of Asia Pacific in terms of mobile phone industry is South Korea. In South Korea, six out of ten people own mobile phones and more stocks are traded online than off.

Japan has been the oldest market in Asia Pacific. Japan has the privilege of introducing the first ever-cellular standard in 1979. Currently Japan's NTT DoCoMo has announced the first 3<sup>d</sup> generation phones to be launched in May 2001. DoCoMo has already started selling the popular I-mode phones and services. These phones are ultra light devices used by almost 13 million Japanese people to access the web, send text messages and other features. This usage is expected to climb to 20 Million by the end of this year<sup>40</sup>.

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<sup>39</sup> Barry Naughton is the professor of Chinese economy at the University of California, San Diego's School of International Relations & Pacific Studies.

<sup>40</sup> Source: NTT DoCoMo's official website



One of the major drawbacks in the mobile phone industry in Asia Pacific has been the incompatibility in the technological standards all across the Asian countries. Japan has always introduced new and unique standards in cellular telephony starting from 1979 till to date but none of these standards showed compatibility with others. Presently Japan has Japanese standard I-mode, South Korea has CDMA, China has GSM, and Thailand has TDMA and so on. Japanese NTT DoCoMo and South Korean Samsung are the key players in Asia besides the global mobile phone giants i.e. Nokia, Motorola and Ericsson.

### **Strategic Implications of 3G**

#### **What is 3G or Third Generation technology?**

Third-generation or 3G mobile communications is a new world of multimedia wireless information at speeds greater than 384 kilobits per second. The difference between 3G and today's mobile communications technology is that 3G promises increased bandwidth for sending and receiving information. The increased bandwidth will handle much more data at a faster rate than today's technologies. Another plus is that 3G is an 'always-on' technology. Users will be connected to the Internet all the time, and will have the ability to receive and send voice, video, text and data instantaneously and simultaneously.

A video advertisement promoting 3G, shows a school girl gossiping, sending a friend homework by e mail, playing a game with another friend,

showing her mother the jacket she wants to buy and getting mom to download her credit card to make the purchase-all on a single device with a tiny imbedded camera and a palm sized flat screen<sup>41</sup>.

3G will not only bring global roaming for its customers, but will also ramp up the data speeds to 40 times that of todays. At such speeds things like video, e-mail and phone conversation would be simultaneously possible.

The 3 G mobile phone technology would be mostly a splendid show of the power of technological convergence. A number of technical standards will converge, to act in collaboration with one another, into a single device, known as the 3<sup>rd</sup> generation mobile phone. Most probably the technologies, which will form part of this new standard, would include<sup>42</sup>:

**The 3G network**, which would enable swift, always-on interactive voice and data services at the mobile hand phone set;

**Blue Tooth**, a short range wireless alternative replacement for cables and infrared links;

**Location Services**, the ability to locate a cellular phone on the map in real time; and

**Digital certificates**, which would provide verification and identifications of the phone users as themselves.

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<sup>41</sup> Source: Motorola

<sup>42</sup> Source: Harvard management communication letter January 2001

Joining all of them together, would give rise to a blend of all these services in one mobile hand phone. This would be a great facility and source of unprecedented convenience for people from all walks of life, for business executives-who would be able to access the online database of their companies where ever they are, to check the status of a current order or to place a new one etc, for researchers-who would be able to access any item either from the web or from other sources, or for travelers-who would be able to get an instant update on weather as well as the index of all the available modes of transportation or for a family man-who would be able to watch and cheer up his 10 year old kid playing his first football game, sitting thousands of miles away from him, all through their mobile phones.

The 3G mobile phone will not replace the PC as a device for computing, no miniature spread sheets etc or not even a word processor **(See Appendix M for customer segments and applications)**. It will, however, combine the phone book, calendars and task lists much more effectively than was previously possible. It will be able to encapsulate a description of its user, his identity and preferences in such a way that the same mobile phone could be used to pay for items like highway tolls, drinks from vending machines etc. The mobile phone could be even used to confirm ones presence to devices such as ATMs and flight/ train check in machines.

3G is the logical extension of internet and the world' s new economy. With the number of mobile phone users increasing dramatically each year, 3G offers those on the go, the ability to be connected wherever they are. 3G will allow users to access communication services from virtually anywhere, at anytime. No longer will it be necessary to have a desktop computer and a separate telephone to send and receive E-Mail, talk to your office or even buy movie tickets. Similar to the cellular phone revolution that allows us talk whenever and wherever we want, 3G mobile communications offers the next step. Once fully implemented, 3G hand held devices will send and receive high-speed data and multimedia applications including video and audio. Everything we do today on the Internet, we' ll be able to do on a hand-held 3G device.

3G not only will change the way we communicate, but also will change the way we make purchases. Using a 3G handheld device, E-commerce companies will be able to sell anything and everything available today on the Internet. The communications and m-commerce (mobile commerce) possibilities are endless with the 3<sup>rd</sup> generation mobile phone technology.

**3G Technologies:**

IS-136 Time Division Multiple Access (TDMA) operators in the Americas and smaller Global Solutions for Mobile communications (GSM) operators are looking at Enhanced Data rates for Global Evolution (EDGE) solutions

for their 3G and 3G-like needs. Data speeds can exceed 384 kilobits per second over existing frequencies.

IS-95 Code Division Multiple Access (CDMA) operators are looking first at the cdma2000 for their 3G solutions and then beyond to Universal Mobile Telecommunications System (UMTS). Data speeds will reach 2 Megabits per second.

Many GSM operators, especially the larger ones in Europe and Asia are using General Packet Radio Services (GPRS) as a 2.5 G solution before moving up to UMTS and speeds up to 2 Mbps<sup>43</sup> on new spectrum. W-CDMA, which is backward compatible with GSM, is expected to be launched in Japan by the middle of 2001<sup>44</sup>.

### **Strategic Challenges and Opportunities of 3G:**

Third Generation mobile cellular system, undoubtedly mark a giant leap ahead of all current technology standards, in the mobile telephone industry. 3G will provide its users with an access to technologically sophisticated services for the first time in the industry of mobile phones. Some of them will resemble those that will be delivered by broadband fixed networks, while others will be entirely new and 3G exclusive characteristics. This all represents a series of upcoming challenges for the vendors, subscribers and service providers in particular, and the entire mobile phone industry in general.

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<sup>43</sup> Mbps: Mega Bits per Second

<sup>44</sup> Source: World Cellular Review 2000-2004

A lot of deliberations and research has gone already into the dynamics of 3G and many of the issues have been addressed, yet new challenges keep popping up. The 3<sup>rd</sup> generation mobile telephone system and the issues related to it have been proved to be quite unpredictable. The mobile phone companies find it complicated to devise an absolute strategy for their 3G networks. Operators face technological challenges to implement 3G though they can always look back at the network evolution in the 2G era.

Based on their experiences of 2G and 2.5G era, the vendors and operators are able to mould and accommodate 3G systems into their requirements but entirely new challenges, which are exclusive to the third generation systems, come up in the process. For instance, the pitfalls in the existing technology standard e.g. GSM, TDMA, AMPS etc.

Because of such practical problems, the think tanks of all the key mobile phone players have certain reservations about this cutting edge technology. At present it is really hard to find anyone within the mobile phone industry, or even outside it, who can safely guarantee that 3G will not fall flat on its face. A number of operators worldwide are allocating humongous sums of money comparable to the national debts of developing countries like Pakistan, Sri Lanka etc, to 3G infrastructure and the license to operate this technology about which, they know very little. As a matter of fact keeping in view the uncertainty of the 3G technology

and its unpredictable implications, there is even a shortage of these people who know very little about it.

The question arises as to why so much of investment has been made into an uncertain technology. The second-generation mobile phones play an important role in answering this question. Back in the late eighties there were only a few who invested on the 2G mobile phones and it came out to be an extravagant success. This time 3G is also offering the same scenario and operators don't want to lag behind in 3G even when the future is unpredictable.

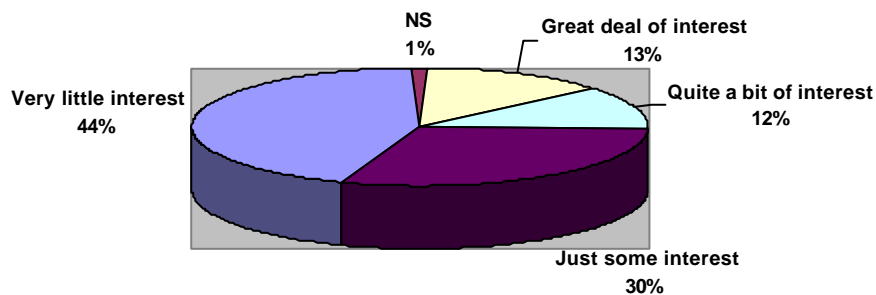
Operators are fully aware of the challenges of 3G. The Internet users are used to free content and it may prove difficult to get the same subscribers to pay extra to access the 3<sup>rd</sup> generation services. Presently the operators are dwelling on their strengths such as convenience, mobility and location – all of which the wired Internet lacks. Using these criteria, operators can attempt to hire their users with the “tailor-made” applications. The more personalization an operator can offer the user, the more likely they are to pay for the services.

The current operators are looking forward to leverage their brand power and space on the handsets in short run, like the flashy 3G handset advertisements by Nokia, Ericsson etc. In the long term, however, the content providers will have to contribute much more to keep the creativity and innovation of 3G flowing.

The operators should not ignore this fact that not very many subscribers of theirs would be checking the stock price or travel updates on their mobile phones **(See Appendix P for public opinion about wireless data services)**. It is probably already an established fact in the mobile phone industry that the gravity of Internet usage via WAP would be less frequent due to impractical, costly and restrictive nature of surfing via WAP handsets.

Before the emergence of 3<sup>rd</sup> generation WAP phones, it was considered that most of the current wireless users would express interest in web enabled wireless phones but the same has come out to be limited to a segment of the market as yet.

### Interest In Having A Wireless Phone With Data Services



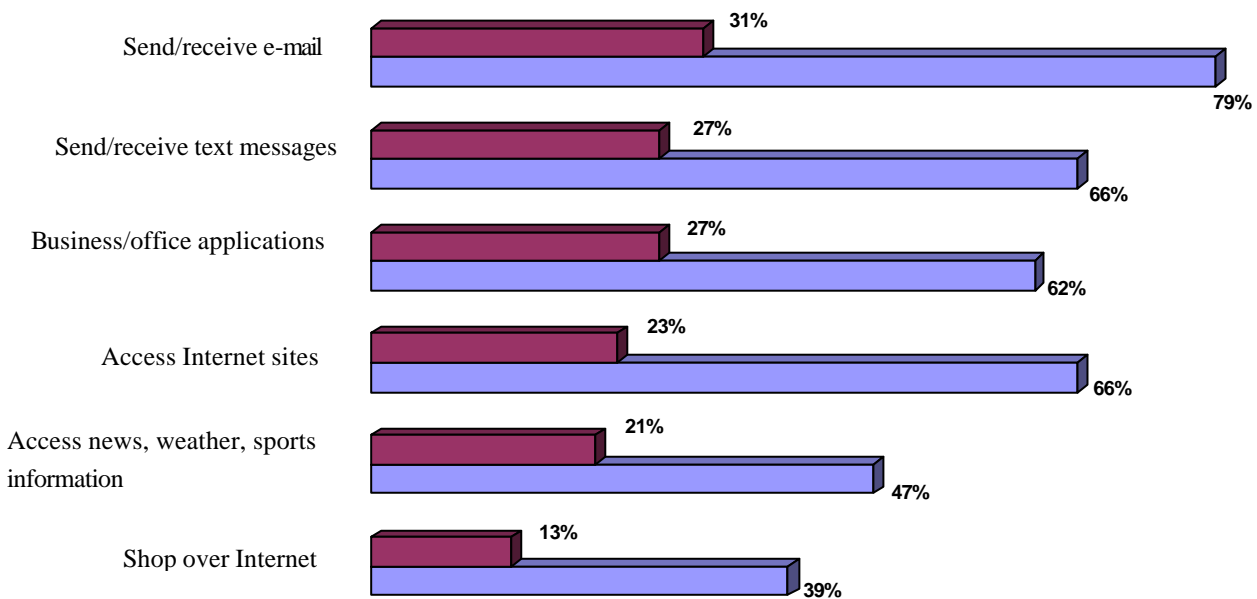
**Source:** *The Wireless Market Place in 2000, Peter D. Hart Research Associates*



Users are more interested in the wireless data services, which enhance communication and productivity. A wireless phone that enables a user to send and receive email catches 31% of subscribers' interest and nearly equal proportion (27%) find the text messaging wireless phone appealing.

### Interest In Wireless Data Services

(% Great deal/quite a bit of interest)



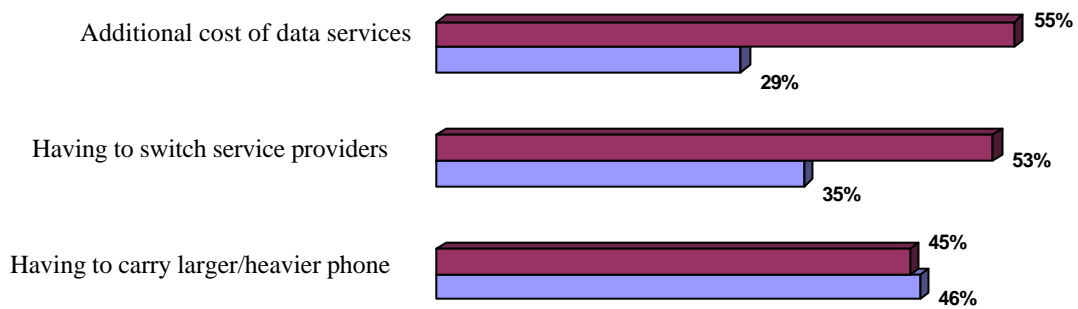
**Source:** EMC-Database

In order to make an estimate of the number of wireless users who would opt for the data services on their mobile phones. Peter Hart

research associates Inc, in USA conducted a survey and found out that 55% of users believe that the benefits of wireless data services outweigh the additional costs.

Other findings of the survey are as follows:

**Weighing Benefits & Drawbacks  
Of Wireless Data Services**  
*(Among Users Interested In Data Services)*



**Source:** EMC-Database

So much hype about the 3G so far has given rise to a lot of expectations by the subscribers. Resultantly, soon after the launch of the 3<sup>rd</sup> generation phones, the operators will have to digest a lot of criticisms regarding the contents, reliability, surfing, operations etc but this is not all. It will also affect the subscriber' s future demand for the 3G phones. It is all up to the operators now, as to how they confront the upcoming challenge of 3G and mould it into an opportunity for them.

## **STRATEGY OF KEY PLAYERS**

There are three major components to the wireless industry. They are the manufacturers, the carriers or service providers and the third party agents. Manufacturers make the wireless equipment, the telephone handsets, while secondary market manufacturers usually contract with the manufacturers to make the variety of accessories that accompany many wireless telephones. Carriers provide the actual cellular telephone service including the phone number that is assigned to the wireless telephone. Finally, third party agents are companies, not affiliated with either the manufacturers or the carriers, who sell service and/or telephone equipment.

Generally when we refer to major players of the wireless industry we mean the manufacturers of the wireless equipment. The manufacturers compete with each other introducing new models of mobile phones with fancy looks and attractive features. The technology standards that whether the phone works for GSM or CDMA etc, is also decided by the manufacturer. In the last decade, there were three big players in the global wireless industry Motorola, Nokia and Ericsson. But recently, a number of new companies have emerged in this industry, bringing with them a blend of features and characteristics. Some out of them have been tremendously successful, e.g. Samsung, Siemens etc, whereas a number of others have entirely ceased to exist.

A brief mention and the salient features of the big five companies of the global wireless industry, shall be made in this research.

## **Nokia**

The Finnish Telecom Company was started in 1865 as a diverse conglomerate managing a wide array of businesses from rubbers to chemicals. In the late eighties and early nineties, Nokia went through a massive restructuring and refocusing strategy and divested eight businesses concentrating solely on telecommunications.

Since then (1994) Nokia has been doing remarkable in the global wireless industry showing more than 25% growth in sales<sup>45</sup>. In 2000 the net sales grew by 46% and it maintained #1 position in the global mobile phone industry with 31% market share **(See Appendix I for market shares)**. Its stock price has also shown an impressive 2300% growth since its IPO in 1994. Its market capitalization has reached 242.19 billion, ninth in the world (July 2000)<sup>46</sup>. Nokia has also made a lot of progress in its brand awareness all around the world. This has made the 5<sup>th</sup> most valuable brand in the world with a brand value of 38.5 billion dollars **(See Appendix J for financial figures)**.

During the course of the refocusing on telecommunications there had been some points that contributed positively towards the success of Nokia. Some of them, also referred to as the strengths are as follows:

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<sup>45</sup> Source: Nokia.com

<sup>46</sup> Source: Fortune weekly

- a. In the early nineties, Nokia associated itself with the GSM and the system became so successful that it represents 65% of the global digital market now. GSM has served as one of Nokia's major strengths.
- b. Nokia has a clearly defined mission, to play a leading role in developing the mobile information society by contributing maximum technology. In other word, Nokia only concentrates on the handsets market.
- c. Nokia appeals the customer segments in a unique manner. Nokia has become a very customer friendly name. In fact customers are the biggest strong point for Nokia. A customer<sup>47</sup>, Ms Mirva Antilla says that, " Nokia was the first to recognize that different models would appeal to different market segments- teenagers, the fashion conscious, bargain hunters and mobile professionals. Nokia in fact reinvented the mobile phone as an accessory that more and more people just had to have" .
- d. Another strength lies in its flat and unhierarchical organization, which is based on hands off management.

Nevertheless Nokia, in spite of such a tremendous success attributed to it, is facing lot of challenges in present day environment. In 1990's Nokia rode on the GSM technology and made a fortune out of it but presently with the onset of 3<sup>d</sup> generation mobile phones, GSM is at a comparative disadvantage. CDMA, the rival technology of GSM, and its

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<sup>47</sup> Source: Josephthal & Co

other compatible systems, support the 3<sup>rd</sup> generation phones and Nokia is still not more than a novice in it. CDMA has emerged as a weakness for Nokia till now and unless it accepts the 3G as a challenge and react quickly, it would not bring optimistic news for Nokia like its glorious past. Although Nokia is working on W-CDMA, a wireless standard which is compatible with 3G phones, it hasn't manufactured a full-fledged 3<sup>rd</sup> generation device yet. News<sup>48</sup> are that one such device is in the making; let's hope it really is, otherwise Nokia may have to face some real hard times from its competitors in future.

## **Motorola**

Motorola was founded in 1928 as Galvin Manufacturing Corporation in USA. It had been a market leader in the International Mobile Phone Industry till 1998 when Nokia surpassed it. Motorola is regarded as a global leader in providing Integrated Communications Solutions and embedded electronic solutions. Motorola had been one of the pioneers of the mobile phones manufacturing. It produced the first generation portable phone in 1973, the first cellular car phone in 1983, then the first cellular portable phone in 1984 and is still manufacturing a number of them.

Three years back, Motorola dominated the global handset market with US as its major share. Now its share of \$129 billion global market has

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<sup>48</sup> Source: Nokia group press releases, January 2001

shrunk from 22% to 13%<sup>49</sup>. Even in US also, Motorola is suffering and one of the reasons is the cutting edge competition from the overseas companies like Nokia, Samsung and Ericsson. The consumers instantly switched over to the cute, easy to use devices of Nokia, Ericsson and Samsung with their interchangeable colored skins, games and attractive features.

Another reason that contributed to Motorola's downfall was its incorrect estimate of the future technology. It continued to concentrate on the Analog transmission when it should have concentrated on digital technology, wrongly foreseeing a very slow change from analog to digital, at that time. Unfortunately for Motorola, it happened otherwise and today 90% of world's 715 million mobile phones, are digital.

Today Motorola share prices are same as were five years back and its cell phone division barely managed a 2% margin in 2000. Still with a market capital of 67.25 billion, it stands second in the mobile phone industry.

Some of the salient characteristics of Motorola are as follows:

- a.** Motorola basically is a technology-oriented company. It is and has always been technologically advanced as compared to its competitors. Needless to mention that it's the same company which pioneered the car radio, pager and the mobile phone. This technological edge doesn't always help Motorola. Lately Motorola has been manufacturing needlessly complicated phone sets when

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<sup>49</sup> Source: Motorola.com

the need was to make a simple, smart and small set. Similarly Motorola makes hundreds of different phones thus increasing the costs, while successful players like Nokia manufactures only one phone at a time.

- b. Unlike the successful players of the industry, Motorola could not concentrate on a single technology, like Nokia did on GSM. Being in the US market that has many cellular systems, Motorola had to invest more and more and reap lesser and lesser with the increase of competition. But it had a positive side also, Motorola now has a know how of all the existing cellular systems i.e. CDMA, TDMA, GSM etc and at this moment when even the market leader, Nokia, is facing problems with encountering the new CDMA standard for the 3<sup>rd</sup> generation phones, Motorola is ready to roll out its technology.
- c. Motorola has a home market of more than 100 Million subscribers and the biggest mobile phone market in the World. Historically Motorola has always been the market leader in USA. This is a great advantage for Motorola to compete with overseas competitors in the home ground.

Presently Motorola is undergoing huge restructuring and rightsizing. In January 2000 it closed its biggest phone plant in USA, firing 2500 employees thus reducing costs. It is investing over \$1 Billion in its 3G



solutions. The Aspira Architecture from Motorola is the company's communications architecture that will combine voice, data and multimedia into one broad band, IP based network thus making the 3<sup>rd</sup> generation devices a success. If 3G turns out to be a success for Motorola and it captures the US market than there wont be anyone stopping it because Motorola is the one which has a command over all the technologies i.e. CDMA, TDMA, GSM, AMPS, unlike its other competitors.

### **Ericsson**

Ericsson was founded in 1876 as a wire based network equipment company in Sweden. Like Nokia, Ericsson also emerged as one of the leading telecommunications company in the Nordic countries in the later half of the 1980' s. Since then, Ericsson has been in the first three mobile phone companies of the world in terms of the market share. Last year Ericsson faced a major blow when its US phone sales dropped from 19% to 11.5% thus decreasing its global market share from 15% to 10%<sup>50</sup>. Though the sales grew by 27% in 2000<sup>51</sup>, Ericsson outsourced mobile phone manufacturing to Singapore based Flextronics in order to focus attention on the 3<sup>rd</sup> generation devices to reinforce its success.

Last year Ericsson had acquired Qualcomm of USA, the company which is the incubator of CDMA technology. This has proved to be a

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<sup>50</sup> Source: Gartnet Dataquest

<sup>51</sup> Source: Ericsson Annual Report 2000

strong point for Ericsson, especially since the time CDMA has come out to be a compatible standard for 3<sup>rd</sup> generation devices.

Some of the salient characteristics that are serving as strong points for Ericsson, are as follows:

- a.** The acquisition of Qualcomm has provided Ericsson an instant access to the CDMA, a technology of the 3G<sup>52</sup>. This has placed Ericsson in an advantageous position in the industry.
- b.** Ericsson has already captured almost 50% of the GPRS (2.5G) and 3G orders.
- c.** Ericsson has recently undergone a restructuring and now it is successfully following its Back-to-profit program due to which its orders grew by 60% ever since the program.

However, Ericsson is faced with serious challenges in the industry also. Its failure in the US market, last year, has given a severe blow to Ericsson due to which new companies like Samsung have grabbed a large chunk of the US market.

In addition to that, there have been some pitfalls in the supply line management at Ericsson, due to which huge losses occurred recently. Losses have also been caused by delivery failure from key suppliers and an inadequate product mix in the entry-level market. This has also been a weakness of Ericsson, which they seem to be correcting in their

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<sup>52</sup> Source: Qualcomm

restructuring process. Ericsson with a market capitalization of US\$ 158.05 billion is striving hard on the 3G solutions to cater for future challenges.

## **Samsung**

Samsung, the South Korean electronics company has made an aggressive come in by bombarding more than 100 types of cellular phones in less than three years in the mobile phone industry. Samsung has quickly grabbed the fourth place in the global mobile phone industry with a market share of 6.2%, only after the top three telecom companies i.e. Nokia, Motorola and Ericsson. Samsung is indeed a very viable threat to all the key players of mobile phones in the world. It has already grabbed 22% of the US market and a third place in the CDMA phones<sup>53</sup>. As a matter of fact it has nearly surpassed its competitors in the WAP phones in the US market. SPRINT, one of the leading mobile phone providers of USA has four Samsung models as against 2 models from Nokia.

According to twice magazine, Samsung mobile phones are making rapid inroads into the US market. The January 2001 issue of the magazine carried a market share survey based on data selected from US based market specialist companies like NPD Intellect etc. The data revealed that in the year 2000 Samsung mobiles outsold all other brand in terms of revenues whereas in terms of number of units sold, Samsung was ranked second only after Nokia.

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<sup>53</sup> Source: Samsung' s official website i.e.Samsung.com

Samsung's strong performance can be attributed to the ongoing investment in R&D efforts aimed at addressing local customer needs. At the same time, Samsung has worked untiringly to boost the retail structure and process of handsets. The tremendous success of Samsung mobile phone, not only in Korea but especially in US market has serious implications for other Korean industries particularly, the mobile phone industry. Samsung is presently building a strong and reputable image of all Korean-made mobile phones and thus the global customers have started trusting the Korean made electronics through the brand name of Samsung. According to one of the US market surveys, it is revealed that Samsung mobile phone handsets are the top sellers in stores that directly reflect the consumer preferences. In 2000 Samsung electronics exported US \$ 3 billion worth of mobile phones, which represented 70% of the total US \$ 4.3 billion Korean made mobile phones exported in 2000. In 2000 Samsung sales increased by 31% and net profit boosted by 89%.

### **NTT DoCoMo**

In 1992 the telecom giant of Japanese Nippon Telegraph and Telephone Corporation (NTT) started NTT Mobile Communication Network Inc, as a provisional parent company. The NTT public corporation had been offering its telephone services since March 1959. It started its mobile telephone service in April 1987. But after 1992, NTT DoCoMo started offering cellular phone services independently. In another year the number of cellular

phone subscriber exceeded 1 million and touched 10 million by February 1997 and doubled to 20 million by mid 1998<sup>54</sup>. NTT DoCoMo maintains a very strong and competitive position in Japan because of its innovative technology.

NTT is privileged to launch the first mobile phone service, then pioneered the first generation phones and now is about to roll out its 3<sup>rd</sup> generation phones in May 2001, earlier than any other vendor in the world. As a technological counterpart to WAP, NTT DoCoMo has already launched its I-mode service, which enables users to access internet services via their cellular telephones and has proven to be a glorious success among the consumers. It sells both; the I-mode phones and service. The phone is an ultra light device used by 12.6 million people only in Japan to access the web, to send text messages and to use several other features. Its usage is expected to climb to 20 million by end of 2001.

I-mode has made DoCoMo remarkably successful. Its earnings rose by 22% after the launch of I-mode. Even the European cellular operators are trepidated on the phenomenal success of NTT DoCoMo' s wireless internet offering, I-mode and its expansion into Europe. In fact a European subsidiary by the name of DoCoMo Europe (UK) Ltd has already been established, headquartered in London, but the move to expand in the global market forms part of a long-term plan in the DoCoMo' s strategy.

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<sup>54</sup> Source: NTT DoCoMo' s official website

DoCoMo also invested \$100 Million for a 42.3% stake in AOL and took a 15% stake in KPN mobiles, a European operator. These moves show its desire to move out of Japan, in the global market. The expertise gained in these processes would help DoCoMo to further shape the global wireless Internet market. In fact its European strategy is tightly bound up with its 3G strategy. Already DoCoMo is all set to have the first 3G experience. Now all of its actions point towards creating a global environment that will allow it to utilize its experience in influencing and shaping 3G internationally with more emphasis on Europe.

DoCoMo's success in expanding into Europe, currently hinges on acquiring licenses in the key markets and making a success of 3G business. At present it possesses access to the UK, Netherlands and Germany. If it loses out in other markets, however, it might be forced to reassess its strategy. What remains is that DoCoMo has the ambition, financial clout and technical innovation to become a real global player.

### **Others**

Apart from all the above mentioned names, there are a number of other companies such as, NEC, Phillips, Panasonic, Sony, Siemens etc who have emerged as formidable competitors in the mobile phone industry though their global market share still remain below 5%. A vast array of US companies from Palm to Phone.com to Microsoft also wants a share in the mobile telephone industry through the introduction of WAP and Internet based solutions.

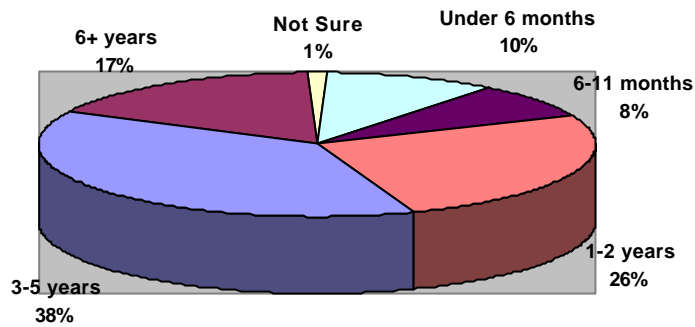
## CONCLUSION

### **Summary of Key Findings**

The history of mobile phone has had many phases, its evolution started from a highly selective device used by high profile agencies. Then it started to be used by an elite segment of society to a phone available to the masses. The key to success of any new service lies in the degree of its expansion beyond a small population segment to a vast array of consumers belonging to virtually all backgrounds. The global mobile telephone industry undoubtedly has been successful in meeting this goal as today's wireless market place includes individuals from all walks of life comprising both men and women regardless of age, education or household income. There has been a marked annual increase in the wireless subscribers over the period of past few years. This tremendous increase in the subscribers has baffled the strategy makers of the mobile phone industry and has left them with innumerable opportunities to exploit, by evolving diverse strategies.

## Wireless Phones

*How long have you used a wireless telephone?*



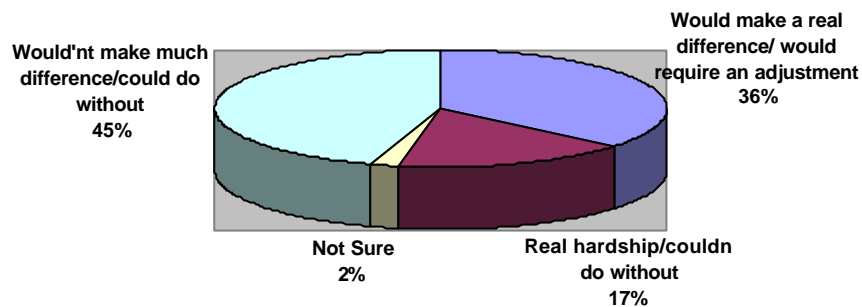
**Source:** *The Wireless Market Place in 2000, Peter D. Hart Research Associates*

While doing a comparison of the new entrants into the market with those who have been using mobile phones for more than three years, it is realized that the new users form part of a lesser-concentrated group, mostly younger with a lower household income and education. But the reliance of users and their mobile phones is increasing day by day. The strategy makers are, therefore, concentrating on the newly emerging customer segments and by far Nokia has been the most successful player in making fruitful strategies that appeal its customer segments to the optimum level.



## Limited Dependence On Wireless Phones

*If I had to give up my wireless phone for three months*



**Source:** *The Wireless Market Place in 2000*, Peter D. Hart Research Associates

It reveals that more than 50% mobile phone users feel a strong need for the phones and it would be hard for them to endure without them. Less than ten years back, the mobile phone subscribers comprised of a negligible number and the future of the industry at that particular moment of time appeared ordinary but now it seems that it was the only industry that has prospered at such a remarkable pace. In such a short duration more than 50% of its subscribers think that there is no alternate to this device. Such a swift growth performance has become an exception for the mobile phone industry, as it is unprecedented in the history of global industries maybe with the exception of online computer industry that would be close enough to mobile phone industry.

In 2000, worldwide mobile phones sales totaled 412.7 Million units, a 45.5% increase over 1999 results thus bringing the total world cellular subscriber base to almost 715 Million<sup>55</sup>. According to the EMC- World Cellular Database, the global mobile phone industry is expected to have an addition of almost 185 Million subscribers during 2001 as against 215 in 2000, thus taking the world total to 900 by year end.

The year 2000 has been critical in the shaping of the future mobile phone industry worldwide in many perspectives.

**First;** it is likely to have represented a growth peak, with the absolute number of new users, set to stabilize or drop slightly during the next few years.

**Second,** Year 2000 has been the year of a technological change for the global mobile phone industry from 2<sup>nd</sup> generation phones to 2.5 and 3<sup>rd</sup> generation devices thus a revolutionary shift from transfer of voice alone to transfer of data, text, video, voice and Internet via the mobile phones.

**Third,** the dynamic expansion of the mobile phone industry from the barriers of mobile phone operators to a vast array of companies like software, land telephone, internet solution providers etc. Today we find a number of companies like Microsoft, Phone.com etc which have started investing in the 3G mania, and;

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<sup>55</sup> Sources: EMC-World Cellular Database, Gartner Dataquest

**Fourth**, the convergence of the hitherto diverse and numerous technological standards e.g. TDMA, AMPS, GSM, CDMA into one global standard W-CDMA or UMTS (Universal Mobile Telecommunications System) for all the mobile phone operators worldwide. All of these revolutionary changes took place in Year 2000.

As per the Gartner data quest analysts, Year 2000 was a transitional year for the mobile phone industry and a number of issues have affected growth in the industry. Global capacity caught up with the demands. Lowered barriers to entry allowed an influx of smaller manufacturers that were able to exploit demand in some of the key far esteem markets such as China. Wireless application protocol (WAP) failed to impress increasingly savvy mobile users, and thus what had been appointed as the catalyst for the next wave of terminal sales growth turned out to be a little more than a ripple. Finally mobile operators began to shift attention away from straightforward subscriber acquisition to a greater focus on a lifetime customer loyalty.

In the beginning of 2000, the strategy makers concentrated on WAP focused strategies assuming that it would sweep the entire mobile phone industry. But towards the end of 2000, they realized that WAP couldn't make any considerable difference and the future prospects continued to appear as vague as they were before.

“ The long term prospects for the mobile sector look tough, few manufacturers are able to generate healthy profit margins, placing the necessary investments in next generation handsets developments at risk. The smart money may be riding on players that are unfamiliar with the upper echelon vendors”.

(Peter Richardson<sup>56</sup>)

### Summary of the cellular world at Year-end 2000<sup>57</sup>

|   |                                      |                      |
|---|--------------------------------------|----------------------|
| 1 | World largest GSM market             | China, 73.3 Million  |
| 2 | World largest CDMA market            | USA, 31.2 Million    |
| 3 | World largest TDMA market            | USA, 30.4 Million    |
| 4 | World largest Cellular market        | USA, 101 Million     |
| 5 | World largest Cellular growth market | Morocco, 629% growth |
| 6 | Highest penetrated Market            | Iceland, 78%         |
| 7 | Highest Penetrated Region            | West Europe, 47%     |
| 8 | Biggest marketplace by region        | Europe, 38%          |
| 9 | Most widely used Standard            | GSM, 65%             |

<sup>56</sup> Peter Richardson is the principal analyst for Gartner Dataquests worldwide telecommunications group.

<sup>57</sup> Sources: EMC-Database, Mobile Communications International

These days the global mobile phone industry is faced with the challenge of 3<sup>rd</sup> generation devices. But the advancements are so spontaneous that a few years back no one could have predicted this scenario in the industry. These uncertain technological challenges pose a serious threat to the industry vendors and strategy makers. The strategists and managers of the industry are just waiting for another technological turn after which they are able to develop new strategies, as they are unable to predict any future environment of the mobile phone industry that should invariably empower them to evolve successful strategy.

On the face of a cutting edge competitive environment of the wireless industry, this uncertainty and unpredictability in the future trends of the industry bears consequential implications for the managers and strategists. The strategists have to evolve successful strategy irrespective of future predictions, under uncertainty. The vendors are not bothered as to which way the technology leads them to, what they are concerned about is, that they should conquer both the market and their competitors, no matter what means are adopted in the pursuit of this objective.

Presently the problem for the mobile phone industry players is, where to go from here? The 3<sup>rd</sup> generation devices would not be available until June 2001, so the next version of handsets are not realistically deliverable till the end of this year. Under these circumstances the industry strategists are whimsical of the situation that where should they head for? The WAP take-up has been slow so there is not a great deal of useful

feedback from users. Experience from application developers has also suffered for the same reason so their input is not as valuable as it might otherwise be.

In this unpredictable and uncertain scenario, the mobile phone vendors have to constantly update and reinvent their portfolios as users are replacing their handsets at a frightening pace. But at the same time it is getting trickier to figure out as to what would be a successful 3<sup>rd</sup> generation hand set? Or whether would there be any successful handset at all or not? This explains the increasing diversity of models but if they don't prove successful, then what next??

This prevailing scenario of the industry is posing serious implications for its strategy makers. Recent history has shown that this cutting-edge industry is more than capable of whipping up a marketing frenzy. It now depends on the strategies of the key market players if they could bring a series of saleable, usable, revolutionary yet practical and appealing products to the market, then the demand may return to the highs once again, similar to the one, this industry experienced towards the end of the last decade. Because in cutting-edge industries like this, nobody knows what the tide might bring tomorrow.

## **APPENDICES**

## APPENDIX A

### Mobile Phone Penetration (By Region)<sup>58</sup>

|                  | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|------------------|------|------|------|------|------|------|------|------|
| <b>USA/Can</b>   | 16.6 | 20.8 | 25.9 | 30.4 | 35.4 | 40.1 | 46.0 | 51.4 |
| <b>S/America</b> | 4.2  | 6.23 | 10.3 | 13.7 | 17.1 | 19.8 | 24.3 | 26.0 |
| <b>Africa</b>    | 0.5  | 0.75 | 1.81 | 2.67 | 3.85 | 5.0  | 5.92 | 6.72 |
| <b>W/Europe</b>  | 13.9 | 23.4 | 33.1 | 46.8 | 56.2 | 63.9 | 69.8 | 73.7 |
| <b>E/Europe</b>  | 1.8  | 3.4  | 6.57 | 10.4 | 14.6 | 18.4 | 22.5 | 23.4 |
| <b>M/East</b>    | 8.1  | 10.6 | 14.4 | 18.2 | 21.9 | 25.5 | 28.9 | 32.0 |
| <b>Asia Pac</b>  | 6.1  | 8.2  | 11.9 | 13.1 | 17.9 | 20.7 | 22.5 | 24.4 |

% age

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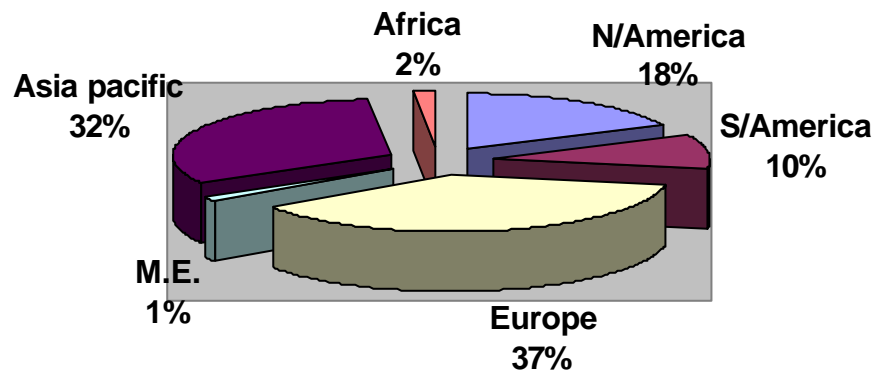
<sup>58</sup> Sources: EMC World cellular database, Dataquest



## APPENDIX B

### Market Share (By Region)<sup>59</sup>

| Regions       | Market Share (%) |
|---------------|------------------|
| North America | 18               |
| South America | 10               |
| Europe        | 38               |
| Middle East   | 1.4              |
| Asia Pacific  | 32               |
| Africa        | 1.6              |
| Total         | 100              |



<sup>59</sup> Sources: EMC World cellular database, Dataquest

## APPENDIX C

### Global Technical Standards<sup>60</sup>

Sept 2000

| <b>S/No</b> | <b>System</b> | <b>No of Subscribers<br/>(Millions)</b> |
|-------------|---------------|---|
| <b>1</b>    | PDC (Japan)   | 49.3                                    |
| <b>2</b>    | TDMA          | 55.3                                    |
| <b>3</b>    | GSM           | 381                                     |
| <b>4</b>    | CDMA          | 74.2                                    |
| <b>5</b>    | Total Digital | 559.3                                   |
| <b>6</b>    | Total Analog  | 76.0                                    |

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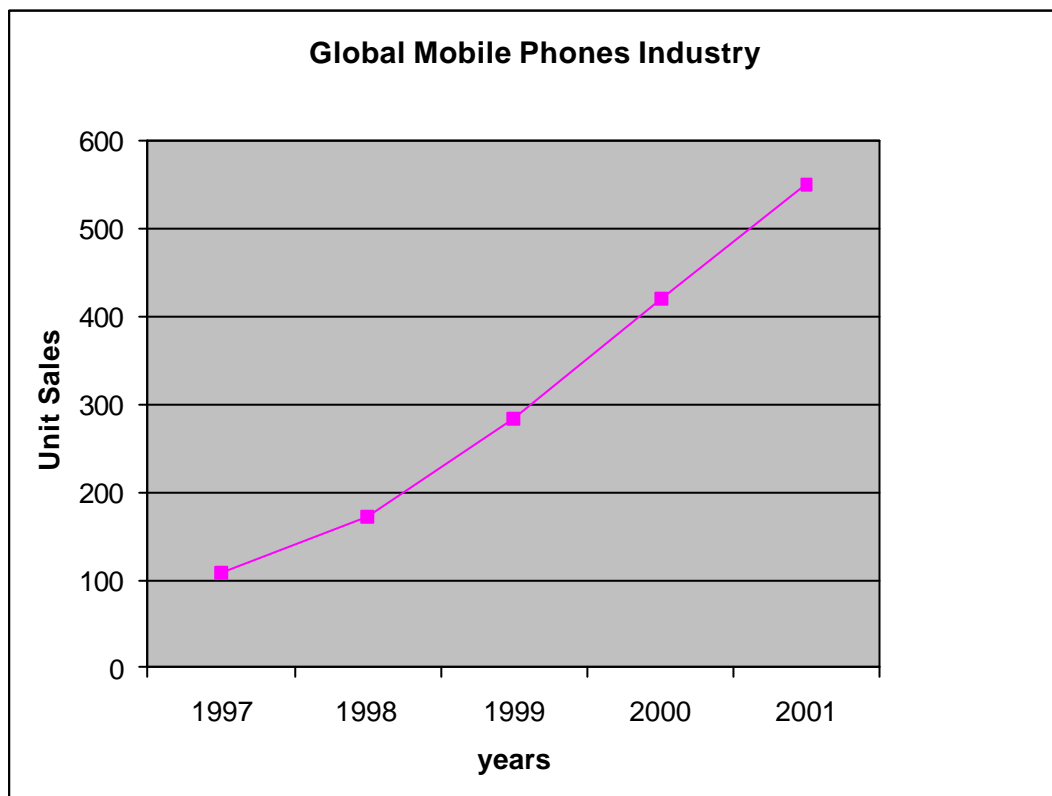
<sup>60</sup> Sources: EMC World cellular database, Dataquest

## APPENDIX D

### International Mobile Phone Industry Growth

| Years | Unit sales (in millions) |
|-------|--------------------------|
| 1997  | 107                      |
| 1998  | 171                      |
| 1999  | 283                      |
| 2001  | 420                      |
| 2001  | 550                      |

Source: Dataquest



## APPENDIX E

### Number of Subscribers (By Region)<sup>61</sup>

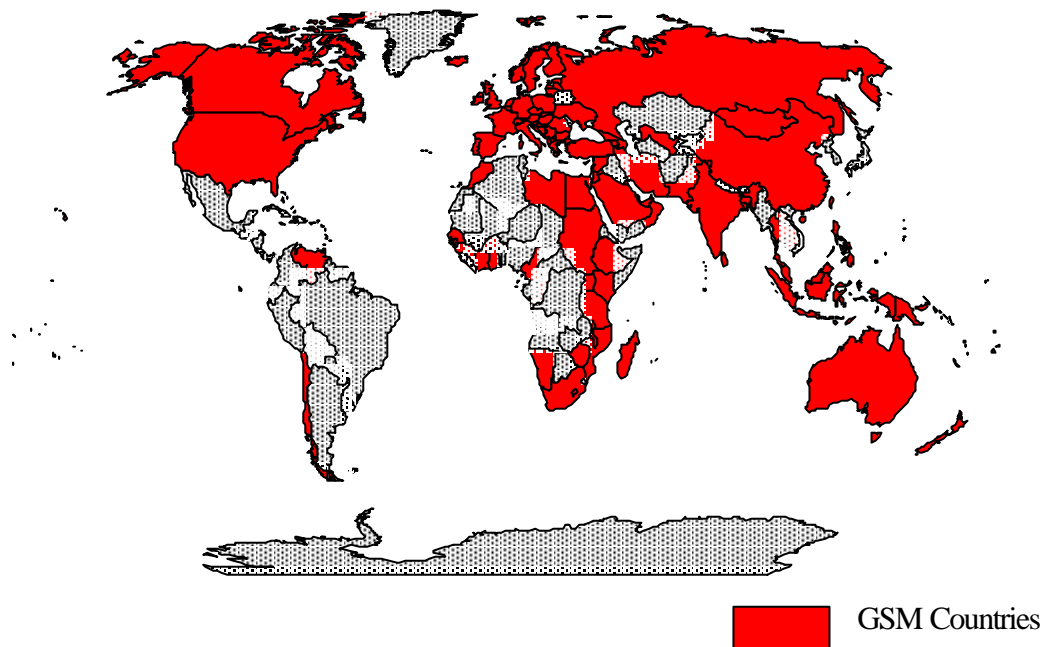
In Millions

|           | 1997  | 1998   | 1999   | 2000   | 2001   | 2002   | 2003   | 2004   |
|-----------|-------|--------|--------|--------|--------|--------|--------|--------|
| USA/CAN   | 59.00 | 73.95  | 92.97  | 109.88 | 128.31 | 147.78 | 168.24 | 188.50 |
| S/AMERICA | 12.62 | 21.48  | 40.54  | 61.74  | 89.98  | 123.38 | 158.17 | 189.22 |
| AFRICA    | 1.96  | 3.56   | 7.18   | 1.16   | 18.66  | 27.50  | 37.31  | 47.67  |
| W/EUROPE  | 56.85 | 95.64  | 162.21 | 211.80 | 260.80 | 304.35 | 339.09 | 363.05 |
| E/EUROPE  | 3.95  | 7.97   | 15.12  | 26.39  | 40.84  | 55.02  | 60.84  | 76.22  |
| M.E.      | 3.24  | 4.71   | 6.59   | 9.54   | 13.97  | 20.70  | 29.86  | 39.38  |
| ASIA-PAC  | 67.59 | 102.14 | 154.39 | 201.62 | 251.70 | 302.21 | 351.54 | 399.20 |

<sup>61</sup> Source: EMC World Cellular Database

## APPENDIX F

### World presence of GSM family standards<sup>62</sup>



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<sup>62</sup> Source: GSM World.com

## APPENDIX G

### Asia-Pacific Cellular Subscribers<sup>63</sup>

|             | % growth from Sep 2000 | % Penetration(Sep 2000) |
|-------------|------------------------|-------------------------|
| Australia   | 32%                    | 49%                     |
| Bangladesh  | 87%                    | 0.17%                   |
| Brunei      | 73%                    | 33%                     |
| Cambodia    | 66%                    | 1.33%                   |
| China       | 76%                    | 5.18%                   |
| Hong Kong   | 38%                    | 70%                     |
| India       | 98%                    | 0.26%                   |
| Indonesia   | 78%                    | 1.32%                   |
| Japan       | 21%                    | 45%                     |
| Korea       | 19%                    | 56%                     |
| Laos        | 44%                    | 0.22%                   |
| Malaysia    | 66%                    | 20%                     |
| Maldives    | 311.4%                 | 2.17%                   |
| Mongolia    | 34.6%                  | 3%                      |
| Myanmar     | 41%                    | 0.03%                   |
| Nepal       | 179%                   | 0.03%                   |
| New Zealand | 59%                    | 43%                     |
| Pakistan    | 34%                    | 0.25%                   |
| Philippines | 123%                   | 7%                      |
| Singapore   | 61.1%                  | 64.1%                   |
| Sri Lanka   | 58%                    | 1.75%                   |
| Taiwan      | 66.3%                  | 68%                     |
| Thailand    | 31.4%                  | 5%                      |
| Vietnam     | 157.5%                 | 0.76%                   |

<sup>63</sup> Source: Mobile Communications International

## APPENDIX H

### Market Characteristics in Europe<sup>64</sup>

|                    | % growth from 99 | % penetration |
|--------------------|------------------|---------------|
| <b>Austria</b>     | <b>64.3%</b>     | <b>63%</b>    |
| <b>Belgium</b>     | <b>74%</b>       | <b>39%</b>    |
| <b>Denmark</b>     | <b>38%</b>       | <b>59%</b>    |
| <b>Finland</b>     | <b>16%</b>       | <b>70%</b>    |
| <b>France</b>      | <b>70%</b>       | <b>41%</b>    |
| <b>Germany</b>     | <b>97%</b>       | <b>41%</b>    |
| <b>Greece</b>      | <b>65%</b>       | <b>45%</b>    |
| <b>Iceland</b>     | <b>42%</b>       | <b>78%</b>    |
| <b>Ireland</b>     | <b>73%</b>       | <b>52%</b>    |
| <b>Italy</b>       | <b>45%</b>       | <b>62%</b>    |
| <b>Luxembourg</b>  | <b>50%</b>       | <b>57%</b>    |
| <b>Netherlands</b> | <b>75%</b>       | <b>54.5%</b>  |
| <b>Norway</b>      | <b>23%</b>       | <b>68%</b>    |
| <b>Portugal</b>    | <b>39%</b>       | <b>53%</b>    |
| <b>Spain</b>       | <b>100%</b>      | <b>50%</b>    |
| <b>Sweden</b>      | <b>23%</b>       | <b>64%</b>    |
| <b>Switzerland</b> | <b>80%</b>       | <b>52%</b>    |
| <b>UK</b>          | <b>83%</b>       | <b>52%</b>    |

Source: Mobile Communications International

<sup>64</sup> Source: Mobile Communications International

## APPENDIX I

### Global Mobile Telephone Market Shares in terms of Sales.

(Thousands of Units)

| Order | Company   | Market Share<br>1999 (%) | Market<br>share 1998<br>(%) | Growth<br>(%) |
|-------|-----------|--------------------------|-----------------------------|---------------|
| 1     | Nokia     | 26.9                     | 22.5                        | 97.6          |
| 2     | Motorola  | 16.9                     | 19.5                        | 43.3          |
| 3     | Ericsson  | 10.5                     | 15.1                        | 14.8          |
| 4     | Samsung   | 6.2                      | 2.7                         | 277.4         |
| 5     | Panasonic | 5.5                      | 8.4                         | 7.7           |
| 6     | Others    | 34.0                     | 31.8                        | 76.7          |
|       | Total MKT | 100                      | 100                         | 65.3          |

Source: Dataquest (February 2000)



## APPENDIX J

### Selected Financial Figures of Key Players (1999)<sup>65</sup>

| <b>Company</b>                                   | <b>Nokia</b> | <b>Motorola</b> | <b>Ericsson</b> |
|--|--------------|-----------------|-----------------|
| <b>Net Sales<br/>US \$ (M)</b>                   | 20,362       | 30,931          | 25,735          |
| <b>Profit before Tax US \$ (M)</b>               | 3,959        | 1,168           | 1,957           |
| <b>Share Price as on 1st Nov,2000,<br/>US \$</b> | 43           | 24              | 14              |
| <b>EPS<br/>US \$</b>                             | 2.30         | 1.31            | 0.7372          |
| <b>Market Cap<br/>US \$ (B)</b>                  | 215.624      | 67.25           | 158.05          |

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<sup>65</sup> Sources: Nokia Annual report 1999, Motorola Annual report 1999, Ericsson Annual report 1999, Business Week July, 2000

## APPENDIX K

### Mobile Phone Patents<sup>66</sup>

Dr. Martin Cooper for Motorola. US 03906166. Dated: 09/16/1975.

#### Radio Telephone System

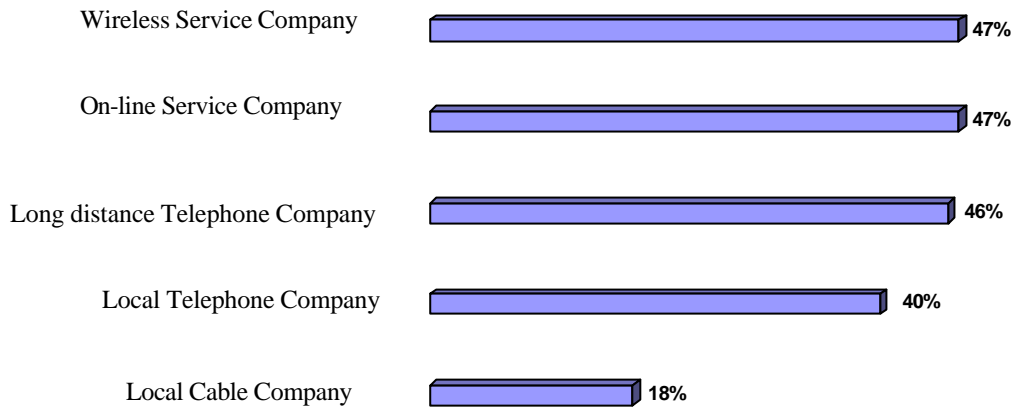
- Martin Cooper
- Richard W. Dronsuth
- Albert J. Mikulski
- Charles N. Lynk Jr
- James J. Mikulski
- John F. Mitchell
- Roy A. Richardson
- John H. Sangster.

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<sup>66</sup> Source: Encyclopedia Britannica

## APPENDIX L

### Wireless Stacks In Terms Of Value



**Source:** Survey conducted by Peter D. Hart Associates, Washington D.C. in February 2000

## APPENDIX M

### Major Customer Segments and Applications<sup>67</sup>

|  |  |
|--|--|
| <p><b><u>Professionals</u></b></p> <ol style="list-style-type: none"><li>1. Messaging e.g. e mail</li><li>2. Phone Book</li><li>3. Corporate Info</li><li>4. Banking</li><li>5. Route Finder</li><li>6. Calendar</li><li>7. Weather</li><li>8. Traffic Info</li><li>9. News</li><li>10. Contacts</li></ol> | <p><b><u>Technophiles</u></b></p> <ol style="list-style-type: none"><li>1. Messaging e.g. e mail</li><li>2. Phone Book</li><li>3. Calendar</li><li>4. News</li><li>5. City Guide</li><li>6. Greetings</li><li>7. Games</li><li>8. Contacts</li><li>9. Weather</li><li>10. Traffic Info</li></ol> |
| <p><b><u>Female</u></b></p> <ol style="list-style-type: none"><li>1. Messaging e.g. e mail</li><li>2. Phone Book</li><li>3. Greetings</li><li>4. Calendar</li><li>5. City Guide</li><li>6. Weather</li><li>7. News</li><li>8. Games</li><li>9. Contacts</li><li>10. Route Finder</li></ol>                 | <p><b><u>Youth</u></b></p> <ol style="list-style-type: none"><li>1. Messaging e.g. e mail</li><li>2. Games</li><li>3. Phone Book</li><li>4. Greetings</li><li>5. City Guide</li><li>6. Calendar</li><li>7. News</li><li>8. Contacts</li><li>9. Route Finder</li><li>10. Weather</li></ol>        |

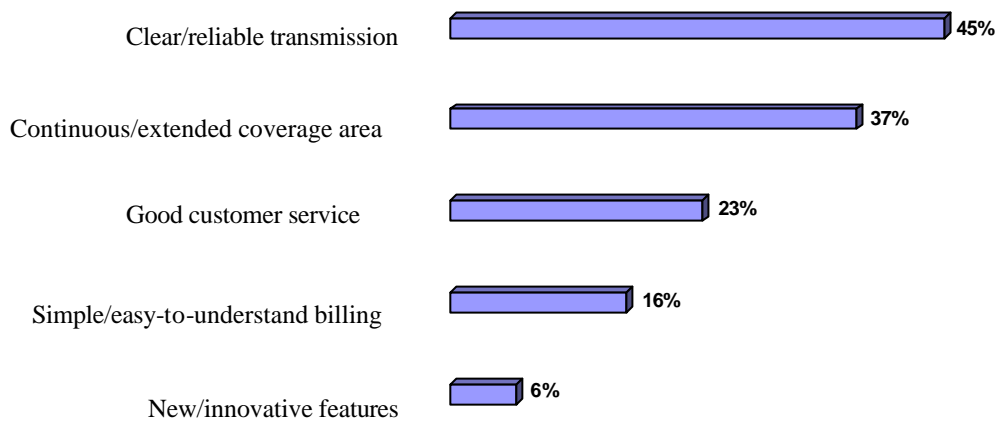
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<sup>67</sup> Source: Nokia Group

## APPENDIX N

### How Consumers Evaluate Wireless Service Value

#### And Satisfaction w/Provider In Each Area



**Source:** Survey conducted by Peter D. Hart Associates, Washington D.C. in February 2000

## APPENDIX O

### Public Opinion about Wireless Data Services<sup>68</sup>

| <b>WIRELESS DATA SERVICES: PROPORTION OF WIRELESS USERS WHO HAVE A GREAT DEAL OR QUITE A BIT OF INTEREST</b> | <b>Use Mostly For Business Needs<br/>%</b> | <b>Use Mostly For Personal Needs<br/>%</b> |
|--|--|--|
| <b>Interest in wireless phone with data services</b>   | <b>30</b>                                  | <b>17</b>                                  |
| <b>Interest in wireless phone that allows you to:</b>  |  |  |
| Send and receive e-mail  | 40   | 23   |
| Send and receive text messages   | 37   | 20   |
| Access office computer network & business applications   | 45   | 15   |
| Access Internet sites and on-line information  | 29   | 16   |
| Access information about news, weather, and sports   | 22   | 18   |
| Purchase goods and services over the Internet  | 13   | 11   |

| <b>PERCEIVED VALUE OF WIRELESS SERVICE</b> | <b><u>2000</u><br/>%</b> | <b><u>1999</u><br/>%</b> | <b><u>1998</u><br/>%</b> | <b><u>1997</u><br/>%</b> |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| Good/above average buy                     | 48                       | 45                       | 58                       | 52                       |
| Average buy                                | 41                       | 40                       | 31                       | 38                       |
| Below average/poor buy                     | 11                       | 12                       | 8                        | 9                        |

<sup>68</sup> Source: Survey conducted by Peter D. Hart Associates, Washington D.C. in February 2000

## **APPENDIX P**

### **ABBREVIATIONS**

PSTN: Public Switched Telephone Network

MTSO: Mobile Telephone Switching Office

IMTS: Improved Mobile Telephone Service

AMPS: Advanced Mobile Phone System

FCC: Federal Communications Commission

TIA: Telecommunications Industry Association

CDMA: Code-division Multiple Access

TDMA: Time-division Multiple Access

NAMPS: Narrowband Advanced Mobile Phone System

NMTS: Nordic Mobile Telephone System

TACS: Total Access Communication System

GSM: Global System Mobile Communications

APCS: Aeronautical Public Correspondence System

NATS: North American Terrestrial System

ETSI: European Telecommunications Standards Institute

TFTS: Terrestrial Fight Telephoning System

PCS: Personal Communication Systems

CEPT: European Conference on Post and Telecommunications

DECT: Digital European Cordless Telephone

PHPS: Personal Handy Phone System

CCITT: International Telegraph and Telephone Consultative Committee

ISDN: Integrated Services Digital Network

ADSL: Asymmetric Digital Subscriber Lines

FDM: Frequency Division Multiplexing

TDM: Time Division Multiplexing

FDMA: Frequency Division Multiple Access

SSMA: Spread Spectrum Multiple Access

UMTS: Universal Mobile Telecommunications System

AFSK: Audio Frequency Shift Keying

DPLMRS: Domestic Public Land Mobile Radio Service

PTT: Push to Talk



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