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PREVIEW

A PARADIGM FOR CHANGE:

The Diffusion Of Innovation Theory

And The Cellular Industry

By

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Candidate for DPS degree 1994

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*Dedicated to my parents, my father, Benedict, of blessed memory,
and my mother, Regina, of blessed memory,
who always wanted their son to be a doctor.*

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ABSTRACT

Since the beginning of time, mankind advanced by the creation and adoption of new and improved technologies. However, the adoption of new "technologies" was always notable by the varying rate of diffusion across different types of innovations and across different types of societies. Understanding this process is of great importance. The success or failure of societies, over time, can be traced back to their ability to adopt new technologies. More recently, many businesses have succeeded by inventing new products or services or failed by their inability to either innovate or to follow through on their initial breakthroughs.

This topic of diffusion of innovation has been studied for many years. Theories have been developed to describe this process in terms of attitudes and behaviors of individuals in a society. Also empirical work has been done to test "innovativeness" among individuals as related to a number of different products or ideas. This study focuses on the experience of the cellular industry, in the United States in general and one metropolitan area in particular, from its inception (approximately ten years ago) to date.

Specifically, a mail survey was conducted among a group of cellular service customers who first subscribed to the service in 1985 and a group that subscribed, for the first time, in 1994. The objective of the study was to determine if there were significant differences in attitudes, behaviors or economic/demographic profiles, between the two groups. Comparisons were made between the two groups as a whole and on a segmented (i.e., ethnicity) basis.

This study targets the attitudinal and behavioral elements and ethnicity as the potential points of difference. By focusing on one market, the variables of price, topography, etc., are excluded as potential causal factors explaining the difference between segments in the

rate of adoption. Furthermore, by conducting the study among different ethnic groups in the same area and same time, the element of an ethnic difference can be isolated as a potential driver of innovation adoption.

The study findings showed that there were significant differences between the 1985 and 1994 customer groups. There were also some differences between the ethnic group segments that subscribed to cellular service, at the same point in time.

The implications of these findings relate to both the research and business world. For research, there is empirical evidence to support the theory that purchase behavior is a “better” measure of “innovativeness.” Also, the limitations of this study suggest areas for further research either in terms of expanding the scope of the study to other geographical areas or other technological products or possibly testing the diffusion theory with institutions as opposed to individuals. For businesses involved in the provision of cellular service, the research findings provide insight into the changes taking place and suggest potential approaches to pricing, promotions and distribution channels.

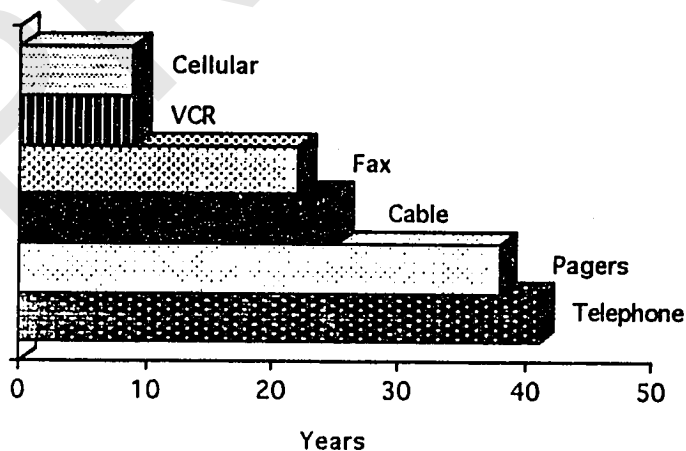
This study is based on the previous work involving diffusion of innovation theory and applied to the cellular industry. It combines original empirical research with data from secondary sources on the performance of the industry over time. In this way the theoretical world and the real world are used to test the hypothesis in the “paradigm of change.”

INTRODUCTION

All new ideas follow a similar pattern as they penetrate society. This diffusion process has been studied and researched for over a hundred years. The theoretical paradigms developed to “explain” this process have evolved mostly from the social science fields. However, an exciting application of this theory is in the world of business. With numerous new products entering the marketplace, major financial investments are made in anticipation of their eventual success. However, there is limited understanding of the process of penetration from the customer point of view. The diffusion of innovation theory can provide business with the framework for understanding, and thereby for planning the optimal strategy for their new products or services.

The cellular industry offers a unique opportunity for research. Just entering its second decade, the industry is young enough so that the researcher can easily examine its origin. Yet, with its fast growth, resulting in perhaps the fastest penetration of any new product or service in US history (see below), the industry is moving rapidly through the stages of market development. As such, it is confronting the classic concerns of managing growth that new industries face.

**Figure 1: PENETRATION RATE OF DIFFERENT PRODUCTS
YEARS TO REACH 10 MILLION CUSTOMERS**



Source: Cellular Business, November, 1993, p. 26

To those responsible for managing the industry, understanding the situation and testing the “paradigm for change” in the context of the real world is of particular importance. As such, researching the validity of the paradigm in this case has dual value. The information gained from the real world adds to the existing theoretical body of knowledge. In addition, the information will be used in practice for business strategy development.

The study methodology and focus were based on very practical considerations regarding the research scope and applicability. The key issues dealt with the availability and accessibility of a sufficient number of candidates that could be interviewed when gathering data. The practicality and applicability of the research findings also drove this requirement. Consequently, the scope of research was limited to using a mail survey in one metropolitan area.

The hypothesis (H_1) to be tested is that the initial adopters of a new product or service can be identified by attitudes, behaviors and demographic variables that are deterministically different from later adopters of the same product (i.e., cellular). Furthermore, within the total group of users in the market, the hypothesis is that there are segments that can be differentiated. In this study, ethnicity was the basis for segmentation with the hypothesis (H_2) being that segments exhibit different attitudes towards the adoption of innovations, as well as different behaviors and other characteristics. Finally, it is hypothesized (H_3) that within the ethnic groupings the later users would be different from the earliest users in their attitudes, behaviors and demographic characteristics.

A number of works were instrumental in inspiring and shaping this research effort. Of particular note are the studies by Everett M. Rogers on *Diffusion of Innovation* (Rogers 1983) and Thomas S. Robertson on *Innovative Behavior and Communication* (Robertson 1971). David F. Midgley and Grahame R. Dowling's work *Innovativeness: The Concept and Its Measurement* (Midgley and Dowling 1978) was the third cornerstone supporting this study. The work of Elizabeth C. Hirschman on *Innovativeness, Novelty Seeking and Consumer Creativity* (Hirschman 1980) and Clark Leavitt and John Walton on the *Development of a Scale for Innovation* (Leavitt and Walton 1975) were important in the design of this research. More so, it was the book *Crossing the Chasm* by Geoffrey A. Moore (Moore 1991) that bridged the theoretical work on innovation diffusion, and the real business world's need to explain the performance (success and failure) of innovative products in the market place. These works stand out from the vast body of literature that was reviewed in advance of the primary research effort described in this study.

However, before a more in-depth review of the literature is discussed, a brief background of the cellular industry is presented in the next section.

THE CELLULAR INDUSTRY OVERVIEW

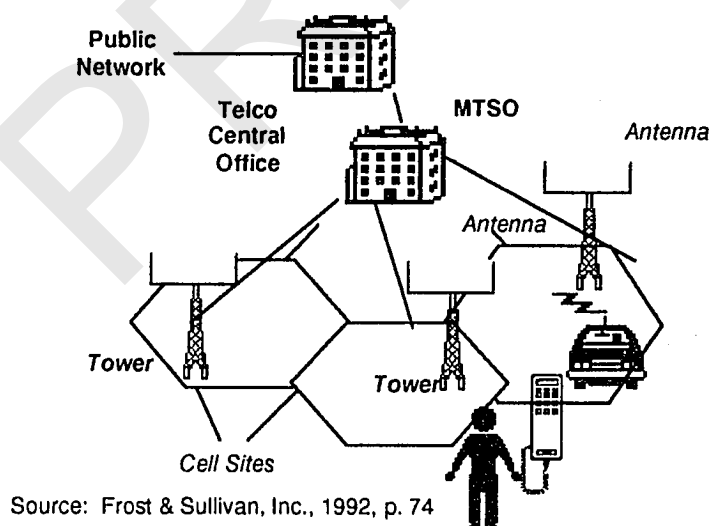
INDUSTRY HISTORY

American society can be recognized by a number of characteristics that generated a demand for a unique communications technology. Americans love to communicate and are seduced by technology. The telephone was invented in the United States, and American inventiveness has dominated the telecommunications industry since its inception almost 120 years ago. American society is also noted for its mobility. Whether in the social or economic arena or in the growth of suburbia, America is a country on the move.

America is a society that thrives on “instant gratification” and on the theory that “time is money.” As such, an ability to communicate while on the move (i.e., in a car) or be in touch while away from easily accessible communications devices is of great importance. It is a society that would be naturally receptive to a mobile communications capability.

In the late 1950s, scientists at Bell Labs, experimenting with radio technology, developed a technology that could “reuse” radio frequencies within a short distance. This capability increased tremendously the number of radio conversations than can take place simultaneously. Also with advances in computer technology engineers were able to develop switching systems that would provide the infrastructure, along with radio towers, for a mobile communications network (see figure 2).

Figure 2: TRADITIONAL CELLULAR COMMUNICATIONS



There were many technological obstacles to overcome as the cellular systems matured. These included the ability to identify and recognize the phone instruments that had no fixed location. Phone conversations had to be seamlessly switched from cell to cell with conversations conducted to/from moving phones. Finally, even with reuse, the ability to handle a very large number of conversations simultaneously was limited. However, this last issue of capacity was thought to be a non-issue since early projections, made for AT&T, estimated the total market to be 1 million subscribers by the year 2000 (Wickham 1993). This underestimation of the market potential may have been the greatest obstacle for the industry.

As it turned out those (e.g., McCaw) with the vision to see the opportunity were very successful, and those (e.g., AT&T) who didn't see the market potential wound up paying a great deal of money (i.e., \$12.6 billion) to get back in the game (Meresman 1993). Ironically, it was the acquisition in 1993 of McCaw by AT&T that was the result of the earlier decisions to, on the one hand, pursue the vision and, on the other hand, to abandon the opportunity.

More recently there have been a flurry of activities in the industry as new entrants jockey for position and the existing players attempt to protect their turf. MCI had attempted to enter the market by aligning with a company called Nextel that while using a different radio technology is able to provide a similar service. A number of the Regional Bell Operating Companies have begun to merge their cellular operations to form large regional networks (Staff Writer USA Today 1993). Lastly, the federal government has begun to auction off radio frequencies that would allow the winning companies to offer wireless communications services utilizing yet another new technology.

REGULATORY FRAMEWORK

While advances were taking place in the spheres of technology, the regulatory framework was frozen in time. Communications services in the United States were provided by AT&T as a monopoly. AT&T was in turn regulated by the Federal Communications Commission (FCC), and at the state level, by Public Utility Commissions (PUCs). In 1984, under intense public pressure, the Justice department broke up the Bell System into Regional Bell Operating Companies (RBOCs) providing local telephone service with AT&T left to provide long distance service.

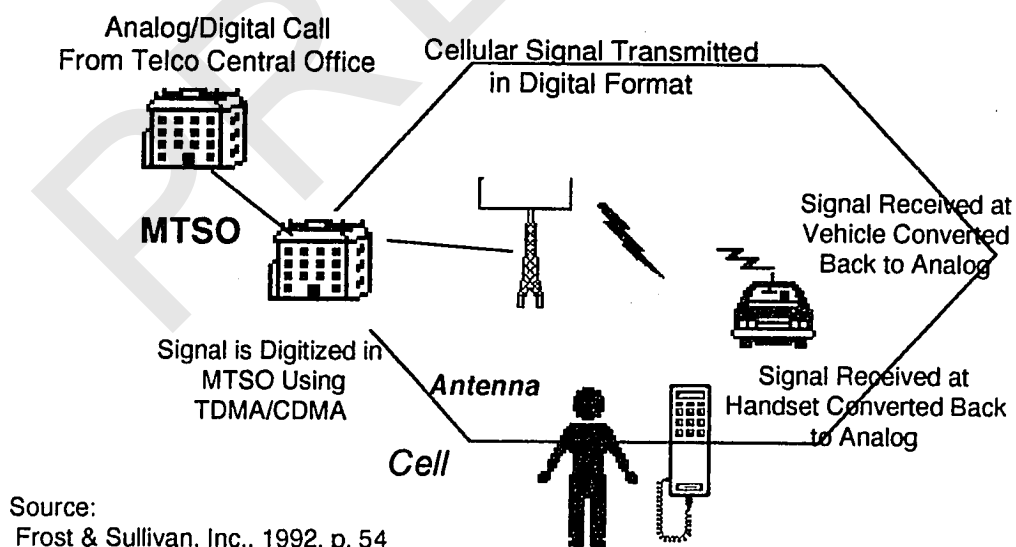
The regulatory environment affecting cellular service preceded the breakup. In 1982, the FCC gave AT&T licenses to provide the service. At the same time, to encourage competition, the FCC also gave licenses to non-Bell companies, selected through a lottery system, to provide services in 305 Metropolitan Statistical Areas (MSAs). More recently, in late 1994, the FCC began to auction radio frequencies to companies who would provide a mobile communications service but using a slightly different technology. As a result, to date, all markets are serviced by only two carriers. This situation is important when considering the diffusion of innovation under noncompetitive (i.e., duopoly) market conditions particularly as this relates to pricing.

TECHNOLOGICAL DEVELOPMENTS

Another factor affecting the rate of diffusion is the ability by the service providers to meet the demand. The explosive growth of the industry, as described in the next section, has created capacity problems for the industry. This in turn has allowed for a “skimming” opportunity for the carriers in terms of their pricing strategies. However, coupled with developments on the regulatory arena have been developments in the technical area. Cellular technology was somewhat revolutionary in its ability to tremendously increase the capacity of a limited resource (radio frequencies). This increase in capacity and its attendant benefits of offering wireless communications on a large scale tapped into a reservoir of demand that is yet to be significantly drained. This high demand for cellular service is causing limits in capacity to be reached in high traffic areas.

There are a number of potential solutions to the capacity problem. One is the building of more and more cells wherein the same frequency is reused. Another approach is to use microcells that are particularly suitable in areas where a high volume of pedestrian traffic exists (e.g., cities). The use of yet other technologies, such as Specialize Mobile Radio (SMR) and even different frequency services such as the Personal Communications Networks (PCN) can help alleviate some of the congestion. However, the future of the service lies in the use of digital technology (see figure 3).

Figure 3: DIGITAL CELLULAR COMMUNICATIONS



Digital technology enables carriers to more efficiently use the available spectrum by carrying multiple conversations on a single channel. Additionally, digitalization enables the delivery of more advanced wireless communications services that seem to be in great demand (e.g., messaging). This capability, in turn, is expected to further fuel the demand for the service. Another extremely important benefit of digital technology is its cost effectiveness. The building of the cellular network requires a major investment. By deploying digital technology, carriers can expand capacity by replacing analog radio equipment with digital, thus not needing to build new cell sites.

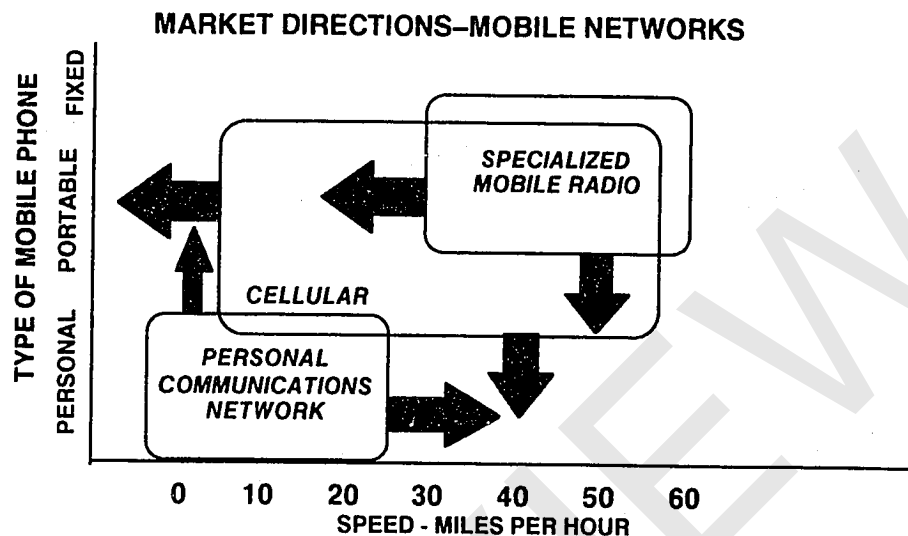
COMPETITIVE ENVIRONMENT

When considering the success of a particular product or service in terms of market penetration, and the success of particular companies in terms of market share, the role of the competitive environment must be considered. As mentioned, the FCC, by design, created duopoly competition in every market. In all cases one service provider was the existing wireline phone company (one of the “Baby Bells” after the breakup of AT&T). The other carrier was a non-wireline company. This structure limited direct competition and allowed for the development of the system, along with allowing for some very high service prices.

As it was also noted new technologies have enabled the offering of wireless service by “non cellular “ companies. Principally, to date, it has been Nextel using the old Specialized Mobile Radio (SMR) frequencies along with digital technology to provide cellular like service. In the near future a new set of potential competitors will enter the market via the acquisition, by an auction process, of radio frequencies not in the current cellular spectrum. These services, dubbed Personal Communications Networks (PCN), will be similar to cellular in their ability to provide wireless mobile communications to end users.

These developments will turn a “cozy” duopoly situation into a fiercely competitive marketplace. (see figure 4).

FIGURE 4:



However, it is the existing wired telephone service that provides the cellular industry with its greatest threat and opportunity. Due to its current relatively high service cost, usage of cellular service is limited. When available either at home in the office or on the street corner (via pay phone), the wireline service offers a high quality, comparatively low cost, substitute.

Yet in this cost difference lies the opportunity.

Currently only 20% percent of households (8% of the population) have cellular service. Furthermore, in terms of communications traffic, the cellular industry share is estimated at less than 1%. For a number of countries, especially in Eastern Europe, cellular technology is proving to be a very cost-effective way to quickly provide high quality telephone service in areas where the existing wireline infrastructure doesn't exist or is of very poor quality. In this way wireless service is becoming the de facto mass communications technology.

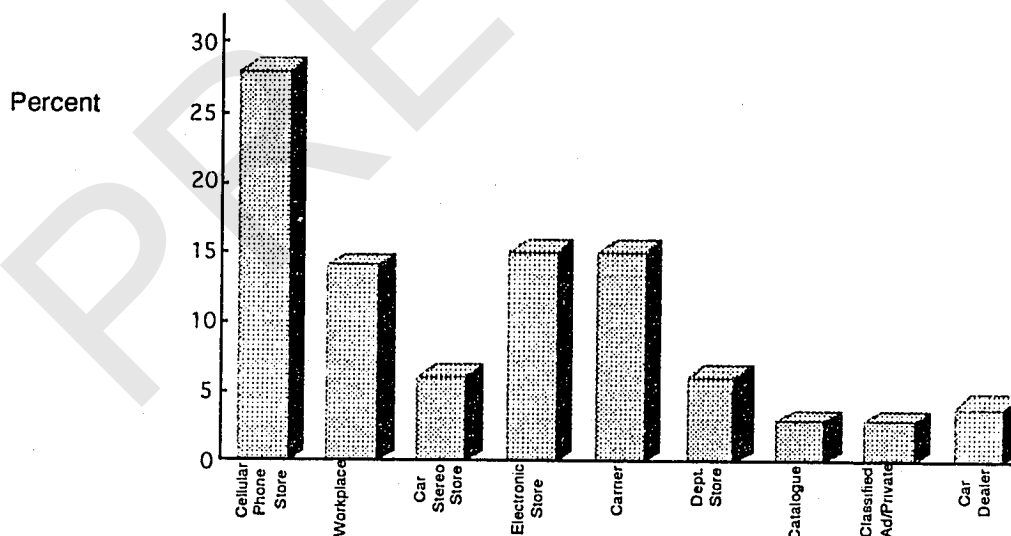
If the price of cellular service were substantially lower, even if it were at a slight premium to the wireline service, a much larger number of households would have cellular phones and the amount of overall communications traffic via the wireless cellular network would be much greater.

DISTRIBUTION STRATEGY

Another important factor in the growth of the industry and the evolution of the customer profile has been the distribution strategy employed by the carriers. Two major channels exist with a third one playing a more minor part. The main distribution channels are the direct and indirect. The third channel is that of a reseller. Resellers are responsible for the various aspects of service provision including having their own pricing and customer service operations, but not cellular networks. They buy network services from the existing carriers and resell the services, hence their name.

In the indirect channel there are a number of very different segments. Traditionally these have been agents of the carrier. The agents sold cellular phones and equipment through dedicated cellular stores or electronic specialty stores. Over the last year, retail stores and mass merchandisers have become an increasingly important factor (see figure 5). A direct response channel (e.g., catalogue) has also recently emerged as yet another distribution channel. These changes are a direct result of the different type of customers that have entered the category over the last year.

Figure 5: Purchase Place of Cellular Phones in 1993

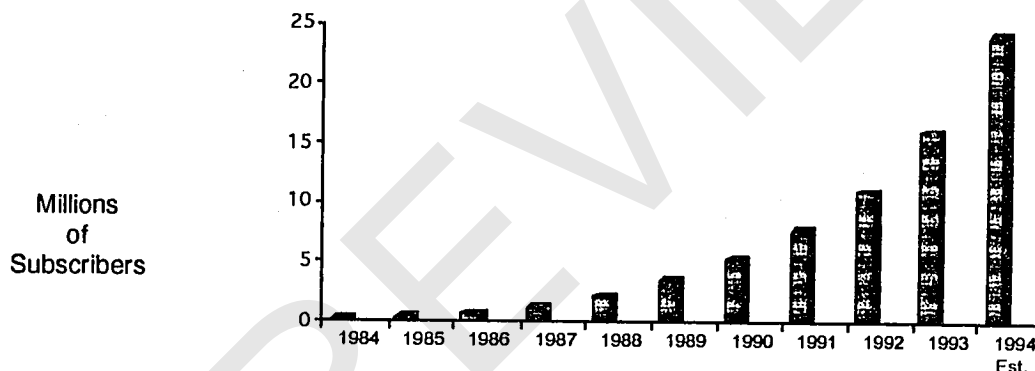


Source: EMCI, Inc., based on CELLTRAC surveys, p.164

US MARKET PENETRATION

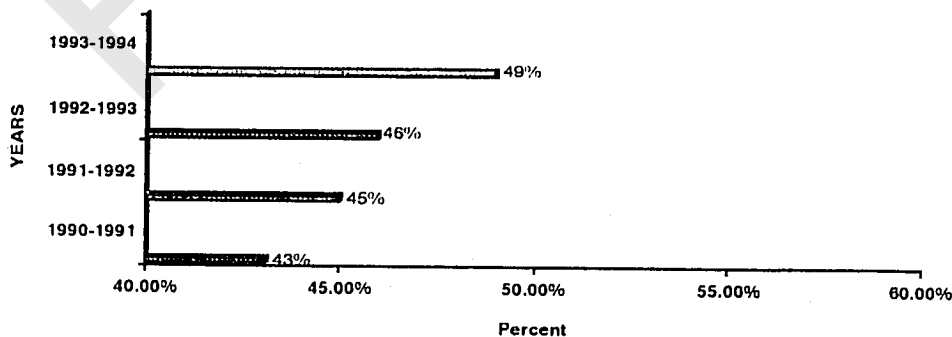
From the beginning the cellular industry growth surprised the “experts.” Consumers were embracing the technology in unexpected numbers. Even the high cost of the equipment did not deter customers. Initially the 1 million subscriber level was forecast for the year 2000. In reality, this level was reached by the fourth year from introduction (late 1987), and the number quadrupled by the end of the 1980’s (see figure 6). Over the last four years, the rate of growth of cellular subscribers in the United States has been accelerating. From 43% in 1990-91 to 45% in 1991-92, 46% 1992-93 and 49% over the last year (figure 7). This explosive growth has resulted in almost twenty-five million subscribers by the middle of 1994 and shows no sign of abating in the near future.

**Figure 6: Cellular Subscribership
1984-1994**



Source: Cellular Marketing, October, 1993, p. 74 and CTIA.

**Figure 7: Cellular Subscribership Growth Rates
1990-1994**



Source: Cellular Marketing, October, 1993, p. 74 and CTIA.