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Mobile commerce business models and technologies towards success

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Mobile Commerce Business Models and Technologies Towards Success

By

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- Chetan Sharma, 2000
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ABSTRACT

Mobile Commerce Business Models and Technologies Towards Success

By
Pinar Nilgun Acar

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Mobile commerce is any transaction with a monetary value that is conducted via a mobile telecommunications network. This thesis tries to examine the factors leading to the success of mobile commerce as well as factors that may hinder its success.

This research is separated into five parts:

In the first part of this thesis, an analysis of wired e-commerce businesses is made; followed by advantages of mobile commerce over wired e-commerce. In the second part of this thesis, new wireless business models that are expected to generate substantial revenue flows as well as some successful examples of these business models are discussed.

In the third part of this thesis, advances in wireless technologies that will lead to the success of mobile commerce are discussed. In the fourth part of this thesis, competition strategies and revenue structure of mobile commerce are discussed.

And finally, in the fifth part of this thesis, drawbacks of wireless technologies towards the success of mobile commerce as well as how they can be overcome are discussed.

The research and the conclusion suggest that although wireless technologies and their related business models are fairly new, they are growing at rapid speed. These are incredible sources of revenue. Once the factors hindering their usability, reliability, development and deployment are overcome, mobile technologies show great potential as revenue generators for both existing and newly developing businesses.
INTRODUCTION

Mobile commerce is any transaction with a monetary value that is conducted via a mobile telecommunications network. This thesis tries to examine the factors leading to the success of mobile commerce as well as factors that may hinder with its success. (Sadeh, 2002)

Mobile commerce is very different from traditional e-commerce. Wireless communication is a technical and business revolution. Mobile phones and PDAs impose very different constraints than desktop computers do. Therefore, mobile commerce is expected to have different expectations and outcomes among investors and businesses than wired e-commerce.

Mobile commerce is changing the role of most players across the telecom value chain, while also providing room for new entrants. In the process, new business models are being invented.

In the mobile business, each new cellular platform has meant new technologies, functionalities, and markets, which have given rise to increasingly specialized services. In the pre-cellular era, the early wireless technologies allowed a very primitive, simple, homogeneous service concept. It was only with the arrival of the digital cellular standards that rudimentary data services (e.g. SMS) became possible. With 2.5G / 3.5G technologies, providers could craft more sophisticated and heterogeneous service concepts.

Competition strategies and revenue structure of mobile commerce are also adapting to globalization of the world economy. Wireless businesses are now playing in a global market, versus local markets of the past.

Security, usability, price pressure and privacy are some of the areas where m-commerce imposes new constraints. The ultimate success of mobile commerce is heavily dependent on the success at overcoming these hindering factors.
CHAPTER ONE

Success of Mobile Commerce In Comparison to wired Electronic Commerce

Mobile Commerce will be more successful than wired Web E-Commerce in the US in the future mainly because wired web E-Commerce have provided the businesses familiarity and necessary tools with the technology and the precautions that they have to take against any vulnerabilities of their businesses.

Mobile commerce involves new technologies, services and business models. It is quite different from traditional (wired) e-commerce. Mobile phones and PDAs impose very different constraints than desktop computers. (Sadeh, 2002)

1.1. Analysis of Wired Electronic Commerce Businesses

In order to plan for success, it is necessary to develop a deep understanding of the factors that have undone those who have gone before you, understand how these factors acted and what measures proved insufficient to contain them. If such factors proved fatal to your predecessors, they may prove equally fatal to you. (Glass, 2001)

1.1.1. Lack of experience on electronic commerce business models:

The main business failure of most dotCom companies was because of the fact that they did not have the necessary e-commerce infrastructures and correct business models due to their being very inexperienced in this arena. Premature market entry and the ensuing frantic efforts to adjust to the new economy can be traced to a lack of business experience at many wired dot.coms, the easy access to venture capital and the need to establish market leadership quickly.

Wired Dot Coms were characterized by very rapid product development, forgoing the traditional multi-step development process. Because of competition, real or imagined, they have been forced to try new methods of discovering user need and launching new products rapidly. During the early stages of the wired Internet frenzy, it was possible to invest in a company, take it public and cash out before the company proved its business model.

Pets.com is one of the highest-profile failures. It underscores how such business-to-consumer Internet sites haven't found sustainable business models — even with massive infusions of capital, dwindling competition and national ads that grabbed the public's imagination. Pets.com's fundamental problem was that its cost model would only have worked if it had very high level of sales. Pets.com did not have the financial resources to sustain itself till it reached that level of scale. Many pet supplies are heavy and costly to ship- cat litter, cans of dog food — and the firm could not sell enough higher-profit items such as pet toys. Moreover, to attract customers, the
company depended heavily on discounts. As a result, the firm was selling supplies below cost the entire time. (Glass, 2001)

1.1.2. Management with no Internet experience:

Wired web companies often failed also because even their most experienced executives were traditional managers with no Internet experience trying to run a dotCom company.

In 1995, according to Standish, 31% of all software projects were cancelled, 53% were challenged (completed, but behind schedule, and/or over budget and/or without all features desired), and 16% were successful. On the other hand, in 2000, Standish reports suggest that 23% of all software projects were cancelled, 49% were challenged and 28% were successful. (Glass, 2001). As we can see from the above statistics, software projects are becoming more successful as companies are getting more experienced with managing and implementing them.

1.1.3. Lack of experience on pricing:

Unlike wireless companies that are very experienced with telecommunications pricing, the wired companies were very inexperienced about pricing as well. Most wired Internet companies determine their prices based on demand, or negotiate their prices or use a combination of those pricing methods. Normally, such methods would produce superior profits. However, given the lack of profits, one must surmise that such an approach has been producing losses because pricing is based on high-"visionary" future demand, not realistic estimates. (Glass, 2001) Wired Internet companies do not have cost-plus pricing that the wireless telecommunications companies use.

1.2. Advantages of Mobile Commerce Over Wired Electronic Commerce

1.2.1. Loyal customers and brand awareness:

One of the main reasons that many wired dotCom companies failed was that they ran out of customers. (Glass, 2001) With already established and loyal set of customers of wireless companies, customers will not be a major problem also because wireless companies are already very experienced with their customer retention techniques and programs. In 1992, the number of GSM subscribers worldwide amounted to only 23 million. By early 2001, the figure had soared to 707 million and today it exceeds 1 billion. (Steinbock, 2002)

Wireless business models allow greater opportunities for brand loyalty and strong customer relationships. Brand loyalty and strong customer relationships directly and indirectly translate to higher revenue. Content providers can partner with paging and other wireless service providers to offer value-added content to their subscribers, thus increasing chances for brand awareness.
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MCommerce (mobile commerce) is also becoming a logical brand-value-enhancement channel for pure net players.

1.2.2. Emphasis and experience on price-to-earnings ratio:

Wired Dot.coms have been failing because they regard sales revenues and profits as distractions - concentrated instead on capturing the largest share of a market vision. As a result, they have been replacing the widely accepted valuation measure of price to earnings (P/E), with a boundless price-to-vision (P/V) ratio, in which the larger the vision, the higher the stock price. Meanwhile, fewer than 10% of these companies reported any profits.

In fact, many such companies have entered the market without fully developing and market-testing their products and services, and the fact that 80% of even systematically developed and market-tested products fail does not seem to concern them. (Glass, 2001). Many wireless companies have a lot of product and market experience with a more clear emphasis on price-to-earnings ratio, as a part of their traditional evaluation of business and this will help them take the lead in the new mCommerce revolution.

1.2.3. More experienced investors:

The wired Internet bubble had one thing no past manias had: the push from online brokers, who made speculating on stocks easier than ever and advertised heavily to encourage people to chase riches. For example, in September 1998, employees at online broker E*Trade Group Inc. hit TV viewers with a barrage of commercials in an effort to add one million customer accounts to its total of 500,000 in the coming year. Some ads suggested that trading stocks over E*Trade was a better route to wealth than waiting to win in the lottery; others suggested that it was better than waiting for a rich relative to die. All promised a fast, cheap, powerful way to play the stock market.

The astonishing growth made online brokers a powerful force in the market, as their customers drove the stocks of newly public and established companies to unprecedented levels. By some estimates, individual investors - most of them trading online - accounted at the peak for 65% of the volume on Nasdaq. The marketing campaigns by these Internet brokers encouraged novice investors, who had no business trading securities, to short-term trade stocks, and they in many instances ended up losing a major portion of their net worth. (Glass, 2001)

So these speculations led by the online brokers made novice investors invest in insecure stocks and this was the reason behind so many people losing on Internet stocks.

Investors already have a lot of knowledge about wireless companies and they have learned a lot of lessons from the wired Internet companies. Investors therefore will be more knowledgeable about investing on mCommerce stocks and the losses from mCommerce stocks will be less severe and thus less skeptical by future investors.
1.2.4. **Transaction based fee-for service model:**

Mobile Commerce provides transaction-based fee-for-service model used by cellular phone service providers while wired-Web users have been accustomed to having free information at their hands. This mobility advantage will provide the users with willingness to pay for information if they can have it immediately; which means more investment return opportunity for businesses.

1.2.5. **Pouring resources from investors:**

Although investors are increasingly hesitant to assume the risk of a dotCom failure, in ventures related to the wireless technologies, resources are pouring into any application that has a wireless component.

By the late 1990s, the realization of the rapidly growing economic importance boosted the stock prices of leading equipment vendors, such as Nokia and Ericsson and leading operators, such as Vodafone-Mannesmann and NTT DoCoMo. Between 1980 and 1994, during the PC revolution, more than 580 technology companies went public and created more than $240 billion in net market capitalization. In the long term, the industry is poised for a new era of incremental growth.

The mobile device management (MDM) market grew 45.8% in 2001 to $121.3 million in revenue and is expected to reach $715.1 million by 2006. IDC believes growth will increase in 2003 and 2004 with the expectation of improved economic markets and increased investment in mobile and wireless projects. (Raina, 2002)

1.2.6. **Learning from the global mobile success stories:**

Already more experienced European wireless technology companies will want to capture the US market or form mergers with the US wireless technology companies. The success and experience of wireless technologies in the European market will be inherited to the United States. This will help Mobile Commerce to grow even at a faster pace compared to the wired E-Commerce with which nobody had any prior experience.

If the experience of NTT DoCoMo transfers to the United States, the subscriber churn rate, or rate at which subscribers leave for other carriers each year, should decrease significantly. (Bergeron, 2001) In October 2000, AT&T and NTT DoCoMo announced the formation of a strategic alliance to develop the next generation of mobile multimedia services. In the process, NTT DoCoMo invested nearly $10 billion (16 percent) in AT&T Wireless. By 2002, AT&T Wireless, with almost 20 million subscribers, was the third largest U.S. mobile operator, behind Verizon Wireless, an SBC-BellSouth joint venture. And it provided service nationwide. (Steinbock, 2003)
Today, Japanese “m-commerce success story” NTT DoCoMo is building on its success at home and looking for ways to replicate it abroad through partnerships with AOL Time Warner and key mobile telecom operators in the United States, Europe, and elsewhere in Asia. This includes minority-stake investments in companies such as U.S. operator AT&T Wireless, Dutch operator KPN, Hong Kong’s Hutchinson, Taiwan’s KG Telecom and more recently, Korea’s SK Telecom. (Sadeh, 2002)

The important lessons of NTT DoCoMo have become clear. First, the right technology has helped to attract a great number of partners, reducing barriers for entry. Second, the alliance structure, which searches for the win-win in every relationship, has attracted not only eager content providers, but also other platform creators, to develop a better environment for all involved. Third, the right services, always considering the mobile needs of the user, have strengthened NTT DoCoMo overall. Fourth, the right marketing has stressed what can be done, and has not misled the user or focused on aspects not of interest, such as technology. These four factors have been essential, but the most important thing that DoCoMo has done is coordinating all stakeholders in the value map, to design the best proposition for the user. Mobile commerce follows the same philosophy, by developing useful services for users and win-win relationships for the players involved. (Mennecke & Strader ,2003)

More wireless oriented European and Japanese business trends suggest that along with globalization, US will also be going towards wireless oriented business.

1.2.7. New business models:

The mobile Internet opens the door to a number of services and applications that would simply be inconceivable from a desktop PC. These include new ways of staying in touch with others while on the move, such as sending SMS (Short Message Service) messages. Many of these business models revolve around time-critical needs that require short, to-the-point interactions. (Sadeh, 2002) Chapter 2 will be focusing on these new business models in more detail.

1.2.8. Affordability and easy access of mobile technologies:

The added value that mobile technology has over wired communications is related to the affordability of and easy access to the features provided by these technologies. From a business perspective, communications and networking technologies define the cost of circuit and component design, within the constraints of fulfilling customer needs.

Despite the technological prowess of NTT DoCoMo and the political savvy of Europe’s wireless access providers, the United States and Canada have an opportunity to take the lead in the use of some niche technologies, such as wireless PDAs, and in the development of middleware
or software that pulls everything together. It may be that U.S. companies are best equipped to
profit from adding value to core technologies developed elsewhere and providing them to rapidly
developing markets like China.

1.2.9. "To make money now" versus "to gain loyalty in the long run":

Due to the wired e-business structure, in most wired e-commerce companies, the aim is not
to make money immediately. Instead, e-commerce companies aim at gaining loyalty in the long run
that will "hopefully" bring big financial success in the future. Gaining in the long run in the wired e-
commerce takes a lot of time and investment upfront; and a lot of DotCom companies are likely not
to be able to survive though this initial time frame. Amazon has only shown profit one quarter out of
its whole existence. (Prof. Daniel Garrison, classroom communication, 1/6/2003)

On the other hand, mobile commerce is based on fee-for-service model that provides
immediate revenues. Immediate revenues make a company much more secure financially and
robust against failures and enables further investments in the future.

For example, NTT DoCoMo is a mobile phone operator with a pre-existing billing
relationship with the customer. It is possible for NTT DoCoMo to collect payment on behalf of
content providers for their services. These payments are added to the user’s phone bill every month
and all but a 9% commission is passed back to the content provider. It has offered a chance, if their
content is competitive, to some content providers to receive revenue directly from the end user.
(Mennecke & Strader, 2003)

News companies, who traditionally provide news in other media using advertising revenue,
can charge users small fees for essential information via mobile networks. Entertainment
companies, who have not yet found a true moneymaking model on the fixed-line Internet, can
transform their properties into mobile content and begin to receive revenue. (Mennecke & Strader,
2003)

1.2.10. Authentication ease of mobile commerce user:

When the customer uses her cell phone, it authenticates itself so the network knows whom
to bill. (Schneider, 2000). This is a more traceable and reliable source of revenue compared to
wired commerce revenues because the wired commerce companies have little connection with the
customer information (especially when the customer is using a public computer to make her wired
e-commerce transaction) and a lot less financial sanction; for the same reason, than the wireless
companies with already established databases of detailed customer information.
1.2.11. More experienced consumers:

Existing wired Internet users want to access the Internet using their wireless devices. For users who have already experienced the benefits of the Internet, wireless Internet applications will be easier to learn. (Sharma, 2000)

Moreover, the major appeal of mobile data technology is that it provides information to the mobile user on a device that consumers are comfortable with—the mobile telephone. (Mennecke & Strader, 2003) This is a very big advantage for mobile commerce compared to wired Internet commerce because many it took people a lot of time to adopt PC technology while wired e-commerce was developing.

1.2.12. Location, urgency and utility and social acceptance (critical mass):

Location, urgency and utility represent those variables that either solely or in combination are what most dramatically distinguishes between electronic commerce and mobile commerce.

Also, there is a social pressure aspect to the growing potential of mobile technology. Social pressure refers to the service usage and choice as the result of influence from supervisors, peers, or others that are highly regarded. It signifies the extent to which an individual believes that an innovation will give him added prestige or status in his relevant community. Consumers might experience the need to own and use mobile technologies in order to feel accepted by their friends. Critical mass theory states that individuals who have access to multiple communication media will generally use the medium most widely available within their communication community, even when it is not the medium they prefer. (Mennecke & Strader, 2003). The above facts show that as mobile technologies are becoming more and more popular, it is gaining a critical mass where users will feel socially obligated to get involved more and more in mobile transactions.

1.2.13. Businesses becoming more familiarized with new Technologies:

Businesses are becoming more familiarized with new technologies than they used to be when wired e-commerce revolution was newly starting. The results of a statistical survey analysis (Akkeren, 2003) show that companies who are already full-adopters of technology are more excited about the prospect of new wireless technologies compared to the partial- and non-adopters. (Mennecke & Strader, 2003) Therefore, it can be deduced that the more technically savvy the business currently, the easier their adoption of wireless technologies will be. Since businesses have become familiar with Internet technologies with wired e-commerce, they will be more ready to adapt themselves to m-commerce.
CHAPTER TWO

Mobile Commerce Business Models that will lead to the Success of Mobile Commerce

Wireless Business Models are developing, and they will be pouring a great amount of cash flow into the M-Commerce industry. (Bergeron, 2001)

2.1. Wireless Business Models as Revenue Generators:
In the wireless business, technology change typically has reshaped existing markets and resulted in new ones, which have influenced innovation. (Steinbock, 2003)

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<td>Location-Sensitive Billing</td>
<td>Low to Medium</td>
<td>Indoor/Outdoor</td>
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Table 1. A taxonomy of mobile location applications and services (Mennecke & Strader, 2003)

2.1.1. Auctions:

Wireless online auctions that are very valuable revenue generators, are also becoming very popular: QXL.com, Europe's largest online auction company and eBay, the US equivalent, offer wireless access to online auctions.

2.1.2. Hotels:

Immediate access and check in to near-by hotels will be possible by wireless systems.
2.1.3. Media and entertainment:

Strong sales of Nintendo's Gameboy and Sony's PSone suggest that the wireless game market is significant. Nokia and Ericsson are also giving importance to the wireless game markets. Datamonitor recently estimated that four out of five mobile phone users will be playing mobile games by 2005. The advantage of mobile gaming is the market reach of mobile technology. Analysts estimate it took Nintendo 10 years to sell 100 million GameBoys, whereas four times as many mobile phones are estimated to sell each year, forming a potential worldwide market of 950 million mobile subscribers. The mobile gaming experience is expected to be worth $5 billion with over 100 million players by 2006, according to a study released by consulting firm Strategic Analytics. (Raina, 2002)

Mobile gaming services allow users to play interactive multi-player games (MPG) against other remote users (UMTS Forum, 2000) independent of time and location. M-gaming services serve as leisure time entertainment as well as time-killing activity (Mennecke, 2001).

2.1.4. News:

Most current news sites, such as CNN, Reuters, and BBC, have started offering services whereby users can configure their mobile device to receive news and information content from online news providers. (Raina, 2002)

Figure 1. BBC News for a WAP phone (Sharma, 2000)

2.1.5. Wireless car:

A recent survey by US based IDC suggested that as many as 69% of wireless calls were either placed or received in vehicles. Telematics, which until recently was essentially a niche
industry delivering a limited range of RF (Radio Frequency) based commercial services to vehicles (i.e., fleet management, emergency response, taxi dispatchment, etc.), is now poised to enter the mass market and location-based service is one of several technologies that will drive this transition. (Mennecke & Strader, 2003)

The use of in-car location-based information services such as OnStar, Wingcast (partnership between Ford and Qualcomm) and Mercedes Benz SOS Service, have increased. The use of GPS (Global Positioning System) along with location-based mobile technology allows the service provider to assist customers by providing directions, maps, traffic information, and emergency roadside assistance services. (Raina, 2002)

Mapquest.com wireless portal offers information on traffic conditions, driving directions and alternate route suggestions. Traffictouch.com wireless portal provides up-to-the-minute notifications of adverse traffic conditions; defines the roadways and areas you travel. Webraska.com wireless portal provides information on real-time traffic conditions for major European cities. (Sharma, 2000)

![Traffic Touch for a Palm device](image1)

**Figure 2.** Traffic Touch for a Palm device (Sharma, 2000)

![Webraska.com for a WAP phone](image2)

**Figure 3.** Webraska.com for a WAP phone. (Sharma, 2000)

### 2.1.6. Shopping:

Shopping has already gained tremendous popularity on the wired Internet, and despite the security issues and concerns from wireless end users, it is believed by analysts such as IDC that
retail mCommerce over the wireless web will also be equally, if not more, popular, reaching a market size of $491.7 million dollars by 2005.

While a shopper might visit a brick and mortar shop once a week, and a PC-based retailer once a day, with the wireless Internet always in your hand, the frequency of access could be many times per day. Therefore, it is important to present information in the form of content to attract the user back frequently, and to keep it fresh so they are satisfied each time they return. (Mennecke & Strader, 2003)

Nordea (Finland)'s WAP Solo's "Solo Market" gives customers access to over 600 merchants. Customers can browse merchant sites from their WAP-enabled phones. When they decide to make a purchase such as a movie ticket or a bouquet, they are transferred back to WAP Solo site where they can securely pay for their purchases while selecting from a number of payment options – not just from Nordea bank accounts, but also from third party credit cards. Nordea charges a monthly fee of 4 Finnish Mark (about $0.6 US) for access to its WAP Solo Market.

Lawson is one of the largest chains of convenience stores in Japan, with over 7,500 shops nationwide. Lawson stores already have "Loppi" multimedia kiosks that allow shoppers to select products, print out a ticket with barcode and pay at the checkout counter to receive their purchase. DoCoMo and Lawson have aligned for the iLawson online convenience store, and "iConvenience" on i-mode. With iConvenience users can make purchases from a huge inventory of books, CDs, cosmetics and other products. A purchase number is provided and the user then goes to the physical store. At the store, the user inputs their purchase number into the Loppi kiosk (in the future, it is hoped that an infrared link between the i mode handset and the Loppi kiosk will eliminate this input step). The ticket and barcode can be taken to the counter for payment and exchanged for the actual product. The user first registers online and selects their preferred location, but the pickup store can be selected and changed at time of purchase. This registration procedure also provides valuable information for customer profiling, which is usually carried out by store clerks upon checkout. The customer relationship management aspect of iConvenience is very important for Lawson. (Mennecke & Strader, 2003)

2.1.7. Retail information:

Use of the wireless phone's memory to store and forward information about purchases and demographics is becoming a very popular trend in obtaining customer information. Advertisers are trying to tie in geophysical information to determine how best to position sales strategies. For example, if a large number of Starbucks customers go to a bagel shop after buying their coffee, then perhaps Starbucks may consider selling bagels. (Raina, 2002)
2.1.8. Travel:

Sabre Holdings, one of the most comprehensive travel processing systems in the US, now offers wireless services where customers can create, access, and change flight, car and hotel reservations using WAP-enabled handheld devices. The company also makes its consumer Web site www.travelocity.com viewable on mobile devices. Most leading airline sites and online travel providers, such as Expedia, Worldspan, and Gethere.com, now offer wireless services.

In the case of mobile ticketing, EMPS, a joint initiative between Nokia, Nordea and Visa, is exploring solutions that will make it possible for users to download reservation information on their mobile phone and later beam it at the airport and movie check-in counters, using a technology such as Bluetooth. (Sadeh, 2002)

Delta Air Lines mobile portal provides flight itineraries; access to up-to-the-minute flight information, including same-day gate information; flight numbers and schedules. (Sharma, 2000)

![Delta Air Lines for a Palm Device](image)

Figure 4. Delta Air Lines for a Palm Device (Sharma, 2000)

2.1.9. Transport, logistics and location-based tracking:

Management consultants at McKinsey calculate that the total American logistics market, which includes basic transport and in-house administration costs, is worth about $1 trillion a year, and grows annually around 4%. According to a report by Accenture, advances in wireless technologies and the mobile Internet could significantly improve supply chain management. This shows us that mobile commerce business models as applied to logistics and transportation brings a lot of opportunities in terms of revenues. ("A Moving Story", 2002)

Omnitracs system, developed by Qualcomm in the 1980s, was the first satellite-based mobile communications and tracking system for the transportation industry. With the system, trucking companies can track each truck's progress from pickup to drop-off, as well as maintain real-time contact with drivers. The degree of control and certainty that it enabled has opened up new markets for the trucking industry, including accounts with manufacturers that demand just-in-time delivery.

In addition, tracking services can be utilized to monitor the exact whereabouts of, for example, children and elderly people. (Mennecke & Strader, 2003)
2.1.10. Banking and finance:

Initiated by Japanese and European wireless service providers, mobile banking promises to be a lucrative business for both financial institutions and the service providers that charge transaction pass-through fees.

In the United States, PDAs are frequently used for conducting trades and logging on to wireless brokerage services. Wireless banking is rapidly becoming a significant market worldwide for mobile customers. In most cases, customers are now able to log in to their web banking accounts and register for wireless banking. For people to be able to see their own money instantly offers them an emotional, intimate relationship with their bank, thus serving as a good example of personalized mCommerce at play. IDC has forecast the growth of the mobile banking and finance market to reach $1311.1 million by 2005. In Europe, the situation is expected to be even more dramatic, attracting one-third of the European population into the wireless user-base. Special financial exchanges have been developed for the purpose of enabling mobile banking.

In Japan, Daiwa Securities reported in late 2000 that 35 percent of its customers bought and sold stock over the Internet, with 20 percent of these transactions taking place over i-Mode, accounting for close to 7 percent of all their transactions. Daiwa has also reported that its mobile online transactions were about 50 percent cheaper than traditional ones. (Sadeh, 2002)

Nordea, a long-time pioneer in Internet banking, was the first to offer its customers WAP banking services through the launch of its WAP Solo portal in October 1999. The portal makes it possible for customers to pay bills, check balances, review statements or trade shares from their mobile phones. It is fully integrated with Solo’s other online banking channels, which include wired Internet access and Internet-enabled cable TV access. This integration ensures that WAP Solo customers are presented with a consistent experience, independent of the access channel they select – same look and feel, same logical set of menus. In less than 2 years, WAP Solo has garnered a substantial portion of Nordea’s 2 million online banking users.

NTT DoCoMo of Japan is another good example of mobile banking services. Nordea’s business model, however, is quite different from that of DoCoMo’s. It is part of a broader strategy of building a close and long-lasting relationship with its many clients, both private consumers and merchants, through as comprehensive a set of services as possible. As such, WAP Solo can also be viewed as a response to the potential threat of being dis-intermediated by mobile telecom operators, which, like DoCoMo, are eager to leverage their billing relationship with customers and grab a slice of every m-commerce transaction. By offering a credible payment alternative, services such as WAP Solo make it possible for banks and credit card issuers to compete with mobile telecom operators for a slice of the m-commerce revenue pie. (Sadeh, 2002)
2.1.11. Wireless enablers:

Wireless enablers allow a content provider such as a click-and-mortar business or dotCom to maintain a single version of their information and make it available on a variety of wireless platforms. Given that millions of already established dotComs could be potential customers for this service, this market seems like a low risk.

Gomes et al. (2001) presented ongoing research into a mobile device interface that does not require a separate server to store and provide Web content to mobile devices (i.e., the system works with existing Web pages). It first uses a clipping filter to get rid of items that users do not want to see on a handheld device (e.g., ads and other content). It then minimizes the text it presents to the user through heuristics that use parsing and abbreviations. However, the user can zoom into greater levels of detail if desired, to the point of seeing the complete original text. (Mennecke & Strader, 2003)

GoAmerica is a provider whose wireless Internet service provides wireless access to virtually any Internet site, as well as branded content grouped into useful channels. The company also allows businesses and consumers to access wireless e-mail and information on corporate intranets. GoAmerica's web access services go through its network operations center (NOC). The NOC forms a bridge between Internet/intranet content and the wireless networks and mobile handheld devices. Each handheld device comes with a GoAmerica's browser(client) embedded in it. There are other web access providers similar to GoAmerica such as OmniSky, Aether Systems, Outcurve Technologies, Openwave (previously known as Phone.com), Wireless Knowledge, InffoSpace and AvantGo. AvantGo, for example, offers a popular web access service that can format any web site for display on a mobile device screen. (Raina, 2002)

2.1.12. Customer relationship management and sales force automation:

In the case of m-commerce, CRM can be described simply as providing support for one's customers, with useful online services in the mobile environment.

Developing a relationship with the consumer is all about creating a dialogue with the consumer on their terms. You develop that relationship as you would a friendship; you want to learn about their preferences (likes and dislikes), understand when they want your support and guidance, and know when they need some space. It's about being helpful without being intrusive and it's built on a platform of trust and common interest.

Spamming the consumer with unwanted messages would only do more harm than good. Therefore, it's important to let the consumer dictate the terms of the relationship while the marketer adheres in a helpful, non-invasive manner. (Mennecke & Strader, 2003)

Both Instant messaging (IM) and SMS are now being used in conjunction with Customer Relationship Management (CRM) and Sales Force Automation (SFA) applications to greatly
enhance the end user's experience. IDC estimates that by 2004, there will be 43 million wireless IM users. Companies are rapidly seizing the wireless Internet opportunity to elevate their sales force from lone representatives to powerful team players. Many salespeople nowadays depend on their PDAs for scheduling and contact management.

CRM is always a wise investment, as it increases both the satisfaction and the loyalty of customers. CRM applications on wireless networks can be far more immediate, effective and timely. (Mennecke & Strader, 2003)

2.1.13. Price management and inventory tracking:
Department stores are increasingly using mobile devices for price management and inventory tracking. Wal-Mart Stores Inc. is experimenting with radio-frequency identification tags - tiny chips that soon will cost only a few cents. These let computers track products as they move from truck to warehouse to store - replacing repeated human scanning of bar codes. ("All Net, All the Time", 2002).

2.1.14. Manufacturing and distribution:
Mobile technologies are also playing a key role in streamlining the processes and functions governing manufacturing and distribution. The task of automating part or all of a company's route sales process, making key information available anytime, anywhere - throughout the sales flow from the initial order through the load creation to delivery and adjustments at the customer site has become a major driver of mCommerce technology use.

2.1.15. Healthcare:
Wireless technology is also becoming an integral part of the healthcare field, enabling caregivers to review patient records and test results, access charge captures, enter diagnostic information during patient visits, and consult drug formularies, all without having to resort to a wired network connection. IDC has forecast the U.S. based mobile healthcare market to grow to $1966.6 million by 2005.

Wireless services will be providing new services such as medical portals that specialize in providing references for its clinician members including drug and disease management information. Investment money for development and operations could come from managed care organizations.

Wireless technology provides an effective information "glue" to link patient data to doctors and associated entities. Wireless MD is using wireless technology to increase efficiency and improve productivity and decision-making in healthcare.
2.1.16. Emergency services:
Perhaps the clearest market application of location based services, as already discussed in the previous section, is the ability to locate an individual who is either unaware of his/her exact location or is not able to reveal it because of an emergency situation (injury, criminal attack, and so on). (Mennecke & Strader ,2003)

Automatic identification of the customer, directions and pre-notifications to the nearest emergency room can be possible via mobile location-based services. Through these services, subscriber's electronic medical records can be forwarded to the emergency room before she arrives.

2.1.17. Public service (law enforcement and safety services):
Mobile technologies have been instrumental in improving the efficiency of public service agencies especially within law enforcement and safety services. Police departments and other law enforcement agencies have been using mobile technology to check up on criminals and suspects in the field, issue electronic citations, query multiple databases, such as those at the state and federal level; automatically run license plate checks through DMV databases, and perform other functions that generally improve performance and speed. It is possible using modern tracking technology to determine the precise location of a wireless handset whenever it is operational. It is also possible that such information may have to be made available to law enforcement agencies and emergency services organizations by the carriers. For example, in 1993, Colombian drug lord Pablo Escobar was identified partly by tracking him through his cellular phone usage: a technique known as pinpointing. 1996, the Russian Army killed Chechenyan leader Dudayev with an air-to-surface missile after pinpointing his location from the transmissions of his personal satellite phone. (Schneider, 2000)
2.1.18. E-Books, e-music, e-video:
The ease of using an electronic book, which can be read anywhere that a portable device can go, clearly helped to create a market for e-books. The concept of e-books even persuaded many consumers to buy PDAs. This concept also offers the facility of being able to delete a completed e-book from the portable device as opposed to having to recycle an unwanted paper book through second-hand or charity book shops. Where e-books go, e-music and e-video follows.

2.1.19. Advertising, marketing and promotion:
Early experience with mobile marketing suggests that if properly used, it can be a very effective tool.

In October 2002, a US mobile and marketing management company and Cambridge Side Galleria, a shopping mall in Massachusetts, launched a service that allows shoppers to use their wireless phones to receive instant coupons from the mall’s stores. Shoppers dial an 800 number and choose from a menu of options to receive an SMS blast with a code good for a store coupon. (Luna, 2002). Tsutaya, a video rental and CD retail chain with 1,000 outlets across Japan, reports that among its customers, mobile users who had received online coupons were 70 percent more likely to visit their stores and, on average, spent 59 percent more time than their non-mobile counterparts.

Tsutaya lets its users enter their music preferences and sends them notifications when their favorite artists release new CDs or scheduled to give concerts. As of 2000, Tsutaya’s mobile marketing channel was reporting over 650,000 users and over 2 million accesses per week. (Sadeh, 2002)

2.1.20. Restaurants:
Wireless devices can be applied to restaurants from locating a restaurant to selecting items from a menu. (Bergeron, 2001). Disney’s outdoor restaurants also use a wireless restaurant management system.

2.1.21. Brand Building:
Attracting useful content to the mobile service, and giving the partner company the opportunity to expand their brand into a new medium, a win-win relationship is developed between the mobile operator and the wireless existence of a partner company. (Mennecke & Strader, 2003)

2.1.22. Wireless Aggregators:
Another business model, found often in the “database” category of content, is that of the aggregator. These content providers include restaurant guides, real estate guides or job search sites. The classic aggregator would be the yellow pages telephone directory. While free to the user, companies pay for listings or extra advertising space. (Mennecke & Strader, 2003)
2.1.23. Information Sharing:
Webraska has developed tools that can be used to publish or store information for friends
or associates. This information is cached in the form of an m-note, which offers a structured
message format by which users can pull, push, share and search for information. There are two
types of m-notes: 1) m-Vite, which acts as a structured mobile invitation application that allows
users to use predefined invitation templates to post and retrieve mobile invitations, and 2) m-
Classifieds, which allows users to post and retrieve classified announcements. (Mennecke &
Strader, 2003)

2.1.24. Wireless Telemetry:
The 240 million gas, water, and electricity meters in the USA represent a potentially
large telemetry opportunity
One example of wireless telemetry in the energy industry is the recent partnership
between Aeris.net and American Innovations, who joined forces to offer remote monitoring
capability covering two million miles of pipelines throughout North America.
Data such as level of flow, temperature, and pressure is set through a wireless telemetry
hub and then routed to the internet. Wireless telemetry is also being utilized for meter reading and
consumer monitoring of energy consumption. (Mennecke & Strader, 2003)

2.2. Examples of Some Successful Wireless Business Models:
The value chain, or rather value map, for a successful wireless internet service is
composed of a mixture of players. The handset vendor must create a handset that is attractive to
the end user. Network and server vendors must create the right infrastructure for high quality of
service and scalability. Other vendors must create the enterprise solutions to increase corporate
demand. For a mass-market consumer focus, content providers must develop rich services for the
end user to use. Finally, the mobile operator is the provider of this combined value proposition
directly to the end user. In this position, with a focus on the end user's needs, the mobile operator is
best placed to coordinate the entire value map to provide the best service. (Mennecke & Strader,
2003)

2.2.1. Mobile e-commerce sites:
- ebay (www.ebay.com): Offers person-to-person online auctions
- Amazon (www.amazon.com): Subscribers with Internet-ready handsets who are
  registered with Amazon.com can purchase items directly from their handsets.
Customers who do not have accounts with Amazon.com can set them up from their handsets. Customers can access some of Amazon.com’s features including the Gift-Click feature, Personal Recommendations, and Best Seller lists. Users can also search for specific products, compare prices and check on orders.

eCompare (www.ecompare.com): eCompare offers online comparison shopping for categories such as books, electronics, music/videos/movies, auctions, software, games, appliances, wines and cars. When phone numbers of electronic retailers (etailers) are available, eCompare offers users an option to initiate a voice call to buy a product.


2.2.2. Mobile portals:
Portals are the preferred starting point for searches that provide the user easily customizable architecture for finding relevant information. Portals provide the valuable gateways for getting users to their desired destinations. About 15% of all wired web page-view traffic goes through the top nine portals, making them some of the most valuable land on the wired web. This heavy traffic flow gives the web-based portal a unique position in the corporate E-commerce strategy with even greater potential influence for mobile applications. For mobile devices, these portals take on even greater significance, as consumers are unwilling to spend long periods “surfing” on these inherently less user-friendly wireless devices. By the year 2006, 25 million people are expected to be dedicated wireless portal users. Therefore, the success of M-commerce may be partially dependent upon the successful development of effective consumer-oriented mobile portals. (Mennecke & Strader, 2003)

Yahoo! Everywhere: Provides Yahoo! Mail, Calendar, Address Book, Finance for Phones, Palm, and pager alerts.
- MSN Mobile: Hotmail and alerts for phones
- Lycos Anywhere: Paging alerts and access for Palm phones
- AOL Anywhere: AOL mail for Palm, PocketPC, WinCE devices and phones, and IM for pagers
- Excite Mobile: Excite email, Phonebooks, Planner for Palm, WinCE, PocketPC, Symbian and Phones
- Verizon MobileWeb: Customer Care, email, Calendar, Contacts, ToDO, Alerts, General News, and Entertainment
- AT&T PocketNet: Customer Care, email, Calendar, Contacts, ToDO, Alerts, General News, and Entertainment
- SprintPCS Wireless Web: Message Center and alerts
- Nextel Online: Hotmail, MSNBC.com, MSN MoneyCentral, Expedia, Yellow Pages, General News, and Entertainment
Shadowpack: Personalization, enhanced navigation, e-commerce information, and content translation

Yodlee2Go: Online personal account access and synchronization with general Internet content partners for mobile e-commerce

Spyonit Mobile: Search engine and wireless alerts for user-specified content

OmniSky: Branded Internet content, open Internet Access, and e-mail

GoAmerica: Branded Internet content, open Internet Access, and e-mail

Palm.Net: Branded Internet content and e-mail.

Figure 6. Yahoo! Mail for a Palm device. (Sharma, 2000)

Figure 7. People Search for a Palm device. (Sharma, 2000)
2.2.3. Leading wireless equipment vendors:

The top wireless equipment vendors are Ericsson and Nokia in Europe and Motorola and Qualcomm in the United States. In 2000, wireless infrastructure equipment vendor market was already worth around $50 billion. (Sadeh, 2002). Other major players include Lucent, Cisco, Nortel (infrastructure equipment vendors), Siemens, Alcatel, Fujitsu, Samsung.

Motorola: In the 1G era, the U.S.-based Motorola was the industry leader. In 1983, 1992 and 2000, its foreign sales accounted for 26 percent, 44 percent, 52 percent respectively, of the total sales. Unlike its Nordic rivals, it was headquartered in a large country market, which ensured the kind of scale economies small-country vendors could only dream of. Unlike its more focused rivals, Motorola also remained a diversified electronics conglomerate, with a diverse product portfolio. At a closer inspection, its U.K. sales played a substantial role in the total, accounting for some 12 percent even in 2000. Indeed, the vendor obtained some 60 percent of its revenues in just the United States and the United Kingdom, even if it had manufacturing operations and sales offices in more than forty countries.

In 1998, Motorola's executives had a showdown with engineers over web browsers being built into Motorola mobile phones. In another effort, Motorola bought Starfish Software, a specialist linking data between mobile devices and computers.

Ericsson: The Nordic rivals were far more global than Motorola. By the end of 2000, Ericsson had been active worldwide since the early 1880s. In 2000, Ericsson operated in more than 140 countries and had more than 150,000 employees worldwide. More than 71,000 employees are located in Europe, Middle East and Africa while 13,500 are located in United States and Canada. Latin America and Asia-Pacific each had 8,500.

With a strong R&D focus, Ericsson's annual investment in technical development averaged 15 percent of sales. The company filed 1,300 patent applications during 2000; expecting these investments to contribute to its leadership in mobile infrastructure and mobile Internet, especially as it had been committed to 3G development for more than a decade.

Unlike Nokia, Ericsson achieved its first telecom internationalization well before World War I. The second wave was initiated in the 1960s; in the next two decades, Ericsson's digital switch served as its calling card to access new foreign markets. With the onset of the cellular era, the Swedish vendor already obtained 81 percent of its revenue in foreign markets.

Starting in 1997, Ericsson's strategic leadership began to reorganize and refocus, while reinforcing outsourcing. Meanwhile, the very nature of technology development was changing. New technologies and system complexity substituted for old technologies and simpler systems. Existing offerings became obsolete more quickly than ever before. The eclipse of the old telecom strategy and the leading position in technology development forced senior management to seek new solutions and test new approaches.
Geographically, Ericsson's operations were organized in five market areas: Western Europe; Central and Eastern Europe, the Middle East and Africa; North America; Latin America; and Asia Pacific.

Ericsson was a specialist in wireless technology and it combined with Sony on the handset business to build the joint venture (Sony Ericsson Mobile Communications). Sony brought a deep knowledge of music, games, and entertainment as well as consumer-end view of things. In March 2002, Sony Ericsson Mobile Communications made a strong start with the sleek T68, the world's first color-screen phone. But it was caught up by the phone's success, badly underestimating the demand, and hence, producing too few. The struggle with manufacturing capabilities that had begun in late 1980s continued to haunt the company, but now the reasons were different. Ericsson outsourced its production, while Sony retained its own production. The short-term financial target is to make profit this year (2000); after a loss of SEK 1.4 billion ($136 million) in the last quarter of 2001.

By 2001, Ericsson saw itself as the world's leading telecom supplier with the largest customer base, including the world's top-ten operators. In August 2001, Ericsson announced sweeping changes in its management structure to focus on its five largest customers: Vodafone Group, France Telecom, Deutsche Telecom, Telefonica, and Telecom Italia Mobile. The vendor provided total solutions covering everything from systems and applications to mobile phones and other communication tools. In doing so, it aspired to generate a competitive economic return for its shareholders.

**Nokia:** In 2000, Nokia sold its products in more than 130 countries, had manufacturing plants in ten countries, and R&D centers in fifteen countries. But unlike Ericsson, Nokia was the latecomer in the business and got into telecom and mobile segments only in the 1960s and 1970s. In contrast to these diversified electronics players, Nokia had not integrated into semiconductors. It focused its activities on mobile communications. In 1983 and 1992, its foreign revenues accounted for 50 percent and 82 percent of the total, respectively. But these figures refer to many nonwireless businesses, most of which the vendor divested in the early 1990s; mobile revenues remained tiny. As Nokia focused on mobile communications, the proportion of foreign revenues soared to 99 percent.

Nokia is struggling to exploit several strategic advantages simultaneously and worldwide. These strategic advantages include innovation (new technology and new marketing approaches), cost (manufacturing, logistics and new product development) and differentiation (brand, segmentation and design). Nokia relied on international markets from the very beginning to capture scale economies.

By 2002, Nokia invested boldly in building and maintaining its brand name worldwide. It adopted the logo "Nokia Connecting People" for immediate global recognition. Nokia developed its brand on five basic dimensions: high technology, Nordic design, individualism, freedom and
enduring quality. By September 1996, Nokia had the strongest cellular brand awareness and image in Europe. Nokia made sure that the look and feel of its mobile phones created a single and unified approach across entire regions.

By 1998, Nokia pumped out new models every thirty-five days. By August 1997, Nokia supplied GSM systems to fifty-nine operators in thirty-one countries.

Nokia Corp's net sales in 2000 increased by 54 percent to a total of EUR 30,376 million. Operating profit grew by 48 percent to a total of EUR 5,776 million. With 60,300 employees, Nokia served customers in 130 countries, had production facilities in ten countries and carried out research and development in fifteen countries. It had a global network of distribution, sales, customer service and other operational units. It had two basic business groups: Nokia Networks and Nokia Mobile Phones (NMP) as well as the Nokia Research Center, Nokia Communications Products, and the Nokia Ventures Organization. In 2000, Europe accounted for 52 percent of Nokia's net sales, the Americas 25 percent, and Asia-Pacific 23 percent. The ten largest markets were the United States, China, the U.K., Germany, Italy, France, Brazil, the Philippines, Australia, and Spain, together representing 64 percent of total sales.

NMP had become the world's largest mobile phone manufacturer, with a strong global brand identity. In 2000, it had 23,508 employees and sold products in more than 130 countries. It developed sophisticated mobile phones and accessories for all major analog and digital standards, including GSM, AMPS, CDMA, and TDMA. Sales increased from FIM 10.7 billion in 1994 to FIM 27.6 billion in 1997 and more than FIM 78.4 billion in 1999. By 2000, sales in NMP grew by 66 percent to EUR 21,887 million. Overall, Nokia sold 128.4 million mobile phones, representing 64 percent year-on-year growth. Replacement sales accounted for an estimated 40 percent of the 405 million total volume. This share was expected to rise around 50 percent of total volume in 2001. Nokia's sales volume growth was clearly higher than market volume growth in all regions, most notably in Asia-Pacific and Europe. Nokia continued to strengthen its market leadership in 2000, leading to a total global market share of approximately 32 percent.

In 2000, Nokia Networks was a leading supplier of mobile, broadband, and IP network infrastructure products and related services. With 23,508 employees, it also developed mobile Internet applications and solutions for operators and Internet service providers. In 2000, sales increased in Nokia Ventures Organization (NVO) by 106 percent to EUR 854 million. By late January 2002, Nokia's shares had risen about 70 percent since September 11, beating other European companies in the sector.

Nokia's $25 billion in annual sales roughly equals the entire budget of the Finnish government, which finances one of the world's most-generous welfare states. Until summer 2000, Nokia's translocal strategy seemed invincible. In Spring 2002, suddenly the Finnish vendor's product leadership in the 2G era was challenged by a "Wintel II" attack when Microsoft and Intel targeted mobile communications. Based on the Internet vision, Microsoft's
operating system and application software, and Intel's hardware building blocks, the Wintel duopoly advocated greater differentiation advantages worldwide while relying on extensive developed communities. The proliferation of new access devices (i.e. cellphones, PDAs, 3G laptops, 3G web tablets, info appliances) rendered Nokia's product segmentation less effective. (Steinbock, 2003)

**Qualcomm:** Dr. Irwin Mark Jacobs co-founded Qualcomm Inc. in July 1985. His dream was to modify the CDMA system for commercial use- first in the United States, then worldwide. In 1988, the company introduced OmniTRACS, a satellite-based system that tracked the location of long-haul trackers. Qualcomm's initial expansion was built on success in the road transit industry. Historically, this business reflected the thriving postwar mobile services, particularly the dispatch segments. With OmniTRACS, Jacobs sought to bring the transportation industry into the information age. The satellite-based two-way data messaging and position reporting system helped transportation companies improve their rate of return on assets, while increasing efficiency by improving communications between drivers and dispatchers. In 1996, most of the major U.S. cellular carriers upgraded to CDMA, and Qualcomm's overall revenues grew 111 percent to a total of $814 million. Concurrently, the primary source of CDMA revenues shifted from development and licensing fees to sales of Qualcomm products. With rapid deregulation and privatization, the company was also able to access new international markets. In 1996, CDMA digital wireless services were launched in markets across the United States by many major cellular and PCS service providers; now users became familiar with QPE (Qualcomm Personal Electronics)'s portable phones. In 1998, digitalization swept the U.S. cellular markets and Qualcomm's revenues broke the $3 billion mark.

Qualcomm evolved into one of the top-three digital wireless phone manufacturers in the United States. It also began installing CDMA infrastructure networks as the sole source contractor on five continents, while participating in joint projects with strategic partners.

Qualcomm's revenue flows had four kinds of product sources: CDMA technologies, wireless systems, technology licensing, and other sources. CDMA technologies were the most important revenue source, accounting for 39 percent of total sales in 2000. Technology licensing and wireless systems each accounted for 22 percent of the total sales. Other products covered 17 percent of sales, ranging from digital motion picture delivery systems and e-mail software (Eudora) to government wireless communication systems. Qualcomm also had a number of subsidiaries and joint ventures with companies such as Microsoft and Kyocera.
Having absorbed the lessons of i-mode’s success in Japan, Qualcomm designed a standard for custom mobile-phone software (BREW) and initiated the development of digital distribution system for cinemas worldwide.

With OmniTRACS, Qualcomm was already operating in the United States, Canada, Mexico, Japan, and in several European countries including Germany, Italy, the U.K. and France as well as emerging markets such as Brazil, Turkey and Russia.

As partner in Globalstar low-earth orbit satellite communications system, it had installed pre-production and commercial gateways on four different continents.

In 1991, only trade people knew about Qualcomm, which had barely 600 employees and generated only $90.3 million in revenues, with a net loss of $8.4 million. In 2000, it was the most successful start-up in San Diego. Known worldwide, it had more than 6,300 employees, $3.2 billion in revenues, and more than $670 million in net income. The hypergrowth status was boosted after the spring of 2000, when mobile vendors and operators agreed on the 3G standards, in which Qualcomm’s CDMA would serve as the central roadmap.

By 2001, Qualcomm made chipsets, software, global positioning systems, and satellite ground stations used in wireless communications. In the mobile business, it had pioneered the commercialization of the CDMA standard for digital wireless transmissions, while manufacturing products for digital, cellular, personal communication services, and wireless local-loop systems. It provided equipment to low-orbit satellite phone service provider Globalstar and was known for the popular Eudora e-mail software and OmniTRACS system for tracking long-haul truckers. Finally it had designed a standard (BREW) for custom mobile-phone software and was developing a digital distribution system for cinemas worldwide.

Qualcomm did not build its empire by playing by the rules. In the 1990s, European mobile visionaries expected the future to belong to GSM. CDMA redefined the rules and turned GSM dreams into ashes. But as a latecomer, CDMA was disadvantaged. Had Qualcomm played by the rules, it would have been “just-another” third-or fourth-tier supplier. By developing an exciting standard of its own, the company transformed the competitive environment. Understandably, technology innovation has been seen as the driver of Qualcomm’s success. It was critical, but not sufficient to success. Rather, it was innovation leveraged worldwide that made the company so successful.

Qualcomm’s internalization differed from that of all incumbents. The company was created a century after Ericsson and Nokia and more than half a century after Motorola. It opened in a large-scale home base, but it was a challenger, not an incumbent. As a latecomer, it was disadvantaged in competition that built upon existing strengths and legacies and had locked in most of the worldwide distribution outlets. By 2001, it obtained some 65 percent of its revenues from foreign markets and had offices in some seventeen countries. (Steinbock, 2003)
Psion: Psion PLC is a world leader in mobile computing and wireless networking and has a reputation for innovation and technological leadership.

Psion one of the UK’s foremost technology companies with a history of pioneering new markets for digital products. After three years as a publisher and developer of software for the first home computers, Psion began development of its first hardware product. With the Psion Organiser in 1984, Psion launched the world's first volume-produced handheld computer, inventing and defining the product category.

Sales of Psion for the first half of 2002 were £70.8m (2001 - £100.5m). Sales from the continuing businesses were £62.1m (2001 - £64.2m).

Today, Psion’s principal divisions are Psion Teklogix, Psion Software and Symbian. Psion Teklogix is the largest operating division in the Psion Group following its formation in September 2000. Psion Teklogix was created through the merger of Psion’s existing Psion Enterprise division with the newly-acquired Teklogix International Inc. The new division combines the strengths of Teklogix, a world leader in real-time mobile data solutions, with Psion Enterprise’s strengths as a European innovator of mobile devices for industrial, commercial and professional markets.

Psion Teklogix is a global provider of mobile computing solutions for the enterprise. The company's wireless systems enable total mobility, freeing mobile workers from wired systems and providing access to mission critical information and enterprise IT systems whenever and wherever it's needed. There are more than 15,000 Psion Teklogix systems installed in warehousing, distribution, transportation and logistics, and field sales and services sites around the world.

Signa Services is a new member of the Psion Group of companies formed during 2001. Signa provides comprehensive Wireless Local Area Network (WLAN) specification, installation and management services on a global basis. Signa draws on Psion Teklogix’s market-leading technology and expertise in wireless networking to offer corporate customers and system integration partners tailored hardware-neutral, WLAN solutions.

Psion Software is a new Psion business activity, established in 2001. The company's mission is to develop software for the next generation of Symbian OS mobile devices, particularly Smartphones, which will be based on the latest 2.5 and third generation cellular communication network technologies.

Psion is the largest shareholder in Symbian Ltd, owning 26.6%. Symbian is a joint venture between Psion, Nokia, Motorola, Ericsson, Panasonic and Sony Ericsson. Symbian's mission is to set the standard for mobile wireless operating systems and to enable a mass market for Wireless Information Devices.

(http://ww6.investorrelations.co.uk/psion/EditHistory.shtml)
(Sources: Hewlett-Packard, RIM, Mitsubishi, NeoPoint, Clarion, and Psion)

Figure 8. Wireless devices (Sharma, 2000)

Figure 9. Symbian: The convergence of the computing and communications industries. (Sharma, 2000)
2.2.4. Leading electronic manufacturing services (EMS) supporting wireless manufacturing and technology development:

Wireless business has contributed to the acceleration of outsourcing. The EMS sector has evolved into one of the world’s most dynamic industries in just a decade or two, with an average growth of 25 percent per year. The total available EMS market has been estimated at $500 billion.

Many EMSs were former contract manufacturers that focused on consumer electronics, computers, and communications. While the firms did not provide branded products, they did try to differentiate themselves vis-à-vis service strategies.

Biggest EMSs contributing to the wireless industry are Celestica, Flextronics Slectron and Sanmina-SCI.

**Flextronics:** Between 1993 and 1998, Flextronics acquired more than twelve operations, built a global infrastructure for high-volume manufacturing, expanded purchasing and engineering capabilities, grew from 3,000 employees to more than 13,000 and upped the revenue target to $5 billion. In 1997, Ericsson outsourced some of its wireless switching equipment and awarded a $3000 million deal to Flextronics. Flextronics relied on four tactics to drive its high revenue targets: design and engineering centers, industrial parks, product introduction centers, and regional manufacturing operations. These revenue drivers ensured operational flexibility and customer responsiveness. 3Com PalmPilot and was designed and built by Flextronics. In April 2000, Flextronics acquired the Denver based DII Group in a deal valued more than $2 billion, which propelled the company to the fourth position in contract manufacturing.

Flextronics shares the infrastructure among a bunch of customers, so when demand for one product dries up, they can switch to something else and they do not get struck with an idle factory. For instance, if the market for handheld computers takes a dive, the same assembly lines can be used to produce a product of similar size, like a cell phone.

Flextronics did not rely on just singular advantages. It excelled in cost advantage, but it also exploited differentiation through local responsiveness, just as it had to engage in ceaseless innovation to respond to the changing requirements of the volatile environment.

(Steinbock, 2003)

**NEC (Nippon Electric Company):** Starting as an importer of telephone equipment, NEC became a maker of equipment and a major supplier to Japan’s Ministry of Communications. In 1930s, NEC initiated research on microwave communications. More than 80 percent of Japan’s land consists of mountainous terrain, so the laying of cables is expensive, difficult and time consuming. Given these factors, microwave links appeared to be the best solution for a quickly completed nationwide communications network, and pioneering efforts were made to utilize microwave systems. By the late 1960s, NEC claimed to be the world’s leading exporter of microwave communications systems. NEC used telecommunications to access new business markets, and it used new business markets to find access into new geographic markets. Over time,
NEC also became a major player in switches, base stations, system interconnections and mobile phones.

In 2001, NEC had 150,000 employees. It operated a network of sixty plants and more than 300 sales offices in Japan, as well as subsidiaries and affiliates in forty countries. After the peak years of the Internet revolution, NEC generated more than $43 billion in revenues.

**Huawei Technologies:** Established in 1988, it specialized in R&D, production, marketing of communications equipment, providing customized network solutions for telecom carriers in fixed, mobile and data communications networks. With total sales of $2.7 billion in 2000, Huawei achieved an increase of almost 80 percent upon the previous year's $1.5 billion. In just a few years, Huawei had set up more than forty branch offices worldwide, as well as research institutes in Silicon Valley, Bangalore, Stockholm, Moscow, Beijing and Shanghai.

### 2.2.5. Leading operators:

Mobile operators are connectivity providers that own wireless network infrastructure and have large customer bases for mobile communication services. These players have been the leaders of the development and success of mobile communication markets in Europe, by providing personal communication services and information services through wireless (e.g., GSM) networks. They created the critical mass of mobile customers. They have been investing large amounts on upgrading, maintaining, and expanding their networks, while developing competence in managing customer relations and pricing mechanisms. The mobile communications market presents intense competition, which in combination with continuous technological innovation, is shrinking profit margins as communication services are becoming commodities. Communication services remain the primary revenue source for mobile operators. However, they already face the challenge of developing new strategies towards providing value-added services, content and applications, in order to sustain their profit levels.

Industry leadership in competitive wireless markets requires leadership in products, operations, and markets.

In 1999, the top-four mobile operators, in terms of revenues were NTT DoCoMo ($35.1 billion), Vodafone Group ($9.7 billion), China Telecom ($8.0 billion) and Telecom Italia Mobile ($7.5 billion). Vodafone Group included Vodafone in the U.K. and Mannesmann in Germany.

Most countries have two or three major competing network operators in the mobile market.
Wireless in the United States

In the United States, the process of carriers building nationwide footprints continued to be a significant trend as operators filled in gaps in their coverage through mergers, acquisitions and license swaps. In parallel with the process of footprint building, mobile operators deployed their networks in an increasing number of markets, expanding their digital coverage and developing innovative pricing plans. At the end of 2000, Verizon Wireless was the nation's largest mobile carrier, with almost 28 million subscribers. Cingular, the joint venture between SBC and BellSouth, had the second position with 20 million users. The old industry leader, AT&T Wireless, ranked fourth with 15 million subscribers. (Steinbock, 2003)

In 2001, Vodafone was the largest mobile operator worldwide with interests in wireless networks in twenty-eight countries across five continents. The Group had a staff of more than 100,000 and served more than 95 million proportionate customers worldwide. Its objective was to be the world’s leading wireless telecom and information provider, generating more customers, more services, and more value than any of its competitors. Vodafone’s global strategy embraced voice, data, and Internet-based services, focusing on customer satisfaction. The strategy was expected to enable Vodafone to bring a wider and richer range of services to its customers by capitalizing on

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Table 2. Global Leading Mobile Operators (Sharma, 2000)
new technology developments. Vodafone was a hungry challenger, not a former monopoly. It was not driven by national politics, hierarchical or domestically focused. It was the spearhead of a new generation of operators, an attacker rather than an established leader. It was driven by market responsiveness, flexible, agile and internationally-oriented.

The Vodafone Group had now become the largest mobile operator in the world and one of the top-ten companies worldwide, by market capitalization. Its core operations were in Europe, where it had a customer base of over 32 million, and telecom interests in fourteen countries. The region represented 54 percent of the Group’s worldwide base. In the United States, it combined its wireless properties with those of Bell Atlantic and GTE to form Verizon Wireless, the market leader in the United States. Finally, there was the newly formed U.K., Middle East and Africa region. A few months later, its geographical divisions of operations were reorganized into five regions: Continental Europe, the Americas, and Asia-Pacific, the U.K, the Middle East, and Africa. Vodafone Group continued to solidify its European interests with new acquisitions while signing strategic alliances in Hong Kong and expanding its stakes in Japan Telecom and its J-Phone mobile phone operations by buying out rival BT.

Vodafone’s strategy rested on the three pillars of global focus, innovation and service. First, it leveraged its focus strategy by concentrating on wireless communications globally. Second, through mobile focus, it sought scale through scope. It extended the reach, range, and penetration of wireless services to as many customers as possible in as many geographic territories throughout the world as could sustain viable and profitable operating environments. And third, it stayed close to the productivity frontier in order to develop attractive services. By June 2001, Vodafone’s worldwide base included more than 93.1 million registered customers, while the venture base covered over 202.6 million registered customers. (Steinbock, 2003)

Nordic Wireless:

Finland’s Wireless Valley: Historically, the success of Finland’s Wireless Valley in the 1990s originated from geopolitics (Finland’s special relationship with Tsarist Russia and Soviet Union - Through the 19th century, until the Bolshevik revolution and Finland’s independence declaration, the country was part of the Russian Empire. Through these eras, communication played a crucial role in military efforts), public policies (Nordic cooperation, EU strategies and Finnish liberalization in the 1970s and 1980s.) At firm level- necessary preconditions included first-mover advantages (strategies of mobile vendors and operators, particularly Nokia’s role in was repatriation in the 1950s, diversification into electronics in the 1960s, as well as mobile and telecom segments in the 1970s.).

After the elections of 1991, Finland had its first purely non-Socialist government since 1966. As Social Democrats moved to the opposition, the Centrist-Conservative Esko Aho government formulated an export-oriented economic strategy to revitalize exports and industrial
production. In January 1995, Finland's membership in the European Union signaled the beginning of the innovation stage of competitive development.

In the past, Finland's success originated from comparative advantage. In the future, it would be about competitive advantage.

Sweden: Swedish business managers have historically cherished an international orientation, and Sweden has given rise to more multinationals than any other Nordic country. This mind-set reinforced Ericsson's early internationalization and Nordic views on competition, deregulation, and standards.

As the gentle dinosaurs of Northern Europe completed their pioneership during the growth decade, they made the struggle for globalization the central driver in the industry evolution. The unintended consequence of this transformation was the fact that the Nordic leaders also opened a new entry opportunity for the large Asian operators, vendors, contractors and consumer-electronics giants. And through convergence developments, they opened still another door for the industry leaders in software, microprocessors, and online services in the United States.

From the late nineteenth century to the end of the twentieth century, the epicenter of the mobile business had been either in Western Europe or North America. Amid the 3G transition, that was no longer the case. High volume and high growth were now the prime movers of the great markets. Industry thrust was about to migrate to Asia-Pacific. In the short term, that meant Japan. In the long term, it means China. (Steinbock, 2003)

Japanese Wireless

In 1869, Japan's ministry of Industry established a government-owned factory to produce telegraph equipment. Through this factory, and other initiatives, the Japanese public sector gave rise to many future vendors including Toshiba, Oki, NEC, Fujitsu and Hitachi. What made the Japanese wireless model inferior to the Nordic model and poorly adapted to the industry globalization was the fact that it was neither competitive nor able to globalize. Controlled competition did enable the leading Japanese companies to build competencies in computers, communications and semiconductors.

By 2000, Japan had the second largest cellular market worldwide. A year later, it introduced the world's first 3G system. These first-mover advantages originated from strategic decisions and investments at the turn of 1990s. Despite advanced R&D, commercial cellular growth had started slowly in Japan.

By 2001, Japan had 62 million subscribers, almost half of its entire population. Three years after the creation of NTT DoCoMo, liberalization of the Japanese cellular market boosted growth. As three or four new carriers entered in each regional block, the handset market was liberalized. In the past, Japanese consumers had to lease mobile phones from the network operators; now they could purchase them at retail stores.
In 2001, Japan’s mobile market gained momentum as NTT DoCoMo’s i-mode mobile phone services expanded.

NTT (Nippon Telegraph and Telephone Corporation): NTT is the major and oldest telecommunications operator in Japan. NTT was forbidden to engage in internationalization despite its monopoly power in the domestic market. NTT was the sole operator until the late 1980s, when competition was allowed and two new operators entered the industry. Until 1985, the closed group of NTT suppliers consisted primarily of four companies: NEC, Fujitsu, Hitachi and Oki.

NTT DoCoMo (Do Communications Over the Mobile Network): In 1991, NTT established a subsidiary to adopt its various wireless segments. NTT DoCoMo followed the reverse pattern of NTT’s strategies: market-driven, competitive and hungry for internationalization. Japan’s population was five times greater than that of all Nordic countries combined. NTT DoCoMo was determined to exploit this home base advantage to initiate globalization at NTT DoCoMo. Soon, the number of DoCoMo’s subscribers exceeded 3.5 million, or half the market of mobile phone users.

In 2001, NTT DoCoMo became the first major operator to pioneer and commercialize the 3G infrastructure. i-mode accounted for DoCoMo’s explosive success at the close of 1990s. With i-mode, Japanese cellular phone users had easy access to more than 40,000 Internet sites, as well as specialized services such as e-mail, online shopping and banking, ticket reservations, and restaurant advice. In fall 2001, NTT DoCoMo launched Freedom of Multimedia Access (FOMA) service in Japan. FOMA supported full-motion video image transmission, music and game distribution, and other high-speed, large-capacity data communications. With a maximum downlink speed of 384 Kbps, forty times faster than any conventional wireless data communications, FOMA delivered high-quality video as well as enhanced video clarity.

NTT DoCoMo envisioned a future in which people around the world would benefit from borderless global communications, live-action video on mobile terminals, and even mobile control of home and office appliances. As of early 2002, i-mode service just reached the 30-million user mark, a resounding success in a country of 126 million people. The service, which is available for a monthly fee of about $3, offers a broad range of Internet services most of which are provided by third-party content providers. Some would like to explain the rapid adoption of i-mode services as a reflection of the low number of PCs and wired Internet users in Japan. Japanese people saw i-Mode as a cheap way to access the Internet and have e-mail.

There are two key technological features of i-mode that have led to its success: The first is the packet-switch network for Internet services. The second is the right choice of application layer technology for third-party developers. Through its packet-switch network (PDC-P), i-mode offered "always-on" functionality, making it possible for the users to keep their devices on while only paying for actual traffic. End users pay per packet (128 bytes) of information downloaded rather than for the number of minutes online. This per-packet pricing scheme is most effective with wireless Internet services where the number of bytes downloaded tend to be very small. With a limited
number of kilobytes, the per-packet method is more cost-effective for the average user. Finally, basing i-mode on HTML and standard Internet HTTP allowed content providers to interact with existing systems in a far smoother way. It has allowed companies to concentrate less on the technological adaptation of content and more on the creative side of content development, that is, the development of the right business model and the right content targeting the users’ mobile needs. (Mennecke & Strader, 2003)

Its success has also emerged from the fact that it has managed to assemble the critical mass of content providers from day one. DoCoMo also uses its customer profile database to customize its portal to the needs and interests of each individual user.

i-Mode shows us what it takes to succeed in the m-commerce arena: ease of use, interoperability, a solid business model and a plethora of compelling content through no-nonsense partnership arrangements with a critical mass of third-party providers (Sadeh, 2002)

The business model of i-mode is designed to create a win-win relationship between all members of the value map.

Like the PC-based Internet before it, i-mode has also created a whole industry around i-mode site development. A trip to any bookstore or computer store in Japan will reveal literally hundreds of books and developers’ packages for creating i-mode homepages. This can be attributed in part to the similarity to Internet standards. (Mennecke & Strader, 2003)

Chinese Wireless:

For most of the past two millennia, China was the world’s economic superpower. In 1820, it contributed about a third of global domestic product. Then it slid into more than a century of decline. The Communists promised to reverse the trend, which they actually intensified. The Mao regime proclaimed the People’s Republic of China in October 1949. For three decades, the nation would live in cultural isolation.

As reformists surfaced in the party apparatus, Beijing and Washington announced full diplomatic relations on January 1, 1979. In a matter of months, the massive Chinese market opened its doors to the outside world. In 1999, United States and China signed bilateral World Trade Organization (WTO) agreement in Beijing.

Between 1979 and 2001, global mobile vendors provided a powerful lift to China’s mobile communications, through exports, FDI (Foreign Direct Investment), substantial presence, instruction and training.

At the end of July 2001, China overtook United States as the biggest cellular phone market worldwide with 120.6 million mobile phone users—against 120.1 million in the United States. The number of mobile subscribers in China increased by 35 million, and another 80 million cell phones were expected to be in use by the end of 2002. The number of mobile phone users in China is growing at a rate of nearly one million per week. (Sadeh, 2002) In a geographic area roughly the same size as the United States, China has a population of 1.3 billion (increasing at one birth per
second (Sadeh, 2002) and a very low rate of penetration. On average, every two Europeans already have a cellular phone; in the United States, two out of five people have one. In China, barely one out of ten has a cell. There is an extraordinary potential for continued expansion of mobile phones in China. Increasing competition and declining tariffs will speed growth. Between 1995 and 2001, annual telecom investments in China increased from less than $10 billion to some $35 billion.

2.2.6. Leading wireless software vendors:

They are the suppliers of operating systems, databases, microbrowsers, and other middleware technologies that are central to providing a secure and user-friendly experience to the mobile customer.

Operating System Arena:

- EPOC, developed by the Symbian consortium, which brings together companies such as Psion, Motorola, Ericsson, Nokia and Matsushita.
- Windows CE and its Singer version specifically developed by Microsoft for mobile phones.
- PalmOS, which currently runs on over 60 percent of all PDAs.

Microbrowsers:

The microbrowser war is dominated by Openware (formerly known as Phone.com), Nokia, Microsoft and Ericsson, and also includes new entrants such as 4thPass with its Java-enabled microbrowser. Key players in the mobile database market include Sybase subsidiary, iAnywhere Solutions, Oracle, IBM and a small number of other contenders. Most of these players rely on business models that combine licensing, consulting and maintenance fees. A growing segment of these companies also operate as WASPs.

(Sadeh, 2002)

2.2.7. Europe's WAP services startups:

WapIT - A miscellany of information services: (Location: Helsinki, Finland)

WapIT provides operators with the all the information services that European mobile phone users expect from a wireless portal: address books, calendars, custom icons, and ringing tones. (It also provides operators with tools for creating the latter two.) WapIT offers 200-odd services, such as shoe-size conversions, horoscopes, a vegetarian recipe of the day, and highlights of Finnish players in the U.S. National Hockey League. There are even daily jokes — please specify blonde, Russian, Norwegian, or Swedish.

Some services are developed in-house, but most are developed by WapIT's 100-plus content partners. Some of these partners provide content on a revenue-sharing basis, and others
provide it for free "because they want to get it out there," says Mato Valtonen, WapIT's marketing director and cofounder.

WapIT also offers more practical applications, such as package tracking, flight information, and emergency telephone numbers. Content providers can maintain their data on the Web using a standard Internet browser. Providers can also get detailed usage reports telling how many users accessed what services on what days, how many encountered errors, and so on. Usage data can then be dumped into Excel for further analysis.

On the server side, WapIT may have far-reaching impact on the wireless landscape. Just as Finland spawned Linux, the open-source operating system, WapIT is helping to develop an open-source WAP/short-message-system gateway. Matthew Nordan of Forrester Research recently predicted that it will help knock the bottom out of the gateway market on which developers of proprietary gateways, like Phone.com, Ericsson, and Nokia, are counting.

**Argo Interactive Group - Server software that optimizes Web pages for any mobile device:**

There are two ways to deal with a bandwidth shortage: make the pipe bigger or reduce the amount of stuff flowing through it. As Wireless Application Protocol (WAP) phones increase in number, concerns about bandwidth are growing. While network operators work on expanding the pipe, the Argo Interactive Group, located in the United Kingdom, is working on slimming - and improving - the data flowing through it.

Slimming HTML data is easy enough -- throw out images and colors and break the remaining text into tiny chunks -- but what's left may be useless. Improving it is Argo's business. The company sells Web-to-WAP server software called ActiGate and develops custom templates used by ActiGate to translate Web sites on the fly. Sometimes it bypasses HTML altogether.

"Rather than going in blind, like a generic transcoder does, ours goes in expecting to see a SQL feed," explains Mike Robinson, an Argo vice president. Argo also improves the data by making it device specific. The company develops software modules that tailor Web pages to the quirks of various wireless devices, including browser capability, operating system, screen size and shape, and the device's soft keys, rather than limiting the presentation to the lowest common denominator.

"This way someone using a PDA with a 3-inch vertically oriented screen isn't restricted to what the owner of a phone with a three-line display will see," explains Andrew Foyle, Argo's founder. Mr. Foyle expects Argo's market to expand from operators to content providers as the wireless market develops and content companies seize more control of the customer relationship. Argo is still a private company, but it does operate an informal stock exchange, in which its 400 individual shareholders -- Argo raised part of its seed round of funding in an email campaign -- can mail in checks or stock certificates to Argo, which will facilitate the exchange.

**Iobox - One-stop shopping for hosting, mobile commerce, and customization.**
lobox subscribers can throw away their PDAs: this Finnish company lets users enter personal data like calendar entries, address book, and Web bookmarks onto the company's Web site, then access it from a mobile phone. Mom's birthday coming up? Instruct lobox to send you a reminder via short message system (SMS), a sort of phone-based email. Some argue that Wireless Application Protocol (WAP) is supplanting SMS, but Jari Ovaskainen, lobox cofounder and CEO, insists that the SMS market isn't going away. "We see continued strong usage and growth in SMS," he says. The systems aren't mutually exclusive -- newer WAP-ready phones still have SMS capability -- and can even complement each other. For instance, a user can receive an inexpensive SMS notification (like the reminder about Mom's birthday) and follow up with a more costly, data-intensive WAP session (like ordering flowers) that lobox also supports. Among the company's e-commerce features is a CD-of-the-week service provided by the music retailer Boxman: subscribers get an SMS asking if they'd like to buy the latest CD, they respond with a password, and the disc arrives at their home. Lobox gets a percentage of the sale. It also derives revenues from users, who prepay for services, and from advertisers. Lobox has collected 400,000 users in four countries -- mostly in Finland and Sweden, where it's actively marketed, plus a few in the United Kingdom and Germany. It claims it is adding 1,500 subscribers a day. But the company's focus on consumer services is changing as it garners new and bigger partners. "We are increasingly working directly with content providers that want to go wireless," says Henry Nilert, lobox cofounder and senior vice president. And because it has relationships with operators covering most of Europe, lobox offers one-stop shopping.

**Webraska Mobile Technologies - Real-time maps for your phone.**

In France and the Netherlands, along with its maps, Webraska provides real-time traffic reporting, complete with alternate route suggestions. The service is also being tested in Germany and the United Kingdom, where Webraska has partnered with London-based Trafficmaster to provide traffic and travel-time information derived from a private network of sensors embedded in British roads. Webraska makes money through revenue-sharing arrangements with mobile operators.

Currently, Webraska requires users to provide their location via their phone's keypad, but the eventual goal is for the phone itself to provide its location. Webraska is poised to provide information about nearby parking lots, gas stations, restaurants, lodging, and other user services through partnerships with hotel networks, tourist guides, and auto clubs.

**Room33 - The leading WAP-centric portal.**

Short message service (SMS), the mobile phone text message system that's wildly popular in Europe, is yesterday's news to Sweden's Room33. "SMS is an old technology and doesn't really take advantage of what's coming in the future, which is broadband mobile service right into your
hand," says Zaheed Haque, CEO of Room33. Room33's offerings are delivered using the Wireless Application Protocol (WAP), and it is already looking beyond WAP and building its services accordingly. "Whether it's WAP, or XHTML [HTML reformulated to XML, the next-generation Web language], or Web clipping, we can encode another markup language just by creating some templates." Room33 offers a suite of personal information services, including email, an address book, calendar, weather, financial data, and travel information. It also provides a comprehensive catalog of WAP services; paid placements figure into its revenue plan. Through a Web interface, users customize Room33 to include what's most important to them. Seven thousand users a day access the service, though most still do so over the wireline Web. Room33 plans to provide cobranded service with network operators and ISPs. The first deal has been struck with EuroSeek, a wireline portal that's available in 29 languages and boasts nearly 2 million registered users. Room33 has opened offices in New York, has plans for a presence in the United Kingdom and Spain, and Japan. (Sandsmark, 2000)
CHAPTER THREE

Wireless Technologies that will lead to the Success of Mobile Commerce

In the mobile business, each new cellular platform has meant new technologies, functionalities, and markets, which have given rise to increasingly specialized services. In the pre-cellular era, the early wireless technologies allowed a very primitive, simple, homogeneous service concept. It was only with the arrival of the digital cellular standards that rudimentary data services (e.g. SMS) became possible. With 2.5G / 3.5G technologies, providers could craft more sophisticated and heterogeneous service concepts. (Steinbock, 2003)

Figure 10. Two Evolutionary Trajectories- (Steinbock,2003)
3.1. Technological Developments:

<table>
<thead>
<tr>
<th>Laptop Computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld (e.g., Palm, Pocket PC, Blackberry)</td>
</tr>
<tr>
<td>Mobile Telephone</td>
</tr>
<tr>
<td>Hybrid (e.g., “smartphone” PDA/telephone combination)</td>
</tr>
<tr>
<td>Wearable (e.g., jewelry, watches, clothing)</td>
</tr>
<tr>
<td>Vehicle Mounted (in automobiles, boats, and airplanes)</td>
</tr>
<tr>
<td>Specialty (e.g., the now defunct Modo)</td>
</tr>
</tbody>
</table>

Table 3. Wireless Device Categories (Mennecke & Strader, 2003)

3.1.1. Always-on:
Packet-switching on the wireless web, first implemented in a big way by NTT DoCoMo for their i-Mode, allows an always-on condition since the communications channel is not held captive by a single subscriber, and can receive a packet of information at any time. (Steinbock, 2002)

3.1.2. Digital versus analog:
Wireless technologies are increasingly turning from analog of the past to the digital communications. Digital communications services, on average, require less battery power, offer improved sound quality, and offer a level of privacy and security that's difficult to match with analog networks.

With the rise of the digital cellular, the industry's strategic stakes climbed dramatically in terms of accumulated investment and profitability, locational advantage and employment. (Steinbock, 2002)

3.1.3. Multimedia cellular:
With multimedia cellular, new services represented three dimensions of capabilities: voice communications (i.e. rich voice, including videophone), Internet access (i.e. mobile Internet and mobile intranets/extranets), and mobility (i.e. content, communications, and location-based services)(Luna, 2002)

3.1.4. Multimedia messaging services (MMS):
European operators are also poised to launch new multimedia messaging services (MMS) that should make m-commerce more compelling because it will involve more graphics and multimedia applications. (Luna, 2002)

3.1.5. IEEE 802.11b:
One of the most important network protocols for wireless Web work is IEEE 802.11b, the industry standard for LANs. This protocol provides 10 Mbps throughput with a maximum range of about 300 m (100 ft). This standard forms the basis of many home and office-based wireless networks.
networking products that can extend connectivity to the Web through a variety of handheld devices and laptops. (Steinbock, 2003)

3.1.6. GPRS:

One of the reasons for mCommerce consumer adoption being slow has been the rather cumbersome and long setup process for a new Wireless Access Protocol (WAP) phone. Users have to specify numerous parameters before they can connect to a WAP gateway. Moreover, generally after taking about half a minute to establish a wireless connection, the user needs to follow a pattern of entering a number of parameters as the phone handshakes with the server and establishes a connection. GPRS should eliminate the need to dial up every time a user wants to access services and over-the-air (OTA) provisioning servers can be used to automatically configure phones to reach a particular site. However, modern networks such as Palm.Net and PocketPCs integrated with Cellular Digital Packet Data (CDPD) modems are alleviating the connectivity situation and increasingly finding their way into the enterprise and corporate marketplace. (Steinbock, 2003)

3.1.7. Mobile data and Internet access:

Messaging is perhaps the most widely used mobile technology. In Europe, SMS (Short Messaging System) has become quite popular with young people, who use their mobile phones to send messages to each other. Instant Messaging (IM) allows two users on the same network to send IMs to one another. Wireless IM allows a user to reach people at anytime, which is an enhancement to the location-dependent wired version of instant messaging.

By 2000, the mobile data sector continued its transition from paging/ messaging to mobile Internet access services. Numerous companies, including paging/messaging carriers, mobile telephone carriers, handheld personal assistant (PDA) manufacturers, and dedicated data network operators, offered a myriad of mobile Internet access products on a variety of mobile devices. Starting in late 1999, seven major mobile operators in the United States began offering mobile data services, including wireless web, short message service (SMS), and e-mail, on mobile telephone handsets. Four of those seven operators reported mobile Internet usage and had a combined total of 2.5 million mobile Internet users. In April 2002, AT&T also began offering "mMode", a U.S. version of the highly popular i-mode offered by DoCoMo. (Steinbock, 2003)

3.1.8. Standards:

Wireless data networks require radios that take in digital data, zeros—and ones, modulate and transmit the data as radio waves, receive the radio waves, demodulate the signal, and convert them back to zeros and ones. Coexistence is the ability to have many radios operating without interfering with each other. Interoperation is the ability of radios to share data. These capabilities must be explicitly defined in a specification, confirmed by standard test procedures and adhered to
by manufacturers. Defining the specification is the job of industry and standards groups. (Mennecke & Strader, 2003)

First, an analog standard; AMPS (Advanced Mobile Phone System), emerged in the United States while two analog standards NMT and ETACS emerged in the European countries. Afterwards, multiple digital standards TDMA and CDMA surfaced in the United States. Then, digital standard was standardized as GSM. Then, a different version of the European digital standard GSM was adopted in the United States. Then PCS digital standards were adopted in the United States. (Rajput, 2000)

**Evolution of wireless standards:**
- **GSM (Global System for Telecommunications) 2G**

Today, GSM is the most popular mobile communication standard with two thirds of all mobile phones (Sadeh, 2002)
- **i-Mode (Internet Mode) 2.5 G**

  i-mode (created by NTT DoCoMo of Japan) empowers users to do much more than just talk. It offered them digital intelligence with easy dialing and simple web access from their mobile phones, while keeping them connected to the Internet at all times. By basing its content on iHTML, a subset of HTML, it gave its customers access to the existing network of conventional web servers and therefore provided them with seamless web service. At the same time, its use of iHTML greatly simplified the creation of i-mode sites for its content providers. (Steinbock, 2003)
- **BREW (Binary Runtime Environment for Wireless) - Qualcomm's open, standard applications execution platform for wireless devices. (i-mode's US equivalent) (Steinbock, 2003)**
- **CDMA 2000 (Code Division Multiplexing) 3 G:**

  CDMA has been commercialized by Qualcomm. At the turn of the 1990s, the benefits of CDMA included greater capacity, higher quality, and several advancements that were attractive to operators and users. Not only could CDMA systems carry up far more phone calls than current analog systems, but they were also three times as efficient as TDMA systems. CDMA was further in the productivity frontier than any alternative. (Steinbock, 2003)

**W-CDMA (Wide-Band Code Division Multiple Access) 3 G:** The CDMA standard developed in Japan based on Qualcomm's CDMA technology. (Steinbock, 2003)
- **UMTS (Universal Mobile Telecommunications Systems) 3 G**

  UMTS is also utilizing the packet-based connection schema and is promising to become a very high speed universal standard that will enable the full potential of mobile multimedia services to be realized. (Mennecke & Strader, 2003)

  Within the next five years, UMTS is likely to replace GSM in Europe. UMTS promises data transmission of 384 Kbps in its first iteration and 2 Mbps soon after. That far bypasses the GSM standard, which only offers 14 Kbps today. UMTS will enable users to roam worldwide with a single,
dual-mode handset that will eventually allow the world to enjoy the same advantages the European market has experienced.

CDMAOne and Europe's version of the technology, WCDMA, are competing against UMTS as the best technology for the 3G standard. (Perkins, 2000)

- **IMT-2000 (International Mobile Telecommunications for 2000)**

Some domestic companies are moving from 2G, which was designed primarily to support voice, directly to 3G, which is designed to carry multimedia, bypassing the 2.5 G temporary patch. The risk of course, is that 3G may take several years to materialize, and competing companies may use this window of opportunity to develop their own 2.5 G solutions, some of which may be superior to 2G systems.

The UMTS Forum predicts that by 2010, only 28 percent of the worldwide population of mobile users, which by then should be around 2.25 billion, will be served over a 3G network, suggesting that intermediate so-called 2.5G technologies will continue to play a key role in the years to come. This is customary for any new technology, particularly one that requires new end-user behavior and new business relationships across the industry value chain.

Infrastructure equipment providers have already started to work on the development of 4G technologies with peak data rates in excess of 100 Mbps, which they hope to start deploying by the end of this decade. (Sadeh, 2002)
### Table 4. Specification and Standards (Mennecke & Strader, 2003)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Purpose</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Ethernet Compatibility Alliance</td>
<td>Industry Alliance</td>
<td>Interoperability</td>
<td>802.11</td>
</tr>
<tr>
<td>Bluetooth Special Interest Group</td>
<td>Industry Alliance</td>
<td>Promote, Interoperability</td>
<td>Bluetooth</td>
</tr>
<tr>
<td>HomeRF Working Group</td>
<td>Industry Alliance</td>
<td>Specification</td>
<td>HomeRF</td>
</tr>
<tr>
<td>HiperLAN Alliance</td>
<td>Industry Alliance</td>
<td>Promote</td>
<td>HiperLAN1</td>
</tr>
<tr>
<td>HiperLAN2 Global Forum</td>
<td>Industry Alliance</td>
<td>Promote</td>
<td>HiperLAN2</td>
</tr>
<tr>
<td>IEEE 802</td>
<td>Standards Body</td>
<td>Specification</td>
<td>802.11, 801.15</td>
</tr>
<tr>
<td>ETSI HiperLAN</td>
<td>Standards Body</td>
<td>Specification</td>
<td>HiperLAN1</td>
</tr>
<tr>
<td>ETSI BRAN</td>
<td>Standards Body</td>
<td>Standardize</td>
<td>HiperLAN2</td>
</tr>
</tbody>
</table>

#### 3.1.9. Special protocols:

- **Bluetooth**: Bluetooth is viewed as a way to replace the cable to printers, scanners, mice, keyboards and other peripherals to desktop PCs. Dell, IBM, Motorola, Qualcomm, Ford Motor Company and British Airways are pouring resources into the standard. Microsoft is working with Intel to integrate Bluetooth more closely with the Windows operating system. Motorola offers a Bluetooth car kit, with Bluetooth features available to domestic and foreign car companies. IBM released one of the first widely available Bluetooth devices in 2000, a PCMCIA card for laptops. (Sadeh, 2002)

- **Wi-Fi (Wireless Fidelity)**: Also known as IEEE 802.11b High Rate Standard, Wi-Fi is yet another component-to-component wireless communications protocol that has major industrial backers. Wi-Fi is backed by the Wireless Ethernet Compatibility Alliance, which includes Lucent, Cisco, and 3Com. Wi-Fi is positioned to become the standard for high-speed wireless LANs. It is used by about 2 million people worldwide. It's nothing like the mobile wireless phone systems most people use, which still offer rudimentary Internet connections about half as fast as today's PC modems. Wi-Fi networks can hit 11 megabits a second, nearly 200 times faster than a dial-up modem. This is fast enough to handle everything from large e-mail attachments to videoconferencing.

By late 2003, more than 5.4 million people worldwide are expected to use the technology regularly, according to researcher Gartner Group Inc. The number of networks
available to Web surfers is expected to top 15,000 by the end of 2003, up from 1,100 last year. And those are just public networks. Consumers and companies large and small are deploying hundreds of thousands of such networks at sites around the globe. Microsoft Corp. is fueling the movement by weaving software into its operating system that alerts users when they come within range of a Wi-Fi network. Wireless equipment vendors Cisco Systems Inc. and Agere Systems Inc. have made Wi-Fi innovation a top priority. And computer makers such as Apple, Compaq, and Dell are building Wi-Fi radios into notebook and handheld PCs. By 2004, more than 45 million business laptops - two thirds of the total in use - will be Wi-Fi capable.

Despite its startling growth, Wi-Fi must overcome big hurdles before it lives up to its promise. The most challenging is security. The technology's radio signals easily penetrate the walls of businesses and homes where the networks reside. And the limited range of networks means they're available in only tiny pockets, mostly in major cities. Until Wi-Fi networks offer better security and far more extensive service, their use will be limited to niche groups like mobile professionals and tech geeks.

Wi-Fi has the potential to reshape the workplace and dramatically boost productivity, too. Workers can take laptops to meetings, the cafeteria, the warehouse, or the parking lot. Employees with access to Wi-Fi stay online an average of 105 additional minutes a day, according to London-based NOP Research Group. Technology strategy chief of Merrill Lynch &Co. has stated that Wi-Fi has made his group 20% more productive. Even Starbucks Corp. is offering Wi-Fi access in 600 of its coffee shops for $30 a month and plans to roll the service out to 4,000 stores by the end of 2003.

By 2004, some 4.2 million US homes will have wireless networks - mostly Wi-Fi - up from 835,000 last year, according to researcher International Data Corp. Consumer-electronics manufacturers such as Sony Corp. and Philips Electronics are planning to integrate Wi-Fi technology into stereos and TVs so people will be able to view streaming video or listen to MP3 music files anywhere in the house.

Vendors such as Cisco and Agere are selling the technology as a way for corporations to cut costs and boost productivity. The cost of wireless gear, installation and support comes to about $500 per year, or $1 to $2 a day, for each user, according to Cisco, the world's largest maker of wireless equipment for enterprises. Assuming the average corporate employee costs $100,000 to $300,000 a year in salary and benefits, a company can recoup its $500 investment by squeezing just a few extra minutes of work a day out of each one.

Equipment vendors argue that Wi-Fi is becoming secure enough for most businesses. Cisco, Agere, and Symbol technologies are feverishly building systems they say keep the network door slammed shut. Hugh-end-gear -used by corporations- now comes with complicated encryption keys, which change for every person and every session, and
multiple networks. SWAP is backed by Motorola, Siemens and Proxim, and is positioned as a direct competitor of Wi-Fi. (Sadeh, 2002)

- UPNP and JINI: In the move to connect all appliances in the home with wired and wireless communications to the Internet, allowing everything to be controlled and monitored from anywhere, two additional competing standards, UPNP (Universal Plug and Play) from Microsoft and JINI from Sun Microsystems have evolved. (Sadeh, 2002)

3.1.10. Paging protocols:

- POCSAG (Post Office Code standardization Advisory Group): The traditional protocol used in the paging industry.

- FLEX: The next-generation paging protocol developed by Motorola. (Bergeron, 2001)

In contrast to spotty and regional cellular and PCS coverage, pagers, including the more recently introduced two-way variety, provide more or less blanket coverage of the United States – at least for receiving messages. (Bergeron, 2002)

3.1.11. High-level protocols and languages:

- HDML (Handheld Device Markup Language) is a proprietary language for coding web sites so the content can be downloaded quickly onto wireless systems.

- WML (Wireless Markup Language) is a language for implementing user interfaces on wireless devices.

- WMLScript allows programmers to check the validity of user-supplied data, access device-specific features and generate a message.

- WAP (Wireless Application Protocol): A collection of 2G standards that developers and hardware manufacturers follow to provide a standard environment for wireless applications. WAP works across all three cell phone technologies in the United States, allowing domestic content providers the luxury of not having to create specific messages for different displays. WAP is very big in Scandinavia, France and the United Kingdom, with startups luring executives away from large companies. (Perkins, 2000)

- Java-enabled wireless phones: This will allow the development of “push” applications that can initiate contact with users (e.g., alerting someone to a breaking news story) rather than waiting for the user to pull information off of the Web. (Mennecke & Strader, 2003)

3.1.12. Wireless technologies:

- Terrestrial Fixed Wireless: Fixed wireless, using both terrestrial and satellite technology, promises to provide Web connectivity to residential subscribers denied access to the wired Web because of geographic, wired infrastructure, or economic constraints. Fixed wireless
offers high-speed Web access to customers who either have not elected to use DSL or cable modem because of cost, or because they live in rural areas or in cities that do not offer high-speed wired Web connectivity. In some rural areas of the United States, for example, there simply is not enough of a potential subscriber base for local telecoms to offer DSL service. Economics aside, often the technology simply won't support a critical mass of subscribers. For example, because of signal loss over standard telephone lines, DSL cannot service subscribers more than about 6 km (4 mi) from a telephone switching station.

When set-up time and cost are primary factors, fixed wireless - or more specifically, terrestrial fixed wireless- has an advantage over wired services. Fixed wireless can be installed quickly for large numbers of subscribers without major physical changes to the information infrastructure, such as digging up streets to lay cable for DSL or cable modem subscribers. Installing the infrastructure for a residential fixed wireless network can be as simple attaching a series of microcell radios, each only a little larger than a book, to the public light fixtures of a community. The light fixtures provide a line-of-sight platform for antennas, as well as ready access to power.

Commercial fixed wireless systems often represent the most economically viable means of providing high-speed Internet access to corporations operating in office buildings located in major metropolitan areas, especially when the technology is coupled with wireless LAN technology inside the building. In the United States, less than 5 percent of all urban office buildings are wired for Internet access. (Bergeron, 2001)

- **Satellite-Based Fixed Wireless:** The economics of satellite communications are such that it is often the least expensive method of providing a high-bandwidth channel between points separated by more than a few kilometers. The distance covered by terrestrial microwave hops is limited by the curvature of the earth. A hop of 1700 km might require a network of 20 terrestrial microwave dishes with land-based repeater hardware. The same distance might be covered by a single satellite hop. Because the rental satellite channels are readily affordable and there is no network maintenance overhead to deal with, satellite communications can quickly become a viable option to a traditional terrestrial network. (Bergeron, 2001)

### 3.1.13. Voice recognition:

As voice recognition and synthesis become major components of the next-generation cellular interface, the voice recognition software companies such as Lernout & Hauspie- a major force in voice recognition software, IBM and Philips stand to gain considerably. In the US, Sprint PCS supports a service called voice commands, where a cellular phone responds to a customer's voice. AT&T, Lucent, Motorola, and IBM founded VoiceXML standard with the intention of bringing voice control to web sites, enabling voice response paradigms to navigate web sites and general speech recognition interfaces. The Kelsey Group estimates that by 2005, in North America alone, about 45 million cell phone users will be using voice portals. (Steinbock, 2003)
3.1.14. Voice portals:
After selecting a topic or working context using voice commands, subscribers can request specific information. The system then performs the appropriate search and reads the results back to the subscriber using voice synthesis. Voice Portal represents the marriage of VEI technology with a search engine and connectivity to the Web.

An example to a voice portal is etrieve, an mCommerce company that offers a monthly service whereby a corporate user can dial into a server and have their e-mail read over a phone. Mapquest.com also offers spoken driving directions as an added accompaniment to its graphic maps. (Steinbock, 2003)

3.1.15. Mobile payments:
One advantage mCommerce has in the area of payments is that mobile devices can easily be set up to handle micropayments. Because the device usually is physically with a person, micropayments (usually no more than US$50) can be an efficient means of paying for fuel, small amounts of goods and tolls. Since micropayments usually work on either a debit or low-ceiling credit system, the damage from a compromise of a device with micropayment capability is very low. (Bergeron, 2002)

3.1.16. Location-based services:
A key difference between wired eCommerce using a PC on a fixed line and mCommerce is that within mCommerce, vendors may have access to users' locations because the FCC issued a mandate requiring cellular, PCS, and SMR carriers to be able to locate their subscribers within 50 meters 67 percent of the time for emergency situations. The carriers could leverage this location information, providing it to mCommerce vendors and application service providers (ASPs). This could lead to a suite of valuable location-based applications and services such as driving directions, finding and purchasing air tickets, booking a restaurant, or even making hotel reservations based on the location of the user.

Types of location based services:
User Defined: The majority of early location service deployments had to make do without the benefit of the handset being locatable by the network operator. In such services, the user had to define their own position. This can be done by the user entering a street name, city or postcode.
Network Defined: Mobile phone networks are composed of thousands of base stations, with each base station covering an area called a cell. Technologies based on Cell ID use proximity to a base station to determine mobile handset position.

Handset Defined: The best-known method of location, Global Positioning System (GPS), has been used in vehicle navigation systems and dedicated hand held devices for some time. Provided that at least 3 satellites can be tracked, GPS is capable of positioning objects to a resolution of within 1m.

The lack of a definitive business model and the real risk of technology obsolescence in handset defined technologies have resulted in the majority of global operators limiting their investment in handset positioning technology to Cell ID. (Mennecke & Strader, 2003)

Location-Based Applications:

WAP 411 (www.wap411.com): WAP 411 is a personalized travel information service. You can choose your favorite cities, restaurants and hotels and more as well as rate the quality of each place and event - from one star to four stars.

Whowhere (www.whowhere.com): Whowhere is an application to search for e-mails and phone numbers.

Vicinity (www.vicinity.com): Vicinity is a location-based information provider. Vicinity StationFinder allows users who visit Shell or Texaco Web sites and Vicinity's MapBlast! to enter a zip code and find the Shell or Texaco stations nearest them. (Bergeron, 2002)

3.1.17. The 4G era: Broadband cellular:

Researchers of the leading mobile players are laying the groundwork for what some call 4G and others term “wireless world” which is expected to become operational between 2008 and 2011. Prototypes are expected to become available in 2003. System development and integration would evolve at the end of 2006, leading to first commercial deployment around 2011.

In March 2001, a slate of leading European mobile vendors – Alcatel, L.M., Ericsson, Nokia and Siemens – founded the new Wireless World Research Forum (WWRF). The goal of the new body was to “secure momentum, strategic orientation, and impact for the research on wireless communications beyond 3G. It reflected a variety of R&D efforts driving the 4G era – which will be characterized by broadband cellular communications.

Broadband wireless access technology can solve many of the problems faced by wired networks. Broadband wireless technology enables high-speed network access, unrestricted by traditional wired infrastructures. Broadband wireless technology is also a cost-effective alternative to wired networks, one that can be quickly implemented. A broadband wireless connection is often the best option for high-speed communication in remote areas and in many developing countries due to the lack of an existing wired infrastructure. In these regions, wireless technologies provide
clear advantages over wired networks—advantages that include lower cost, faster deployment, greater flexibility, and increased reliability. (Sharma, 2000)

The transition to 4G will not imply a change in interface technology. Instead, 4G promises to integrate different modes of wireless communication, from indoor networks such as wireless LANs and Bluetooth, to cellular signals, radio and TV broadcasting, as well as satellite communications. The ideal is seamless convergence in which users of mobile devices would roam freely from one standard to another – pervasive and ubiquitous computing. WWRF has sought to put such a technical view into a wider context that encompasses a user-centered approach, looking at the new ways in which users will interact with the wireless systems; new services and applications that become possible with the new technologies and new business models that may prevail in the future, overcoming the now-traditional user/service provider/network provider hierarchy. (Steinbock, 2003)

3.1.18. Wireless Applications:

**HomeRF**: HomeRF is a WLAN specification operating in the 2.4 GHz band, designed for the home to integrate voice, data, and video over inexpensive hardware. The specification provides six simultaneous voice connections and enough data capacity to satisfy the phone and Internet needs of a typical household. The home wireless market is estimated to grow to over $6 billion in 2004.

**OpenAir**: OpenAir is a WLAN specification operating in the 2.4 GHz band, designed for low cost office and vertical networking solutions. The specification began as a proprietary protocol from Proxim and later was adapted by the Wireless LAN Interoperability (WLI) Forum and placed in the public domain.

**HiperLAN1**: HiperLAN1 is a high speed (20 Mbps) WLAN operating in the 5 GHz band under development by the European Telecommunications Standards Institute (ETSI).

**HiperLAN2**: HiperLAN2 is a high speed (54 Mbps) WLAN operating in the 5 GHz band, designed to carry Internet traffic, video (Firewire-IEEE 1394), and digital voice (3G, third-generation mobile wireless technology). The HiperLAN2 standard enjoys support from many European companies including Ericsson, Nokia, and Philips. Anticipated deployment locations include offices, classrooms, homes, factories, and public areas.

**802.11b**: In 1991 the Institute of Electrical and Electronics Engineers (IEEE) formed a committee to develop a specification for a WLAN. Eight years later the 802.11b WLAN specification was approved providing 11 Mbps in the 2.4 GHz band.
companies including Ericsson, Nokia, and Philips. Anticipated deployment locations include offices, classrooms, homes, factories, and public areas.

802.11b: In 1991 the Institute of Electrical and Electronics Engineers (IEEE) formed a committee to develop a specification for a WLAN. Eight years later the 802.11b WLAN specification was approved providing 11 Mbps in the 2.4 GHz band.

802.11a: The 802.11a standard specifies a high speed (54 Mbps) WLAN operating in the 5 GHz band, designed for efficient distribution of Internet protocol packets. Europe and North America are headed towards incompatible standards for next generation mobile phones. Europe is promoting third-generation (3G) for voice and data, while North America relies on a mix of standards (CDMA, TDMA, GSM). For WLAN, Europe will likely use HiperLan2 as North American widely deploys 802.11b, migrating to the faster 802.11a standard. Europe and North America will probably converge on the Bluetooth-based 802.15 WPAN standard once coexistence is solved, since both were involved in the development and promotion of Bluetooth.

802.11e: 802.11e is a modification to provide quality of service (QoS) to all 802.11 WLANs. Specifically, it modifies the radio component to better handle time-sensitive traffic. The draft specification is based on work from ShareWave, Lucent, and AT&T (Wuelfing, 2001).

802.11g: 802.11g is a high speed (20 Mbps) WLAN operating in the 2.4 GHz band. The WLAN is proposed as a transition step from 802.11b to 802.11a, offering information technology managers an opportunity to introduce higher speed WLAN while maintaining backward compatibility with slower 802.11b WLAN. However, the arrival of faster 802.11a products operating in the less congested 5 GHz band will eclipse the need for 802.11g.

802.15: IEEE P802.15 is a working group of the IEEE 802 Standards Committee, developing a standard for short-distance wireless personal area networks (WPAN). In 1999 the group established the needs and requirements for a WPAN citing the following six criteria: broad market potential for many wearable and hand-held devices, compatibility with the 802 family of wireless networks, low power, inexpensive, and simple, technical feasibility using proven technology for a reliable solution, economic feasibility providing a high volume, low cost product, coexistence with other WLANs. (Mennecke & Strader, 2003)
<table>
<thead>
<tr>
<th>Technology</th>
<th>Freq (GHz)</th>
<th>Data (Mbps)</th>
<th>Target Application</th>
<th>Target Country</th>
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<td>HiperLAN2</td>
<td>5</td>
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<td>Europe</td>
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</tbody>
</table>

Table 5. Wireless Applications and Geographies (Mennecke & Strader, 2003)

3.1.19. Convergence of Computing and Communications Industries:

The convergence of the computing and communications industries promises exciting applications. Vendors from these growing sectors are working together on standards and technologies that blur the lines between desktop PCs and mobile communication devices. Devices such as Nokia's Communicator or QUALCOMM's pdQ phones are popular examples of such convergence. Each of these devices is a PDA and phone in one unit. With time, their costs will come down and the form factor will improve to make them acceptable to mass markets. (Sharma, 2000)
CHAPTER FOUR

Competition Strategies and Revenue Structure of Mobile Commerce towards Success

4.1. Competition Strategies of Mobile Commerce

At firm level, a company can outperform its rivals only if it establishes a difference that it can preserve, sustain and renew. To achieve this objective, companies tend to rely on three different kinds of generic strategies: differentiation, cost and innovation or a combination of three. A company must deliver greater value to its customers, create comparable value at a lower cost, find new ways of value creation, or succeed in a combination of the three. Delivering greater value allows a company to charge higher average unit prices (differentiation). Greater efficiency results in lower average unit costs (cost). Finding new ways of value creation enables the company to establish a new base for differentiation, cost or both (innovation). Cost strategies reflect operational effectiveness. These companies perform similar activities better than their rivals. Differentiation means performing different activities from those of rivals or performing similar activities in different ways. Finally, innovation allows companies to achieve the benefits of differentiation, cost or both. (Steinbock, 2003)

Productivity frontier is a hypothetical limit that constitutes the sum of all existing “best practices” at any given historical moment. When a company improves its differentiation, cost or innovation, it moves closer to the frontier, which may be considered the joint function of relative differentiation, cost and innovation. (Steinbock, 2003)

It is the $320 billion market pie (2010 estimate) that serves to intensify growth strategies of the mobile leaders while accelerating the entry strategies of the IT leaders - thus pushing the two strategic groups into a collision curve.

Various access networks may not be viable if they cannot generate sufficient revenue. This scenario would lead to horizontal and vertical mergers. Given the strong economies of scale and the externalities of 4G networks, a market structure involving local monopolies and an oligopoly of global backbone interconnection is quite likely.

Today, mobile economy comprises four horizontal layers; infrastructure, applications, content and aggregation services and retail. (Steinbock, 2003)

4.1.1. Mobile economy layers:
Mobile Infrastructure: With the mobilization of the digital economy, a new infrastructure has emerged; comprising operators, wireless Internet Service Providers (ISPs), access firms, and security companies. In this layer, network operators and mobile handset and systems vendors play a central role.
Mobile Applications: Wireless applications require software products and services to facilitate web transactions, transaction intermediaries, and consultants and service companies to design, build, and maintain mobile websites, from wireless portals to mobile e-commerce sites.

Mobile Content and Aggregation: In the third layer, the wired content and aggregator businesses are about to be augmented by their mobile counterparts (i.e. mobile trading, mobile portals, aggregators, content providers, and ad brokers) who also sought to generate revenues indirectly, through advertising, membership subscription fees, and commissions. Some are purely web content providers, whereas others are mobile market makers or intermediaries. In the long run, these "mobile infomediaries" are expected to have a significant impact on the efficiency and performance of mobile markets. Content and applications providers are expected to enjoy the greatest revenue and profitability growth. (Mennecke & Strader, 2003)

Mobile E-Commerce: The fourth layer, mobile e-tailers will enable mobile web-based commerce transactions and cross a wide variety of vertical industries. (Steinbock, 2003)

4.1.2. Growth of mobile telecommunications market:
A number of factors have contributed to the growth of the mobile telecommunications market:

Technology: Improvements in the underlying technology resulting in reduced drop-out rates and improved roaming capabilities have contributed to improved service. Improvements in battery technology and handset design have reinforced the convenience of mobile services by enabling customers to conveniently carry phones on their person.

Improved Service Levels: There have been improvements in coverage (both in terms of population and transport corridors) which have increased the perceived accessibility of mobile devices. The rollout of digital networks has also facilitated the introduction of a number of value-added services, such as voice mail and message services.

Falling prices: Prices have fallen significantly in most countries as a result of cost reductions and competition. In many cases, there is little sustainable differentiation in the service provided by competitors, and carriers have, to date, competed heavily in terms of price. This has resulted in price innovations, such as handset and service packages and pre-paid services, which in turn have increased the affordability and accessibility of mobile services.

Cultural changes: A culture of mobile calling has developed over the decade with increasing expectations of instant access. Mobile phones are seen as a status symbol in some countries. Also, mobile services are increasingly displacing fixed service penetration and is forecast to reach 91.3 services per 100 population in 2002. (Productivity Commission, 1999)

4.1.3. Telecommunications economy and pricing:
Government intervention in telecommunications market can have significant implications for price outcomes. Price controls and access regulation affect the degree of competition and incentives for efficient
outcomes. Differences in regulation can therefore be expected to result in price variations among the countries, other things being equal.

Factors such as economies of scale and scope, sunk costs, brand loyalty, and any-to-any connectivity provide economic advantages to incumbents and can be barriers to entry for potential competitors.

Prices are affected by internal and external factors. Internal factors include managerial performance, corporate culture and regulatory environment and interventions. External factors are beyond the control of the industry and government authorities and include the impact of differences in population densities on costs and prices.

Telecommunications is a dynamic, diverse and increasingly competitive industry. New technologies and services are emerging and competing with established services. Also, the process of regulatory change in telecommunications markets is encouraging increased competition and new pricing strategies. Generally, consumers are benefiting from this through substantial price reductions.

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Price plans generally take the following forms:

- Percentage h (including capped prices for long-duration calls) in off-peak periods; or
- Lower usage charges to a limited number of specified destinations (such as family and friends packages) or for a limited period.

Operators typically offer a range of mobile price plans and these plans are constantly changing to meet customer needs.

Regulatory arrangements affect prices directly through retail price controls and indirectly through market interventions that influence the extent and development of competition. Governments regulate telecommunications industries for social policy reasons and to correct perceived market failures. Social policies are typically aimed at facilitating broad community access to telecommunications services at affordable prices.

Price controls are used to prevent abuse of market power such as monopoly pricing, so that the benefits of reform are passed on to consumers. Increasingly, however, regulation of retail prices is being supplanted by regulation aimed at promoting competition - that facilitates access to network facilities and services at reasonable prices - and supervision of market conduct under general trade practice law.

(Packetivity Commission, 1999)

Packet-switch network allows for a different pricing model for the end user. End users pay per packet (128 bytes) of information downloaded rather than for the number of minutes online. This per-packet pricing scheme is most effective with wireless Internet services where the number of bytes downloaded
tend to be very small. With a limited number of kilobytes, the per-packet method is more cost-effective for the average user. (Mennecke & Strader, 2003)

Location-sensitive billing includes the ability to offer reduced call rates to subscribers that use their mobile phone when at their home, thereby allowing mobile operators to compete more effectively with their fixed telephony counterparts.

Pricing of Location-based Services:

Network providers will benefit by direct revenues from subscription and usage fees for nearly all location-based service scenarios, but they may need to share these revenues with other parties in many instances. For example, network operators will not typically own the contextual information needed to provide added value navigation services, neither will they be the producers of content in mobile advertisements. Two major charging schemes for mobile location services can be identified:

User-Charged Services: Under this model, users are charged for accessing and using the mobile location services, most likely through a service subscription fee. For example, most navigation and information services are likely to be provided under some form of user charging mechanism. The revenues resulting from user charging may benefit the mobile network operators only, but in many cases will have to be shared between network operators and third parties that provide contextual information or other support needed for location-sensitive service provision.

Free-of-Charge Services: A number of services may be provided without charge to the end user because the service will be paid for by a third party. For example, advertising agencies (or their clients) will normally have to pay for the ability to send mobile advertisements to consenting end users. In other cases, mobile network operators may choose to bear the full cost of implementing mobile location services, expecting to benefit from service differentiation and/or customer churn reduction, as for example in the case of location-sensitive billing. In other cases, some mobile location services will be provided free-of-charge because of regulatory obligations enforced on the mobile network providers (for example, emergency services).
<table>
<thead>
<tr>
<th>Services</th>
<th>Sub-Service</th>
<th>Likely Pricing Scheme</th>
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<tbody>
<tr>
<td>Emergency</td>
<td>Emergency calls</td>
<td>Free-of-charge</td>
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<tr>
<td></td>
<td>Automotive Assistance</td>
<td>User-charged</td>
</tr>
<tr>
<td>Navigation</td>
<td>Directions</td>
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<td></td>
<td>Traffic Management</td>
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<tr>
<td></td>
<td>Indoor Routing</td>
<td>Free-of-charge</td>
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<td></td>
<td>Group Management</td>
<td>User-charged</td>
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<td>Information</td>
<td>Travel Services</td>
<td>User-charged</td>
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<td>Infotainment Services</td>
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<td>People Tracking</td>
<td>User-charged</td>
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<td>Product Tracking</td>
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</tr>
<tr>
<td>Billing</td>
<td>Location-sensitive billing</td>
<td>Free-of-charge</td>
</tr>
</tbody>
</table>

Table 6. A Classification Framework for Mobile Location Services (Mennecke & Strader, 2003)

**New Technology Pricing Strategy:**

New technology pricing strategy should aim at facilitating a smooth migration from existing phones, through similar charges for voice communications to those for current cellular phone service and provision of incentives when migrating from the current phones. In order to promote NTT DoCoMo's 3G FOMA service for the following six months, contract-handling charges were waived for all new customers. Additionally to encourage customers to use FOMA's special features, such as data communications, videophone and multi-access, customers received an extra 7.50 USD worth of bundled free service with their new contracts.

New pricing mechanisms will be needed to give backbone providers sufficient incentives to cover the various QoS requirements of UMTS operators and content providers for end-to-end service delivery. In the current Internet connectivity market, end-to-end QoS is not provided.

The higher cost of mobile and wireless networks is expected to lead to higher service prices.

In order to avoid price competition, network operators will be pursuing differentiation strategies by bundling services with different technical specifications and by introducing content personalization.
4.1.4. Effects of globalization to revenues:

For decades, mobile communications evolved in the shadow of fixed-line telecommunications. Due to regulation, markets were neither global nor competitive but national monopolies. Economies of scope were limited to a single country, and most, if not all revenues were made in that one country. Today, any equipment manufacturer that hopes to join the top-tier players must have a presence in 80-140 countries; and the leading vendors make close to 99 percent of their revenues outside their home base. Consequently, the home base no longer determines potential scale economies; globalization does.

The early internationalization of competitive operators rested on three requirements. First, the monopoly era had to fade away in the core clusters and the lead markets, in order to enable new organizational capabilities while allowing for market entry. Second, the worst turmoil of the great transition had to subside to support internationalization efforts in foreign markets. Third, global telecom reforms had to be initiated in the lead markets. In the absence of new public policies, the internationalizing operators would not have been able to establish a foothold in lead markets because there would have been no market terrain to hold onto.

From the pre-cellular to the 1G era, the United States had been the leading cluster and market center in wireless communications. Starting with digital cellular, mobile innovation split into three key Triad regions: the United States, Western Europe and Japan. By the late 1900s, this split was reinforced by a fourth core region: People's Republic of China. (Steinbock, 2002)

Studies show that American consumers prefer mobile devices for e-mail; surfing; and getting news, travel, and regional information, while some entertainment services that are popular in other countries, like downloadable ring tones, aren't interesting. American users are also not as concerned about sending credit card information over the wireless networks as their Japanese and Swedish counterparts. About 59%, however, fear that location-based services, which can pinpoint a consumer's whereabouts at any given time, will compromise their privacy (Mennecke & Strader, 2003)

Industry Consolidation and Market Expansion in the United States:

Between the mid-1980s and 2000, the number of cellular subscribers soared from 92,000 to 97 million. Through these years, the United States was the most lucrative market worldwide. In July 2001, the subscriber base in the U.S. market exceeded 120 million (though China was about to become the largest market worldwide). In the past fifteen years, total six-month revenues in the United States soared from $178 million to $24.6 billion. At the same time, investments per subscriber declined from $3,873 to $790, while average revenue per subscriber (ARPU) decreased consistently from $1,944 to $240. These figures reflect the industry transition from low differentiation and low volume to high differentiation and high volume. With the 3G convergence, the shift from voice to data coincided with another change; where usage rather than penetration became the paramount revenue criteria. In 2000, the industry witnessed the first signs of a reversal that was expected to become more common with data communications, as ARPU actually increased to $254. In the year 2000, the CMRS industry continued to experience increased competition
and innovation as evidenced by lower prices for consumers and greater diversity of service offerings. Between 1987 and 1998, the average monthly bill fell from $97 to $39. More recently, increasing use of new services has increased the bill to $45. Through analog and digital cellular, industry expansion has translated to substantial employment as well. The mobile telephony sector generated more than $52.5 billion in revenues, increased subscribers from 86 million to 109.5 million and produced a nationwide penetration rate of roughly 39 percent. In 1985, the industry employed 1,400 people; in 2000, it employed 160,000. (Steinbock, 2003)

Emergence of Nordic Model: Toward Open Specifications:

Internationalization, if it is to be competitive and efficient, requires open specifications, which are more responsive to local conditions.

High quality and high performance with simple yet efficient manufacturing practices – these characteristics became an integral part of Nordic mobile pioneers. In the United States, a vast and lucrative market has favored substantial specialization. For decades, most companies have engaged in differentiation or low-cost strategies, while foreign markets have held little pull. In the Nordic countries, the competitive telcos have excelled in quality and cost leadership, while the small domestic home base has served as a powerful push motive for internationalization. (Steinbock, 2003)

Because of their vast home base, U.S. companies, until recently, have been able to achieve scale even while ignoring scope. In contrast, the Nordic firms could achieve scale only through scope. For the U.S. vendors and operators and for many large-country European firms, internationalization has been an afterthought. For Nordic competitors, it was a necessary condition for survival. (Steinbock, 2003)

At the end of World War II, finding themselves between the socialist east and the capitalist West, Nordic countries struggled for a “third way” that would do justice to their mixed economies. In 1945, the Nordic Social Democrats drafted a far-reaching declaration on Nordic cooperation. The explosion of the cellular business was one result of these Nordic initiatives. The major Nordic countries – Sweden, Finland, Denmark and Norway – adopted an unusually progressive attitude toward wireless communications. The use of the wireless was heavily promoted and the use of the available spectrum was encouraged. The Nordic topography favored mobile communications, due to the dispersion of much of the population in remote places. Efforts to develop a common network and to standardize the technology triggered Nordic cooperation. (Steinbock, 2003)

In the postwar era, the strategies and policies of the Nordic countries proved superior to those of the United States on two counts. First, Nordic telecom authorities formulated and implemented liberal policies and excelled in coordination. Second, they aggressively promoted the early adoption of new wireless technologies. The Nordic players envisioned an industry that built upon open and nonproprietary solutions. Open standards accelerated competition and eroded the monopoly power of the Nordic PTTs. This, in turn, boosted the expansion of Nordic equipment manufacturers worldwide. Also, in the Nordic mobile telecommunications industry, consumer needs had been considered during the planning of wireless networks. Therefore, mobile phones quickly moved from business markets to consumer markets. The
competitive superiority of the Nordic model as compared with the U.S. approach became relatively clear – including public policies, roaming as an instrument of scale economies, competitive suppliers, selection of frequency bands, critical differences in tariffs, and the penchant for open specifications. (Steinbock, 2003)

Japan's Service Innovation Has Helped Growth in Revenues:

Japan’s NTT DoCoMo's financials reflected its growth. Its number of employees tripled from 1995 to 2001, from fewer than 6,000 to more than 18,000. Concurrently, revenues quadrupled to $37 billion and net profit margin soared from 2 percent to almost 9 percent. Despite Japan's stagnating economy, NTT DoCoMo's margin grew in excess of 33 percent, while the subscriber base continued to increase. (Steinbock, 2003). The service has grown to 30 million users, in the process of generating several billions of dollars in revenue in the form of subscription fees and increased traffic. (Sadeh, 2002)

The key element of DoCoMo's success has been its ability to turn the popularity of its services into a profitable business. In contrast to the wired Internet, where many popular services are still struggling to come up with a viable business model, DoCoMo relies on multiple sources of revenue, one of the keys to mobile commerce profitability. First, it charges a flat monthly fee for Internet access, around $3/month. In addition to also charging for traffic, DoCoMo offers official sites to collect monthly subscription fees on their behalf. This involves collecting fees from subscribers through DoCoMo's regular billing cycle, ensuring that only authorized users are allowed to access these for-a-fee services. This is enforced by DoCoMo's i-Mode servers, through which all requests have to flow. In return, DoCoMo keeps a small percentage of the subscription fees it collects on behalf of content providers – currently 9 percent. This arrangement makes it significantly easier for content providers to charge for their services without having to worry about setting up complex billing systems. Within one year of its start, i-Mode was already credited for an annual 120 ARPU increase, $30 in the form of subscription fees and $90 in the form of increased traffic. By the late 2000, that figure had doubled, with increased traffic data traffic revenue of 2100 Yen per month per user – around $200 per year. (Steinbock, 2003)

China's Service Innovation and Developments Have Helped Growth in Mobile Revenues:

Between 1995 and 2000, service revenues of Chinese operators nearly tripled from $15 billion to almost $45 billion. These were similar to figures in the United States, where service revenues grew from $16.5 billion to $45.3 billion. In 2000, only two operators generated more than $1 billion in revenues: China Mobile ($1.4 billion) and China Telecom ($1.1 billion). China Unicom’s revenues exceeded $300 million. (Steinbock, 2003)
Wireless Business Contribution to the Growth of Electronic Manufacturing Services (EMS) through outsourcing:

Wireless business has contributed to the acceleration of outsourcing. The wireless business translated to growing outsourcing among mobile leaders. The wireless explosion served as a growth catalyst to the dramatic expansion and consolidation of the EMS sector, which embraced these new technologies through new and highly efficient organizational capabilities. EMS firms incorporate critical elements of the value activities (i.e. productization, manufacturing, distribution, and services), which allow the major wireless vendors like Nokia, Ericsson etc. to focus on their core competencies in R&D, branding, and to some degree, manufacturing.

By 2000, EMS industry became capital intensive and more concentrated. In just a year, the market share for the top-six EMS leaders climbed from 42 percent to 55 percent. Strong financial resources boosted capital-intensive operations, while size multiplied with scale and scope economies. Product diversification and broader service capabilities increased as revenue sources ensued. In the 1990s, the revenues of EMS leaders soared from less than $100 million to almost $19 billion. Between 1992 and 2001, Solectron's revenues climbed from $407 million to $18.7 billion, versus Flextronics ($7.2 billion), Celestica ($9.8 billion) and Sanmina SCI (3.9 billion). Between 1992 and 2001, the number of Flextronics employees climbed from more than 2,000 to 75,000, in comparison to Solectron (60,000), Celestica (31,000) and Sanmina (24,000).

The EMS sector has evolved into one of the world's most dynamic industries in just a decade or two, with an average growth of 25 percent per year. The total available EMS market has been estimated as $500 billion. Biggest EMSs contributing to the wireless industry are Celestica, Flextronics, Solectron and Sanmina-SCI. (Steinbock, 2003)
4.2. Revenue Structure of Mobile Commerce

Figure 11. The wireless Internet value chain. (Sharma, 2000)

mCommerce has very reliable and well defined revenue sources compared to wired web commerce at which most information is free for the customer. Kagan estimates that m-commerce revenue will be increasing from $1.2 billion in 2001 to $93.3 billion in 2005 and $221.8 billion in 2007. Also, according to Kagan, total mobile data revenue percentage compared to total m-commerce revenue will increase from its value of 0.2% in 2001 to 1.4% in 2007. (Luna, 2002)

The early estimates indicate that the worldwide revenue for 3G services will soar from $1 billion in 2002 to $321 billion in 2010. This implies annual growth of 37 percent and a steadily rising adoption curve. Simple voice content will climb from $423 million to $88 billion in estimated worldwide revenues for 3G services, while content will increase from $306 million to $86 billion. Mobile intranet/extranet will be the most critical offering in the business markets. It will grow faster (44 percent in terms of compound annual
growth in 2005-2010) than simple voice (31 percent) or content (33 percent) services. All other services (multimedia messaging service (MMS) business, MMS consumer, mobile Internet, and location-based services) will remain less than $25 billion. Rich voice is expected to soar faster than any other offering (95%), but only in the latter half of the decade. Overall, demand parallels revenue, but the dominant role of simple voice is even more apparent in subscriptions. Simple voice subscriber number is expected to soar from 2.6 million in 2002 to 630 million in 2010, which translates to 46 percent in annual growth. Content (311 million in terms of estimated worldwide subscriptions for 3G services) and mobile intranet/extranet access (258 million), coupled with MMS for business users (207 million), will demonstrate strong growth as well, followed by consumer MMS and mobile Internet. (Steinbock, 2003)

4.2.1. Revenue from eCommerce portals:
   Many eCommerce portals use mCommerce companies and Wireless Application Service Providers (WASPs) that charge them a hosting fee and commission for each customer sent. In exchange for this premium, the mCommerce companies provide wireless services to the eCommerce portal or wired company. (Raina, 2002)

   For example, news companies, who traditionally provide news in other media using advertising revenue, can charge users small fees for essential information via mobile networks. Entertainment companies, who have not yet found a true moneymaking model on the fixed-line Internet, can transform their properties into mobile content and begin to receive revenue. (Mennecke & Strader, 2003)

4.2.2. Revenue from subscription-based services:
   Users can subscribe to news alerts, stock quotes, weather forecasts, and directory listings. Subscription fees tend to be easier to collect than transaction fees and provide a more predictable source of income. (Raina, 2002)

4.2.3. Revenue from location-sensitive services:
   Surveys suggest that users are willing to pay extra for location-sensitive services such as driving direction assistance or location-tracking. The end result is a sector that analysts predict could generate nearly $10 billion a year within the next few years. (Sadeh, 2002)

   The degree to which operators are successful in localizing services for users, responding to user preferences, as well as pricing and ease of integration with existing services will determine competitive advantage.

   For both the consumer and corporate markets, location-based services enable network operators to strengthen their relationship, and their pricing power, with subscribers. It is the revenue opportunity of location-based services—realized through higher fees, lower churn and market share growth—that justifies network operator investment in 2.5G and 3G transmission technologies, technologies that increase bandwidth and enable new wireless data service offerings. (Mennecke & Strader, 2003)
4.2.4. Revenue from current and future cell-phone users:

By the end of 2001, there were over 850 million mobile phone users worldwide – or about 14 percent of the world population- with annual sales of over 400 million mobile phones worldwide. (Sadeh, 2002)

IDC expects the wireless web access space to total $732 million in revenue by 2004 (Raina, 2002).

The market position of each key player is determined by their respective market power or, in other words, their ability to command superior revenues and profits. The main revenue source is the customer base. In many cases, the key player who owns the customer base has the market power to decide on new business relationships with other players. Mobile operators have large customer bases already created from the provision of mobile telephony. (Mennecke & Strader, 2003)

The market for wireless phones exceeded expectations in the third quarter of 2002, according to a recent study by Dataquest. The market increased 7.8 percent over the same period last year, with worldwide mobile phone sales totaling 104.3 million units in the quarter, according to the study. Nokia topped out the biggest winners in the market. The company captured almost 36 percent market share in Europe. The company also managed to break through the 50 percent market share barrier in Western Europe, as well as the Middle East and Africa. Overall, worldwide phone sales reached 104.3 million units—only the second time third-quarter results for the equipment has topped 100 million units, according to the research firm. (Wireless Week, 2002)

Ericsson predicts that by 2004, there will be over 600 million mobile Internet users. (Sadeh, 2002). As the number of mobile Internet users outnumber PC users worldwide, there will be a concomitant shift in eCommerce from wired PCs to Internet-enabled mobile devices. This move requires that customers upgrade their existing cell phones- that will pull a lot of financial advantage for hardware suppliers and developers. In 1999, handset upgrades accounted for about 40 percent of total handset sales. This number was expected to rise to about 50 percent in 2000 and 70 to 80 percent in the next few years. (Steinbock, 2003) For many customers, the history of cell phone in the United States represents a new phone purchase every 12 to 18 months. This is a greater turnover than is experienced in the PC industry, where CPU upgrades average every 18 to 36 months.

Vendors continue to push Internet-capable wireless handsets. Nearly 60 percent of phones shipped worldwide are now capable of browsing the Internet. As the year continues, In-Stat/MDR forecasts a steady rise to nearly three-quarters of all handsets having Internet capability. This is good news to operators hoping to capture more data revenue from wireless customers. However, having an Internet-capable phone does not necessarily mean users are paying for and using wireless Internet data. (Wireless Week, 2002)

U.S. consumers already buy more than 50,000 ringtones each day for about $1 per ringtone. That amounts to $18 million per year for the wireless industry. By 2003, ringtones will become the leading B-to-C premium content delivered over wireless devices. That accounts for $50 million per year for the industry. (Luna, 2002)
In the near future, wireless service providers and equipment makers hope to turn them into devices for sending photos, video clips and other graphical information. Hundreds of millions of cellular users soon will be snapping pictures with camera-equipped handsets and beaming them wirelessly to friends, relatives and business colleagues, not to mention receiving pictures and downloading games, video clips, music and news. Wireless network operators are looking forward to increased revenue per user, while handset, network infrastructure and component makers hope to benefit by selling new and replacement phones, as well as network equipment and software needed to carry an increasing amount of wireless data. (Bergeron, 2001)

In fall 2001, NTT DoCoMo launched Freedom of Multimedia Access (FOMA) service in Japan. FOMA supported full-motion video image transmission, music and game distribution, and other high-speed, large-capacity data communications. With a maximum downlink speed of 384 Kbps, forty times faster than any conventional wireless data communications, FOMA delivered high-quality video as well as enhanced video clarity.

The UMTS Forum, a consortium of 250 organizations that includes mobile operators, vendors, content and service providers, expects that around 2004, data traffic revenues will start dominating mobile voice revenues.

Today, SMS accounts for a substantial percentage of the revenue of some mobile operators. The GSM Association suggests that there were over 200 billion SMS messages exchanged in 2001 – there were 15 billion in December 2000 alone. (Sadeh, 2002)

4.2.5. Revenue from mobile advertising:
The possibility of tapping into mCommerce to generate advertising revenue has created new and distinct advertising models. (Raina, 2002)

In a mobile advertising trial involving 100 different ads and the delivery of 2 million wireless ad impressions in late 2000, wireless advertising company Windwire reported click-through and call-through rates ranging between 10 and 15 percent in the wireless advertising arena, in contrast to regular wired Internet click-through rates of 0.5 percent or less. These figures suggest that mobile devices are at least as good as an advertising medium as the wired Internet and quite possibly a better one. This is in part due to limited screens, which actually increase the chance of user seeing any given ad. In the longer run, the ability to send targeted ads based on the user’s location or other contextual attributes should further increase the effectiveness of mobile advertising.

In late 2000, research firm Ovum predicted that mobile advertising could grow into a $4 billion industry by 2003, reaching $16 billion by 2005, assuming a population of 500 million mobile Internet users by then. (Sadeh, 2002)

Companies such as Spotcast, which has leased its technology to SmartTone and Peoples Tel in Singapore allow users to get free "call minutes" in exchange for listening to a few seconds of advertising. Another example is a mall where subscribers can receive special offers from shops as they pass them.
The overall financial incentive for dotComs to include a wireless Web touch point is to increase traffic to the wired web site and thereby increasing potential advertising revenue. The advertiser generally pays a fee to the content provider for adding promotional messages to the content it delivers to mobile users.

**Flat fees:** The simplest form involves charging the advertiser a flat fee in exchange for showing the ad over a given period of time. Go2.com, a directory service supporting searches for nearby places through specialized queries such as its go2movies, go2restaurants, go2doctors or go2atm services, offers a variation of this model to prospective advertisers. Specifically, it charges them a placement fee of around $20 per month to figure among the companies it will list.

**Traffic-based fees:** Traffic-based fees enable advertisers to pay based on the number of times their message is displayed. Early wireless ad campaigns suggest that advertisers may be willing to pay substantially more for 1,000 ad impressions on the mobile Internet than on the wired one. This is in part explained by the small screens of mobile devices, as well as the higher success rates reported so far for wireless ad campaigns in comparison with traditional online ones.

**Performance-based fees:** Fees based on the number of click-throughs or call-throughs.

An example of this model is implemented by Japanese content provider GolfOnline. The company receives a commission from partnering golf courses on every reservation made via its site. (Raina, 2002)
CHAPTER FIVE

Drawbacks of wireless technologies towards the success of Mobile Commerce and how they can be overcome:

5.1. Explorations on Factors Hindering the Future Success of Wireless Technologies:
The limiting factor in propelling the wireless Web into everyday reality is establishing a standard, secure, affordable, universally accessible, high-speed infrastructure to support Web-enabled devices. Mobile commerce can only be successful in the US if the mobile technologies overcome their current insufficiencies such as:

5.1.1. Bandwidth limitations:
The bandwidth of most mobile phones and wireless PDAs used in the United States is limited to less than 14.4 Kbps, or about a quarter of the speed of the standard 56-kbps connection to the wired Web. (Bergeron, 2001)

5.1.2. Data transfer rates:
Network data transfer rate or speed is normally tied to specific network services, either by technologic limitations, or more often, by licensing restrictions. Increased speed requires an increase in bandwidth, potentially resulting in interference with other services that share the spectrum.

In the wireless word, what constitutes normal speed in the United States is painfully slow- anywhere from 9 to 19.2 KBps. Even the third-generation(G3) wireless network services, considered high-speed at 384 KBps to 2 Mbps, are slow compared to high-speed wired services. Surveys suggest that every additional click required from a user reduces the probability of the transaction by 50 percent. (Bergeron, 2001)

5.1.3. Incomplete service coverage:
With the exception of Japan, most countries including the United States have spotty wireless Web coverage. Moreover, cell phone use is barred in certain hospital wards and on most airplanes because they have the potential of interfering with medical or aircraft navigation equipment. (Bergeron, 2001)

5.1.4. Scarcity of content:
Content written specifically for the smaller Palm Pilot or cell phone display is sparse. Even content designed for NTT DoCoMo's popular I-mode is limited to thousands, not million of sites. (Bergeron, 2001)

5.1.5. Low number of Internet-capable mobile phones in the USA:
The risk is that hardware suppliers – including chip suppliers to wireless devices- may not be able to meet demand, much in the same way that periodic RAM shortages strangled PC sales. (Bergeron, 2001)
5.1.6. **High pricing of wireless web access:**
In the USA, monthly charges for unlimited wireless Web access are about double the cost of comparable wired Web access. Prices should be more reasonable. (Bergeron, 2001)

5.1.7. **Being only technical savvy or business savvy:**
In order to be successful, mobile commerce should break the wired business models of weather being only technical savvy or business savvy. In order to avoid failure, companies in the mCommerce business should have a nice blend of technology and business. (Glass, 2001)

5.1.8. **Cost resistance among customers against upgrading handset:**
Cost resistance among customers for upgrading handsets as communications standards continuously change is another factor hindering mCommerce success. As long as developers can provide the technology with the optimum mix of features in the right form at a reasonable price, there may not be much resistance from consumers to the constant upgrade pressure (Bergeron, 2001)

5.1.9. **Security:**
Security plays an essential role in mCommerce success. Wireless services that lack security in their offering of sensitive information and services will face failure in their businesses.

The security technologies that have been developed applicable to the wireless Web include a variety of password protection schemes, supplemented with biometric security technologies, antivirus utilities for PDAs and Web-enabled cell phones, and encryption technologies for handhelds. (Raina, 2002)

**Security Issues:**

**Digital versus Analog Cellular:** Analog cellular, the most common wireless phone technology in the United States (88 percent) (Productivity Commission, 1999), is plagued with security holes. Since analog cellular signals occupy a fixed frequency, anyone with a modified UHF receiver or scanner can hear and record entire conversations. In addition, the serial number used by analog cellular phones for subscriber authentication can be recorded as well, allowing someone to steal airtime by using the purloined number.

One of the advantages of digital cellular over the older analog technology is improved security. Instead of using a single, nonvarying frequency, digital cellular relies on encoded spread spectrum signals that are much more difficult to intercept and decode. Moreover, new digital cellular systems are less susceptible to interfering signals than are older analog receivers. Even so, with the right equipment, digital cellular signals can be intercepted and their contents examined. (Raina, 2002)

Australian Telstra and France Telecom are moving to closing or have closed their analog networks. In Japan, carriers were required to cease further investment in their analog systems from April 1997. In the US and New Zealand, there has been less regulatory pressure to migrate customers to digital services. (Productivity Commission, 1999)
**Smart Cards:** Mobile devices have certain limitations including memory, computational processing, form factor and bandwidth that cause mobile security approaches to be different than wired security approaches.

Memory limitations of mobile security are solved by usage of Smartcards in Europe. Smartcards provide features that solve two problems: a place for storage of data such as digital certificates or subscriber identity and the ability to take data from phone to phone. However, smartcards have not been the answer across the world for mobile devices because smartcard technologies and standards vary from manufacturer to manufacturer based on region.

A promising approach entails keeping wireless devices separate from personal identifying data stored on special smart cards. (Bergeron, 2001)

France Telecom introduced dual-slot phones that accept smartcards (almost all credit cards in France are smartcards). Hence, phones can process payments, thus becoming fully mCommerce-enabled, point-of-sale terminals.

In Europe, smart cards, called WIMs (Wireless Identity Modules) use Public Key Encryption technology to address the greatest security threat for wireless devices: theft and loss. Some GSM-compatible handsets have a slot to fit the credit-card size WIM card, rendering the phone useless without the card. Subscriber data stored on the card is used rather than the telephone internal serial number. Each WIM card contains a microchip that stores an algorithm that encrypts voice and data transmission and identifies the subscriber to the mobile network as an authentic caller. (Bergeron, 2001)

**Antiviral utilities:** Viruses on mobile phones started to appear in late 2000 and 2001. Hacks created through manipulation of applications can yield a hacker information such as a cell site, carrier and diagnostic information, and possibly even the ability to read mobile traffic through a particular cell site. One of the first known viruses on a mobile phone was the timofonica virus that originated in Spain. This virus used SMS messages to send random people messages and make random, computer-generated phone calls. In the future, with mCommerce transactions gaining in popularity, viruses such as this could move money from the victim's account to the hacker's account, for example. Several products on the market address some of these problems. According to the Gartner Group's John Pescatore (Gartner Symposium/ITExpo, Florida, October 2000), phone viruses will not appear as a major threat until 2005. In the interim, care will have to be taken to avoid viruses at the server level.

In anticipation of the inevitable wave of virus attacks on wireless handheld devices, a number of companies have developed antivirus utilities designed specifically for wireless PDAs. Until wireless devices have sufficient memory and bandwidth connectivity to the Web, the main threat from a virus is to use a handheld device as a carrier. In other words, a handheld wireless device can become infected with email attachments and files that do not damage the device, but are passed along to a PC and the network to which it is connected when the device is synced. Following this line of reasoning, McAfee offers a product, VirusScan Wireless, that is designed to keep Palm OS, PocketPC, Windows CE and Symbian EPOC handheld devices from transmitting viruses while they are being synchronized with a desktop system. That is, their product executes on the desktop, assuming wireless devices will not be downloading applications...
through slow-speed wireless connections. Examples of first-generation products introduced for wireless-
Web-enabled PDAs and cell phones are InoculateIT for Windows CE devices by Computer Associates, F-
SecureCorp’s Anti-Virus for EPOC for devices compatible with the Symbian EPOC standard, and a Palm-
only antivirus utility from Synnatec Corp. (Bergeron, 2001)

Protection from Theft of Mobile Devices: Wireless communications are inherently less secure than wired
communications: Not only must the transactions be secure from eavesdropping, but someone with a stolen
wireless device must be prevented, through the use of some type of personal identification verification
system, from directing the financial transactions of others. There are several methods mobile device
manufacturers have devised to mitigate damage due to physical loss of a mobile device. One of these is
encryption software that encodes information protected by a PIN code or password. The others are power
lock codes that are PIN codes that are required as soon as power is turned on the device and physical
cables that have cable cradles that can secure the device that some PDAs, such as Palm Pilots have.

One interesting method Dutch police have used in the theft of mobile phones is the SMS message bomb. Through some basic research, police can determine the unique number identifying the stolen mobile phone and send SMS messages every few minutes with notification that the phone has been stolen. With
such a defense mechanism, it is much harder to resell the phone at this point.

Some cellular phone systems have a security measure against handset theft: You need the
physical phone and an access code to make calls on a particular cellular account. (Schneider, 2000)

Attacks on the operating system: Attacks on the operating system of a device are common for wired
devices. Generally, wired devices have full-featured operating systems and thus pose many security risks.
On the other-hand, mobile devices generally do not suffer these problems because the operating system
does not get overwritten or replaced. In addition, mobile devices have stripped-down and very basic feature
sets (to conserve space and increase speed).
The easier it is to transmit and receive data, the more likely it is to get a virus or some rogue code. (Charny,
2003)

VPN: One mechanism for protection of mobile network communication is the use of VPNs (Virtual Private
Network) for mobile networks. (Raina, 2002)

Wired Security Concerns: MCommerce transactions flow over the Internet. Therefore, the same security
issues are common to both mCommerce and eCommerce applications.
For mCommerce, a gateway or PKI portal is required to convert from the use of WTLS certificates to a
regular SSL connection. This is the only unique aspect of mCommerce versus wired eCommerce for the
Internet component. After the transactions flows past the gateway, it is then carried over the Internet just
like any other transaction, including eCommerce transactions. Every mCommerce implementation will
require a link back to the wired world. Thus, security issues for the traditional wired world still affect
mCommerce. (Raina, 2002)
Spoofing and Sniffing: Spoofing is setting up a fake site or set of data that look authentic. Sniffing is the ability to read data that passes over the Internet. In the mobile world, with phones and PDAs being increasingly used to access corporate and private networks, it is possible to put a sniffer program onto a mobile device through some type of Trojan horse. From this, the sniffer program could capture account or personal information and perhaps even Pin codes used to access the device itself. The biggest risk of this is in the always-on mobile networks planned for the future.

Many second-generation cell phones in the United States falls under a category called "spread spectrum". An advantage of using spread spectrum modulation for cellular communications is that it deters eavesdroppers because the signals are encoded and difficult to intercept. Communications systems based on spread spectrum technology (DSSS, FHSS) are uniquely suited for applications requiring privacy, signal covertsness, interference rejection, selective addressing and multiple access- all of which apply to wireless Web communications. Unlike cryptography, spread spectrum communications not only conceal the message but the sender's identity as well.

The only way to mitigate the risk of eavesdropping or sniffing is to encrypt data. There are many tools available to encrypt data. Microsoft Outlook, a popular mail package, allows for the use of digital certificates to encrypt mail in transit. SSL certificates can protect data in transit during a web commerce session. (Raina, 2002)

Risks from Stolen Credit Card Payments: Most credit card companies consider an mCommerce transaction to be a person-not-present transaction. This means that the physical identity of the buyer has not been confirmed, lacking a physical signature, as would be required when a person physically presents a credit card. In these cases, should the transaction be disputed, the merchant bears the loss. This means that in a security compromise of credit card numbers, for example, a merchant may inadvertently accept a stolen credit card and then have to bear the cost of loss of goods shipped or services performed. (Raina, 2002)

Fraud Detection: Most good payment processors provide some type of automatic fraud detection capability. Such detection consists of an automatic scoring system calculated based on the transactional and credit card holder buying pattern. Using this score as a basis, the merchant can then decide whether or not to proceed with the transaction.

Biometrics: Companies that develop other security measures such as personal identification verification through biometrics – the use of a thumbprint to validate a credit transfer, for example- have opportunities as well. The challenge for these companies is to provide secure transactions on enough devices. A number of manufacturers, such as SONY and Motorola, offer optical fingerprint identification units that can be used with wireless laptop computer systems. (Bergeron, 2001)

Risks of Always-On Services: Security implications for always-on devices are more complex than for other types of systems. Mobile devices, if they are always connected to the Internet, increase their exposure to being discovered and hacked. The use of always-on devices creates the need for mitigation techniques such as virus checkers and personal firewalls for mobile devices. (Bergeron, 2001)
Database Concerns: In any mCommerce transaction, a database is an essential application component. Transactions must be displayed, logged and resolved. Generally, databases provide mechanisms for error recovery and data rollbacks to compensate for dropped connections. In a mobile environment, data connections are dropped frequently. Such erratic connection behavior is due to signal loss, cell site handovers and operator disconnection. Limiting transparency by keeping the user informed of disconnects, reconnects and data operations can keep users aware of the state of their data security. If data is being read or written to, then it may be worthwhile to ensure that the database is automatically locked from changes when a disconnection occurs. (Sadeh, 2002)

Spamming: Organizations as diverse as the World Wide Web Consortium (W3C) and the Mobile Marketing Association (MMA) are attempting to define standards that will help preserve the privacy of wireless users and prevent spamming. (Sadeh, 2002)

Security Technologies:
Encryption makes even sensitive transactions like stock trading and bank account management relatively safe on wireless devices.
Computational processing need for encryption is reduced by elliptical curve cryptography (ECC). ECC is based on a complex mathematical problem, making it difficult to break the protection it provides for a set of data. The popularity of ECC rests on the fact that it requires fewer bits (relative to other algorithms such as RSA) for strong protection. Fewer bits imply that the algorithm can be processed more quickly and with reduced requirements for computational speed. In addition, the bandwidth required is reduced because fewer bits need to be passed back and forth between sender and recipient.

PKI: One of the generally accepted methods for creating a secure connection on an open system, like the Internet or the wireless world is PKI (Public Key Infrastructure). The ability to extend confidence through security for mobile devices can be accomplished through the use of public key infrastructure (PKI) technology such as certificates. With mobile versions of these certificates, an adequate solution can be presented to enable authentication, confidentiality, integration and nonrepudiation.

The use of PKI technology on mobile devices can enable users to conduct transactions with confidence. This allows applications such as financial or other confidential transactions to extend outside a typical enterprise. Furthermore, given that there is a legal support for digital signatures in most parts of the world, mobile transactions can be legally binding. (Raina, 2002)

A PKI is composed of a number of systems that include policies, legal practices, and technology to deliver a solution for providing essential features for secure mCommerce or eCommerce. To bundle or protect the public keys of PKI, digital certificates are used. A digital certificate is simply a package with some unique data about an entity. To support digital signatures in the wireless world, the WAP WML Script SignText function is used. This function is part of the WAP Forum-defined cryptographic library. The function defines how a certificate is managed and used. The use of PKI requires heavy computational
ability. Since most mobile devices are optimized for space and battery consumption, the use of standard wired PKI certificates are not practical in mCommerce. For this reason, the concept of Wireless Transport Layer Security (WTLS) was developed.

The traditional wireless PKI system relies on ASN.1 standards to service requests. These standards are too computational intensive for mobile devices. Thus, mobile devices use WML and the WML Script SignText function.

The modern trend is to use the elliptical curve cryptographic (ECC) function, which can perform encryption and decryption with a smaller bit size (that is, using less computational power) without compromising security strength. (Raina, 2002)

**WLTS:** The most important protocol specification for security that the WAP FORUM developed. WLTS server certificates were originally defined in WAP 1.1 and are primarily used to validate the identity of a server and provide an encrypted tunnel for subsequent communication. Encrypted tunnels are point-to-point streams of encrypted data. Encrypted tunnels are formed through the use of the public key to encrypt a randomly generated session symmetric key that can be exchanged securely and then used for subsequent secure communication. (Raina, 2002)

**WIM:** WAP 1.2 defines a method for the WAP Identity Module. WIM allows authentication of a mobile client. WIM, combined with WTLS, provides strong authentication using WAP. WIM is a tamper-resistant electronic computer chip that can reside in the WAP device or in smartcards. Many devices have slots for such devices. WIM can store critical information such as private and public keys used in initiating and authenticating secure connections. (Raina, 2002)

**WAP:** In addition, the use of the Wireless Application Protocol (WAP) to better address the small display size on a mobile device raises another set of security issues. (Bergeron, 2001)

5.1.10. **Localization:**
The challenge of being appealing to customers in other countries is still one of the biggest challenges in the mobile industry. (Steinbock, 2003)

5.1.11. **Price pressure:**
As wireless carriers consolidate, the price they charge for phones goes down. This puts additional downward pricing pressure on manufacturers. (Steinbock, 2003)

5.1.12. **Competitive acquisition of next generation licenses:**
Since acquisition of next-generation cellular licenses throughout the world is very competitive, telecom giants; regardless of their past profitabilities, will have to deal with the debt accrued from acquiring subscribers at a cost of between $350 to $1000 each, including next-generation spectrum licenses. (Steinbock, 2003)
5.1.13. International and domestic political issues:

Opposition to foreign investment in the USA, Europe and Asia, standards organizations, contending with political organizations for limited RF spectrum is a big issue of concern. A significant issue determining the ease of entry into mobile markets is the availability of spectrum. Spectrum availability will determine the number of carriers that can be licensed. In some countries, the limited availability of analogue spectrum has contributed to the migration to digital services.

(Productivity Commission, 1999)

In the wireless business, the standardization has never been only about technology innovation. Nor has it ever been about market efficiency alone. It has always been permeated by the politics of standards, international trade and dynamic competition. (Steinbock, 2003)

With its highly successful i-mode, NTT DoCoMo hit the jackpot in Japan, but old regulatory rules have continued to hinder its internalization. (Steinbock, 2003)

Due to heavy telecom regulation worldwide from the late-nineteenth century to the late-twentieth century, the dual nature of the wireless business - driven initially by public sector and today by the private sector - resulted in complicated industry arrangements. As long as national governments and PTTs drove technology innovation and industry evolution, public policies rather than private strategies determined the winners and the losers. Business was domestic and as much about politics as about markets.

Before deregulation and privatization of the telephone industry, in the United States, AT&T controlled communications; while in Europe, PTTs enjoyed a national monopoly in nation states. Since the 1980s, the roles of these drivers have gradually been reversed in the marketplace. After the global telecom reform in 1998, telecommunications sector experienced market liberalization. Today, firm strategies rather than public policies dictate the winners and the losers. Business is increasingly global and market-driven. Political considerations still play a substantial role, because of the importance of the industry for economic growth and national defense, military, and security policies - as witnessed by the U.S. and worldwide mobile developments after September 11, 2001. (Steinbock, 2003)
The political reasons behind United States falling behind in wireless technology allocation – conflict between wireless and broadcasting technologies:

At the end of the 1940s, the Bell engineers had identified the basic elements of the cellular concept, but the technology remained crude and spectrum was not available.

In the postwar era, the United States allowed the powerful new medium of television to evolve through competition. The ensuing success translated to extraordinary bargaining power, which meant regulatory obstacles against the expansion of the mobile business. In contrast, Western Europe and Japan subjected broadcasting to regulation. These differing evolutionary trajectories had substantial repercussions in the wireless business. In the United States, the broadcasters along with the Department of Defense, captured substantial chunks of the spectrum. In Western Europe and Japan, they did not. As nascent mobile technologies evolved and the first cellular platforms became commercialized, adequate spectrum was available in Western Europe and Japan, but not in the United States. For the 1950s and 1960s, spectrum allocation policies of the FCC were strongly skewed to the broadcasters. Regulators hoped that a new technology solution would allow them to avoid a political confrontation with broadcast interests.

After two decades of industry frustration and policy stalemates, the confrontation between mobile and broadcast interests climaxed in 1968, when a House of Representatives select committee initiated hearings on the “crisis in land mobile communications”. The TV interests had been allocated 87 percent of the available spectrum below 960 MHz. Mobile communication as a whole had received only 4 percent and less than 0.5 percent had been allocated to mobile telephony. (Steinbock, 2003)

The FCC was seeking a technological solution to the need for additional bandwidth, and the Committee ultimately recommended that a substantial portion of the underused UHF TV band (the 800 MHz band) be reallocated to public and private land mobile communications (i.e., cellular and dispatch systems). In 1967 the FCC announced it would study the feasibility of these recommendations and subsequently opened docket 18262 (known as the "cellular docket"), which proposed a frequency reallocation of 75 MHz (taken out of TV's UHF band) for mobile service.

In one of the most contentious proceedings in the history of the FCC, the wireless interests were led by AT&T, GTE, Motorola, the National Association of Manufacturers, the American Petroleum Institute, the American Automobile Association, and a host of lesser-known organizations and industrial interests. They were confronted by the Big Three network (CBS, NBC and ABC) and a number of smaller independent TV stations. The FCC concluded that the congestion crisis could be resolved only by allocating additional spectrum.

The FCC's First Report and Order in Docket 18262 reallocated 115 MHz in the upper portion of the TV UHF band and set aside 64 MHz for "land mobile communication" (i.e., cellular). In addition, 40 MHz were allocated for private mobile services (primarily dispatch), and 11 MHz for air to ground service (which never materialized). The FCC asked for recommendations on how this spectrum could be used most efficiently. The FCC's willingness for the first time to allocate a significant amount of new bandwidth for
mobile radio service moved development efforts back to the front burner. In 1970, AT&T was authorized to
develop and test the cellular concept within a testbed system in real urban conditions in Newark and
Philadelphia. (SRI, 1998, Chapter 4, "The Cellular Telephone")

At the same time, the role and nature of public policy players were changing. While regulatory
struggles dwindled and the role of FCC receded, industry struggles escalated and the role of the
Department of Justice expanded.

In 1970, the First Report and the Cellular Docket established the wireless claim to spectrum, but
partitioning prompted an industry struggle. In 1982, the FCC released another docket instituting licensing
procedures, and the actual licensing began a year later. A total of thirty-five years passed between the
emergence of the cellular concept and the FCC cellular licensing in 1983.

In all three leading markets - the United States, Western Europe and Japan – the regulatory
regimes initially supported the old telecom giants. In contrast, competition policy authorities as well as
Europe's pan-regional policymakers, which had embraced more competitive approaches, used the
emerging mobile business to demolish the old PTT natural monopoly.

In 1993, Congress created the statutory of Commercial Mobile Radio Service (CMRS) to promote
the consistent regulation of mobile services that are similar in nature. At the same time, Congress
established the promotion of competition as a fundamental goal for CMRS policy formation and regulation.
This was progress, but the impact would require time. And since cellular arrived late in the United States,
American companies fell further behind in their efforts to stay close to the productivity frontier. Of course,
industry expansion was extraordinary, but it could have been even more extraordinary. (Steinbock, 2003)

5.1.14. Medical hazard concerns:
There are medical concerns revolving around the potential radiation hazard that long-term cell
phone use poses to subscribers. Reports of possible complications arising from radiation levels emitted
from cell phone handsets have also led to many lawmakers calling for limited or restricted use of mobile
devices. (Steinbock, 2003)

Smaller cell size, better base station antennas and other more advanced technologies will allow will
allow future cell phones to radiate much less power and thus be less hazardous for health.
(Bergeron, 2001)

5.1.15. Traffic hazards:
According to the National Highway Traffic Safety Administration, a significant number of car
crashes occur as a result of drivers being distracted by cell phones and other in-car devices. (Steinbock,
2003)
5.1.16. Wireless fraud:
Location-based applications are also being served in telecom fraud detection. Although complicated techniques have been developed to monitor usage patterns in order to detect fraud and identity cloned telephone numbers, this leaves out the most important step- actually locating the perpetrator. Therefore, location technology closes up that gap by offering the location of the perpetrator, which may then be passed on to the law enforcement authorities.

Mobile carriers have used profiling system to detect fraudulent use of mobile phones. In this type of detection, the historical data of a caller is surveyed, and calls outside of this pattern are flagged as possible fraudulent calls. Automated profiling systems can immediately turn off access if a pattern of fraud is detected. The main drawback to this system is that it is based on historical data and must have sufficient data from which to draw. (Steinbock, 2003)

5.1.17. Standardization issues:
European GSM system operates in the 1.8 GHz band, whereas U.S. cellular and PCS services occupy the 800 MHz, 1.7 GHz and 2.3 GHz bands. The lack of a global frequency standard means that for a European communications company to be successful in capturing the U.S. market, it would still have to deal with dual-band phones because the frequencies licensed for use by the United States and Europe are different even for the same type of service.

Also, United States lacks a consistent wireless standard across the country. Modern devices are capable of handling a variety of protocols so they can be used in different parts of the United States, and with different service providers. For example, OmniSky Minstrel wireless modem designed for the Palm V supports TCP/IP, UDP, PPP and SLIP protocols. (Steinbock, 2003)

5.1.18. Bandwidth, range, power and cost:
The issues of bandwidth, range, power, and cost can be illustrated by examining the typical wireless phone or PDA. First of all, the handheld unit has to be light, the battery must be able to support the energy requirements for several days, the range has to be sufficient to allow the phone to be used indoors and outside of the city, and the phone needs to be relatively immune from interference from other remote control systems or unrelated devices. Finally, for the system to be successful in the marketplace, not only does it need to be easy to use and to be able to provide the proper mix of features, it also needs to be affordable.

Smaller cells means lower cell and handheld unit power requirements for reliable communications, and decreased battery drain and relaxed antenna requirements for handheld units. The downside of using low-power levels is the added expense associated with erecting and maintaining additional cells, especially since a typical cell installation can cost over $100,000, including hardware installation and securing rights to erect a cellular antenna.
Compared to analog cellular networks, digital networks resulted in smaller and lighter handsets that have longer battery life. (Steinbock, 2003)

More than any other factor, battery size and capacity limit handheld wireless device form, function and affordability. Bluetooth devices go into a power-saving sleep mode when there is nothing to communicate.

Although new materials, such as lithium polymer and enhanced titanium are being used to extend battery life a few minutes, the most promising technologies on the horizon make use of old materials in a new way. For example, fuel cells that make electricity by mixing oxygen and hydrogen using a process invented in the mid-1800s, are being replaced in a way that may make the technology economically viable. These zinc-air batteries are being marketed as environmentally friendly, high-energy-density disposable batteries that cost about one-sixth as much as a comparable rechargeable lithium ion battery. Zinc-air batteries are relatively free of the heavy metals found in lithium ion and nickel metal hydride batteries.

The demand for increased energy densities and lower profile cases has been a motivation behind the popularity of encapsulated battery pack designs found in virtually every cell phone and in many wireless PDAs. Encapsulated battery packs are extremely compact, available in a variety of interchangeable sizes and capacities, and are relatively impervious to shock, vibration, moisture, and other environmental factors. In addition to providing for mechanical stability, encapsulation reduces the number of terminals exposed to possible corrosion.

Another promising approach is to advance battery technology indirectly by focusing on the battery's controlling circuitry. These so-called smart batteries use embedded microprocessor chips to control their charge and discharge rates, thereby extending battery life. This technology has been applied successfully in laptop computer battery designs.

Processing power can be measured in millions of instructions per second (MIPS). The higher the number of MIPS, the faster the processor. The lower the MIPS-per-dollar cost, the more MIPS a vendor can provide. More MIPS means more complex applications can be made available. With dropping costs and miniaturization of electronics, it's becoming possible to provide enough processing power to handsets and phones to allow them to perform like desktop computers. (Sharma, 2000)

5.1.19. Tension between form, function and affordability:

Developing successful wireless technologies require adequately addressing the tension between form, function, and affordability from both the customer and operator perspective.

The features and affordability of any wireless system depend to a great degree on the nature of the underlying infrastructure – the communications network that provides the support and connectivity to resources on the public telephone network and the Internet.

Form: Form issues of wireless technologies can be classified as size, weight, screen size, shape, color, user interface, screen characteristics, antenna, audio capabilities, style and design.
User friendliness (the user should not have to navigate through many screens to trigger a transaction) and the convenience (application should not cram lots of text onto the device's limited display) of the wireless device are important and are at the moment, limiting factors to the success of mCommerce.

Unlike the traditional wired Internet, m-commerce can only be successful by personalization-presenting customers with services that are relevant to their current locations, activities and surrounding environment.

Thought by some to be the ultimate user interface design, wearable communications and computing are supported by advances such as the development of flexible integrated circuits that can be wrapped around bracelets, including image sensors and displays. For the consumer market, Philips and Levi Strauss developed the ICD+ jacket with a GSM, voice-controlled cell phone, MP3 player for playing music downloaded from the Web, a headset, and a remote control. Nike has integrated MP3 players into their sportswear line and Motorola and Swatch Group have developed telephone wristwatches.

In the commercial area, wearable computers have a more significant impact, especially where ergonomics, efficiency and throughput are driving factors. For example, Symbol Technologies manufactures a wearable scanning and computing system that is used by virtually all UPS warehouse workers to tag packages for tracking. (Bergeron, 2001)

The current limitations of screens on wireless devices are their size, resolution, and color capabilities, all of which are usually less than those found on desktop computers. These limitations make it difficult to display large amounts of text and graphic-based output (e.g., maps, charts, or Web pages). A study by Jones et al. (1999) found that users in a "small screen" environment (simulated by setting monitor resolution to 640x480 pixels) were less effective in completing search and retrieval tasks than users with a "large screen" environment (1074x768 pixels).

There are, however, some recent technological developments that may address some of the disadvantages of current wireless device screens. Flexible screens are on the horizon, which may eventually allow screens that can be rolled or folded up. E Ink (www.eink.com) and Gyricon Media (www.gyriconmedia.com) are developing displays with electronic ink technology (e-paper), first in black and white, but possibly in color in the future. The screens hold an image until voltage is applied to produce a new image, using less overall power than LCD screens.

Monocular units or goggles can be used with magnifying glasses to enlarge small displays (less than an inch diagonal) so that they look like an 800 x 600 resolution monitor. Goggle-type products include InViso’s eShade (www.inviso.com/products), Sony’s Glastron (www.sony.com/products/av/glasstron), and Olympus’ Eye-Trek (www.eye-trek-olympus.com, see Figure 4). Microvision (www.mvis.com) is developing a device that projects an image, pixel by pixel, directly onto the viewer’s retina. Heads-up displays, which have seen limited use in automobiles in the past, might also be used for vehicle-mounted devices. These types of devices allow viewing of color images with similar sizes and resolutions as those found on desktop computers. Potential concerns with these technologies include
interference with users' other visual inputs, and the social acceptance of wearing and using such technologies.

Pascoe, Ryan, and Morse (2000) formulated and discussed two general principles for mobile interface design. The first is Minimal Attention User Interfaces (MAUI), which seek to minimize the user's attention (but not necessarily the number of interactions) required to operate a device. The second is context awareness, in which the mobile device assists the user based on a knowledge of the environment. (Mennecke & Strader, 2003)

![Figure 12. Olympus' Eye-Trek Device (Mennecke & Strader, 2003)](image)

**Function:** The function issues of wireless technologies can be classified as mobility, battery life, operating modes, voice quality, security, coverage area, roaming, cell radius, efficiency of spectrum, privacy, response time and deployment time. (Bergeron, 2001)

Response time of the wireless services is also very important for success in the mCommerce arena. Customers are more likely to abandon wireless internet sites that have poor response times. For example, slow performance of an Internet-based stock trading system may seriously affect the success of the system. (Rajput, 2000)

**Affordability:** In mid-1970s, the price of mobile equipment extended from a high of $4,100 to $4,500 in West Germany to a low of $1,000 to $2,000 in Sweden. Prices in the United States occupied an intermediate zone of $2,100 to $2,500. Monthly mobile service fees in the leading European markets were not that different from those in the United States ($100-$120) but were higher than those in smaller European countries. (Steinbock, 2003)

The Nordic low-cost, high volume service orientation was critical to the success of digital cellular in Western Europe in the early 1990s. In Japan, it formed the foundation of NTT DoCoMo's mass-market-driven strategy around mid-decade. Due to the delays in digitalization, it arrived in the United States as AT&T's innovating pricing scheme only in 1998. It surfaced again in China around 2000 and 2001 to facilitate the growth of the world's largest user base (China Mobile, China Unicom, China Telecom).

In addition, instead of pushing novel technologies and complicated pricing offerings, Vodafone promoted simple, convenient and affordable policies by introducing its "Pay As You Talk" digital package,
which offered no bills, no credit check, no fixed-term contract and advanced digital services. (Steinbock, 
2003)

Some handset manufacturers are now offering disposable phones with fairly minimal functionality 
and a fixed amount of time. (Sadeh, 2002)

The technology involved with wireless communications is reflected in the value subscribers and 
operators place on a particular mix of these three traits. For example, Iridium satellite communications 
system, with its brick-size handheld unit, and the lackluster appeal of the feature-packed and overly 
complicated PDAs that predated the Palm Pilot demonstrate how failure to adequately address form, 
function, and affordability can make the difference between global success and catastrophic failure.

NTT DoCoMo’s i-mode succeeded because it kept things simple: “The mobile Internet contents 
must be simple, due to small screens and keypads found on mobile phones.” (Steinbock, 2003)

5.1.20. Competition with European/Japanese market:
In Europe, lack of high speed wired network access is seen as an opportunity for Wireless Local 
Loop (WLL) access. Europe has the advantage of the GSM continentwide standard. European cellular 
carriers are barred from subsidizing phones by passing costs on to subscribers. Japanese DoCoMo’s i- 
Mode, which has saturated the Japanese market, offers subscribers a constant online connection without 
the hassle and delay of dialing in. Not only has NTT DoCoMo created the world’s smallest, most 
sophisticated, feature-laden handsets, it is also the first operator to introduce third-generation (3G) cellular 
using the same communications standard that will eventually be deployed throughout Europe.

Cell phone penetration is more than 60 percent in the Scandinavian nations and more than 40 
percent in Italy and Austria, compared with less than 30 percent in the United States, according to the April 
special report on European wireless in Red Herring magazine. The penetration of wireless services in 
Europe are so great that there are more wireless accounts than fixed phone lines in Austria, Italy and 
Finland. That said, however, there is no guarantee that the dominance of Europe will continue. Faster, 
more stable technologies are emerging on the global market, and while Europe has to wait for government 
approval for adoption, U.S. companies have the independence to innovate without government restriction. 
(Steinbock, 2003)

5.1.21. Controlling the expanding international operations:
The key issue for many globalizing firms is how they should organize the expanding international 
opérations. In 1972, two pioneer researchers of internationalization, Stopford and Wells, presented a 
“stages model” to explore the structural evolution of multinational companies in the course of their 
globalization. In this framework, firms often first manage their international operations through an 
national division. Foreign sales still play a relatively small role in total sales, and product diversity 
remains low. Subsequently, multinationals tend to exploit one of the two alternative paths to expand in 
overseas markets. Some expand foreign sales without increasing diversity. These firms embrace the “area 
division” structure. Others increase product diversity without expanding foreign sales. They adopt the
"worldwide product division" structure. Finally, third ones manage to expand foreign sales and increase product diversity. They favor a "global matrix" structure. (Steinbock, 2002)

5.1.22. Coverage issues:
Unlike the situation in Western Europe, there is no single domestic cellular or PCS system that provides uninterrupted coverage from coast to coast. From an economic perspective, covering an uninhabited stretch of desert in Arizona may not have a reasonable return on investment, compared to covering a big city. The lack of nationwide coverage in the United States is, in part, due to wide variations in population densities. Europe, being more densely and uniformly populated than the United States, can expect a reasonable return on investment for virtually every cell on the continent. Since there are very few sparsely populated areas in Western Europe, mobile operators can reach more subscribers with a smaller investment in the cellular network. (Raina, 2002)

5.1.23. Personalization:
Most WAP phones today do not support cookies. Therefore, content providers are unable to provide any personalization. Because carriers control the gateway and unique user information such as mobile number and phone ID, they are best positioned to customize and personalize content. At least, until the next generation of phones that support cookies show up, the carriers can use this to their advantage to maintain their handle on the mobile customer. (Raina, 2002)

5.1.24. Consumer payment model:
Consumer payment model of mobile services is a distinct consumer driving force. In the United States, for most mobile operator services, both the user making calls and the one receiving calls pay for the communication. In Europe, however, only the call-making user pays for the charges incurred. The receiver does not pay anything; thus making the user more inclined to keep the cell phone on all the time. Prepaid cellular phones have also become very popular among young people, thus creating a personal mobile channel to a huge consumer market, many of whom may not be fixed Internet users. In both of these aspects, Europe seems well ahead of United States and United States should try to overcome the pricing barrier for incoming calls and should spread the usage of prepaid cellular phones in order to have competitive power with the already established European wireless market. (Raina, 2002)

5.1.25. Cumbersome mobile messaging:
Mobile messaging via cell-phones is currently very cumbersome to use. E-mail reply mechanism via cell-phones should be improved from the current cumbersome numeric key or letter clicking method to perhaps a voice-recognition mechanism that converts spoken words to text. Mobile e-mail also should provide the ability to view images and document attachments. Also, cell phones should be enabled to forward mobile e-mail or propagate mobile content among user groups and individuals. (Raina, 2002)
5.1.26. Limitations of voice-enabled mCommerce methodologies:

Currently, voice-enabled mCommerce methodologies have a lot of limitations. Customers dialing into an automated voice-menu-driven phone system have to go through a series of complex inputs to get to their goal. A possible solution is a voice interface driven by predefined questions and comments. MCommerce services can then recognize common voice inputs and respond to them accordingly. American Airlines' flight booking system offers such a voice-command option for basic services such as flight arrival and departure timings and other inquiries. (Raina, 2002)

Voice- recognition limitations include the need to train devices to recognize a user’s voice, the relative slowness of voice versus other input means, and the difficulty in using visual information (e.g., graphics) with voice input.

5.1.27. Risk of privacy:

Always-on handset is not something that every mobile user is enthused about. It’s possible using modern tracking technology to determine the precise location of a wireless handset whenever it is operational. It is also possible that such information may have to be made available to law enforcement agencies and emergency services organizations by the carriers. WASPs may also be able to receive location information from the carriers to enable them to target and enhance their products. Such types of data consolidation will undoubtedly present a serious risk to individual privacy, since its consolidation will provide hitherto unavailable specific information about the movements of a cell-phone and hence its user. (Raina, 2002)

To ensure commercial success of mobile location services, user trust must be ensured. A clear prerequisite of the trust-building mechanism is that the control over the use of location information is always on the hands of the user, not of the network operator or the service provider.

To minimize the risk of unethical behavior and its impact on profits, businesses should actively engage in the creation of an effective mechanism for industry self-regulation.

A number of industry groups have formed in response to consumers' e-commerce data privacy concerns. Among the best of these groups are the Network Advertising Initiative and the Wireless Advertising Association (http://www.waaglobal.org), each of which has connections with the Online Privacy Alliance (http://www.privacyalliance.org). (Mennecke & Strader, 2003)

5.1.28. Integration:

Integration between disparate technical platforms and with legacy appliances and applications will be the greatest challenge facing the mCommerce world. (Raina, 2002)

Mobile Synchronization Protocol, known as SyncML, is a new industry initiative to develop and promote a single, common data synchronization protocol that can be used industrywide, across multiple devices and applications. The founders of the initiative and the SyncML Forum are IBM, Lotus, Motorola, Nokia, Palm, Psion, and Starfish Software. The goals of the protocol are: supporting synchronization of any networked data with any mobile device, operating effectively with both wireless and wireline networks,
supporting a variety of transport protocols, enabling data access across a variety of applications, address the resource limitations of the mobile devices and building on existing Internet, Web, and wireless technologies. (Sharma, 2000)

Figure 13. The integrated technology ecosystem (Sharma, 2000)
CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH

5.1. Conclusions:

This thesis focuses on examining the factors leading to the success of mobile commerce as well as factors that may hinder its success.

In the first part of this thesis, an analysis of wired e-commerce businesses is made; followed by advantages of mobile commerce over wired e-commerce. Mobile Commerce will be more successful than wired Web E-Commerce in the US in the future mainly because wired web E-Commerce have provided the businesses familiarity and necessary tools with the technology and the precautions that they have to take against any vulnerabilities of their businesses. New mobile technologies, services and business models are quite different from traditional (wired) e-commerce. Mobile phones and PDAs impose very different constraints than desktop computers that will gain advantage in comparison to wired e-commerce.

In the second part of this thesis, new wireless business models that are expected to generate substantial revenue flows as well as some successful examples of these business models are discussed. As can be understood from this section, wireless business models are developing at a great speed, and they will be pouring a great amount of cash flow into the M-Commerce industry.

In the third part of this thesis, advances in wireless technologies that will lead to the success of mobile commerce are discussed. With 2.5G / 3.5G technologies, providers could craft more sophisticated and heterogeneous service concepts.

In the fourth part of this thesis, competition strategies and revenue structure of mobile commerce are discussed. It is the $320 billion market pie (2010 estimate) that serves to intensify growth strategies of the mobile leaders while accelerating the entry strategies of the IT leaders - thus pushing the two strategic groups into a collision curve.

And finally, in the fifth part of this thesis, drawbacks of wireless technologies towards the success of mobile commerce as well as how they can be overcome are discussed. The limiting factor in propelling the wireless Web into everyday reality is establishing a standard, secure, affordable, universally accessible, high-speed infrastructure to support Web-enabled devices.
5.2. Recommendations:

Based on the research for this thesis, the recommendations for business owners transforming their business to a wireless platform are as follows:

Mobile commerce provides potential for fundamental benefits such as improved efficiency and effectiveness of businesses. This level can be achieved when businesses go beyond simple mobile access and reform their operations using wireless features in a holistic manner. However, the implementation of mobile businesses in enterprises will be incremental. It will be slowed down by technical, business, and organizational factors affecting the enterprise and the wireless industry.

In order for the wireless business model to be successful, the business model should be demand-driven rather than technology-driven. Clear market research should be done to anticipate the demand for specific wireless technology integration models. If there is no consumer demand behind a technology, or the technology application has strong substitutes, then implementation of that technology should be frozen until new indications of consumer demand in the future.

On the other hand, the profit model of the technology implementation should also be considered. If the technology does not allow a business model that clearly indicates revenue sources that are going to be obtained from going to a wireless business model, then better technologies for this business model should be investigated.

Next, the business owners/managers should look at Chapter 2 of this thesis and investigate how to implement each business model to their own businesses as appropriate. They should look into the examples of some successful wireless companies and try to compare and contrast themselves with these companies. They should estimate the success of their corporation by comparing themselves to the success/failure stories of these predecessor corporations.

For a particular technology to be implemented successfully, all pros and cons of the technology should be evaluated before choosing the right technology. A technology by itself does not promise much success. In this case it is important to investigate the partnerships involved in this technology. The ability of software and hardware vendors supporting the technology should be investigated as well as taking into account the factors hindering the future success of these technologies such as security and privacy.

If the self-regulatory efforts of those engaged in wireless businesses lead consumers to believe that they have true protection that provides them with control over their personal information, control over who has access to their persons and control over who can focus attention upon them, it is believed that they will not press for additional privacy legislation. Companies that want to integrate wireless technologies into their business models should be careful about getting consumers' consent before using any of their private customer information for profit. To minimize the risk of unethical behavior and its impact on profits, businesses should actively engage in the creation of an effective mechanism for industry self-regulation. Otherwise, they face the risk of either losing their business because of mistrust of consumers or legal charges against them.
There is a trend towards wireless corporations' forming partnerships with other businesses to create a horizontal market in order to rapidly grow towards earning more market share from the wireless revenues. The biggest problem that mobile commerce faces towards its future success is the fact that there are too many wireless technologies and business models that are incompatible with each other. This prevents the current mobile technologies from forming with horizontal business models.

One of the reasons for disappointment in m-Commerce is expecting miracles from it. Companies with already established business models should see m-commerce as another medium to enhance their brand and services and integrate their old business with wireless technologies rather than building a pure, brand-new m-commerce model with great uncertainty.

M-commerce companies that are best able to provide value-added user experiences are expected to achieve long-term success. Some objectives for businesses to go mobile include the following: to conduct ubiquitous transactions, to provide timely information, to increase sales, to improve customer service, to enhance customer relationships and to reach new market segments.

Critical mass theory states that individuals who have access to multiple communication media will generally use the medium most widely available within their communication community, even when it is not the medium they prefer. These show that as mobile technologies are becoming more and more popular, it is gaining a critical mass where users will feel socially obligated to get involved more and more in mobile transactions.

One of the threats to the success of m-commerce is that complicated mobile technologies make consumer adoption harder. The use of relatively uncomplicated services should be encouraged, such as information services similar to SMS services. Customer acquaintance to this category of m-services will lower the barrier to exploit other wireless services.

Location Based Services (LBS) also open the possibility for true interaction with a local customer. In an e-commerce setting, marketers must simply hope that a customer will click to a page or an ad. The new technologies allow marketers to reach out to consumers, sending messages directly to them without any specific customer request. Thus, in LBS, the marketer can initiate the interaction, and if a consumer chooses to respond, she will have the opportunity to engage in synchronous communication. The possibility of real-time two-way communication will engender new opportunities and challenges for marketers. The degree to which operators are successful in localizing services for users, responding to user preferences, as well as pricing and ease of integration with existing services will determine their competitive advantage.
5.3. Future Research:

This thesis is a thorough research on the factors affecting current and future success of mobile commerce. Numerous possibilities exist for extension of this thesis in the future:

- A thorough analysis of the effects of regulations and international standardization issues governing mobile commerce
- The success of mobile commerce can be judged with a similar analysis of mobile companies’ revenues and try to find why they performed better/worse than expected with this thesis.
- The future technologies can be compared to the technologies discussed in this thesis.
- Solutions to wireless security issues can be discussed in detail.


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