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### Korea's Lead in Mobile Cellular and DMB Phone Services

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## KOREA'S LEAD IN MOBILE CELLULAR AND DMB PHONE SERVICES

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### ABSTRACT

Now that the number of cellular phone subscribers is over 1.6 billion in the world and over 180 million in the United States, it is an appropriate time to consider Asia, the "new" wireless economy, with respect to mobile telephony. Several major cellular phone service providers chose Korea as a testing ground to assess the effects of third generation (3G) technology and deployment. Several Korean mobile carriers plan to roll-out the world's first handset-based satellite digital multimedia broadcasting (DMB) services via cellular phones. This letter presents a status report on cellular phone services and applications in Korea. It also describes nine major factors influencing Korea's status as a leader in mobile cellular phone and services. An important influence is the younger generation of cellular phone users in Japan and Korea who associate the cellular phone trend with their social status.

**Keywords:** mobile cellular phone service, DMB service, wireless network

### I. INTRODUCTION

Wireless network technologies witnessed exciting innovations in recent years and will continue to represent a rapidly growing sector in the near future. While 3G (third generation) mobile networks offer broadband transmission with speeds of up to 2Mbps in faster areas of the world, other countries (including the U.S.) lag behind offering only "kbps" speed.

3G wireless access systems provide basic data services together with voice and messaging capabilities. At this time, telecommunication vendors and service providers from various countries (e.g., Japan, Korea, China) are researching and developing a true broadband wireless cellular system, known as 4G.

Asian countries such as Japan, Korea, and Hong Kong once lagged behind the West in information technology. Despite late development and entry into the market, Asian wireless operators have been able to become global leaders with the implementation of the 3G technologies and with the assistance of government policy. NTT DoCoMo, a primary Japanese 3G carrier, rolled out the world's first 3G services in Japan. 3G service is disruptive technology in that it allows for 3D games, videoconferencing, full motion videos, and high-speed Internet access on full roaming mobile phones.

In Korea, the dominant mobile service providers are SK Telecom, KTF, and LG Telecom, of which SK Telecom is the dominant service provider with a 52% market share (Table 1).

Table 1. Cellular Service Providers in Korea

Provider	Subscribers (millions)	Market Share (%)
SK Telecom	18.6	52
KTF	11.8	32
LG Telecom	5.7	16

Note: As of July 2004.

Source: [http://www.sktelecom.com/english/down/The\\_FKI\\_Korean\\_Corporate\\_Global\\_Roadshow.pdf](http://www.sktelecom.com/english/down/The_FKI_Korean_Corporate_Global_Roadshow.pdf)

The Korean penetration rate of cellular phones and mobile services is the highest per capita in the world. Nearly two-thirds of Korean mobile phone users switched to 3G handsets. These handsets offer speeds of up to ten times that of mobiles in the U.S.

This letter presents a report on the current status of cellular and DMB phone and services in Korea. It compares Korea to other countries and evaluates nine factors that affect Korea's lead in cellular mobile business and application (Section V).

## II. CURRENT CELLULAR AND DMB PHONE SERVICES IN KOREA

Several recent studies [Budde, 2002; Jacobs, 2003; Shim et al., 2004] show that Asia leads the world in every segment of the telecommunications market: broadband growth, mobile applications, Internet growth, subscriber growth, and short message services (SMSs). People in China, Hong Kong, Japan, Korea, Taiwan, and Philippines are amongst the most enthusiastic users of telecommunications in the world. Table 2 provides statistics on Internet users and percentage of users around the world. Collectively, Internet users in Asia accounted for 32.6% of the world market.

Table 2. Internet Users & Percentage of Usage in the World

PLACE	NUMBER OF USERS (millions)	PERCENTAGE OF WORLD USERS
<b>Asia</b>	<b>267</b>	<b>32.6%</b>
China	94	
South Korea	32	
Japan	68	
Hong Kong	5	
Taiwan	12	
Philippines	3	
India	18	
<b>North America</b>	<b>218</b>	<b>26.7%</b>
USA	202	
<b>South America</b>	<b>38</b>	<b>14.0%</b>
<b>Europe</b>	<b>231</b>	<b>28.3%</b>
Middle East	17	
<b>Africa</b>	<b>13</b>	<b>1.6%</b>

As of February 3, 2005.

Source: <http://www.internetworldstats.com/stats3.htm>

The mobile cellular industry in Asia remains one of the fastest growing markets in the world. Given the total mobile users and their penetration, while the U.K., Korea, and Finland are countries ranked highest with over 75% penetration of mobile devices (Table 3), Japan and U.S.A. have 68% and 58% penetration of mobile devices respectively. Table 4 lists the six largest cellular handset suppliers in the world. Of these two, Samsung and LG Electronics are Korean companies. Mobile growth in Asia is twice, sometime three times, that of Europe or North America [Budde, 2002]. Growth is especially apparent in those cultures, such as Japan and Korea, where leading edge consumer services and technological innovations are particularly valued.

Table 3. Total Mobile Users in Various Countries

Country	No. of users (in millions)	Penetration(%)
Japan	87	68.0
Korea	37	76.7
USA	171	58.4
Finland	4	75.0
China	330	25.4
U.K	53	87.8

As of 2004.

Source: <http://www.umtsworld.com/industry/Subscribers.htm>

Table 4. Six Largest Global Cellular Handset Suppliers

Manufacturer	2004 Sales Forecast (millions of units)	Market Share (%)
Nokia(Finland)	205	31
Motorola(U.S.A)	99	15
Samsung(Korea)	89	13
Siemens(Germany)	50	7
Sony	42	6
Ericsson(Japan/Sweden)		
LG Electronics(Korea)	39	6

As of November 11, 2004.

Source: <http://www.itfacts.biz/index.php?id=P1999>

## DMB

Digital multimedia broadcasting (DMB) cellular phones from Korea, which began trial operation on January 10, 2005, are the world's first cellular phones that can receive satellite and terrestrial television signals. Korea expects to roll-out terrestrial-based DMB services in May, 2005 [Korea Herald, 2005]. Digital multimedia broadcasting is a process of broadcasting multimedia (text, television images, and videos) over the Internet or satellite that can be tuned in by multimedia receivers or players capable of playing the multimedia program[Scala, 2005]. Table 5 shows the status of DMB services.

DMB began with the United States and European countries developing digital audio broadcasting (DAB) services around mid-1990s [Nyberg 2004; Korean Society for Journalism and Communication Studies, 2003]. DAB, which is broadcast on satellite or terrestrial networks, offers CD-like quality radio programs even in the car without any interference or signal distortion [www.worlddab.org]. The DAB service began in 2001, and then DMB service thereafter. Japan

Table 5. Status of DAB and DMB Services

Country	USA		Europe	Japan	Korea
Service provider	XM	Sirius	Global Radio	MBCO	TU Media(for S-DMB) 6 service providers (for T-DMB)
Number of channels	101 (Audio) channels (music, sports, adult)	102 (Audio) channels (music, sports, news)	150 (audio & data) channels <b>Terrestrial DMB (in Germany)</b>	Terrestrial 9 video channels 55 audio channels 34 data channels	<b>Satellite DMB</b> 14 video channels 24 audio channels <b>Terrestrial DMB</b> 6 video channels 18 audio channels 3 data channels
Receiving device	In-car terminal	In-car terminal	In-car terminal	In-car Terminal	Cellular DMB phone, In-car terminal
Service began	Sep. 2001	Feb. 2002	2005 (T-DMB) (expected)	2005(T-DMB) 2004(S-DMB)	Jan 2005 (S-DMB) May 2005 (T-DMB)

Sources: Korea Times[2005a], Korea Times[2005b],KOREA Research [2004]

provides satellite DMB service only for in-automobile terminals. Korea is the only country to provide a full-blown satellite and terrestrial DMB service on cellular phone while in motion (including in an automobile).

As shown in Figure 1, satellite DMB and terrestrial DMB enable users on the move to receive a variety of contents such as seamless video, CD-quality audio and data through hand-held devices and in-automobile terminals [Republic of Korea MIC, 2003]. Several models of DMB cellular phone devices are pictured in Figure 2. DMB data service is a framework of the following groups:

• data provider	• audio/video contents producer	• DMB producer
• advertiser	• customer	

A schematic view of DMB data service and the components, shown in Figure 3, provides a basic understanding of the general structure of DMB business model. The figure also depicts the interaction of the DMB producer with other groups of DMB data services. For example, the DMB producer provides contents and programs to customers for a service fee. The DMB producer charges an advertising fee to the advertiser, from whom customers can purchase directly for advertised services via the DMB device. The audio/video contents producer and data provider each offer content to DMB producers for a fee.

The mobile handset evolved into the universal remote control which became integrated into a person's daily life: in education, residence, and leisure and entertainment. As listed in Table 6, these capabilities are demonstrated by of the many ways the cellular phone can currently be used in Korea [Fortune, 2004; Shim et al, 2004].

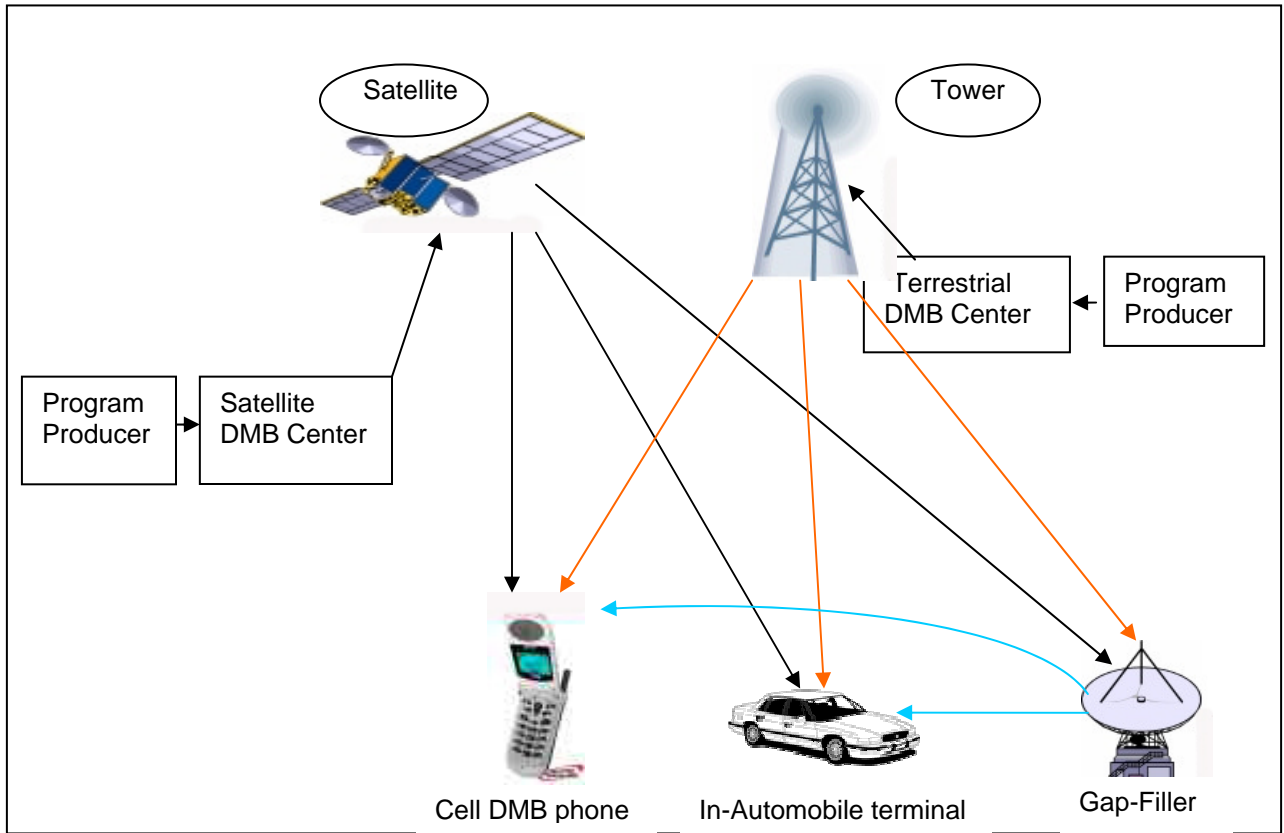
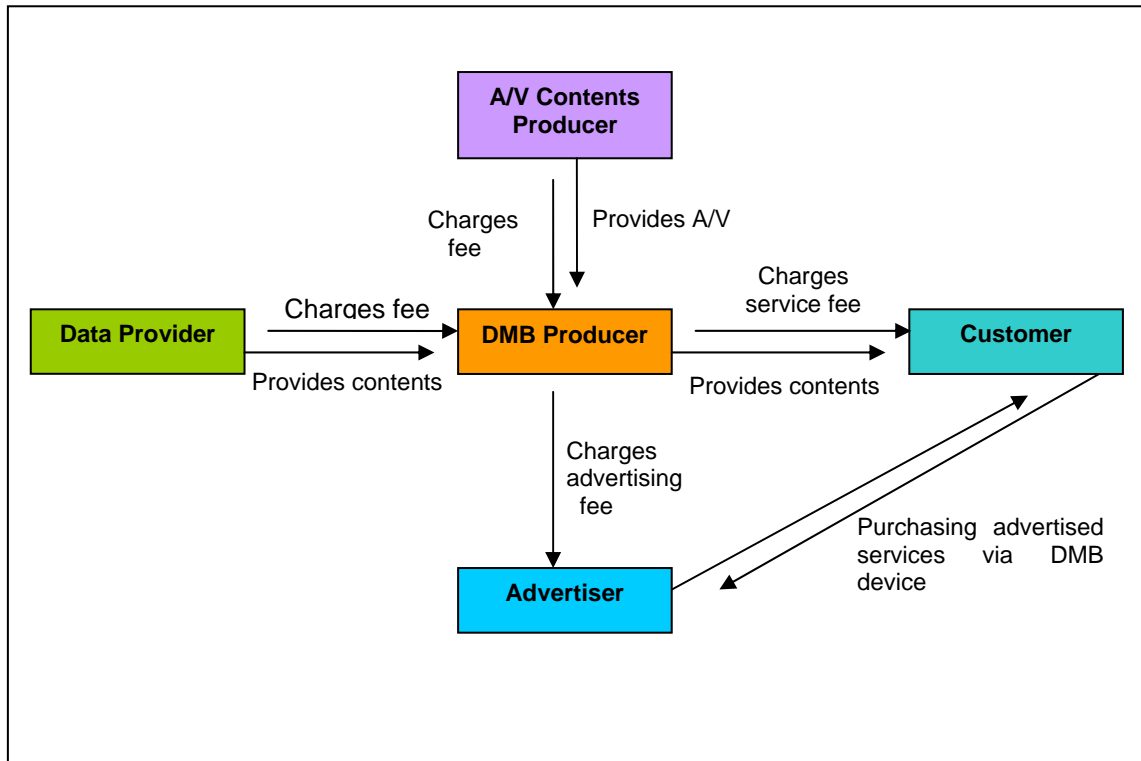


Figure 1. Overview of Satellite and DMB (Digital Multimedia Broadcasting)



Pantech & Curitel DMB ST3; Samsung NEXiO XP30

Figure 2. DMB Cellular Phone Devices



Source: Adapted from [KORA 2004]

Figure 3. A Schematic View of DMB Data Service Business Model

**IV. KOREA’S ROLE IN WIRELESS**

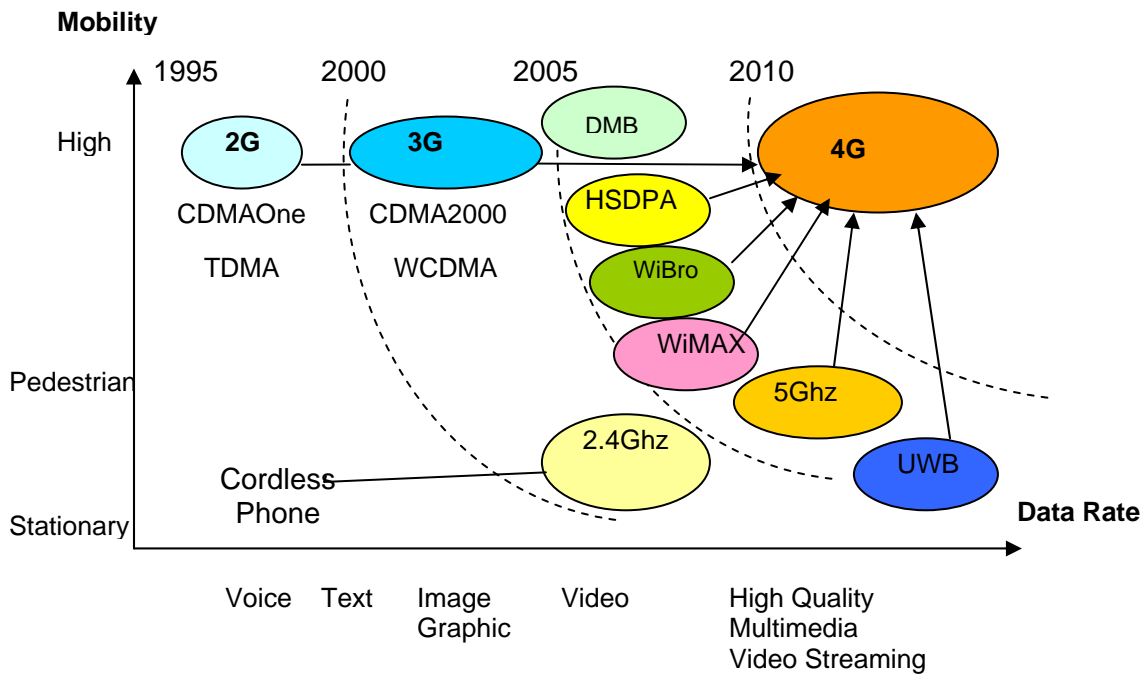
In 2004, several cellular phone service providers chose Korea as a testing ground to assess the effects of 3G technology and deployment. Korea is the world’s leading country in CDMA cellular phone applications [Fortune, 2004]. Despite being without natural resources, Korea is also a major semi-conductor, shipbuilding, automobile, and mobile phone manufacturer [Fortune, 2004]. The wireless broadband (WiBro) standard was recently approved by the Telecommunications Technology Association of Korea. WiBro networks are scheduled to be rolled out in mid 2006 [Republic of Korea MIC, 2003]. WiBro, a portable Internet service, will provide high data rate wireless Internet access with a personal subscriber station in either a stationary or a mobile environment, anytime and anywhere. Figure 4 shows the wireless network evolution.

Table 6. Cell Phone Capabilities in Korea

<p><b>Education</b></p> <ul style="list-style-type: none"> <li>• Receive homework assignments from teacher</li> <li>• Take foreign language lessons</li> <li>• Exam cheating<sup>1</sup></li> </ul>	<p><b>Residence</b></p> <ul style="list-style-type: none"> <li>• Switch on/off home appliances before arriving home (e.g., air conditioner, heater, oven, light)</li> <li>• Control home/car security systems remotely</li> <li>• Download and view movies or TV shows</li> <li>• Watch TV on DMB phone while traveling in automobile or in motion</li> </ul>
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<sup>1</sup> Hundreds of Korean students were under investigation for cheating on the College Scholastic Ability Exam with cell phones in November 2004) [Korea Times 2004a] – [new technology prevents cheating: <http://times.hankooki.com/lpage/tech/200501/kt2005012617542312350.htm>

<p><b>Leisure &amp; Entertainment</b></p> <ul style="list-style-type: none"> <li>• Download songs or “karaoke” music</li> <li>• Interactive mobile games</li> <li>• Download ringtones</li> <li>• Take and send photos and videos to friends and family</li> <li>• Browse the Internet</li> </ul>	<p><b>Daily life</b></p> <ul style="list-style-type: none"> <li>• Check real-time traffic conditions</li> <li>• Access personal bank account with “BankON” chip [“BankOn” chip for mobile banking]</li> <li>• Trade stocks</li> <li>• Locate/ Track your position (location-based services)[Mathew et al., 2004]</li> <li>• Shop/Purchase goods</li> <li>• Pay phone and utility bills</li> <li>• Buy lottery tickets and gamble on mobile phone</li> <li>• Use real-time mobile cellular phone GPS service (e.g., “NATE” GPS service)</li> <li>• Use it as a smart card (embedded electronic transportation card)</li> <li>• Monitor physical/health condition</li> </ul>
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Notes: HSDPA is High Speed Downlink Packet Access in WCDMA  
 WiBro is Wireless Broadband (similar to the IEEE802.16e variation of WiMAX)  
 Sources: Jacobs [2003], Shim [2003], Yoon [2004]

Figure 4. Wireless Network Evolution

**V. FACTORS AFFECTING KOREA’S LEAD IN CELLULAR MOBILE BUSINESS**

Korea’s lead in the cellular mobile business results in part from vision in the Korean business community. Korean “Chaebols” (associations of many firms clustered around a parent company) played an especially key role in cellular mobile. Some chaebols were formed through various support plans initiated by the Korean government.

The author’s analysis indicates that Korea’s lead in mobile technology is the result of nine factors:



### **1. Consumer Behavior**

Most Asian people, particularly Koreans, are culturally similar in their penchant for fashion, brand name retail items, and novelty. The Korean consumers' behavioral patterns are those of "early adopters" of technology, which is crucial when it comes to penetration and adoption of new media. For example, when new electronic products and mobile phones are first released and marketed to the public, the Koreans' lack of self-restraint and zealous tech gadget nature leads them to impulse buying of "must have" toys that contain more bells and whistles.

### **2. A Hurry Up Culture**

Koreans live in an intense, "bbali-bbali" (translation: "speed up and "hurry-up") culture where all processes are speeded up. This view applies to a wide range of behavioral patterns from eating rapidly to repeatedly pressing the elevator button, and of course, acquiring the latest model of mobile phones that will provide high-speed access to the Internet.

### **3. Education Focus**

The Korean parents' primary focus is on their children's education. Although parents may experience financial difficulties, their children's education is a first priority. The parents' support of their children's wants and needs includes not only their children's cell phone bill, but also extends onto the pricey handsets. Thus, the children take advantage of the mobile phones' newest offerings such as tracking services, games, TV channels, camcorder, MP3, SMS, camera, and GPS. The combination of high mobile user subscriber rate and the wide range of services led to the success of Korean mobile service providers. As prior studies show [Fortune, 2004; Shim and Shim, 2003], most Korean youngsters replace their integrated, multi-functional cellular phones every 6 months to a year.

### **4. Pervasive Infrastructure**

The required technology infrastructure is pervasive in Korea. Korea was the first country to commercialize Code Division Multiple Access (CDMA). With standardization, Korea was able to differentiate itself from other countries, such as the U.S., which did not yet select a common interoperable standard<sup>2</sup>. Korea rolled out 3G networks [Fortune, 2004; Dekleva, 2004; Jacobs, 2003; Shim et al., 2004].

### **5. Aggressive IT Planning**

With the Korean government's push and drive to meet huge consumer demand for electronics, Korean chaebols use aggressive IT planning to implement cellular technology and the Internet. Over the past several decades, Korean chaebols (e.g., Samsung, LG, SK) exerted enormous influence on IT and related sectors [Khanna and Palepu, 1999]. In the past year, the Korean government developed an IT strategy implementation plan spanning the areas of services, infrastructure, and new growth engines [Republic of Korea MIC, 2005]. Also, the government is instrumental in stimulating consumer demand. For example, major shopping districts are zoned specifically for electronic gadgets such as the "Yongsansangka" district in Seoul which is similar to Japan's "Akihabara" electronic shopping district.

### **6. Free Incoming Calls**

Unlike the United States, users in other countries do not pay for incoming phone calls on their mobile phones. The users only pay for the usage time in outgoing calls. As a result, users pay little heed to minutes of use.

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<sup>2</sup> Several standards are available, including Time Division Multiple Access (TDMA), Global System for Mobile communication (GSM), and CDMA.

## 7. Subsidies

The Ministry of Information and Communication of Korea decided to allow cellular service operators to subsidize handsets to support development, foster new technologies, and to encourage new services. The Ministry's plans were to offer a subsidy on handsets of up to 40 percent. That is, users were able to purchase the handsets below market price. Handset sales subsidies are now forbidden in Korea.

## 8. Convenience

As shown in Table 2, over 75% of Koreans use the cell phone. Without a cell phone, daily life is inconvenient. Although the younger generation of cellular phone users in Korea associates the trend of cellular phones with their social status, the older users no longer consider the cell phone as a status symbol any more. Cell phone usage (such as unnecessary voice calls and sending photos) and frequent cellular phone replacement boost Korea's cellular phone makers and service provider's mobile business.

## 9. Population Density

Korea is densely populated compared to the widespread and vast land of the West. Thus, it is easy to install "base transceiver stations"(towers) in Korea. The smaller land size and close proximity of towers provide most Korean people with a favorable cell phone experience, particularly excellent reception and advanced voice quality.

The mobile services and applications are beginning to experience some success, because of the Asian wireless operators' close relationship with their equipment makers and their enormous influence over this value chain. The future success of mobile business depends on the wireless application developers' utilization of wireless technology and devices and the delivery of those desired applications to the users.

The cellular phone brings up ethical, privacy, and legal issues. Recently, laws in Japan and other Asian countries banned camera cell phones from public baths (bathhouse). In Korea, hundreds of Korean high school students were under investigation for cheating on a college scholastic ability exam with cell phones. Even though cell phone service poses serious problems, the advantages of cell phone services in education, residence, leisure and entertainment, and daily life (Table 6) outweigh the disadvantages.

## VI. CONCLUSION

In Korea, cellular phones are a lifestyle tool, allowing consumers/users to connect, access, and communicate when they want, how they want, and where they want. Recently, satellite digital multimedia broadcasting (S-DMB) received a great deal of attention. Several Korean mobile carriers plan to roll-out the world's first handset-based satellite DMB services via cellular phones in May 2005. The Korean government is currently in the process of launching ubiquitous computing (u-computing), computer technology that is accessible anywhere, anytime, and from anything [Republic of Korea MIC, 2005]. This development is expected to be extremely beneficial, particularly for users in rural areas and for the physically handicapped. The trend of satellite DMB, terrestrial DMB, u-commerce, and u-business in Asia should play an important role in the near future.

The future of Korea's cellular business industry is bright. The following capabilities should be available shortly:

- HSDPA (high speed downlink packet access which provides up to 10Mbps)
- UWB data services (802.15.3a standard which provides up to 480Mbps).
- Two categories of 3G are available:

-WCDMA 3G standard including UMTS

-CDMA2000 3G standard supported by Qualcomm

The introduction of DMB cellular phones and services, WiBro service, telematics (in-vehicle multimedia) service, RFID (radio frequency identification) services should be popular and will stir up competition within the telecommunication and related companies to produce more compatible and sophisticated devices. The multimedia content creators can use this opportunity to create value-added business. DMB cellular phone technology can allow a great number of government officials to stay informed on critical information in the event of an emergency or national disaster. By contrast, it will take a while to obtain DMB cellular phone services in the United States, since technical, standards, and logistical barriers need to be overcome first.

Of the nine factors listed in Section V, the author believes that the government commitment and push for IT strategy and long-term goals are one of the most important factors to advance a country's cellular mobile business, particularly for less developed countries. The cellular mobile service industry's issues are complex and span technical, logistical, social, and cultural dimensions. Therefore, cellular and network service providers, service developers, and equipment makers need to collaborate with the government and users/consumers to create growth in the cellular telecommunications industry.

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## REFERENCES

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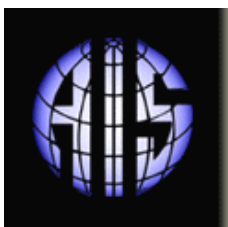
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