The Domestic Trap versus the Launchpad:

The Political Economies of Wireless Telecommunications

in Japan and South Korea

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Abstract

The wireless telecommunications markets of Japan and South Korea both developed rapidly, offering extremely sophisticated and advanced wireless services. Yet, their fortunes in international markets diverged significantly – while Japanese firms retreated to become virtual non-players, Korean firms became top global handset manufacturers.

This paper argues that the politics of standard-setting and liberalization, set in motion by differences in the initial conditions of each sector, are critical in explaining this divergence. The Korean government, seeking independence from foreign equipment, sought to actively build domestic technological capacity in choosing a standard that would advantage domestic firms in international markets. In contrast, the Japanese government, independent from foreign technology, was not initially focused on international markets, making it difficult later on to shift the terms of market competition away from exclusive focus on the domestic market.

Keywords:

Japan, South Korea, Political Economy, Telecommunications, ICT, Wireless, Standards, Liberalization

Introduction

The Information and Communications Technology (ICT) sectors in Japan and South Korea (hereon, Korea) developed rapidly beginning in the mid-1990s. Particularly in wireless and broadband, the two countries often led the world in building high speed networks, developing applications and services that took advantage of these networks, and introducing high-end equipment. These highly developed markets resulted from the dynamics of competition in each domestic market (Funk, 2002; International Telecommunications Union [ITU] 2005), shaped by interventionalist telecommunications regulatory regimes quite similar to one another ((Kushida & Oh, 2007).

However, the two countries' fortunes in international cellular markets could not have been more different. While Japanese equipment manufacturers were prominent in global markets from the 1980s until the early 1990s, they had withdrawn almost completely by the mid-2000s – despite even continued Japanese success in other high-tech sectors. Korean manufacturers, on the other hand, burst into global handset markets from the late 1990s, quickly taking large shares of world markets.

The purpose of this paper is to explain this divergence of the two countries' experiences in international cellular markets; a divergence that occurred despite both countries developing sophisticated domestic markets and employing similar regulatory regimes. While existing explanations focus on a combination of particular market factors (such as the dominance of Japanese carriers over equipment manufacturers) and specific policies (such as the choice of cellular standards), this paper goes deeper to examine how the *politics* of telecommunications policymaking in each country led to the *technological choices and policies* which shaped the *market dynamics* that resulted in the observed outcomes.

We find that, while both governments aimed to "manage" competition to develop their domestic markets, initial differences in the level of dependence on foreign technology created different strategic priorities in linking their domestic market to international markets, which in turn affected their respective politics of liberalization and choice of standards. The resulting market dynamics led the countries in different directions, trapping Japanese manufacturers in the domestic market while allowing Korean firms to use their domestic market as a launching pad into global markets. In a second round of standard-setting, both governments reorganized their markets to rapidly deploy third-generation digital standards, but the unexpectedly slow development of international markets undermined Japan's strategic attempt to re-enter global markets, and the unwillingness of Korean firms to follow the government's licensing strategy ended up aiding them in maintaining global market presence.

This paper first sets up the analysis by comparing the numerous similarities between the two countries' cellular sectors, contrasting their performance in international markets, and reviewing common explanations for this divergence. The core analysis consists of three parts: first, an overview of the initial conditions in each country's wireless sector; second, a detailed examination of the politics and resulting market dynamics of liberalization and standard-setting in late 1980s and early 1990s; and third, an overview of the politics and market dynamics of third-generation networks.

Wireless in Japan and Korea: So Similar Domestically, yet So Different Internationally

The wireless sectors of Japan and Korea were remarkably similar in a variety of aspects: the manner in which liberalization took place; the rapid growth that followed; their pursuit of high end applications and services; close carrier-equipment manufacturer relations, their rapid deployment of third generation (3G) high speed networks; and their regulatory regimes.

Both countries liberalized their wireless markets by licensing new competitors, carefully chosen ex ante, rather than through spectrum auctions or other forms of bidding. The new competitors greatly increased the intensity of competition, fueling several years of rapid growth in each country's cellular sector. Until the early 1990s, the population penetration levels of both countries were lower than most other OECD countries, but the introduction of multiple new competitors – 1994 in Japan and 1996 in Korea – led to a rapid catch-up phase.[1] By the late 1990s, both country's markets saw consolidation, leaving each with three nation-wide cellular carriers: SKT, KTF, and LGT in Korea, and NTT DoCoMo, KDDI, and Softbank (previously Vodafone, and before that, J-Phone) in Japan.

In both countries, cellular applications and services, coupled with high-end handsets unavailable outside their domestic markets, have been at the global technological forefront since the mid-to-late 1990s. Japanese handsets led the world in miniaturization from the mid-1990s, as have Korea handsets since the early 2000s. Japanese handsets first introduced polyphonic ring tones, color displays, embedded cameras, and commercially successful music downloads.[2] Japan pioneered successful cellular internet business models, beginning with DoCoMo's *i-mode*

[1] In 1994, 3 out 100 inhabitants of Japan had cellular subscription, which grew to 21 in 1996, 45 in 1999, and 72 in 2004. In Korea 7 out of 100 inhabitants had subscriptions in 1996, which grew to 51 by 1999, and 76 by 2004 (ITU, 2007).

[2] Color displays appeared in late 1999, and camera-embedded handsets (along with services enabling pictures to be emailed) appeared in late 2000. In early 2001, java applet downloads were introduced, enabling applications to run on handsets without further data transfers. The Japanese market for song downloads to cellular handsets, commenced in 2004, exceeded that of Apple's online *iTunes Store* as recently as 2006 (Masuno, 2006).

introduced in 1998, and Korea was an early adopter of cellular internet services.[3] More recently, carriers in both countries have been either pioneers or very early adopters of services including: Global Positioning System (GPS) navigation, micropayments enabled by IC chip-embedded handsets, high speed network-enabled video-chats, and access to an array of applications based on high speed access to cellular Internet platforms.

Close R&D collaboration between carriers and handset manufacturers, another shared characteristic of the two countries, is in contrast with most of the rest of the world, where a few globally dominant equipment firms (notably Nokia and Motorola) exercise more influence in R&D than do carriers (ITU, 2005). The close carrier-manufacturer collaboration in Japan and Korea facilitates the rapid rollout of advanced services, since new services usually require new handsets capable of running them. In Japan, to a greater degree than in Korea, R&D resources are concentrated in the carriers. This enabled both the development and the rapid deployment of Japan's commercially successful platform for cellular Internet services.

Japan and Korea were among the first countries in the world to deploy high speed third generation (3G) cellular networks and services. 3G refers to a set of standards agreed upon by the International Telecommunications Union (ITU), an organization under the United Nations tasked with approving telecommunications standards (among other functions). In the mid-1990s, multiple incompatible "second generation" (2G) digital cellular standards (with the original analog standards being "first generation") were deployed around the world. The ITU aimed to

[3] According to the government estimates, Japan's mobile content market, which did not exist prior to 1998, grew to approximately 299 billion yen ($2.6 billion at Y115=$1) in 2002, and 929 billion yen ($8 billion) by 2006. (MIC, 2007b)

create a single high speed, global 3G cellular standard, but ended up initially approving two – W-CDMA and CDMA2000.

A lower speed variant of CDMA2000 was deployed in Korea in October 2000, and W-CDMA in Japan the following May. In 2004, over 85 percent of the approximately 15 million 3G subscribers worldwide were in Korea and Japan, and moreover, both W-CDMA and CDMA2000 were available in each country (ITU, 2005). Many of the two countries' recent sophisticated cellular applications and services were enabled by these high speed networks.

Finally, the regulatory regimes of the two countries resembled each other much more closely than those of any other country in the world. Each had a central government ministry, staffed with career bureaucrats from top universities, capable of wielding considerable formal and informal power over the sector. In terms of formal tools, both ministries used licensing and spectrum allocation to compartmentalize the sector into segments, such as local, long distance, wireless, and value-added services, with a different set of regulations over each segment. The ministries orchestrated the entry of new competitors into the market by allocating operating licenses after extensive informal and closed door negotiations with the potential entrants. In the case of wireless carriers, they allocated spectrum on a discretionary basis – a contrast to the spectrum auctions undertaken in the US and many European countries. Both ministries also commanded significant R&D resources, which, as we will see, they deployed to channel technological development and deployment in their respective countries toward strategic ends. Much of their informal power lay in the wide jurisdiction accorded them by the laws governing the sector, and their use of discretion over licensing and spectrum allocation as a bargaining tool to reach negotiated settlements with carriers over a variety of issues (Kushida & Oh, 2007). Since the early 2000s, much to the dismay of comparative researchers, including this author, the

two countries' lead ministries for telecommunications policy even share the same official acronym – MIC, for Korea's Ministry of Information and Communications, as well as Japan's Ministry of Internal Affairs and Communications. (To avoid confusion in this paper, the acronyms K-MIC and J-MIC will be adopted when referring to the MIC of Korea and Japan, respectively.)

Korea's Launchpad and Japan's Domestic Trap

This array of similarities between the two countries' telecommunications policy regimes and wireless sectors renders their contrasting fortunes in international markets all the more striking. Japan's retreat from global cellular equipment markets was nothing short of dramatic. Until the early 1990s, Japanese manufacturers enjoyed a healthy global presence in analog cellular equipment markets. As seen in Table 1, in 1990, when NEC was tied with Nokia in second place for global market share, and five out of the nine top manufacturers were Japanese. However, by 2000, they were marginalized. Most only sold in the domestic market and Panasonic, with the largest global market share among Japanese manufacturers, had 5 percent while Nokia had slightly over 30. By 2002, Japanese firms had dropped out of the top five, and Samsung came in third.[4] By 2007, Samsung had slightly edged out Motorola to come in second, with LG appearing in fifth place, with only slightly less than the estimated total of all Japanese manufacturers combined ("Keitai," 2007) .[5]

[4] SonyEricsson, a joint venture between Sony and Ericsson, did rank among the top five, but although Sony contributed much of the design and software, it was Ericsson's handset platform and global sales channels which were used in international markets.

[5] Data on Japanese handset shares after 2000 are difficult to obtain, since most data is produced by private market research firms, charging thousands of dollars, putting them out of reach for academic research. The research firms

Table 1
Manufacturers and Global Shares (%), Selected Years

1990		2000		2002		2007	
Motorola	22	Nokia	31	Nokia	36	Nokia	38
Nokia	10	Motorola	15	Motorola	15	Samsung	14
NEC	10	Ericsson	10	Samsung	10	Motorola	14
Novatel	7	Siemens	7	Siemens	8	SonyEricsson	9
Panasonic	6	Panasonic	5	SonyEricsson	6	LG	7
Uniden	5	Samsung	5				
Toshiba	4						
OKI	4						
Ericsson	3						
Others	29						

Notes: Sources vary. 1990: (Häikiö, 2001), 2000, 2002: (CellularOnline, 2001) citing Gartner Dataquest 2007: ("Nokia," 2008) citing IDC.

In the early 2000s, firms including NEC, Matsushita (Panasonic), and Kyocera geared up to enter global markets again. However, by early 2008, they had all withdrawn completely, even from the largest and fast growing Chinese market, representing a complete failure to recapture global markets ("Kyocera," 2008).

Explaining the Divergence: Market Dynamics and Standards

Two causal factors are often cited to explain the divergence of the two countries' international performance in cellular markets: the choice of digital cellular standards, and the peculiar dynamics of competition in Japan's cellular market (Cole, 2006; Funk, 2002; ITU, 2005).

Regarding the first factor – standards – Korea helped develop and commercialize the CDMA standard, deploying it domestically. As CDMA was adopted widely adopted in North America and Asia, Korea's equipment manufacturers were able to use their domestic market as a

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and carriers who did show their data to this author did so on condition that it would not be publically quoted. In terms of data from the 1980s, one informal estimate puts the stock of Japanese mobile handsets in North American markets at almost 60 percent in the late 1980s (Communication&Intelligence, 1989), and Steinbock (2003) notes a large order of Oki mobile phones by the Bell System in the 1980s (p. 97).

springboard for exports. In contrast, PDC, the standard developed and deployed in Japan, failed to gain a foothold outside the domestic market. PDC's lack of incompatibility with the other standards used worldwide, when combined with the R&D dominance of Japanese carriers who constantly updated PDC, isolated the Japanese cellular from imports while preventing manufacturers from using their domestic market to launch exports.[6]

The second factor that trapped firms in the domestic market – the particularistic dynamics of competition in Japan's wireless sector – was recently even acknowledged by a government study group, which likened the Japanese cellular market to the Galapagos Islands, where isolation pushed evolution along its own course (MIC, 2007a). At the root of Japan's particularistic market dynamics was the carriers' financial and R&D dominance. The logic is as follows. Carriers purchased handsets from equipment manufacturers outright, selling them to consumers under their own brand name, and heavily subsidizing them by several hundred dollars. In the absence of long term contracts, this facilitated consumers' frequent purchases of new handsets. To compensate for subsidizing handset prices, carriers charged high fees for service subscriptions and minutes of communication. With the booming cellular market, Japanese carriers were the most profitable cellular carriers in the world (see table 2), and they invested heavily in new network infrastructure and R&D to develop new handsets and services. Equipment manufacturers were fed a stream of performance specifications, constant updates, and new services to implement. The focus for competition in handset markets turned to sophisticated features and design, with new services implemented – not, critically, production cost. Thus, equipment manufacturers continued to make handsets that were fundamentally unsuited for

[6] For an explanation of how Japan's postwar industrial success was enabled by the domestic market becoming a platform for exports, see (Tyson & Zysman, 1989).

international markets, and as long as the domestic market was reasonably profitable, they faced little incentive to push abroad. Hence, Galapagos.

Table 2
Average Annual Revenue per User (USD): Japan Compared to G8 Countries and Finland

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Canada	703	642	610	499	553	466	431	388	381	432
France	875	1487	1329	818	391	310	241	242	288	358
Germany	1129	1829	1571	1234	896	701	319	274	298	353
Italy	886	726	724	564	380	292	222	243	271	331
Japan	**3132**	**2160**	**1388**	**1140**	**966**	**1056**	**1122**	**1008**	**921**	**932**
Korea	1232	1351	1338	506	272	311	407	372	369	396
UK	551	465	571	602	467	328	245	256	275	319
US	630	593	588	597	535	583	578	581	547	554
Finland	2995	2952	2765	2533	455	485	447	430	473	533

Source: (OECD, 2005)

It is not particularly well known that carriers were heavily subsidized in Korea as well, until the early 2000s when government policies banned the practice. The political origins of this ban on subsidies is noteworthy, since it strengthened Korean manufacturers' focus on global markets.

These factors – the choice of standards and domestic market dynamics – in trapping the Japanese handset manufacturers seem all the more convincing in light of widespread international success of handset component manufacturers who supply global handset leaders. Japanese firms leading global component markets include: Omron for backlights, Murata for capacitors (40%), Kyocera for Temperature Compensated Xtal Oscillators (50%), Nihon Densan for vibration motors, Rohm for energy-saving integrate circuits, Daiichi Seiko for connectors between motherboards and LCD screens ("Components," 2007). These component markets are only marginally affected by differences in standards and dynamics of competition surrounding handsets as finished products, though the markets themselves are much small in scale.

As for the policies which shaped the contrasting choice of standards and differences in market dynamics between Japan and Korea, existing analyses usually cite a combination of

successful Korean strategy and good fortune for choosing and implementing the CDMA standard. Most chide Japan for its lack of strategic thinking in adopting PDC, and its inward-looking decisions focused on the domestic market at the expense of international markets (Cole, 2006; Funk, 2002; ITU, 2005). However, this paper drives deeper, unraveling the precise interaction between policies and market dynamics, and examining the politics that led to critical policy decisions and market outcomes.

The Analytical Departure Point: Initial Conditions vis-à-vis Foreign Technology

While changes in markets and policies do not universally take the form of critical junctures and punctuated equilibriums (Pierson, 2003; Streeck & Thelen, 2003), Japan's and Korea's wireless markets are cases in which key events that shaped subsequent decisions occurred at specific moments in their development. These moments were phases of liberalization (an increase in the level of competition through both deregulation and reregulation), when the governments licensed new entrants, allocated spectrum for them to use, and chose which standard(s) they could deploy. The political dynamics and strategic concerns in each country were strongly shaped by the initial conditions in each sector vis-à-vis foreign firms and foreign technology.

Japan's Initial Conditions: NTT and its Family – Domestic R&D Competencies

From well before the advent of wireless telecommunications technology, Japan's state-owned monopoly, Nippon Telegraph and Telephone (NTT), possessed considerable R&D resources and capabilities, subsidizing and dominating a set of Japanese electronics conglomerates.

From NTT's inception in the late 1800s as a government bureaucracy commissioned to build national communication infrastructure, R&D resources were concentrated in NTT. An R&D regime developed by the early 1900s, in which NTT received massive budget allocations from the government, subsidizing the R&D efforts of a "family" of equipment suppliers including NEC, Fujitsu, Hitachi, and Oki. These manufacturers owed much of their technological capacity to NTT, who made them compete against one another for procurement shares on the basis of quality, but paid them on a cost-plus basis. In effect, NTT supported their R&D in other areas, such as consumer electronics (Anchordoguy, 2001; Fransman, 1995). This early configuration of power and resources concentrated in NTT, with close relations to a "family" of manufacturers, persisted through the rest of the twentieth century.

NTT was a pioneer in mobile services when it commenced car phone services in 1979, although in comparison to European and US carriers, its 1987 introduction of cellular services (as distinct from car phone services) was relatively late. NTT used its own proprietary analog cellular standard, HiCap. NTT "family" firms competed for OEM procurement shares, determined by quality. At this time, most advanced industrialized countries employed proprietary analog standards, and few contemplated the possibility of regional or global cellular markets. In this international context, especially given NTT's legal prohibition against engaging in international operations (lifted in 1999), it is unsurprising that NTT did not focus on the linkages between the domestic and international markets.

Korea's Initial Conditions: Late Development and Foreign Dominance

Korea's telecommunications sector was younger than that of Japan, largely due to the Japanese occupation and the Korean War. Korea's state-owned monopoly, Korea Telecom (KT)

did not dominate R&D to the extent of NTT in Japan. Instead, government R&D organs such as the Electronics and Telecommunications Research Institute (ETRI) spearheaded research and helped finance manufacturers. Equipment firms including Samsung, LG, Daewoo, Daeyung, Donyan, and Hyundai were aided by ETRI and KT in R&D efforts to develop landline equipment such as exchanges (Jho, 2003).

KT commenced analog cellular services in 1984, but as a late developer, Korea was almost completely dependent on foreign cellular technology and equipment. KT adopted an analog standard used by carriers in North America known as Advanced Mobile Phone Service (AMPS), relying almost exclusively on Motorola and AT&T for infrastructure and handsets.

Thus, Korea's cellular market started with a heavy reliance on American technology and equipment, while Japan's cellular market initially deployed NTT's proprietary analog standard, with equipment provided by domestic "family" firms. This initial difference drove the politics of liberalization and choices of technology in different directions.

The Politics of Liberalization and Standard-Setting

Liberalization of the cellular market in Japan occurred in two phases; first in the mid to late 1980s using analog standards, when Japan became embroiled in a debate with the US, and then again in the early 1990s, when Japan orchestrated new competitors to the market and adopted the PDC standard. Korea's liberalization occurred in the early 1990s, involving a bureaucratic turf war that resulted in a strengthened commitment to deploy CDMA.

The Politics of Japan's 1980s Liberalization: Foreign Conflict on Home Turf

The first phase of Japan's liberalization of the cellular sector in the 1980s precipitated a political debate with the US over standards and licenses. The eventual settlement, combined with

the market dynamics it shaped, affected the second wave of liberalization in the mid-1990s, when the PDC standard was chosen.

The broader politics of privatizing NTT and ending its monopoly determined the timing of cellular liberalization. With roots in the late 1970s and culminating in the mid-1980s, the politics of privatizing NTT and liberalizing the telecommunications sector were extremely complex and contentious, involving a turf war between the Ministry of Posts and Telecommunications (MPT) and the Ministry of International Trade and Industry (MITI), along with multiple struggles between NTT, other government ministries, a strong labor union, and telecom policy specialist politicians (Johnson, 1989; Kushida, 2005; Vogel, 1996). In a 1984 settlement, NTT was partially privatized, some competition was introduced, and MPT succeeded in gaining a vast swathe of regulatory powers.

MPT actively used its new formal and discretionary powers in both landline and wireless markets to orchestrate the entry of competitors and micromanage competition ex ante through control of prices and authority to determine the scope of firms' businesses. This regulatory regime has been labeled "managed" or "controlled" competition (Kushida, 2006; Vogel, 1996)). However, MPT's attempt to control the entry of a cellular competitor to NTT sparked a major trade dispute with the US government, mobilized by Motorola, during a period of broader bilateral trade friction.

MPT initially intended to license a single competitor by orchestrating a consortium of major companies. As a result, Nihon Ido Tsushin (IDO) was created with major investments from Toyota, Tokyo Electric Power Company, and others. However, one of the new long distance telecommunications competitors, Daini Denden (DDI), also desired entry into the cellular market. The critical point was that while IDO intended to use the NTT standard with

equipment from NTT family firms, DDI planned to deploy Motorola equipment, which used the TACS standard, a derivative of the AMPS standard developed by AT&T. DDI projected that the Motorola equipment would lower its operating costs to half, or even a third of NTT and IDO. MPT attempted to force a merger between IDO and DDI, even preparing to allow the new company to use the Motorola standard, but the negotiations fell apart due to disagreements between the two parties over management control and the choice of standards (Suda, 2005).

MPT proceeded to attempt denying DDI's request, using one of its strongest policy tools – the Supply Demand Adjustment Clause in the Telecommunications Business Law. This clause allowed MPT to deny license applications on the basis of insufficient projected demand or potential oversupply, without substantive stipulations about criteria for calculating the projections. MPT argued that three cellular carriers would produce an oversupply of service capacity, given its projected demand. MPT also contended that since NTT was allocated half the available spectrum, the remaining half was insufficient for two additional carriers. It went so far as to justify the denial in granting a license by pointing out that DDI was unlikely to become profitable.[7]

A compromise plan reached in 1987, decided behind closed doors, allowed both carriers to enter the market, but in mutually exclusive geographic regions. IDO received the greater Tokyo area and Eastern/Northern Japan, while DDI was given Western Japan. (It is worth noting that it was "administrative guidance" rather than a legal decree that determined this geographic division.)

[7] A MPT official at the telecommunications bureau was quoted as saying "We think it would be difficult for two more companies to go into this business... N.T.T. is now using more than half of the available channels, and besides, *we doubt that two more companies could both make a profit* [italics added]." ("Japanese Barriers," 1986)

However, Motorola, keenly interested in the Japanese market, was dissatisfied that it would not have access to Tokyo, the largest market. It successfully lobbied the US government to pressure Japanese policymakers, leading to complaints by the US Treasury Representative, Department of Commerce, and State Department to various parts of the Japanese government. Communications equipment had been a focus of the bilateral Market-Oriented, Selected Sector (MOSS) talks of 1984 to 1986, and in a follow-up session, the US argued that Japan's failure to license DDI constituted a non-tariff barrier to Motorola equipment (Suda, 2005).

As a result of this external pressure, MPT adjusted the division of service areas, reallocating Northern Japan to DDI, though still excluding it from the Tokyo area ("Daini Denden-Motorola," 1987). Motorola, still dissatisfied, went so far as to demand that a specific new company be established to deploy Motorola equipment exclusively ("Motorola," 1989).

In May 1989, in a fascinating turn of events, IDO announced that it would adopt the AMPS standard to use Motorola equipment *in addition to* the proprietary NTT standard it was already deploying. This made little business sense, since IDO was proposing to create a second network, incompatible with the network it had already installed. In fact, it is widely acknowledged that Toyota, the largest shareholder of IDO, fearing an escalation of trade friction which could damage automobile exports, was behind this decision. IDO's management opposed Toyota's plan, but had few alternatives, especially in the face of Toyota's threat to withdraw its guarantee of the loans needed by IDO to build its networks.[8]

[8] This is common knowledge among industry insiders, noted in various Nihon Keizai Shimbun newspaper articles, (Communication&Intelligence, 1989), and verified by Naoe Shigehiko, former member of MPT's Telecommunications Deliberation Council (Naoe, 2007).

Thus, Japan's first competitors to NTT – IDO and DDI – began analog services in 1988 and 1989, respectively. IDO competed against NTT in the greater Tokyo and Central Japan regions using its NTT standard network (it did not operationalize the TACS network until 1992), while DDI competed in all other regions, including Osaka, using TACS. The political settlements that led to these market outcomes both shaped the dynamics of competition in Japan's cellular market through the 1990s, and influenced the adoption of PDC – the factors contributing to Japan's isolation from global cellular markets.

Japan's Market Dynamics: the Domestic R&D Regime Strengthened

The new competitors, especially DDI, quickly devoured NTT's market share, reducing it from 96 percent in 1988 to 65 percent in 1991. The Motorola equipment that DDI introduced had the effect of pushing NTT and its family firms closer together in their R&D efforts. DDI delivered a shock to NTT when it introduced Motorola's *MicroTAC* in April, 1989 – the first handset to fit comfortably in a shirt pocket, and roughly half the size of NTT's existing handsets. NTT prided itself on its technological sophistication, and had introduced a new handset of its own just two months earlier, in itself a dramatic improvement from the previous "shoulderphone" (DoCoMo, 2001).

NTT hastily mobilized its extensive R&D resources and close relations with "family" equipment firms NEC, Matsushita, Mitsubishi, and Fujitsu, moving to create a handset smaller than that of Motorola. NTT also attempted to reap the benefits of competition among its suppliers, shifting from strict OEM manufacturing to allowing competition between suppliers based on design and circuits, with NTT providing core specifications. By November, 2000, NTT

unveiled a handset prototype half the size of Motorola's MicroTAC, commercializing the various manufacturers' versions in April 2001 (DoCoMo, 2001).

The Politics of Japan's 1990s Liberalization and Choice of PDC

Japan's choice of PDC was partially the result of MPT's attempt to avoid another round of potentially messy political debates over licensing and spectrum allocation.

In the early 1990s, when it became clear that the analog standard would be insufficient to accommodate the burgeoning number of subscribers, a ministry study group examined the digital GSM standard, already in use and gaining popularity in Europe, as a possibility. However, it immediately became clear that GSM as a system required 10 MHz per carrier to implement, while PDC required only 5MHz. NTT had already been allocated 10MHz, but IDO and DDI had only been only granted 5MHz each. Rather than redistributing spectrum and potentially opening the door to another round of political fights, choosing PDC allowed the government to retain the spectrum allocation status quo.[9]

Since IDO had started its AMPS service with Motorola equipment in 1992, it was given until 1996 – two years later than the 1994 date for other carriers – to adopt a digital standard, which did not have to be PDC. This preempted Motorola from opening the market access issue at this juncture, since it was not focused on the digital standard, instead concentrating its energies in getting IDO to deploy TACS infrastructure.[10] Motorola also saw one of its demands made in

[9] I am indebted to former Telecommunications Deliberation Council member Professor Naoe Shigehiko for explaining this point (Naoe, 2007).

[10] Motorola successfully lobbied the US government to apply pressure, even proposing numerical subscriber targets. A settlement was reached when IDO pledged to undertake large investments in TACS rather than the NTT standard infrastructure ("Numerical Target," 1994).

1989 come to fruition in 1994, when a government measure allowed direct purchase rather than rental of handsets by consumers, leading to a rapid expansion in the market, and hence, Motorola equipment.[11]

In addition, there was no real domestically developed alternative to PDC. NTT's mobile division had been spun out in 1992 as part of the continued political process of privatizing and breaking up NTT, creating NTT DoCoMo. DoCoMo received NTT's extensive wireless R&D labs, despite some concerns within MPT about the advantages this gave the company.[12] Research on the PDC standard had already begun before the spinout, and it was natural for DoCoMo to prefer its own technology. Other domestic carriers did not have the R&D strength to create their own standard (Steinbock, 2003). Moreover, equipment manufacturers had no incentive to develop cellular standards independently, since they relied on the specifications passed down from carriers.

Finally, MPT had institutional origins in operations of the postal services, with telecommunication regulation added during the Allied Occupation (the pre-war Ministry of Communications that had operated telephone networks had become NTT) (Vogel, 1996). Therefore, unlike international trade-oriented MITI, MPT had never been focused on international strategy. While it was interested in providing competition to NTT, its focus was naturally limited to the domestic market. Thus, in 1992, MPT decided that NTT, IDO, and the new entrants to be licensed in 1994 would adopt PDC.

Two new entrants were given spectrum at the 1.5 GHz frequency in 1994 – the Digital Phone group under the umbrella of Japan Telecom, one of the landline competitors, and Tsuka

[11] As it turned out, Motorola was late in developing equipment for digital standards worldwide, leading it to dramatically lose market share and political clout in the mid to late 1990s.

[12] The author would like to thank former MPT official Nakamura Ichiya for this point (Nakamura, 2003).

Cellular, of which Nissan was the main investor (Masuno, 2006). Further intensifying competition, three additional wireless carriers using a technology known as Personal Handyphone System (PHS), a product of MPT's industrial policy, were also licensed and given spectrum.

Japan's Underappreciated PHS: Industrial Policy Shaping Market Dynamics

PHS, a domestically developed wireless technology and standard without much consideration for global markets, is often overlooked in international comparisons. However, it actually had a significant role in fostering the dynamics of competition that trapped Japan's manufacturers in the domestic market. When PHS services commenced in 1995, several performance attributes gave them competitive advantages over cellular services at the time. First, PHS handsets were technologically simpler (similar to cordless phones) than cellular handsets, enabling higher performance, illustrated by Sharp's first model, offering 400 hours of standby time ("PHS," 1995; "Low Price," 1995). Second, voice quality of PHS was higher than that of existing cellular services, since it was built on top of NTT's high capacity ISDN infrastructure, and because each base station served a smaller radius of coverage with a dedicated connection allocated to each caller. Third, monthly subscription fees and per-minute charges were substantially lower – less than half the monthly price of cellular services (3000 yen versus 7000 or 8000 yen[13]), and approximately a fourth of the per-minute fees. Finally, PHS base stations cost much less than cellular base stations, allowing rapid installation inside subway terminals and stations, before cellular coverage was extended to these areas. In short, PHS services put significant pressure on cellular carriers to improve their handsets, lower subscription fees, and

[13] 3000 yen is approximately $26 at 1 USD = 115 JPY.

improve their service coverage areas.[14] Competition between cellular carriers and PHS carriers was a significant driver of Japan's rapid subscriber growth, especially given the lack of long term contracts that locked in consumers.[15]

PHS was the product of MPT's industrial policy. MPT spearheaded the R&D, tightly controlled spectrum allocation and orchestrated a set of consortia to grant operating licenses. It used the R&D resources acquired in the 1985 political settlement over privatization of NTT to conduct field experiments, set the standard, and commercialize the technology. It directed the existing cellular carriers to offer PHS services, resulting in three operators – NTT Personal Communication Network (a joint venture of NTT and DoCoMo), DDI Pocket (a subsidiary of DDI), and Astel (a consortium including Japan Telecom and KDD) (Murase, 2003).

In promulgating the PHS standard, MPT seems to have deliberately excluded foreign firms from the process. Although a consortia of domestic electronics firms were involved in the standard-setting process, foreign manufacturers were not given an opportunity to provide input or access information. Indeed, they were not given the specifications until immediately prior to PHS service commencement (Funk, 2002).

The market dynamics unleashed by PHS services accelerated the Japanese cellular market's move towards competition based on handset features rather than lower service prices or low handset costs. Since PHS handsets were far less costly than cellular handsets, PHS carriers could virtually give away handsets without particularly large subsidies. Cellular carriers were

[14] The average weight of digital cellular phones were reduced from approx. 200 grams in early 1995 to 100g by April 1997 (Funk, 2002).

[15] DDI had shifted the terms of competition by offering its services without long term contracts. Other carriers followed, and as it became the industry norm, all carriers faced the constant threat of losing subscribers (Weber & Wingert, 2006).

forced to match these prices to compete, though this required much larger subsidies vis-à-vis PHS carriers. By around 1997, subsidy price wars between carriers, and among distributors, who took smaller and smaller cuts from their retail sales, led to new, high-end handsets often virtually given away at prices such as 1 yen (about a US penny). Since handsets were branded with the carrier's name rather than the manufacturer's, and each carrier had a different (though not totally mutually exclusive) lineup of manufacturers, the lineup of stylish and sophisticated handsets became critical to the competition between carriers.

A set of carrier-handset "groups" emerged; NTT "family" firms such as NEC, Fujitsu, and Matsushita manufactured handsets for DoCoMo, but not other carriers, while consumer electronics firms new to cellular equipment, including Sony, Sharp, Sanyo and Kyocera manufactured for the other carriers, but not DoCoMo. With the advent of PHS, the number of handset manufacturers ballooned. Between around 1996 and 2000, the list of domestic manufacturers for cellular and PHS handsets included NEC, Sharp, Sony, Denso, Fujitsu, Panasonic, Mitsubishi, Casio, Kyocera, Sanyo, Toshiba, Hitachi, Pioneer, Victor, and Kenwood. Many of these firms purchased components from the same suppliers, making their products relatively similar, with competition based mainly on styling and extra features (Funk, 2002).

Even after PHS services began to decline as cellular services lowered their prices and matched (later exceeded) PHS handset performance, the logic of competition in which carriers massively subsidized costly handsets that competed on the basis of sophisticated features rather than production cost, was firmly entrenched.[16]

[16] A major reason for the decline of PHS carriers was the failure of MPT to provide carriers with regulatory protection against predatory interconnection pricing by NTT, whose public networks provided the core of PHS networks. Without any regulatory support, PHS carriers were at the mercy of NTT's interconnection rates, which sapped half of their revenue, leading to the exit of several carriers (Masuno, 2006).

As cellular service prices decreased and coverage areas improved, cellular handsets came closer to matching PHS handset performance, and carriers led by DoCoMo improved their networks to increase voice transmission quality. As the relative merits of PHS faded, its growth slowed, and the failure of MPT to provide carriers with regulatory protection against predatory interconnection pricing by NTT, whose public networks underlay the core PHS network, led to lack of profitability and the eventual exit of all but one carrier.

Galapagos: Japanese Manufacturers Trapped in the Domestic Logic of Competition

The intense competition by a large number of domestic manufacturers is, at first glance, similar to Japan's automobile or semiconductor industries, the competition of which spilled into global markets in the form of low cost, high quality exports. However, Japan's handset manufacturers were kept focused on the domestic market partly because of their need to constantly keep up with changes to the PDC standard. NTT DoCoMo's dominance in R&D of the PDC standard allowed it to issue a constant stream of updates and new features requiring compliance by manufacturers. Although a semi-government organization, the Association of Radio Industries and Businesses (ARIB), approved all official changes to the standard, it acted more as a rubber stamp, with DoCoMo possessing de facto control (Funk, 2002). Constant updates significantly drained the R&D resources of manufacturers, who could not attain economies of scale to lower prices before rolling out new models. They also built each model from the ground up, rather than using a standard platform as Nokia, and later Samsung did to modify each model for different markets (Cole, 2006).

Manufacturers, especially family firms, also had a multifaceted relationship with NTT, the largest company in Japan by several measures. NEC, for instance, worked closely with NTT

in its IT solutions businesses, Internet backbone equipment, conventional telephone network equipment, and other areas. With cellular handsets as only one of their lines of business, and with many of those businesses depending on close relations with NTT, they could only follow DoCoMo's constant updates to PDC – a power struggle was out of the question.

Furthermore, for much of the 1990s, given Japan's overall slow growth, manufacturers were busy rationalizing operations and cutting costs. While handset businesses provided stable profits, incentives to invest massively in overseas markets, given the different logic of competition, were by no means strong.

Thus, in addition to the financial dominance of the carriers, leading to competition based on subsidized handsets offering high-end services, with a large number of cellular and PHS carriers competing intensely with one another due to the lack of long term contracts, the constant updates to the PDC standard by DoCoMo further trapped manufacturers in the domestic market. That the domestic market operated on different terms from global markets was clearly shown when, by the late 1990s, handsets from global market leaders such as Nokia, Motorola, and Ericsson failed to make significant inroads. Though subsidized to some extent, their models were not popular, often striking consumers as large, clunky, and lacking standard features offered by Japanese phones, such as polyphonic ring tones and large displays.

The Politics of Liberalization in Korea: Bureaucratic Turf Wars and a Scandal

Liberalization in Korea's cellular sector involved a series of political struggles between industrial and bureaucratic interests, a turf war between bureaucracies, and a political scandal. The politics surrounding the privatization of KT itself was smooth, unlike the case of Japan's

NTT.[17] A bureaucratic turf war over control of the emerging cellular sector, reminiscent of the turf wars between Japan's MPT and MITI in the mid-1980s, occurred between Korea's Ministry of Communications (MOC) and Ministry of Trade, Industry, and Energy (MOTIE). This struggle revolved around: the level of *chaebol* (vertically integrated Korean industrial conglomerates) involvement in telecommunications services; the timing of entry for new competitors; and choice of the CDMA standard.

The introduction of cellular competitors to KT pitted MOC, who wanted to limit chaebol influence in the sector, against MOTIE, interested in boosting the manufacturing base of the conglomorates. Chaebol had been interested in directly operating telecommunication services for some time, but MOC, fearing chaebol dominance of services market, continually rejected their attempts to enter.[18] MOTIE, which oversaw high tech manufacturing and exports, disagreed, contending that chaebol participation in telecommunications services was critical to their overall technological competency. In 1991, a political battle involving the Prime Minister's Office, the powerful Economic Planning Board (EPB), MOC, and MOTIE ensued. MOC tried, unsuccessfully, to engage the incumbent Democratic Liberal Party to weigh in on their side, and was forced to cede the licensing of a chaebol group as the cellular competitor to KT (Jho, 2003).

[17] Strong political support by Prime Ministers Presidents Roh Tae-Woo (1987–93) and Kim Young-Sam (1993–98), the Economic Planning Board (EPB), the Ministry of Finance and Economy (MoFE), and the chaebol facilitated the smooth political process. An accord was easily reached with the only remaining major potential source of resistance, the labor union, with the promise that foreign ownership would be limited to ensure employment security. Chaebol ownership of KTA was also limited to 5% until the final stages of privatization (Kushida & Oh, 2007).

[18] The government's concern about excessive influence of chaebol in telecom services was part of a larger pattern of tension between economically dominant chaebol and the government.

MOC and MOTIE also butted heads over the timing of entry for the new competitor. MOC hoped to have a second carrier commence services soon – by 1994 – to promote competition. However, MOTIE, closely aligned with chaebol equipment manufacturers, desired a delay of one or two more years, contending that domestic manufacturers required more time to develop competitiveness in infrastructure and equipment to prevent further reliance on imports. Foreign companies, predictably, joined MOC's side to advocate earlier entry of competitors with Motorola attempting to alleviate MOTIE's concerns by promising it would transfer technology to Korean firms. However, the powerful EPB weighed in on MOTIE's side, advocating a delay in entry (Jho, 2003).

One issue that all domestic parties could easily agree on was the strict limitation of foreign participation in the cellular services market. MOC stipulated that foreign interests join consortia led by domestic firms, without management rights. Six consortia ended up applying for the license to compete against KT, each with a foreign participant (Jho, 2003). Motorola, already the dominant equipment provider in Korea, unlike in Japan, did not significantly involve itself in these debates.

The outcome of the political debates was that in 1992, a license was awarded to Daehan Telecom (Greater Korean Telecom) consortium, backed by the Sunkyung chaebol group. However, a political scandal derailed this initial settlement. Allegations of favoritism arose over President Roh Tae Woo's close relationship with the Sunkyung group, given the government's high level of discretion in allocating the license. The ensuing political firestorm resulted in Daehan being forced to return its license. MOC, despite having been able to push through its wishes to license a competitor earlier rather than later, was forced to wait until a change in political leadership to conduct a second round of licensing in 1994 (Jho, 2003). Thus, MOCIE

and the chaebol got their desired outcomes against the opposition of MOC. It can be argued that these losses strengthened MOC's resolve to assert jurisdiction over the ICT sector by taking a strong position in choosing the digital cellular standard.

Korea's Politics of Choosing CDMA: Turf Wars and a Gamble

Given the importance of Korea's successful choice of CDMA as its digital standard in global markets, existing analyses tend to credit the government for its bold strategy and its ability to take a potentially risky gamble (Chung & Lee, 1999; ITU, 2005; Yang, 2003). In particular, they focus on the collaboration of ETRI, the research arm of MOC, with the American startup Qualcomm, then a small firm with only approximately 15 employees and the core intellectual property of CDMA, but without a commercialized technology system offering. However, the often underplayed political debate surrounding the selection and commercialization process resulted in a much firmer commitment by the Korean government, a faster rollout of CDMA services, and the rise of MOC as the industry's lead agency.

The initial push for CDMA came from a Korean government-led initiative, with MOC subsidizing the initial development. In 1988, MOC published a document outlining its plans to develop a new standard, which it expanded in 1990 to include the development of an entire mobile communications system. In the first phase, MOC gave ETRI (placed under control of MOC in 1992) the task of developing digital technology, and it brought together researchers from the government, scientists, and large equipment manufacturers such as Samsung, Hyundai, LG, and Maxon (Chung & Lee, 1999). This close government-industry collaboration sparked the third and final major conflict between MOC and MOTIE.

MOTIE's status had been declining by the early 1990s as chaebol gained international competitiveness, requiring less protection and support from the government. Yet, MOTIE had an institutional prerogative to retain its jurisdiction over the manufacturers. In 1993, MOTIE published a report criticizing MOC's plans for CDMA, arguing that TDMA, the existing technology upon which the globally popular GSM standard was based, had more potential to become globally dominant. MOTIE went so far as to launch TDMA research programs, enlisting manufacturing companies to join (Jho, 2003).

MOC, unsurprisingly, immediately opposed MOTIE's efforts, contending that CDMA was technologically superior and more flexible in its future applications. This bureaucratic turf war, with MOC and MOTIE each setting up parallel and opposing research efforts, led MOC to strengthen its plans for CDMA. It moved the deployment date for commercial CDMA deployment services forward by two years. Finally, and most significantly, it used all the jurisdictional authority at its disposal to promulgate CDMA as the sole domestic digital standard. In the application for the cellular license (now in the second round), MOC included the provision that the second mobile carrier use CDMA. The license was allocated to Shinsegi, a consortium led by the steel company POSCO. Although Shinsegi had wanted to build a GSM rather than CDMA-based network, since CDMA had yet to be commercialized, MOC rejected its wishes (Jho, 2003).

MOC's use of this trump card, bolstered by a 1993 US Telecommunication Industry Association announcement that it would recognize CDMA (ITU, 2005), was decisive in determining the manufacturers' strategies. Following MOC made far more sense for manufacturers, since following MOTIE and its TDMA initiative would limit them to manufacturing exports in markets in which they were newcomers, while simultaneously locking

them out of the domestic market – a domestic market that promised rapid growth, and which could give them an opportunity to develop high levels of competency for entering global markets. Thus, manufacturers limited their participation in MOTIE's GSM project, and MOC secured its jurisdiction over manufacturers at the expense of MOTIE (Jho, 2003). (See Table 3 for an summary of the MOC-MOTIE debates).

Table 3
Korea's Policy Debates: Positions of MOC, MOTIE, and Outcomes

Policy Positions	Chaebol Entry in Services	Timing of Entry	Standard
MOC	Limit	Earlier	CDMA
MOTIE	Allow	Later	TDMA-based, e.g., GSM
Outcome	Allowed	Later (due to scandal)	CDMA

After the MOC-MOTIE debate was settled, a second round of research to commercialize CDMA was conducted, largely by industry in partnership with Qualcomm, with a task force under KMT (the mobile division of Korea Telecom had been spun out in 1988, creating Korea Mobile Telecommunications, KMT). The government subsidized approximately $6.7 million from the Information Promotion Fund, obtained through taxes on carriers' profits. In 1994 KMT contracted LG to provide base stations and handsets, and Shinsegi selected Samsung in 1995, cementing the close carrier-manufacturer R&D relationships (Jho, 2003).

Korea's Market Dynamics: Cultivating Domestic Competencies

The Korean government licensed three additional competitors to the market in 1996 and 1997, just as the incumbent's digital services commenced. KMT had been sold to the SK group in 1994, which renamed the former state-owned monopoly incumbent SKT. SKT shifted to CDMA, and the new entrants, Shinsegi Telecom, Korea Telecom Freetel (later renamed KTF), LG Telecom, and Hansol, all entered the market with CDMA.

Korea's shift to CDMA achieved the government's overriding strategic objective of nurturing domestic manufacturers and reducing the country's dependence on foreign equipment. Since Korea was the first country to commercialize CDMA, Motorola and the other foreign firms that dominated Korea's equipment markets lacked expertise in the technology. As a result, Motorola's share equipment plummeted, even as Korea's cellular market expanded rapidly.[19] In 1995, it had slightly over half the market share, but by 1999, domestic manufacturers had over 90 percent of the market (See Table 4) (Yang, 2003).

Table 4
Korea's Domestic Cellular Equipment Shares Before and After the Digital Standard

Vendor	1995	1996		1997
	Analog (AMPS)		Digital (CDMA)	AMPS + CDMA
Samsung	44	41.5	44.5	59
Motorola	51	**40.6**	**0.5**	-
LG	3	5.7	24.3	33
Hyundai	2	3.8	9.2	4
Qualcomm	-	0	13.6	-
Others	-	8.5	4.9	-
Total	100	100	100	100

Notes: Adapted from Jho (2003, p. 258)

In terms of international markets, Korea's collaboration with Qualcomm in commercializing CDMA yielded significant benefits. Qualcomm held the core intellectual property, forcing Korean manufacturers to pay significant royalties. In exchange, Korean manufacturers were given rights to distribute CDMA handsets worldwide. This paid off handsomely when major American carriers adopted the standard for their digital networks.

With five carriers in the market, Korea's cellular subscription fees and per-minute charges dropped rapidly. The incumbent, SKT, came under intense market pressure, evidenced by its rapid drop in market share – from approximately 66% in 1997 to 43% in 1999. Shinsegi's service, which commenced in 1996, reached 100,000 subscribers within seven months, and a

[19] Motorola worldwide had enjoyed dominance in analog equipment, but it was blindsided by the transition to digital standards in Europe and Asia, dramatically losing market share worldwide. (Steinbock, 2003)

million in a year. The other new entrants, who had received higher frequencies, could offer lighter phones and better service coverage areas, partly due to the denser cell requirement.[20] New entrants discounted their services, and roaming agreements, such as between KTF and Hansol, allowed some to share the construction and operating costs networks in provincial areas(Jho, 2003).

The logic of competition moved towards subsidies for handsets, just as it did in Japan. The high frequency spectrum carriers initially offered larger subsidies as they attempted to battle SKT and Shinsegi, and the incumbents countered by increasing their subsidies as well. Subsidies for a typical handset costing around 440 USD began at around 160 USD in 1997, but escalated to the point that handsets were given away for free by 1999. Unlike in Japan, however, these subsidies were given in exchange for ever-longer obligatory subscription periods, starting at one year in 1997, and reaching three years by 1999. Subscribers had to repay the subsidy to terminate their subscription or switch to a different carrier (Kim, 2004). These were known as adhesion contracts. Korea's massive increase in subscribers was facilitated by these market dynamics, and handsets quickly became more sophisticated as subsidies caused high end models to become the norm. In the late 1990s, a policy debate, unplanned by the telecom ministry, shifted the dynamics of competition away from subsidized handsets.

Korea's Policy Debate over Handset Subsidies: Confusion with a Fortuitous Outcome

The debate over handset subsidies occurred between different government bureaucracies coming at issues from different regulatory angles. K-MIC, the strengthened MOC which had

[20] Higher frequencies meant more base stations were needed, since their signal did not travel as far, which in turn allowed handsets to be smaller.

absorbed the IT-related industrial policy functions of MOTIE and parts of the government, was pitted against the Korea Communications Commission (KCC), established in 1992 to oversee telecommunications policy, and the Korea Fair Trade Commission (KFTC). In almost every step of the way, K-MIC's actions to maintain what it viewed as healthy competition were frustrated or blocked by the KFTC or KCC.

K-MIC regulated subsidies under the Telecom Business Act, requiring carriers to report the terms and conditions of their adhesion contracts, such as price and service provisions. However, K-MIC was not alone in becoming concerned as the rapid inflation of subsidies reached the point where carriers gave away handsets in exchange for increasingly long lock-in periods. First, K-MIC proposed a cap on the subsidy amount each carrier could allocate to a handset – approximately $125 – to curtail the subsidy inflation. However, at the core of the problem were the business practices of carriers, who were not required to fully explain or give documentation to subscribers about the termination penalty. The KFTC, reacting to consumer complaints about the adhesion contracts, lent its support by ordering the abolition of penalty clauses that forced subscribers to return the subsidy amount when terminating their contracts early (Kim, 2004).

The cellular markets reacted to abolition of the penalty clauses abruptly and dramatically. Consumers, no longer locked into their contracts, began rapidly switching handsets, since carriers still competed against one another on the basis of subsidy amounts. This raised Korean imports for components at a bad time for the government – 1999 – when a top political priority was to meet IMF bailout conditions for balance of payments. K-MIC, in favor of ensuring carrier profitability to maintain competition against SKT, which had over half the market share and deep pockets, pressed ahead to curtail subsidies. In September 1999, KTF, LG Telecom, Hansol PCG

and Shinsegi agreed to cap subsidy levels, though they later broke ranks and began increasing subsidies again. However, this informal arrangement to cap subsidies caused the KFTC to turn against K-MIC. From KFTC's perspective, the informal agreement on subsidy caps amounted to industrial collusion, and it stepped in to levy fines on the carriers. This interference in what K-MIC viewed as its jurisdiction, and the uncertainty it cast on the market, was too much for the ministry. In June 2000, K-MIC banned handset subsidies all together (Kim, 2004).

Following the ban on handset subsidies, demand for handsets shrank dramatically. Monthly sales of between 1.4 and 2 million units before the ban were reduced to 250,000 immediately following it. This led K-MIC to announce plans to alleviate the suffering of equipment manufacturers, such as allowing installment sales of handsets. K-MIC also tried to prop up the competitors to SKT by exempting subscribers switching from SKT to new carriers from certain fees. However, this latter move caught the eye of KCC, whose primary institutional concern was fair competition. The KCC weighed in, arguing that the asymmetrical regulation hindered fair competition. (See Table 5 for an overview of different phases of subsidies.) The KCC and K-MIC also investigated the market between mid-2000 and 2001, and found that many carriers continued to offer subsidies, fining those they caught (Kim, 2004).

Probably the greatest contrast to Japan was the reaction of Korea's generally more active consumer groups. They organized protests against carriers, calling for the abolition of subsidies in exchange for up to 40% lower subscription fees. Korean consumer groups went so far as to organize a rotating sit-in in front of K-MIC for the better part of a year (Kim, 2004).

Table 5
Three phases of subsidies

	1997-1999	4/1999-5/2000	6/2000 – 2006
Phase	Subsidies with Adhesion Contracts	Subsidies Without Adhesion Contracts	Subsidy ban
Policy		KFTC ruled against adhesion contracts	KCC ruled against K-MIC's subsidy cap, K-MIC banned subsidies

Market effects	Subsidy price war, escalation to free handsets, 3 year lock-in	Subsidies Continued, rampant user switches	Slower rate of domestic handset turnover, focus on global markets

Notes: Adapted from (Kim, 2004).

The uncertainty over subsidies, part of their business models, helped realign the strategies of Korean handset manufacturers. To prepare for an environment without carrier subsidies – in effect, the demise of a small but lucrative domestic market – they became even more tightly focused on attaining scale to reduce production costs, all the better for competing in international markets.

Thus, Korea's dependence on foreign cellular equipment drove the government's strategy in allocating spectrum and choosing a digital standard to nurture the technological capacity of domestic firms. Digital spectrum allocation became a politically messy battle, from which MOC/K-MIC emerged as a strong lead bureaucracy, firmly committed to CDMA. Qualcomm's success in getting US carriers to approve its standard cemented Korea's relationship with it, and greatly facilitated Korean equipment manufacturers in gaining a foothold in the US market. With the additional push from unexpected policy actors which abolished handset subsidies and reduced the profitability of the domestic market, Korea's manufacturers focused on international markets.

So far, this paper has shown how the initial conditions shaped politics at critical junctures – when liberalization and standard-setting reshaped the configuration of markets, market players, and the terms of competition. Japan's standard-setting without a focus on international markets contrasted with Korea's strategy explicitly aimed at international markets – a contrast shaped by the difference in each country's initial dependence on foreign technology. These strategic orientations were not simply the product of monolithic governments, but grew out of the politics of liberalization – Japan hoped to avoid another row with the US, moving swiftly to adopt the

PDC standard, while the bureaucratic turf wars in Korea strengthened its commitment to CDMA. Next we turn to the adoption of 3G networks, the next opportunity for the governments to reorganize markets and move strategically to gain advantage in international competition.

The Politics of Licensing 3G: Focusing and Re-focusing on Global Markets

The next critical juncture – spectrum allocation and standard-setting for 3G cellular services – gave Japan an opportunity to reconnect its domestic market to international markets, and Korea an opportunity to further plan its international strategy. It also gave both countries an opportunity to rapidly develop their domestic cellular markets to reach the technological forefront.

Japan's choice of an international standard, which DoCoMo helped develop, may very well have propelled its equipment manufacturers into international markets; policymakers seemed to have learned a valuable lesson from the experience with PDC and acted strategically. However, an unexpected slowdown in international markets for 3G deployment undermined this strategy.

Korea's governmental strategy focused on international markets, explicitly hedging its bets on the two incompatible international 3G standards. However, despite the licensing scheme, the government had difficulty in getting carriers to actually deploy the 3G networks to which they had been allocated licenses. Ironically, this reluctance prevented the Korean domestic market from affecting manufacturers' focus on international markets.

The International Political Fights in Setting the 3G Standard

As noted earlier, the ITU's original aim for 3G was to create a single global standard.[21] However, a political struggle over whose standard to use, with a European-Japanese alliance attacked by the US government lobbying on behalf of Qualcomm's interests, led to the compromise in which two incompatible standards were approved (Cowhey, 2006). The first standard, W-CDMA, was positioned as an upgrade from GSM, the dominant standard in Europe with the most subscribers worldwide. The other, CDMA2000, was developed by Qualcomm, and could be achieved through incremental upgrades of the existing CDMA standard used in South Korea and North America. (See Table 6).

Table 6
Expected Migratory Path from 2G to 3G

2G Standard		3G Standard (Developer)
GSM, PDC	→	W-CDMA (European firms, DoCoMo)
CDMA	→	CDMA2000 (Qualcomm)

Japan's 3G Strategy: Refocusing on Global Markets, but Leading Without Followers

In Japan, the initial process of choosing 3G standards and allocating spectrum was relatively uncontroversial. Japanese government and industry participants understood that the PDC standard had hindered Japanese cellular equipment in gaining global market shares, and as concrete talks of a 3G standard emerged in the ITU, it was obvious to all that Japan should adopt the international standard. DoCoMo was heavily involved in developing W-CDMA, and a tie-up

[21] The ITU had planned since the late 1980s to create a global digital standard, in its initiative IMT-2000 (International Mobile Telecommunciatons-2000). By the late 1990s, European participants such as Nokia did not think they could win in competition against the Japanese, leading to a coalition between Japanese and European players (Steinbock, 2003).

with major European players, including Ericsson, seemed to open an opportunity to link Japan's domestic market with global markets.

In 1999, the J-MIC (successor to MPT) announced that it would allocate three 3G licenses for nationwide service. This precipitated a consolidation of carriers in late 2000, resulting in three cellular firms with nationwide networks: NTT DoCoMo, KDDI, and J-Phone. KDDI was the product of a merger between cellular competitors DDI and IDO, and the former international service monopoly firm, KDD. DDI and IDO, which had operated in mutually exclusive geographic regions, had been brought closer together with the urging of Toyota, jointly adopting Qualcomm's CDMAOne network in 1998. J-Phone was a consolidation of the cellular firms that had entered in 1994 with capital from Japan Railway, the former state-owned railroad firm.

KDDI had initially wanted a W-CDMA license, since it was to be adopted in Europe, and as of early 2000, CDMA2000 had yet to be recognized as an ITU global standard. However, after price negotiations with Qualcomm during a visit by Toyota and Kyocera executives, a simplified form of CDMA2000, an incremental upgrade from KDDI's CDMAOne network already in place, was presented as a viable option. KDDI's management resisted, but Toyota, again threatening to pull out of guaranteeing the massive loans needed to build 3G infrastructure, forced its hand. (Toyota also required that KDDI sell its PHS business).[22]

In the end, three applicants applied for three licenses – DoCoMo and J-Phone for W-CDMA, and KDDI for CDMA2000. The licenses were granted later in 2000 by J-MIC,

[22] The authors thanks Professor Naoe Shigehiko, former Telecommunications Deliberation Council member, for these points (Naoe, 2007).

essentially free of charge to ensure that carriers, especially DoCoMo's competitors, had enough capital to rapidly deploy 3G networks nationwide.

DoCoMo commenced W-CDMA services in October 2001, as did J-Phone in December 2002. KDDI, upgrading its CDMA network, began offering CDMA2000 1x, a slower but less costly version of CDMA2000, in April 2002. DoCoMo's W-CDMA service (named FOMA), grew disappointingly slowly, largely due to DoCoMo's hasty and premature commencement of services; technical issues made the early handsets larger than 2G handsets in addition to having a shorter battery life, and FOMA's initial coverage area was limited and relatively poor. However, as handsets became smaller with a longer battery life and DoCoMo improved the coverage area, the number of W-CDMA subscribers began to grow. Meanwhile, KDDI's CDMA2000 1x grew rapidly, as it was a simple upgrade for most users. J-Phone, with costlier infrastructure than KDDI, but with far less capital than DoCoMo, was slow to invest in its W-CDMA network, trailing behind the others. (See Table 7)

Table 7
3G Subscribers in Japan by Technology (millions)

	W-CDMA (DoCoMo, Softbank*)	CDMA2000 (KDDI)
2002	0.15	4.6
2003	2	11.7
2004	16.8	25.7
2005	22.4	20.6
2006	38.1	25.1

Notes: J-Phone became Vodafone, then Softbank
(Telecommunications Carriers Association)

Competition between the three carriers led to KDDI introducing flat-rate data services (2.4Mbps downstream) in November 2003, enabled by another incremental upgrade of its standard (from CDMA2000 1x to CDMA2000 1x EV-DO). DoCoMo followed with flat rates for 3G data in June 2004, but capacity problems restricted the number of flat-rate users until Feb 2006, when it upgrated its own network (an incremental upgrade from W-CDMA to W-CDMA HSDPA) (Masuno, 2006).

Thus, with the rapid deployment of Japan's domestic 3G services, it seemed that the manufacturers would be poised to re-enter global markets. However, unfortunately for them, the pace of W-CDMA deployment in Europe trailed far behind expectations. Spectrum auctions around 2000 had escalated to titanic amounts, but the bursting of the technology bubble in 2001 rendered most of the winners short on capital. W-CDMA networks were costly, since they completely replaced existing GSM network infrastructure, unlike the incremental upgrade from CDMA to CDMA2000 1x. Furthermore, new sources of revenue for European carriers, such as camera embedded handsets that could send pictures, weakened their incentive to build 3G networks immediately.

Thus, despite Japan's success in strategically allocating 3G licenses and fostering rapid domestic network deployment to secure technological and service leadership, it ended up

running ahead of most of the rest of the world. Moreover, even as 3G networks were slowly deployed across the world after 2003, Japan's domestic logic of competition – carrier-driven R&D allowing the rapid introduction of new services with heavily subsidized handsets – hindered manufacturers from attaining economies of scale to build low cost handsets.

Korea's 3G Strategy: The Irony of Market Disobedience

The Korean government's strategy in allocating 3G licenses was to hedge its bets on the two 3G standards, forcing at least one carrier to choose the standard that others did not. A struggle ensued between the K-MIC, carriers, and chaebol equipment manufacturers, with the result that the rollout of W-CDMA, which the government strongly pressed for, was far slower than predicted. However, this delay in W-CDMA deployment turned out in favor of equipment manufacturers, who could concentrate on their CDMA and CDMA2000 1x exports, given the slow adoption of 3G in international markets.

In 1999, K-MIC announced that it would award 3G licenses. Concerned about excessive competition that would sap carriers of the capital to deploy networks, it limited the number of licenses to three, and it again favored applications by consortia in order to limit chaebol and foreign participation. As in the case of Japan, this sparked a wave of consolidations, as SKT acquired Shinsegi Telecom over a period of several months beginning in December 1999, and KTF acquired Hansol in 2001.[23] Thus, the three consortia, SKT, KT, and LG Telecom (LGT), applied for the 3G licenses.

[23] SKT's takeover of Shinsegi brought about some of the most extreme market interventions by the Korean government. Both the MIC and FTC were concerned that SKT, already the dominant carrier, would dominate the market so completely as to render it uncompetitive. They gave their approval with the condition that SKT actually lower its market share to less than 50% within six months of the merger. (Jho, 2003)

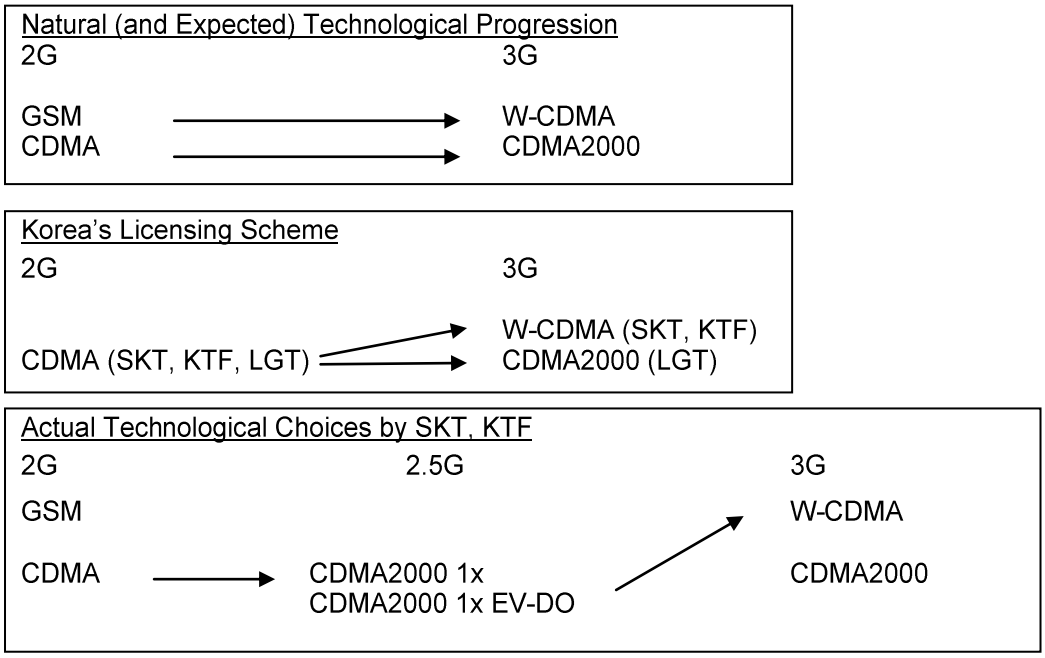
Another political battle erupted, this time between K-MIC, carriers, and equipment providers over who should apply for which license. K-MIC took the position that one or two carriers should adopt W-CDMA, since it was projected to be most widely deployed in the world as the successor to GSM. Existing 2G carriers, SKT, KTF, and LGT, also argued for W-CDMA, despite the fact that this entailed building a completely new network to upgrade from their existing CDMA infrastructure. However, the equipment manufacturers, including Samsung, Hyundai, and small CDMA equipment providers, strongly preferred CDMA2000 – though they did not take a strong public position. Since CDMA2000 was a direct and incremental upgrade, they could utilize much of their existing technological expertise and continue exporting to the US market, which seemed to be headed towards CDMA2000 (Jho, 2003).

The government, in balancing these interests, urged carriers to adopt CDMA2000 to facilitate exports. Later in 2000, K-MIC considered delaying the W-CDMA license offering to give equipment manufacturers time to gain technological competencies with the standard. It recommended that two carriers choose CDMA and one select W-CDMA. However, none of the carriers took the government's recommendation, with all three applying for W-CDMA licenses in October 2000. The government then granted two, rather than three licenses, to the SKT and KT consortia, for W-CDMA. It publicized a plan to set aside an additional license to allocate later, hoping that LG would apply for a CDMA2000 license. LG was reluctant however, having spent several years concentrating resources to develop W-CDMA technology. In the end, the government used a combination of informal pressure and financial incentives to convince LG to apply for a CDMA2000 license, but with a significantly lower licensing fee than those of SKT or KT (approximately $800 million compared to slightly over $1 billion – significantly lower than the $6 billion to over $9 billion for each of five licenses allocated in Great Britain, six licenses at

$6.7 billion each in Germany, and two licenses for $4.5 billion each in France) (ITU, 2001; Jho, 2003; Park & Chang, 2004).

As a result of these strained circumstances in licensing 3G, and the slow adoption of W-CDMA in Europe, carriers did not rush to build and market W-CDMA networks. In fact, SKT and KTF chose to continue pouring investments into their existing CDMA networks to upgrade them incrementally – towards CDMA2000, even though they could never reach full-fledged CDMA2000, since they were licensed for W-CDMA (See Figure 1)

Figure 1
Natural Technological Paths from 2G to 3G, Compared to Korean Carriers' Strategies



It has been argued that the Korean carriers' incremental upgrades towards a dead-end were wasted investment in the long term (Kim, 2004). However, in the short term, since CDMA2000 1x EV-DO had faster data transmission speeds than the initial W-CDMA standard, SKT and KTF were able to offer advanced services. Since the carriers pooled their core resources in CDMA 1x despite rolling out W-CDMA services, they did not invest in W-CDMA heavily, limiting the coverage area, variety of handsets, and services available. Early W-CDMA

subscriber numbers were so low, in fact, that neither the government nor carriers include them in official or public documents (See tables 6 and 7 below for a partial overview). With the introduction of the incremental upgrade to W-CDMA enabling high speed data (W-CDMA HSDPA), Korean carriers could offer comparable speed to their CDMA 1x EV-DO services, and began putting their weight behind W-CDMA. The rise in popularity of SKT's service can be seen in Table 8.

Table 8
Korea's CDMA 2000 1x and W-CDMA Subscribers

	CDMA2000 1x (SKT, LGT, KTF)	W-CDMA (SKT)
2002	400,000	-
2003	16,517,747	-
2004	24,826,737	70
2005	32,537,118	1,300
2006	36,076,421	3,250
2007	38,363,373	2,000,000

Notes: CDMA2000 1x includes 1x EV-DO. Sources: K-MIC internal documents, (MIC, 2008), (SKT, 2008).

Conclusion

This paper posed the question of why the relatively similar, sophisticated domestic cellular markets of Japan and South Korea experienced radically different performance outcomes in international markets. It finds that the market-based causes of this divergence – differences in the logic of competition in domestic cellular markets, and the choice of standards – were shaped by government policies and decisions at key moments. These key moments were liberalization and standard-setting, in which heated political debates, originating from differences in the initial level of technological dependence on foreign technology, shaped the outcomes.

In Japan, domestic firms dominated wireless technology, leading to foreign pressure to facilitate market access at the critical moment of liberalization. To avoid repeating this heated debate, the government quickly approved the proprietary digital standard during the second phase of liberalization without considering international strategy. The proprietary standard, when

combined with the NTT-dominated R&D regime and domestic logic of competition, trapped Japanese manufacturers in the domestic market. Learning from its mistakes, MPT adopted international standards in the next moment of market reorganization, but this strategy was undermined by the slow development of international markets and Japan's continued domestic logic of competition. Japanese manufacturers continued to be trapped in their domestic market – Galapagos.

For Korea, initial foreign technological domination led to a focus on gaining domestic competency. Bureaucratic turf wars during liberalization strengthened the government's commitment to strategically deploy a standard that could link the domestic market to global markets. A fortuitous and unexpected set of policy debates then reshaped the domestic logic of competition which further focused manufacturers on international success. The failure of market players to follow government's strategic plans for 3G turned out in favor of Korea's international market presence when 3G deployment worldwide faltered and Korean firms continued to invest in interim technologies deployed widely across the world.

What are the policy implications of this study? The complex reality this analysis reveals does not lead to a simple condemnation of government actions to strategically foster development of their domestic markets. Indeed, few would consider the rapid development of wireless networks and services in Japan and Korea to have been failures in of themselves – many applications and services enabled by high-speed networks enhance the lives of users, who are willing to pay for many of them. However, the issue at stake is the opportunity cost with respect to international markets – whether government strategy for domestic development traps firms in that domestic market, or allows them to use it as a springboard into global markets. Given that markets built upon wireless spectrum almost always require sustained government intervention

(in allocation, re-allocation, and defining usage to prevent interference to other users), and laissez-faire virtually never occurs in practice (even in liberal market governments such as the United States and Great Britain), governments willing to act strategically to develop their domestic markets should consider the implications for linkages to international markets.

The experiences of Japan and Korea also show that, even if governments do explicitly consider the success of domestic firms in international markets, "getting the policies right" may not suffice. International market trajectories can take unexpected twists, rendering the best laid plans ineffective. Nonetheless, engaging with participants in international markets, embracing inward foreign direct investment, and allowing foreign firms to participate in domestic standard-setting processes may somewhat alleviate the risk of "leading without followers" or creating a industrial Galapagos.

As a scholar, the lesson here is that when evaluating the effectiveness of government policies in hindsight, one must keep in mind the international market context. When global market trajectories and domestic market dynamics are aligned, it is easy to take global market developments for granted, focusing solely on the success or failures of domestic policies. However, when global market trajectories shift in unexpected directions, the same domestic policies that seemed successful or farsighted can suddenly seem myopic and destined to fail. This may be applied to broader considerations in areas including "best practices" for corporate governance and "optimal" configurations of government institutions and industrial organization – often an underlying theme in comparisons across countries. What seemed to work best during one set of global market trajectories may be exposed to have contained grave problems when conditions change, and may not necessarily have been optimal in of themselves.

Finally, this study points to an emerging thrust of inquiry into a transformation of the relationship between services and products, and its implications for international competition (Kushida & Zysman, forthcoming; Zysman, 2006). As companies attempt to avoid commoditization, many are moving to embed products within service offerings.[24] Cellular services provide an early example of a dynamic likely to hit other markets that are currently considered products, in that features of high-end cellular handsets cannot be taken advantage of unless the services support them – and services rely on IT networks, the providers of which are often nationally based. Entering international competition with high-end products therefore requires working closely with service providers in various countries, or entering overseas service businesses directly – requiring a different set of skills from making high-end products.

Taking services internationally, however, is likely to present a different set of challenges from those of selling products abroad, since a different set of national policies can profoundly affect service businesses. Consider recent hardware-enabled mobile commerce or healthcare services and applications, in which IC chip-embedded handsets can be used to physically contact cash registers to make purchases, or handset-embedded sensors can take daily vital readings and send them to family members (or a healthcare organization) for monitoring. The terms for international competition in such services does not simply involve the quality of handsets and services, but their ability to work with various national regulations governing e-commerce, information privacy, and healthcare, and potentially very different consumer concerns shaped by various broader national political economic factors. For example, in the US, one may want US

[24] Prominent examples include IBM's shift from selling servers to selling services with servers embedded, the success of Apple's iPod, enabled by its iTunes software and online store (in contrast to Sony's reliance on manufacturing capabilities), and the array of "Web-based" software that allow new business models such as charge-by-use when freed from software as products, distributed on physical media.

healthcare delivery organizations to access and monitor one's elderly parents' vital signs remotely, but would probably not want the company providing the remote healthcare data service to sell that information to insurance companies, who use that information to deny coverage. This would not be a concern in countries with nationalized healthcare insurance. To sell services internationally, the national politics shaping the various national policies and regulatory regimes matters all the more, with implications for how companies interact with target country policymakers – who to lobby, and how, for what – beyond traditional trade issues.

This nature of services, potentially dependent on a wider range of national rules and regulations than conventional products, can increase the danger of firms getting trapped in domestic markets due to reliance on "services infrastructure" that is only available domestically. In addition to hardware that required services to take advantage of advanced features, innovation in software-based services and applications can get trapped if they depend on particular characteristics of domestic networks (such as flat-rate high speed 3G cellular) or a platform (such as Japan's cellular Internet) that may be unavailable elsewhere. In the context of debates around the globe over reregulating telecommunications sectors and deploying so-called Next Generation Networks – as a set of broadband and wireless technologies, and as a new platform for services and applications – the various forms of how the domestic market trapped or launched firms into international markets shown in this paper should be taken into consideration as a starting point.

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