The Political Economies of Wireless in Japan and South Korea: The Politics of Standard-Setting and Liberalization

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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, with Japanese firms retreating from relative success in the 1980s to become virtual non-players, while Korean firms stormed into global handset markets since the late 1990s.

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 its standard that would advantage domestic firms in international markets. Fortuitous policies from unexpected sources ended up aiding Korean market players' focus on international markets. In contrast, the Japanese government was not focused on international markets in its early policymaking, making it more difficult later on to shift the terms of market competition away from an exclusive focus on the domestic market. In addition, some of Japan's strategic policymaking aimed at global markets was partly undermined by unexpected shifts in international market conditions.

I. Introduction

The ICT sectors of Japan and South Korea (hereon, Korea) have developed rapidly since the mid 1990s, especially in wireless and broadband services. In particular, the wireless markets of the two countries offer extremely sophisticated and advanced wireless services, with high speed networks, technologically leading-edge handsets, thriving mobile Internet content markets, and are extremely profitable to carriers. However, the two countries' fortunes in international cellular markets could not offer a more stark contrast. Japanese equipment manufacturers, prominent in global markets in the 1980s and early 1990s, withdrew almost completely by the mid-2000s despite considerable success by Japanese manufacturers in other high-tech sectors. Korean manufacturers, on the other hand burst into global handset markets in the late 1990s to take significant global shares. At the most basic level, we ask: why did both countries develop highly sophisticated domestic wireless markets, and why did their fortunes in international markets diverge so dramatically?

In seeking answers, we must immediately direct our attention to the interaction between government policies and market dynamics in each country. It is well known that the processes and outcomes of *spectrum allocation* and the *selection of cellular standards* in various countries strongly influenced the terms of market competition in their domestic markets, which in turn affected the fortune of their domestic companies in international markets.[1] Through previous studies of the two countries' telecommunications sectors in general, and recent analyses of their broadband market development, we know that the

[1] See Steinbock, Dan. 2003. *Wireless Horizon: strategy and competition in the worldwide mobile marketplace*. New York, NY: AMACOM.; Funk, Jeffrey. 2002. *Global Competition Between and Within Standards: The Case of Mobile Phones*. New York, NY: Palgrave. For a US-Europe comparison, see, Koski, Heli. 2006. Factors of Success in Mobile Telephony: Why Diffusion in the United States and Europe Differs. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology in the Digital Era*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press.

Japanese and Korean governments have a propensity to act strategically in attempting to shape the terms of market competition in order to achieve specific objectives.[2]

Are the two countries' diverging fortunes in international markets a result of variation in the *level of success* in policy design or implementation? In other words, did both countries aim to shape market dynamics that would lead to domestic sophistication *and* international competitiveness, with Korea succeeding in both, and Japan failing in the latter? Alternatively, was it a case of *different strategic goals*, with the Korean government focusing on both domestic development and international markets, while the Japanese government only focused on domestic development? Or, were the outcomes some form of *fortuitous policy backfire*, in which the unintended consequences of strategic policy led to market dynamics that produced the observed outcomes?

We can also hypothesize about the nature of the *politics* that drove the policymaking processes and government-market interactions. Historically, Korea's telecommunications policymaking was relatively smooth, dominated by a strongly hierarchical relationship between the government and the governed, while Japan's telecommunications policymaking was more politicized, with multiple government actors battling a politically powerful incumbent telecom carrier.[3] If their spectrum allocation and standard-setting process conform to these national patterns of telecommunications policymaking, then we would expect to see more decisive and less politicized Korean strategic policies, while we would expect to see a less decisive, more politicized Japanese policy process.

This paper finds the opposite. It turned out to be Korea that experienced a more politicized struggle between a wide range of domestic actors, while Japan's choices over

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[2] See Kushida, Kenji, and Seung-Young Oh. 2007. The Political Economies of Broadband in South Korea and Japan. *Asian Survey* 47 (3): 481-504.
[3] Ibid.

spectrum allocation and standard setting were relatively smooth, with some degree of foreign pressure. In terms of government goals and strategy, this paper contends that while both countries were focused on actively promoting the development of their domestic industry, they had different initial strategic priorities regarding international markets, largely due to different initial levels of dependence on foreign wireless technology and equipment. The Korean government, seeking independence from foreign equipment, sought to actively build domestic technological capacity, and fortuitous policies from unexpected sources ended up aiding market players' focus on international markets. In contrast, the Japanese government was not focused on international markets in its early policymaking, making it more difficult later on to shift the terms of market competition away from an exclusive focus on the domestic market. In addition, some of Japan's strategic policymaking aimed at global markets was partly undermined by unexpected shifts in international market conditions.

Korea's and Japan's Cellular Markets – Similar Domestically, Contrasting Internationally

A snapshot of key indicators and characteristics of Japan's and Korea's domestic cellular markets show them to be quite similar in their pattern of development and defining characteristics, in many cases resembling each other more closely than other advanced industrial nations. This makes the contrast between their fortunes in international markets all the more stark.

Domestic Similarities

In the mid-1990s, both countries experienced spurts of rapid subscriber growth after new competitors were licensed – growth spurts more rapid than those in other notable OECD countries. The table below shows the rapid growth spurts in Japan from 1994-1996, and in Korea from 1996 to 1998.

Table 1: Growth rates of mobile cellular telephone subscribers per 100 inhabitants over previous year - G8 Countries plus Denmark, Finland (percent)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Denmark	18	20	69	40	63	59	9	33	36	28	17	13	6	8	5
Finland	23	20	26	38	51	46	44	31	15	14	12	8	5	5	5
France	32	16	30	54	47	88	135	92	90	35	26	4	8	6	8
Germany	85	73	82	40	49	48	50	68	68	105	16	5	10	10	11
Italy	117	38	54	85	75	64	83	75	48	40	20	9	2	10	15
Japan	58	24	24	103	170	129	42	23	20	17	12	8	7	5	5
Korea	107	63	73	102	70	93	115	103	66	14	5	11	3	8	4
UK	13	19	50	73	45	26	22	68	82	59	6	8	10	12	7
US	41	44	43	49	37	29	24	24	23	26	16	9	12	14	14

Source: ITU World Telecommunication Indicators Database 2006

Japanese and Korean handsets and services have been pushing the forefront of technological sophistication for some time – since at least the mid-1990s for Japan, and from the late 1990s and early 2000s for Korea. The most sophisticated handsets are only available for the respective domestic markets (despite Korea's success in export markets) where cellular service providers take full advantage of their features. Japanese handsets were first to market with polyphonic ring tones, color displays, and cameras.[4] More recent developments, common with Korean handsets include IC chip-embedded handsets that can be used with a variety of services, video-chat capabilities, and song downloads. Japanese handsets led in miniaturization throughout most of the 1990, and more recently, it has been Korean handsets that have been at the forefront.

Japan pioneered successful cellular internet business models, beginning with DoCoMo's *i-mode* introduced in 1998, and Korea was an early adopter of cellular internet

[4] Color displays appeared in late 1999, and camera-embedded handsets (along with picture mailing services) appeared in late 2000. In early 2001, handsets that could download java applets, enabling applications to run on the handset without further downloads (I-appli), appeared.

services. More recent popular services taking advantage of the sophisticated handsets available in the two countries' respective domestic markets include IC chip-enabled micropayments, train and bus passes, various forms of mobile commerce, and Global Positioning System (GPS)-enabled content ranging from determining children's whereabouts to location-specific information and coupons. In Japan, the market for song downloads to cellular handsets exceeded that of Apple's *iTunes* as recently as 2006.[5]

Most of these services required close R&D coordination between carriers and handset manufacturers. Though to a greater degree in Japan than Korea, the two markets are often noted for their extensive R&D resources concentrated in the carriers rather than in handset manufacturers – a contrast with European and US markets, in which equipment manufacturers had far more R&D resources, with carriers cutting R&D expenditures over time. The close carrier-manufacturer R&D relations in Japan and Korea allow them to solve the chicken-and-egg problem of introducing new services; i.e. carriers are not interested in offering services that handsets do not support, while handset manufacturers are not keen to include new service capabilities when carriers do not yet offer such services.

Furthermore, many of the advanced services in the two countries were enabled by their exceptionally rapid and extensive deployment of third-generation (commonly known as 3G) cellular networks and services.[6] Let it suffice here to say that in the late 1990s, 3G was hailed as the technology that would revolutionize cellular markets worldwide by enabling fast Internet and data connections and seamless global roaming. Influenced by the telecom investment bubble that burst in 2000-2001, many European carriers bought wireless spectrum

[5] Masuno, Daisuke. 2006. *Gyoukai Kenkyu Shiriizu: Tsushin [Industry Analysis Series: Telecom]*. Tokyo, Japan: Nihon Keizai Shimbun Sha, p. 30.

[6] In mobile communications, analog standards that prevailed across the world until the mid-1990s are referred to as first generation (1G), the digital standards currently dominating the world as second-generation (2G), and high-speed digital systems first commercialized in the early 2000s as 3G. The International Telecommunications Union (ITU), a branch of the United Nations approves the major cellular standards.

for 3G at extremely high prices through auctions. However, after the bubble burst, many were unable to pay to their license fees, let alone invest in costly 3G network infrastructure. As we will see, this unforeseen collapse of potential 3G markets in the early 2000s hindered Japan's push to reenter global markets.

In this international 3G context, Japan and Korea were among the first countries to commercialize 3G services, with CDMA2000 1x (an earlier version of full-scale the 3G standard CDMA2000) introduced in Korea in October 2000, and W-CDMA in Japan in May 2001. In 2004, over 85 percent of the approximately 15 million 3G subscribers worldwide were in Korea and Japan.[7] Moreover, each country has both of the two major competing global 3G standards, W-CDMA and CDMA2000.[8]

Differences in International Performance

While Japanese firms enjoyed a significance presence in global markets for analog cellular equipment until the mid-1990s, they retreated significantly thereafter.[9] By 2001, they had dropped out of the list of top five manufacturers, with little more than a sliver of global market shares, though the joint venture between Ericsson and Sony, creating SonyEricsson, led to somewhat of a resurgence (from the standpoint of Japanese manufacturers – Ericsson had enjoyed larger market shared previously). In the early 2000s, Japanese manufacturers NEC and Matsushita (Panasonic) geared up to enter global markets again, but by 2006, they

[7] ITU. 2005. Ubiquitous Network Societies: the Case of the Republic of Korea: International Telecommunication Union.
Includes W-CDMA and CDMA2000 1xEV-DO, though some argue that the latter is not truly 3G because it is a more advanced version of the same technology that is ITU-approved.
[8] We will return to the politics of creating 3G standards later.
[9] Reliable figures of market shares are difficult to come by, but one estimate puts the stock of Japanese mobile handsets in North American markets at almost 60 percent. Communication and Intelligence. 1989. *Jidosha Denwa Sensou* [The Car Telephone Wars]. Tokyo: Eru Shuppansha. P.60. Steinbock notes a large order of Oki mobile phones by the Bell System. Steinbock 2003, p. 97

had withdrawn from even the fast-growing Chinese market, representing a complete failure to recapture global markets.

Korean equipment firms, however, began gaining global market share rapidly after the late 1990s. Samsung ranked fourth in 2001, and by early 2006, Samsung and LG were ranked third and fourth.

Table 2: Global Handset Shares: 1999-2002 (percent)

	1999	2000	2001	2002
Nokia	26.9	30.6	35	35.8
Motorola	16.9	14.6	14.8	14.8
Ericsson*	10.5	10	6.7	5.5
Samsung	6.2	5	7.1	9.8
Siemens	4.6	6.5	7.4	8.2
Panasonic	5.5	5.2	-	-

Source: Gartner Dataquest cited at [http://cellular.co.za/stats/stats-handsets.htm, last accessed 12/06]
* SonyEricsson from 2001

Table 3: Global Handset Shares: 2006 (percent)

	2006**
Nokia	34.9
Motorola	21.4
Samsung	13.5
LG	7.3
SonyEricsson	6.2

** Jan through March
Source: Nikkei

Virtually all explanations for this divergence in international performance between the two countries cite *choices in cellular standards*.[10] While the CDMA standard, pioneered and used in Korea, became a mainstream standard in North America, Japan's PDC standard

[10] For example, see Funk, Jeffrey. 2002. Global Competition Between and Within Standards: The Case of Mobile Phones. New York, NY: Palgrave.; Cole, Robert E. 2006. Telecommunications Markets in World Markets: Understanding Japan's Decline. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press. pp.101-124.

remained confined to its domestic market. Therefore, while Korea's equipment manufacturers could use their domestic market as a springboard for exports, Japan's equipment manufacturers were "stuck" in their domestic market, though simultaneously protected from imports. However, most analyses offer only simplified accounts of the standard-setting process, usually attributing the Korean decision to some combination of "smart government" and luck, and Japan's decision to the strength of NTT and complaisance of the government.[11] This paper goes well beyond simplistic explanations, analyzing the decision-making and political processes in much more detail.

The Politics of Spectrum Allocation

In both countries, choices over spectrum allocation (who received wireless spectrum), were products of national government strategies of liberalization (when and how to introduce competition into the sector through a mix of deregulation and reregulation). Both countries began with their respective national monopoly carrier operating cellular services. Both lagged behind international benchmarks of cellular price and penetration levels until competitors were introduced. In allocating spectrum to new competitors, both governments carefully managed not only their number, but also their character and ownership composition.

The major differences between the liberalization strategies of two countries were the initial role played by foreign firms, and the R&D capacities of domestic firms. This initial difference drove the divergence in politics and strategies of Japan's and Korea's policymaking vis-à-vis international markets.

[11] For example, see ITU. 2005. Ubiquitous Network Societies: the Case of the Republic of Korea: International Telecommunication Union.

Initial Conditions -- Monopoly Analog

Japan's Analog Cellular Market and R&D Regime

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.

R&D resources were concentrated in NTT from its inception in the late 1800s as a government bureaucracy commissioned to build national communication infrastructure. An R&D regime which began in the prewar era involved NTT's receiving massive procurement budgets from the government, and subsidizing R&D efforts of a "family" of equipment firms such as NEC, Fujitsu, Hitachi, and Oki. These manufacturers owed much of their technological capacity to NTT, who made them compete for procurement shares with each other on the basis of quality, but paid them on a cost basis, effectively supporting their R&D in other areas such as consumer electronics.[12] These relationships persisted well through the postwar period, making it natural for NTT to develop its own cellular standard and get its "family" firms to provide equipment.

Japan was actually a pioneer in mobile services when NTT began car phone services in 1979. However, it was relatively late in commencing cellular services as compared to Europe and the US. NTT's cellular services began in 1987, using its own proprietary analog cellular standard, HiCap. NTT "family" firms competed for procurement shares on an OEM basis, with order size determined by the previous order size and quality. At this time, many major industrialized countries in the world used their own proprietary analog standards, and

12 See Anchordoguy, Marie. 2001. Nippon Telegraph and Telephone Company (NTT) and the Building of a Telecommunications Industry in Japan. Business History Review (75, Autumn):507-541.; Fransman, Martin. 1995. Japan's Computer and Communications Industry: The Evolution of Industrial Giants and Global Competitiveness. New York, NY: Oxford University Press.

the possibility of regional or global markets was seldom contemplated. Therefore, especially because NTT was legally prohibited from engaging in international operations at this time, it was natural for NTT to lack a focus on international markets for its suppliers.

Korea's Analog Cellular Market and R&D Regime

The Korean telecommunications sector was younger than that of Japan, largely due to the Japanese occupation and the devastation of the Korean war. Korea did not develop an NTT-style, carrier-dominated R&D regime. Instead, government R&D organs such as ETRI [full name], rather than the state-owned monopoly, Korea Telecom (KT) by itself, helped finance manufacturers. Focused on building landline telephone infrastructure, firms such as Samsung, LG, Daewoo, Daeyung, Donyan, and Hyundai were aided by ETRI and KT in R&D efforts to develop landline equipment such as exchanges.[13]

KT's analog cellular services began in 1984, but as a consequence of being a late developer, Korea was almost completely dependent on foreign technology and equipment for its cellular services. Korea adopted an analog standard used in North America known as Advanced Mobile Phone Service (AMPS), and it relied overwhelmingly on the American firms Motorola and AT&T for its infrastructure and handsets.

The Politics of Orchestrating Competition in Japan

Japan introduced competitors into the cellular market in three phases – the late 1980s, the mid 1990s, and again in the early 2000s. In the first two phases, international competiton was not a strategic focus.

[13] Jho, Whasun. 2003. Building Telecom Markets: Evolution of Governance in the Korean Mobile Telecommunications Market, Political Science, Northwestern University, Evanston, IL. p. 186.

The timing of introducing the first set of cellular competitors was determined by the broader process of privatizing NTT and ending its monopoly. The politics of NTT privatization and market liberalization were extremely complex and contentious, characterized by struggles between NTT, multiple government ministries, a strong labor union, and telecom policy specialist politicians. In the end, NTT was partially privatized, some competition was introduced, and the Ministry of Posts and Telecommunications (MPT) gained vast regulatory powers. In both landline and wireless markets, MPT used its new formal and discretionary powers to orchestrate the entry of competitors and micromanage competition.[14] However, its attempts to orchestrate competition into the cellular market were somewhat frustrated by a battle against the US government, mobilized by Motorola, in the context of broader US-Japan trade disputes of the late 1980s.

MPT's initial plan was to orchestrate the entry of a single competitor by consolidating interested firms into a consortium, Nihon Ido Tsushin (IDO).[15] However, a second carrier, Daini Denden (DDI), also desired entry, and it wanted to use Motorola equipment (and therefore the AMPS standard). Motorola, which had a strong interest in entering Japan, used US governmental pressure as a bargaining lever to attempt to gain privileged entry into the market. MPT argued that since NTT was licensed for half the available spectrum, there was insufficient spectrum for two additional competitors.[16] MPT

[14] See Kushida, Kenji. 2006. Japan's Telecommunications Regime Shift: Understanding Japan's Potential Resurgence. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology in the Digital Era*, edited by A. Newman, and John Zysman. Stanford, CA: Stanford University Press.; Kushida, Kenji. 2005. The Politics of Restructuring NTT: Historically Rooted Trajectories from Actors, Institutions, and Interests. *Stanford Journal of East Asian Affairs* 5 (2):29-36.; Vogel, Steven K. 1996. *Freer Markets, More Rules: Regulatory Reform in Advanced Industrial Countries*. Ithaca, NY: Cornell University Press.

[15] Members included Toyota, Tokyo Electric Power Company, and others.

[16] The issue at hand was the projected magnitude of cellular phone growth – conservative estimates put it as 3 million by the late 1990s, but more aggressive estimates put it at 30 million. (Naoe Shigehiko, personal interview, February 2007.

also attempted to deny DDI's request on the basis of its potential lack of profitability.[17] Motorola lobbied the US government, arguing that if there were only one competitor to NTT, and that competitor adopted NTT's proprietary standard, Motorola would be effectively shut out of Japan – a non-tariff barrier, they contended. In the context of the broader US-Japan trade friction of the late 1980s, high-level political involvement led to a series of compromises.

An initial compromise plan in 1987 allowed both carriers to enter the market, but in different geographic regions. IDO received the greater Tokyo area and Eastern Japan, while DDI was given Western Japan (interestingly enough, it was administrative guidance rather than a legal decree in this geographic division). However, Motorola was dissatisfied at its exclusion from Tokyo, and stepped up pressure on the Japanese government. This led MPT to adjust the service areas, giving DDI Northern Japan as well.[18] Motorola, still unsatisfied, went so far as to demand a specific new company be set up to use its equipment exclusively.[19]

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 using. This made little business sense, in that IDO was hereby proposing to create a second network, incompatible with the network it had already installed. In fact, behind this decision was Toyota, the major shareholder of IDO, which feared the escalation of trade friction that could damage it automobile exports. IDO's management was opposed,

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[17] 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 Slow Motorola Mobile Phone" The New York Times. December 15, 1986, p.D1)

[18] "Daini-Denden-Motorola Team Gets Wider Car Telephone Service Area" Jiji Press Ticker Service, April 22, 1987.

[19] "Motorola Makes Broader Demands On Japan" Jiji Press Ticker Service, July 11, 1989.

but had little choice other than to accept the plan, especially in the face of Toyota's threat to withdraw from guaranteeing the loans needed by IDO to build its networks.[20]

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, while DDI competed in all other regions, including Osaka.[21] These competitors quickly devoured NTT's market share, reducing it from 96 percent in 1988 to 65 percent in 1991.

The new competitors pushed the R&D efforts of NTT and its family firms closer together, as DDI 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. This was a shock to NTT, which 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." NTT hastily mobilized its extensive R&D resources and close relations with "family" equipment firms NEC, Matsushita, Mitsubishi, and Fujitsu, moving away from strict OEM manufacturing and allowing them to compete against each other on the basis of design and circuits (with NTT providing core specifications.) By November, 2000, NTT had unveiled a prototype of a handset half the size of that of Motorola's MicroTAC, commercializing the various manufacturers' versions in April 2001.[22]

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[20] This is common knowledge supported by several sources, including ibid.; Naoe Shigehiko, former member of the telecommunications deliberation council, and David Hytha, who was involved in the negotiations on the Motorola side.
[21] Masuno 2006.
[22] NTT DoCoMo. 2001. NTT DoCoMo junenshi: Mobairu furontia e no chousen [NTT DoCoMo Ten Year History: The Challenge Towards Mobile Frontier]. p.8-10

Choosing the Digital Standard, PDC, and Orchestrating Further Entry

In choosing a digital standard to replace the analog standard and thereby use the spectrum more efficiently, Japan's choice of another proprietary standard, PDC, isolated its domestic market from international competition – protecting it from imports but blocking exports as well. This choice was partially the result of MPT's attempt to avoid another round of potentially messy political debates over spectrum allocation, as well as its historical lack of focus on international markets.

When it became clear in the early 1990s that the analog standard would be insufficient to accommodate the burgeoning number of subscribers, a ministry study group examined the GSM standard, already in use and gaining popularity in Europe, as a possibility. However, it became immediately 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. Ratherh 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.[23]

IDO had started its AMPS service with Motorola equipment only in 1992, and was given until 1996, two years later than the 1994 date for other carriers, to adopt a digital standard. This prevented Motorola from opening the market access issue at this juncture. In any case, 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.

In addition, there was no real domestic alternative to PDC. Although the mobile division of NTT had been spun out in 1992 to create NTT DoCoMo as part of the continued

[23] I am indebted to former Telecommunications Deliberation Council member Professor Naoe Shigehiko for explaining this point (personal interview, Tokyo, Feb 2007).

political process of privatizing and breaking up NTT, DoCoMo received NTT's extensive wireless R&D labs. Research on the PDC standard had already begun before the spinout, and it was natural for DoCoMo to prefer its own standard. Other domestic carriers did not have the R&D strength to create their own standard,[24] and equipment manufacturers had no incentive to undertake independent R&D into cellular standards, since they could also rely on information passed down from carriers. In 1992, MPT decided that the new entrants to be licensed in 1994 would use the PDC standard.

Two new entrants were given spectrum at the 1.5 GHz frequency in 1994, the Digital Phone group under the umbrella of Japan Telecom, and Tsuka Cellular with Nissan as the main investor.[25] Further intensifying competition was the entry of three additional wireless carriers using a technology known as Personal Handyphone System (PHS), a product of MPT's industrial policy.

The Underappreciated PHS: Industrial Policy Shaping the Market

PHS, a domestically developed standard without much consideration for global markets, is often underappreciated. In fact, PHS significantly shaping the terms of competition in Japan's cellular services from the mid to late 1990s and contributing to the rapid sophistication of the domestic cellular market. When services commenced in 1995, PHS had several performance attributes that were advantageous over cellular telephony: the handsets were technologically simpler (similar to cordless phones) than cellular handsets, enabling higher performance, such as Sharp's model offering 400 hours of standby time[26];

[24] Steinbock 2003, p. 159.
[25] Masuno 2006, pp. 20-21
[26]PHS no Kashikoi Sentaku [The Smart Choice of PHS]. 1995. *Ekonomisuto*, June 20, 68-71.; Yasusa buki ni "shinai" wo kuu: daini jiyuuka no hikigane ni [Penetration "metropolitan" Areas With Low Price as a Weapon: Becoming a Trigger for the Second Liberalization]. 1995. *Nikkei Business*, July 3, 50-52.

PHS services offered clearer voices since it relied on the public ISDN infrastructure; lower monthly fees (less than 3000 yen versus 7000 to over 8000 yen for cellular subscriptions); per-minutes fees at a fourth of cellular services, and cheap base stations that could be installed inside subway terminals and stations. In short, PHS services put significant pressure on cellular carriers to improve their handsets, lower subscription fees, and improve their service coverage areas.[27]

PHS was the product of MPT's industrial policy efforts. MPT spearheaded the R&D, tightly controlled spectrum licensing, and micromanaged the composition of new entrants. Assuming that conventional cellular subscriptions would be too expensive for the masses, MPT used its R&D resources, acquired in the political settlement during the privatization of NTT, to conduct field experiments, set the standard, and to commercialize the technology. It orchestrated competition by directing the existing carriers to join PHS services, resulting in three consortia or joint ventures – 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).[28]

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 right before the services were rolled out.[29]

[27] The average weight of digital cellular phones were reduced from approx. 200g in early 1995 to 100 by April 1997. (Funk 2002, 187)
[28] Murase, Emily. 2003. Keitai Boomu: The Case of NTT Docomo and Innovation in the Wireless Internet in Japan. In *PhD Dissertation, Communications Department, Stanford University.* Stanford, CA. p.42
[29] Funk 2002. pp. 76-78.

As cellular service prices decreased and coverage areas improved, cellular handsets came closer to matching the PHS 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 the exit of several carriers.[30]

The Domestic Logic of Competition

In addition to the technical difficulties of having domestic proprietary wireless standards, the logic of competition in Japan's domestic wireless industry drove carriers and manufacturers inward, towards the domestic market and further away from global markets. With a regulatory shift in 1994, allowing direct sale of handsets to consumers rather than renting them, handset manufacturers, aided by the distribution system, began competing with each other on the basis of advanced features rather than cost.

Carriers purchased handsets outright from manufacturers, then selling them to consumers and wholesale distributors at a significant discount. Carriers compensated for the subsidized handset price with higher monthly and per-minute access charges. A set of carrier-handset "groups" emerged, with former NTT "family" firms such as NEC, Fujitsu, and Matsushita manufacturing handsets for DoCoMo, but not other carriers; new consumer electronics entrants such as 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

[30] The biggest difficulty in the cost structure for PHS carriers was their reliance on NTT's ISDN telephone network. Without any regulatory support, they were at the mercy of NTT's interconnection rates, which sapped half of their revenue. Masuno 2006. p.33.

and PHS 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 to each other, with competition based mainly on styling choices and extra features.

The intense competition by a large number of domestic manufacturers is, at first glance, similar to Japan's automobile sector, 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 with which manufacturers needed to comply. Although all official changes to the standard were approved by a semi-government organization, the Association of Radio Industries and Businesses (ARIB), it acted more as a rubber stamp, with DoCoMo holding de facto control.[31] Constant updates were a significant drain on the R&D resources of manufacturers, who could not attain economies of scale to lower prices before rolling out new models.

However, lowering prices was not the objective of manufacturers, because consumers were insulated from the direct handset costs, carriers would subsidize them. With competition from PHS, by around 1997, subsidy price wars had developed between carriers, and among distributors, who took smaller and smaller cuts from their retail sales. New, high-end handsets were often virtually given away, with prices such as 1 yen.

Thus, the constant need to update domestic handsets, combined with the lack of financial incentives to lower costs, led manufacturers to lack the resources or be willingness to adapt their phones to the GSM standard. In the context of their rationalizing different areas

[31] Funk 2002. p. 70.

of business as the 1990s slowdown overall economic growth of the Japanese economy wore on, their handset businesses provided stable profits for the major manufacturers, leading them to stay in the cozy domestic market. Those who were not as competitive eventually left the business. That the domestic market operated on different terms from global markets was clearly shown when handsets from global market leaders such as Nokia, Motorola, and Ericsson failed to make inroads in the mid to late 1990s. Though subsidized to a similar extent, they were not at all popular, striking consumers as large, clunky, and lacking standard of Japanese phones, such as polyphonic ring tones and large displays.

In sum, Japan's spectrum allocation policies were strategic in that the government had concrete goals – increasing the level of competition to reduce prices and raise performance – and to this end, it attempted to micromanage entry. Initial conditions giving NTT vast R&D resources, and the government's experience in dealing with the politics of spectrum allocation in the first round helped precipitate the decision to adopt a proprietary domestic digital PDC standard, and limit foreign participation in PHS. The increasing number of competitors shifted the terms of carrier competition towards lower service prices, improved coverage areas; and subsidies mobilized the carrier-equipment manufacturers teams to rapidly shrink and enhance handsets. It was within these market conditions that the dramatic increase in Japan's cellular subscribers occurred. However, the terms for handset manufacturing competition, with constant updates and subsidized prices, channeled their efforts towards staying updated with, and competing in, the domestic market with little regard or resources for international markets.

The Politics of Orchestrating Competition in Korea

The first round of liberalization in Korea's cellular telecom market revolved around three critical issues: limiting chaebol influence in the sector, choosing a digital standard, and limiting foreign influence in order to develop domestic capacities.

In the early 1990s, a political struggle over chaebol involvement in telecom services came to the fore, part of the broader tension generated between the government and chaebol, as chaebol influence over the economy as a whole increased.[32] Chaebol were interested in the growing telecom services market, but the Ministry of Communications (MOC) continually rejected their attempts to enter, fearing they would dominate the market. In 1991, a political battle ensued, with chaebol the Prime Minister's Office, the Economic Planning Board (EPB), MOC, and the Ministry of Trade, Industry, and Energy (MOTIE). MOTIE, who oversaw high tech manufacturing and exports, took a position against MOC, supporting the chaebol in their demands to operate services. The MOC tried, but was unsuccessful in getting the incumbent Democratic Liberal Party to weigh in on their side.[33]

This debate over chaebol involvement influenced the scope and timing of allowing spectrum and licenses to new competitors. MOC hoped to have a second carrier commence services by 1994, but MOTIE, closely aligned with equipment manufacturers, was opposed. MOTIE argued that service competition should wait one or two years for domestic manufacturers to increase their ability to provide infrastructure and equipment, thereby preventing further reliance on imports. The EPB weighed in on MOTIE's plan. Foreign companies, predictably, joined MOC's side to advocate foreign entry sooner, with Motorola

[32] 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.
[33] Jho 2003, pp. 203-206.

attempting to alleviate MOTIE's concerns by promising it would transfer technology to Korean firms.[34]

There was little need for a domestic debate over limiting foreign participation, however, and MOC was able to stipulate that foreign interests would have to enter Korea's telecom services market as members of consortia led by domestic firms, and without management rights. Six consortia ended up applying to be the second mobile carrier, each with a foreign participant.[35]

In 1992, a license was awarded to Daehan Telecom (Greater Korean Telecom) consortium. However, a political firestorm erupted with allegations of favoritism in the allocation, due to President Roh's close relationship with one of the main shareholders of Daehan, the Sunkyung group. Daehan was eventually forced to return its license, and MOC waited until the political leadership changed to conduct a second round of licensing in 1994.[36] This delay, however, thrust the issue of spectrum allocation and licensing new competitors into the debate over Korea's digital standard.

In the second attempt, the government included the provision that the second mobile carrier would use the CDMA standard.[37] Shinsegi, a consortium led by the steel company POSCO, won the license. Although Shinsegi wanted to build a GSM rather than CDMA-based network, since CDMA had yet to be commercialized. MIC rejected its wishes.[38]

[34] Ibid., pp. 208-210.
[35] Ibid., pp. 213-214.
[36] Ibid., , 214-215
[37] ibid., 215
[38] ibid., 2003, 218

Choosing CDMA

Reducing Korea's dependence on foreign equipment and building up the competitiveness of domestic equipment manufacturers were the government's key concerns in choosing a digital cellular standard. Given Korea's success at handset exports, largely due to its domestic cellular market acting as a launching pad, many analyses tend to credit the government for its far-sighted strategy. In particular, they focus on ETRI, the research arm of MOC, for collaborating with US firm Qualcomm, then a small startup firm with only 40 employees and the core intellectual property of CDMA, to commercialize the technology.[39] However, the often-underplayed political debate surrounding the selection and commercialization process resulted in a much firmer commitment to the standard, a faster rollout of CDMA, and the rise of MOC as the industry's lead agency.

The initial push for CDMA came from government led-initiative, with MOC subsidizing the initial development. In 1988, MOC published a document outlining its plans, 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 representatives from government, the scientific community, and large equipment manufacturers such as Samsung, LG, Hyundai, and Maxon.[40] This close government-industry collaboration sparked a major conflict between MOC and MOTIE.

MOCIE' status had been declining by the early 1990s, and did not want to lose jurisdiction of the equipment manufacturers. In 1993, it published a report criticizing MOC's plans for CDMA, arguing that TDMA should be the underlying technological choice, as it

[39] For example, see ITU 2005, "Korea." p. 23.
[40] Jho 2003, pp. 237-239

was the basis for GSM and had the potential to become the dominant global standard. MOCIE launched TDMA research programs, getting manufacturing companies to join in its efforts.[41]

MOC immediately opposed MOCIE's efforts, arguing that CDMA was technologically superior and more flexible in its future applications. Later in 1993, MOC strengthened its plans for CDMA, moving the deployment date for commercial CDMA deployment services by two years, and exerting its full jurisdictional authority to promulgate that CDMA be the only domestic digital standard.[42]

Manufacturers were left in a position where they could only follow MOC, since following MOCIE and TDMA would only allow them to manufacture exports, and be locked out of the domestic market. Thus, they limited their participation in MOCIE's GSM project, and MOC secured its jurisdiction over manufacturers at the expense of MOCIE.[43]

	Timing of entry desired	Standard advocated
MOC	Early	CDMA
MOTIE	Later	TDMA

In commercializing CDMA, a second round of research was conducted largely by industry, 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 relationships in R&D.[44]

[41] ibid pp. 241-242
[42] ibid p. 243
[43] ibid, p. 244
[44] ibid. pp. 255-256

Competition in Korea's Cellular Market – Digital Services

The Korean government licensed four competitors in the market in 1996 and 1997, just as the incumbent's digital services commenced. In 1994, KMT had been sold to the SK group, which renamed the carrier SKT. The new entrants, Shinsegi Telecom, Korea Telecom Freetel (later renamed KTF), LG Telecom, and Hansol, all used CDMA.

The shift to CDMA achieved the government's goal of nurturing domestic manufacturers and reducing the country's dependence on foreign equipment. Motorola, the dominant manufacturer, and the other foreign firms lacked expertise in CDMA, since Korea was the first country to commercialize the technology. Motorola's share equipment plummeted, even as Korea's cellular market expanded rapidly.[45] In 1995, it had slightly over half the market share, but by 1999, domestic manufacturers had over 90 percent of the market.[46]

Table 3: Korean 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

(Adapted from Jho p. 258)

In terms of international markets, Korea's collaboration with Qualcomm in commercializing CDMA yielded significant benefits. Qualcomm held the core intellectual

45 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.)

46 Yang, Heedong, Yougjin Yoo, Kelle Lyytinen, Joong-Ho Ahn. 2003. Diffusion of Broadband Mobile Services in Korea: The Role of Standards and its Impact on Diffusion of Complex Technology System: Case Western Reserve University.

property, forcing Korean manufacturers to pay significant royalties. In exchange, manufacturers were given rights to distribute CDMA handsets worldwide. This paid off handsomely when the US adopted CDMA as one of its domestic standards.

With five carriers in the market, Korea's cellular subscription fees and per-minute charges dropped rapidly. KMT was under intense market pressure, evidenced by their 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 million in a year. The other new entrants, offering what is known as PCS services – essentially cellular services using higher frequencies – could offer lighter phones and better service coverage areas, partly due to the denser cell requirement.[47] New entrants discounted their services, and roaming agreements, such as between KTF and Hansol, allowed them to share the construction and operating costs networks in provincial areas.[48]

The logic of competition moved towards subsidies for handsets, just as it did in Japan. PCS carriers initially offered larger subsidies as they attempted to battle incumbents, and incumbents began countering 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. These subsidies were given in exchange for ever-longer obligatory subscription periods, starting at one year in 1997, and reaching three years by 1999, during which subscribers wanting to terminate their subscription had to pay back the subsidy.[49] Again, in a similar fashion to Japan, these were the market conditions in which Korea's massive increase in subscribers occurred. However, a

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

[48] Jho 2003, pp.283-236. New entrants also did not need to offer facility deposit requirements (ibid).

[49] Kim, Han-joo, Sang-kyu Byun, Myeong-cheol Park. 2004. Mobile handset subsidy policy in Korea: historical analysis and evaluation. *Telecommunications Policy* 28:23-42.

fortuitous set of policy debates, unplanned by MIC, led to a renewed and vigorous focus by handset manufacturers on lowering production costs and focusing on international markets.

Handset Subsidies and Exports

The logic of competition between carriers based on subsidized handsets became a significant policy issue in Korea in the late 1990s. The debate pitted the MIC, concerned with market share and equipment manufacturers' financial health, against the Korean Communications Commission (KCC, established in 1992 to oversee telecommunications policy) and the Korean Fair Trade Association (KFTA), whose main interests were to assure fair competition and prohibit collusive behavior.

MIC regulated the terms of subsidies under the Telecom Business Act, which required that carriers report the terms and conditions of adhesion contracts such as price and service provisions.[50] However, with the rapid inflation of subsidy amounts to the point that carriers were giving handsets away for free, but with correspondingly long contracted lock-in periods, several branches of government become concerned. First, MIC proposed a subsidy cap (approximately $125) to curtail subsidy inflation. The KFTA lent its support, reacting to consumer complaints by ordering the abolition of penalty clauses that forced subscribers to return subsidies when terminating their contract early. The core of the problem was that carriers were not required to fully explain or give documentation to subscribers about the penalty in the contract when they entered into it.[51]

The market dynamics reacted to the abolishing of this penalty clause abruptly. Consumers were no longer locked into their contracts, and began switching handsets at a

[50] Ibid.
[51] ibid.

rapid pace, since carriers still competed against one another on the basis of subsidy amounts. However, this raised Korean imports for components in 1999, just as political concern about Korea's balance of payments was high, as it had to meet IMF bailout conditions involving balance of payments. MIC was in favor of carriers curtailing subsidy amounts to ensure their profitability, and in September 1999, KTF, LG Telecom, Hansol PCG and Shinsegi agreed to subsidy caps, though they later broke ranks and began offering higher subsidies again. However, the KFTC fined carriers for this arrangement, since from their perspective, this amounted to industrial collusion. This interference in its jurisdiction, which it had won in the massive policy battles earlier in the decade over spectrum allocation and the CDMA standard, was too much for MIC, leading it to ban subsidies altogether in June 2000.[52]

Following the handset subsidy ban, demand for handsets shrank dramatically, from monthly sales of between 1.4 and 2 million units before the ban, to 250 thousand immediately following it. This led MIC to announce plans such as allowing installment sales of handsets to alleviate the suffering of equipment manufacturers. MIC also tried to encourage competition between carriers by exempting subscribers switching from the incumbent to new carriers from certain fees. However, this time, the KCC, whose primary institutional concern was fair competition, weighed in, arguing that the asymmetrical regulation hindered fair competition. The KCC and MIC also investigated the market between mid 2000 and 2001, finding that subsidies, now illegal, were still continuing to some extent, and fining carriers engaged in the practice.[53]

Korea's generally more active (compared to Japan) consumer groups also organized protests against carriers. They called for the abolishment of subsidies and up to 40% lower

[52] ibid.
[53] ibid.

subscription fees, going so far as to organize a rotating sit-in in front of the Ministry for the better part of a year.[54]

Table 4: Three phases of subsidies

	1997-1999	4/1999-5/2000	6/2000 – 2006	2006 ~
Phase	Subsidy wars	Subsidies without Penalty clause	Subsidy ban	Subsidy re-introduction
Market effects	Escalation to free handsets, 3 year lock-in	Free handsets, rampant user switches	Slower rate of domestic handset turnover, focus on Global markets	Yet to be determined
Bureaucratic friction	-	MIC vs KFTC	MIC vs KCC	-

In this context, Korean handset manufacturers had little choice but to realign their business strategies to prepare for an environment without carrier subsidies – in effect, the demise of a small but lucrative domestic market. This meant a focus on attaining scale to reduce costs, which entailed focusing on international markets.

In sum, 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 emerged as a strong lead bureaucracy, firmly committed to CDMA. Qualcomm's success in getting the US 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 to abolish carrier subsidies and reduce the profitability of the domestic market, Korea's manufacturers were pushed to focus on international markets.

[54] ibid.

The Rapid Deployment of 3G: Focusing and Re-focusing on Global Markets

The spectrum allocation and standard-setting for third generation cellular services gave Japan an opportunity to reconnect its domestic market with 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 of cellular services. Japan's choice of an international standard, which DoCoMo helped develop, may very well have propelled its equipment manufacturers into international markets had it not been for the unexpected slowdown in international markets for 3G. Korea's governmental strategy focused on international markets, explicitly hedging its bets on the two incompatible international 3G standards. However, the Ministry of Information and Communications (MIC, successor to MOC) had difficulty in getting carriers to build the 3G networks to which they had been allocated licenses.

The irony was that due to shifts in international market conditions, Japan's strategy, successful in facilitating rapid global standard 3G buildouts in its domestic market, did not lead to international markets. Korea's difficulty in getting carriers to quickly deploy the 3G networks for which they had been licensed, allowed carriers to be more in tune with the unexpectedly slow shift to 3G globally.

The International Political Fights over 3G Standard-Setting

The original aim of 3G, spearheaded by the International Telecommunications Union, an organization under the United Nations, was to create a single global cellular standard.[55]

[55] 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

However, a political struggle over whose standard to use, with a European-Japanese alliance attacked by the US government lobbying Qualcomm's interests, led to a compromise in which two incompatible standards were approved.[56] The first standard, W-CDMA was positioned as an upgrade from GSM, the standard which dominated Europe, and with the most subscribers worldwide. The other, CDMA2000, was developed by Qualcomm, and could be achieved through incremental upgrades of the existing CDMA standard, dominant in South Korea and popular in North America.

3G Strategy in Japan

In Japan, the initial process of choosing 3G standards and allocating spectrum was relatively uncontroversial. It was also clearly a strategic attempt to foster both domestic market development and a resurgence into global markets.

Japanese government and industry participants understood that the PDC standard had hindered Japanese cellular equipment from gaining global market shares, and as concrete talks of a 3G standard emerged in the ITU, it was obvious that Japan should adopt the international standard. DoCoMo was heavily involved in developing W-CDMA, and a tie-up with major European players, including Ericsson seemed to open an opportunity to link Japan's domestic market with global markets.

In 1999, the Ministry of Internal Affairs and Communications (MIC, successor to MPT) announced that it would allocate three 3G licenses for nationwide service. This led to consolidation of carriers in late 2000, resulting in three cellular firms with nationwide

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not think they could win in competition against the Japanese, leading to a coalition between Japanese and European players. (Steinbock 53-54)

[56] For a detailed analysis, see Cowhey, Peter F., Jonathan D. Aronson, John E. Richards. 2006. The Peculiar Evolution of 3G Wireless Networks: Institutional Logic, Politics, and Property Rights. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press.

networks. NTT DoCoMo was already nationwide in its deployment. KDDI, the second national firm resulted from a merger between DDI and IDO, who had operated in different geographic regions, but had been brought closer with the urging of Toyota to jointly adopt Qualcomm's CDMAOne network in 1998. The former state-owned monopoly for international services, KDD, joined to create KDDI in early 2000. The rest of the cellular firms, most of which had entered in 1994 with capital from Japan Railways, formed J-Phone.

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, they determined that one form of CDMA2000 was a viable option. KDDI resisted, but Toyota, again threatening to pull its guarantee of massive loans needed to build infrastructure, forced its hand (Toyota also required that KDDI sell its PHS business).[57]

Thus, as a result of these market maneuvers, 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 MIC, essentially free of charge. In making the license free, the government wanted to ensure that carriers, especially DoCoMo's competitors, had enough capital to build out 3G networks on schedule.

DoCoMo commenced W-CDMA services in October 2001, as did J-Phone in Devember 2002. KDDI, upgrading its CDMA network, began offering CDMA2000 1x, a slower but cheaper version of CDMA2000, in April 2002. DoCoMo's W-CDMA service (named FOMA), did not take off as rapidly as the company had hoped, largely due to its hasty and somewhat premature commencement of services, technical issues making handsets

[57] The authors thanks Professor Naoe Shigehiko, former Telecommunications Deliberation Council member, for these points.

larger with shorter battery life, and relatively poor coverage area.[58] As handsets became smaller with 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 was slow in its investment into 3G, trailing behind the others.

Chart 2: 3G Growth in Japan (millions), carriers in parenthesis

	W-CDMA (DoCoMo, Vodafone*)	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

Source: Telecommunications Carriers Association, Japan
* Vodafone Japan was purchased by Softbank in 2006

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.[59] DoCoMo followed in June 2004, but capacity problems restricted the number of flat-rate users until Feb 2006, when it, in turn, introduced an incremental upgrade to its standard.[60]

Unfortunately for Japan's carriers and manufacturers, W-CDMA growth in Europe trailed far behind expectations. As mentioned earlier, European spectrum auctions around 2000 yielded much fanfare, but with the bursting of the technology bubble in 2001, most of the winners found it difficult to make investments. W-CDMA networks were costly, since they completely replaced existing GSM network infrastructure, in contrast to the incremental upgrade from CDMA to CDMA2000 1x. Furthermore, with new sources of revenue for

[58] Put simply, it was in effect a substitute for existing 2G services, but with poorer performance attributes.
[59] The upgrade was CDMA2000 1x EV-DO.
[60] W-CDMA HSDPA. Masuno 2006, p. 30.

European carriers, such as Vodafone's successful VodafoneLive!, which gained 27 million subscribers by the end of 2005, with new services such as camera phones that could send pictures – the former pioneered by DoCoMo, closely followed by its competitors, and the latter by J-Phone – there was little incentive to build 3G networks immediately.

Thus, Japan succeeded in strategically allocating 3G licenses to foster rapid domestic network development and secure technological and service leadership. However, it ended up running ahead of most of the rest of the world – and in a direction that may or may not be followed by other countries, since many carriers became interested in cheaper, alternative wireless technologies, such as WiMax.[61] Moreover, the domestic logic of competition, in which carrier-driven R&D allowed the rapid introduction of new services with heavily subsidized handsets, hindered manufacturers from attaining economies of scale to build low cost handsets.

Korea

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 MIC, carriers, and chaebol equipment manufacturers, with the result that the rollout of W-CDMA, which the government strongly pressed for, was embarrassingly slow. However, this delay in W-CDMA growth ironically helped equipment manufacturers who could concentrate on their CDMA and CDMA2000 1x exports, since international markets were slow to adopt W-CDMA anyway.

[61] WiMax is one of the technological possibilities for high speed communications, based on WiFi, currently in use as a wireless broadband technology. While each WiFi transmitter only covers short distances and uses unlicensed spectrum, WiMax is capable of covering much longer distances, and therefore large areas.

In 1999, MIC announced that it would award 3G licenses. Concerned about excessive competition, it limited the number of licenses to three, and it again favored applications by consortia, to limit chaebol and foreign participation. This sparked a wave of consolidations, as SK Telecom acquired Shinsegi Telecom over a period between December 1999 and April of the following year, and in 2001, KTF acquired Hansol.[62] Thus, three consortia, SK, KT, and LG Telecom (LGT), applied for the 3G licenses.

Another battle between MIC, carriers, and equipment providers erupted over who should apply for W-CDMA and CDMA2000 licenses. MIC took the position that one or two carriers should adopt W-CDMA, since it was the successor to GSM in Europe, with initial projections of wider adoption. Existing 2G carriers, SKT, KTF, and LGT, also argued for W-CDMA, despite needing to create completely new networks to upgrade from their CDMA infrastructure. However, equipment manufacturers including Samsung, Hyundai, and small CDMA equipment providers strongly preferred CDMA2000 – though they did not take a strong public position. With CDMA2000, a direct and incremental upgrade from Korea's existing CDMA standard, they could utilize much of their existing technological expertise, and continue exporting to the US, which seemed to be headed towards CDMA2000.[63]

The government, in balancing these interests, urged carriers to adopt CDMA2000 to facilitate exports. Later in 2000, MIC considered delaying in offering the W-CDMA license to allow equipment manufacturers time for gaining technological competitiveness with the standard. It recommended that two carriers choose CDMA and one select W-CDMA. However, none of the carriers took the government's recommendations, with all three

[62] 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, p. 322.)

[63] Ibid., pp. 332-337

applying for W-CDMA licenses in October 2000. The government then granted two, rather than three licenses, to the SKT and KT consortia with W-CDMA. It publicized a plan to set aside an additional license in early 2001, hoping that LG would apply for a CDMA2000 license. LG was reluctant though, having spent several years concentrating resources on developing W-CDMA technology. In the end, MIC 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.[64]

As a result of these strained circumstances in licensing 3G, carriers were not enthused in commencing W-CDMA services. In fact rather than beginning the process of replacing their existing CDMA networks with W-CDMA infrastructure, SKT and KTF chose to continue incrementally upgrading their CDMA networks towards CDMA2000, even though they could never reach full-fledged CDMA2000, since they were licensed for W-CDMA.

To make the alphabet soup easier to understand, see the table below, depicting the two technological paths. The successor to GSM was W-CDMA, to which SKT and KTF were licensed. However, they were already operating CDMA services, and they chose to pursue incremental upgrades, CDMA2000 1x and CDMA2000 1x EVDO, which took them closer to CDMA2000. However, they could never reach CDMA2000, since their license was for W-CDMA.

[64] ibid., pp. 339-348

Table 5: Technological Paths from 2G to 3G, GSM and CDMA

2G		2.5G		3G
GSM	→		→	**W-CDMA** (SKT, KTF licensed, but slow to commence services because they were focused on CDMA2000 1x, 1x EV-DO)
CDMA	→	**CDMA2000 1x, 1x EV-DO** (SKT, KTF upgraded to here from CDMA, but could not move to CDMA2000)	→	**CDMA2000** (SKT, KTF were not licensed, LGT was)

In the long term, it has been argued that the Korean carriers' incremental upgrades towards a dead-end were wasted investment.[65] But in the short term, since CDMA2000 1x EVDO was faster than the initial W-CDMA standard, SKT and KTF were able to offer the advanced services mentioned in the beginning of this paper. 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 the government does not include them in their reports or white papers, and carriers do not publish early numbers (See tables 6 and 7 below for a partial overview). With the introduction of a high speed data upgrade to W-CDMA, known as 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 7 below.

[65] Kim et al. 2004.

Table 6: Korea's CDMA 2000 1x* Subscribers (millions)

CDMA2000 1x* Subscribers	
2001	0.4
2002	16.7
2003	24.8
2004a	38.2
2005b	48.1
2006	54.1

Source: MIC
*includes 1x EV-DO
a) as of November
b) as of June

Table 7: SKT's W-CDMA subscribers

	Total SKT subscribers	SKT's W-CDMA subscribers
2003*	18,313,000	70
2004	18,783,000	1,300
2005	19,530,000	3,250
2006 (Q1)	19,733,000	5,250
2006 (Q2)	19,984,000	43,905
2006 (Q3)	20,031,877	120,736
2006 (Q4)	20,271,000	272,612
2007 (Q1)		394,213

*end of FY for 2003-2005
Source: Wireless Intelligence (http://www.wirelessintelligence.com)

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 vis-à-vis international markets. Through a detailed historical examination of the politics of spectrum allocation and standard-setting, we find that differences in the logic of domestic competition played a major role in this divergence; that those logics of competition were shaped by shaped by the governments' contrasting strategic goals; and fortuitous (and unfortunate for Japan) policy and international market outcomes further bolstered the divergence.

The logic of domestic competition for Korea from the early 1990s focused on attaining competency in manufacturing wireless equipment for the CDMA standard, popular in the US and several other international markets. This allowed carriers' and handset manufacturers' efforts in the domestic market to directly benefit their expansion into global markets.

The Korean government's strategic choice and efforts to help commercialize the CDMA standard grew out of initial conditions of the wireless sector, which relied almost exclusively on foreign equipment. Yet, that strategy was not entirely the products of a premeditated blueprint by an enlightened and autonomous bureaucracy. In contrast to the case of broadband, Korea's wireless spectrum allocation and standard-setting processes were characterized by political strife between bureaucracies and tension between the government and chaebol. Furthermore, fortuitous and unexpected policy interventions by other government agencies (the KCC and KTA), led to the abolition of subsidies by carriers to handset manufacturers, which aided manufacturers to focus further on export markets.

In 3G licensing, the Korean government's difficulty in implementing its strategy of putting a heavy domestic emphasis on W-CDMA ended up working well with global market conditions, as most countries were much slower than expected in deploying W-CDMA networks.

In Japan, the domestic logic of competition in the 1990s was led by carriers competing against each other on the basis of features offered by their affiliated group of handset manufacturers, heavily subsidizing consumer purchases. While the close relationships between carriers and manufacturers facilitated extensive service innovation and commercialization (such as mobile internet services), the businesses relied heavily on domestic market arrangements that could not be easily exported. Combined with the proprietary domestic PDC standard, Japan's domestic cellular market, unlike that of korea or of other Japanese manufacturing sectors, could not act as a springboard into global markets.

Japan's government acted strategically to develop the domestic market, but did not include global markets as part of that strategy. The ministry in charge, MPT, unlike international trade-oriented MITI, never had international strategy as a strategic focus, and the initial conditions of the sector in which domestic firms dominated the Japanese market only further diminished the focus on strategy for external markets. The lack of political strife over setting domestic proprietary standards rendered what, in hindsight, should have been a strategic policy issue worthy of debate, into a virtual non-issue.

In 3G licensing, the Japanese government aimed to reestablish the link between domestic and international markets by adopting global 3G standards, and NTT was quick to deploy services, but unexpected developments in international markets left Japan sprinting along the W-CDMA trajectory, but almost alone for the first few years.

Only recently has Japan's government begun to seriously study the domestic business models hindering domestic firms from penetrating international markets. The "International ICT Competitiveness Study Group" which commenced in late 2006, was the essentially the first major study group organized by the Ministry of Internal Affairs and Communications (MIC, successor to MPT). The study group issued a report in April 2007, identifying Japan's problem in international markets to a variety of factors including a lack of government strategy (making an explicit contrast with Korea), and going so far as to liken Japan's telecommunications market to the Galapagos Islands, with evolution in an isolated environment having taking a course of its own.[66] One of the follow-up actions of this study

[66] MIC. 2007. ICT Kokusai Kyosoryoku Kondankai Saishu Torimatome [International ICT Competitiveness Study Group Final Summary]: Ministry of Internal Affairs and Communications. <http://www.soumu.go.jp/s-news/2007/pdf/070423_1_1.pdf> last accessed 8/6/2007.

group was to establish a regularized set of meeting between the ministry and business to create strategy with an eye towards international competition. In addition, the “Mobile Business Study Group,” which began in January 2007, has tentatively proposed basic changes to domestic business practices, such as prohibiting carriers from “locking” cellular handsets to make them work only on their own networks.[67]

Implications

Wireless telecommunications, in which “global markets” remain very much an interaction of multiple domestic markets, is a sector in which government policy and strategy has hitherto strongly affected domestic market outcomes and their interaction with international markets. In the future, technological developments may render standards to be less important technologically, with chips capable of adapting to multiple standards. However, but their importance in business models and markets, and therefore policy, may not diminish as rapidly. Thus, strategic government efforts can be continue to privilege domestic firms, especially when advanced network environments may provide “playgrounds for experimentation” in which new innovations may occur. As Japan’s experience shows, lack of a coherent strategy aimed at international markets can be detrimental. Yet, as Korea’s experience indicates, even successful strategies were aided by fortuitous circumstances, and indeed even difficulty in implementation did have its benefits in the case of 3G. What is clear, however, is that the range of perceived options by participants were shaped by historical trajectories of development, to a greater degree than participants at the time realized. This is

[67] Reports at MIC website. <http://www.soumu.go.jp/joho_tsusin/policyreports/chousa/mobile/index.html> [last accessed 8/6/2007.]

an important point for self-reflection as next generation networks loom on the technological, and therefore strategic policy horizon.

Bibliography:

Anchordoguy, Marie. 2001. Nippon Telegraph and Telephone Company (NTT) and the Building of a Telecommunications Industry in Japan. *Business History Review* (75, Autumn):507-541.

Cole, Robert E. 2006. Telecommunications Markets in World Markets: Understanding Japan's Decline. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press.

Cowhey, Peter F., Jonathan D. Aronson, John E. Richards. 2006. The Peculiar Evolution of 3G Wireless Networks: Institutional Logic, Politics, and Property Rights. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press.

DoCoMo, NTT. 2001. NTT DoCoMo junenshi: Mobairu furontia e no chousen [NTT DoCoMo Ten Year History: The Challenge Towards Mobile Frontier].

Fransman, Martin. 1995. *Japan's Computer and Communications Industry: The Evolution of Industrial Giants and Global Competitiveness*. New York, NY: Oxford University Press.

Funk, Jeffrey. 2002. *Global Competition Between and Within Standards: The Case of Mobile Phones*. New York, NY: Palgrave.

Communication and Intelligence. 1989. *Jidosha Denwa Sensou [The Car Telephone Wars]*. Tokyo: Eru Shuppansha.

ITU. 2005. Ubiquitous Network Societies: the Case of the Republic of Korea: International Telecommunication Union.

Jho, Whasun. 2003. Building Telecom Markets: Evolution of Governance in the Korean Mobile Telecommunications Market, Political Science, Northwestern University, Evanston, IL.

Kim, Han-joo, Sang-kyu Byun, Myeong-cheol Park. 2004. Mobile handset subsidy policy in Korea: historical analysis and evaluation. *Telecommunications Policy* 28:23-42.

Koski, Heli. 2006. Factors of Success in Mobile Telephony: Why Diffusion in the United States and Europe Differs. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology in the Digital Era*, edited by J. Zysman, and Abraham Newman. Stanford, CA: Stanford University Press.

Kushida, Kenji. 2005. The Politics of Restructuring NTT: Historically Rooted Trajectories from Actors, Institutions, and Interests. *Stanford Journal of East Asian Affairs* 5 (2):29-36.

———. 2006. Japan's Telecommunications Regime Shift: Understanding Japan's Potential Resurgence. In *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology in the Digital Era*, edited by A. Newman, and John Zysman. Stanford, CA: Stanford University Press.

Kushida, Kenji, and Seung-Young Oh. 2007. The Political Economies of Broadband in South Korea and Japan. *Asian Survey* 47 (3):481-504.

Masuno, Daisuke. 2006. *Gyoukai Kenkyu Shiriizu: Tsushin [Industry Analysis Series: Telecom]*. Tokyo, Japan: Nihon Keizai Shimbun Sha.

Murase, Emily. 2003. Keitai Boomu: The Case of NTT Docomo and Innovation in the Wireless Internet in Japan. In *PhD Dissertation, Communications Department, Stanford University*. Stanford, CA.

Steinbock, Dan. 2003. *Wireless Horizon: strategy and competition in the worldwide mobile marketplace*. New York, NY: AMACOM.

Vogel, Steven K. 1996. *Freer Markets, More Rules: Regulatory Reform in Advanced Industrial Countries*. Ithaca, NY: Cornell University Press.

Yang, Heedong, Yougjin Yoo, Kelle Lyytinen, Joong-Ho Ahn. 2003. Diffusion of Broadband Mobile Services in Korea: The Role of Standards and its Impact on Diffusion of Complex Technology System: Case Western Reserve University.