Globalism and Localism in Telecommunications
E.M. Noam and A.J. Wolfson (Editors)

Standards Competition in Wireless: Regionalism vs. Globalism
The Case of the Third Generation Mobile Communications Systems

Liching Sung

The end of territoriality in communications also brings tensions between regionalism and globalism. Nowhere is this tension more acute than in international standardization. This article uses the international standardization of the third generation mobile communications systems as a case study to illustrate the conflicts between regionalism and globalism.

1. Introduction

The global standardization of third generation mobile communications systems, to follow today's analog and digital cellular telephone systems, is currently taking place in the International Telecommunication Union (ITU). Also known as the Future Public Land Mobile Telecommunications Systems (FPLMTS)[1] in ITU's vernacular, the third generation mobile systems are expected to usher in an era of personal communications wherein a user will get access to an array of voice, data and even video communications services anywhere in the world at any time. The central element of the FPLMTS concept is a small, lightweight handset usable throughout the globe. Although first conceived as terrestrial systems, FPLMTS will be supplemented with satellites to ensure worldwide coverage.

In addition to the provision of ubiquitous personal communications, FPLMTS will address the question of how the multitude of existing mobile communications systems may progress toward one integrated network. Therefore it represents an important opportunity to rectify the chaotic situations created by the first and second generation cellular telephone systems, where the world market has split into different blocs using incompatible standards. However, this last hope to unify mobile communications standards may be dashed again as regional powers, particular the United States and Europe, pursue different agendas to fulfill their own political and economic goals.

The history of telecommunications is tainted with expensive examples of parochial policies in standards setting. The most famous is probably the color television case in which three incompatible systems existed in the world, preventing free exchange of video programming. Less known, yet no less influential, is the different digital transmission systems used in North America and Europe, creating added interworking problems. In each case, standards were used as a ploy for safeguarding national or regional commercial interests. The practice of using standards as part of industrial policy, calculated to enhance comparative advantage, is likely to increase as global competition intensifies and as the world moves into an era of economic regionalism.

The coming of mobile personal communications directly relates to the coming of the Information Age itself. It portends fundamental and even unsettling changes in the nature of the telecommunications industry. From a trade policy perspective, the emerging mobile communications revolution represents a major export market and an important source of trade revenue. All regional powers are eager to dominate the world market for this new technology. Europeans, who look at telecommunications as a critical facilitator for integration, are particularly interested in the expansion of mobile communications systems because of their desire to develop pan-European networks to replace the current fragmented national systems.

Standards are one of the most important non-tariff devices to enhance or restrict international trade. The negotiation and enactment of technical standards is a form of political behavior. It incorporates all the dilemmas of international relations. Mobile personal communications, an emerging technology with major political and economic implications, presents a good example of the increasingly nontechnical dynamics involved in the process of setting standards internationally.

1.1. Background

In anticipating the spectrum needs for FPLMTS and in an effort to ensure global compatibility, the ITU identified 230 MHz of radio spectrum worldwide in the 1-3 GHz band for this new service at the 1992 World Administrative Radio Conference (WARC-92). A common spectrum is only the first step toward international standardization. A tremendous amount of work is required to produce the standards necessary to ensure the global operation of FPLMTS. Task Group 8/1(TG 8/1)[2] within ITU's Radiocommunication Sector (ITU-R) is entrusted with the major responsibility for developing international standards for FPLMTS, scheduled to start service around the year 2000.

Despite ITU's policy to unify standards, Europe and the United States are taking divergent courses in developing future mobile communications systems. In Europe, since 1988 the Research on Advanced Communication for Europe (RACE), under the aegis of the European Commission, has been developing the Universal Telecommunications System (UMTS) as the European third generation mobile communications system. UMTS has a similar timetable as FPLMTS: neither is expected to commence until the year 2000. The Europeans are not eager to implement UMTS immediately because they have just installed the second generation digital cellular system, the Global System for Mobile Communications (GSM), and it will take several years to recover the heavy capital investment. The European goal for UMTS is to build a universal system, which will not only be used in Europe but all over the world. Europeans have explicitly stated that UMTS may be based on or identical to the worldwide standard for FPLMTS.[3] To this end, they have actively participated in the ITU to try to influence the development of FPLMTS standards to coincide with that of UMTS.

The United States, on the other hand, has been taking actions independent of the developments in Europe and in the ITU. Determined to maintain its competitive leadership position in global telecommunications markets, the United States has decided to implement the Personal Communications Services (PCS), viewed as a domestic version of FPLMTS, as early as 1995. The U.S. desire to implement PCS as early as possible is motivated by several political and economic factors. First, there is strong pressure from the eager PCS industry to reap profits from the projected high demands for personally-oriented mobile communication services. Second, the United States does not have an entrenched capital investment concerning

the implementation of the second generation digital cellular system. The transition to a digital system is comparatively inexpensive because, as an outgrowth of the existing analog Advanced Mobile Phone Service (AMPS) system, it requires limited physical change on the existing infrastructure. In contrast, the GSM is totally different from any existing national analog systems in Europe and a new European infrastructure has to be built.[4] Above all, there are significant advantages to being the first to get a standard developed. When one standard starts to establish itself, more and more countries jump on the bandwagon to adopt it. And once a standard is in place, trading relationships can become entrenched.[5]

The divergent development between North America and Europe has raised concerns in the ITU. Fearing a repetition of multiple incompatible standards that has plagued the first two generations of cellular telephone systems, the ITU issued a non-binding opinion in 1993 to urge the two regions to cooperate.[6] Although the opinion was intended to encourage regions to support the ITU effort in developing global standards for FPLMTS, it plainly reflected the divergent trends that already exist in the development of the future generation mobile communications systems.

The ITU action was prompted in part by the U.S. intention to deploy PCS several years before FPLMTS is scheduled to be introduced worldwide. That the U.S. plan might be detrimental to the goal of a single set of global standards for FPLMTS was made evident when the Federal Communications Commission (FCC) allocated almost the same area of the spectrum set aside for FPLMTS internationally for the domestic PCS. Specifically, by occupying a large part of the spectrum reserved for a worldwide service for its domestic PCS, the United States will make it difficult, if not impossible, for FPLMTS to be implemented globally. This is because the United States is the world's largest telecommunications market, and without its participation the global operation of FPLMTS would be considerably curtailed.

Whether the U.S. action will ultimately impede the global standardization effort of the third generation mobile communications systems remains to be seen as both PCS and FPLMTS are still in the early stages of development. However, the divergence illustrates the fact that various regions are pursuing distinct agendas to achieve individual objectives. The goal of a common worldwide system may be cast aside as regions race to establish a leading position in the new technology.

2. History of FPLMTS

The standardization of future mobile communications systems was originally prompted by the lack of global standards for cellular telephone systems. Cellular telephone, the first popular mobile telephone service, was introduced in the early 1980s.[7] Because mobile telephony was considered part of the public telephone service, which was mostly provided by a government-run monopoly, countries implemented different standards to protect their home markets. By the mid 1980s, nine different cellular telephone standards had emerged in the world,[8] seven of which were in Europe alone. The fragmentation of cellular telephone standards in Europe and the world was due to discriminatory domestic purchasing policies of most countries which employed incompatible technical standards as non-tariff barriers.[9] Several of these systems were just different enough from one another to provide a rationale for a "domestic" system and cellular telephone industry.

The fragmentation of standards has resulted in higher costs and reduced efficiency and usefulness of cellular telephone. The relatively high costs associated with multiple standards also contributed to the delay in the dissemination of the technology in developing countries. These problems were recognized by the ITU. The rapid development of cellular telephone service and its prospect for becoming a mass consumer product further brought calls for standardization. In 1985 the ITU set up a special group, Interim Working Party 8/13 (IWP 8/13), to study the need for collaboration in the development of harmonized standards for future public land mobile telecommunications systems, hence the acronym FPLMTS.

FPLMTS was originally intended to develop a unified standard for the second generation, digital cellular telephone systems before competing standards emerged. This attempt, however, was preempted by the European effort to develop a pan-European digital cellular system. Recognizing the economic inefficiency of the proliferation of multiple standards, European countries collaborated within the European Conference for Posts and Telecommunications Administrations (CEPT) to create a Groupe Speciale Mobile (GSM) with the mandate to develop a set of common standards for a future pan-European cellular mobile network.[10] The development of GSM standard, envisaged as a solution for Europe's hodgepodge of incompatible cellular systems, coincided with the European plan for a Single Market. The political agenda of European unification provided legitimacy and momentum to the development of a pan-European digital cellular standard.

By the mid-1980s when ITU's IWP 8/13 was formed, the European work on GSM was well under way. In the meantime, in the United States efforts to develop a digital cellular standard based on the existing AMPS system also began to emerge. Essentially overtaken by regional events, members of IWP 8/13 recognized that it was too late to try to standardize digital cellular telephone systems. The group then decided to look beyond the second generation, focusing instead on the uncharted and as not yet defined third generation systems.

Between 1986 and 1991, IWP 8/13's work on FPLMTS progressed slowly, in part because the concept of FPLMTS was not defined. Particularly, since the matter being studied was still far in the future, there was little urgency to speed up the work. But more important, the sluggish performance of the group in the early years was due to the unwillingness of the United States to commit itself to international standardization of mobile communications systems.

The United States was not in favor of global mobile communications systems such as FPLMTS, and objected to the establishment of IWP 8/13. This was because (1) international standards were not to its interest in land mobile communications, and (2) FPLMTS was seen as a European-led initiative to serve the region's political aims.

The United States is a continent-sized country with vast uninterrupted landmass. International standards, which would allow seamless mobile communications between and among countries, are not as critical to the United States as to Europe, where almost every country is bordered by several others. Americans also argued that transnational mobile communications can be achieved through common interoperability requirements rather than uniform global standards.[11] Most of all, rigidly-defined international standards were not in line with the general U.S. policy of keeping radio services as flexible as possible.

The U.S. objection to FPLMTS was also rooted in the suspicion that Europeans were trying to parallel FPLMTS with GSM. The U.S. suspicion was not totally unfounded as Europeans did try to promote GSM as a universal standard for digital cellular telephone in the

ITU.[12] This attempt was short-lived, however, as the effort to unify digital cellular standards was quickly aborted. Fortuitously, the new FPLMTS charter to develop standards for the third generation systems provided Europeans with an even greater opportunity to pursue their political goals in mobile communications.

Although the concept of FPLMTS was not initiated by Europeans,[13] there are several political and region-specific reasons why they have supported FPLMTS since its inception. First, FPLMTS's mandate of universal standards fits into European plans for a unified mobile communications infrastructure to facilitate the economic unification of European countries. Second, land-based mobile communications solutions such as FPLMTS[14] better suit the needs of Europe, a densely populated continent. Accordingly, Europe has focused on the development of terrestrial mobile communications systems, which have ascended to high priority in European telecommunications policy in recent years. In contrast, the United States promotes satellite-based new mobile communications systems more vigorously as space systems can easily cover its large landmass, delivering services in rural and sparsely populated areas.

Due to the undefined nature of FPLMTS and the lack of support from the United States, FPLMTS made little progress in the 1986-1991 period. After 1991, however, the project began to pick up steam, propelled mainly by the emergence of personal communications and the outcome of the 1992 World Administrative Radio Conference (WARC-92).

3. The Emergence of Personal Communications

The term "personal communications" appeared in the late 1980s as cellular communications services evolved from predominantly vehicular to portable, personal uses. The trend of using cellular systems, designed primarily for moving cars, for personal communications has prevailed as it became clear that people coveted the freedom to communicate anytime, anywhere. Equally significant was the gradual shift of the cellular users from the business and professional community to mass consumers. These shifts reflect the nature of the modern workforce which increasingly relies on instant access to information.

The United Kingdom provided the spark that helped ignite global interest in personally-oriented mobile communications. In January 1989, the Department of Trade and Industry released a paper entitled "Phones on the Move," which proposed the development and introduction of a mobile communications system for the mass market based on low cost lightweight pocket terminals. A new name, Personal Communications Network (PCN), was coined for such a system which was foreseen not only to bring universal mobility to the population but to introduce real competition in the local telephone service. The PCN concept excited considerable interest in Europe where various proposals soon came about under the PCN banner. To provide solutions to ubiquitous communications service, which requires bridging mobile and fixed public telephone networks, the concepts of single personal numbers and the full implementation of intelligent networks were included in the conceptualization of some PCN systems.

European PCN activities increased worldwide awareness in FPLMTS which, until this time, had remained an obscure project known only to a handful of international telecommunications standards experts. The envisioned PCN services also helped define the not yet sufficiently described FPLMTS concept. In 1990, the ITU finally developed the definition of FPLMTS. It was now recognized as a small pocket terminal usable worldwide

and capable of supporting the full range of telecommunications services. According to the ITU, FPLMTS should also be designed in such a way that the caller does not have to know the location of the called party. Further, it should be possible for FPLMTS to be used as a temporary or permanent substitute to fixed networks where fixed network facilities are limited or not available, or where reasons of convenience or economics make this desirable. Additionally, FPLMTS should be designed to allow international operation and automatic roaming of mobile subscribers and stations.[15] The requirements for international operation and automatic roaming have provided forceful justifications for global standardization of FPLMTS. The rising saliency of international roaming is due to the assumption that, although people may not take their cars across the border, they are likely to take their pocket-sized portable phones with them when traveling abroad.[16] International roaming has thus emerged as a valid technical concern which can only be addressed with common worldwide standards.

The British and other European experiences in PCN have prompted the interest in personal communications-type services in the United States, whose industry already lagged behind Europe in the development of advanced mobile communications services. In contrast to Europe, the United States chose to use a broad term, Personal Communication Services (PCS), to address the new technological concept. This allows any mobile or portable radio communications system that could provide services to individuals and business to fall under the umbrella term of PCS. Similar to PCN and FPLMTS, PCS was expected to exist independent of local wired telephone networks, filling gaps in existing communications services and creating new markets. The broad definition of PCS has helped invite a deluge of industry proposals. Proposed services range from digital cellular telephone, advanced digital cordless telephone, and portable facsimile to wireless private branch exchange (wireless PBX) and wireless local area network (wireless LAN) services. The industry's obsession with PCS has exerted great pressure on the FCC. Responding to industry demands, the FCC took exceptionally quick action to set up a regulatory framework for PCS. Its actions, including a Notice of Inquiry proceeding and a frequency reallocation proceeding, culminated in the adoption of the PCS rules in September 1993 which authorized PCS operation in the 2 GHz band.[17] The FCC's drive to make frequencies available for PCS as soon as possible was an attempt to help American PCS systems become operational quickly, an important consideration from a marketing perspective. This could provide the United States with an important competitive advantage in the global market for future mobile communications systems.

The domestic interest in PCS in turn has injected American industry with the interest in FPLMTS, viewed as the internationally-developed PCS. Desiring to be part of the international PCS action, various U.S. corporations began to participate in the ITU's work on FPLMTS. Since 1991, the number of American participants in FPLMTS meetings has increased substantially.

4. WARC-92

The 1992 World Administrative Radio Conference (WARC-92) marked a watershed for FPLMTS. With the push of European countries and the support of developing nations, the conference identified 230 MHz of the global spectrum in the bands 1885-2025 and 2110-2200 MHz for FPLMTS.[18] This identification was a strong endorsement for the concept of FPLMTS. It also provided the crucial foundation for international standardization, because a

standard cannot be fully elaborated without knowledge of the frequency plan that will be used or without the actual allocation of spectrum. With a global spectrum set aside for FPLMTS, it is now realistic to talk about international standardization. The privilege of a defined frequency band reserved ahead of time for its exclusive or shared use also distinguishes FPLMTS from its predecessors: previous attempts to standardize analog and digital cellular systems were futile in part because there was no common spectrum. With the success at WARC-92, IWP 8/13, now renamed Task Group 8/1 (TG 8/1),[19] has gained momentum to plunge into the actual work of drawing up the standards. Since the WARC, the task group has adopted an aggressive working schedule to meet at the minimum of two times a year, and has taken on new working methods to expedite the production of key components of the standard.

The legitimacy FPLMTS achieved at the WARC enhances its marketability. FPLMTS now appears as a commercial reality and, with a global market projection of hundreds of billions of dollars,[20] countries have begun to consider it with great economic interest. As the interest in FPLMTS intensifies, so does the competition among countries and regions for the global market for this new technological innovation.

Most significantly, the outcome of WARC-92 galvanized PCS activities in the United States, which feared being left behind in this new technological "rush." Initially the United States did not support an international spectrum identification for FPLMTS, fearing a fixed global allocation would limit the flexibility for the country to implement FPLMTS-like services domestically.[21] However, in view of the clear trend in the rest of the world toward a worldwide spectrum reservation for FPLMTS, and eager to obtain European concession on other WARC-92 items,[22] the United States changed its position toward the end of the conference. With the insertion spelling out that the spectrum is only *intended* for FPLMTS use and that individual countries reserve the right to use the spectrum for non-FPLMTS services, the United States finally agreed to the identification.[23] The FPLMTS decision strengthened the voices of domestic PCS advocates who had been pushing for an early spectrum allocation for PCS. After the WARC, the FCC took swift actions to make spectrum available for PCS. In 1994, after revising from its previous decision, the FCC allocated 140 MHz of spectrum at 1850 - 1990 MHz to PCS, 105 MHz of which overlaps with the spectrum identified for FPLMTS.[24]

The overlap of the spectrum for the two systems was intentional. The FCC stated openly that "establishing services in the same spectrum as other countries would facilitate the export of American products and services."[25] It also rationalized the decision by arguing that "(a) domestic allocation that differed from the allocation in the rest of the world could retard domestic development and implementation by forcing manufacturers to develop incompatible equipment for smaller markets."[26] In essence, using the same frequencies for PCS was a calculated move to enable the American systems to fit into an international FPLMTS service more easily, thereby opening an important long-term opportunity for the U.S. mobile communications industry. Further, the matching of the spectrum gave the United States an important source of leverage by showing American support for the international development of FPLMTS, yet allowing the United States to maintain its opposition to explicit allocations for such a system in the meantime.[27]

The FCC action will have serious repercussions as one European delegate to TG 8/1 explained: "The FCC matched the FPLMTS spectrum for PCS but did not match its concept."[28] This is in reference to the opinion shared by many Europeans that PCS is only a "two and a

half" generation system, not a "third" generation system as is UMTS or FPLMTS. Specifically, they are concerned that PCS would "steal" spectrum from FPLMTS; namely, with PCS occupying the spectrum as early as 1995, by the time FPLMTS is developed around the year 2000, there may not be enough spectrum left for global implementation of the more advanced system.

5. Wireless Access: A Paradigm Shift

What the recent international interest about FPLMTS amounts to is *economics*, i.e., international trade and market share. FPLMTS can generate such a furor because the world is on the verge of another major communication revolution, the economic potential of which is as great as the telegraph's or the transistor radio's. Together with cellular mobile radio and other prospective wireless communications concepts such as wireless LANs and wireless PBXs, FPLMTS represents a fundamental change in the telecommunications industry: the emergence of wireless mobile communications systems for providing access to the telephone network or *wireless access*. The advent of *wireless access*, with its potential to liberate communications users from the physical constraints of a wholly wired telecommunications network, signals a major communications paradigm shift.[29] It will redefine our expectations about what communications services can do.

The coming of *wireless access* is primarily related to the coming of the Information Society where almost all forms of economic activity have become more information intensive.[30] Information gathering is now a routine function of most jobs and instant access to information has become imperative for the productivity of the modern workforce. The need to access information from anywhere, anytime demands a different communications infrastructure from the fixed wireline telephone network. *Wireless access* thus emerged to respond to the pressing communications needs of the modern workforce.

Wireless access is hailed as one of the major innovations in the 100-year history of telecommunications. It has generated great excitement in the telephone industry. With the wireline services market being saturated, wireless mobile services now represent the most promising growth areas for the industry. The increasing economic weight of the wireless operations in the whole telephone industry was cogently demonstrated by AT&T's recent acquisition of McCaw, the largest cellular operator in the United States. The move will set the scene for AT&T, the world's largest wireline telephone company, to exploit large scale opportunities in wireless mobile communications.

According to Calhoun,[31] *wireless access* may also push the development of network grand plans such as Integrated Services Digital Network (ISDN), broadband services and advanced intelligent network (AIN). Despite enormous technological improvements that have occurred in the switching and long distance transmission segments of the telephone network, the copper-based local access plant remains relatively antiquated and technically primitive, thus hindering the penetration of new technologies. The copper network, optimized to carry the human voice, is not suited to handle new types of communications traffic that increasingly incorporates data, graphics, and video. Consequently, the access facility has become the bottleneck, handicapping information processing and holding back the evolution of the entire telecommunications system.

Wireless access, through the use of digital radio, promises a radical change in the overall access equation. By avoiding the use of a physical medium and its embedded economic constraints, *wireless access* presents a viable means for universal deployment of ISDN and enhanced digital techniques such as asynchronous transfer mode (ATM) communications for broadband services. Likewise, *wireless access* will facilitate the development of AIN.[32] The requirement for immediate network accessibility for individuals anywhere and anytime necessitates intelligent network capabilities to keep track of users as they move from one place to another.

Wireless access is now poised to become a mainstream access method. Unlike cellular systems, which are adjuncts to the telephone network, future wireless systems such as FPLMTS will be an integral part of the network. The advent of *wireless access* will have a great impact on the future development and configuration of telecommunications infrastructure by providing greater flexibility and functionality. As wireless communications systems become a mainstay of the telecommunications network, which is global in nature, it is imperative that certain commonality exists among systems to allow global connectivity. This in turn provides a compelling reason for international standardization.

6. The High Stakes of International Standards Setting

Despite obvious reasons for global standardization for new access technology such as FPLMTS, the possibility of multiple standards looms. This is because of the high stakes involved in international standard setting. In the past, multiple standards came about when standardization threatened the political strength or economic vitality of a nation or region. Such was the case for the color television and the digital transmission system.

The failure to establish internationally compatible technical standards for color television systems in the 1960s was due to nations' ambitions, particularly the French, to develop their own color television industries and to create an export market for their products. The difference in technical standards between the three systems, NTSC of the United States, SECAM of France and PAL of Germany,[33] was used as a non-tariff barrier to protect the domestic color television industries. The political ego of the French Gaullists and their manipulation in the ITU was cited as the greatest impediment to the adoption of an international color television standard.[34]

The existence of two different digital transmission systems -- T, used in North America and Japan, and E, used in Europe and the rest of the world -- is another failed example of setting standards internationally. Despite the fact that the United States had already developed and implemented the T1 line for digital transmission since the late 1950s, Europe proposed a new system, called E digital line, to the ITU ten years later to be the worldwide digital standard. The powerful European bloc, banded together in the European Conference of Posts and Telecommunications Administrations (CEPT), outweighed the United States and its allies and the E digital line was ultimately chosen by the ITU as the global standard. Following the ITU approval, most other countries adopted the European system. The interworking problems between the two digital transmission systems have plagued international communications ever since. This event was seen as a European plot, politically motivated to safeguard the European manufacturing interests and to stem the expansion of their powerful US counterparts.[35]

In the two past cases, nations and regions approached the issue of standards from a parochial point of view. They were unwilling to compromise when the proposed standard posed significant implications for political power and economic well-being. Standardization of the best technology and efficiency of transmission took a distant second place to the guaranteed survival and growth of home manufacturing industries and assurance of potential export sales. The international mechanisms for debate, negotiations, and agreement on standards was rendered ineffective because the ITU either lacked the authority to impose a solution (as in the color television case) or was relegated to a forum manipulable by a regional bloc (as in the case of the digital transmission system).

Both cases were played out more than two decades ago, but the nature of the disputes illustrates points which remain valid today. In the previous cases, the role of international markets was a major factor leading to the disagreements on standards. In today's globalized telecommunications environment, global markets have become even more focused as a point of contention. As a major technological innovation with large economic potential, the emerging personal mobile communications appears to parallel the examples of the color television and the digital transmission systems. Further, as is often the case with emerging technologies, nations and regions have invested significantly in their own research and all are reluctant to give up on their preferred approach. In the case of FPLMTS, the investments are not yet entrenched on either side. However, if regions insist on pursuing individual interests and refuse to reconcile their differences, the North American personal communications systems may once again be different from those of Europe and the rest of the world.

7. Standards as Industrial Policy in the Era of Regionalism

The rise of regionalism is one of the three global economic trends to have emerged since the late 1970s. According to Robert Gilpin,[36] a leading U.S. political economist, the international economic system based on free trade principles established after World War II has been significantly transformed as a result of the decline of US hegemonic power and the divergence of national interests among the advanced industrialized countries. By the mid-1980s, a mixed system of revived mercantilism, economic regionalism, and sectoral protectionism had emerged to replace the liberal international economic order.

The revival of mercantilism came about as a consequence of increasing struggle for world markets by various nations as American economic leadership waned. Since then, economic activity has become increasingly politicized as government interventions on behalf of national economies has yielded positive results.[37] High-technology industries, because of their value-added characteristics, are particularly being targeted as strategic sectors subjected to government protection.

As countries have recognized they cannot compete successfully on an individual basis, they have begun to form economic alliances with nations of common interests. This has led to the rise of economic regionalism, the foremost example of which is the European Union (EU). The economic unification of European countries was based on the rationale that in a world of politicized economic relations, a more closely integrated Europe would be able to confront the United States and Japan more effectively. As a counterweight to the European move, the United States has formed a North American Free Trade Agreement with Canada and Mexico. An Asia-Pacific trading area is also looming on the horizon. As regionalism takes

hold, the mercantilistic competition among nations in the 1970s and 1980s could potentially be transformed to regional confrontations in the 1990s.

Standards developments have to be viewed in the context of fundamental changes in the international economic system. In light of economic regionalism and sectoral protectionism of high-technology industry, standards are likely to be used more often as mechanisms to advance national and regional industrial policies. More significantly, as standards policy is coordinated on a regional level, it allows regions to use their combined markets to wield the power of establishing de facto international standards. This is particularly true with the EU.

Standards play a central role in the European plans for unification and industrial development. With a market size comparable to the United States, the EU now has a great economic and political leverage to promote its standards in the international arena. GSM, a politically motivated attempt to forge a European equipment market around a European standard, is a good example. Europe has been very successful in exporting the GSM standard to other countries. As of 1994, 60 countries had either adopted or agreed to adopt the GSM standard, 31 of which are outside of Europe. The widespread acceptance of GSM around the world makes it the *de facto* global digital cellular standard. Europe is now taking the same approach toward UMTS, the European third-generation mobile communications system. Instead of using an established standard as a marketing device to create an international market for their products as in the case of GSM, however, Europeans now aim at influencing the development of the international standards while the third generation systems are still being defined and developed.

It is hardly a coincidence that Europe's UMTS has the same timeframe as FPLMTS. Until recently, the ITU work on FPLMTS was more influenced by Europeans than Americans. Such European dominance may reflect ITU's Eurocentric past. But more important, it was because Europe, which comprises of many small-sized countries, has a greater need for international roaming than the United States, a continental-sized nation. Because the international roaming capability requires common standards, Europeans were more eagerly involved in the global standardization of FPLMTS.[38]

While RACE,[39] an R & D initiative of the European Commission, is conducting pre-normative research on UMTS, ETSI[40] is responsible for drawing up detailed technical standards for the system. Attempting to reuse the previous GSM expertise and the successful project management team structure, ETSI entrusted the UMTS standardization to the same committee which drew up the GSM standard only to change its name to Special Mobile Group (SMG).[41] SMG members have actively participated in TG 8/1 for FPLMTS standardization, intending both to influence and be influenced by the TG 8/1 work on FPLMTS in order to closely match UMTS with FPLMTS.

While Europe makes explicit industrial policy toward mobile communications standards, the U.S. Government, despite its philosophical commitment to a free market approach, also intervenes in the standards development process to help its industry compete. In the absence of a political mechanism such as ETSI to centralize standards activities, the responsibility for developing a PCS standard in the United States is delegated to Committee T1 (T1), the standards organization for telecommunications carriers,[42] and the Telecommunications Industry Association (TIA). In 1991, in light of heightened international interest in personal communications activities, the State Department[43] instructed T1 to increase its activity on PCS and to accelerate PCS standards development.[44] Subsequently, T1 created a new subcommittee

T1P1 to focus foremost on PCS standardization.[45] The establishment of T1P1 is important because it provides a centralized forum from which PCS standardization can be accelerated.[46]

The State Department also determined that the United States should participate in TG 8/1 more aggressively. Although the United States had been participating in the ITU work on FPLMTS since its inception in 1985, its early involvement was only lukewarm. The less active US participation earlier also reflected US complacence that, based on a large domestic market and superior R & D, a U.S.-developed mobile communications technology would carry a large part of the world market just as AMPS did in the past. That U.S. complacence was eroded as it became clear that the rest of the world preferred an a priori standard as evidenced by the overwhelming support for the FPLMTS spectrum reservation at WARC-92. Realizing that it may not be able to rely solely on its domestic market power, the United States decided that it will benefit from a standards setting arena where influence is determined by expertise and resource contributions.

Since 1991, the United States has expanded its participation in TG 8/1 in terms of the number of participants, leadership positions held, and the proportion of technical document contribution. The current U.S. strategy is to influence FPLMTS with its PCS thinking, and to drive the development of FPLMTS in the direction of PCS so that the United States can reuse the research and development for PCS for FPLMTS. This strategy is also aimed at eliminating the cost of introducing a different system around the year 2000, several years after PCS is to be deployed.[47] The recent aggressive U.S. participation in TG 8/1 is intended to counter the early European influence in the ITU: if the United States supports the development of standards in international standards bodies, it could preclude the European-favored standards being adopted by the ITU. Since a key factor determining outcomes in standards development bodies is the amount of resources and expertise that participants bring to bear, the weighty U.S. contributions may help sway the development of FPLMTS standard in its favor.

The U.S. policy to accelerate PCS standardization is also a response to strong industry pressure from eager PCS entrepreneurs.[48] The push from the industry is exerting tremendous pressure on T1 and TIA, both of which have been working rigorously to meet the industry demand. The two groups formed a Joint Technical Committee (JTC)[49] in 1991 to coordinate PCS standardization work. JTC is scheduled to meet eight times a year, a tighter schedule than TG 8/1 which meets roughly twice a year. As a result, the U.S. standardization work on PCS is now progressing much faster than TG 8/1's work on FPLMTS, raising concerns among Europeans that early developed U.S. standards may dictate the development of the world standards.[50]

8. Different Regional Policies

The tension between Europe and the United States in the standardization of the third generation mobile communications systems is compounded by the different regional goals pursued in their respective regulatory policies in mobile communications. European regulatory policy, as spelled out in the 1987 Green Paper, focuses on the creation of harmonized pan-European standards. With regard to the second generation system, Europe is converging toward one unanimously accepted GSM standard, reversing the previous trend of a multitude of incompatible analog systems. This converging trend will be strengthened further with the introduction of UMTS which will unify all digital mobile communications systems in Europe

around the turn of the century. In contrast, the U.S. regulatory policy, which emphasizes market forces and efficient use of the spectrum, is fostering the flexible introduction of proprietary technology. The current standards quagmire concerning the introduction of digital cellular systems in the U.S., where two standards compete head to heard with each other, is a result of such a policy. It seems likely that United States will adopt more than one second generation mobile system. This fragmentation trend is likely to be perpetuated by the deep divisions within the U.S. telecommunications community on the future direction of PCS. The potential disparate aspirations of the multitude of stakeholders in the future of wireless PCS may lead to a "chaos" as far as standards are concerned.[51] Thus, starting out with one fully harmonized analog standard -- AMPS -- the United States is now adopting more than one digital cellular standard, and perhaps several for PCS, thereby creating a technologically fragmented market similar to the one Europe faced before. In comparing European and U.S. standards-setting progress in land mobile communications, it becomes clear that the standardization policies in the two regions are moving in opposite directions.[52] This divergence bears a direct impact on the development of the third generation mobile communications systems and poses one of the greatest threats to global standardization of FPLMTS.

A further obstacle to the harmonized introduction of FPLMTS is the uncoordinated nature of the implementation of major mobile communications systems in Europe and the United States. Major European countries have just launched GSM and several other advanced digital mobile communications systems.[53] Hence they prefer to delay the introduction of a full-fledged third generation system so as to maximize the potential of existing and newly introduced networks. On the contrary, the absence of large scale implementation of advanced digital mobile communications technology in the United States has prompted the industry to fill the void with PCS. Although PCS may be less advanced than FPLMTS, an early implementation of personal communications-type services will yield high short and medium-term dividends. The preoccupation of U.S. industry with short-term gains has exacerbated the problem of time scale differences, a potential hurdle to bringing into consonance the global implementation of the third generation mobile communications systems.

9. Driving Forces for International Standardization

While regional competition and different regional policies may lead to multiple standards, two potent forces are driving toward international standards. The first of these forces is the growing complexity of telecommunications network and the rapid pace of technological change. The second is the important role multinational corporations play in the global telecommunications industry.

The Information Society functions through a pervasive telecommunications network, composed of high speed data lines, computers and terminal stations. The ever-increasing level of sophistication and the amount of machinery in telecommunications networks are magnifying the demand for standards. According to Wallenstein[54] because machines are less tolerant than humans in making allowance for errors or omissions, making them perform intricate steps in response to a few coded signals at some distance from each other requires a very high degree of standardization. Wallenstein observed that the progression of network standards from minimal, voluntary performance objectives to very detailed, binding specifications has been gradual, but relentless.

In addition, the pace of technological change has accelerated. The increasing velocity of technological change also drives the need for standards. The faster the progress of technologies, the greater the risk in research and development. As a result, more and more standards are being set before a product is fully developed.

International telecommunications standards are the bridges providing interconnectivity and interoperability of national telecommunications networks and services. As the global telecommunications web becomes more extensive, considerably more standards work will take place in the international arena. As wireless communications systems such as FPLMTS become an integral part of the global telecommunications network, there is an obvious need for international coordination of this segment of the network. The international roaming capability itself requires global standardization. Further, the sophistication and complexity of the technical apparatus needed to make FPLMTS work and the tremendous research and development required to develop the technology will also drive toward global standards.

The second factor pushing for international standards is the growing presence of multinational telecommunications corporations in global markets. A major reason for the increasing importance of multinationals is that new technologies such as FPLMTS are very expensive to develop. They necessitate large economies of scale and will require mass markets to amortize development costs. In addition, the rapid pace of product innovation and development no longer allows companies the luxury of testing the home market before probing abroad. Unless a company operates in all regions of the world economy, it will not be able to achieve economies of scale in order to pay for production.[55]

For these reasons multinational mobile telecommunications equipment manufacturers desire international standards which allow them to benefit from a large market and lowered production costs. Global standards are also pursued by service providers as they are more likely to attract customers when the equipment cost is lower. Further, service providers will not be locked in by a specific supplier as standardized equipment allows more competition among manufacturers.

Because the outcome of an international standards process will greatly affect their profit margin, multinationals such as Motorola, AT&T, Ericsson and Nokia are the most eager and consistent participants in the FPLMTS forum. They are leading the way for global standards, as well as trying to influence the choice of standards to their advantage. Multinationals' interests do not always coincide with the home governments' interests. Managers of global corporations must make decisions on the basis of profit margins, not nationality. In essence, their independent status will add an important dimension to the dynamics of international standardization of FPLMTS. The dominant role they play in the telecommunications industry will have significant implications for counteracting regionalism.

10. The Role of the ITU

The success or failure of the global standardization of FPLMTS also hinges upon the ITU's leadership. The ITU's historic monopoly in standards setting in telecommunications has been threatened in recent years by the rise of regional standards bodies, such as T1 and ETSI. These regional bodies have emerged to become the primary suppliers of standards for their individual regions, sidestepping ITU's authority as the sole international standards maker. The emergence of regional standards organizations reflect the vast accelerating development of new

and sophisticated telecommunications technology, and the global trend toward pro-competitive regulation and service liberalization. More open and agile regional bodies can respond more effectively to the rapidly changing telecommunications environment than the unwieldy ITU which suffers from a broad membership and slow procedures.

In response, the ITU has reorganized itself to become more business-like and has streamlined its standardization procedures. It has begun to circulate documents more rapidly among participants in its standards working groups and it has changed some of its voting procedures. Another impetus for change is that the old ITU structure separating radio and wireline sectors was no longer appropriate in the new technological situation where wire and wireless systems coalesce and no line of demarcation can easily be drawn between the two segments of the telecommunications network. FPLMTS best represents such a coalescence. Although it is a radio-based service, a critical aspect of the FPLMTS systems design is in the network. The new ITU structure, which combines both wire and wireless standardization work in one sector, will be more in tune with the needs of the merging network.

The reorganization is the ITU's effort to show its commitment to remain as the world's supreme telecommunications regulatory agency and to solidify its leadership role in international standards setting. FPLMTS will be the first major standards project on which the ITU's future leadership role will be judged.

11. Conclusion

Unlike analog and digital cellular telephone systems where no serious international standardization efforts took place, the ITU has committed itself to the standardization of the third generation mobile communications systems, also known as FPLMTS. The principal justification for international standardization of the next generation mobile communications systems is the major shift toward personally-oriented communications and the advent of *wireless access* as a mainstream access method to the global telecommunications network. The pressing needs for global interconnectivity and interoperability among new mobile communications systems mandate that nations compromise their prerogatives in radio communications matters in favor of global standardization. The technical requirements of global roaming, which will allow a subscriber to use the same portable phone set in different parts of the world, further demand international standardization of FPLMTS.

Despite obvious needs for universal standards, the prospect of multiple standards looms. The foremost obstacle to international standards is a political one: nations and regions have imposed industrial policy toward mobile communications, now deemed a strategic component of the general telecommunications policy. The strategic importance of mobile communications is considerable in terms of industrial participation and benefits. Competitive imperatives among nations and regions inevitably led to the potential for conflicts.

The initial conflicts lie between the United States and Europe. The success of GSM, the pan-European digital cellular system, and its potential to become a de facto global standard have convinced Europeans as well as others that industrial policy yields powerful results. Europe is now taking the same approach toward the third generation system, championing a European third generation system which will be identical to FPLMTS. In part to counteract the European lead in terrestrial mobile communications, the United States has expedited the authorization of the introduction of PCS, viewed as a domestic version of FPLMTS, as an attempt to leapfrog European advances.

Although regional competition may thwart the international standards effort, two other factors are driving toward global standardization. The real players in the standards negotiation are commercial interests, particularly multinational mobile communications corporations who have incentives to access global markets. A standards "war" would not suit their interests. Further, the complexity of the new mobile communications systems and the enormous costs of research and development required for setting up such systems speak toward standardization. At the moment it is too early to determine which tendency will predominate. What can be said is that unless the regional interests can be successfully balanced, once again the world will be burdened with a multiple standards telecommunications system.

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Endnotes

1. At the time of this writing, the ITU was considering proposals to use the term International Mobile Telecommunication-2000 (IMT-2000) instead of FPLMTS.

2. TG 8/1 is a subgroup of Study Group 8 of ITU-R.

3. See 'Special Mobile Group (SMG): framework for services to be supported by the Universal Mobile Telecommunications System (UMTS)', ETSI Technical Report, Draft-ETR/SMG-50201, September 1992, p. 5.

4. Interview.

5. Office of Technology Assessment (1993).

6. The opinion was drafted by TG 8/1 in its third meeting in Palermo, Italy in October 1992 and approved by the ITU Radiocommunication Assembly in 1993.

7. The first commercial cellular system in the United States went into service in 1983. The first European country to introduce a cellular telephone system was Sweden in August 1982. Japan, however, introduced its cellular service in 1979.

8. The nine cellular standards and their countries of origin are: US (AMPS), UK (TACS), Nordic countries (NMT 450/900), Benelux (variant of NMT), France (Radiocom 2000), Germany (C Netz), Italy (designed by Italel), Austria (C Network), and Japan (HCS). Among them, AMPS, TACS and NMT are the most dominant standards.

9. Whitten (1986).

10. GSM was created within CEPT in 1982. Following the creation of European Telecommunications Standards Institute (ETSI), GSM responsibility was transferred to ETSI in 1989.

11. Interview.

12. Interview.

13. The FPLMTS idea originally came from a U.S. and a Canadian delegate to ITU's Consultative Committee on Radiocommunication (CCIR), the predecessor of ITU-R.

14. Originally FPLMTS were intended to be land mobile communications systems. The satellite component of FPLMTS was added later, reflecting the interests of the newly emerged mobile satellite industry.

15. The FPLMTS definition originated in 'Recommendation 687: Future Public Land Telecommunications Systems' which was adopted in CCIR XVII Plenary Assembly in 1990, held in Dusseldorf, Germany.

16. Interview.

17. FCC Gen Docket No. 90-314 (1993).

18. It should be noted that the FPLMTS spectrum is only identified, not allocated. The identification appears in a footnote of the Final Acts of WARC-92 rather than in the actual allocations table. Since an identification of spectrum is not legally binding, countries have the right to decide whether to use the spectrum for FPLMTS-like service and, if they choose to use it for that purpose, which portion of the spectrum to employ. WARC-92 identified the bands 1885-2025 MHz and 2110-2200 MHz on a worldwide basis for use by the terrestrial component of FPLMTS, expected to be needed by the year 2000. Within these bands the portion 1980-2010 and 2170-2200 MHz can be used on a worldwide basis for the satellite component of FPLMTS from the year 2005.

19. IWP 8/13 was renamed TG 8/1 in 1990 due to the reorganization of its parent body, Study Group 8.

20. For example, Motorola projected that the wireless communication market will be $600 billion by 2010.

21. The early U.S. objection to global spectrum reserved for FPLMTS also reflected the strong lobbying effort from the fixed microwave operators who did not want to give up their spectrum for PCS-type services, and from cellular operators, who initially viewed PCS as a competitor to challenge their comfortable duopoly right.

22. The U.S. agreement to FPLMTS was used as a bargaining chip to obtain Europeans' concession in the allocation of Low Earth Orbit Satellite bands, which was a top U.S. priority at WARC-92. See Liching Sung, "WARC-92: setting the agenda for the future" *Telecommunications Policy Journal*, November 1992, pp.

624-634.

23. The FPLMTS spectrum identification was made in footnote 746A which reads: 'The frequency bands 1885-2025 MHz and 2110-2200 MHz are intended for use, on a worldwide basis, by administrations which wish to implement the future public land mobile telecommunication systems (FPLMTS). Such use does not preclude the use of these bands by other services to which these bands are allocated.'

24. The FCC initially allocated a total of 160 MHz at 1850-1970, 2130-2150, and 2180-2200 MHz for PCS in its Second Report and Order adopted in September 23, 1993. The industry's objection to the separation of bands, however, forced the FCC to revise the allocation by consolidating all PCS spectrum in the lower part of the 2 GHz band.

25. FCC General Docket No. 92-314 (1992).

26. FCC General Docket No. 92-314 (1992), p. 13.

27. Office of Technology Assessment (1993).

28. Interview.

29. Cox, (1992).

30. Calhoun (1992).

31. Calhoun (1992).

32. Calhoun (1992).

33. NTSC stands for National Television System Committee. It is the first operating color TV system which began regular operation in the United States in 1954. SECAM, short for Sequentiel a Memoire, is a French system developed in the late 1950s. In 1962 West Germany also developed a color TV system called Phase Alternation by Line, hence PAL, which employs some of the best elements of NTSC and SECAM.

34. Crane (1979).

35. Wallenstein (1990).

36. Gilpin (1989).

37. Office of Technology Assessment (1993).

38. The European influence surfaced in the CCIR Report to WARC-92. In the Report, which provided the technical guidance for the WARC, the CCIR recommended that 230 MHz of spectrum be set aside globally for FPLMTS by the year 2000. This recommendation, prepared by TG 8/1, largely reflected European thinking. Because of the authoritative nature of the report, many developing countries followed its recommendations. With the support of these countries, which form the majority of the ITU's membership, the FPLMTS spectrum identification was finally adopted.

39. RACE is 50 percent funded by the European Commission and 50 percent by the private industry.

40. ETSI was created in 1988 as a direct response to the 1987 Green Paper in the Development of the Common Market for Telecommunications Service and Equipment, which called for liberalization of telecommunications networks and services and harmonization of telecommunications standards in Europe.

41. "ETSI shifts third-generation project into GSM group" (1991).

42. Committee T1 was created in 1984 to fill the void left by the breakup of AT&T, previously the sources of standards for the US telecommunications industry. T1 is sponsored by the Exchange Carriers standards Association and is an accredited member of the American National Standards Institute.

43. The State Department is the official US representative to the ITU, an intergovernmental organization. It represents US positions to ITU's Radiocommunication Sector (formerly CCIR) and Telecommunications Standardization Sector (formerly CCITT) and approves contributions papers from the industry to these sectors.

44. The State Department held a joint meeting of US CCIR and CCITT National Committees in 1991 to discuss issues interfacing both committees. The meeting identified PCS as a strategically important issue which should receive priority attention.

45. T1P1 was established on a broad mandate to manage large, complex projects involving multiple T1 technical subcommittees. So far, however, it has been working only on PCS, which is its first assignment.

46. Although T1P1 has the primary responsibility in developing PCS standards, it is not the only subcommittee within T1 that has involved in the PCS work. T1P1 focuses on addressing high level system objectives, service definition and architectural issues, whereas T1A1, T1E1, T1S1, and T1M1 are also involved in addressing more specific aspects of the PCS standards.

47. Interview.

48. For example, the Personal Communications Industry Association (PCIA), formerly Telocator, had threatened that if North American PCS standards were not developed by 1994, the industry would deploy non-standard equipment as soon as they received licenses from the FCC.

49. JTC focuses only on the standardization of radio interfaces, the most important element in the standardization of PCS. JTC is comprised primarily of T1E1.9 from Committee T1 and TR46.3.1 from TIA. The immediate parent body of T1E1.9 is T1E1, and the immediate parent of TR 46.3.1 is TR 46.

50. Interview.

51. Channing (1993).

52. Paetsch (1993).

53. These new systems include Digital European Cordless Telecommunications (DECT), Cordless Telephone Second Generation (CT-2) and DCS-1800, a variant of GSM.

54. Wallenstein (1990).

55. Gilpin (1987).