International Cooperation and the Logic of Networks: Europe and the Global System for Mobile Communications (GSM)

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Introduction[1]

Contrary to the United States, the European Union (EU) has established a single technical standard for second generation wireless telecommunications. The successful creation of the pan-European digital standard GSM[2] is of utmost industrial significance. It has provided Europe's equipment manufacturing industry with a market large enough to exploit economies of scale and has thus enabled European manufacturers to become world leaders in the mobile communications industry.[3] Given the centrality and crucial importance of wireless technology for the emerging information society and digital economy, the story of the establishment of GSM is of interest to anybody studying the growth and trajectory of digital technology and its commercial applications. After all, the nature of digital economies implies that control over network evolution translates into control over the architecture of the digital marketplace, as François Bar has argued.[4] Hence, control of and influence over network evolution has global economic ramifications. In addition, however, the political process that enabled GSM featured pivotal supranational leadership in the form of European Commission initiatives in a domain that has traditionally been dominated by national players. Grasping standard setting in the case of GSM thus also contributes to an understanding of the changing governance patterns of the European economy and consequently is of interest to anybody concerned with issues of European integration as a whole.

How can one explain the successful establishment of a pan-European standard for mobile communication? Apart from the general complexity of the issue, the case of GSM is complicated by the fact that the actors involved in the process changed considerably over time. While international deliberations began on the level of PTT representatives, the final bargain was struck by national governments. Supranational institutions and private corporations had played key roles even before

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[1] For comments and suggestions I would like to thank Karen Adelberger, John Cioffi, Mike O'Dell, Nicolas Duchenmeaut, Hans-Willy Hohn, John Leslie, Abe Newman, Niklas Ponnert, Elliot Posner, Annina Ruottu, Steve Weber and John Zysman, as well as participants at the 12th International Conference of Europeanists, Chicago, Illinois, March 30 – April 2, 2000. Part of this research was carried out during a visit to the European Center for Advanced Research in Economics (ECARE) at the Université Libre de Bruxelles in the summer of 1999. I thank ECARE's director, André Sapir, its faculty, graduate students and staff for providing such a hospitable environment.

[2] GSM was originally the acronym for the Groupe Spécial Mobile, a working group that began the development of a common European standard in 1982. In 1991, the project was renamed and GSM now stands for Global System for Mobile Communications.

[3] See, for example, Peter Martin, "The new generation," *Financial Times*, 15 June 1999, p. 18, Alan Cane, "Epicentre of earthquake has shifted to Europe," *Financial Times*, 15 March 2000, p. 13, and "The future is mobile," *Financial Times*, 11 October 1999, p. 30.

[4] François Bar, conference presentation, *The Digital Economy in Comparative Perspective*, 27 May 1999, the Willard Inter-Continental, Washington D.C.

the general agreement was reached, but their importance grew substantially once it came to implementing the framework, determining technical specifications and rolling-out service. This study therefore offers an explanation that consists of two parts, an analysis of the initial interstate bargain and an examination of the collaborative implementation once a general agreement on development had been reached.

Establishing an international technical standard is a process characterized by a collective action problem that is an initial obstacle to a commonly advantageous outcome.[5] In principle, all participating actors benefit from sharing a common standard that makes possible international network interoperability as well as provides for a market large enough to enable the exploitation of economies of scale. However, agreeing on a particular common standard is often difficult because the developer of the chosen standard has a head start compared to proponents of alternative standards that were not adopted.[6] The first step in explaining the creation of GSM is thus a demonstration of how the collective action problem in this particular case was solved and how the interstate bargain to establish a common standard was struck. In Part I, I show that the collective action problem in the case of GSM was one that followed the logic of Battle-of-the-Sexes, rather than the more familiar logic of Prisoner's Dilemma. Policy adaptation on the national level ensured governmental demand for international cooperation and supranational institutional actors supplied international political leadership by supplying a focal point in a multiple equilibrium game and thus paving the way towards a commonly advantageous bargain.[7] In addition, economies of network led to tremendous potential value built into the network itself, thereby increasing the project's potential value beyond the benefits from economies of scale in network manufacturing markets alone. As will be shown, the existence of national telecom monopolies at the time enabled fair access to potential network gains while the anticipated technical superiority of the new standard reduced anti-cooperative sentiments among equipment manufacturers. In combination, the logic of network economics, the regulatory state of

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[5] Stephen Krasner, using a concept first developed by Arthur Stein, has referred to problems of this kind as "dilemmas of common aversion," situations "in which actors must coordinate their policies to avoid mutually undesirable outcomes." See Stephen D. Krasner, "Global Communications and National Power: Life on the Pareto Frontier," *World Politics* 43 (April 1991), p. 338. For the original idea see Arthur A. Stein, "Coordination and Collaboration: Regimes in an Anarchic World," in Stephen D. Krasner, ed., *International Regimes* (Ithaca: Cornell University Press, 1983) and Arthur A. Stein, *Why Nations Cooperate* (Ithace: Cornell University Press, 1990).

[6] Technically speaking, the collective action problem in the case of GSM thus had a distributive dimension. See Krasner, p. 339.

[7] For the notion of "demand for cooperation" and "supply of leadership," see Wayne Sandholtz, "Institutions and Collective Action: The New Telecommunications in Western Europe," *World Politics* 45, 2, January 1993, pp. 243-244.

Europe's telecom industry and a few specific technical characteristics of the collective good, GSM, ensured a just distribution of benefits from cooperation and thus limited the distributional component of the collective action problem.

Part II examines the implementation of the previously struck bargain. While the process of reaching an international agreement on a common technical standard is primarily characterized by the "logic of collective action,"[8] implementing the agreement, that is, providing the legal framework, determining all technical specifications and coordinating the international roll-out, requires an extensive degree of collaboration among various state, supra-state and non-state actors. Inadequate institutions and policy processes often inhibit commonly advantageous cooperation despite genuine support for and commitment to an international solution by the contracting parties. In the case of GSM, new institutions, innovative institutional design and an original division of labor between the private and public sectors in the standardization process contributed significantly to the project's dramatic success.

Parts III and IV finally put the findings in broader perspective by first identifying the distinct approach to technical standardization featured in the case of GSM and then assessing the prospects for replicability in related domains. The global success of GSM and the importance of wireless technology for the digital information age have brought about a situation in which "for perhaps the first time since the computer era began, the US has been willing to share its pre-eminence in setting standards," as Peter Martin of the *Financial Times* maintains.[9] Europe's brief technological and comparative advantage vis-à-vis the US has propelled the Europeans into a position where they can negotiate over certain characteristics of the emerging digital economy rather than simply swallowing what American corporations such as Microsoft and Cisco Systems come up with. Given the crucial importance of control over standards and de-facto standards in an age of information goods and network economies, an assessment of whether the European policy process and the underlying approach to technical standardization that enabled GSM is likely to be replicable in other areas and hence further increase Europe's potential to shape the development of global trade on digital networks and to secure competitive advantages for its industries, must be a part of this undertaking.[10]

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[8] Mancur Olson, *The Logic of Collective Action* (Cambridge: Harvard University Press, 1971).
[9] Martin, p. 18.
[10] On the importance of standards in a digital world, see Michael Borrus and John Zysman, "Globalization with Borders: The Rise of Wintelism as the Future of Global Competition," *Industry and Innovation* 4:2, December 1997. On information goods and network economies, see Carl Shapiro and Hal Varian, *Information Rules* (Boston: Harvard University Press, 1999), pp. 13-16 in particular, and J. Bradford De Long, "How 'New' is Today's Economy?," http://econ161.berkeley.edu/comments/how_new.html, pp. 10-12.

In sum, this study seeks to accomplish two goals: first, it offers an explanation for the successful creation of a pan-European standard for digital wireless communications, and secondly, it investigates the question whether GSM was ultimately the result of a particularly favorable industrial and political constellation or whether the policy process that led to its creation is robust enough to produce similar successes in the future.

I. European Mobile Communications between the Logic of Collective Action and the Logic of Networks

This section constitutes the first part of the explanation of Europe's successful establishment of a pan-European digital standard, an assessment of the initial interstate bargain to develop GSM. It is divided into first, an assessment of the character of the strategic interaction in which European states found themselves in the process of bargaining over a common standard, secondly, an analysis of the general motivation that drove them toward a multilateral solution, thirdly, an evaluation of states' specific bargaining interests, and finally an assessment of how exogenous political entrepreneurship in the form of European Commission initiatives interacted with some of the characteristics of the collective good, GSM, to ensure the realization of an equilibrium outcome by supplying a focal point and ensuring an acceptable distribution of gains among the participants.

Strategic Interaction

The establishment of a common technical standard is a classic collective action problem, whether the main actors are states, as in the case of GSM, or whether they are firms in a domestic economy. Common technical standards enable economies of scale in markets that might not have seen scale had there been technological fragmentation. Furthermore, standards are often instrumental in creating markets as innovators can port value-added products to established standards. While standards are thus considered beneficial to the developers and promise gains that might not be reaped in their absence, concern about the distributional consequences of cooperative standardization often impede the provision of the collective good. While each player might benefit from a common standard in the abstract, seeing a technology that a competitor has a leading edge in assume the status of industry standard can be detrimental. As a result, technical standardization, particularly in the realm of international politics has often been seen through the prism of the famous Prisoner's Dilemma. In this game's story line, all players would prefer cooperation and getting away with a substantially lower punishment, however, the fear of being the "sucker," i.e. cooperating while others

defect, inhibits mutually beneficial cooperation.[11] In the case of standardization, the equivalent of being the sucker is having invested in a technology that is not adopted as the standard and having failed to promote one's technology through other means, for example through the market. Despite the potential gains from cooperation, players are driven toward uncooperative behavior, the collective good tends not to be supplied and the result is Pareto sub-optimal.

The strategic interaction in the case of GSM, however, is not captured by the Prisoner's Dilemma. Instead, the case of GSM follows the logic of what is commonly referred to as the Battle-of-the-Sexes, for GSM is a *network* standard, not simply a *product* standard. The difference is crucial and warrants some elaboration.

The potential gains from controlling any industrial standard are high for sure. Advocates of VHS and BetaMax fought bitterly in the early 1980s for dominance of the video cassette recorder (VCR) market. Similarly, the 1990s saw a bitter fight between Microsoft and Apple over the de-facto standard user interface for personal computing. Just as the potential gains from setting and controlling a technical standard are high, the potential losses from investing in a technology yet losing out to a rival technology that assumes the role of market standard can be severe. No common standard is preferable than seeing a competitor's standard adopted industry wide. The logic inherent in such undertakings is consequently that of a Prisoner's Dilemma.

The fight over the standard for video recording was a fight over the standard for a specific product, however, whereas a system for mobile communications is a network. Realizing that GSM is not a product standard but a network standard has profound implications as networks are affected by what economists call positive externalities or network effects. In short, any network participant's utility from participation increases with every additional participants. Put differently, as suggested by Bob Metcalfe and known as "Metcalfe's Law," connecting n machines in a network creates n^2 potential value.[12] The network value thus increases exponentially with the number of network nodes as displayed in figure 1.

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[11] See among many others, Robert Axelrod and Robert O. Keohane, "Achieving Cooperation under Anarchy: Strategies and Institutions," *World Politics* 38, October 1985, pp. 226-254, Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Books, 1984), and Robert O. Keohane, *After Hegemony* (Princeton: Princeton University Press, 1984).

[12] On Metcalfe's Law, see George Gilder, "Metcalfe's Law and Legacy," *Forbes ASAP*, 12 September, 1993, pp. 158-166.

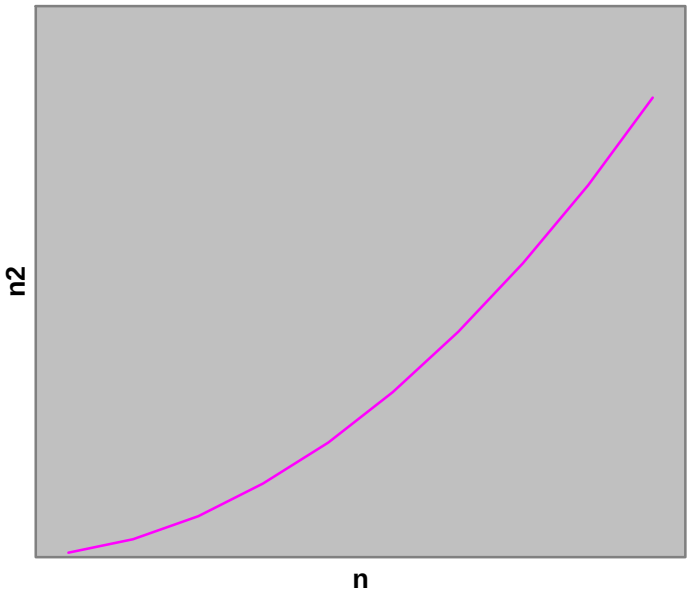

Figure 1: Metcalfe's Law

Given the exponential scaling of value in the realm of networks, players' preference ordering in a network standard setting game is slightly different than in the product standard setting game depicted above where gains are exclusively in product economies of scale. A common standard is prerequisite for the large gains promised by economies of network. Any standard is thus better than none. The game is hence not a Prisoner's Dilemma but a Battle-of-the-Sexes, as recent research in the area of network standardization has suggested.[13] In this latter game, husband and wife would like to go on vacation together and being together is their primary objective. However, she would prefer traveling to the ocean while he prefers vacationing in the mountains.[14]

The game has two principle forms, depending on whether the players have already made investments in their preferred outcome. If they have not, the game becomes a simple coordination

[13] I thank Hans-Willy Hohn for helping me clarify my thoughts on this question. See Hans-Willy Hohn, *Kognitive Strukturen und Steuerungsprobleme der Forschung* (Frankfurt: Campus Verlag 1998), pp. 199-202 in particular, Susanne K. Schmidt and Raymund Werle, *Coordinating Technology* (Cambridge: The MIT Press, 1998), ch. 4 in particular, and Joseph Farrell and Garth Saloner, "Coordination through committees and markets," *RAND Journal of Economics*, Vol. 19, No. 2, September 1988, pp. 235-252.
[14] Krasner, p. 339.

game.[15] If the players have made investments, however, the game has a distributional component. Figure 2 depicts the payoff matrix of a Battle-of-the-Sexes with a distributional component.[16]

	Mountains	Ocean
Mountains	3 2	0 0
Oceans	0 0	2 3

Figure 2: Battle-of-the-Sexes payoff matrix

Contrary to the Prisoner's Dilemma, players in Battle-of-the-Sexes do not have a dominant non-cooperative strategy. Rather, the game has multiple equilibria and the factors determining whether an equilibrium outcome is achieved and which equilibrium is realized are exogenous to the game.[17]

Having identified the strategic interaction in the realm of intergovernmental negotiations in the realm of network standard setting as one characterized by the logic of the Battle-of-the-Sexes, I now turn to the origin of states' general demand for cooperation in the area of wireless communications at the time and the factors shaping their bargaining positions in particular. Subsequent sections explain how a particular equilibrium was identified as a focal point by exogenous political leadership on behalf of the European Commission and how that particular focal point solved many of the distributional problems in conjunction with the monopolistic state of Europe's telecommunications landscape at the time.

Adaptation and demand for cooperation

Prior to liberalization in the 1990s, European telecom markets were firmly controlled by national governments and their respective PTT monopolists. Consequently, when France and Germany back in 1982 sought a forum to express their concerns about the danger of future frequency scarcity for existing analog wireless services as well as the continuously high costs of service provision, they addressed the Conférence des Administrations Européenes des Postes et

[15] Krasner, p. 339.
[16] Krasner, p. 339.
[17] Krasner, p. 339, and Hohn, p. 200.

Télécommunications (CEPT), an intergovernmental organization that comprised the national telecommunications administrations of at the time twenty-six European countries. CEPT responded to the challenge by setting up a working group named Groupe Spécial Mobile (GSM) and the group's objective became the development of "the specifications of a pan-European mobile communications network capable of supporting the many millions of subscribers likely to turn to mobile communications in the years ahead."[18] Rather than seeking unilateral solutions to the problems facing the mobile communications industry, European PTT representatives explored the feasibility of multilateral cooperation.

The national telecom administrations' initial preference for a multilateral solution should not surprise as analog mobile communication systems in place at the time were completely incompatible with one another and limited service to the extent of the respective national jurisdictions. Europe-wide roaming was technically impossible. Furthermore, it was apparent at the time that "localized solutions to the development of mobile communications did not make long-term economic sense. Given the daunting R&D costs facing operators and manufacturers, it was essential to be able to exploit the economies of scale inherent in global market penetration. Home market revenue simply wouldn't justify sustained programs of investment."[19]

However, the potential benefits of sharing R&D costs in developing solutions to common technical challenges did not daunt on national governments only in the case of digital wireless technology. In fact, states had previously opted for unilateral solutions in the area of wireless communications, well aware that cooperation was a possibility. To explain the origin of states' sustained demand for a multilateral solution it is necessary to consider the learning process that Wayne Sandholtz has identified as prerequisite for any explanation of successful international cooperation.[20] Why did states reject the alternative of a set of unilateral responses to the problem of frequency scarcity? Why did they adapt to favor a multilateral solution?

Adaptation is a cognitive process less far-reaching than learning. It does not require the revaluation of ends in light of new consensual knowledge but is instead the realization that new means are necessary to reach previously determined ends.[21] Adaptation is thus essentially learning from previous experiences and exploring new means of achieving goals. In the case of European

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[18] GSM Association, *A History of GSM*, http://www.gsmworld.com/about/history_gsm.html, p. 4.
[19] GSM Association, p. 4.
[20] Wayne Sandholtz, *High-Tech Europe* (Berkeley: University of California Press, 1992), pp. 14-32.
[21] For the notion of "demand for cooperation" and "supply of leadership," see Wayne Sandholtz, "Institutions and Collective Action: The New Telecommunications in Western Europe," *World Politics* 45, 2, January 1993, pp. 243-244.

mobile telecommunications in the 1980s, adaptation occurred in response to the contrast between the complete failure of bilateral or multilateral attempts to establish common analog standards in part of the European Community in the first half of the 1980s and the simultaneous successful creation of a common analog standard among the Scandinavian countries. In addition, adaptation took place against the backdrop of the prospect of digital technology.

Before CEPT formally launched the GSM project in 1982, cooperation on analog standards for mobile communications in Europe had been attempted between France and the U.K. and France and Germany respectively.[22] However, simultaneous efforts by the national governments to protect their own industries frequently interfered with the realization of gains from cooperation. In the end, neither of the two projects was successful and unilateral solutions in each of the larger European states left the European market fragmented and networks incompatible with one another.

Whereas France, Germany, Italy and the U.K. each developed national technologies independent of one another to support their own "national champions," the Scandinavian analog standard, NMT 450, was the result of successful cooperation of Denmark, Sweden, Norway, Finland and later Iceland. The idea of a common Nordic mobile telephone system dates back to 1969 when it was first proposed to a meeting of NordTel, an organization for cooperation between telecommunications administrations of Norway, Denmark, Finland and Sweden, by a Swedish official.[23] In response, NordTel established the Nordic Mobile Telephone Group (NMT) and it was "assigned the task of developing a common Nordic mobile telephone standard."[24] While technology on the basis of Sweden's own MTD standard was also made available in Denmark and Norway in the late 1970s, Nordic cooperation in the domain of mobile telephony culminated with the introduction of NMT 450 in 1981.

Apart from creating an integrated cellular network for Scandinavia, NMT 450 became a successful export commodity and NMT 450-based systems were built in Saudi Arabia, Thailand, Algeria, Spain, the Netherlands, Belgium and Switzerland.[25] Upon realization that frequency allocations in the 450 Mhz band would become insufficient in light of growing demand, NMT

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[21] Sandholz, *High-Tech Europe*, pp. 18-19.
[22] Annina Ruottu, "Governance within the European Television and Mobile Communications Industries: PALplus and GSM – A Case Study of Nokia," PhD. diss., University of Sussex, 1998, pp. 250-251.
[23] Staffan Hultén and Bengt G. Mölleryd, "Mobile Telecommunications in Sweden," in Karl-Ernst Schenk, Jürgen Müller and Thomas Schnöring (eds.), *Mobile Telecommunications: Emerging European Markets* (Norwood: Artech House, 1995), p. 4.
[24] Hultén and Mölleryd, p. 4.
[25] Hultén and Mölleryd, p. 16.

developed a similar system for the 900 Mhz band that was rolled out in Scandinavia in 1986. NMT 900 systems were subsequently adopted in the Netherlands and parts of France.[26]

As a result of the success of NMT 450 and NMT 900 on Scandinavian as well as international markets, Scandinavian equipment manufacturers such as Nokia and Ericsson developed considerable competitive advantages.[27] As early as 1985, for example, Nokia and Ericsson controlled roughly one fifth of the world market for mobile phones when all other European manufacturers together held less that ten percent.[28] Whereas concern about domestic industries had impeded bilateral and multilateral cooperation on analog standards among France, Germany and the U.K., successful cooperation in Scandinavia clearly strengthened Scandinavian manufacturers vis-à-vis their international competitors.

The experience of cooperation failure among EC countries contrasted with cooperation success in Scandinavia and the resulting presence of clear indicators for the superiority of the multilateral approach in reaching the goal of strengthening domestic industry laid the ground for adaptation on the national level. Having realized that unilateral means had failed to produce the anticipated result, European states had considerable demand for international cooperation in the field of mobile communications.

As important, however, was that the GSM project was intended to lead to a digital standard. Digital wireless communications was at the time a largely unexplored technology field and was considered a quantum leap forward. The R&D costs for such a new technology promised to be particularly severe and none of Europe's telecommunications manufacturers had yet mastered the technology all-out. Digital thus offered Europe's PTTs a fresh take at trying to establish a cooperative standard against the backdrop of the lessons from previous developments in the realm of analog technologies.

State preferences

As suggested above, early on in the process of technical deliberation, CEPT's GSM working group had decided to pursue a digital route towards the establishment of a pan-European standard, if technically feasible. Digital technology, i.e. encoding a signal as a sequence of zeros and ones, would not only enable a more efficient management of scarce frequency bands, it would also provide high

[26] Hultén and Mölleryd, pp. 7-8.
[27] Ruottu, p. 218.
[28] Ruottu, p. 232.

speech quality and advanced features such as speech security and data communications.[29] In addition, digital technology promised smaller and cheaper access devices, thereby making hand-held terminals a definite possibility. Lastly, a digital solution promised full compatibility on a high level of technical sophistication with the Integrated Services Digital Network (ISDN) that was being developed for land-based communications at the time.[30]

Not long into the deliberations, initial tests in PTT laboratories suggested that a digital solution would be feasible. There were however two other technical questions that required project-defining decisions early on: first, it had to be determined whether to employ Frequency Division Multiple Access (FDMA) or Time Division Multiple Access (TDMA) to allow several users access to the same base station, and secondly, a decision on whether to adopt narrow-band or wide-band technology had to be made.[31]

The same initial tests that revealed the feasibility of a digital solution also suggested that TDMA technology would be better equipped to meet the performance benchmarks set forth for the development of a common European standard.[32] While the first question was thus largely decided by engineers and technocrats without significant controversy, the political battle erupted over the question whether to adopt a wide-band or narrow-band TDMA solution. Wide-band technology promised superior performance but was even further from technical realization than the narrow-band alternative.

Whereas France and Germany supported a wide-band solution, the Scandinavian countries in particular favored the narrow-band alternative.[33] These governmental preferences were a clear reflection of the preferences of the respective countries' domestic equipment manufacturers. The wide-band version had been developed by Germany's SEL and AEG and acquired by France's

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[29] GSM Association, p. 5.
[30] GSM Association, p. 5.
[31] Ruottu, p. 255. For a brief discussion of the different technologies, see Scourias, International Engineering Consortium, *Fundamentals of Telecommunications Tutorial: Wireless*, http://www.webproforum.com/iec/topic07.html, and Ruottu, pp. 255-257. It has to be emphasized that just as analog and digital devices cannot communicate with one another, two digital devices employing different encoding technologies cannot exchange any bit of information. Whether to send digital signals between a base-station and a handset on a designated frequency (as in the case of FDMA) or whether to send several strains of data divided by time on the same frequency (as in the case of TDMA) is a fundamental technical choice. Similarly, the size of the bandwidth between channels on the available frequency spectrum has to be identical for all parts of the network to interoperate.
[32] International Engineering Consortium, *Global System for Mobile Communication (GSM) Tutorial*, http://www.webproforum.com/iec04/topic02.html, p. 1. See Ruottu, pp. 255, 260 for a list of these criteria and benchmarks.
[33] Ruottu, pp. 257-258.

Alcatel with its purchase of SEL in December 1986.[34] The rival narrow-band alternative had been developed in large part by Sweden's Ericsson and Finland's Nokia and had received most GSM development engineers' endorsement after the first round of system validation tests.[35] Italy and the U.K., in turn, were the subjects of intense lobbying on behalf of the two camps with the result of frequently changing coalitions.[36]

The culmination of the controversy between the two camps was CEPT's Madeira Meeting in February 1987. The Scandinavian countries had finally convinced Italy, the U.K. and a few smaller states of the technical superiority of narrow-band technology and had left Germany and France as the only proponents of the wide-band alternative. Since CEPT followed purely intergovernmental procedures, however, decisions had to be taken unanimously and Germany and France were able to veto a decision that would have led to the adoption of narrow-band TDMA as the technology underlying the GSM project.[37]

At this point, the danger of two competing digital standards, a Pareto sub-optimal outcome in light of the gains promised by realizing largest possible economies of network, was high.

The choice between the wide-band or narrow-band technology solutions fits the strategic situation captured by the Battle-of-the-Sexes with distributional component as depicted above very nicely. Any standard is better than none, but two camps had stakes in alternative ways of realizing the goal of a single standard as a result of prior investments of their constituents in these respective alternatives. The case of GSM thus featured the multiple equilibrium situation that the Battle-of-the-Sexes matrix suggests. In order to explain how an equilibrium was realized it is therefore necessary to consider factors exogenous to the game. Specifically, it needs to be considered how political leadership by the European Commission interacted with some of the technology's features to establish a focal point for cooperation that minimized if not eliminated distributional concerns.

International Political Leadership

Foreseeing the high probability of a deadlock at the Madeira Meeting, France and Germany had encouraged the European Commission to outline the state of the GSM project to the heads of state at the European Summit in December 1986.[38] While the Commission had endorsed the GSM

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[34] Gerd Bender, "Technologische Innovation als Form der europäischen Integration: Zur Entwicklung des europäischen Mobilfunkstandards GSM," *Zeitschrift für Soziologie* Vol. 28, No. 2, April 1999, pp. 85-86.
[35] See Bender, pp. 85-86 and Ruottu, p. 257.
[36] Ruottu, pp. 259-268.
[37] Ruottu, pp. 266-269.
[38] GSM Association, p. 6.

project early on in 1984, it had no formal role in subsequent negotiations as it is not represented in CEPT.[39] The Commission's presentation to the heads of state resulted in a "recommendation and a Directive which between them laid the political foundations for the development of GSM."[40] Both documents were drafted by the Commission in February at the time of the Madeira Meeting and enacted by the Council in June 1987. In its recommendation "on the coordinated introduction of pan-European cellular digital land-based mobile communications in the Community," the Council, following a Commission proposal, asked all member states to "rapidly complete the technical arrangements necessary to allow unrestricted access to digital cellular mobile communications" and to ensure that the new system be operational by 1991.[41] Following another proposal by the Commission, the Council also issued a Directive that required member states to reserve the 900 Mhz frequency band for the new pan-European digital standard.[42] This was crucial as member governments had contemplated and in a few cases even begun allocating slots in the 900 Mhz band for other purposes and trans-border system interoperability depends not only on the use of the same digital technology but also on system operation in the same frequency bands. At the time of imminent deadlock and grave danger to the project, the Commission thus emerged as a crucial actor in the field of European mobile communications.

Furthermore, in June 1987, the Commission issued a Green Paper "on the development of the common market for telecommunications services and equipment," in which it emphasized the crucial importance of a "technically advanced, Europe-wide, low-cost telecommunications network" for the competitiveness of the European economy.[43] The Green Paper outlined the Commission's challenge to PTT dominance of European telecom markets by suggesting Community-wide competition in the areas of network equipment, terminals and communication services.[44] In addition, the Commission proposed the creation of a European Telecommunications Standards Institute (ETSI), a crucial

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[39] GSM Association, p. 5.
[40] GSM Association, p. 6.
[41] Council of Ministers, *Council Recommendation of 25 June 1987 on the coordinated introduction of pan-European cellular digital land-based mobile communications in the Community* 87/371/EEC (Brussels: European Community, 25 June 1987).
[42] Council of Ministers, *Council Directive of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community* 87/372/EEC (Brussels: European Community, 25 June, 1987).
[43] Commission of the European Communities, *Towards a dynamic European economy: Green Paper on the development of the common market for telecommunications services and equipment* COM (87) 290 (Brussels: CEC, 30 June 1987).
[44] For the notion of "demand for cooperation" and "supply of leadership," see Wayne Sandholtz, "Institutions and Collective Action: The New Telecommunications in Western Europe," *World Politics* 45, 2, January 1993, pp. 243-244.

institutional innovation with far-reaching consequences for the implementation of GSM as will be shown in Part II below.

The Commission's engagement in the debates over European mobile communications and liberalization of telecommunications markets was part of a concerted effort to widen Community influence in the field of Information and Communication Technology (ICT) policy that had begun with Commissioner Etienne Davignon's establishment of an Information Technology Task Force in 1979.[45] Subsequent important steps of the Commission's offensive in this domain were the creation first of the ESPRIT, and later of the RACE research programs, as well as the above mentioned Green Paper.[46] The successful ESPRIT and RACE programs in particular provided the Commission with channels to European equipment manufacturers, laid the foundation for intra-industry R&D networks and equipped the Commission with technical expertise in the domain of information technology. Sandholtz has identified the presence of technical expertise and substantive knowledge on behalf of an international political leader as one of the key conditions for the leader's success in facilitating international cooperation and, to this end, ESPRIT and RACE were very valuable initiatives.[47] Not surprisingly, the Commission was keen to emphasize support of European manufacturers for its position during its initial engagement in the GSM project in the spring of 1987.[48]

The Commission's involvement in the project and its directives kept a window of opportunity for a pan-European standard open after the two main camps had clashed at Madeira. More importantly, however, the Commission helped establish a focal point for the second round of bargaining, one that was made technically possible by GSM's modular design. The compromise solution favored by both Commission and independent CEPT officials was a standard that consisted of several technical components, a basket of modules designed by several different industry consortia.[49] Designing GSM as a component standard with specified interfaces was only possible because CEPT had worked from the beginning toward a standard of *system functions*, rather than a set

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[45] Sandholtz, "Institutions and Collective Action," pp. 255-258,.
[46] For comprehensive discussions of ESPRIT and RACE, see Sandholtz, *High-Tech Europe*, chs. 7-8. For a general overview of the development of EU information and communication technology policy, see Laura Cram, *Policy-making in the European Union: conceptual lenses and the integration process* (New York: Routledge, 1997), ch. 3 and Mark Thatcher, "The Development of European Regulatory Frameworks: The Expansion of European Community Policy-Making in Telecommunications," in Stelios Stavridis, Elias Mossialos, Roger Morgan and Howard Manchin (eds.) *New Challenges to the European Union: Policies and Policy-Making* (Brookfield: Dartmouth Publishing Company, 1997), pp. 297-327.
[47] Sandholtz, *High-Tech Europe*, pp. 20-28, and Sandholtz, "Institutions and Collective Action," pp. 251-252, 255-258.
[48] 87/372/EEC and Sandholtz, "Institutions and Collective Action," p. 262.
[49] Bender, p. 86.

of *device specifications*.[50] Furthermore, the standard was to be non-proprietary and specifications were to be publicly available. Such a non-proprietary component or "basket standard" had the benefit of not giving any particular industry consortium a significant advantage over its competitors. Explicitly incorporating several features of the Franco-German, or better AEG-SEL-Alcatel proposal, CEPT agreed on specifications for GSM in the summer of 1987 that drew on several of the eight component proposals submitted by European industry consortia in the Winter of 1986. As a result of the "basket standard" solution, GSM's technical specifications ended up being far more complex than technically necessary, indicating that the compromise was entirely political in nature, not technical.[51]

Ensuring juste retour

The basket standard solution proposed advanced by the European Commission not only supplied a focal point in a bargaining game with multiple equilibria[52], however, it also reduced if not eliminated concern over disproportionate gain by any camp. Sandholtz has suggested that states need some kind of assurance that their investment in multilateral cooperation will yield a satisfactory return – *juste retour*, as he calls it.[53] The basket standard solution explains how the two opposing camps' concerns for *juste retour*, something that had prevented an agreement at Madeira, was handled. Having fused modules from various proposals in a narrow-band compromise, initial competitive advantages were in GSM system *components*, not in the entire system.

While the previous discussion provides an explanation for the two camps' assurance of satisfactory returns in the area of GSM equipment, it does not illuminate how other participating states, those that did not have a strong indigenous telecommunication equipment industry expected to assure *juste retour* from cooperation. It is the previously alluded to logic of network economics that guaranteed a significant investment return for all participating states, whether they had indigenous manufacturers or not.

As suggested in the discussion of the differences between product and network standardization, the gains from establishing and part-taking in a network standard are likely to surpass those of controlling a product standard due to the positive externalities that lead to exponential

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[50] Bender, p. 82.
[51] Bender, p. 86.
[52] For a study on the Commission's role in supplying focal points in deliberations leading to the Single European Act, see Geoffrey Garrett and Barry R. Weingast, "Ideas, Interests and Institutions: Constructing the EC's Internal Market," paper presented at the NBER Conference on Political Economics, 15-16 November 1991.
[53] Sandholtz, *High-Tech Europe*, pp. 28-29.

(potential) value growth. No matter how large the market for GSM equipment, the market for services was likely to dwarf the former. Since a large share of the potential value generated by the new system would thus be located in the network and its applications itself, it could not be harvested by a single player as in the case of the controller of a proprietary product standard. Rather, each network participant has the ability to realize and harvest potential value.

Combine the logic of value potential, value distribution and value realization in networks with an analysis of the European telecom landscape at the time of negotiation and the solution to the problem of *just retour* in the case of GSM becomes clear. Throughout the 1980s, each of the cooperating parties had a monopoly for licensing operators and in most cases a monopoly over telecommunications as a whole. Since national governments were thus free to choose whom to issue a license and with the exception of the United Kingdom issued the first GSM licenses to their national PTTs, they could not be deprived of their individual gain from implementing the new standard and participating in the network.

The idea that a pan-European network technology like GSM is characterized by both the establishment of economies of scale in equipment markets as well as economies of network in service markets and that the latter grows exponentially with the number of users and should thus constitute an increasing share of the value as the system matures, is in fact supported by some recent data. In 1998, for example, the EU wireless service market was worth 70 percent of the entire EU wireless market (switching, transmission, cable, terminals and services), a figure estimated to grow to over 83 percent by 2005.[54]

In sum, the existence of tremendous potential value in the network itself following the logic of Metcalfe's Law and network economies, in addition to the basket standard solution in equipment markets ensured that no government would lose-out by agreeing to a multilateral solution. Combined with telecom monopolies ensuring equal access to potential network value provided all governments with sufficient assurance for satisfactory investment returns and hence solved the problem of *juste retour* that often hinders international cooperation.

Overcoming the Deadlock and Securing the Bargain

A suggested above, in the aftermath of the Madeira Meeting states faced a choice between finding a compromise and realizing the gains from collective action or maintaining their positions and accepting two incompatible standards with the consequences familiar from the previous failures to

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[54] J. Schwarz Da Silva, "Beyond IMT-2000," (Brussels: CEC DG-INFSO, 2000).

establish common analog standards. A bargain became possible, however, because exogenous political leadership identified a focal point in a multiple equilibrium game and because the logic of network economics combined with the state of Europe's telecommunications landscape at the time guaranteed *juste retour* for everyone.

Adaptation on the national level had led states to explore new means to achieve their goal of promoting domestic industry while simultaneously securing benefits for consumers. The comparison between Scandinavian manufacturers and EC manufacturers clearly suggested that cooperation in Scandinavia had been more beneficial to this end than unilateral action among individual EC member states.

When faced with deadlock, the European Commission supplied international political leadership to the project when it was most needed. Having built technical expertise in the domain of ICT policy throughout the 1980s, the Commission assumed a leadership role when it proposed a recommendation and a Directive that lent the GSM project political weight while reserving the frequencies necessary to implement the standard. More importantly, the Commission took a lead role in pressing for a basket standard solution, thereby contributing to the solution of the problem of *juste retour* for governments whose constituents had already invested in a particular technology. Throughout, the Commission could bed its GSM engagement in a larger context of market integration by calling for the creation of a common market for telecommunication services and equipment. A common standard was a prerequisite for such a market. In addition, failure to establish a pan-Europe standard would have counteracted the spirit of the Single European Act (SEA) since incompatible standards would have functioned as new non-tariff barriers (NTB) at a time when the elimination of NTBs was seen as the key to the establishment of the Single Market.[55] By linking the creation of a pan-European digital standard to issues of market integration, the Commission effectively threw the authority it had acquired as the broker of the SEA behind the GSM project.[56] Combining this institutional authority with technical expertise and policy adaptation on the national level, three important conditions for effective international political leadership to facilitate international cooperation were met.[57]

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[55] For an argument about how the SEA was a "legitimizing concept" for Commission efforts to expand Community policy-making in the domain of telecommunications policy, see Cram, p. 69. For a general discussion of how the Commission linked the Green Paper to the Single Market project, see Cram, pp. 86, 88-92.

[56] On the Commission's role in brokering the SEA, see Wayne Sandholtz and John Zysman, "1992: Recasting the European Bargain," *World Politics*, 41:1, 1989, pp. 95-128.

[57] Sandholtz, "Institutions and Collective Action," pp. 251-252.

The basket standard solution eliminated much of the concern about unequal *retour* in the area of physical system components. While the eventual adoption of the Scandinavian narrow-band architecture proposal might have given Nokia and Ericsson an initial small competitive advantage over their French and German counterparts in some system components, no manufacturer commanded a hegemonic advantage. In addition, the prevalence of monopoly PTTs at the time ensured that the governments of France and Germany were free to order equipment for GSM networks built by their own PTTs from Alcatel, Siemens and SEL, thereby ensuring that these companies would get their share of the new market for GSM equipment.

More important for the overall solution of the problem of *juste retour* among all participants, however, was the prospect of network economies in the application market along the scale economies in equipment markets. The former ensured sufficient investment returns for each participant since vast potential value was located in the network itself and governments retained the ability to regulate access to the network in their respective jurisdictions. This configuration ruled out vastly unequal *retour* across the participants and enabled governments to implement the new standard and realize potential value according to their own preferences.

The prevalence of PTT monopolies at the time thus significantly reduced the problem of *juste retour* in two important ways, by providing governments with leverage over procurement decisions and by guaranteeing gains from networks built by and according to the preferences of governments in their respective territories.

Policy adaptation on the national level, international political leadership by Commission at a crucial moment, and a sufficient degree of assurance on just returns accounts for the successful completion of the negotiations in the form of a compromise between the two camps. As indicated above, in the end, France and Germany accepted the narrow-band TDMA solution under the provision that several elements of the French wide-band proposal were incorporated.[58] The agreement was manifested on 7 September 1987 when fifteen operators, the national PTTs of thirteen states and two independent British operators, signed a Memorandum of Understanding (MoU) on the introduction of GSM networks by 1 July 1991.[59]

II. Implementing the agreement and securing its success

Once the choice for narrow-band TDMA as the underlying architecture for GSM had been made, two goals needed to be accomplished: first, the technical specifications for base stations,

[58] Ruottu, p. 270.
[59] GSM Association, p. 7, and Ruottu, pp. 270-271.

switches and access terminals had to be agreed upon to ensure full interoperability and interconnectivity of systems and parts across Europe, and secondly, equipment manufacturers had to be formally included in the development to ensure the availability of equipment at the envisioned 1 July 1991 launch date. The existing institutional structures, most notably CEPT and its GSM working group, were ill suited for the task.

Because CEPT membership was restricted to national PTTs, the group was mainly comprised of PTT technocrats and research engineers.[60] Moreover, the institutional design severely limited the flow of information in and out of the working group with the consequence that little was known about "what the organization was actually discussing and deciding."[61] Potential private operators and, more importantly, equipment manufacturers were not part of the official deliberations. Observers familiar with the development of the Scandinavian NMT standard, a project that benefited enormously from the formal inclusion of manufacturers, not surprisingly referred to the lack of industry representation in CEPT's GSM group as a "strange situation."[62]

Whereas the European Commission played an important role in overcoming the deadlock and paving the way for the MoU, its role in providing the institutional structures necessary to lead the GSM project to success is even more significant. As already indicated above, an important aspect of the Commission's 1987 Green Paper on telecommunications was the proposal to establish a European Telecommunications Standards Institute (ETSI). Having realized that a "pan-European telecommunication infrastructure with full interoperability is the only basis on which a Community-wide open competitive terminal equipment and service market can thrive," the Commission argued that "a substantial reinforcement of resources applied to standardization is a necessary requirement [to realize such] a truly open competitive market."[63] To this end, the Commission proposed the establishment of ETSI as a jointly financed and independently managed standard setting body that should draw "flexibly on experts from both the Telecommunications Administrations and industry, in order substantially to accelerate the elaboration of standards and technical specifications."[64]

In many respects, ETSI's institutional design is a direct response to the deficiencies of CEPT. CEPT was created in 1959 and is independent of political or economic organizations such as the

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[60] Ruottu, p. 253, and Stanley M. Besen, "The European Telecommunications Standards Institute: A Preliminary Analysis," *Telecommunications Policy* Vol. 14, No. 4, December 1990, p. 522.
[61] Ruotto, p. 254.
[62] Keijo Toivola as quoted in Ruottu, p. 224. See also Ruottu, p. 215 for a discussion of the inclusion of manufacturers in the development of NMT.
[63] CEC, *Green Paper* COM (87) 290 final, pp. 20, 22.
[64] CEC, *Green Paper* COM (87) 290 final, p. 22.

European Union.[65] Among its particularities is the fact that CEPT does not maintain a fixed head office with permanent management or research staff except for a secretariat in Berne, Switzerland.[66] Contrary to ETSI, "CEPT is not intended to be a standardization organization," as the former chairman of CEPT's Commission Télécommunications, Michel Toutan, explains.[67] Instead, CEPT's main task has been the harmonization of existing equipment and technical requirements as well as making recommendation on behalf of European PTTs to the International Telecommunications Union (ITU).

In the mid-1970s, the European Commission first called on CEPT to facilitate the harmonization of technical equipment used in the Community's telecommunications networks.[68] CEPT responded by setting up a Committee for Coordination and Harmonization (CCH) that consulted regularly with the Commission and organizations representing European equipment manufacturers such as EUCATEL and ECMA.[69] The result has been the publication of "numerous CEPT Recommendations concerning harmonization."[70] In the mid-1980s, again following a request by the Commission, CEPT began to standardize and harmonize the technical conditions and formalities of national equipment type approval procedures to pave the way for a single European telecom equipment market.[71]

While CEPT was well suited to harmonize existing national technical regulations to enable interconnectivity of existing networks and equipment during a time of PTT dominance, the lack of a head office with permanent staff, the restriction of membership to PTTs and the unanimity principle stood in the way of a timely conclusion as well as implementation of the GSM project. ETSI's institutional design is an obvious attempt to correct the obstacles to rapid standardization built into CEPT. First, ETSI is explicitly a standardization organization and consequently maintains a headquarter with a core management and research staff located in Sophia Antipolis, a high tech research park in Southern France. ETSI employs about 100 people permanently and a total of more than 3500 experts drawn from ETSI's members currently work in over 200 technical groups.[72]

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[65] Michel Toutan, "CEPT Recommendations," *IEEE Communications Magazine* Vol. 23, No. 1, January 1985, p. 28.
[66] Toutan, p. 28.
[67] Toutan, p. 28.
[68] Toutan, p. 29.
[69] Toutan, p. 29.
[70] Toutan, p. 29.
[71] Toutan, p. 29.
[72] ETSI, "About ETSI," http://www.etsi.org/aboutetsi/aboutetsi.htm

Secondly, contrary to CEPT, membership in ETSI is not restricted to national PTTs. Instead, "any European organization proving an interest in promoting European telecommunications standards has the right to represent that interest in ETSI and thus to directly influence the standard setting process."[73] Consequently, ETSI's membership is comprised of national telecom administrations and regulators, network operators, equipment manufacturers, private service providers, research bodies and users.[74] This arrangement reflects the increasing liberalization of the European telecommunications industry, allows for the degree of openness and transparency that CEPT lacked and, for the first time, permits users to formally influence the standardization process.

Thirdly, ETSI has abolished the unanimity principle that is employed by CEPT and most international standard setting bodies and has replaced it with a system of weighted qualified majority voting (QMV). Standards are adopted if they receive 71 percent of the vote in the Technical Assembly. Votes are weighed and cast nationally, which means that the various members from a particular country have to agree prior to a vote how to cast their vote.[75] While ETSI's Rules of Procedure state that the views of all members from a particular country shall be taken into account when a decision about how to cast a vote is made, countries are free to adopt individual procedures to meet this obligation.[76] In Technical Committees, bodies ranking below the Technical Assembly and in charge of submitting proposed draft standards for approval, a simple majority is sufficient to make a decision.[77]

By establishing a headquarter with permanent management and research staff, expanding membership far beyond PTTs and abolishing the unanimity principle, ETSI has clearly corrected some of CEPT's deficiencies that were apparent during the first five years of the GSM project. Whereas CEPT was designed primarily to coordinate the technical aspects of telecommunications policy among national PTTs and facilitate harmonization of existing networks among member states, ETSI is designed to enable a more rapid development of new technical standards. In short, ETSI was designed to make deadlocks of the kind encountered at CEPT's Madeira Meeting impossible.

Apart from ETSI's internal institutional structure, the place of ETSI in the web of European cooperative institutions and in particular its relationship with the Commission must be considered to explain why this body was so central to the success of GSM. While ETSI is formally a body independent of the European Union just like CEPT, EU institutions have considerable influence on

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[73] ETSI, "About ETSI."
[74] Besen, p. 522. ETSI currently has 647 members from 49 countries. See ETSI, "About ETSI."
[75] Besen, p. 523.
[76] Besen, p. 526
[77] Ruottu, p. 266 and Besen, pp. 523-524.

ETSI's operations as well as on the implementation of ETSI standards. The institutional arrangement gives EU institutions three ways of affecting ETSI's standardization efforts as well as standard implementation. First, the Commission can provide ETSI with voluntary contributions to support the development of particular standards that it deems urgently needed for market competitiveness.[78] Secondly, the Commission can prevent the "adoption of standards that may be desired by some members if it believes that those standards will inhibit the flow of trade."[79] Thirdly, and most importantly, a Council Decision of 22 December 1986 "on standardization in the field of information and telecommunications,"[80] requires EU members and their telecommunications administrations to use official European standards in public procurements.[81] To this effect, the Commission publishes Commission Decisions on Technical Regulation, alerting members to a new ETSI standard and requiring its use in public procurement.[82] This institutional arrangement ensures that ETSI standards will be the basis of public networks in all member states, as ETSI has become the EU's principle standard setting body in the area of telecommunications.[83]

Soon after ETSI's formal creation in 1988, the responsibility for the development of GSM was transferred from GSM Permanent Nucleus, a body CEPT had set up in 1986, to the newly created ETSI. Whereas CEPT was primarily a brokerage table for national governments and their PTT representatives, ETSI is an institutional actor in its own right, capable of concentrating the support of all relevant parties behind a project like GSM. The shift of the responsibility for GSM away from the brokerage table of CEPT and towards ETSI thus epitomizes the conclusion of the interstate bargain and the move toward the task of implementation. From this point on, governments, or the PTT representatives and national champions that they backed, were no longer the primary actors in the

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[78] Besen, p. 529.
[79] Besen, pp. 529-530.
[80] COM (87/95/EEC), 22 December 1986.
[81] The requirement to use official European standards in public procurement was upheld for public telecom operators in the *Council Directive 93/38/EEC of 14 June 1993 coordinating the procurement procedures of entities operating in the water, energy, transport and telecommunications sectors*. However, Article 8 of that particular Directive states that entities will be exempt from the requirement if they face competition in their markets and that the Commission is asked to regularly publish a list of entities that are exempt in this respect. See also Besen, p. 529, and Commission of the European Communities, *Standardization and the Global Information Society* (Brussels: COM (96) 359, 24 July 1996), p. 8.
[82] See, for example, Commission of the European Communities, *Commission Decision of 21 December 1993 on a common technical regulation for the telephony application requirements for public pan-European cellular digital land-based mobile communications* (94/12/EC) and *Commission Decision of 4 September 1998 on a common technical regulation for telephony application requirements for public pan-European cellular digital land-based mobile communications, phase II (edition 2)* (98/542/EC).
[83] Thatcher, p. 308, Besen, p. 527, and Sandholtz, "Institutions and Collective Action," p. 261.

standardization process. Rather, a multitude of actors, analogous to the diverse membership of ETSI plus the European Commission moved into the spotlight.

The move away from a PTT-controlled body and towards a much more open forum comprised of many different stakeholders gave the project a "significant boost," as one observer has noted.[84] ETSI increased the speed of the GSM standardization process considerably and "the combination of a co-operative environment and improved resources…enabled the majority of Phase 1 of the GSM 900 specifications to be published in 1990."[85] Moreover, by formally incorporating terminal equipment manufacturers into the deliberations, a commitment by manufacturers to produce equipment on the basis of the new standard was ensured.

Despite a considerable increase in the speed of specifying technical details as a result of the switch from CEPT to ETSI and despite the formal inclusion of equipment manufacturers and service operators into the standardization process, it became apparent that the envisioned launch date of 1 July 1991 would not be met. While "the networks themselves were fully operational, [the] problem was that there were no GSM terminals available."[86] The main reason for the lack of terminal equipment was that manufacturers had been reluctant to produce terminals in large quantities as long as it was not ensured that terminal approved in one country would meet terminal requirements in other countries. A rigorous terminal approval regime had taken longer to develop than anticipated, thereby creating a large degree of uncertainty for manufacturers.

As before when the project had encountered problems, the Commission stepped in. Upon recommendation of the Commission, the Council passed a resolution that suggested the use of Interim Type Approval (ITA) and required the mutual recognition of terminal licenses among member states.[87] As a result, ITA terminals became widely available in 1992 and by the second half or the year, the first GSM systems were launched in Denmark, Finland, France, Germany, Italy, Portugal and Sweden.[88] The first roaming agreements had been signed even before the systems became operational, thus making the vision of international roaming a reality from day one.[89]

With the exception of Italy, each of the first-wave participants had at least two, in the case of Sweden even three initial GSM operators. In most states, at least one private operator received a

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[84] GSM Association, p. 10.
[85] GSM Association, p. 10.
[86] GSM Association, p. 11.
[87] GSM Association, p. 11, and Ruottu, pp. 255-256. See Council of Ministers, *Council Resolution of 14 December 1990 on the final stage of the coordinated introduction of pan-European land-based public digital mobile cellular communications in the Community (GSM)* (90/C 329/09).
[88] GSM Association, p. 12.
[89] GSM Association, p. 12.

license to build a GSM network in addition to the one built by the respective national PTT. This development has led one observer to note that "mobile communications networks act as a catalyst in providing a means of introducing competition in voice telephony."[90] To foster competition in mobile communications in member states that had not previously licensed private network operators, the Council of Ministers, acting in response to a Commission proposal, mandated in June 1995 that member states issue a GSM license to at least one private operator.[91] As a result of competition, prices across Europe have fallen considerably and the number of subscribers has increased rapidly since the first GSM systems were launched.[92] In 1998, for example, the number of mobile phone users in Europe increased by 66 percent to almost 100 million, with penetration rates of more than 50 percent in Scandinavia and around 20 percent in the UK, France and Germany.[93] In 1999, EU subscriber growth was even more dramatic at 69 percent as penetration rates in Scandinavia surpassed those of even fixed-line phones.[94]

Although GSM is a communications system "designed by Europeans for deployment in Europe,"[95] the system has been successfully exported to countries all over the world. Apart from Europe and North America, GSM systems have been built in Australia, India, South East Asia, throughout the Arab world and in parts of Africa.[96] In April 2000, one in about twenty-one people on the globe enjoyed GSM service as 365 GSM networks delivered service to more than 300 million users in 135 countries.[97] At the same time, GSM networks constituted roughly two-thirds of the global market for digital wireless communications system with digital in turn constituting roughly 85 percent of the entire market, thereby making GSM the most successful wireless technology in the world.[98]

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[90] Saadet Toker, "The Integration of Mobile Telecommunications in Europe," in Karl-Ernst Schenk, Jürgen Müller and Thomas Schnöring (eds.), *Mobile Telecommunications: Emerging European Markets* (Norwood: Artech House, 1995), p. 247. For an interesting case study, see Michael Berlange and Thomas Schnöring, "The Introduction of Competition in German Mobile Communications Markets," in Schenk, Müller and Schnöring (eds.), pp. 29-49.
[91] Ruottu, p. 279.
[92] See, for example, Ruottu, p. 280, and Berlange and Schnöring, p. 38.
[93] "Number of European Mobile Subscribers Rises by 66%," *Total Telecom*, 10 June 1999.
[94] J. Schwartz Da Silva (European Commission, DG-INFSO), "Beyond IMT-2000," Geneva, 7-10 March 2000.
[95] GSM Association, p. 14.
[96] GSM Association, p. 14. GSM networks are currently in operation in more than 135 countries; see GSM Association, http://www.gsmworld.com/gsminfo/gsminfo.htm. Depending on the particular network, GSM systems operate in the 900 Mhz band (GSM 900), 1800 Mhz band (GSM 1800, formerly know as DCS 1800) and 1900 Mhz band (PCS 1900, also know as GSM 1900). See GSM Association, p. 15.
[97] GSM Association, "GSM approaches half a billion customers," 25 April 2000, and GSM Association Network Statistics, 26 April 2000.
[98] GSM Association, "Digital Subscribers: 385 + m," 2000, http://www.gsmworld.com/membership/graph5.html.

While two important reasons for the dramatic global success of GSM were its comparatively early launch date and, more importantly, a large, competitive supply of equipment provided primarily by European manufacturers, the system's technological evolution since the initial roll-out should not be overlooked. ETSI project teams continued their work even after 1991 in an effort to increase the system's sophistication and allow for the provision of an increasing number of value-added services. In 1995, ETSI published Phase 2 of the GSM standardization, which enables value-added services such as fax, data and even video communication on GSM networks.[99] Phase 2 has also enabled Short Message Service (SMS), a popular feature that allows messages up to 160 alphanumeric characters to be sent from handset to handset or from the Internet to handsets.[100] According to one industry observer, SMS has become the most popular means of communication among Scandinavian teenagers.[101] In March 2000 alone, GSM users sent almost five billion SMSs to other GSM handsets, a figure expected to increase to ten billion a month by the end of 2000.[102] Developing technologies that enable services of this kind has kept ETSI's specialists busy and by 1997 the working groups had filled 130 Volumes with a total of over 6000 pages of technical specifications for GSM.[103]

III. Assessment of the GSM Standardization Process

There can be now doubt about the dramatic success of GSM, in Europe and worldwide. As Europe has been outperformed by Asian and American competitors in the fields of consumer electronics, personal computes and semiconductors, digital mobile communications is a building block of the information society in which Europe has established and retained an important comparative advantage.[104] This comparative advantage, however, is the result of a concerted European effort throughout the 1980s and 1990s to establish a single market and thus enable economies of scale in the field of mobile telecommunications. The creation of a single technical standard was a prerequisite for such a market. Consequently, the case of GSM is one of strategic standard setting for the digital economy and an evaluation of the political process that led to GSM has

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[99] GSM Association, p. 14.
[100] See International Engineering Consortium, *Global System for Mobile Communication (GSM) Tutorial*, http://www.webproforum.com/iec04/topic06.html for a description of SMS and other sophisticated digital services.
[101] Erkki Ormala, conference presentation, *The Digital Economy in Comparative Perspective*, 27 May 1999, the Willard Inter-Continental, Washington D.C.
[102] GSM Association (2000), "G-Mail growth: Global surge continues," Press Release, 25 April.
[103] GSM Association, p. 9.
[104] Ruottu, p. 241.

implications for the prospects of Europe's industries in a digital age as well as the growth and trajectory of the global digital economy.

The case of GSM features an approach to technical standardization that differs sharply from a market-led, laissez-faire approach that is more prevalent in the United States. The European Commission began calling for common European telecommunications standards as early as 1979 and ever since standard-harmonization and pan-European standardization have been important components of Commission strategy in this field.[105] As the case of GSM demonstrates, the Commission seeks an active role in the standardization process. The Commission provided international political leadership to enable international cooperation at a time of deadlock, supplied institutional structures necessary to secure the implementation and global success of GSM, and stepped in to provide legal security at times of uncertainty. In addition, the Commission's ESPRIT and RACE programs provided the ground for extensive inter-firm cooperation in the European ICT industry and the Commission's overall drive toward market integration and liberalization made possible an active participation of non-PTT organizations in the GSM deliberations. Not surprisingly, the Commission's comprehensive engagement has caused one observer to argue that "it is largely the Commission…which can claim credit for pushing forward the Global System for Mobile Communication (GSM) digital communication standard."[106] Another observer has described the Commission appropriately as "the political catalyst" of the GSM project.[107]

The institutional division of labor between the Commission and European standardization bodies such as ETSI that was at work in the case of GSM seeks to combine the strengths of the market-led and the government-led approach to standardization while attempting to eliminate some of the respective approaches' weaknesses. Within ETSI, for example, "the technical work that underlies the standardization process is often carried out by the individual member companies."[108] While the private sector thus takes the lead in determining technical specifications, the public sector in the form of the Commission provides investment security by requiring the use of these standards in public procurement. Furthermore, standards developed in this fashion are open, thereby making market monopolization on the basis of proprietary standards impossible.[109] In addition, particularly with respect to ETSI, the Commission has ensured that users and providers of advanced communication services are represented and can participate in the standardization process. Hence, ETSI's design has

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[105] Sandholtz, "Institutions and Collective Action," pp. 260-261.
[106] Cram, p. 85.
[107] GSM Association, p. 6.
[108] Besen, p. 527.
[109] Anybody can download ETSI standards from the web or order them on CD-Rom; see http://www.etsi.org.

institutionalized the influence and thus led to an empowerment of the coalition that most strongly demanded liberalization of Europe's telecom markets in the 1980s: major telecommunications equipment manufacturers and major users and providers of advanced services.[110] While the Commission supports collaboration necessary to ensure interoperability as well as a timely and coordinated roll-out of new technologies, the institutional structures put in place minimize the danger of consumers getting locked-in in outdated technologies, a danger inherent to standardization processes that feature a pro-active public sector.[111]

Given GSM's dramatic success in Europe and abroad and given that technical standards assume crucial importance in a digital age, it should not surprise that the Commission seeks replication in related domains. Arguing that US dominance of technical specification in the ICT area is inseparable from the competitive advantages many US companies enjoy in this domain, the Commission asserts that "standards form a vital part of European industrial competitiveness policy."[112] Similarly but more aggressively, the Commission has argued that "the current speed of technological developments, the high stakes in the uptake of electronic commerce, and the efforts of Europe's competitors to try to establish market dominance make a more coordinated and targeted approach to standardization in electronic commerce a matter of urgency."[113] Since interoperability of systems is seen as being in the public interest, "the Community has to monitor developments in standardization" in order to "enable European citizens and enterprises to take full advantage of the possibilities offered by the Global Information Society."[114]

This view differs sharply from that of the US government as the Clinton administration maintains that "the marketplace, not government, should determine technical standards and other mechanisms of interoperability. Technology is moving rapidly and government attempts to establish technical standards to govern the Internet would only risk inhibiting technological innovation."[115] This American preference for market-led standardization is not confined to the Internet and also applies to the area of mobile communications as "the country's Federal Communications Commission (FCC) is determined to let the market – not government – decide which technologies should be used."[116] While the European Commission shares the Clinton administration's view that the private

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[110] Sandholtz, "Institutions and Collective Action," pp. 246-248.
[111] See, for example, William J. Clinton and Albert Gore, Jr. *A Framework For Global Electronic Commerce*, http://www-06.nist.gov/eleccomm/ecomm.htm, July 1997, p. 20.
[112] CEC, *Standardization and the Global Information Society*, p. 2.
[113] CEC, *Standardization and the Global Information Society*, p. 8.
[114] CEC, *Standardization and the Global Information Society*, pp. 10, 4.
[115] Clinton and Gore, p. 20.
[116] Tammy Parker, "US split over 3G standard proposal," *Communications Week International*, 2 March 1998.

sector should lead, it clearly envisions a far more pro-active role of the public sector in facilitating and enabling private sector-led standardization. Whereas the US government views competing standards as beneficial, the Commission supports competition among products and technologies and rules out "conflicting solutions be offered in standards for the *same* product or technology."[117] Thus, contrary to the American understanding, the Commission's notion of private sector leadership does not mean laissez-fair but rather private sector leadership within a frame determined by the public interest and broad political objectives.

To replicate the success of GSM, the Commission has proposed guidelines for cooperation of enterprises in consortia. Much like ETSI, these consortia ought to have transparent decision-making processes, provide for a balanced representation of various interests and are asked to issue technical specification "in such a manner as to allow competition within the framework of the envisaged technical solution."[118] While asserting that "market operators are responsible for the output and quality of standardization," the Commission emphasizes that European standards organizations recognized by law, such as ETSI, CEN and CENELEC, "have a role of maintaining a cohesive system of European standards."[119] Again, institutional structures are to fuse the public interest in interoperability and cohesion with private sector leadership and competition.

IV. Prospects for Replication

In beginning the task of assessing the likelihood of successful replication of the policy process that made GSM so successful in related ICT domains, the important distinction between *product* standard and *network* standard has to be recalled. The development of the GSM network since its commercial launch in 1992 supports Metcalfe's assertion of n connected machines creating n^2 potential value. While the network configuration, particularly after the upgrade to Phase 2 in 1995, has made data services such as fax, SMS and e-mail technically feasible, the specifics of recent value-added service innovations on GSM networks could not have been predicted in the 1980s when the

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[117] CEC, *Standardization and the Global Information Society*, p. 6, *emphasis added.*

[118] CEC, *Standardization and the Global Information Society*, p. 4. Recent examples of consortia that fall into this category are the Digital Audio-Visual Council (DAVIC), the European Committee for Banking Standards (ECBS) and the European Computer Manufacturers Association (ECMA). For a more extensive list and additional information, see European Commission, *Information Society Initiative for Standardization* (Brussels: CEC DGIII, June 1999).

[119] CEC, *Standardization and the Global Information Society*, p. 5. CEN, the European Committee for Standardization, and CENELEC, the European Committee for Electrotechnical Standardization, are standardization bodies similar to the pre-ETSI CEPT. Work in CEN/CENELEC is still largely organized around national delegations. For a brief discussion of CEN/CENELEC and an institutional comparison with ETSI, see Besen, pp. 523-524.

project was launched or even in the early 1990s when basic service became available. The key to the development of these services is technical feasibility and, above all, sufficient potential value in the network to justify large investments by manufacturers, basic service providers and, most importantly, third parties seeking to establish themselves in the area of value-added services. The number of users thus becomes the key determinant for a network's innovation potential. While the American laissez-faire approach to standardization and the resulting multitude of analog and digital standards created a competitive environment that put pressure on prices early on and led to a rate of diffusion initially higher than Europe's, following the logic of Metcalfe's Law, the American wireless market is inherently limited in its application potential as a result of incompatibility of networks and market fragmentation. Not surprisingly, data services are only slowly emerging on US markets and many European states have passed the US in wireless network penetration.[120]

Europe has not acquired a dominant role in the field of mobile communications because the technology underlying its GSM standard is objectively superior to that of any competitor. In fact, many observers argue that Code Division Multiple Access (CDMA) technology, developed by Qualcomm of the US and currently the second most successful wireless technology in terms of global market share, is technically more advanced than the type of TDMA employed in GSM. Rather, the main reason for the project's dramatic success lies in GSM's large network value potential resulting from it being the only network in an unfragmented market.

With respect to third generation (3G) wireless technology, the European Commission's concept of a mutually beneficial division of labor between the public sector and private-sector-led consortia in creating technical standards for the digital age appears to work again. Led by European equipment manufacturers, ETSI's working groups have advanced a pan-European proposal for a broadband digital wireless communications standard. The standard proposal, officially referred to as Universal Mobile Telecommunications Standard (UMTS), has already received endorsement by the European Union as the Council and Parliament have recently passed a decision on its coordinated introduction in the Community by 1 January 2002.[121] While being closely related to and backward compatible with GSM, UMTS will employ a wide-band Code Division Multiple Access (W-CDMA)

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[120] Judith Berck, "Interview with Charles Healy, Chairman of the North American Interest Group of the Europe-based GSM Association," *PCS Data Today*, 10 February 1999, and "Number of European Mobile Subscribers Rises by 66%," *Total Telecom*, 10 June 1999.

[121] Council of Ministers, *Decision of the European Parliament and of the Council of 14 December 1998 on the coordinated introduction of a third-generation mobile and wireless communications system (UMTS) in the Community* 128/1999/EC (Brussels: COM, 14 December, 1998). See also Roger Tuckett, "Perspective: There's more to 3G than a choice of technology," *Communications Week International*, 23 November 1998.

technology instead of TDMA.[122] Due to a data transfer rate much higher than GSM, UMTS will allow for fast and thus affordable wireless access to the Internet with dramatic new opportunities for advanced network architecture, services and applications. On the basis of a broadband standard such as UMTS, for example, wireless is likely to become a serious alternative to the personal computer in terms of Internet access.[123]

The same coalition of equipment manufacturers, network operators, telecommunications administrations and supranational institutions that paved the way for GSM has lent its support to UMTS. Contrary to GSM, however, efforts are led primarily by manufacturers and private operators with supranational institutions focusing on the provision of fora for cooperative exchange and, as appropriate and desired, legal backing. As a result of continued cooperation, the Europeans have jointly advocated the adoption of UMTS as the basis of the International Telecommunications Union's (ITU) IMT-2000 standard, a global standard that would make intercontinental roaming a reality.[124] At the ITU's March 1999 meeting in Brazil, Europe's W-CDMA-based UMTS proposal competed with CDMA2000, supported by a coalition led by Qualcomm of the US, and a further developed version of TDMA endorsed by the Universal Wireless Communication Consortium (UWCC).[125] As participants failed to reach a compromise on IMT-2000, it appeared that current network incompatibility would be carried over into third generation technology. Three months later, however, the Operators Harmonization Group (OHG) succeeded in securing a compromise between the competing camps. Rather than adopting a single standard for IMT-2000, a coalition of operators and manufacturers proposed to base 3G equipment on an umbrella standard with three nodes for the three alternative technologies. 3G handsets should thus be able to function in any network employing one of the node standards.[126]

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[122] European manufacturers' choice of W-CDMA as the access technology underlying third generation wireless in the form of UMTS was at the heart of a major industry conflict between Qualcomm of the US and Ericsson of Sweden as Qualcomm owns the patents to second generation narrow-band CDMA technology. The two manufacturers settled their dispute, dropped lawsuits against each other and agreed to cross-license their respective patent portfolios in March 1999. In addition, Ericsson agreed to buy Qualcomm's previously unprofitable manufacturing units. See Alan Cane, "Deal on third generation mobile phone standards boosts European prospects," *Financial Times*, 30 March, 1999, p. 8.

[123] See, for example, Alan Cane, "Epicentre of earthquake has shifted to Europe," *Financial Times*, 15 March 2000, p. 13, and Peter H. Lewis, "Wireless Valhalla: Hints of the Cellular Future," *The New York Times*, 13 July 2000, p. D1.

[124] Jeremy Scott-Joynt, "ETSI Pulls Off 3G Deal And Wins Asian Support," *Total Telecom*, 29 January 1998.

[125] Vanessa Clark, "ITU Gives Up on Single 3G Standard," *Total Telecom*, 22 March 1999. In addition to ETSI and the manufacturers, operators and others it represents, the European UMTS proposal was also supported by Japan's NTT and more than twenty Japanese operators that NTT had lined up. See Jeremy Scott-Joynt, "Japan Joins GSM Association to Push W-CDMA," *Total Telecom*, 5 May 1998.

[126] Vanessa Clark, "Operators Propose 3G Compromise," *Total Telecom*, 7 June 1999.

While a thorough explanation of the agreement on IMT-2000 is not attempted at this point, two relevant aspects of the 3G story must be pointed out. First, the tremendous potential value of a large 3G network according to Metcalfe's Law appears to have driven the Europeans and Americans to a compromise in the matter. Peter Martin of the *Financial Times* argues that "the growth of the network age" has made interoperability immensely important and that consequently, for the first time, the US is willing to cooperate in the area of IT standards.[127] Secondly, the need for the US to seek an agreement with the European-led UMTS camp results primarily from the strength of that alliance, which, in turn, flows from the dramatic success of GSM and the unity of European stakeholders in supporting UMTS. The high degree of unity among European manufacturers, operators and national governments in supporting UMTS, however, was only achieved in ETSI's Technical Assembly when Nokia and Ericsson, backed by several large European operators, reached a compromise with an alliance consisting of Siemens, Nortel, Alcatel, Bosch Telecom, Itatel, Motorola and Sony Europe on the question of whether to base UMTS on W-CDMA or TD-CDMA technology.[128] Both sources of European strength in the international 3G negotiations, the success of GSM and the high degree of unity among European stakeholder in the question of UMTS, are therefore are at least in part due to the institutional structures and policy processes put in place by the European Commission in the 1980s.

While a rough first look at UMTS suggests that the policy process enabling GSM can be replicated in an effort to further expand Europe's role in global ICT standardization with the benefits for industry and consumers that the Commission has envisioned, there is reason to be skeptical. UMTS was launched out of GSM deliberations at ETSI in 1991 and the astonishing success of GSM certainly fueled efforts to look beyond second generation wireless and jointly invest in third generation technology. Furthermore, institutional stickiness and lower transaction costs played a role in ETSI retaining the role as the main forum for manufacturers and operators in the development of UMTS. According to one observer, however, the most important 3G decisions were taken and continue to be made outside of ETSI.[129] Increasingly, ETSI's role is limited to up-or-down votes on proposals drafted by coalitions of key industry players. When more convenient, industry players have created additional fora better suited for specific standardization tasks. Nokia, Ericsson, Motorola and Unwired Planet, for example, have founded the WAP Forum in order to develop an industry-wide standard for a Wireless Access Protocol (WAP), a format for the delivery of Internet content to

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[127] Martin, p. 18.
[128] See Scott-Joynt, "ETSI Pulls Off 3G Deal And Wins Asian Support," *Total Telecom*, 29 January 1998.
[129] Interview with Leo Koolen, European Commission, Brussels, 22 June 1999.

mobile phones.[130] Business alliances and interest groups have assumed the role of driver and catalyst that the Commission played in the development of GSM. With respect to 3G, the Commission's ability to shape future European markets seems to be limited to efforts to "harmonise the allocation of frequencies, conditions and procedures for the award of UMTS licenses in Europe by 1 January 2000"[131] and to ensure that member states build at least one UMTS system to enable EU-wide 3G roaming. Nevertheless, the cooperative impetus as well as the formal and informal structures enabling a high degree of collaboration in Europe's mobile communications industry stem – to a considerable extent – from previous initiatives by the European Commission.

Given that UMTS is in many respects a continuation of the GSM process with corporate actors having assumed some of the roles previously played by the public sector, the question whether Europe's success in wireless technology resulted from a particularly favorable industrial and political constellation or whether it is the result of a robust and replicable ICT standardization process remains. The Commission will certainly continue to pursue Europe-wide ICT standards as interconnectivity and interoperability is not only seen as in the public interest but also a requirement for the Single Market. However, the landscape of Europe's ICT industry has changed considerably since the mid-1980s and several of these changes profoundly affect the prospects of international cooperation á la GSM. First and foremost, the liberalization and integration of Europe's telecom markets has deprived official European standards of their "guaranteed market." As an increasing number of public networks are privatized, the size of the market that has to adopt ETSI standards as a result of the public procurement requirement shrinks. In 1991, when ETSI published Phase 1 of the GSM requirements, at least one large mobile communications operator in every EU member state with the exception of the UK was public and thus required by law to use GSM in its procurement. With full competition in Europe's markets for voice telephony introduced in 1998, all but three member states are currently exempt from using ETSI standards in their fixed telephony networks and all but Luxembourg are exempt from using official European standards in the construction of wireless networks.[132]

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[130] See Bob Emmerson, "Why WAP is a winner," *Communications Week International*, 1 June 1999, and Vanessa Clark, "Microsoft Set for Rocky WAP Forum Membership," *Total Telecom*, 7 May 1999.
[131] Robert Verrue, Director General of DG XIII, "Future Key Issues from the European Point of View," speech given at the Third Forum of the *Verband Alternativer Telekom-Netzbetreiber (VAT)*, Vienna, 27 January 1999, available at http://www.europa.eu.int/comm/dg13/telecomlib.htm.
[132] See Commission of the European Communities, *Communication from the Commission pursuant Article 8 of Directive 93/38/EEC* 1999/C 156/03 (Brussels: CEC, 3 June 1999).

Liberalization has not only led to the virtual disappearance of the requirement to use official European standards in telecom procurement, it has also dramatically increased the number of corporate players in the industry. The number of authorized operators in the EU, for example, increased from 100 at the end of 1997 to almost 300 in early 1999.[133] Apart from making the coordinated introduction of pan-European standards more difficult, liberalization also affects states' calculation of *juste retour*. As stated above, the presence of national telecom monopolies ensured that national governments could affect the construction of networks in their jurisdiction through public procurement decisions in a way that was beneficial to their domestic manufacturers. A fully integrated and liberalized European market for telecom equipment and services, however, means that national governments no longer have this ability. Consequently, the problem of *juste retour* on cooperation investments could increase and lower the probability of successful international cooperation in this domain. Ironically, the very rationale of market liberalization and integration that legitimized Commission involvement in the area of mobile communications now lowers the probability of future successful pan-European cooperation à la GSM.

Furthermore, the large potential value built into the GSM network following the logic of Metcalfe's Law ensured sufficient investment returns to all cooperating states regardless of the distribution of gains from the exploitation of economies of scale in equipment markets. These large, more-or-less uniformly distributed potential gains from cooperation, however, cannot be expected when it comes to product standardization where potential gains are primarily located in product markets and small competitive advantages between companies determine winners and losers. Consequently, we should expect the problem of *juste retour* to be more severe when it comes to cooperating in order to establish a product standard. Complicating the matter further, product life cycles are even shorter than network life cycles, thereby making the generally faster market-led standardization or de-facto standardization process more attractive than a slower negotiated process.

Given the importance of telecom monopolies and the logic of network economics for the solution of the problem of *juste retour*, it appears as if GSM was in fact "the right system at the right place at the right time," as one observer has argued.[134] While chances for exact replication of the standardization process enabling GSM are slim or even non-existent, GSM is an important precedent and the lessons learned from the project's success have fueled efforts in related domains. Having realized the value of Memoranda of Understanding (MoU) for industry governance in the case of GSM, the Commission pursues the conclusion of similar agreements in a variety of issues arising

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[133] Verrue, "Future key issues from the European point of view."
[134] Interview with Leo Koolen, European Commission, Brussels, 22 June 1999.

from electronic commerce and the growth of the information society.[135] Formal institutions such as ETSI are just as important in facilitating intra-industry cooperation of this kind as informal fora, consortia and workshop series, whether initiated by the Commission or not.[136]

Conclusion

Particularly with the arrival of 3G high-bandwidth mobile communication technology in the not too distant future, wireless will become a serious contender for Internet access and the leader in wireless technology will significantly affect the evolution of digital networks, both with regard to infrastructure and applications. The establishment of GSM as a pan-European standard for digital mobile communications has been pivotal for Europe's global success in the field of wireless technology and has given European companies an advantage vis-à-vis American and Japanese industry competitors. The analysis has shown that the dramatic success of GSM and the accompanying benefits to European manufacturers and consumers are in large part due to intelligent public policy initiatives in the area of technology standardization – intelligent in the sense that they were well suited for the nature of the technology at hand and the industrial reality of the time. While Community policy and Commission leadership in particular are indispensable for an explanation of the origins of a pan-European standard for mobile communications, however, an explanation resting only on the Commission as a political catalyst and provider of favorable institutional structures would be incomplete.

Adaptation on the national level is an important prerequisite for international cooperation of the extent witnessed in the case of GSM. There are many examples of failed cooperation in Europe despite extraordinary political leadership on behalf of supranational actors in Brussels. Among the more recent is the case of advanced television standards and the failure to reach a pan-European strategy on High Definition Television (HDTV).[137] Alongside efforts to push the development of GSM, European Commission officials attempted to foster the development of a European HDTV standard.[138] While the case of HDTV is too complex to be analyzed in detail at this point, there are several important differences between the European HDTV and GSM projects that hint at why GSM succeeded and Europe's HDTV failed. For once, Europe's publicly sanctioned and financed HDTV project was a response to Japanese attempts to elevate its technology to the level of "world standard."

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[135] See, for example, CEC, *Information Society Initiative for Standardization*, p. 5.
[136] Interview with Bror Salmelin, European Commission, Brussels, 25 June 1999.
[137] See Alan Cawson, "High-Definition Television in Europe," *The Political Quarterly* V66:N2, April-June 1995, pp. 157-173, and Ruottu, ch. 5.
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Whereas Europe's HDTV initiative was thus defensive in orientation[139], its efforts in second generation wireless technology were the result of a shared "internal" problem, frequency scarcity and exorbitant R&D costs for next generation technology. Secondly, contrary to GSM, Europe's proposed HDTV standard, HD-MAC, was always intended to be a proprietary standard to maximize the European manufacturers' ability to extract rents and royalties from technology export. The preference for a proprietary system also suggests that the largest returns were expected in the area of HDTV equipment, not in services as was the case with GSM. Thirdly, at its time, GSM was the only notable cooperative project in the area of second generation wireless technology. There were simply no alternative cooperative projects manufacturers interested in digital wireless technology could have participated in. In the case of HDTV, several of Europe's leading firms, Philips and Thomson most notably, participated in the Commission-sponsored EU 95 consortium as well as efforts in the U.S. and elsewhere to establish HDTV standards despite technological and political irreconcilability of the various projects.[140]

Whether the differences in the character of the collective good, a proprietary product standard (HDTV) as compared to an open network standard (GSM), and the situational environment, defensive standardization with several alternative development projects in the same industry (HDTV) as compared to standardization in an almost entirely uncharted technological field (GSM), account for the different outcomes in the cases of HDTV and GSM or whether the lack of prior government adaptation[141] and insufficient customer demand for HDTV[142] or any combination of these factors led to the failure of HDTV in Europe cannot be determined at this point. Clear is that as a result of governments' inability to commit to a multilateral solution, the Commission withdrew its support and left the task of finding a standard for HDTV to the American Federal Communication Commission (FCC).[143] While the cases of GSM and HDTV differ in many respects, the brief example demonstrates that Commission leadership alone is insufficient to facilitate cooperation á la GSM.

In addition to strong national demand for a multilateral solution and international political leadership, this study has maintained that assurance of sufficient returns on investments is a prerequisite for international cooperation. Network economics combined with the presence of national telecom monopolies and the expected technological superiority of GSM provided such sufficient assurance. Tremendous potential value was located in the network itself and national

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[139] Cawson (1996), p. 154
[140] Cawson
[141] Cawson, pp. 157-158.
[142] Ruottu, ch. 5.
[143] Cawson, p. 157.

monopolies for telecom regulation and operation ensured that no cooperating state could be deprived of its ability to benefit from economies of network in addition to the potential gains from economies of scale in equipment manufacturing markets. With respect to the latter, the basket standard solution prevented vastly unequal *retour* in equipment markets.

The initial interstate bargain can be explained in a relatively straightforward way once the character of the strategic interaction is identified as resembling a multiple equilibrium Battle-of-the-Sexes far more closely than the non-cooperative Prisoner's Dilemma situation. The European Commission supplied a focal point for cooperation and the interaction of the logic of network economics, the character of Europe's telecommunications landscape at the time and the modular, non-proprietary nature of the collective good ensured *juste retour* for each player. The interstate bargain can thus be comprehended fairly easily with standard analytic tools of International Relations. Once the initial bargain was struck and the Memorandum of Understanding was signed, however, institutional arrangements and collaboration of state, supra-state and non-state actors became more important than the problems inherent to international cooperation. Moving from second generation GSM to third generation UMTS was mostly a continuation of the post-MoU GSM deliberations assessed in Part II of this study, albeit featuring increased influence and importance of corporate actors. As corporate actors increasingly dominate Europe's ICT landscape and as the reaches of corporate actors no more coincide with national boundaries, formal international cooperation as seen in the case of GSM and assessed in Part I of this study will be less important. Consequently, standard International Relations tools are likely to be less useful in explaining when cooperation fails and when it has a chance to succeed. Instead, frameworks for intra-industry cooperation and private-public-sector collaboration will have to be applied to analyze future concerted European efforts to shape digital markets to Europe's advantage.

While the case of GSM has set a precedent for strategic standard setting in Europe in a digital age, there is reason to be skeptical about the probability of replication in related domains. With respect to network standards, the increasing liberalization and integration of European telecom markets could ironically lower the probability of replication by eliminating public procurement requirements as a means to provide a guaranteed market for ETSI standards. With respect to Internet technologies and electronic commerce applications in particular, the extremely short life cycles of technologies as a result of the rapid speed of innovation could leave the market-led approach as the default standardization mode. In addition, product standardization should be expected to be characterized by more serious concern for *juste retour* than network standardization.

Although it is questionable whether the Europeans will be able to replicate the success of GSM in related domains, it is certain that the creation and implementation of GSM has increased and

further legitimized the Commission's role in the field of ICT policy. After all, GSM has propelled the European Union into a position where its views on the digital future have to be heard and taken seriously in Washington D.C., Redmond, Silicon Valley and elsewhere. In Europe, with GSM, precedents have been set, channels of communication and influence have been built and technical expertise in Brussels has grown. Europe's network of private and public ICT stakeholders has tightened and widened. Shaping digital markets in a manner most beneficial to European consumers and businesses requires a variety of regulatory and self-regulatory approaches. The policy process that enabled GSM is unlikely to become the standard policy tool for enhancing Europe's interests in a digital world, probably not even in the much narrower field of network standardization, as it was the right tool for a particular industrial and political constellation in the 1980s. To expect fewer European Commission ICT policy initiatives in the future in light of the dramatic changes in technology and industry would be a mistake though. Who is to say that the Commission cannot craft policies and institutional arrangements that will cope with new obstacles to a pro-active public sector? Europe's success in mobile communications will certainly be an inspiration to attempt just that.