

**Policy Development for  
Cellular Telephone Service  
in the United States and  
the United Kingdom**

**Christopher W. Mines**

***Program on Information Resources Policy***

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**Policy Development for Cellular Telephone Service in the United States  
and the United Kingdom**

Christopher W. Mines  
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## Executive Summary

- Development of cellular mobile telecommunications in the U.S. and the U.K. took place in very different policy environments, rooted in the relationship between business and government institutions of each country. Different styles of policymaking and industry regulation had profound impacts on the establishment and early growth of cellular, in particular on the length of time and amount of regulatory procedure needed to launch commercial mobile telephone service. The U.S. had about thirty-five years of regulatory and industry conflict before cellular telephone operators were licensed and began operations in 1983. In the U.K., only about five years elapsed between the first government report on cellular and the beginning of commercial operations in 1985.
- In the U.S., the participatory, adversarial style of regulation of industry was the principal reason for the lengthy gestation of cellular service. The interests of industry stakeholders ranging from broadcasters to radio carriers to telephone companies, all under the purview of the FCC's public service mandate, collided in a series of regulatory proceedings and court challenges. These conflicts were exacerbated by sweeping changes in structure and regulation of the telecommunications industry during the 1960s and 1970s.
- In the U.K., by contrast, regulatory style emphasized participation and cooperation by industry stakeholders, who made up the working committees that investigated cellular policy issues. The U.K. also had the advantage of the U.S. example; technology and policy risks were lower in 1980, when the U.K. began its cellular deliberations, than in 1950, when the U.S. started. The U.K. was able to speed up establishment of cellular by following policy choices made earlier, and after much debate, in the U.S.
- Regulated duopolies for cellular service were crafted in both countries, a policy compromise between the network and spectrum efficiencies of a monopoly and the benefits of price competition and service innovation in an open-entry market. This industry structure has only partially delivered the supposed benefits of competition to the market and has failed to relieve regulators of their oversight responsibilities.
- Mobile telecommunication is being reinvented in the 1990s with new, digital technologies. A variety of new system architectures, developed since standards for cellular were frozen in about 1970, are vying to become a supplement and eventually replacement for existing mobile telephony, and perhaps for traditional land-line telephone systems as well. Policymakers face similar issues of spectrum allocation, supplier licensing, and industry structure as they did during the original cellular debates in the 1970s, but in different technological, industry, and political contexts. Decisions made during the original establishment of the cellular industry offer examples of both good and bad policy choices that may be useful for regulators revisiting these issues.
- Next-generation cellular systems are being implemented more rapidly in the U.K. (and throughout Europe) than in the U.S. This shift in leadership roles, rather than a cause for alarm, may offer U.S. policy and industry decision makers useful examples of opportunities and pitfalls in implementing new mobile telecommunications technologies.



## Preface

This paper presents a comparative analysis of the development of cellular mobile communications as viewed through the lens of relationships between businesses and national governments. It attempts to characterize the impact of different policymaking styles in the United States and the United Kingdom on the evolution of cellular telephony and the possible lessons for industry and regulators again delving into issues of spectrum availability, licensing, and industry structure as new technologies reinvent mobile telecommunications in the 1990s.

Chapter One is a brief introduction to the historical relationships between business and government institutions in the U.S. and U.K., a necessary background for the discussion in Chapter Two of different styles regulation in the telecommunications industry. Together, these chapters argue that industry stakeholders, suppliers, regulators, and customers spend more time and energy implementing policy decisions through the open, adversarial regulatory process used in the U.S. than they do following the more closed and cooperative style of the U.K. Chapters Three and Four examine this contrast in detail, tracing the origins of policy and regulation concerning cellular mobile communications systems.

As the importance of mobile telecommunications increases in the 1990s, policymakers face issues similar to those encountered during the initial creation of the industry, but in different industry and political contexts. Chapter Five outlines lessons from the development of past cellular policies, even though changed conditions limit the usefulness of history for present and future policy decisions. It also examines the possible consequences of a shift in roles of the U.S. and U.K., with the British (and the European Community generally) now taking the lead in policymaking and implementation of next-generation mobile communications systems.



## CHAPTER ONE

### INTRODUCTION: BUSINESS AND GOVERNMENT RELATIONSHIPS

#### 1.1 The Historical Context

The structure and pace of a nation's economic activity strongly depend on the nature of relationships between business and government institutions. Much of the history of governmental affairs can be seen through the lens of major economic initiatives: tariffs and trade, natural resource development, protection of consumer welfare, environmental legislation. This section examines the historical and comparative dimension of the relationships between business and government in the United States and the United Kingdom, as a precursor to closer study of the impacts of those relationships on the development of the cellular mobile telephone industry.

The United States has a long history of government involvement in developing new industrial or technological infrastructure. "Government played a major role in most of the great innovative thrusts which drove American growth in the nineteenth and twentieth centuries,"<sup>1</sup> including virtually all large-scale technological enterprises in the U.S. over the last 200 years: canal systems, railroads, telegraph, mineral resources, automobile and airplane, highway construction, health care, and agricultural technologies. Paradoxically, however, the political and ideological climate in the U.S. has often resisted government intervention in private and commercial affairs, especially when done in a systematic fashion. Since the nation's founding, the business and government institutions of the U. S. have been adversaries, not only in the commercial sector but also in the judicial and political systems. This adversarial relationship has often limited the scope and effectiveness of economic intervention by the government. "A legitimate role for public authority and its notion of a partnership between 'big business' and 'big government' never really took root in American business culture;

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<sup>1</sup>Harvey Brooks, "Towards an Efficient Public Technology Policy," in *Emerging Technologies: Consequences for Economic Growth, Structural Change, and Employment*, Herbert Giersch, ed., (Tubingen: JCB Mohr, 1982), p. 330.

## 2 Cellular Policy in the U.S. and U.K.

American executives remained both extremely jealous of their autonomy and highly mistrustful of public authority.<sup>2</sup>

In Europe generally and Britain in particular, the historical situation was different. In the 18th and 19th centuries a rising merchant class enlisted emerging democratic governments in breaking up the feudal system, with its restrictive class privileges, royal charters, and the like. Unlike the U.S., the European merchant class was willingly ceded some measure of individual autonomy to government institutions, and therefore government's role in business affairs was viewed as both natural and positive. "Government bureaucracies charged with mobilizing resources and directing trade were firmly established within Germany, France and Italy by the 1870s, and in Japan by the 1890s."<sup>3</sup> In the U.K., an expert and highly respected civil service developed, business leaders were generally willing to defer to the authority of government, and the public was not overly suspicious of the motives of either business or government. "Together these three elements make possible a high degree of cooperation and trust between industry and government."<sup>4</sup>

In America during the heyday of capitalistic growth in the second half of the 19th century, businessmen were committed to profit maximization, company growth, and industry expansion; the government was viewed as a constraining influence, especially with the coming of antitrust, consumer protection, and workers' rights legislation between the 1890s and the 1920s. In Britain during that time, business leaders sought to gain social acceptability, economic stability, and movement into the upper class. Cooperation with government, in both institutional and personal settings, was a key to fulfilling these ambitions.

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<sup>2</sup> David Vogel, *National Styles of Regulation: Environmental Policy in Great Britain and the United States* (Ithaca: Cornell University Press, 1986), p. 245.

<sup>3</sup> Robert Reich, *The Work of Nations* (New York: Knopf, 1991), p. 35.

<sup>4</sup> Vogel, *National Styles*, p. 26.

## 1.2 Regulatory Styles

Significant differences developed in the regulatory style of the U.S. and the U.K., most strikingly in the adversarial and pluralistic nature of the U.S. system of industry regulation. Right from the beginning of a regulatory proceeding, rival stakeholders advocate their positions at the expense of other interests. Regulatory bodies require submission of evidence and hold hearings to acquire a broad set of viewpoints from the parties to a particular issue. U.S. regulators leave behind an enormous, public paper trail, which can be examined in mind-numbing detail even though how much of the total deliberation it represents remains an open question. Much may be left off the record, as various *ex parte* and external influences weigh on the decisions of policymakers. Chapter 3 notes the impact of changes of administration (in 1980, especially), Congressional influence through budgets and appropriations, and other factors beyond the voluminous commentary that the regulators and courts put on the record.

U.S. regulatory agencies produce comprehensive command-and-control regulations, specifying not only goals for the industry under scrutiny but detailed means of achieving them. In the telecommunications industry as in many other sectors, this approach often has the predictable result of exacerbating tensions between government regulators and the industry under scrutiny. "In part, this [adversarial relation] is because the regulator must lead the industry to perform in a way different from that dictated by the incentives of the unregulated market.... The procedural context and use of lawyers further encourages the framing of issues in an adversary manner."<sup>5</sup>

After a regulatory decision is reached through the time-consuming inquiry, order, reconsideration process, the U.S. courts often umpire further disputes between rival interests. For the government agency, developing and promulgating regulations can be viewed as building a defensible record of impartial inquiry, since the decision will almost surely be challenged in court. There is a considerable degree of irony in this outcome: the ultimate instrument of the self-assertive, adversarial U.S. regulatory system is the

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<sup>5</sup> Stephen Breyer, *Regulation and Its Reform* (Cambridge, Mass.: Harvard University Press, 1982), p. 7.

#### 4 *Cellular Policy in the U.S. and U.K.*

courts, where two rival parties cede their power of self-determination to a third party, the judge, who makes the ultimate decision.

In Britain, the regulatory story is different, reflecting the different origin of the relationship between business and government. The British emphasize integral participation by industry representatives, who are part of the advisory committees that work on specific regulatory issues. Early input, negotiation, and cooperation by industry in formulating regulations is coupled with voluntary compliance once the regulations are finalized, thereby eliminating much of the mutual suspicion and political overtones that are by-products of the adversarial system in the U.S.

Unfortunately for the researcher, the regulatory paper trail in the U.K. is much less visible. Working groups and advisory committees work behind the scenes, after which government pronouncements are handed down. Little public participation and no court review results in a relatively skimpy procedural record.

In sum, two countries that would seem to have much in common have developed very different relationships between business and government institutions, and thus different styles of regulation. U.S. regulators seek to influence directly the operational methods, technology choices, and financial results of regulated industries through complex command-and-control regulations. The U.K. has a more cooperative, less legalistic regulatory environment that takes advantage of a friendlier atmosphere between business and government, and emphasizes industry participation in the development of regulations.

American regulatory policy has been more ambitious, but as a result it has produced greater resistance from business. British regulatory authorities demand less, but because their demands are perceived as reasonable, industry is more likely to comply with them. On the whole, British regulation is relatively informal and flexible while American regulation tends to be more formal and rule-oriented. Britain makes extensive use of self-regulation and encourages close cooperation between governmental officials and representatives of industry. The United States does little of the former and has generally been suspicious of the latter.<sup>6</sup>



The impact these differences had on the establishment and development of the cellular mobile telephone industry is the focus of this study. A technology that was first conceived in the 1940s, and for which substantial demand was evident virtually from the outset, was not offered commercially until the 1980s. The reasons for this delay have a little to do with technology, and a lot to do with regulation. As slightly overstated by one observer, "...from its invention to its first public offering, virtually every important decision about cellular [in the U.S.] was made not by businessmen and customers, but by lawyers."<sup>7</sup>

Cellular service at the beginning of the 1990s is viewed as not only viable but perhaps irresistible competition for the last bastion of monopoly in the telephone industry – local exchange service. Cellular is shifting from a potential to a real substitute for traditional telephony, and thereby becoming another check on the monopoly power of the local telephone companies.<sup>8</sup> By comparing the policy choices and regulatory processes that established cellular service in the U.S. (1945-85) and in the U.K. (1980-85), we can uncover valuable lessons about the role future policy decisions will have on the role of cellular in the telecommunications industry.

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<sup>6</sup> Vogel, *National Styles*, pp. 23-24.

<sup>7</sup> John W. Berresford, "The Impact of Law and Regulation on Technology: The Case History of Cellular Radio," *The Business Lawyer* 44:3, May, 1989, p. 721.

<sup>8</sup> "As science makes it possible to create substitutes for more and more products, the combination of these two protection mechanisms – the threat of substitution and its actual occurrence – provide an important check on the social losses attributable to monopoly power." F.M. Scherer and D. Ross, *Industrial Market Structure and Economic Performance*, 3rd ed. (Boston: Houghton Mifflin, 1990), p. 356.



## CHAPTER TWO

### TELECOMMUNICATIONS POLICY AND REGULATION

#### 2.1 Overview of the U.S. Regulatory Process

##### 2.1.1 The FCC's Charter

The telecommunications industry in the United States has been regulated by the Federal Communications Commission (FCC) since its creation by the 1934 Communications Act, as it was previously by the FCC's predecessors, the Interstate Commerce Commission and the Radio Commission. Among the many economic rationales for government regulation of industry, the ones most applicable to the telecommunications industry are control of output and price levels by suppliers with significant economies of scale. Unrestrained, suppliers in businesses that require large fixed investments (such as telephone networks) can become natural monopolists, restricting their output and raising prices in ways that are both economically inefficient and socially undesirable.<sup>9</sup> The FCC was chartered in the Communications Act to prevent such abuses by telecommunications companies through two complementary activities: maintaining efficient (i.e., single-supplier) market structures by restricting competitive entry, and preventing monopolistic pricing practices by regulating the price structures of suppliers. The efficacy of governmental regulation to achieve these goals, especially in light of the administrative and competitive costs, has come under scrutiny over the last two decades,<sup>10</sup> but the FCC's regulatory mandate, and its basic processes for fulfilling that mandate, remain essentially intact.<sup>11</sup>

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<sup>9</sup>See W. K. Viscusi, John Vernon, and Joseph Harrington, *Economics of Regulation and Antitrust* (Lexington, Mass.: D.C. Heath, 1992), Ch. 10.

<sup>10</sup>See, for example, Mark Green and Ralph Nader, "Economic Regulation vs. Competition: Uncle Sam the Monopoly Man," *The Yale Law Journal* 82, April 1973, pp. 871-889.

<sup>11</sup>What *has* changed is the consensus about which segments of the telecommunications industry are natural monopolies. By the mid-1980s, local (or "exchange") telephone service was the last remaining market segment judged to have natural monopoly characteristics, and even there the FCC was allowing some competitive entry.

Under Title III of the Communications Act, the FCC is responsible for allocating electromagnetic spectrum frequencies and licensing commercial users of the spectrum.<sup>12</sup> To implement this part of its legislative mandate, the Commission has two formal processes at its disposal: rule-making (quasilegislative), and adjudication (quasijudicial). The FCC derives governmental legitimacy through its expertise in the arcane world of telecommunications law and technology. Observers have noted that its flexibility in implementing its legislative mandate is arguably more powerful than that of many other federal agencies. The Commission has often been granted "unusual deference" by federal courts reviewing its decisions, especially in attempts to fit a new technology into the existing regulatory scheme.<sup>13</sup>

The FCC apparently takes this powerful role seriously, and goes to great lengths to build an unimpeachable record of inquiry and discussion before making or changing rules. In particular, "public participation is important both as a normative value to maximize political accountability and, in a more pragmatic sense, for its informational value. Often the method by which a political decision is reached will be as important as its substantive content."<sup>14</sup> But some of the "public" is clearly much more interested in FCC proceedings than others. The primary stakeholders in FCC regulatory decisions are less the diffuse public interest than tightly concentrated commercial interests that are potential beneficiaries or losers. During the cellular proceedings considered in Chapter 3, "the commission heard a great deal more from Motorola and AT&T than it did from other interests."<sup>15</sup> Not until the late stages of the FCC's cellular proceedings, when the focus turned from spectrum allocation to assignment of frequencies to particular carriers,

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<sup>12</sup>Federal government spectrum users are authorized by the President, who has delegated this authority to the Commerce Department's National Telecommunications and Information Administration (NTIA). The NTIA thus shares responsibility with the FCC for overall radio spectrum management. In addition, other federal departments, especially State and Defense, have important roles in spectrum allocations. See National Telecommunications and Information Administration, *U.S. Spectrum Management Policy* (Washington, D.C.: NTIA, 1991), pp. 17-19.

<sup>13</sup>Mark Nadel, Robert E. Glanville, and Philip L. Bereano, "Land Mobile Communications and the Regulatory Process," in *Communications for a Mobile Society: An Assessment of New Technology*, Raymond Bowers, Alfred M. Lee, and Cary Hershey, eds. (Beverly Hills, Cal.: Sage Publications, 1978), p. 92. (Hereafter cited as *Mobile Society*.)

<sup>14</sup>*Ibid.*, p. 99.

<sup>15</sup>*Ibid.*, p. 100.

was the public interest represented (and then only indirectly) by the decision to license two competitive suppliers in each cellular service area.

### **2.1.2 Industry Structure**

Even before the establishment of the FCC, the telephone industry had settled into a comfortable near-monopoly, with AT&T and its subsidiary local companies controlling some 85 percent of the nation's telephones, and the independent (non-Bell System) companies the rest. After World War II, competitive elements crept into the periphery of the telephone network, in the customer premises equipment market, opened up by the FCC's Hush-a-Phone and Carterfone decisions in 1957 and 1968, respectively.<sup>16</sup> This breach in the industry's monopoly structure was widened by another series of decisions that gradually opened up the long-distance service market to competitive suppliers.

In resisting the spirit and implementation of these FCC actions, AT&T made itself vulnerable to antitrust allegations by the Department of Justice, which ultimately resulted in the 1984 divestiture of AT&T's local telephone companies from the parent company. This watershed event altered the structure of the industry on many levels; most important for this paper, AT&T's mobile telephone service subsidiary, Advanced Mobile Phone Systems (AMPS), was cut into seven pieces and aligned with the newly formed local Bell operating companies (BOCs).

The path to limited competition in the U.S. telephone industry provided an example for much of the rest of the world, which, for better or worse, began privatizing government-owned telephone monopolies (a step the U.S. did *not* have to take) as a precursor to introducing competition into some or all segments of their domestic telecommunications industries. The U.K. was the first to follow the U.S. along the path of mandating and nurturing competitive entries into telecommunications.

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<sup>16</sup>For a summary of the introduction of competition into U.S. telecommunications markets, see Carol L. Weinhaus and Anthony G. Oettinger, *Behind the Telephone Debates* (Norwood, N.J.: Ablex, 1988), Chapter 2.

## 2.2 The U.K. Regulatory Process

### 2.2.1 Historical Context

Historically, the British telecommunications industry was a pretty sleepy place. The British Post Office retarded development of telephony between World Wars, seeking to milk its investment in the telegraph network, and later stalled service upgrades to recoup investments in electro-mechanical switching gear. Until the 1960s, "lack of investment precluded the necessary technological upgrading, while lack of marketing kept usage rates low."<sup>17</sup>

The heavyweight combination of the Treasury, Defence, Foreign and Commonwealth and Home Offices interested in U.K. communications policy kept the planning role of the Post Office, and later the Department of Industry (DoI; now the Department of Trade and Industry, DTI) a minor one. "Until around 1980 Britain scarcely had a telecommunications policy. Decisions were made in the Post Office and were dominated by Treasury goals for managing the national economy and the pound sterling."<sup>18</sup> Network investment was tightly controlled by the Treasury, for example, and related to broad economic goals rather than to development of telecommunications service. Modernization thus proceeded at a snail's pace, and during the 1960s and 70s the penetration and quality of telephone service in the U.K. were far below American standards .

The British public was not represented in any regulatory proceedings, leaving the Post Office virtually free of restraint: "The balance between the costs of various services and tariffs were not matters of public debate.... And the government itself did not receive the information necessary from the Post Office to make decisions on trade-offs between investment strategies, quality of service, operating costs and prices."<sup>19</sup> The conflicting interests of the heavyweight government agencies, theoretically but ineffectively mediated by the Department of Industry, made for long delays and

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<sup>17</sup>Jill Hills, *Deregulating Telecoms* (Westport, Conn.: Quorum, 1986), p. 78.

<sup>18</sup>Michael Palmer and Jeremy Tunstall, *Liberating Communications* (Oxford: Blackwell, 1991), p. 263.

<sup>19</sup>Hills, *Deregulating*, p. 89.

uncertainty in formulating and implementing policy, especially in communications which cuts across so many fields. The DoI was often preoccupied during the 1970s by a dominant policy issue, such as the Leyland bailout, deregulation of financial services, or the British investment in the Airbus consortium.

### 2.2.2 The Coming of Liberalization

In the early 1980s, Britain attempted a policy and industry structure leapfrog from the Post Office era into competition U.S.-style, without the intervening stage(s) of regulated but private monopoly (which the U.S. took some 25 years to make into still-not-quite full-fledged competition). The longstanding criticism of British phone service, especially from the business and financial communities, coalesced with the 1979 election of the Conservative Thatcher government which wanted a smaller direct governmental role in industry. The policy rapidly evolved through two complex stages:

- **Liberalization.** The 1981 Telecommunications Act established British Telecom (BT) as a nationalized company, separate from the Post Office, began the sale of the government-owned overseas telecommunications company, Cable & Wireless, and licensed Mercury Communications as a prospective domestic competitor for BT.
- **Privatization.** The 1984 Telecommunications Act established BT as a privately held company via sale of 51 percent ownership to the public and founded the regulatory Office of Telecommunications (OFTEL) within the DoI.

A lack of expertise and manpower plagued the new U.K. telecommunications regulators. "By comparison with...the work in Washington of the OTA [Office of Technology Assessment], the FCC and the relevant Congressional subcommittees, the British documents in these areas tended to be narrowly focused and oblivious to surrounding policy issues."<sup>20</sup> While "many of OFTEL's responsibilities conflicted with each other,"<sup>21</sup> including ensuring provision of services to satisfy demand, and promoting

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<sup>20</sup>Palmer and Tunstall, *Liberating*, p. 305.

<sup>21</sup>Hills, *Deregulating*, p. 130.

the interests of both consumers and manufacturers, it therefore had a wide sweep of potential powers, also including attracting international investment to Britain and encouraging the export of telecom equipment from Britain. But this broad charter, which theoretically could have been used to energize the telecommunications industry, was weakened by the administrative structure. OFTEL only indirectly advised the Department of Trade and Industry; its direct power was simply licensing BT and Mercury, and even that was limited by a negotiated formula for setting prices. Recently, as discussed below, OFTEL has been moving towards greater independence and power.

The potential regulatory influence of the British Monopolies and Mergers Commission (MMC) is also more limited than antitrust law and practice in the U.S. in restricting the pricing behavior of a monopolist. The MMC operates without binding precedents, and thus "determines the public interest afresh, case by case."<sup>22</sup> This practice doesn't put much *a priori* restriction on potential monopolists, and often "leaves the policy agenda to be formulated by companies' takeover ambitions."<sup>23</sup>

Even after privatization of BT, the government remained interested in its operations and profitability. Through the 1980s, BT continued to have serious public relations and operational problems, culminating in a wave of consumer complaints during 1987 regarding lack of detailed billing, slow repair response, and confusing and rising tariffs. OFTEL was still unknown to the public, and in general was simply presiding over BT's actions. The aggressiveness of the government as a regulator was balanced by its role as shareholder of 49.8 percent of BT. In 1988, the government received the not insubstantial sum of £1.6 billion from BT, about 1 percent of total government receipts.<sup>24</sup>

Two examples from the DTI's White Paper of March 1991 on competition in telecommunications provide insight into the regulatory situation in the U.K. vis-a-vis the U.S.

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<sup>22</sup>Michael E. Beesley, "Regulation, Legislation and the 1984 Telecommunications Act," *Computer Law and Practice*, Nov./Dec. 1984, p. 38.

<sup>23</sup>Palmer and Tunstall, *Liberating*, p. 240.

<sup>24</sup>*Ibid.*, p. 279.



The government proposed that interconnection to BT's network by new competitors be handled by private negotiations between BT and the new carrier. In addition, equal access provision (to guarantee similar quality of service by new carriers) is required only as part of normal investments by BT; "Local operators will not be required to modernise exchanges purely for equal access."<sup>25</sup> In contrast to the voluminous technical specifications and investment timetable mandated for equal access by the U.S. court in the AT&T divestiture, which are now being superseded by the FCC's Open Network Architecture specifications, the British regulatory oversight is a soft touch indeed.<sup>26</sup>

The second example concerns the requirements for financial information disclosed to OFTEL's Director General. The White Paper debates the pros and cons of requiring disclosure, then concludes that "detailed audited statements giving financial results for individual services may be necessary in some circumstances. In the case of BT, such an obligation will be a proviso for allowing it greater pricing flexibility. BT's audit report will also need to deal with the methods of cost allocation used."<sup>27</sup> In light of the reporting requirements put on AT&T, this demand is child's play. Further, OFTEL decided that public disclosure of such information would not be required!

### 2.3 Convergence

This section has explored some of the differences in telecommunications regulation between the United States and Great Britain, especially during the turbulent early 1980s, the period when the cellular mobile industry was being established in both countries against the backdrop of sweeping changes in the entire telecommunications industry.

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<sup>25</sup>Department of Trade and Industry, *Competition and Choice: Telecommunications Policy for the 1990s* (London: HMSO, 1991), p. 74. (Hereafter cited as *Duopoly Review*, as this document has come to be known.)

<sup>26</sup>The court's directives on equal access, and the FCC's zealotry in implementing them, are summarized in Peter Huber, *The Geodesic Network* (Washington, D.C.: U.S. Department of Justice, 1987), Ch. 3.

<sup>27</sup>*Duopoly Review*, p. 46.

Since the 1965-1985 period, which forms the primary focus of this paper, there are some indications on both sides of the Atlantic that the differences in the two regulatory styles are lessening. "Ironically, just as there are some signs that the regulatory process is becoming more cooperative in the U.S., it is becoming more adversarial in much of Europe."<sup>28</sup> The U.K. is moving to emulate the American model more closely by becoming more aggressive and applying more resources towards direct regulation of industry, partly in response to continued public outcry over BT's profitability. The rapid growth of OFTEL's staff (now about 150), which lessens its dependence on industry expertise, is just one sign of the Americanization of the British regulatory process. The U.K. is increasingly under the purview of the European Community (EC), which has taken a prescriptive role in developing competition in European telecommunications markets, with mobile service as the test case (see Chapter 5). In the U.S., moves are underway towards earlier industry participation and binding negotiations to replace more traditional regulatory directives. To avoid setting standards or timetables that are unrealistic and therefore cannot be enforced effectively, American regulators are negotiating with affected parties, which then promise not to challenge the settlement in court.

Both countries are searching for ways to introduce more market-based behavior into the telecommunications industry as a substitution for more direct command-and-control techniques. The possibility of spectrum allocation and assignment through competitive bidding (see section 5.3.1), is being actively explored, for example.<sup>29</sup> Competition, of course, is the primary touchstone of such efforts, although the carefully crafted duopolies of both nations' cellular industries have not delivered the supposed benefits of competition to the market and have not only failed to relieve regulators of their oversight burden but may have increased that burden.

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<sup>28</sup>Vogel, *National Styles*, p. 26.

<sup>29</sup>Hugo Dixon, "Air Wave Auction to be Proposed by Trade Department," *Financial Times*, February 20, 1989.

## CHAPTER THREE

### DEVELOPMENT OF CELLULAR POLICY IN THE U.S.

The development of radio-based mobile telephony in the United States was plagued by a mismatch of technological capability and political will. AT&T first proposed high-capacity cellular technology for mobile telephone systems in 1947; the supposed readiness of such systems caused much hand-wringing over the next two decades by regulators and the courts. But cellular technology was probably not nearly ready to deliver on its promise until the early 1970s;<sup>30</sup> even then, policymaking and industry infighting delayed the commercial introduction of cellular until 1983. What appears at first glance to be a 35-year regulatory delay in the implementation of cellular mobile systems, caused primarily by the presumed spectrum requirements of broadcast television, is probably closer to a 10-year delay (1973 to 1983).<sup>31</sup>

The history of regulatory moves to establish the cellular industry is well documented in secondary sources, as well as the primary FCC and court submissions and reports. The following account concentrates on the how and why of various regulatory actions, rather than the what. This chapter examines the process by which the FCC made its decisions and the relative influence of several sets of stakeholders which coalesced over a couple of decades. Comparisons will be drawn from this base case in two directions: with the British experience in introducing cellular (Chapter 4), and with current battles over the policy framework for "re-inventing" the cellular industry, in both the U.S. and Britain, with new digital technologies (Chapter 5).

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<sup>30</sup>George Calhoun, *Digital Cellular Radio* (Boston: Artech House, 1988), p. 26. (Hereafter cited as *Digital Cellular*.)

<sup>31</sup>Jeffrey Rohlf, Charles Jackson, and Tracey Kelly, "Estimate of the Loss to the United States Caused by the FCC's Delay in Licensing Cellular Telecommunications" (Washington, D.C.: National Economic Research Associates, 1991), p. 1.

### 3.1 Decision Forums

Mobile communication provided by radio transmissions has been regulated by the federal government since the Radio Act of 1912. The Federal Radio Commission was established in 1927 and folded into the FCC on the latter's founding under the Communications Act of 1934. The FCC controls the allocation and assignment of radio spectrum for commercial telecommunications, broadcasting, and other uses. Its control is subject to appeal and court review, as well as the influence of other federal agencies including the Commerce, State, and Defense departments (see section 2.1.1). Both important FCC proceedings on cellular, *Land Mobile Radio Services* (Docket 18262, 1968-75) and *Cellular Communications Systems* (Docket 79-318, 1979-82), were upheld on court review, but the decision in the first case (*National Association of Regulatory Utility Commissioners [NARUC] v FCC*, 1976) was influential in shaping the FCC's subsequent policies.

Aside from the NARUC court decision, state regulators did not have a direct role in the establishment of cellular service, though telephone companies had always operated under state regulations that governed both the establishment of local telephone service (entry-level regulations), as well as ongoing rate regulation. "Because cellular service was a form of local telephone service offered to the public for pay, it was assumed at the beginning that the state regulatory commissions could, and would, subject cellular to their full powers."<sup>32</sup> Over a series of decisions, the FCC preempted virtually all state entry-level regulation in the cellular industry; by 1982, the FCC had prohibited state regulators from consideration of the number, capacity, or technical standards of cellular carriers in granting state certification for operation. States retain jurisdiction over cellular operators with respect to rates (prices), although many have opted for partial or full deregulation. Specifically, 24 states and the District of Columbia do not regulate cellular mobile services, while only 11 apply full rate regulation.<sup>33</sup>

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<sup>32</sup>Berresford, "Impact of Law and Regulation," p. 723.

<sup>33</sup>National Association of Regulatory Utility Commissioners, *Annual Report on Utility and Carrier Regulation* (Washington, D.C.: NARUC, 1991), p. 646.

### 3.2 Finding Spectrum Space for Mobile Communications

In 1949 the FCC's *General Mobile Radio* decision for the first time recognized Land Mobile Radio as a separate service category. The emphasis during this proceeding was on emergency two-way radio services, then just coming into general civilian use. A 1947 proposal by AT&T for a general-service cellular telephone system was given short shrift in the Mobile Radio proceeding, because the FCC saw other uses for the frequencies as more important than "those [telephone] services which are more in the nature of convenience or luxury."<sup>34</sup> The notion that mobile telephone service was an unwarranted luxury was a theme in the FCC's spectrum decisions over the next two decades, culminating in Commissioner Robert E. Lee's 1968 characterization of mobile telephony as "another status symbol--a telephone for each family car."<sup>35</sup>

#### 3.2.1 The Radio Common Carriers

The original frequency allocation to land mobile radio in 1949 was 4.7 percent of the spectrum considered useful for the service (i.e., between 25 and 890 MHz). The other allocations included broadcast television 59.2 percent, government 25.0 percent, shared 9.1 percent, and other 2.0 percent.<sup>36</sup> Significantly, the FCC decided at this early stage to assign half of the limited frequency space it did make available for mobile service to non-telephone company suppliers, the Radio Common Carriers (RCCs), which became the first fledgling competitors to the Bell System. Frequency allocations were so small that mobile telephone service could handle only 23 simultaneous conversations in a service area roughly 75 miles across, limiting subscriber capacity to approximately 250 users per city.<sup>37</sup> The mobile systems that grew out of the FCC's 1949 decision were at capacity by the mid-1950s.

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<sup>34</sup>*General Mobile Radio Service*, Docket 8976, 13 FCC 1190 (1949).

<sup>35</sup>*Land Mobile Radio Service, Notice of Inquiry*, Docket 18262, 14 FCC 2d 320 (1968).

<sup>36</sup>*Report of the U.S. Advisory Committee for the Land Mobile Radio Services*, Vol. I (Washington, D.C.: U.S. Government Printing Office, 1967), p. 28. (Hereafter cited as *Advisory Committee Report*.) The percentages cited are the Committee's; changing technology makes such figures variable over time.

<sup>37</sup>Berresford, "Impact of Law and Regulation," p. 723-24.

Even so, the early years of the RCC industry foreshadowed the bonanza of the long-distance startups in the 1970s and cellular service entrepreneurs in the mid-1980s. AT&T and its associated telephone companies, primarily interested in expanding the geographic scope and traffic volume of their local and long-distance networks by expanding household penetration of telephone service from the 40 percent level immediately after World War II, paid scant attention to mobile services in the 1950s and 1960s. While AT&T's Bell Laboratories developed most of the important technologies for mobile telephony, in these years the small RCCs made a profitable business out of mobile communications. The RCCs had two specialties: (i) sales, often of a grab bag of loosely related services such as telephone answering, private radio systems, and paging; and (ii) litigation, both in defense of their existing spectrum rights against newcomers and in attempting to loosen others' hold on potentially useful frequencies.<sup>38</sup>

### 3.2.2 Mobile vs. Television

The 1950s and 60s were marked by two divergent trends: a generally unforeseen explosion in usage of mobile communications services, and a steadfast unwillingness on the part of the FCC to make more radio spectrum available for such services. The number of land mobile transmitters in use increased from 500,000 in 1955 to over 2.5 million in 1967.<sup>39</sup> "Frequency congestion in the land mobile band produced increasingly long delays in two-way voice communication and a consequent loss of economic productivity. Faced with the specter of such losses if they stand pat, the land mobile users and their major hardware suppliers sought relief by other means," such as: improvement of equipment to reduce the spectrum needed, a move into higher frequency bands, and attempts to "wrest spectrum allocated to other services."<sup>40</sup> The effective spectrum available for mobile uses was quadrupled through channel-splitting technology, which made large-scale mobile telephony look feasible.

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<sup>38</sup>Ibid., p. 724.

<sup>39</sup>*Mobile Society*, p. 77.

<sup>40</sup>Harvey J. Levin, *Invisible Resource: Use and Regulation of the Radio Spectrum* (Baltimore: Johns Hopkins University Press, 1971), p. 205.

The FCC responded to the pleas of mobile users with a seven-year inquiry begun in 1957 (under Docket 11997). It demonstrated extreme reluctance to reallocate spectrum to mobile, focusing instead on the development of a television broadcasting system with "the largest possible number of program choices and providing as many outlets of local expression as possible."<sup>41</sup> The Television Age was then the dominant theme in the communications industry, and it "would stand astride the road to the realization of the cellular idea for more than 20 years."<sup>42</sup> The FCC defended the broadcasters' spectrum even as continued growth in mobile usage by the early 1960s created an increasingly obvious problem. The determination to foster a pluralistic, local-oriented television broadcasting system was reinforced by the FCC's 1962 ruling that all TV receivers be equipped with UHF receivers. Even so, UHF developed much more slowly than either the industry or the regulators had envisioned, and "the vast ocean of prime UHF spectrum lay largely unused."<sup>43</sup>

The next response by the FCC in 1964 was to establish an Advisory Committee for Land Mobile Radio to address "the serious frequency congestion problem affecting the land mobile radio services *without involving the allocation of additional spectrum space to the LM services* [emphasis added]."<sup>44</sup> The FCC was again determined to protect the nascent UHF television industry by keeping its spectrum allocations intact, even after nearly 15 years of spectrum starvation by a wide community of mobile radio users. This determination is puzzling because, aside from a vocal educational TV lobby, no constituency argued for it at the FCC; UHF broadcasters were a diverse, struggling lot. Nevertheless, television held the high ground, and the FCC treated UHF television as a vital spectrum investment in broadcast diversity.

The Advisory Committee recognized the nature of the problem for mobile communication services and understood its duration. Its Report (published in 1967) quoted E.M. Webster, an FCC commissioner, as saying in 1951: "my imagination did not permit me to completely envisage the colossal and rapid growth of these services and

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<sup>41</sup> *Mobile Society*, p. 77.

<sup>42</sup> *Digital Cellular*, p. 46.

<sup>43</sup> *Ibid.*

<sup>44</sup> *Advisory Committee Report*, p. 2.

the terrific impact which they would have on the lives of the American people. And I have talked with no one who claims to have foreseen that which has come to pass in connection with such services."<sup>45</sup> Sixteen years later, this statement was still valid.

The Committee made a three-and-one-half-year study of the technical alternatives, economic impact, and regulatory procedures that could alleviate the problem. It enumerated the positive economic impacts and public goods inherent in the increased usage of mobile communications, including more efficient use of resources (by delivery services, fire, police, taxi, bus, etc.), their timely availability, and business savings. "Two-way radio is an essential tool of business.... It is vital to public safety services. Its contribution to the national economy is large enough (est. at \$8-13B in 1967) to constitute a significant element in American industry's competition with foreign firms and in maintaining the American standard of living."<sup>46</sup> This was forward thinking for 1967, and compares favorably with more recent views of the same subject (see section 5.1).

The Advisory Committee's study yielded obvious conclusions: manufacturers and carriers should continue to tighten channel spacing with improved radio technology in order to maximize use of existing spectrum and the FCC should attempt to streamline its regulatory process. Given a population of 2.5 million mobile radio transmitters (1965) and applications coming into the FCC at a rate of 15,000 per month, the Committee felt it could not stop there. Its concluding recommendation exceeded the scope of its powers: "if the public is to continue to receive the benefits, services and efficiencies provided to it by all the areas of the land mobile services ... additional frequency must be allocated for this use."<sup>47</sup> This was not a difficult recommendation to make, especially after 25 years of requests from the mobile community, but the decision would prove difficult for the FCC to make and then implement.

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<sup>45</sup>Ibid.

<sup>46</sup>Ibid., p. 41.

<sup>47</sup>Ibid., p. 59.



### 3.3 The First Spectrum Allocations for Cellular

Between 1967 and 1975, the FCC continued to explore the allocation of spectrum for mobile communications services through a second advisory committee and two investigatory dockets. The FCC's interest turned to the high-capacity cellular system proposal that AT&T had put forward in 1947 and been upgrading since. A cellular system features many radio transceiver towers in a metropolitan area, low in height and power requirements, several of which cover a "cell" a few miles across. Each radio tower uses only a few of the total frequencies allocated to the system, and as cars move across the area their calls are handed from tower to tower and from channel to channel. The towers are connected to one another and to the conventional fixed telephone network by a central switch. By reusing the available frequencies in different conversations at far smaller distance intervals than conventional systems allowed, and by expanding capacity by shrinking the size of cells ("cell splitting"), cellular systems, in theory at least, could have infinite capacity. This original concept, very robust in its technological day, would prove severely limited in the face of new technologies that emerged during the policy and business debates over cellular industry structure (see section 5.2).

Again in this round the battle was joined between land mobile interests, who advocated a major reallocations of spectrum as the only solution to their capacity problems, and broadcasters and independent television stations, who argued that even limited sharing of their spectrum was unacceptable. In Docket 18261 (1969), the FCC finally broke with its (and Congress's) historical commitment to an 82-channel nationwide television system and found that substantial additional spectrum was needed to achieve long-term relief for mobile services.<sup>48</sup> A primary consideration in this change of heart was the continued sluggish development of UHF.

In the First Report and Order of Docket 18262 (May 1970), the FCC went considerably further by reallocating UHF Channels 70 through 83 (the 900 MHz band), giving 115 MHz to mobile communications services. A suballocation of 75 MHz was

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<sup>48</sup>*Mobile Society*, p. 79.

ordered specifically for the "development of high capacity common carrier mobile communications [i.e., telephone] systems to be operated by wireline common carriers."<sup>49</sup> This was the first victory for AT&T, GTE, Motorola, and their allies in the telephone and RCC industries in their quest to provide high-capacity mobile telephone service. Although another dozen years would be needed to administer and assign this initial spectrum allocation, it was clear for the first time that a sizable new industry was being created. The next 12 years were marked by many more controversies, but now industry stakeholders and policymakers would be determining the structure of the prospective cellular industry, not its existence.

In the aftermath of the 1970 Order, the absence of a comprehensive, long-range plan for spectrum allocation made the FCC vulnerable to criticism from the broadcasters and their advocates. (This same criticism is visible in British decision-making about spectrum allocations – see section 4.1.) Two of the five FCC Commissioners dissented from the reallocation order because it was a loss for educational broadcasting. The decision was also criticized as *ad hoc* and as responsive to political pressure (Robert Galvin, chairman of Motorola, was finance chairman of the Republican campaign in 1968). Among other pressures on the FCC were hearings held by the House Select Committee on Small Business's Subcommittee on Activities of Regulatory Agencies in 1968-69 on the mobile spectrum shortage, which emphasized the lopsided allocations between broadcasting and mobile services.<sup>50</sup> In retrospect, however, it is hard to view the decision as a reaction to political considerations, regardless of the supposed influence of the radio carriers, Motorola, or AT&T. Given 20 years of steadfast resistance to change, it's difficult to fault the FCC for finally making mobile frequency allocations.

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<sup>49</sup>This ruling in Docket 18262's *First Report and Order* is summarized in *18262 Second Report* at 752.

<sup>50</sup>*Mobile Society*, p. 87.

### 3.4 How Many Carriers?

#### 3.4.1 The Original Monopoly View

The FCC originally mandated that the telephone company (wireline carrier) in a given service area should be the sole provider of cellular mobile service. This was done despite commenters' "general feeling of malaise" about the telephone monopolies expanding into the mobile arena, which had previously been competitive (although AT&T had a 50 percent share in the RCC business).<sup>51</sup> The Commission noted that "the wireline carriers are the only organizations which have demonstrated that they possess the resources and the expertise necessary to establish cellular systems"<sup>52</sup> and that AT&T was the only one at this point to submit a comprehensive system proposal. Converts to the idea that cellular was badly needed, the Commission was convinced that "since a cellular system is technically complex, expensive, and requires a large amount of spectrum to make it economically viable, competing cellular systems would not be feasible in the same area."<sup>53</sup> This view was influenced by AT&T's submissions and testimony regarding its AMPS cellular system, the architecture of which in turn reflected AT&T's assumption of monopoly service provision as an extension of wireline telephone service.

AT&T's local telephone companies (telcos), which served 85 percent of the U.S. population and almost all large cities, were to be restricted to providing mobile services through separate subsidiaries, to prevent cross-subsidization of prices and other potential abuses of their monopoly power. Foreshadowing similar regulations in other segments of the industry, the FCC promised to "establish detailed regulations and procedures" for monitoring the operations of the subsidiaries.<sup>54</sup>

The FCC's telco-only policy was modified in the Reconsideration of Docket 18262 in 1975, when it conceded the point raised by Airsignal (an RCC): if only telcos

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<sup>51</sup> 18262 *Second Report* at 760.

<sup>52</sup> *Ibid.*

<sup>53</sup> *Ibid.*

<sup>54</sup> *Ibid.*

are capable of operating cellular systems, then excluding others by regulation is superfluous. The FCC modified its order to allow "any qualified entry...to apply for authorizations to develop and eventually to operate cellular radio systems."<sup>55</sup> But it still envisioned only one system per area: "If two or more qualified applicants apply for authorization to provide service to the same area, we will decide between them on the basis of a comparative hearing."<sup>56</sup> The FCC seems to have considered the possibility of more than one applicant (or of a successful applicant other than AT&T) unlikely, especially because of the requirements it promulgated for developmental system applications.

### 3.4.2 The Reintroduction of Competition

The RCCs protested the FCC's decision vigorously, considering the cellular spectrum rightfully theirs as early developers of the mobile communications industry. They gained a key ally in Motorola, which expected cellular to create an upheaval in its radio communications equipment markets and wanted to become a supplier of cellular network equipment (in addition to handsets, which AT&T was prohibited from providing by the 1956 Consent Decree). Motorola teamed up with its current radio customers, the RCCs, to (i) take the FCC's decision in Docket 18262 to court, and (ii) file with the FCC for permission to build a developmental cellular system in Washington, D.C. (AT&T had announced plans to build a system in Chicago, which, interestingly, would *not* use Motorola mobile equipment).<sup>57</sup>

The final decision in docket 18682 was upheld by the D.C. Court of Appeals in January 1976, but the court was concerned about the anticompetitive implications of a one-system-per-area cellular industry. It was clear to the court that AT&T would operate most if not all cellular systems, replacing a competitive industry with a monopoly, and that the separate subsidiary requirements imposed by the FCC would probably prove "cosmetic."<sup>58</sup> The Court nevertheless felt that these anticompetitive

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<sup>55</sup>*Land Mobile Radio Service, Memorandum Opinion and Order on Reconsideration, Docket 18262, 51 FCC 2d at 953.*

<sup>56</sup>*Ibid.* at 954.

<sup>57</sup>*Digital Cellular, pp. 52-53.*

concerns were "speculative and distant in time," and did not constitute a breach of the FCC's traditionally wide discretion. Because the FCC's 1975 Order only reallocated the spectrum and authorized construction of the two demonstration cellular systems, and strongly influenced by the Department of Justice's willingness to let the order stand, the Court upheld it.

These decisions about the prospective structure of the cellular industry during the 1970s took place in a whirlwind of technological, regulatory, and demand changes that swept the telecommunications industry toward an increasingly competitive environment. The long-distance and customer premises equipment markets were pried open, and by 1980 such companies as MCI, Rolm, and Northern Telecom were well on the way to becoming viable (albeit niche) competitors with AT&T. Against this backdrop, the FCC was hard pressed to implement a monopolistic market structure for mobile telephony.

In addition, the FCC itself became a different agency during the 1970s. More proactive, better armed to fend off competing interest groups, and cognizant of the (then) successful deregulation of airlines and trucking, the FCC became less dependent on AT&T for technical expertise, and attempted to work within a more scientific framework of competitive policy, spectrum management, and public interest advocacy.<sup>59</sup> Inputs from the executive branch were also important during this period, particularly the Office of Telecommunications Policy in the White House and the Department of Justice's Antitrust Division, which "viewed the docket [18262] as providing the commission with a unique opportunity to expand the role of competition in the communications industry."<sup>60</sup>

Because of the NARUC court decision, the increasingly competitive industry context, and inputs from other government interests, in January 1980 the FCC began a new proceeding (Docket 79-318) to reconsider whether and how to introduce competition into cellular. It received reply comments from 48 parties, and also had data from the two developmental systems operated by Illinois Bell (an AT&T telco) in

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<sup>58</sup>*National Association of Regulatory Utility Commissioners v. FCC*, 525 F.2d 1095 at 637 (1976).

<sup>59</sup>*Digital Cellular*, pp. 60-61.

<sup>60</sup>Quoted in *Mobile Society*, p. 89.

Chicago and American Radio Telephone Service (ARTS, a subsidiary of Motorola) in Washington-Baltimore.

In what may now appear a foregone conclusion, the FCC changed its original one-per-market approach and proposed two systems per market as the best balance between spectrum efficiency and the benefits of competition.

Because regulatory policies and technology had changed dramatically in the intervening years, making possible the introduction of competition into markets formerly closed to competition, the Commission determined that it was appropriate to reconsider its previous decision to license only one cellular operator per area.<sup>61</sup>

The NARUC court decision was undoubtedly influential in this change, as was the demonstrable fact that firms other than AT&T could build and operate cellular systems. In the background was the new Reagan administration's pro-competition ideology. So the FCC settled on two 20-MHz systems per market, splitting the allocated spectrum. "It is our view that even the introduction of a marginal amount of facilities-based competition into the cellular market will foster important public benefits of diversity of technology, service and price."<sup>62</sup> Throughout this proceeding, the FCC again balanced the extreme options proposed by the various stakeholders, ranging from single-system, telco-only (AT&T's position), to unrestricted "open entry," advocated by the Justice Department.

### **3.4.3 The Wireline Set-Aside**

The FCC considered the pros and cons of the telcos in cellular and concluded again "that it is very much in the public interest to seek participation from wireline carriers, and, in particular, AT&T which has demonstrated that it possesses the resources and the expertise necessary to establish expeditiously cellular systems with nationwide capability. These are factors, we should emphasize, that we are obligated to consider in reaching a public interest determination."<sup>63</sup> The FCC decided to reserve one of the two

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<sup>61</sup>*Cellular Communications Systems, Report and Order, Docket 79-318, 86 FCC 2d (1981) at 474.*

<sup>62</sup>*Ibid.* at 478.

bands of spectrum in each market for the local telephone company. It believed that, among other benefits of a two-per-market approach, this would reduce the need for comparative hearings, and thus speed the implementation of cellular systems.

The FCC considered the possibility that cellular might compete with traditional fixed telephone service, diminishing the incentive of wireline carriers to complete cellular systems and promote the service. It concluded that this was not a significant worry, but went on to note that: "The key to local exchange substitutability in any practical sense is the availability of an inexpensive handheld portable unit that is light in weight."<sup>64</sup> AT&T commented that cross-elasticity between mobile and fixed service was limited by handset cost and service rate differentials. As cellular technology continues to improve, in particular by shifting to digital transmission and handsets, the issue of mobile substitution for fixed service will be revisited by regulators and carriers alike (see section 5.2.1).

The FCC seems to have weighed very carefully the speed of implementing cellular service against the dangers of letting the telcos into markets adjacent to those where they already held monopoly power: "Regulatory agencies, including this Commission, are required to consider pertinent competitive policies in making public interest findings. Promotion of competition alone, however, is not synonymous with the public interest."<sup>65</sup> Reserving a cellular franchise for the local telco generated considerable controversy within the Commission; Chairman Fowler dissented from the majority in the 1982 Reconsideration of Docket 79-318, stating that the inevitable court appeal would overrule the FCC's wireline set-aside provision and result in delayed rather than speedier implementation.

In 1984, the D.C. Court of Appeals upheld the wireline set-aside, citing the importance of speedy implementation: "it is high time to move cellular telephone services from the FCC's regulatory process to the marketplace. To ignore this point would be to ignore Congress' fundamental mandate to the FCC to make communications

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<sup>63</sup>Ibid. at 483.

<sup>64</sup>Ibid. at 484.

<sup>65</sup>Ibid. at 486.

systems available to the public."<sup>66</sup> In one sentence, the three principal government actors in the regulatory arena – the FCC, Congress, and the Court – were aligned, and the cellular industry finally moved from approval to implementation.

### **3.5 Early Development of the Industry**

The early development of the cellular industry was marked by further miscalculations by both regulators and industry participants. In retrospect, the theme of the first five years of cellular implementation was consistent underestimation of demand. The FCC greatly misjudged demand for cellular licenses and saw its comparative hearings process overwhelmed by applications, leading to the widely criticized decision to use random lotteries to choose among applicants for cellular licenses. Early projections of the cellular subscriber market also proved drastically low (see section 4.4 for a comparison of growth in the U.S. and U.K. markets), which has created the ironic situation of cellular systems being in danger of obsolescence less than ten years after going on the air (see section 5.2).

#### **3.5.1 Deciding Among Competing Applications – the Licensing Process**

At this point, the FCC had to resolve its acceptance of "the traditional arguments on both sides of the competition question – the free-market view which stressed the virtues of competition and the public utility-natural monopoly view which stressed its dangers."<sup>67</sup> The solution to this dilemma – a regulated duopoly – was to be created through the licensing process.

In theory, the FCC wanted to avoid or reduce the delay of comparative hearings, but was not willing to adopt straight auction or lottery procedures because it anticipated wide variation in the quality of license applications. Although attractive to academics and other observers of the communications industry, auctions of spectrum assignments

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<sup>66</sup>*MCI Cellular Telephone Co. v. FCC*, 738 F. 2d 1322 (1984).

<sup>67</sup>*Digital Cellular*, p. 121.



have not yet become fully acceptable politically in the early 1990s (see section 5.3.1).<sup>68</sup> An attempt during the Carter administration to pass legislation authorizing spectrum auctions by the FCC failed before the cellular authorization process began in 1983.

As part of its underestimation of the demand for cellular service, the FCC anticipated speedy license awards, proceeding through three rounds of geographic service areas in descending order of population. After so many years of delays, the FCC was now itching to get going: "Our decision to adopt these new streamlined hearing procedures for cellular applicants is based on our weighing of difficult issues of public policy, administrative efficiency and due process. We expect cellular to become an important communications tool, the extensive use of which can be of significant benefit to the American economy and to the more general public interest, and we are accordingly anxious to have it implemented as quickly as possible."<sup>69</sup>

Unfortunately, the applications for the top 90 cellular markets far exceeded what the FCC anticipated and overwhelmed its hearings process. The telephone companies quickly formed cooperatives which divided the relevant markets among them, but nonwireline (NWL) applicants, aggressive RCCs like Metromedia and LIN Broadcasting, accustomed to the competitive world of paging and other services and backed up by 1,000-page applications that cost \$100,000 or more, stayed the course, confident of winning in the hearings. The prospect of significant delays in implementation (particularly among the nonwireline carriers – see section 3.5.2) and the difficulty of choosing between well-qualified applicants, forced the FCC to change the licensing process.

In mid-1984, the FCC decided delays in service implementation because of the NWL hearings were intolerable and instituted a lottery, but the consequences were "almost exactly the opposite of what the FCC intended."<sup>70</sup> What had been a flood of

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<sup>68</sup>"An auction is merely a fair and efficient way to establish the value of the license before the FCC grants it and thereby assure that the public retains the windfall benefits of awarding such a privilege." Charles Jackson, "Managing the Spectrum Resource," in *New Directions in Telecommunications Policy*, Paula Newberg, ed. (Durham, N.C.: Duke University Press, 1989), p. 266.

<sup>69</sup>*Cellular Communications Systems, Memorandum Opinion and Order on Reconsideration*, Docket 79-318, 89 FCC 2d at 93 (1982).

applications for the first 90 markets turned into a tsunami for the smaller cities, with the chances for unqualified, purely speculative applications equal to those for experienced NWL cellular players. The investment potential of cellular licenses became the object of intense speculation, with an ascribed value largely independent of the actual operation of a cellular system. License lotteries were followed in short order by private auctions by lottery winners selling their licenses. Start-up service costs in the smaller markets included the cost of buying out the lottery winner.

The FCC is still trying to recover from the lottery fiasco, which was caused by its ambiguous attitude towards competition in the cellular industry. "The clarification of regulatory attitudes toward competition is one of the key hurdles on the road to the next generation of cellular"<sup>71</sup> (see section 5.3.2).

### 3.5.2 System Startups

The first round of cellular licensing decisions, based on comparative hearings, had two undesirable outcomes: the FCC awarded licenses on the basis of razor-thin differences in the applications, and the nonwireline franchises often lagged a year or more behind the telephone companies in starting up cellular service. The telcos were on the air first, given a head-start by quicker FCC approval, inherited network equipment and expertise from AT&T, and the relative ease of creating joint ventures to share the wireline franchise in each market. "For the wireline carriers, jurisdiction and ownership in the venture reflected the market power of each partner in the service area."<sup>72</sup> Wireline cellular franchises were created among the telcos serving a particular area, e.g., NYNEX, Bell Atlantic, and United Tel. in the New York City service area.

Systems started in the top 30 markets between October 1983 (in market #3, Chicago; by Ameritech/Centel) and mid-1985 (in San Francisco, #7, and Portland, #30). Nonwireline system started in December 1983 (in Washington, #8, and Baltimore, #14, by Cellular One [a joint venture of RCCs Metromedia and Graphic Scanning]), but by

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<sup>70</sup>*Digital Cellular*, p. 125.

<sup>71</sup>*Ibid.*, p. 134.

<sup>72</sup>The Yankee Group, "Mobile Communications Update", (Boston, February 1985).

early 1985 only nine NWL systems were operational in the top 30 markets, as opposed to 26 wireline systems.

The possible market-share advantage gained by wireline carriers because of their regulatory head-start is obscured by other events of this period, principally the January 1984 divestiture of the AT&T operating companies. Soon after their birth as independents, BOCs began acquiring nonwireline cellular franchises outside their telephone service areas. "The Justice Department, the FCC, and the courts agreed that such acquisitions were allowed by the terms of the Bell System breakup and under antitrust principles in general. Five Bell regional companies acquired approximately one-third of the nonwireline side of the cellular business outside of their respective regions."<sup>73</sup> This trend was accelerated by the disenchantment of some of the larger NWL carriers with the entire cellular licensing process, hastening their exit from the business altogether. The ownership of NWL franchises by the telcos, unforeseen in the FCC's competition deliberations in the early 1980s, blurred the distinction between wireline and nonwireline cellular carriers nearly to the point of irrelevance. Within three years, the cellular market was characterized by widespread competition between the local BOC and another operating out-of-region as an NWL franchise.<sup>74</sup>

### 3.6 Conclusion

In the U.S., the tortuous path of high-capacity mobile telephony from concept to reality was more regulatory than technological. The participatory and adversarial style of industry regulation meant a very lengthy and, in the end, not wholly successful process of putting cellular systems into operation. One independent (albeit AT&T-sponsored) study estimated a loss to the economy of more than \$80 billion during the 10-year regulatory delay in implementation of cellular.<sup>75</sup> Regardless of the

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<sup>73</sup>Berresford, "Impact of Law and Regulation," p. 729.

<sup>74</sup>See Huber, *Geodesic Network*, pp. 4.7-4.10.

<sup>75</sup>Rohlf, Jackson, and Kelly, "Estimate of the Loss," p. 4.

plausibility of such figures, cellular clearly could and should have been available to American businesses and consumers earlier than it was.

This conclusion is borne out in the examination of cellular development in the U.K., which brought the industry to a similar level of usage with less than five years of regulatory deliberation, compared with the almost 35-year process in the U.S. The British had two advantages: a more direct and cooperative regulatory style, and their awareness of political and technological hazards made evident by the American experience.

## **CHAPTER FOUR**

### **DEVELOPMENT OF CELLULAR POLICY IN THE U.K.**

Some of the precursors to the establishment of cellular in Britain were similar to those in the U.S. experience. A primitive land mobile telephone system operated by the British Post Office (later British Telecom) had a long waiting list for service and generated complaints from business users; entrenched radio spectrum holders loath to part with their assignments, whether they were using them or not; and a telecommunications industry and regulatory structure undergoing dramatic changes in the early 1980s, in some ways modeled after the U.S.

In many respects, however, the situation in the U.K. circa 1980 was quite different from that in the U.S. ten or fifteen years before. The two long-time corporate champions of mobile telephony in the U.S. – Motorola and AT&T – had neither presence nor counterparts in Britain, and, similarly, there was no counterpart to the competitive RCC industry, which pushed the development and especially the early adoption of mobile communications. The structure of the telecommunications industry was profoundly different in the U.K. British Telecom, the sole provider of telecommunications services throughout Britain, was a government-owned monopoly. Although privatization and competition would change this structure during the period that cellular was established, the relationship between industry and government was much closer, more hidden from view, and more agreeable, than in the U.S.

The most striking difference was the relatively late start of cellular in the U.K. The British began deliberations about the establishment of cellular service much later than the U.S. and therefore had fewer risks, both technologically and politically, to deal with. The example of American market development was profoundly influential on the structure of the cellular industry in the U.K.

#### 4.1 Spectrum Allocation

Control of the radio spectrum was in the hands of the British Post Office, part of the U.K. government's Home Office, until 1981, when British Telecom was created and subsequently privatized. Other government stakeholders, particularly the Defence Ministry, played a big role and had squatters' rights to much of the available spectrum. Radio spectrum allocation and assignment was (and in 1992 still is) a function of the Radiocommunications Division (RD), which in 1983 was transferred from the Home Office to the Department of Industry. Spectrum monitoring functions were transferred to the RD from British Telecom the following year, integrating procedural and technical functions more closely.

Frequency allocations take place in the context of international agreements hammered out at the International Telecommunication Union's World Administrative Radio Conferences (WARC). Individual countries have discretion in parcelling out spectrum space, especially for frequencies designated for shared use, or unassigned. The initial allocations for land mobile service in the U.K., for example, were in the upper range of the FM radio band. As mobile allocations increased in response to growing demand, other countries found their ability to increase allocations for sound broadcasting limited by potential interference from U.K. mobile services.<sup>76</sup> Land mobile frequencies were shifted out of this radio broadcasting band by agreement at the 1979 WARC, one of the catalysts for a thoroughgoing review of U.K. spectrum use in the early 1980s.

Assignment of frequencies is representative of the "insiders" process that characterizes the U.K.'s style. Major spectrum users such as the BBC in broadcasting and BT and Mercury in telecommunications are granted "omnibus" licenses that allow wide discretion in using a broad range of frequencies. Individual frequency assignments, site locations, and other routine tasks are delegated by the RD to the licensee,<sup>77</sup> which is also free to devise its own equipment specifications. For other, "standard" licensees,

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<sup>76</sup>Department of Trade and Industry, *Deregulation of the Radio Spectrum in the UK* (London: HMSO, 1987), p. 8. (Hereafter cited as *Deregulation*.)

<sup>77</sup>*Ibid.*, p. 10.

including cellular mobile operators, frequency assignments and equipment specifications are selected and cleared by the RD staff.

Frequency allocation and assignment during the early years of cellular development in Britain were largely holdovers from the days of the British Post Office. Major spectrum users, along with representatives of equipment manufacturers and researchers (from industry and academia) were appointed ("co-opted" in government parlance) to advisory committees, where most of the decision-making took place. Nongovernmental interests had an influential voice integral to the policymaking process. Through advisory committees, "a wide but controlled range of interests is brought to bear on spectrum management, while at the same time ensuring that Ministerial authority is maintained over contentious issues."<sup>78</sup> The public, adversarial elements of regulation in the U.S. were missing altogether in Britain. Government and industry combined forces to develop a consensus on the best path of action, and government decisions, once issued, were not challenged by industry which made its contributions during the developmental stage.

Several important limitations in spectrum management were pointed out by the study commissioned by the government in 1987:

- The development of consensus is time-consuming and will become more difficult as the number of interested parties grows
- No means of resolving conflicts between insiders are developed
- The process is largely hidden from public view
- Existing users, especially Defence and other Crown agencies, have strong "squatters' rights" to allocated spectrum, limiting the RD's ability to accommodate new technologies

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<sup>78</sup>Ibid., p. 5.

- Outsiders or newcomers to the industry are not represented and have no procedure for gaining a voice. The study deemed it "both unfair and inefficient that established users should be under little pressure to economise on the use of frequencies assigned to them while there is congestion in bands occupied primarily by users on the fringe of the decision making process."<sup>79</sup>
- "Commercial incentives" or other economic criteria are needed for making decisions on allocation or assignment

The last three points are the same as in the U.S.; every other limitation of the U.K. spectrum allocation process pales before its counterpart in America. Certainly what is viewed as "time-consuming" in the U.K. is nothing like the time scale of FCC decisions and their subsequent court reviews.

#### **4.2 Spectrum Allocation Applied to Cellular**

The idea of cellular mobile service for the U.K. was first publicly hatched in government reports on information technology issues by the Department of Industry (DoI; now the Department of Trade and Industry, DTI) early in the Thatcher years. Although there is no documentary evidence of the genesis of the advisory committees that authored the reports, it is a fair bet that the experience of the U.S. in demonstrating the viability of cellular systems was an influential factor. British Telecom operated the primitive Radio Phone System, switched manually by operators, which reached capacity in 1979, and by early 1981 a waiting list of over 2,500 potential subscribers existed.<sup>80</sup> The Home Office was still working, after the 1979 WARC, on frequency allocation, so BT followed the time-honored technique of squeezing the channel spacing from 25 KHz to 12.5 KHz. In 1980, BT had quietly proposed a high-capacity mobile system to relieve the mobile phone congestion; along with the 1979 WARC, this was the catalyst for the

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<sup>79</sup>Ibid., p. 21.

<sup>80</sup>Lisa Wood, "Mobile Radio," *Financial Times*, April 27, 1981.



formation of the Mobile Radio Committee, which issued its Report in 1982, followed by the Report of the Independent Review of the Radio Spectrum in 1983.

Both of these reports, the second the larger at 137 pages, were based on roughly a year's work and were later thought to be "remarkably brief effort[s] for such a vast and vital topic; there was in particular no effort at all to match the subject with long-term national goals in information technology and telecommunications."<sup>81</sup> The same could be said about U.S. efforts such as the 1967 report of the mobile Advisory Committee, although it was certainly longer and more complex. Although U.S. policymakers were getting advice earlier and in greater volume, whether this resulted in any lasting advantage for prospective cellular suppliers or subscribers is not clear. In addition, the FCC was continually criticized, even by its own Commissioners, for lacking a long-term, coherent policy for spectrum management. The U.K. was strikingly successful in getting its cellular mobile industry up and running in about five years; clearly, U.S. policy and technology experience provided helpful examples

The most important difference between the development of the British cellular phone industry and the U.S. was that the U.K. started after technology was proven and policy choices narrowed. The big risks for suppliers in a new technology-based market come before a dominant technology is established, especially "In industries with large costs for development and prototyping, [where] the probability that the innovator will emerge as a winner at the end of the pre-paradigmatic stage is low."<sup>82</sup> This risk was already out of the way for Britain's aspiring cellular operators, since AT&T's AMPS system was a reasonably clear technology choice by the time development started.

A pre-1980 move into cellular, using prestandard technology, might have been seen in the U.K. as a risk for the government and the nation. The glaring example is the British jet aircraft debacle just after World War II. "By moving [prematurely] into

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<sup>81</sup>Palmer and Tunstall, *Liberating*, p. 251.

<sup>82</sup>David Teece, "Capturing Value from Technological Innovation," in *Technology and Global Industry: Companies and Nations in the World Economy*, Bruce R. Guile and Harvey Brooks, eds. (Washington D.C.: National Academy Press, 1987), p. 75. See also Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

production, significant [design] irreversibilities and loss of reputation hobbled deHavilland..., " which was eventually displaced by Boeing and other U.S. manufacturers as the worldwide leader in jet aircraft production.<sup>83</sup>

In a broader context, all *analog* cellular systems might be considered pre-paradigmatic, and only *digital* cellular systems capable of making universal mobile communications a reality (see section 5.2).<sup>84</sup>

### 4.3 Selection of the Carriers

In 1982, the British government acted quickly to establish the framework for cellular implementation. As part of its overall review of spectrum usage, it provisionally allocated 30 MHz in the 900 MHz band for cellular. Because this was carried out roughly in parallel with planning for privatization of British Telecom and the introduction of competition through the licensing of Mercury (see section 2.2.2), from the start cellular was thought of as a competitive market. The government's announcement of spectrum allocation agreed with the conclusion of a preliminary DoI working group that "two competing networks may well provide the best balance between the benefits of competition and those of maximizing spectrum efficiency."<sup>85</sup> In one stroke the British short-circuited about ten years of FCC and court deliberations on the same issue, and reached the same balance between efficiency of network construction and utilization (single carrier) and efficiency of competition (open entry). In advance of the telephone service or other parts of Britain's telecommunications market, cellular was "one of the few fields which was duopolistic by conventional definitions."<sup>86</sup>

The DoI solicited proposals on the basis that each of two carriers would be awarded half the allocated spectrum and create a nationwide cellular system. BT beefed up its earlier cellular proposal and resubmitted it in October 1982, now as a joint venture

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<sup>83</sup>Teece, "Capturing Value," p. 74.

<sup>84</sup>This view is advanced in *Digital Cellular*.

<sup>85</sup>"DoI speeds the radio phone," *British Business*, July 7, 1982, p. 381.

<sup>86</sup>Palmer and Tunstall, *Liberating*, p. 273.

with Securicor (an alarm company) to meet the stipulation that BT should own less than half of the new cellular carrier. It was clear to regulators that BT could get service up and running quickest: "In order that at least half the frequencies could be brought into use quickly, the intention was that a license...should be issued to a subsidiary company of BT."<sup>87</sup> This is a compressed replay of the deliberations of the FCC regarding AT&T's (or other monopoly wireline carriers') presence in the cellular market. And again, the balance between the benefits of competition and speed of implementation was struck as in the U.S.: the dominant carrier got half the spectrum, and one of the other applicants the rest.

The granting of a license for a BT-backed cellular service provider was ammunition for opponents of BT privatization, then being planned for 1983-84. Critics complained that the government was looking at telecom piecemeal, without a coherent policy, thereby allowing BT to extend its monopoly into other, potentially competing technologies.<sup>88</sup> The government was torn between encouraging competition as the best way of controlling BT's pricing practices (much preferred over direct rate regulation), and enhancing BT's value during the run-up to an initial public share offering. "The result was that even amendments to which the government could have been expected to agree in the interests of competition had to be defeated in the interests of keeping the City [s prospective shareholders] happy."<sup>89</sup>

Nothing in the U.S. resembled this state of affairs, another reminder of the intimate connections between the government and the telecommunications industry in the U.K. Paradoxically, by attempting to sever or at least loosen those connections, the privatization effort has probably resulted in more regulation and direct government involvement in the affairs of BT and other telecom providers, rather than less. In this respect, the experience of OFTEL parallels that of the FCC, which has found its workload and employment climbing under a regime of industry "deregulation."

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<sup>87</sup>"DoI speeds."

<sup>88</sup>Hills, *Deregulating Telecoms*, p. 129.

<sup>89</sup>*Ibid.*, p. 130.

The cellular system proposals from prospective BT competitors were required to include detailed submissions on technical specifications, financial wherewithal, cost and revenue projections, and management resources. Applications were considered in three steps: review by outside consultants (SRI International), review by the Radio-communications Division for technical suitability under the Wireless Telegraphy Acts, then review of both reports by independent advisers, who issued a recommendation to the Secretary of State for Industry.

Five nonwireline applications were filed in September 1982: Racal-Millicom (owned by Racal Electronics 80 percent, Millicom 15 percent, and Hambros Bank 5 percent); National Radiophone Service Ltd. (London Car Telephones and Baring Bros.); Cellular Radio Ltd. (Air Call PLC, GL Electronics, Autocall, Cable & Wireless, et al.); Metagate Ltd., and Rushbridge Ltd. Despite reports that Cellular Radio was a shoo-in, Racal-Millicom was "speedily awarded" the franchise, "because of its ability to transfer cellular technology into the UK."<sup>90</sup> Because the two cellular systems were to be nationwide, the comparative application and licensing process was a one-time event; there was no counterpart to the lengthy and chaotic city-by-city licensing in the U.S.

#### **4.4 Early Development of the Industry**

Cellular service began in the U.K. in early 1985. Both national carriers, Cellnet (the BT-backed entry) and Vodafone (Racal et al.), were prohibited from the distribution end of the business; service contracts and billing were handled by more than 100 service agents, and handset and other equipment sales were completely unregulated. As in the U.S., a sluggish start was followed by a growth phase that outstripped the projections and capacity of service providers. By mid-1986, each carrier had roughly 45,000 subscribers and needed more frequencies, especially in London, because of "unexpectedly quick growth in demand for the service."<sup>91</sup> By the end of that year, the government estimated

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<sup>90</sup>The Yankee Group, "Cellular Mobile Radio," (Boston, January 1983), p. 146.

<sup>91</sup>David Thomas, "Car phone channels to grow," *Financial Times*, August 29, 1986.

there were 130,000 subscribers, representing just under 50 percent of total spectrum capacity.<sup>92</sup> The concentration of mobile users in London created a channel squeeze and transmission quality problem, which was relieved temporarily when the Ministry of Defence released spectrum space that allowed each cellular carrier to put on the air an additional 200 channels in the London area by the end of 1987.

The 1987 DTI report forecast demand at 400,000 cellular subscribers by 1990, and 600,000 to 1 million by 1995.<sup>93</sup> As depicted in Figures 4-1 and 4-2, this estimate was low by a factor of 2; in 1990 there were actually about 950,000 subscribers in the U.K. The report tried to allow for this possibility, noting that "Since the introduction of cellular service in the U.K., the industry's expectations of demand growth have repeatedly been exceeded," accordingly, it characterized the forecast as "pessimistic" and the upper range as "significantly higher than current industry expectations."<sup>94</sup>

Figure 4-1 shows the absolute number of cellular subscribers in both countries through the 1980s. Despite recessions in both countries in 1990-91, subscriber growth of cellular has continued impressively.

Figure 4-2 plots the cellular subscriber growth on a logarithmic scale to show the similarity in *rate* of growth in the two countries. The gap between the growth curves represents the roughly 18-month head start of cellular system operation in the U.S.; otherwise, performance of the British cellular industry has matched the U.S.

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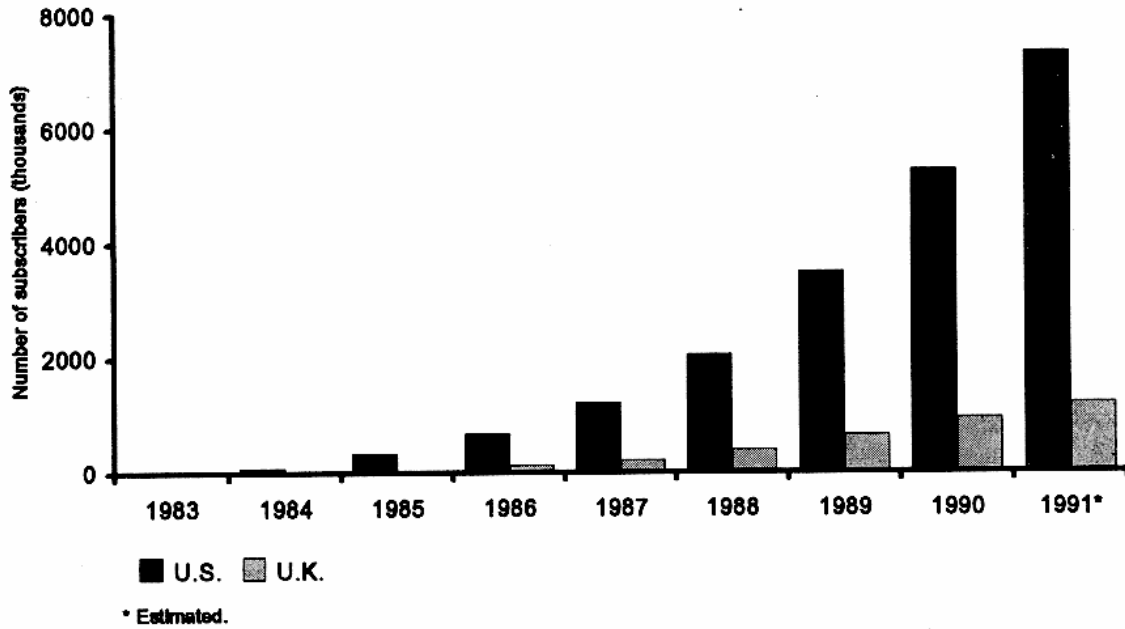
<sup>92</sup>*Deregulation*, p. 61.

<sup>93</sup>*Ibid.*

<sup>94</sup>*Ibid.*

Figure 4-1

Cellular Subscribers in the U.S. and U.K.  
(in thousands)

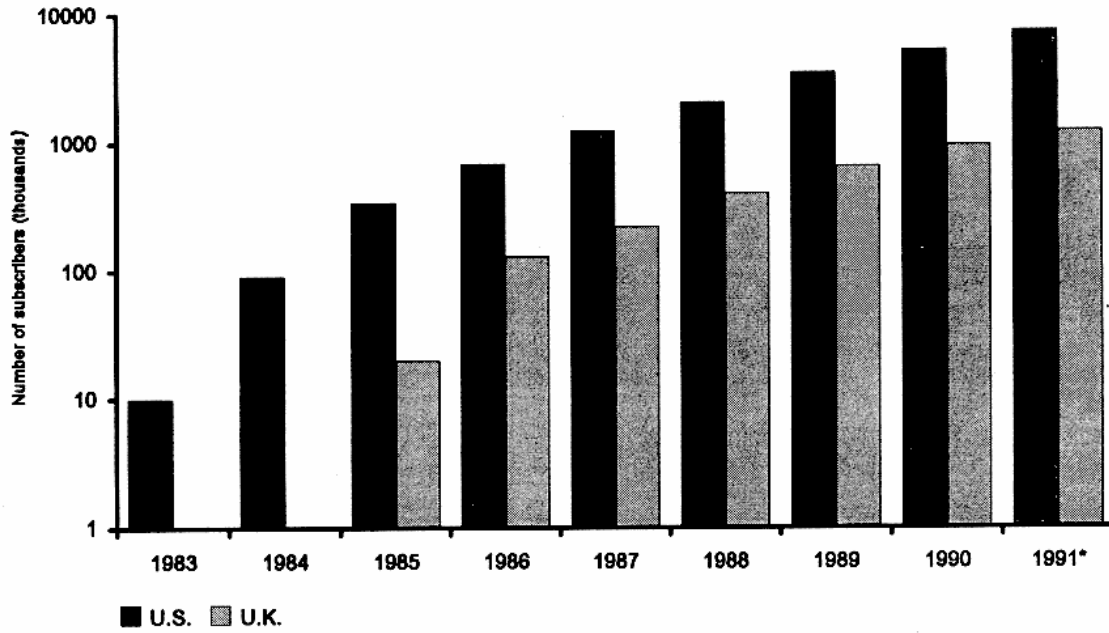


Source: data from Cellular Telecommunications Industry Association and *The Economist*, October 6, 1991, p. S8.

Graphic: © 1992 President and Fellows of Harvard College. Program on Information Resources Policy.

Figure 4-2

Cellular Subscribers in the U.S. and U.K.  
(in thousands, log scale)

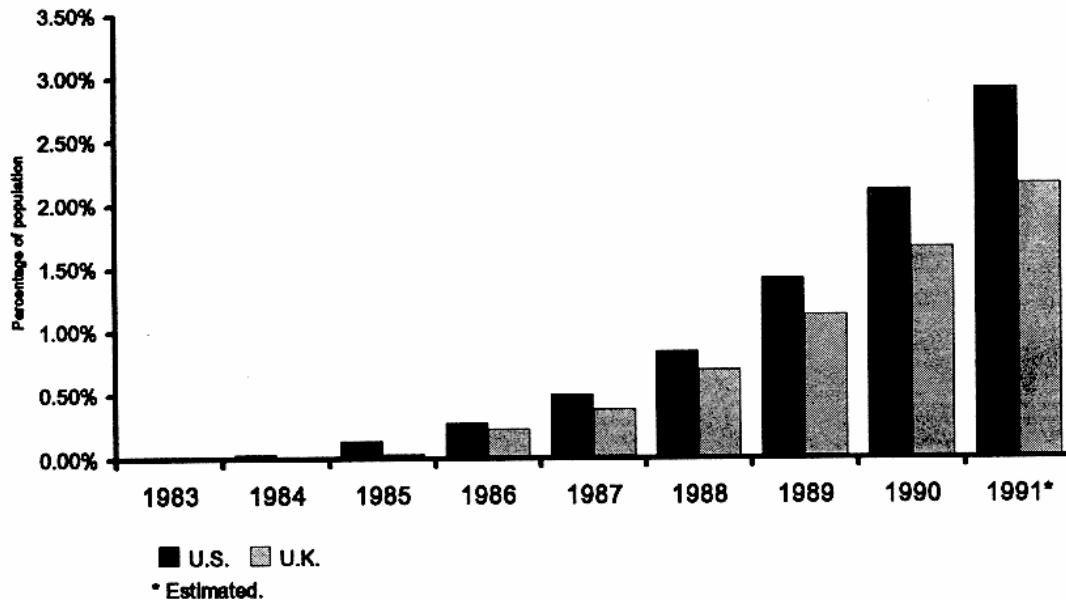


\* Estimated.

Source: data from Cellular Telecommunications Industry Association and *The Economist*, October 5, 1991, p. S8.  
Graphic: © 1992 President and Fellows of Harvard College. Program on Information Resources Policy.

Figure 4-3

## Cellular Subscribers as a Percentage of Population



Source: data from Cellular Telecommunications Industry Association and *The Economist*, October 5, 1991, p. S8.  
Graphic: © 1992 President and Fellows of Harvard College. Program on Information Resources Policy.

Figure 4-3 plots the number of cellular subscribers as a percentage of the country's total population. The 25 to 30 percent annual growth in revenues of the U.K.'s cellular operators through the 1980s made Cellnet and Vodafone the two largest and most profitable mobile operators in the world, with combined reported revenues equalling roughly \$1 billion in 1990.<sup>95</sup> This impressive development, along with other factors such as the implementation of a pan-European digital cellular system mandated by the European Community, have made the U.K. a hotbed of new developments in mobile communications.

<sup>95</sup>"Tomorrow's Bulging Pockets," *The Economist*, October 5, 1991, p. S8.



## CHAPTER FIVE

### THE NEXT GENERATION(S) OF MOBILE TELEPHONY

After nearly forty-five years of regulatory debate and technology development but fewer than ten of commercial availability, in the 1990s mobile telephony is entering a new stage of evolution. New digital communications technologies have been developed since the regulatory battles over cellular of the 1960s and 1970s, which are being tested as next-generation cellular systems. The analog systems of the 1980s, most observers agree, are destined to be supplemented and then replaced by more commodious, flexible, and eventually cheaper digital cellular, but disagreement continues about the speed and ultimate destination of this transition. Regulators and cellular suppliers are attempting to apply lessons from the early rounds of cellular implementation to the task of guiding the evolution of the mobile communications industry.

#### 5.1 Visions of the Future

Mobile telephony has captured the imagination of technology and business visionaries who see the potential for radical changes in the telecommunications industry over the next decade or so. Today a supplement to the fixed-line telephone network, mobile phone systems may replace it in the future. At its extreme, this view takes in nothing less than the entire communications industry: "Most information we receive through the ether today – television, for example – will come through the ground by cable tomorrow. Conversely, most of what we now receive through the ground – such as telephone service – will come through the airwaves."<sup>96</sup>

Even with a narrower focus on just the telephone industry, it is possible to foresee significant changes in the basic product of telephone carriers. A transition from calls that connect to a *place* to calls that connect to a *person* has been underway for some years,

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<sup>96</sup>Nicholas P. Negroponte, "Products and Services for Computer Networks," *Scientific American* 265, (September 1991), p. 108.

abetted by such technologies as call forwarding and paging (as well as nontechnological means like competent secretaries). A universal mobile telephone network is technologically a more elegant means of accomplishing person-to-person connectivity, but the financial and regulatory (as well as social) prerequisites and implications are far from worked out. Although many believe that "once high-quality cellphones can fit the pocket, and most pockets can afford one, the distinction between place-calls and person-calls will evaporate,"<sup>97</sup> the implementation of digital mobile telephone networks is only one of several steps necessary for true "person calling." Within several years, digital technology will bring the price of cellphones to the mass market level of \$50 to \$200, equivalent to 1992's cordless models), but it's more difficult to postulate mobile *call charges* equivalent to fixed phones. Only when (if ever) this second step is accomplished will "people no longer have any need of fixed phones for ordinary voice conversations, [and] instead of being a niche value-added market, mobile communications will have become the mass market, and fixed communications will have moved up-market to concentrate on data and video communications."<sup>98</sup>

Obviously, the consequences of such a fundamental shift in the character of the ubiquitous telephone network would be dramatic for the whole range of industry participants. Regulators and suppliers have barely begun to struggle with hydra-headed issues such as stranded (fixed network) investment, technology standards and interconnection requirements, and the enormous software investment required to implement "personal telephone numbers." Industry stakeholders, including the telephone companies, cellular suppliers, cable television companies, and new "personal communications" service entrepreneurs (sometimes all under the same corporate umbrella), are lining up to reenact the battles over spectrum allocation, competitive structure, and technology standards of the early cellular days, this time with potentially bigger consequences.

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<sup>97</sup>"Tomorrow's Bulging Pockets", p. S6.

<sup>98</sup>"The World at Your Fingertips", *Financial Times*, October 15, 1990.

The telephone companies, most of them significant cellular system operators, are the most resistant to realizing the full potential of emerging next-generation technologies. The phone companies, fighting to preserve their (already diminished) monopoly in local telephone service, often continue to "see cellular telephony as a complement or even supplement to conventional phone service, not its successor."<sup>99</sup> As the stakeholders with the most to lose if true replacement technologies emerge, the telcos have taken a position that is hardly surprising. Even the partial "loss" of basic telephone service provision would cripple any telephone company, so they will simultaneously advocate that new mobile services be treated as extensions of traditional telephone service (rather than alternatives), and attempt full participation in the development and deployment of new mobile technologies through joint ventures and other partnering arrangements.<sup>100</sup>

The telcos have attempted to slow the evolutionary process in mobile communications by insisting that cellular will become PCS as technology advances while simultaneously seeking to participate in PCS field trials and market tests. They are repeating a pattern seen throughout the history of communications, as when the AM radio stations both resisted and invested in new FM technology in the 1950s and television and newspaper interests invested in cable TV franchises in the 1960s and '70s.<sup>101</sup>

## 5.2 New Technologies

The development of radio-based telephone systems of virtually unlimited capacity and unrestrained mobility is within sight, spurred by parallel developments in digital transmission and computing technologies during the last twenty years. Since 1970, when the technology of FM-based analog cellular systems was specified and essentially frozen,<sup>102</sup> digital technologies have raced down price-performance curves to obsolete

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<sup>99</sup>George Gilder, "Into the Telecosm," *Harvard Business Review* 69, March-April 1991, p. 158.

<sup>100</sup>For details on new wireless services and industry stakeholder positions, see Derrick C. Huang, *Up in the Air—New Wireless Communications* (Cambridge, Mass.: Harvard University Program on Information Resources Policy, 1992).

<sup>101</sup>Vincent Mosco pointed out these examples.

<sup>102</sup>Bell Labs authors published a 600-page textbook, based on a 1971 submission to the FCC, that set forth the technological foundations for cellular as it was implemented through the 1980s; cited in NERA's

analog approaches in a wide variety of electronics industries.<sup>103</sup> The technology of cellular systems of today, "the final flower of FM analog radio" can be viewed as "similar to that of the LP record industry a few years back, faced with the onset of digital compact laser disk media."<sup>104</sup>

### 5.2.1 Limitations of Current Systems and the Coming of Digital

Many problems of analog cellular, including its high prices relative to traditional telephone service, capacity shortages, and slow acceptance as a true consumer service, can be traced to the limitations of its analog transmission technology, which "determines to a large extent the cost of the system and the price of the service."<sup>105</sup> The continuing fight in regulatory forums for additional spectrum space, although a valid reaction to capacity constraints by suppliers to protect their analog investment, is a rear-guard action to protect systems that will be supplanted eventually by digital technology.

"The economics of analog cellular simply do not come together to ignite the classic chain reaction" of scale economies, where an increased number of users translates into lower costs per user and thence lower prices, broadening the appeal of the service to bring in more users and setting off another round.<sup>106</sup> Cellular industry prices do not behave according to the typical dynamics of technology, or of utility, industries: "the prices charged have less to do with costs incurred than with *managing demand*. Operators must work with a natural ceiling which is dictated by the amount of spectrum they have been allocated; consequently they will charge as much as the market will bear. Thus there is no reason to suppose that prices will fall—unless new access technologies emerge which provide the connectivity which subscribers need at significantly lower cost [emphasis added]."<sup>107</sup>

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"Estimate of the Loss," p. 3.

<sup>103</sup>Detailed in, e.g., Anthony G. Oettinger, *The Abundant and Versatile Digital Way*, (Cambridge, Mass.: Harvard University Program on Information Resources Policy, 1985).

<sup>104</sup>*Digital Cellular*, pp. 17, 21.

<sup>105</sup>*Ibid.*, p. 134.

<sup>106</sup>*Ibid.*, p. 423.

<sup>107</sup>The Yankee Group Europe, "In Touch: New Access Technologies and Personal Connectivity", (London, November 1990), p. 45.

The technological determinism evident in these views of the cellular industry suggests important caveats. For instance, the history of the spread of digital data communications facilities through the fixed-line telephone network argues for longevity of older technology. With the first digital transmission facilities in the mid-1960s came predictions that analog was dead and modems for connecting digital computers with analog transmission facilities would soon be extinct. Nearly thirty years later, analog data communications, and the modem, are very much alive. Installed "analog cellular networks [may] be the modems of the 1990s, showing prodigious powers of survival in the face of digital competitors."<sup>108</sup> Such survival will depend on the pricing, functionality, and deployment speed of services based on newer technologies.

A second caveat on the speed of digital implementation is that the technology called "digital mobile radio" is not monolithic but continues to advance too rapidly for standards to be solidified with confidence. The paradox of applying digital technology to communications systems is the contrast between fast development of new capabilities but slow evolution of widespread networks that require interconnectivity through standards or other means of compatibility. Building a large-scale digital cellular infrastructure will force a supplier to make a technology choice and stick with it, even as the price-performance of all digital technologies continues to improve.

Both general types of digital mobile telephone systems may eventually gain acceptance as successors to analog cellular systems. The first is exemplified by the European GSM system<sup>109</sup>, which uses the same cell sizes and basic network structure as current analog cellular systems but with digital handsets and transmission techniques. Several such technologies, using different digital coding techniques, are under development and will initially be implemented during 1993 by capacity-bound U.S. cellular carriers.

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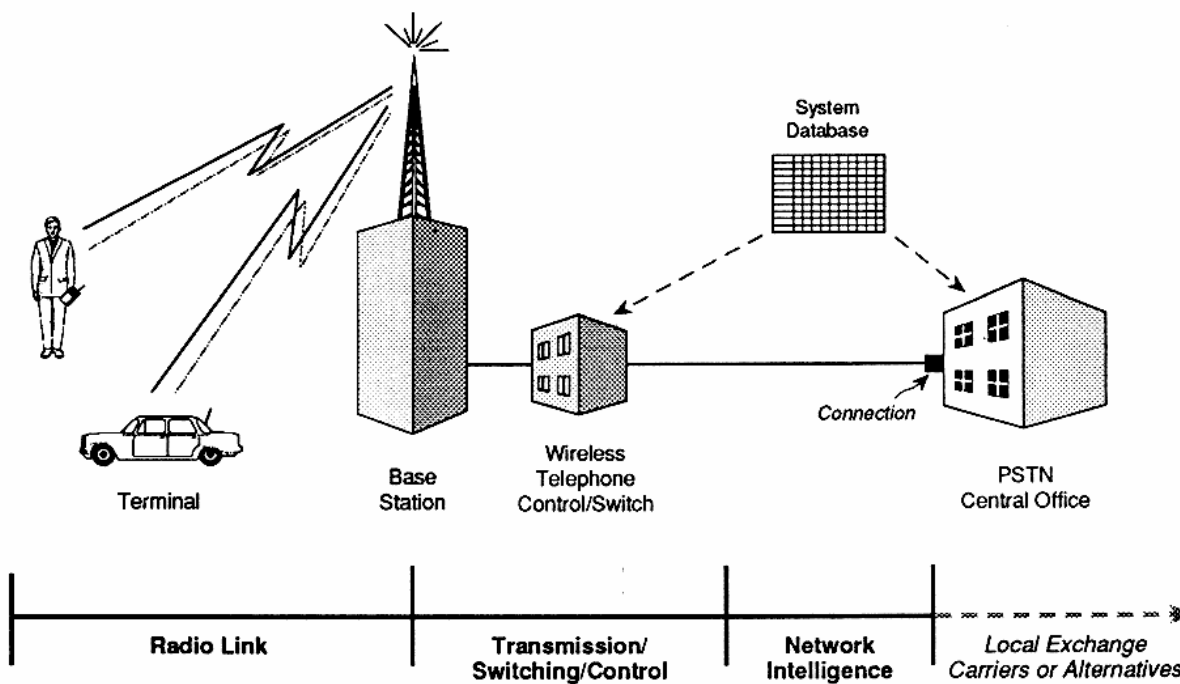
<sup>108</sup>Ibid., p. 49.

<sup>109</sup>GSM originally stood for Groupe Speciale Mobile but has been changed to Global Standard for Mobile, reflecting the EC's hope that the technology would be adopted by American and Japanese digital cellular suppliers.

The other type of digital mobile communications systems falls under the umbrella of Personal Communications Network or Service (PCN or PCS – neither term is sufficiently well-defined to distinguish one from the other). The system architectures and capabilities of proposed PCS systems largely duplicate those of traditional cellular, except for several differentiating characteristics: pocket-sized, inexpensive handsets, lower power requirements, and "micro-cell" system architecture (cell radii of less than one-half mile). Figure 5-1 shows the basic architecture of a PCS (or traditional cellular) network. As cellular evolves towards digital technology, it looks more and more like "PCS": a mobile communications system capable of providing universal and completely portable connectivity – a truly personal phone. In its 1992 state of development, PCS technology is limited; hand-off between micro-cells cannot occur, for example, when the telephone is in a car at highway speeds.<sup>110</sup>

Figure 5-1

Components of a PCS Network



Source: Adapted from Michael Noll, *Introduction to Telephones and Telephone Systems* (Norwood, Mass.: Artech House, Inc., 1988), Figure 7-2, p. 122. Graphic: Derrick C. Huang, *Up in the Air — New Wireless Communications* (February 1992), Figure 4-1. © 1992 President and Fellows of Harvard College. Program on Information Resources Policy.

<sup>110</sup>For details on PCS system architecture, see Huang, *Up in the Air*.

As hand-held cellular phones have come to dominate the market in the early 1990s, cellular service has begun to look increasingly similar to proposed PCS architectures. The biggest change in the mobile communications market from PCS will be the availability of new spectrum space and the probable introduction of another set of competitors. Various technologies and system architectures are being explored for PCS, which, coupled with ongoing debates over digitizing traditional cellular systems, make the technology picture in mobile extremely fluid. Among other impacts, uncertainty has temporarily given potential investors cold feet; the U.S. venture capital community is not rushing to finance the enormous capital requirements of PCS-type systems: "It isn't clear yet who will make money from PCN in the near term.... The market experience in the U.K. of predecessor services [CT-2] is mixed to date; the future technology and frequency choices are unclear; and the financial requirements for building widespread 'microcell' networks are enormous (at a time when debt is hard to secure)."<sup>111</sup>

### **5.2.2 Early Implementations**

Europe is providing the initial proving ground for dealing with two interrelated issues in the transition to digital cellular, standardization and migration. In 1992, Europe has five national analog cellular systems, none compatible with another. The EC has mandated the GSM digital system as a pan-European standard in order to offer Community-wide connectivity and the accompanying economies of scale for cellular infrastructure and handset equipment manufacturers. GSM systems are designed to operate with the same cell size as current analog systems and therefore offer little improvement in features and capability, and will initially have bulkier and more expensive telephone handsets. Without the strict regulatory mandate (and possibly a subsidy for service prices), European cellular users may remain on their existing analog networks.

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<sup>111</sup> Accel Partners, "Telecommunications Industry", (Princeton, N.J., undated mimeograph), p. 4. Construction costs for a PCS network in the U.S. are unknown; in the U.K., an estimated £4 billion (roughly \$7.5 billion) would be needed to construct a national microcell network. See Huang, *Up in the Air*, pp. 66-67.

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Several factors are likely to aid the eventual migration to GSM: the European "roamer" that needs EC-wide connectivity; existing analog systems that are out of capacity; and the countries in the EC that never built analog systems, and will go directly to GSM. In addition, GSM will be offered competitively; countries that today have a monopoly cellular supplier will authorize additional entrants that will implement GSM-based cellular networks. Of these factors, only the capacity issue will be relevant for the migration to digital in the U.S., but given the capacity limitations in major metropolitan cellular systems, the migration of European countries toward the digital GSM technology could provide valuable lessons for U.S. cellular operators. How newer microcell technologies, with much smaller and cheaper handsets, will fit into the GSM technology framework remains to be determined.

Europe, and the U.K. in particular, may provide the U.S. with experience and examples as the cellular industry enters its digital technology phase, reversing the relationship of the 1980s. In 1989, the U.K. licensed four operators for simple PCN-type services (known as "telepoint") which proved market disasters. The three consortia licensed to enter the U.K. PCN market in 1992 have been reconfigured, and despite regulatory go-ahead and spectrum space, PCN still awaits launch in early 1993. Even so, both PCN and digital cellular (GSM) systems are or will be on the air in Europe before the U.S.; as was the case with analog cellular, the country that acts as a fast second, rather than a first mover, may have a less painful experience.

### **5.3 The Regulatory Framework**

The regulatory issues to be faced in the transition to the next generation of mobile telephone systems fall into three categories: spectrum allocation and assignments; market entry and competition; and standard setting and technology migration.



### 5.3.1 Spectrum Allocation

Several factors may mitigate the contests for new spectrum needed to implement microcellular mobile telephony in the U.S.:

- a broader recognition, in and out of government, of the importance of spectrum management issues, in particular, a perceived association (however tenuous in fact) with economic competitiveness;
- the perception of significant economic losses associated with regulatory delay in establishing cellular networks the first time around;
- the licensing mess created by hearings and the subsequent lottery process, which has made spectrum auctions a viable alternative politically.

In the 1990s the issue of allocation and usage of radio spectrum is much more visible than twenty years ago. A 1990 cover story in *Business Week* expressed the worry that

Nations that haven't used their airwaves as extensively as the U.S. has can adopt new technology faster because they have more bandwidth available.... If other countries with less crowded airwaves permit new services first, their companies may be first to develop advanced radio gear--and their economies the first to benefit from better communications. Britain has taken the lead in new mobile communications such as PCN by making room on turf once reserved for TV.<sup>112</sup>

A similar theme was sounded a year later in *Forbes*, in an article that claimed that regulatory restrictions on spectrum availability have constrained the innovativeness of American industry and that spectrum limitations are a function of government control of the resource: "any resource can be made scarce if its price is artificially controlled or its availability restricted."<sup>113</sup>

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<sup>112</sup>Mark Lewyn and Peter Coy, "Airwave Wars," *Business Week* 3170, July 23, 1990, pp. 40, 53.

<sup>113</sup>George Gilder, "What Spectrum Shortage?," *Forbes* 144, May 27, 1991, p. 328.

Because of the widely recognized importance of spectrum management in developing new communications technologies and the example of regulatory delay and resulting economic losses in the introduction of cellular, there is intense interest in improving the process in several directions: getting spectrum resources to those who can use them most efficiently, encouraging the development of new technologies (through preferential treatment for entrepreneurs with new service offerings—the "pioneer's preference"), and, not incidentally, raising revenue for the deficit-burdened federal government. All three criteria are at least partially satisfied by the notion of spectrum auctions, which are theoretically also speedier than comparative hearings or lotteries. A working paper done at the FCC in 1985 estimated that an auction would complete the regulatory process in just three months, as opposed to one year for lottery and eighteen months for hearings.

The auction of a spectrum license is supposed to guarantee that the most economically efficient user will obtain the resource by bidding highest. In practice, limitations must be adopted to prevent such abuses as spectrum "warehousing," in which a firm bids successfully for spectrum but does not use it, freezing out potential competitors and new technologies. In addition, the bias of auctions towards the deep pockets of large companies and the seeming indifference to public interest considerations, must be overcome through, for example, spectrum set-asides for start-up companies, nonprofit organizations, and the like. Despite the limitations, the auction concept has gained bipartisan support in Washington, as embodied in the Bush administration's proposed Emerging Telecommunications Technology Act, which earmarked 200 MHz of spectrum space to be assigned by the FCC using competitive bidding "within fifteen years, with 30 MHz of that spectrum to be made available on an expedited basis (1994-96)."<sup>14</sup> Even if that bill had been passed early in 1992, the lead time required to develop equipment and build network infrastructure means that the mid-1990s would be the earliest point for the introduction of commercial services in that part of the spectrum.

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<sup>14</sup>HR 1407, p. 25.

### **5.3.2 Market Entry and Competition**

Parallel to the vast developments in communications technology since the early cellular days has been the widespread introduction of competition into a previously monopolized industry. In both the U.S. and the U.K., mobile communications was one of the first segments of the industry to be structured competitively (see Chapters Three and Four), but "structured competitively" seems increasingly self-contradictory. From the start, regulators have managed the industry, creating and nurturing duopolies. Without price competition between service providers, and without technological innovation in cellular service provision (unlike the competitive free-for-all in the cellular *equipment* market), the theoretical benefits of competition have not been realized by cellular customers.

The duopoly market structure was a compromise between single-supplier efficiencies – a network of optimum scale, efficient use of spectrum, and minimum investment for network infrastructure – and the efficiencies of competition, such as price competition and service innovation to attract more customers. Regulators in both the U.S. and the U.K. view the number of competitive suppliers as a key measure of a market's health, so they will probably act to insure some minimum number of suppliers of new mobile services, without assuming a desirable maximum number except as dictated by spectrum availability.<sup>115</sup> As the British telepoint experience made clear, however, too many prospective suppliers can freeze investment, because the potential demand and returns may not be large enough to sustain all the participants.

### **5.3.3 Standards and Technology Migration**

The role of technology standards is closely related to the competitive structure of the industry. Standards will be a key question for regulators attempting to balance the views of competing industry stakeholders: either force early standardization, with the attendant benefits of lower cost and higher volume production for equipment suppliers

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<sup>115</sup>See Huang, *Up in the Air*, p. 51.

(theoretically passed on to consumers) and less customer confusion, or let new and potentially incompatible digital systems proliferate, to stay on the price/performance curve of underlying component technologies and avoid the hazards of "picking winners" early. Despite the telecommunications industry's long-standing preference for early standardization of emerging technologies, more recent experiences (e.g., the nearly stillborn ISDN standard) influence regulators and suppliers to keep options open, especially early in the digital transition. A proliferation of digital cellular systems using different technology approaches may not be the connectivity nightmare it first appears because one fundamental attraction of digital representation or transmission is ease of transformation into other formats. Connectivity of dogs and cats, as long as both are digital, can be accomplished with relatively cheap and easy "cadog" (or "docat") transformers.<sup>116</sup>

The structure of the central office telephone switch market is instructive in this regard. Despite efforts by the major switch manufacturers (Northern Telecom, AT&T, Ericsson, et al.) to standardize the requirements of the world's telephone companies, many different physical, interface, and software compatibility standards are used, and the suppliers adapt their products to meet them. Manufacturers are only helping themselves when they argue "for the benefit of future generations of customers, we need uniform worldwide ISDN standards for cellular technology."<sup>117</sup> The phrase "we need" – "we" being AT&T and its manufacturer brethren – is telling.

In a 1987 Notice of Proposed Rule Making the FCC recognized the dangers of specifying a technology standard too early:

We believe it would be inappropriate at this time to embark on a proceeding to select technical standards for future cellular systems. Such a course would be premature given the early stage of development of new cellular technologies, and is likely to discourage technical innovations.... We believe that a particular technology, or combination of technologies, may ultimately gain widespread

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<sup>116</sup>A.G. Oettinger coined this terminology that makes the point easy to grasp. "Cadogs" can work for digital-to-analog connectivity as well, just not as easily or cheaply.

<sup>117</sup>Ian Ross, then-President of Bell Laboratories (1986), quoted in *Digital Cellular*, p. 427.

marketplace acceptance and service as a new standard for the next generation of cellular systems.<sup>118</sup>

In this statement the FCC recognized the nature of digital technology, in which product life-cycles are inherently shorter, as well as the innovation-freezing nature of *de jure* technology standards.

#### **5.4 Conclusions**

A fundamental increase in the usefulness of the ubiquitous telephone network by a shift in its primary mode of service delivery from fixed-line to radio-based mobile is intellectually attractive and appears technologically feasible, but clearly it will take place over a number of years (or decades) and in a piecemeal fashion. The full set of battles fought to bring about the establishment of cellular mobile telephone service may not recur, but the larger and more diverse supplier population of the telecommunications industry, and the faster pace of technological development in comparison with that of twenty years ago, would seem to assure another lengthy process. How well regulators can adapt to these conditions and apply lessons from the original debates over cellular will in part determine the success of the evolution of new forms of telephony.

Widespread recognition of the regulatory problems encountered with spectrum allocation and assignment during the first phase of cellular development makes their repetition less likely. In particular, spectrum auctions may speed up the licensing phase of the next round considerably. The problems of technology standards and market structure also need to be addressed in regulatory forums; regulators in both countries lean toward diversity of technology and relative ease of market entry, suggesting more market-oriented policies on these two issues than occurred during the initial cellular implementations.

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<sup>118</sup>Quoted in *Digital Cellular*, p. 430.

Regulators in both countries also must take into account the growing presence of "outside" or international influences, especially the U.K. as the EC becomes the focus for business-government relations. The EC's view of mobile as the best way to break down telecom monopolies in many of its member nations will undoubtedly influence the future structure of the telecommunications industry in the U.K.. Other supranational organizations, such as the ITU and GATT, will influence the structure of many aspects of the telecommunications industries in the U.S. and U.K. The 1992 WARC narrowed the spectrum options of policymakers in individual countries in services including both satellite and terrestrial mobile telephones.<sup>119</sup>

Uncertain demand and technology choices, and a more fragmented industry structure in the U.S., mean that Europe, and the U.K. in particular, took an early lead in the reinvention of mobile telephony. This has caused concern in the U.S., but perhaps the clearest lesson from the history of cellular is that the first mover does not necessarily gain an advantage either in technology nor in the pace of consumer acceptance and industry growth. The preliminary steps taken in the U.K. and the EC should be seen not as a loss of American leadership in mobile communications technology but as an advantage, as additional information for policymakers about the opportunities and hazards in implementing new communications infrastructure.

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<sup>119</sup>"Tug of WARC," *The Economist*, March 7, 1992, p. 89.