

# III.9

## **Spectrum Management: Private Property Rights or Commons**

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### INTRODUCTION

The growing demand for mobile services has led to a world-wide reconsideration of established methods of spectrum management. The potential flaws of the dominant administrative licensing process are known and include rigidity, long delays and patterns of over- and under-allocation of spectrum to uses. Following the general trend towards a more market-based organisation of the information and communication industries, an increasing number of countries has replaced administrative licensing procedures with spectrum auctions. However, a much broader range of alternative approaches, including more radical proposals to privatise spectrum but also strong voices in favour of creating a true spectrum commons, is being discussed. The specification of the rules governing the use of spectrum has implications for the evolution of the wireless industry. Sound spectrum policy will have to understand this nexus and the advantages and disadvantages of alternative regimes. This contribution offers a preliminary exploration of these issues.

### A PROPERTY RIGHTS PERSPECTIVE

Efficient spectrum management has to address three interrelated problems:

1) the allocation of the correct amount of spectrum to certain uses or classes of uses; 2) the assignment of frequencies to certain users or groups of users; and 3) the adjustment of these allocations and assignments as technologies and markets evolve over time. Inefficiencies can be introduced at any one of these levels.

Inappropriate attention to the allocation of spectrum will distort otherwise efficient assignment methods (Melody 2001b). Even if an efficient allocation is established at a particular point in time, it will have to be continually adjusted to reflect technological advances and changing market conditions. In general, new applications in hitherto unused frequency bands pose fewer problems than modifications in occupied spectrum bands, as existing users will have to migrate to other frequency bands (or be shifted off the air entirely) and possibly compensated for stranded investment.

Property rights are complex bundles of rights and obligations. Spectrum management regimes also define different bundles of property rights. Three principal spectrum management regimes are possible: 1) full privatisation;

2) common property; and 3) open access. These approaches differ in how they define rules for spectrum access and use; management of a certain band; exclusion of others from that band; and alienation, that is the right to sell or lease spectrum to others. In a private property regime the owners of spectrum can execute all these rights. In an open access setting, everybody would have access to the spectrum resource but no user would enjoy any of the other rights. Although these models recently have attracted an increasing number of supporters, they are the exception rather than the rule. The most widespread approach is the treatment of spectrum as a common property resource.

While spectrum differs in important respects from other forms of common property resources, such as fisheries or forests, important insights can be gained from the vast literature on common resources. Various specifications of property rights are possible within a common property framework (Stevenson 1991; Ostrom 1990). Schlager and Ostrom (1993) identify four different roles based on the assignment of rights: authorised users, claimants, proprietors and owners. Authorised users only have the limited right of access to and use of the resource. Claimants have management in addition to usage rights. Proprietors also have the right to participate in decisions excluding others from the use of the resource. Owners have all these rights plus the right to sell or lease their use. The only difference to pure private property is that common resources usually restrict ownership rights in the interest of the common good. Thus, the governance options for spectrum management within a common property framework span a range that touches on private property at one end, and on open access at the other. A key question for spectrum management is how efficient these alternative are and how they influence industry performance.

#### PRIVATE PROPERTY AND OPEN ACCESS

After early proposals to establish private property rights for spectrum in the 1950s (Herzel 1951; Coase 1959) were largely ignored, this model is receiving renewed attention in more or less radical versions. Privatisation requires the initial assignment of private property rights, typically using a market-based mechanism such as spectrum auctions. For existing licensees, Spiller and Cardilli (1999) have suggested the auctioning of warrants to convert existing usage privileges into ownership rights. In principle, the private property model can solve the three problems of spectrum management simultaneously as market forces drive allocation, assignment and dynamic adjustment.

So far, there is only limited experience with privatisation of spectrum in New Zealand and Guatemala. However, serious conceptual objections were raised,

including the pervasiveness of externalities, the non-competitive nature of wireless markets and the fact that large portions of spectrum are used by non-profit organisations or for purposes that defy market pricing (Melody 1980). Moreover, where international frequency coordination is necessary and spectrum is allotted to regions, a private market mechanism may raise serious equity issues. Whereas some of these issues probably could be overcome by appropriate institutional design, privatisation does not offer a panacea.

The introduction of spectrum ownership could also alleviate some of the potential problems of auctions, namely that the licence fee affects the emerging market. It is true that under ideal conditions, such as the existence of perfect capital markets, bids at spectrum auctions would reflect the present value of spectrum to a potential licensee. Licence fees therefore are only transfers of rent from the private to the public sector and do not affect subsequent prices or investment (Cave and Valletti 2000). However, both theoretical and empirical objections were raised against this stance. Building on work by Sutton (1991), Gruber (2001) showed that under real world conditions of imperfect information and imperfect capital markets bids may systematically deviate from their competitive level and, consequently, increase concentration in the post-auction market. In an empirical study of the GSM and Personal Communication Service (PCS) market, Bauer (2001) showed that licence fees increase the cost of supply and thus increase the market price. These potential disadvantages must be netted against the advantages of auctions in assessing their overall efficiency.

Another avenue to utilise market forces is advocated by Noam (1998). He endorses opening access to spectrum but proposes the introduction of market-based fees to reflect the opportunity costs of spectrum. This model would allow the establishment of futures and derivative markets in spectrum and hence would allow users to sign long-term contracts. As it would convert sunk licence fees determined in an auction into variable payments determined in spot and future spectrum markets, the proposal would avoid some of the potential distortions of auctions. A key problem in this approach is that so far no workable mechanism has been devised for the collection of the spectrum fees.

## SPECTRUM AS A COMMONS

Throughout most of the history of radio communication, spectrum was treated as a common property resource. Licences typically give temporary, exclusive usage privileges to an individual or an organisation as long as certain eligibility criteria are met. Most licences also can be transferred to third parties as long as these meet the same eligibility test. This transferability is not equivalent to the right of

alienation granted by full ownership rights. However, licensees typically do not have direct rights to participate in the management of the spectrum resource nor do they have a direct voice in determining who should be excluded from spectrum use. In terms of the common property research, the role of spectrum licensees resembles the role of the authorised user. Surprisingly, empirical studies of common property arrangements have found that authorised user models are less efficient than proprietor or owner models, as the latter have higher incentives to invest in the development of the resource.

It is therefore a legitimate question whether a modification of property rights within the common property framework would improve the efficiency of frequency management. One particularly interesting suggestion is the reliance on more community-based arrangements for spectrum management. Two rationales can be associated with these proposals. It is first pointed out that recent advances in spread spectrum technology eliminate the necessity of assigning a specific channel to a user. Rather, the technology of ultra-low power code division multiplexing allows the orderly use of broad spectrum bands by competing uses and users. As the efficiency of spread spectrum technology increases, ever more applications may be able to use the same spectrum band. This would allow a radical reorganisation of spectrum management. Exclusive use privileges would not be required for an orderly use of spectrum; they would even become unconstitutional (Benkler 1998). Spectrum could be shared and managed by the user community based on rules developed in a decentralised fashion (Buck 2002 forthcoming).

Second, the proponents of this position point to the specific nature of innovation and the new organisation of the production process in advanced information and communication industries. Innovation in the information industries is often cumulative, with developers of information goods and services highly dependent on access to previously created knowledge. Likewise, there is anecdotal evidence and a swelling conceptual debate linking the speed of innovation on the Internet to the availability of an open access platform (Bar et al. 2000; Lemley and Lessig 2001). The next generations of mobile communication will resemble the value chain in the fixed Internet and a large innovation impetus is expected from open access to the wireless network platform. Unfortunately, the use of auctions will likely increase the incentive of network providers to close access to their own affiliates, potentially reducing the overall dynamics of the entire sector. Therefore, the development of spectrum as a commons is seen as crucial in supporting innovation processes and maximising the benefits from advanced mobile communication.

The US Federal Communications Commission has designated more than 300 MHz of spectrum in the 2 GHz and 5 GHz bands as unlicensed. Critics point out that the experiments with unlicensed spectrum have resulted in low investment and local overuse. These observations would seem to indicate the weaknesses of the commons model of spectrum management. However, it seems that the major flaw of unlicensed spectrum is the lack of rules that would allow its systematic utilisation. Buck (2002 forthcoming) discusses eight meta-rules for a spectrum commons, including a clear definition of boundaries, congruence between appropriation conditions and local conditions, collective choice arrangements and appropriate monitoring procedures. Based on general insights from the commons literature, these rules could create a structured environment for spectrum use without creating exclusive rights based on financial strength.

Defined spectrum commons are a promising alternative institutional arrangement for addressing the three issues of spectrum management. Like privatisation, in principle, they could address allocation, assignment and dynamic adjustment simultaneously without the disadvantages associated with financially-driven spectrum markets. Moreover, they would allow modification of broad principles of spectrum management based on the needs of the local user community. However, this approach is afflicted with potentially significant transaction costs. These will, in part, depend on the state of technology and application in question. If an application requires national or even international allocation of a specific band, a commons-based approach may be too cumbersome and not be very different from the status quo of International Telecommunication Union spectrum management. If local mobility and interconnectivity are the main objectives, however, the model will likely be superior to the existing administrative process and the market-based alternatives.

## TOWARDS A COMPARATIVE ANALYSIS

Despite the strong push towards privatisation, spectrum policy has a choice of a range of options. As this discussion illustrates, these approaches define systematically different sets of property rights. In turn, they will influence pricing, investment and innovation processes in the wireless industry. Given the vast range of uses of spectrum, it is unlikely that one model will suit all situations. Both the market-oriented models as well as commons-based proposals have their own advantages and disadvantages. It will be necessary to carefully monitor the experience with these approaches. The coexistence of multiple institutional arrangements for spectrum management should facilitate a better understanding of their impacts for the evolution of wireless markets.