Chapter 6
The Impact of Regulations on the Business Case for Cognitive Radio

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ABSTRACT
Cognitive Radio holds an interesting promise for improved utilisation of the radio spectrum. However, there is a considerable degree of uncertainty regarding the potential application of cognitive radio. One of the reasons for this uncertainty is the need for changes in the regulatory regime to allow for more dynamic forms of spectrum access. In addressing the necessary changes in regulations, the regulator should be well aware of the perspective of the entrepreneur. Eventually, it is the entrepreneur who invests in CR technology and thereby realises the goal of improved utilisation of the radio spectrum. This chapter addresses the impact on the business case for cognitive technologies of the regulatory regime and the choices on the fundamental CR technology that regulators will have to make.

INTRODUCTION
Cognitive Radio (CR) and Cognitive Networks (CN) are promising innovative technologies that can be used to improve spectrum utilisation. Especially the ability of cognitive technology to provide access to spectrum that is already assigned to other user(s) or usage, but partly unused when considered on a time or geographical basis holds an interesting promise. This CR capability is considered as highly valuable for the introduction of new radio communication services, as essentially all (usable) radio spectrum has been allocated and assigned. However, there still is a large degree of
uncertainty associated with CR that will have to be mitigated before successful, large scale deployment may be expected and the potential economic and social value can be realised.

One of the reasons for this uncertainty is that the current regulatory model is not compatible with this new technology. In the current model, radio spectrum is divided into fixed and non-overlapping blocks, which are exclusively assigned to different users, services or wireless technologies. Regulatory provisions are needed to align the regulatory model with the new capabilities of cognitive technology to realise the goal of more efficient and flexible utilisation of the radio spectrum.

In addressing the necessary changes in regulations, governments should be well aware of the perspective of the entrepreneur. Ultimately it is through the actions of the entrepreneurs, individually and collectively, that the realisation of improved utilisation of the radio spectrum can become a reality.

In a somewhat simplistic view of the world, governments, as custodians of the radio spectrum, allocate and assign rights to the use of the radio spectrum with an aim of efficient use of the radio spectrum, while firms develop products and services that use radio waves with an aim to maximize profit. Hence, governments and firms have different roles and different objectives. Nonetheless, in the realisation of their objectives they are highly interdependent. If as a result of profit maximisation considerations firms decide not to use the radio spectrum as intended or decide not to use the radio spectrum efficiently, the government fails in realising its governance objectives related to the radio spectrum.

In general firms will only decide to invest in new products and/or services if they can expect a future return. These investment decisions are driven by three major considerations: (1) the prospective demand and willingness to pay for new products and/or services; (2) the magnitude of the investments required; and (3) the degree of risk or uncertainty involved.

The profile of the business case, in terms of depth of investment and the recovery period required, will influence the ability to obtain the necessary (external) funding. As such the business case is especially challenging for communication services provisioning that requires an associated infrastructure roll-out. In these cases the right to exploit the radio spectrum over a significant period of time and on an exclusive basis will contribute to the willingness of entrepreneurs to invest, as it lowers the degree of uncertainty.

The dilemma that governments are now facing is that, since the liberalisation, prevailing policy suggest a technology neutral assignment of radio spectrum to improve dynamic efficiency, while enabling the deployment of a specific technology, i.e. cognitive radio technology, is of public interest to achieve more efficient utilisation of the radio spectrum. It appears that in this light regulations to allow deployment of a specific type of CR technology in parts of the radio spectrum that would otherwise be underutilised or not used at all is justified (Lemstra, Anker et al., 2011).

The subsequent challenge governments will be facing is the choice among some of the more fundamental features of CR, such as sensing and/or the use of database and the band in which the CR is allowed to operate. Their choices will need to be well informed as their choices play a pivotal role in the business models of the entrepreneurs. The way governments allocate the use of radio spectrum to particular radio communication services on the (inter)national level and assign the rights to use the radio spectrum on the national level is determining the viability of the business case for particular radio communication products and services. In this respect there is the issue of ‘the chicken and the egg’: certain types of radio spectrum rights assignment facilitate certain types of usage, while certain types of perceived usage will require a particular type of assignment. In other words, entrepreneurs are reluctant to invest in new products and/or services based on CR technology because of the degree of regulatory