Submission to the Spectrum Review

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Summary[1] -

In view of the terms of reference specified in the Spectrum Review issues paper, I make the following submission.

1. **Simplifying the framework:**

- **Objects of the Act should be fewer. Dynamic efficiency is the key goal of spectrum management.**
- **Planning, assigning, allocating and re-issuing should be devolved to market operations provided spectrum markets mature and spectrum rights are redefined.**
- **Licensing is only required for initial assignment of rights. Government authorisations are not necessary in a deregulated market-based system.**
- **Technical frameworks can be designed by title owners. Interference management obligations should be built into owners' property rights, as in German law.**

2. **Improving framework flexibility:**

- **Compliance with ITU band regulations can be done through market players and their industry associations.**
- **Spectrum sharing should be used where possible through spectrum commons but not for high value, high power services.**
- **Where spectrum commons are not optimal, the framework should rely on spectrum titles traded on competitive market. Market transparency provides the necessary flexibility for developers of new technology.**

3. **Ensure efficient allocation/use, incentivising users:**

- **Efficient allocation and use of the spectrum is important in the short-term (allocative efficiency is the most important of these two objects).**
- **In the long-term economic welfare depends on dynamic efficiency and spectrum access for innovation**
- **Incentivising public and community licensees to manage and trade their spectrum holdings is a key aspect of promoting dynamic efficiency**
- **Licences for service- and technology-neutral applications should be made perpetual to give greater certainty to investors and prospective buyers of rights**
- **Spectrum markets still have to mature. Band managers could become the real estate agents of the radio spectrum. There is a role for government in promoting and ensuring quality standards in band management**

4. **Institutional arrangements and regulatory role:**

- **Regulatory authorities should play a central and pro-active role in the staged transition from a mixed-regulatory regime to an efficient combination of market and commons regime, with more weight on the former.**
- **Regulatory authorities should broadly define and uphold the rights and public interest responsibilities of spectrum tiles.**
- **Regulatory authorities have a key role to play in providing the mediation and court system with the necessary expertise to decide rights and obligations disputes**
- **Technical and legal expertise can initially be accredited and certified by regulators, then eventually handed over to market forces.**

5. **Promote consistency across sectors:**

- **Class licensing could be retained for short-range low-power applications. Alternatively, some (such as those used for WiFi) could be converted to spectrum titles on the presumption that equipment suppliers would buy titles on behalf of their customers. The latter approach improves spectrum valuation.**
- **Apparatus licences that are service neutral (or potentially so) and can be merged or subdivided should be converted into marketable spectrum titles**

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- **A simpler, more consistent approach would yield considerable benefits in terms of improved information flows, reduced transaction costs and certainty for market operators and for innovators' investment decisions.**

6. Appropriate framework for public interest users:

- **The Act adequately defines the subset of public and community users providing critical and life-saving services to the benefit of the community.**
- **Due to the public good nature of these services, the adequate provision of spectrum to these services under the Act should not be reconsidered.**
- **However, more discretion and incentives to maximise the value of the spectrum should be given to these users.**
- **Apparatus licences regularly renewed for these users should be converted into service-neutral tradable perpetual titles.**

7. Whole of government approach to spectrum policy:

- **The overarching strategic vision for spectrum policy over the long-term should be a system independent of government planning in which allocation and price of units of spectrum is decided by market forces.**
- **For low value applications or where transaction costs of market operations are too high, a secondary system of spectrum commons operates as back-up.**
- **A near-term objective is create the stepwise conditions that will facilitate this transition in the long-run, such as redefining rights towards more flexibility and certainty and reducing the degree of planning and control.**

8. Whole of government approach to spectrum valuation:

- **Under a deregulated, market approach to spectrum allocation, spectrum titles should be perpetual and there are no re-issues or renewals (their equivalent consists of new market transactions).**
- **Under a deregulated, market approach to spectrum allocation, the relative value of competing spectrum uses is determined through the strength of demand for the wireless services provided.**
- **Because it is very difficult to construct demand curves for public goods, the relative value of security and life-saving services should not be evaluated through market forces, but it is nonetheless important that public interest users participate to spectrum markets and develop expertise in the valuation and trading of their spectrum resources.**

I. INTRODUCTION

The *Radiocommunications Act 1992* (the Act) is the last set of major legislative reforms made to spectrum policy in Australia. Enacted in 1993 it added market and commons mechanisms to the prevailing command and control orthodoxy that had prevailed until then.

It did so with the explicit aim of maximising the efficient allocation and use of the radio spectrum, together with the pursuit of other public interest objectives. Nonetheless, later reviews of the Act, including the 2001 review by the Productivity Commission, identified a legacy of rigidities in the way the spectrum is allocated and managed, partly due to the still large presence of regulatory frictions, poor incentives from market and non-market players and regular contradictions and uncertainties between different objects of the Act. Even in 'beachfront' bands where great efforts have been made to align and maximise public policy objectives, apparatus and spectrum licences still present rigidities owing to the prescriptive basis upon which they were constructed, and improvements could be made through much higher reliance on market forces.

Are the various objects of the 1992 reforms therefore still of application? In the late 1980s / early 1990s the main trademark of spectrum management reforms was the development of Coasian instruments (tradable licenses endowed with leasehold property rights and quasi-neutrality of service) with a view of enhancing allocative and technical efficiency.

The relentlessly accelerating pace of technological change, which so much characterises modern wireless telecommunications industries, has sharpened spectrum scarcity. This evolution could not be anticipated 25 years ago and in this submission I make the point that the heavy regulatory framework and instruments authorised by the 1992 reforms currently accentuates rather than relaxes spectrum scarcity. Legislative reforms should aim at transitioning Australia's regulatory arrangements towards a 'lighter' spectrum management framework with a sharp reorientation of the object of the Act towards dynamically-efficient objectives for public policy.

Since 1992 wireless markets that use the radio spectrum as an input have changed considerably. Spectrum usage is generating considerably more economic activity than it used to and the value of internationally harmonised radiofrequencies has increased dramatically. New communications technologies such as digital television (DTV) and digital radio (DAB+, DRM), wireless internet standards (4G) and their many underlying technologies, and spectrum sharing technologies such as cognitive radio (CR) and Ultra Wide Band (UWB) have all emerged after the Act. Cognitive radio technologies, to provide but one example, were developed in the wake of several influential papers by Joseph Mitola [1-3], written about a decade after the HORSCOTCI review that lead to the Act in

1992. The pace of change in technology, applications and adoption of new business models has considerably accelerated over the last two decades.

Although the Act has more than doubled in size since 1992 most of its additional provisions are related to specific policy proposals (such as digital radio) and there have been no economically significant reforms of the Act since 1992. Economists in Australia [4, 5] and in similar contexts overseas [6-8] have regularly pointed out that current spectrum management regimes consisting of regulated mixed regimes (combining command and control, marketed property rights and commons approaches) still presented many rigidities and could be improved upon.

The underlying argument is that regulation is a source of 'artificial' spectrum scarcity. First, this is due to delays and uncertainties associated with obtaining authorisation (a licence) for operations, changes of service or technology or technical frameworks, ensuring compliance etc. By contrast, in a purely deregulated market setting, regulators set rules and authorisations only for the bands that they own. In other bands, these frictions can be permanently removed by defining property rights in terms of acceptable levels of received or transmitted interference and then let markets juggle the supply, demand and valuation of these rights, with the courts system as back-up to protect against infringements of these rights. This is essentially how the management of most scarce but renewable public resources, such as land, water and forests, operates.

Second, where regulators have jurisdiction over certain markets and technologies their coercive powers are inevitably courted by market participants to intervene on behalf of their corporate objectives at the expense of others. Regulation rarely responds directly to corporate lobbying but the process of listening to all sides with a vested interest in a portion of spectrum, evaluating the relative merits and challenges (including judicial ones) through submissions, deliberations and resubmissions is typically very time-consuming and imposes large rigidities onto the technology-to-market process.

It is timely then to question whether the overall spectrum management framework enabled and developed under the Act still enables commercial, public and community users to satisfy their spectrum needs in a 'just-in-time' fashion. It is also timely to question whether the outcomes sought by the Act (as set out in the 'object' of the Act) are still relevant and provide authorities with the right set of incentives to leverage opportunities for efficient use of the radio spectrum.

II. MANAGING THE SPECTRUM: A CHANGING LANDSCAPE

THE CONTEXT OF THE 1992 REFORMS

Prior to the 1992 reforms, Australia's spectrum management regime followed a standard administrative licensing model largely premised on the needs and requirements of the broadcasting, telecommunications and transport industries and government services such as defence and law enforcement. That environment was characterised by few players, little transparency from decision-makers and a relatively slow pace of technological innovation (with colour and digital modulation as notable milestones). As in most other countries provision of pre-ICT services was still the preserve of government-regulated monopolies.

Increasing spectrum demand for other commercial applications prompted the House of Representatives Standing Committee on Transport, Communications and Infrastructure – (HORSCOTCI) to inquire into and make recommendations about spectrum management that were implemented through the Act in 1992.

These reforms made administrative licensing (apparatus licensing) more flexible, auctionable and tradable but, more significantly, the reforms introduced a property-rights supported market-based licensing instrument (spectrum licences) for high market-value services and a commons-supported unlicensed instrument (class licences) for applications with unlikely potential for interference.

This 'trichotomic' licensing structure was a by-product of the microeconomic reforms of the Hawke-Keating era where policy reform was aimed at breaking-up government-led monopolies in utilities and increase competition and contestability in the use of public assets and resources. The Act's requirement to make efficient allocation and use of the radio spectrum fully reflects these new policy drivers: improved apparatus licences' flexibility and introduction of spectrum licences would enhance allocative efficiency through market instruments, whereas class licences would promote technical efficiency in the use of spectrum.

Although these reforms were ambitious in the pursuit of the public interest (as proxied by economic efficiency and subsidiary objectives under the Act) they did not prove as significant for airwaves deregulation as might have been surmised. Ten years onwards, in its 2002 Inquiry the Productivity Commission for instance noted that "There is little dispute that clear and substantial market failures in the form of interference warrant some form of intervention in the management of spectrum" (p. LVIII) but that "despite the market-based reforms of recent years [1992], the regulatory framework is still highly prescriptive. It includes spectrum plans, frequency band plans, mandatory standards, and licences with varying degrees of technical constraints, all of which may hinder competition".

Part of the perceived inadequacy of the goals pursued by the Act and the spectrum allocation methods developed under it stem from the radically changing market environment over the last two decades - particularly the ever increasing pace of technological innovation.

THE 21ST CENTURY CONTEXT

The wireless environment has witnessed considerable changes relative to the 1992 context; new generations of mobile telecommunication standards have emerged enabling combination of voice and data services, digital standards-enabled convergence towards an "evolving ICT ecosystem" of broadcast, network-based and internet-supported applications and services was entirely unanticipated 25 years ago. Simultaneously, a range of overlay and underlay technologies have facilitated new ways of sharing the radio spectrum in ways that could not be anticipated in the early 1990s.

The marked feature of the current context is not the emergence of new technologies (which has always characterised the communications industry) but instead, it is the accelerated pace at which these technologies appear and replace older ones and the ever expanding economic value of communications markets, which bear no resemblance with what it was in the early 1990s.

The huge and rapidly increasing underlying market value of communications standards, driven by insatiable demand for new wireless products and services is of course the main reason why wireless technologies keep appearing in ever shortened waves (or generations). World Radiocommunication Conferences of the ITU (ITU-WRC) once convened every 3 or 4 years to discuss and decide broad international telecommunications regulations and rules now take place at much reduced time intervals.

Acute competition among (and abundance of) standards impose a frenetic pace to the research-to-market cycle. In each wave competing standards are developed, tested and trialled, and then as soon as possible manufacturers need be persuaded of their value for corresponding robust and cost effective equipment to be designed, which itself needs to be technically trialled and consumer-tested for eventual market adoption.

Developing a wireless standard is therefore an increasingly risky business because the eventual market share of the standard is highly unpredictable at the onset and lack of quick mass adoption often dooms the standards to oblivion. The failed course of various digital radio standards or the evolution of the WiMAX standard, initially expected to become a dominant enabler of mobile internet access services are cases in point.

Although these difficulties and developments have been commonly encountered for over two decades now, their incidence has sharpened in the last few years. The role of spectrum availability both at the R&D stage (as enabler of standard and equipment testing) and at market deployment stage (as provider of input certainty for operators) is critical in reducing lead times from innovation to market and thereby influencing the chances of market success for new technologies.

Let us note in passing that new technology can have a double-edged effect on spectrum scarcity: whereas digital and spectrum-sharing technologies have considerably improved the throughput (technical efficiency) of existing spectrum use (reducing spectrum scarcity), newer network technologies such as LTE also require larger spectrum endowments for carrier operations (thereby increasing scarcity).

III. WHY INTERVENE?

RATIONALES FOR GOVERNMENT INTERVENTION

Despite the 1992 reforms, the degree of government intervention in spectrum allocation remains huge: the regulator is still the main authorising, planning and pricing authority for spectrum usage.

It is well acknowledged that the main reason governments regulate spectrum access, allocation and usage worldwide is to foresee and prevent interferences that (by ignorance or design) their originators would not otherwise take into consideration in the conduct of their operations (i.e. a problem of negative externality in production).

Another rationale for government intervention (recognised as object (b) of the Act) is recognition that the spectrum is a key input into the provision of public goods such as defence, emergency services, radionavigation and scientific research. According to this argument ensuring appropriate provision of this input to these key public services to market forces would threaten national security, safety of life resources and domestic scientific capacity. Because public goods cannot be traded on markets, the correct (efficient) valuation of these services would not be recognised through the price mechanism in spectrum trading and the spectrum purchasing power of public operators would inevitable be severely hampered relative to that of commercial operators.

MINIMISING GOVERNMENT INTERVENTION

On the matter of interference control, government interventions are based on engineering solutions, which aim at eliminating or minimising interference through large buffer spaces between adjacent frequencies. As economists have long argued, these solutions are inefficient because they prevent market players to freely determine the acceptable level of received interference for their services when the value of the service justifies the cost of mild interference. As a consequence, the number of users and services is necessarily sub-optimal, regardless of the underlying market structure [4, 9-13].

To some degree, government intervention and planning is driven by the need to meet international coordination efforts through the ITU. These efforts aim at ensuring the inter-operability of equipment and technologies across countries, generating large economics of scale for equipment manufacturers, themselves an important source of consumer benefits for non-manufacturing countries such as Australia. But, as noted in [4] these harmonisation efforts would very likely be provided through market forces in the absence of

government intervention because market players have a strong stake (economies of scale from international harmonisation of equipment) in the supply of band harmonisation outcomes. Why shouldn't investors rather than governments decide about frequency coordination efforts? Is there any evidence that some sort of global market failure argument justifies band harmonisation efforts to be coordinated by government and international agencies rather than market players and their associations?

On the second matter of provision for public and community users, there is of course merit in the concern that unfettered market operations could fail the input needs of these users. But why would public and community operators necessarily need the government to defend their rights to spectrum access through regulation? Why not simply make these public operators owners of the spectrum resources they need to comfortably deliver their services in times of peak demand? In slack times public operators could then freely decide on the terms and quantum of rights they could profitably trade with other prospective users.

Other than by providing rules, incentives, guidelines and safety guards (such as the courts system) governments do not intervene directly in other input markets such as labour, capital or raw materials. In neither of these inputs markets does the Australian government centrally plan access for each user of these resources, rigidly codify what can be done with the resource or how intensively the resource can be used, nor does the government arbitrarily sets the price of the resource.

To some extent government intervention of this type was common practice in the labour and commodity markets of bygone times (e.g. in the days of centralised wage setting) but they no longer have any place in the operations of a modern market economy.

Why is this degree of state intervention nonetheless still resorted to (and so widely tolerated) for the radio spectrum? After all scarcity and externalities characterise the use of almost all natural resources, yet few are subject to the degree of government control that still grips the radio spectrum. Even the trading of property-rights, market-oriented based spectrum licences is still a long way from the flexibility encountered in the trading of grain, water, minerals, forest titles, hours of work, financial securities, real estate, or durable equipment goods.

IV. Achieving efficiency: through regulation or deregulation?

Efficiency dimensions

The three key dimensions of spectrum management efficiency are well-known and consist of: (i) productive efficiency – producing at least (spectrum) cost; (ii) allocative efficiency – allocating the spectrum to highest valued use; and (iii) dynamic efficiency – deploying the spectrum so as to encourage the most desirable level of R&D and innovation [11]. The first definition can also be interpreted as producing the highest possible level of output given a fixed amount of spectrum (technical efficiency), whereas the second definition can alternatively be presented as allocating spectrum to a service as long as the opportunity cost of using one extra unit of spectrum is less than the benefits that unit generates.

Both dimensions (i) and (ii) have been long recognised through object (a) of the Radiocommunications Act, which requires efficient allocation and use of the spectrum. The lack of pecking order amongst these two objects of the Act have at times been a source of contrariety for regulators when they conflicted with one another in practice, for instance in the spectrum-licensed 2.3 GHz band [14] or in the apparatus-licensed 400 MHz band [15]. More importantly, both are expressed as static objectives, that is none of these two efficiency objectives makes due account for the rapidly evolving rate of technological change in ICT industries.

Dynamic efficiency

Market adoption of new standards and protocols is a process fraught with delays, hurdles, uncertainties and inefficiencies. Yet new technologies with new spectrum requirements to test or deliver new services have in the past twenty years often been able to integrate relatively smoothly with existing regulatory requirements – such was the case with Wi-Fi in the class licensed IMT band, personal broadband networks, WiMAX and 3G carrier services in the spectrum-licensed UHF and micro-wave bands. In the case of 4G this is being enabled through a one-off relaxation of spectrum scarcity in the highly congested UHF Band - the digital switchover of TV signals.

There are few reasons to expect to expect seamless transitions of this type in the near-future. On the one hand, spectrum releases of the type generated by the digital dividend are an unlikely reoccurrence. On the other hand, new ICT technologies will often require more power, bandwidth or interference buffering than allowed under existing regulations. They may also need to exploit real-time spectrum sharing opportunities that would be denied them by the licensing conditions of the allocated spectrum.

Given the key roles of technological innovation and market adoption in the particular context of the ICT industry, concerns for the economic costs of spectrum access for technology developers and associated equipment manufacturers should take precedence over static allocative and technical efficiency consideration. The latter may yield economic benefits in the short-term but would require regular recalibration to maintain these benefits in the long-run. As discussed earlier, the rigidities associated with a regulated mixed spectrum management regime such as currently used in Australia under the Act is unlikely to be compatible with the

brisk pace and innovative nature of technological change in the ICT industry.

The Act needs to recognise the long-run as the appropriate time horizon over which to make efficient decisions and set public interest objectives. Under this perspective, dynamic efficiency becomes the key efficiency objective of spectrum management policy. Allocative and technical efficiency objectives are subsidiary short-term objectives, which should be pursued where relevant and in cases of conflict between allocative and technical efficiency, allocative efficiency should generally have priority[14].

TRADING PERPETUAL RIGHTS

For spectrum allocation to become dynamically efficient, spectrum trading itself needs to mature and become more efficient. The flexibility afforded by spectrum trading is key for ICT innovation and transitions to market. Cave and al. (2007) note that "In practice, trading will confer greater benefits in circumstances where innovation is rapid and demand for final services is variable…trading of spectrum will increase once restrictions on use are lifted" [p. 103-4]

Progress in the markets for spectrum rights is needed in terms of information flows (to increase competition and reduce information asymmetries about band quality), multiple traders need to emerge with credentials and experience in spectrum markets, fluidity of property rights (spectrum licences are tradable but they are not truly service-neutral) and particularly in terms of reducing transaction costs.

The regulatory framework defined under the Act has long reached its limits in terms of encouraging spectrum trading, and new incentives are needed to migrate spectrum access and allocation further away from the still rigid and static setting under which spectrum markets operate in Australia.

The Act recognises a role for licensing flexibility, market forces and spectrum trading, but pays no or little attention to the incentives of market players to engage with flexible market instruments.

For instance, the 15 years maturity of spectrum licences reflects a regulatory conviction that long timespans are necessary to generate appropriate (dynamically efficient) incentives for technological investment and infrastructure deployment. Unfortunately arbitrary duration limits may deter both trading and investment. It will deter trading if potential purchasers are concerned that the remaining duration of the licence is insufficient to make a profitable use of the acquired spectrum. It may deter investment in necessary assets for similar reasons, as could be surmised was the reason for lack of network development in the 2.3 GHz Band in the last ten years.

Why shouldn't the maturity of spectrum licences simply be converted to perpetuity to remove all uncertainty about licence renewal or speculations about licence value as a function of remaining years of licence? Perpetuity can be a source of concern when licence conditions fix spectrum usage (earmark the spectrum for specific services). Service fixity is usually driven by international band harmonisation efforts but it can be a large source of inefficiency in a context where demand and technology change rapidly because fixed allocations 'lock in' pre-established standards authorised by government and 'lock out' innovative new standards often long after the pre-established standard has reached obsolescence [16]. With service fixity it is therefore appropriate for regulators to set a time-limit within the terms of the licence so that revisions of use and technology be made on a regular basis.

However, spectrum licences are service and technology neutral; their technical frameworks are built with a specific service in mind but licensees have the rights to modify the service and request corresponding changes to the technical framework. Some apparatus licences, such as the PMTS licences originally designed for the introduction of GSM technology de facto benefit from very similar conditions [17]. Changing services and technology entail significant transaction costs as do most changes in resource usage but at least these changes are not subject to regulatory approval. Why then specify an arbitrary termination date in the conditions of spectrum licences?

Perpetual spectrum rights provide all the right incentives to trade unused spectrum with prospective acquirers, invest in R&D and innovation, and to invest in long-term band development [11]. It also eliminates the wasteful resources licensees devote to lobbying regulators for licence renewal under the most beneficial terms possible. Auction proceeds and renewal fees could then be replaced by annual royalties levied on the ownership of the traded rights [18].

To reduce transaction costs (both in trading and in service reallocation whenever that happens) perpetual licences would have to be fewer than the currently large number of apparatus licences and comparatively lower number of spectrum licences. Less but longer term licences would not necessarily mean fewer users or fewer licensees: in similar way to New Zealand's band management system, owners of perpetual licences could be intermediaries - band managers with or without a user stake in the band - who trade rights to third parties for band access. Perpetual licences would also considerably reduce government input into planning service and technological compatibility amongst users.

AUTHORISATION-FREE

If dynamic efficiency in spectrum usage becomes the primary objective of policy, what is conceivably the largest hurdle to its implementation? How could policy makers quickly allow developers of new spectrum-based technologies, applications, equipment and business models to access the frequencies they need to bring their innovations to the market?

The first impediment currently faced by innovators and developers is the mandatory requirement to obtain explicit authorisation from the regulatory authority. Any potential user of the spectrum needs a licence from the ACMA in order to legally gain restricted access of some form to the frequencies of interest. Of course in many cases, a subsidiary impediment is the non-availability of said frequencies due to prior exclusive assignments to other users.

The requirement for authorisation and licensing rests on a perennial bedrock assumption in the Act that unregulated usage leads to interference and loss of economic value. Is this unquestioned principle still appropriate after nearly a century of centrally planned radio wave management? What if we no longer needed this approach? Or at least, what if increasing spectrum scarcity warranted a different postulate to the licensing control mantra?

Regulators such as the FCC, OFCOM and the ACMA have now long authorised unlicensed or class-licensed operations in several bands. These authorisations have allowed a commons-like deployment of wireless devices such as residential and commercial Wi-Fi networks, PCS devices, remote garage door opening controls etc. These uses of unlicensed spectrum have been successful with few interference problems reported and large deployment and adoption of the supporting technologies. However, it is well known that any expansion of this model is limited by the type of applications involved (short-range low-power).

What if instead of regulators authorising further unlicensed operations, we reduced spectrum scarcity by authorisation-free licensed operations based on harm-minimisation rules?

"RIGHTS AS RESPONSIBILITY"

A license free or authorisation-free regime would not necessarily be constructed on the spectrum commons long advocated by several prominent US legal scholars [19-22]. As they suggest, interferences in an unauthorised world would have to be managed through social norms and protocols - rules of the road – and through technologies such as smart radio sensing.

Yet, as numerous economists have convincingly argued, rules of the road can also co-exist with a property rights regime and the promise of cognitive radio has not materialised through market deployment despite nearly 20 years of development.

As I have argued in a separate contribution [23], shared and propertised approaches to radio wave management are not necessarily mutually exclusive approaches. A property rights regime that rests on an initial assignment to a large range of commercial, public and community users followed by trading of these rights in mature markets is perfectly compatible with a 'rules of the road' approach to interference management and use of spectrum sensing technologies where feasible and appropriate.

However, for such an approach to be successful, property rights needs to be redefined from the current doctrine of 'unlimited rights to do as one will with property' (implicit under the prevailing Torrens doctrine) to the German notion of 'property rights as responsibility' [24].

Both property laws systems take their roots in the development and management of land title registration rules. Both have been hugely influential internationally, with the former in use in Australia, the Asia-Pacific region, Africa, the Caribbean and large tracts of the North America, whereas the latter, more decentralised system, applies in Central and Eastern Europe + Japan, Korea and Taiwan.

The notion in German (public and private) law that property brings responsibility towards the public interest is not an arbitrary add-on to land title transactions; it is a fundamental aspect of property. A government injunction that limits land use to promote overall environmental quality is not viewed as interference with owner's property rights but as part of the responsibilities that come with land titles [25].

In a deregulated framework based on the transferability of spectrum property rights and adherence by market players to a code of conduct to minimise harmful interference, the German system of rights and obligations appears superior to the Torrens system. Under this system, market players (owners of spectrum rights) would gradually take over the roles and responsibilities of regulators in the knowledge that their use of these rights incorporates duties and obligations towards maintaining and safeguarding minimum levels of spectrum quality, not unlike environmental obligations under the management of land titles in use in German property law countries.

Adopting such a doctrine for the context of transfers of spectrum property titles may be a long-term affair for a common law country such as Australia. It is possible that such changes may be entirely unfeasible in juridical terms. Nonetheless, to the extent that it is possible to incorporate such concepts (or similar changes) as statutory exemptions of the common law of property in Australia it would be useful to consider such legislative amendments with a view of better designing the rights and obligations of spectrum licensees in a deregulated framework.

Property rights partly defined in terms of responsibility to the public interest (minimising interferences) and enforced by a system of 'technical mediators' (and eventually by nuisance and trespass law courts) would over time add a sense of stability and expected behaviour as is largely observed amongst road users in Australia.

INCENTIVISING PUBLIC LICENSEES

If a regime of property rights and market trading is to succeed in significantly reducing spectrum scarcity it should apply to a much wider array of bands and frequencies than is

currently the case. It should in essence be the norm that any potential user of spectrum should be able to negotiate the purchase of rights in any band of interest. It would then be the prerogative of incumbent licensees to choose to reject such offers or take an interest in them. In the current situation, this would not happen in perhaps half of the bands because public licensees - who have no ownership over their spectrum holding - have no incentives to release and trade their frequencies for productive third party use, and reap the rewards from profitable trades.

If for instance the Department of Defence was to lease 'defence' frequencies in the 400 MHz band to a carrier interested in the spectrum for provision of communications services in low population density areas, the proceeds from the trade would have to be transferred to the government, who is the ultimate owner of the asset (public spectrum).

Public sector and community use of the spectrum need to evolve towards the type of efficiency standards one would expect from competitive market operations. This can be done without threatening the supply of spectrum to these key service providers. Indeed it can be done in a way that leaves public and community operators better off through generation of revenue streams no agency is currently benefiting from.

To provide credible incentives to public licensees to trade their spectrum holdings, why not separate public spectrum ownership from the regulator and gift the rights to sell, lease, subdivide and merge to the public agencies which manage it? Incentivising public holdings through asset ownership would go a long way toward changing public managers' attitudes and behaviour towards a longer-term, more dynamic approach to spectrum management in large tracts of the radio spectrum.

For this to happen, spectrum property rights need themselves to be redefined so as to provide a longer horizon and more certainty to their owners. Rights also need to become much easier to trade. Only through the opportunities generated by mature and experienced spectrum markets should we expect public licensees to recognise the opportunity costs of a fallow segment of spectrum and act upon the obvious benefits from a more interactive management of their spectrum holdings. A similar debate in the US stresses the importance of guaranteeing the efficiency gains to the line agency: if efficiency gains in the management of the spectrum are offset by budgetary cuts from central agencies any public licensee incentives to make better use of the spectrum will quickly dissipate [12].

V. Adjusting the Object of the Act

Objects of the Act in the current context

Although goals of flexibility and responsiveness represent one of the 8 objects of the Act, the context under which these goals had been drafted has considerably changed. Two questions arise: (i) the context has changed to a point where the instruments and regulations authorised under the Act may no longer suit the pursuit of these objects, and (ii) these objects themselves may no longer be relevant given the much faster pace of change in technologies and services. This also begs the subsidiary questions as to whether the public interest in Australia might be best served by a hierarchy of objects rather than a collection of objects standing on an equal footing.

Stripped to the bare essentials, the eight main objects of the Act require regulators to:

a) maximise allocative and technical spectrum efficiency
b) ensure adequate provision for non-commercial users
c) ensure flexible response to spectrum users' needs
d) encourage diversity and quality of services
e) ensure appropriate, equitable and value-based charging
f) to pursue (a-e) subject to ministerial priorities
g) support competitiveness of the domestic industry
h) a-e) pursued subject to international compliance (ITU)

Through its Spectrum Review, the Department has asked whether the 8 objects of the Act and the way they are structured (without implicit hierarchy, thus leaving ambiguity whenever they conflict with one another) are still relevant. It specifically asks whether objects should be clarified, removed, updated and/or ordered and if clauses should be added to resolve conflicts between objects [14].

In light of the preceding discussion, what changes should be applied to the current set of regulatory instruments to better reflect current priorities in the pursuit of the public interest?

Are the objects of the Act still relevant?

Objects (a), (c) and (d)

Object (a) and (c) of the Act need to be replaced by "maximise by ensuring the dynamically efficient use of the radio spectrum the overall public benefit derived from this resource"

Object (b)

Object (b) of the Act needs to be replaced by "gift adequate provision of the spectrum to defence, and other public and community users and incentivise their dynamically efficient use of the spectrum by devolution of proceeds from trade to these agencies and users"

Other objects (e, f, g, h)

Object (e, f, g, h) of the Radiocommunications Act 1992 no longer play a suitable or relevant role in the quest to maximise

the public benefit from spectrum usage in the current context of exponential technological progress.

Conclusions

The Radiocommunications Act was legislated at a time when the key objectives were to transition spectrum management from a highly prescriptive framework inherited from the broadcasting days to a mixed regulatory regime focused on enhancing the allocative and technical efficiency of the spectrum. Since then, the accelerating pace of technological innovation has reduced the adequacy of these static objectives. What is needed in the Act is recognition of dynamic efficiency as the main driver of economic welfare created through spectrum use.

Dynamic efficiency can be promoted by reforms aimed at simplifying and consolidating spectrum usage rights (through perpetual, service-neutral licenses), facilitating the maturity of spectrum markets where these rights can be exchanged and removing the requirement of seeking licenses from regulatory agencies. Licences define rights, which are issued once and are eventually exchanged and valued through market forces.

Interferences are managed through harm-minimisation rules built in the spectrum rights calling on the German property law doctrine of “property rights as responsibility”.

Dynamic efficiency is also achieved by incentivising all public sector and community licensees to exchange unused portions of their spectrum holdings against payment by prospective users. For these incentives to work, central agencies must relinquish their claims over any income stream generated from spectrum trades by line agencies. Licensees should be the direct beneficiaries of such trades.

Moving from the current situation to this dynamic, interactive future will not merely happen through an act of Parliament. It will require staged implementation. There will be progress and setbacks. Eventually though, spectrum titles will be exchanged just like land and real estate titles exchange today: with no regulatory intervention other than charging duties on transactions and supplying the mediation and court system to settle litigious transactions.

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