LESSONS FROM AUCTIONS

South Africa and other nations are under pressure to allocate spectrum by auctions but, as **CHARLEY LEWIS** details, it is important to take stock of what has gone right and wrong so far

Spectrum is widely viewed as a finite national and global resource that needs to be managed in the public interest to derive the "greatest benefit to the entire population", as South Africa's spectrum policy has put it. The ITU says the goals of spectrum management are to "stimulate social and economic progress" and to make "efficient and effective use of the spectrum".

As ICT access, usage and consumption patterns swing from telephony interaction, through internet connectivity, to widespread broadband availability devouring multiple forms of data-intensive audiovisual content, the pressure on spectrum has never been more severe. The rising tide of connectivity – South Africa for example has over 92 million active SIM cards in a population of some 57 million, but still only 9.5% of households have internet access at home – along with the proliferation of smartphones, notebooks and tablets and the predilection for bandwidth-hungry online content and apps, has put increasing demands on operators to supply wireless access, services and content.

According to estimates reported by the UN Broadband Commission, "three-quarters of all internet use was via mobile by 2017, with a growing number of consumers around the world accessing the web on smartphones and tablets".

South Africa may lag behind the global curve – it has dropped down the ITU's ICT Development Index rankings – but the trend towards data and data-intensive usage is inescapable. Broadband access in Africa means providing wireless access predominantly, and wireless access requires spectrum. South Africa's national broadband strategy, SA Connect, places such emphasis on spectrum,[1] and spectrum was central to the recommendations of the country's ICT policy review panel.[2] Mobile operators have long been complaining that a shortage of spectrum is hampering their ability to roll out services (and it is partly a cost trade-off: having less spectrum requires more base stations). Access to spectrum is also critical for the rollout of the planned, albeit controversial, wholesale wireless open access network (WOAN) in South Africa.

A man on his mobile in a poor area of Kenya: are auctions taking account of social welfare?

For some, access to spectrum is synonymous with auctioning and a double benefit: the release of spectrum into the market and an inflow of revenue for government. For example, an opposition member of South Africa's telecoms portfolio committee, Cameron MacKenzie, has called for spectrum to be auctioned because "valuable revenue can [thereby] be secured for an increasingly cash-strapped fiscus".

The country's regulator, ICASA, seems to have had similar views, when in 2016 it issued an invitation to apply for 4 lots of high demand spectrum with an overall asking price of $1bn – although this was subsequently halted by a court ruling, pending the finalisation of government policy on spectrum. Even the minister of finance, unsurprisingly, seems well disposed to the notion, putting the idea of a "well-designed telecommunications spectrum auction" into his recent medium-term budget policy statement, albeit without a specific proposal.

SPECTRUM MANAGEMENT

Spectrum management in general, and spectrum auctions in particular, have been the subject of ➡

wide-ranging debate and the focus of academic research for a number of years. A search for "spectrum management" on Google Scholar yields 50,300 articles and papers, while a narrower search for "spectrum auctions" still returns an impressive 6,990 results.

Spectrum auctions, however, are but one of several mechanisms for placing spectrum. John Alden and Catherine Schroeder distinguish three models for spectrum assignment:[3]

- Administrative licensing
- Flexible rights-of-use
- Licence-exempt (or unlicensed).

Historically, most spectrum was awarded via administrative procedure, directly to government users, on a first-come-first-served basis to licensees, and by administrative tender in what is commonly known as a beauty contest (so-called because spectrum is awarded according to a set of criteria, often with a financial component in addition to broader public interest considerations, with a value judgement component in such awards underpinning the "beauty contest" epithet). This has also resulted in much painful, public litigation in those countries where the rule of law applies. Most jurisdictions employ a combination of the three methods.

Spectrum fees in this model may, or may not, include an up-front fee, as well as ongoing annual usage fees, such as under the administered incentive pricing (AIP) model[4] employed by ICASA, which has a variety of factors to weight spectrum pricing to incentivise its optimum and efficient use (ICASA collects fairly substantial annual revenues for the fiscus from licence fees – $20m in 2017).

The flexible rights-of-use model uses market mechanisms, principally "spectrum licence auctions [which] are widely recognised by economists as more efficient... [in accordance with the principle of] allocative efficiency [which] requires that the spectrum goes to its highest and best use"[5] to determine how spectrum is assigned and priced. This approach usually includes a secondary spectrum market, which permits spectrum refarming, spectrum sharing and spectrum trading – all of which are, to varying degrees, also compatible with the administrative model. Primary revenue generation in this model occurs at the point of auction, with subsequent pricing determined in the secondary market, and revenues accruing to the owner of the spectrum. Annual usage fees may or may not be levied.

The licence-exempt model, rooted in the long-standing designation of industrial, scientific and medical (ISM) spectrum (used for Wi-Fi hotspots and car remotes), also includes the slightly more ideological "spectrum commons" approach, under which spectrum is made freely available, without individual or specific assignment, to users on an open access and self-managed basis.[6] There are number of variants that have a greater or lesser degree of overlap with this approach. These include, for example, TV white spaces (locally unused broadcast channels) for the provision of wireless broadband access or for deployment in the internet of things (IoT).[3] TV white spaces trials have been conducted in South Africa, Namibia, Kenya and Tanzania, among other countries in Africa and elsewhere.

Similarly, dynamic spectrum access (DSA) is based on spectrum sharing, enabled by specific technologies and software techniques to provide opportunistic assignment of spectrum on the basis of user demand and local availability.[3] Both these approaches have been endorsed by ICASA.

Several things need to be noted about the three models. First, they are not mutually exclusive. Many spectrum management regimes will have some spectrum assigned by administrative procedure, some sold via some form of auction, and some set aside either directly as spectrum commons or earmarked for some form of sharing. The appropriate mix is likely to be country-specific, and to require careful, research-based consideration and public-interest formulation.

Second, each of the models has both advantages and shortcomings, supporters and detractors. For example, administrative assignment of spectrum can be cumbersome, does not promote allocative efficiency, and can be open to corruption. Auctions, on the other hand, can undermine consumer welfare, favour licensees with significant market power and deep pockets, and may be deleterious for universal access and service (and may still offer opportunities for corruption, at the pre-qualification stage).

SPECTRUM AUCTIONS: COUNTRY BENCHMARKS

Pioneered by the FCC in the US in 1994, spectrum auctions are now widely viewed as part of international good practice in spectrum assignment.[7] The number of countries that have undertaken spectrum auctions is now large, albeit with both positive and negative outcomes. It is therefore important to review, benchmark and evaluate that experience to inform South Africa's own possible venture into the world of the spectrum auction.

The selection of benchmark comparator countries can be controversial. My selection is motivated by the qualitative nature of the analysis: countries in Africa with some auction track record, with the addition of two BRICS countries, a group of which South Africa is a member.

With new countries entering the auction fray all the time – Angola, Tanzania, and, potentially, South Africa – it is important to learn from those who have already ventured there.

(Note: figures in the country snapshots are mainly from news sources, in particular the excellent TeleGeography.)

BRAZIL Brazil has made widespread use of spectrum auctions over the years, with mixed success. A number of planned auctions have had to be cancelled. For example, in 2001, there were no takers for a pair of wireless licences with an asking price of $560m. And the 2006 auction by the regulator (Anatel) of a series of regional GSM licences – its third attempt – was cancelled after the sole bidder failed to meet the required guarantee payment.

Others have been more successful. Anatel's 2007 auction for 23 blocks of 2G mobile spectrum, with spectrum caps, raised $188m, some 40% above the reserve price. A total of 20 blocks were sold, mostly to the main national incumbents. Later the same year, a number of blocks of 3G spectrum were auctioned off, attracting eight bidders and raising $2.9bn, nearly double the reserve price. The auction did include universal and access stipulations, that "required operators to deploy services in a highly profitable area and in a lower development area simultaneously".[8] Once again most of the lots went to national mobile incumbents.

A further auction in 2012 of 4G spectrum met with mixed results. Although there were four successful bidders in the valuable 2.5 GHz band, there were no bids for the 450 MHz spectrum, more suited to rural deployment, on offer. Some $1.3bn was raised, but the winners were again the country's major mobile licensees. To increase universal access, the regulator decided to allocate some 450 MHz spectrum to each of the winning bidders, and to impose rural rollout obligations on them.

In 2014 the regulator auctioned six lots of

spectrum in the 700 MHz LTE band, some national and some regional. This generated $2.4bn, just three quarters of its target, with only the largest three of the four mobile incumbents bidding, and two of the lots attracting no bidders at all. Mobile incumbent, Oi, marginally the smallest of the three large mobile operators, did not bid, and was teetering on the edge of bankruptcy, having defaulted on loans in late 2017.

In late 2015 the regulator auctioned two more lots, three blocks totalling 45 MHz in the 1800 MHz band, and a 20 MHz block in the 2.5 GHz band, as well as some 9,000 blocks at municipal level. The auction raised $192m, well above expectations.

There does not appear to be any recent published research into the auction of spectrum and licences in Brazil, and their outcomes. It seems clear that the auction model is the primary one adopted by the regulator, Anatel, for high demand spectrum. One overview suggests that evaluation criteria consider more than just the "highest licensing price offering" to include "best coverage offering; best quality of use, taking into account the best possible use of the frequency range or channel, and priority of public interest services over restricted ones".[8] It is, however, hard to see how this would be effected, other than through pre-qualification requirements.

Certainly, revenue maximisation seems high on Anatel's list of objectives, given the emphasis in its press releases on the prices realised. Most of the auctions have benefited the incumbents. Little attention appears to have been given to broader issues such as market development, universal access and service (the 450 MHz auction aside), consumer welfare, and broader benefits to the economy.

EGYPT

Spectrum in Egypt is assigned through administrative procedure, with auctions only having been used on a single occasion, and then largely as a threat against recalcitrant licensees. The country's GSM market was first liberalised in 1998 with the award, by request for proposal or beauty contest, of licences to two new entrants for $515m each. A third licence was awarded in 2006 for $2.9bn.

The planned assignment in 2016 of 40 MHz of 4G spectrum to the four incumbent licensees, for $50m per MHz, was met with protests from the three foreign-owned mobile operators, which claimed that the price demanded was far too high, and that the terms favoured the state-owned operator's new entrant, Telecom Egypt's WE, which launched in 2017, as well as that the amount of spectrum on offer was much too limited. After the regulator, NTRA, threatened to auction the licences to international bidders instead, they came to an agreement, realising a combined total of $2.2bn from the four spectrum deals.

In the context of cumbersome administrative processes for the award of licences and the allocation of spectrum, a recent GSMA-sponsored report laments the impact of the shortage of spectrum on the market in Egypt, and calls for spectrum auctions to be considered.[9] The example of Egypt also illustrates the risks of excessive pricing of spectrum, along with the desire of incumbents to protect their status quo in the market.

GHANA Ghana recently ventured into the spectrum auction market, when the regulator, NCA, offered two lots of 2 x 10 MHz LTE spectrum in the digital dividend 800 MHz band in 2015, with a reserve price of $67.5m per lot (the price had initially been $92m per lot, but was cut after an outcry from operators). Under the management of audit firm KPMG, the auction was intended to raise revenue for Ghana's digital migration, and was structured to favour "indigenous Ghanaian ownership" according to the NCA.

However, of the four companies that registered to bid, only dominant operator MTN (trading as Scancom) actually participated, and thus secured one of the lots at the reserve price. The decision to auction the spectrum has been described as "political", with pricing well above what was "realistic in the light of cost of deployment and what returns could be made from it within the short to medium term".[10] Not only that, the regulator has been accused of exploiting its privileged access to licensees' financial information to price the spectrum at the very maximum level affordable to them.[10] Another spectrum expert criticises the Ghana spectrum auction for its "inefficient allocation of spectrum" and for its "failure to achieve policy goals", and points out that this resulted in MTN securing an LTE monopoly, leaving a number of "future policy challenges".[11]

> **"The auction was intended to raise revenue for Ghana's digital migration."**

Prior to this, in 2012, the regulator had awarded three broadband wireless access (BWA) licences in the 2.6 GHz band for $6m each to indigenous companies, well below what it could have expected to raise, in the absence of set-asides. This was an administrative process, not an auction, but had equally poor outcomes: of the BWA licensees, only two are still operational, an outcome that has undermined the rollout and uptake of 4G.[12]

Both instances highlight the problems that can occur when extraneous policy exigencies (revenue maximisation, and local economic empowerment provisions, in this case) are allowed to override the best interests of the ICT sector as a whole. Thus Ghana's 2015 spectrum auction has arguably failed the socioeconomic best interests of the country, and negatively affected its consumers, because short-term financial gain was allowed to trump longer-term public interest goals. The NCA appears undeterred and plans to auction the country's last 4G spectrum, at an asking price of $67m.

INDIA The spectrum management regime in India was several years ago described as an "extreme example of detailed spectrum management or micro-management by a regulator", with access to additional spectrum contingent on the licensee's subscriber base, further exacerbated by "long delays in decision making and intense controversy".[13] The country is also home to the notorious 2G spectrum scam, which saw spectrum corruptly ➡

assigned to certain licensees at low prices.

The first spectrum auctions in India were held in 1995, with two blocks of 4.4 MHz in the 900 MHz GSM band, spread across a number of regions or "circles" (there are 22) being sold. The outcome was problematic, leading to a post-auction cap being imposed on the winning bidder, and to some circles being re-auctioned, but nonetheless left some lots still unsold at the end of the process. However, after running a subsequent three-stage process to auction spectrum in the 1800 MHz band, India reverted to administrative allocation for a time. (It is unclear why this decision was taken: there seems to be no detailed account of the auction.)

Auctions were only undertaken again after the 2G spectrum scam, when a nearly annual series of auctions commenced:

- After 34 days and 183 rounds of bidding, seven of nine bidders were awarded spectrum in the 2010 3G auction, which raised $17bn. Later the same year, six operators, out of an original 11 bidders, were to secure 44 4G licences between them raising $5.5bn
- In 2012 the government put 271 MHz of spectrum up for auction, mostly GSM in the 1800 MHz band (following a Supreme Court ruling in the spectrum scam) but also several lots in the 800 MHz CDMA band. The CDMA auction was abandoned after all four qualifying bidders withdrew. With less than half the available spectrum being sold, the 2G auction too was described as a "flop", undermined by reserve prices having been pegged too high
- The following year, 2013, saw a further auction for spectrum in the 800 MHz, 900 MHz and 1800 MHz bands. The latter two auctions had to be cancelled, as there were no bidders. There was only one bidder in the 800 MHz CDMA band
- Spectrum in the 900 MHz and 1800 MHz bands was again put on offer in 2014. After 68 rounds of bidding, spread over 10 days, the three bidders in the 900 MHz band secured seven lots, 62 lots of 1800 MHz spectrum went to seven successful bidders and $9.9bn was raised
- There was a further spectrum auction in 2015, where spectrum in the 800 MHz, 900 MHz, 1800 MHz and 2100 MHz bands was put up for sale. This time nearly 90% of the available spectrum was sold, after 19 days and 115 rounds of bidding, raising a total of $17bn. A subsequent court challenge to the spectrum caps imposed in the auction was recently overturned
- In 2016 a mass auction saw a further 2355 MHz of spectrum, ranging across seven bands), going on sale. However, only 40% of the spectrum was sold, because the reserve price had been set too high.

India has recently commenced what has been described as its largest spectrum sale, of more than 3000 MHz of frequencies in multiple bands, with the focus on 5G spectrum. Unsold 700 MHz spectrum is again on offer, but with the reserve price slashed by 40%.

India's spectrum auctions – now effectively mandatory following the recent Supreme Court ruling – have been criticised as having been heavily focused on revenue maximisation at the expense of benefits to the sector and its consumers. An independent report points to complaints that an "auction raised prices to unreasonable levels and forced [the operators] to take on high debt levels".[14] Worse, it appears that the government intervened to set reserve prices over a third higher than those recommended by the regulator, because the focus of the government has been overwhelmingly "on short run revenue maximisation at the expense of long run healthy growth of the sector and possibly also long run revenue maximisation for the government through higher tax earnings from a thriving telecoms sector".

The report recommends:

- Making more spectrum available to licensees
- Keeping the cost of spectrum reasonable
- Improving auction design, and ensuring greater access to capital
- Encouraging spectrum sharing and trading.

MOZAMBIQUE Mozambique's experience with spectrum auctions appears short-lived. In 2013, the regulator, INCM, announced plans to auction off five lots of 2 x 5 MHz in the 800 MHz band, each with a reserve price of $30m. According to commentator Steve Song, the "auction did not attract any bids and was widely perceived to have an excessively high reserve price" with the result that it was "quietly withdrawn and no subsequent auction has been attempted by the regulator".

NIGERIA Nigeria's spectrum management regime calls for a "transparent, fair, competitive and nondiscriminatory pricing structure that include [sic], but not limited to, auctions, beauty contest and other internationally accepted methods" with the objectives of ensuring "uniformity, consistency and

MOROCCO

Like many other countries, Morocco first ventured into spectrum auctions via GSM with its associated spectrum. The country's 1999 auction for a second GSM licence was widely regarded as highly successful, reaping the "highest prices ever paid for a mobile licence relative to population size".[15] It attracted seven bids, with the winning consortium paying $1.1bn, well in excess of what had been expected, and had a credible regulatory framework, transparent tender process, and attractive terms for the licence,[15] while the dotcom bubble may have played a part.

Morocco later turned to a beauty contest to award 3G spectrum in 2006. This produced positive market outcomes in the view of at least one commentator, who suggested that the resultant "lower costs for operators", together with the award of spectrum to a new entrant, Inwi20, resulted in "shaking up the existing duopoly and triggering intense competition in the mobile broadband market" and led to a 530% increase in mobile broadband subscriptions.[16]

Morocco returned to the auction model in early 2015, when three packages of LTE spectrum totalling 240 MHz were sold by the regulator, ANRT, via sealed bid, raising $277m, modestly above the reserve price. The auction is regarded as successful, because of the "modest reserve prices" (compared for example with Ghana), but benefited only incumbents.[17]

efficiency...", realising fair "market value" for spectrum, promoting "efficiency and competition" in the spectrum market, facilitating "access" to spectrum, and achieving "universal service goals".[18]

The regulator, NCC, has had several encounters with auctions. Its 2001 auction for GSM licences (and associated spectrum), allegedly the world's first combinatorial clock auction, resulted in awards to three bidders (including MTN), and was widely regarded as a success. The two GSM licences issued raised a total of $570m (the high prices paid reflect the fact that the auction was for GSM licences as opposed to spectrum licences per se). The auction was notable for the complexity of its carefully planned approach, which included measures as finely scripted as keeping the five bid teams incommunicado in randomly assigned hotel rooms.

Subsequently, one of the three winners was to default on its bid, allegedly after discovering that the block of spectrum it had been assigned was the subject of litigation and effectively unusable (that was CIL, owned by Nigerian oil tycoon, Mike Adenuga, who later received a licence in 2003 operating as Globacom). Another, Econet Wireless (owned by Zimbabwe tycoon, Strive Masiyiwa), was subsequently to sell out, amid allegations of corruption and political infighting.[19]

In 2002, on the back of the perceived success of the GSM auction, the NCC went on to auction a series of regional fixed wireless access spectrum licences, also viewed as being a success. Of the 80 licences on offer, 67 were awarded, raising $38m. It is unclear how many are currently still in use.

A subsequent auction in 2007 for 4 x 10 MHz lots of 3G spectrum in the 2 GHz band was cancelled when only four of the 19 applicants were able to pay the pre-qualification fee of $15m. The ensuing licences were therefore awarded, at the reserve price, to MTN, Celtel, Globacom and Alheri Engineering (a non-telecoms company owned by local businessman, Aliko Dangote), raising $600m. The latter was unable to roll out a network or services, and its licence was later sold to Etisalat, which became, via a complicated series of transactions, the ailing 9mobile, currently the subject of a troubled sale.

The NCC's more recent 2013 auction of 30 MHz of spectrum in the 2.3 GHz band was also less than successful. It attracted only two bidders, with a wholesale wireless access licence being granted to Bitflux, a new entrant, for $23m. Although it was "lauded as a success in bringing a new market entrant into the field of LTE services", Bitflux has reportedly struggled to break into the market, according to Song.

In 2015, dominant mobile operator MTN became embroiled in controversy over the purchase of spectrum from the national broadcaster.

The 2016 auction for 14 lots of 2 x 5 MHz in the 2.6 GHz band was arguably even less successful, with the auction going ahead on the third attempt. Only dominant operator MTN (it holds a market share of about 40%) was prepared to meet the steep reserve price ($16m per lot), and bought six lots for $96m. The remaining eight lots were unsold.

> **"It is clear that spectrum auctions in these countries have had mixed success."**

SENEGAL The licensing of new operators has not always been transparent in Senegal, with the licences of both Sentel and Sudatel having been awarded under controversial circumstances. Towards the end of 2015, the regulator, ARTP, issued an invitation to apply for 4G spectrum, in 700 MHz (4 blocks of 2 x 20 MHz), 800 MHz (3 blocks of 2 x 30 MHz), and 1800 MHz (3 blocks of 2 x 30 MHz) bands. This auction attempt was, however, said to be boycotted by the country's three mobile incumbents, which took the unusual step of collective and coordinated non-participation and in making a joint objection to the hefty $50m reserve price, as reported by TeleGeography. The regulator announced it would restart the process, inviting bids from new entrants and international operators. In the meantime, it has renewed the licence of the fixed-line incumbent, Sonatel, adding some of the spectrum it proposed to auction to Sonatel's mobile arm, Orange, at the reserve price.

UK AND EU The auctioning of a series of 3G mobile licences across some nine of the member states of the European Union between 2000 and 2001 provides a useful case study of auctions and their outcomes (and Paul Klemperer's seminal work on the theory and practice of auctions offers a comprehensive analysis of the 3G auction process and its outcomes).[20] Klemperer suggests that only three can be considered to be successful, in terms of market diversification and revenue raised: the UK (which secured $34bn, and ushered in a new entrant), Germany (with high revenues and a diversified market), and Denmark (high revenues and a new entrant).

Problems occurred in several of the auctions. For example, the auction in Austria was undermined by collusion between bidders. Those in Netherlands, Italy and Switzerland failed to secure the intended new market entry. Similarly, in Belgium and Greece, all the available spectrum was snapped up by the incumbent 2G licensees. Ewan Sutherland likens the 3G process to the "Charge of the Light Brigade", with incumbent operators scrambling to secure spectrum, leading to a "positive feedback loop driving up prices".[21]

The example of the first 3G auction – held in the UK by Ofcom in 2000, raising $34bn – is instructive. It used the Anglo-Dutch model, with the final price pegged to that of the lowest of the winning bids, and included provisions designed to ensure a new market entrant. Some 13 bidders participated, engaging in 150 rounds of bidding over 7 weeks. Each of the four incumbents secured spectrum, alongside TIW (Three), which was the winner of the spectrum lot designated for the new entrant.

Klemperer lists the objectives of the auction as being threefold: "to assign the spectrum efficiently; to promote competition" and only lastly to "realise the full economic value" from the spectrum. Despite some "media criticism... about the bidders being 'forced' to pay too much for their

licenses", he nonetheless judges the "actual outcome [as being] efficient or very close to efficient" in terms of achieving its objectives.

His view is echoed in Martin Cave's extensive review of spectrum management in the UK, which concluded that there is "no strong evidence that consumer benefit would be reduced through higher prices or slower access to services".[22] The view of veteran telecoms economist, Bill Melody, however, is strikingly different. He describes "the early 3G auctions in Europe [as having] been framed, designed and implemented to extract maximum monopoly rents from an arbitrarily restricted number of incumbent and new 3G mobile operators in national markets". Further, the outcomes served to "promote neither efficiency nor competition in either spectrum allocation or 3G network and service development".[23]

Sutherland describes the use of spectrum auctions as one of the central features of government policy in the UK, with government targeting the sale of 500 MHz of spectrum by 2010, and characterises the UK spectrum market as an "oligopsony" (a fancy phrase for a market in which there are only a small number of buyers for a specific product or service).[24]

In 2013, Ofcom undertook a further auction, putting up some 250 MHz of 4G spectrum in the 800 MHz and 2.6 GHz bands, and attracting seven bidders. There were five winners in the auction, one of which was a new entrant, Niche, a BT subsidiary. A total of $3.6bn of revenue was raised, with a claimed long-term consumer benefit of $30bn.

An evaluation by the National Audit Office (NAO),[25] using broadly the same set of criteria as for the 2000 auction, was rather more equivocal in its findings, and made several key recommendations to Ofcom, in particular that it should:

- Conduct a review of the competitive operation of mobile telecoms markets before offering further spectrum for auction
- Monitor whether the $30bn (£20bn) of consumer benefits from 4G services are being realised
- Select designs for future auctions that take account of the circumstances of likely bidders.

While the NAO felt the competitive nature of the market had been preserved, it noted that the structure of the auction made it unable to pronounce on whether the outcome was economically efficient, and had, moreover, reduced the revenue raised by some $240m.

Ofcom recently proceeded with a further auction of spectrum in the 2.3 GHz (4G, 4 x 10 MHz lots) and 3.4 GHz (5G, 38 x 5 MHz lots) bands, using a simultaneous multi-round ascending auction (SMRAA) rather than the combinatorial clock auction (CCA). The auction imposed spectrum caps, because of Ofcom's view that the "greatest concern to competition [stems] from asymmetry in the amount of spectrum held by different operators". Almost all the spectrum was sold – more or less equally spread between the four main incumbents (EE, O2, Three and Vodafone), with O2 bagging all the 2.3 GHz spectrum on offer – raising $1.75bn.

The auction had been delayed by litigation from one operator seeking to strengthen the caps, but the High Court ruled in Ofcom's favour. Ofcom does not appear to have complied with the first two recommendations above, despite including a regulatory impact assessment in its current foray.

LESSONS TO LEARN

It is clear that spectrum auctions in these countries have met with mixed success. Many have failed, while others can be viewed as problematic. Fiscal greed appears to have been a particular stumbling block, with regulators and governments overly concerned with revenue. In a number of cases, auctions failed or secured only limited participation because of the high reserve prices that had been set (Brazil, Egypt, Ghana, India, Mozambique, Nigeria, Senegal). In some cases, this was further compounded by the limited amount of spectrum on offer (Egypt, Nigeria).

Most spectrum on auction was bought by incumbent licensees, in some cases by the dominant operator alone (MTN in Ghana and Nigeria, Orange in Senegal). Most auctions, therefore, have effectively strengthened market concentration and benefited dominant operators. Few attempts to secure market entry through spectrum auctions – other than greenfield GSM auctions – have been successful, the exceptions being Three in the UK and marginal wholesale licensee Bitflux in Nigeria. Indeed, to the contrary, Brazil's Oi may have been driven to the door of bankruptcy by auctions. And, in Ghana, set-asides for locally-based new entrants may have caused the auction to fail.

Most auctions have failed to pay attention to broader socioeconomic goals and outcomes. Universal access and service have featured in few examples. Almost no regulators have undertaken research studies into the outcomes of their spectrum auctions to ensure that they were undertaken in the public interest and that they promoted broader economic growth and social development, and led to increased benefits for business users and consumers. Corruption too may have played a role in the design and conduct of some of the auctions.

But the focus seems now to have shifted to designing auctions to achieve broader social and economic goals beyond simple revenue maximisation. Countries such as Germany and Denmark have been looking to tie spectrum awards to rural rollout of services.

In the next issue of Intermedia I will explore more issues with auctions, the current picture in South Africa, and implications for spectrum management.

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