The benefits of technology neutral spectrum licences for the growth of a digital economy

By Stefan Zehle, CEO, Coleago Consulting – 25th of September 2020

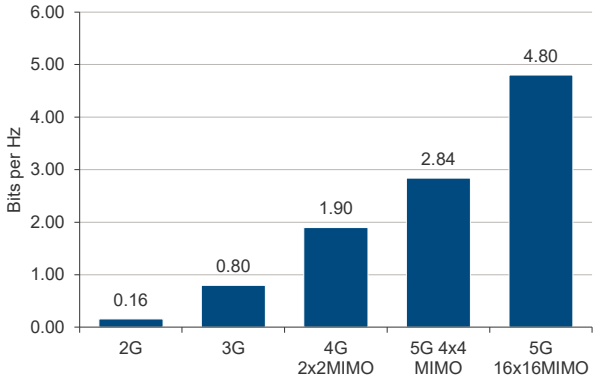
With the introduction of 5G, mobile communications are entering a new area. One of the pillars in the vision for 5G is to provide ubiquitous fibre-like wireless connectivity. With 5G, the user experienced data rate jumps from 10Mbit/s to 100Mbit/s - a factor 10 increase; and Area traffic capacity moves from 0.1 Mbit/s/m^2 to 10 Mbit/s/m^2 representing a 100 fold increase. Radio frequencies are the key ingredient to deliver these requirements and new spectrum in 3.5GHz and mmWave is being made available for 5G. However, the increase in demand and the need to provide 5G coverage with sub-1 GHz and mid band spectrum is such that it is essential to refarm spectrum from older technologies such as 2G and 3G.

In many countries - particularly those which rely on wireless broadband - the process of introducing new technology in existing frequency bands is delayed or held up because spectrum is not licenced on a technology neutral basis. Examples of countries which have not fully implemented technology neutrality include Nepal, Belarus, Tajikistan, Ukraine, Ghana, Morocco, Jordan, Sudan, Uzbekistan, Turkmenistan, Afghanistan and Senegal. Indeed some countries have not learned the lesson from a delayed introduction of 3G and 4G and are now repeating the same mistake for 5G.

New technology delivers high spectral efficiency and stimulates economic growth

Technology neutral spectrum licensing is widely recognised as best practice when assigning spectrum to mobile operators. Technology neutral spectrum licences enable mobile operators to refarm spectrum used for 2G (GSM) or 3G to 4G (LTE) and 5G with the timing of the refarming driven by market demand. This maximises spectral efficiency in a technical sense and also maximises efficient use of spectrum. As a result, users benefit from better mobile broadband coverage, higher data speeds and lower mobile data prices than would otherwise be the case.

New technology delivers higher spectral efficiency



Spectrum is a scarce resource and efficient use of spectrum is one of the key objectives of spectrum management. The spectral efficiency of 4G coupled with MIMO is such that refarming 850MHz or 900MHz spectrum from 2G to 4G with 2x2MIMO delivers a 12-fold increase in mobile data capacity. For 1800MHz and 1900MHz spectrum, where higher orders of MIMO can be deployed, moving from GSM to 4G delivers a bits/Hz improvement of up to 26 times. These are facts which any regulator aiming for efficient use of spectrum should put centre stage when formulating policy and technical conditions for mobile spectrum licences.

The higher spectral efficiency of 4G compared to legacy 2G and 3G technology is a key ingredient in delivering the connected society. There is empirical evidence for the economic benefit brought about by introducing 4G mobile broadband technologies. *"For a given level of total mobile penetration a 10 per cent substitution from 2G to 3G increases per capita GDP by 0.15 percentage points. … A doubling of mobile data use leads to an increase in the GDP per capita growth rate of 0.5 percentage points."* (Source: The Impact of Mobile Telephony on Economic Growth, Deloitte, 2012). *"Doubling the broadband speed will contribute to 0.3% growth compared with the growth rate in the base year"*. (Source: Does broadband speed really matter for driving economic growth? Rohman et al, Division of Technology and Society, Department of Technology Management and Economics Chalmers University of Technology, Gothenburg, Sweden, 2012)

As a positive example, Thailand started introducing 4G in 2013 by using part of the 2.1GHz band which was previously used for 3G and later added 4G in 1800MHz and 900MHz. With this solid mobile internet foundation, Thailand's digital economy developed very quickly, for example e-commerce, online travel, online media, and ride hailing. Thailand's online travel sector ranks among the biggest in the region, valued at $7 billion in 2019 and growing at a brisk 17% annualised growth rate. Online Media has also been expanding rapidly at 39% CAGR since 2015, and as a result Thailand's internet economy grew from $6 billion in 2015 to $16 billion in 2019. In 2019-2020, Thailand released 700MHz and TDD 2600MHz spectrum with technology neutral spectrum licences. Operators use this spectrum for both 4G and 5G and the Thai government expects 5G networks will cover 98% of the Thai population by 2027 with 5G services contributing 6.6% to GDP.

Countries without technology neutrality suffer from a delayed introduction of new technology

There are a number of examples which illustrate the negative impact on mobile broadband development if mobile operators are prevented from introducing 3G or 4G into their networks. Jordan, the Ukraine, Ghana and Bangladesh all have suffered low speed or delays in new technology introduction, which is detrimental for consumers and business mobile users.

There is clear evidence of the impact on users depending on whether spectrum is technology neutral or not. In Jordan 2100MHz spectrum is restricted to 3G. 3G subscribers peaked in 2015 with 4.89 million subscribers, but by 2019, this had fallen back to 2.96 million due to the adoption of 4G smartphones. As a result, the current load in 2100MHz carriers is light, i.e. the spectrum is under-used. Because 2100MHz is restricted to 3G, a quarter of 2100MHz spectrum is not used, despite the fact that demand for 4G capacity increased dramatically as the number of 4G enabled users grew from 0.5 million in 2015 to 3.3 million in 2019. Had there been technology neutrality, operators would have gradually refarmed the 2100MHz spectrum from 3G to 4G in line with market demand. Due to the small amount of 4G spectrum, in January 2020 the average download speed in Jordan was only 16.82 Mbps, ranking Jordan no. 108 in the world for the user experienced data speed. In March 2020, in response to Covid-19, the Jordanian government released temporary spectrum. When operators expanded network capacity in this temporary spectrum, user experienced data speeds immediately improved. In April 2020 Jordan moved up to 87 in the world (21.42 Mbps) and in May, the ranking improved further to position 77 (25.42 Mbps). This is clear evidence that mobile users are the beneficiaries of technology neutrality: Among the operators in Jordan, with the migration from 2G to 3G and 4G, one cannot observe any obvious revenue growth. That is why it is fundamentally misguided to charge operators for technology neutrality.

In the Ukraine 3G was only introduced in 2015, i.e. 12 years after the first commercial 3G launches in the UK and Italy. Not having learned the lesson, the regulator also delayed the introduction of 4G to 2018, i.e. 9 years after the first commercial 4G launches in Sweden and Finland. In 2016, Coleago Consulting carried out a study for an operator in the Ukraine and found that technology neutrality in the 1800MHz band would reduce network costs by 44 to 54%. Of course this value is not captured by the mobile operators. The situation in the Ukraine is made worse because the 2100MHz is also not technology neutral. History has shown that it is consumers who are the winners because they benefit from much higher data volumes and faster data speeds while not paying more for their service. In short, the lack of technology neutrality in the Ukraine deprived mobile users of the benefit of innovation driven competition. Fast adoption of technology neutrality in all IMT bands will significantly speed up mobile broadband experience in the Ukraine.

In Ghana, the misguided approach to technology neutrality not only deprived mobile users of efficiency gains but it also led to a de facto 4G monopoly. Spectrum licences in Ghana are neither technology nor service neutral. The focus of the regulator was to maximise revenue from the sale of spectrum licences. In 2011, the government sold 2600MHz spectrum licences to local ISPs allowing them to introduce 4G fixed wireless access, but not mobile services. In 2015, Ghana auctioned 800MHz spectrum for the introduction of 4G in mobile networks. However, the reserve price was so high that only the leading operator, MTN, acquired 800MHz spectrum. As a result MTN became the only operator to offer 4G mobile services. The lack of technology and service neutral spectrum licences resulted in great harm for the development of the digital economy and caused a competitive disequilibrium. ISPs who had previously acquired 2600MHz spectrum found there was no business case after MTN launched 4G mobile and essentially the 2600MHz band ended up not being used. As regards to competition, MTN became a dominant operator capturing over 90% of the industry free cash flow. Now the regulator plans to introduce regulation to reduce this dominance which was the result of its own misguided approach to spectrum licencing.

In Bangladesh, before 2018, the regulator blocked technology neutral use of existing spectrum licences for many years . As a result Bangladesh ended up being the last country in Asia (except for North Korea) to introduce 4G.

Spectrum is a resource equally available in all countries. Developing countries could use spectrum to reduce the digital divide. Yet, due to not having technology neutral spectrum licences, Bangladesh and many other developing countries have widened instead of reduced the digital divide.

Technology neutrality to foster the deployment of 4G and 5G

2020 saw a ramping up of commercial launches of 5G. While some 5G deployments are in new mobile broadband frequency bands, such as 3.5GHz (C - band), it is essential that mobile operators have the freedom to refarm existing spectrum holdings to 5G, notably to deploy a 5G coverage layer. This is particularly relevant for 700MHz, 800MHz, 850MHz and 900MHz spectrum licences, some of which have been licensed as 2G, 3G, or 4G technology specific spectrum but will be useful as a 5G coverage layer. Regulators need not worry that refarming will leave legacy users unserved. It is now possible to ‘gracefully refarm’ bands using Dynamic Spectrum Sharing so that the same spectrum is used simultaneously for several technologies – including 4G and 5G. This allows a phasing in of the newer technology in line with increasing mobile broadband demand while at the same time supporting legacy users.

The US provides a good example of how technology neutral spectrum licencing results in rapid 5G coverage build out coupled with increasing mobile broadband competition. In the 600MHz spectrum auction of 2018, T-Mobile which had a sub-1GHz spectrum disadvantage acquired substantial 600MHz spectrum holdings which enabled it to build wide 4G and 5G coverage across the US. In contrast, AT&T and Verizon introduced 5G in existing 850MHz spectrum holdings using Dynamic Spectrum Sharing technology which means 4G and 5G operate simultaneously in the 850MHz band. As a result consumers and businesses, even in outside urban areas, now have the choice of three major mobile broadband operators. Policy makers in the US understand that technology innovation is a key driver in a competitive mobile broadband market. By allowing operators to choose what technology to deploy based on market demand, the FCC created an environment where more people benefit, depending on their smartphone, from 4G or 5G mobile broadband far faster than would otherwise be the case.

From the transition to 4G, we already know that technology neutrality brought great benefits to countries where spectrum licences were technology neutral thus allowing this transition to go ahead speedily. We also know that users' connection requirements have changed from making voice calls and sending text messages to accessing the Internet, watching videos, and accessing digital services through apps. Network coverage has been upgraded from voice to 4G data coverage thus delivering a good user experienced data speed. 4G now covers more than 80% of the world's population, and its spectral efficiency is dozens of times higher than that of 2G or 3G. However, in some countries the 900MHz band is still not technology neutral and as a result some rural dwellers still do not have data coverage. Furthermore, in countries where 1800MHz and 2100MHz spectrum is not technology neutral, 4G networks in urban areas tend to be congested which affects the use of digital applications.

Malaysia provides a good example of the positive impact that technology neutrality can have. The government set the plan to improve 4G population coverage from the current 91.8% to 96.9%, the DL experienced speed from a current 25Mbps to 35Mbps by 2022. Made possible because of technology neutrality of the 900MHz, 1800MHz, and 2100MHz bands, the government appealed to operators to upgrade 4,589 existing 2G/3G base stations to 4G thus reaching the Governments coverage and speed targets.

Technology neutrality, an essential element for the Internet of Things

5G has been designed not only for mobile broadband but also for Massive Machine Type communications, i.e. the Internet of Things. Technology neutral spectrum licences are required to allow mobile operators to deploy dedicated networks optimised for IoT. Regulators should adopt a service and technology neutral framework to support IoT or they risk stifling the development of what is referred to as the 4th industrial revolution. Regulatory restrictions of the technology to be used would be particularly harmful in this fast-growing market. Mobile operators should not be prevented from deploying the latest cellular IoT technologies in their licensed spectrum bands.

Spectrum managers can make a difference in the speed of 4G and 5G mobile broadband adoption

Virtually all governments explicitly recognise the need to act in order not to fall behind in making 5G services available to businesses and consumers. Technology neutral spectrum licences are part of this. Rightly regulators seek to maximise efficient use of spectrum as well as consumer benefit. Therefore, rather than holding up the refarming of spectrum from 2G and 3G to 4G and 5G, telecoms regulators should seek to create the conditions which accelerate refarming. There are two opportunities to bring this about:

First, spectrum licence renewal provides an opportunity to re-write spectrum licences to make them technology neutral. However, tying technology neutrality to spectrum licence renewal is likely to delay the introduction of 4G and 5G in existing frequency assignments. Therefore, where licence renewal is not imminent, regulators can deliver positive outcomes for their country by making existing licences technology neutral. However, if regulators demand substantial fees for such an amendment, this will reduce the cash available to invest in new technology.

Secondly, when new bands are licenced to mobile operators, for example 700MHz, TDD 2300MHz or TDD 2600MHz, technology neutral spectrum licences will allow operators to serve both current users with 4G enabled smartphones as well as the growing number people with 5G enabled smartphones. In this context regulators should recognise that with today's software defined radios, network investments are no longer technology specific and operators can seamlessly start serving both 4G and 5G smartphone users. This is particularly relevant for countries which have not yet assigned the 700MHz to mobile operators.