Not just the economy, stupid[1]: a holistic approach to spectrum assignment

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Sustainable economic growth requires an interplay between all domains of a country's structural organisation – that is, its politics, its economy, and its society. Government and regulatory policy need to take account of all of these domains for it to be optimal. However, in several important areas, these interconnections are not accounted for – this is particularly true when looking at the current spectrum policy of various countries. In the developed world this has resulted in the widening of the digital divide; in the developing world it has resulted in unsuccessful spectrum award outcomes – with direct consequences for the economic growth of these countries. In this paper we explore the need for a holistic spectrum policy that caters to all parts of a country's structural organisation, and acknowledges that politics, economics, and society work hand in hand and not in silos or against each other.

Spectrum demand is not only about economic value

The ICT industry acts as a catalyst to the economic growth of all sectors of a country. However, the current COVID-19 pandemic has further highlighted ICT's significance, much beyond the pure economic value. Use cases including staying connected with friends and family, consuming video content or playing online games to stay entertained, as well as the ability to work and study from home, suggest the vast expanse of social impact that ICT has on our economies.

ICT infrastructure is supported by the availability of radio spectrum. This is especially so in rural areas and developing countries where the fixed infrastructure is not well developed. Therefore, as with the ICT industry overall, true spectrum value cannot only be restricted to quantifiable economic output. There are social benefits which – though cannot be directly quantified – have indirect productivity effects on improving the overall economic output.

Spectrum supply should not be only about economic value

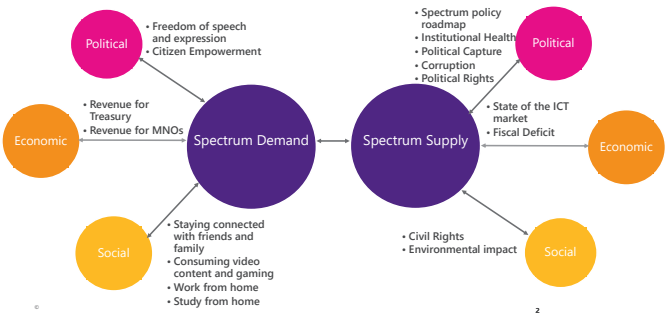
There are three main approaches to government assigning the spectrum – direct assignment, auction, and comparative tender[2]. While auctions and direct assignments can allow for an efficient means to generate revenue for the governments, they sometimes result in very high spectrum selling price.

According to a 2018 study by GSMAi, the spectrum reserve price for a group of auctions and direct assignments in developing countries was found to be five times higher than those in developed countries, once the income level was accounted for[3]. High spectrum reserve prices in developed countries reflect a perception of high demand, mature markets and high purchasing power. These market characteristics are underpinned by robust political, economic, and social structures in the developed world. However, high spectrum reserve prices cannot be justified in developing countries because of their low-income levels which are a result of weak political, economic, and social structures.

There is an emerging realisation of this interplay in some countries that have adopted a comparative tender approach to award spectrum. Comparative tenders focus on the value of spectrum beyond just its economic value. The emphasis is on long term growth than immediate revenue needs. As a part of the comparative tender approach, spectrum can be awarded at a low price but with various obligations to be fulfilled by the Mobile Network Operators (MNOs) in a specific amount of time. The obligations could be related to infrastructure investment, geographic coverage and network or service rollout. Non-compliance with the obligations can result in the spectrum licence being reneged.

Therefore, both spectrum supply and demand are affected by factors beyond just its economic value. The relationship is laid out in Figure 1 below. This understanding should underpin spectrum policy decisions of governments.

Figure 1: Interplay of political, economic, and social factors in determining spectrum supply and demand



Impacts on different countries

When developed countries have not accounted for all the three domains of a country's structural organisation in their spectrum policy, this has resulted in the widening of their digital divide, slow progress in fulfilling universal service obligations and slow economic growth in rural areas.

However, in developing countries the spectrum award outcomes themselves have been impacted, with significant negative consequences for the overall economic growth of the country.

There are various examples to show that not accounting for the underlying politico-economic and social factors while setting the spectrum reserve price has resulted in limited spectrum being sold in developing countries. Some of these underlying factors are a high fiscal deficit, lack of political will, unclear spectrum roadmap, corruption, deteriorated institutional health and political capture. Figure 2 below lays out some of these factors for a group of developing countries with an unsuccessful award outcome – that is, not all spectrum being sold.

Figure 2: Percentage of spectrum sold and the state of institutional health, political capture, and corruption

Country	Date	Band(s) (MHz)	Spectrum sold (%)	Institutional Health[4]	Political Capture[5]	Corruption[6]
IND	Oct 2016	800, 1800, 2100,2300, 2500	41	0.08	-0.28	40
BGD	Feb 2018	2100, 1900,900	33	-0.75	-0.91	26
MOZ	Apr 2013	800	0	-0.61	-0.60	30
JAM	2013	700	0	0.04	-0.28	38
GHA	Dec 2015	800	50	-0.22	-0.19	47
SEN	Nov 2015	700, 800, 1800	39	-0.43	0.06	44

This analysis suggests unfavourable politico-economic and social characteristics of the developing countries under consideration during the time of the respective spectrum awards. Details of these spectrum awards are discussed in the following paragraphs.

India[7]

In Oct 2016, the Government of India conducted a multi-band auction of 800, 1800, 2100, 2300 MHz and 2500 TDD bands. Lots of 2×1.25 MHz for 800 MHz band, 2×0.2 MHz for 1800 MHz, 2×5 MHz for 2100 MHz and 2×10 MHz for 2300 MHz and 2500 MHz bands were up for auction. The average spectrum reserve price was $0.33/MHz/pop, which was almost 50% higher than the median price in developing countries between 2000 and 2017. The auction was not a success and only 41% of the spectrum was sold.

Bangladesh[8,9]

In Feb 2018, the Government of Bangladesh conducted a multi-band auction of 900, 1900 and 2100 MHz bands. 2×34 MHz in the 900 MHz, 2×18 MHz in the 1900 MHz and 2×25 MHz in the 2100 MHz were up for auction. The reserve prices were kept at $0.19/MHz/pop in the 900 and 1800 MHz band and $0.17/MHz/pop in the 2100 MHz band. The price was considered extremely high by the operators. It was reported to be 3.5 times the annual cash flow generated by all the mobile operators. Only 33% of the spectrum was sold.

Mozambique[10,11]

In April 2013, the Government of Mozambique, auctioned five lots of 2×5 MHz of 800 MHz band. The reserve price of $0.12 per MHz/pop was considered excessive by the operators. It was being reported that the operators would need to invest a third of their annual service revenues to be able to meet the starting bid. This equalled $448 million in 2013. The starting bid was said to be 50% higher than the average final price in Sub-Saharan Africa over the period of 2000-2017, after adjusting for per capita income. As a result, no bidders participated in the auction. It was eventually cancelled by the regulator.

Jamaica[12]

In 2013, the Jamaican government auctioned the 700 MHz band for a reserve price between the range of $40-$45 million. The price was reported to be high by the operators, and as a result the spectrum assignment was delayed by a year.

Ghana[13]

In Dec 2015, the government of Ghana auctioned two 2×10 MHz lots in the 800 MHz band. The reserve price was $0.13 per MHz per pop. The reserve price was reported to on the higher end by the operators and only 50% of spectrum at auction was sold.

Senegal

In November 2015, the government of Senegal conducted a multi-band auction of 700, 800, and 1800 MHz bands. 3 blocks of 2×30MHz in 800MHz, 4 blocks of 2×20MHz in 700MHz and 3 blocks of 2×30MHz spectrum in 1800MHz were up for auction. The reserve price was set at $0.08 USD/MHz/pop. The reserve price was considered very high by the MNOs. The Regulatory Authority for Telecommunications and Post (ARTP) also received a letter signed by all three incumbent MNOs calling for a price reduction. However, ARTP did not reduce the reserve price and only 39% of the total spectrum on auction was sold.

Reserve prices should reflect the operating environment

All the above case studies suggest that an unsuccessful award outcome – that is, less spectrum being sold – coincided with high reserve price. This high reserve price was not in line with low income levels of these developing countries, fostered by unfavourable underlying political, economic, and social factors.

Figure 3 and Figure 4 help to illustrate this possible positive correlation between the amount of spectrum being sold and the underlying politico-economic and social factors. They compare the percentage of spectrum sold with institutional health, political capture, and corruption, in developing and developed countries.

Figure 3: Correlation between percentage of spectrum sold, institutional health and corruption

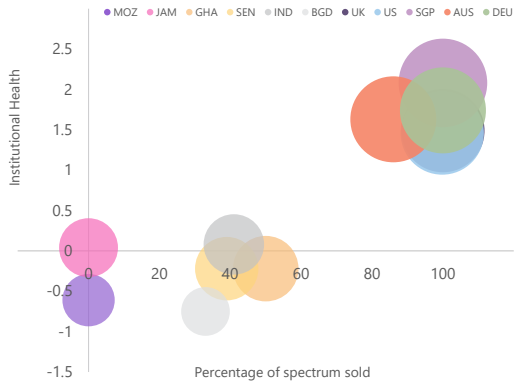
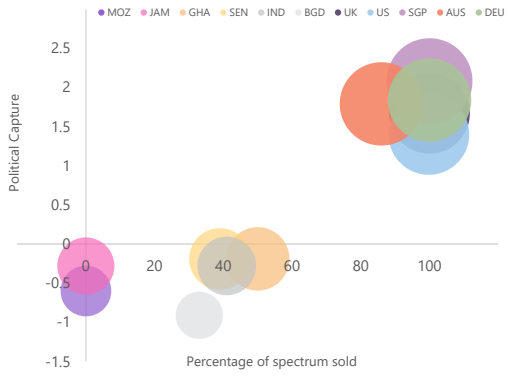


Figure 4: Correlation between percentage of spectrum sold, political capture and corruption



Note: The size of the bubble shows the amount of corruption in the country. (See endnote 6)

This analysis suggests that, in developed countries, a greater amount of spectrum was sold for 3G and LTE awards, coinciding with their favourable political, economic, and social factors. However, in developing countries minimal spectrum was sold coinciding with their unfavourable underlying characteristics – and as previously discussed, this may be due to high reserve prices not reflecting these differences.

Therefore, for a spectrum award to be successful (which in this paper is defined as the amount of spectrum being sold), all the domains of a country's structural organisation need to be accounted for. One option is for the governments to decide the spectrum reserve price keeping in mind the underlying factors. Specifically, for developing countries, the reserve price is expected to be lower than for developed countries – not only because of lower income levels, but also because of comparatively unfavourable politico-economic and social factors, all which feed into their low purchasing power. The alternative approach is to undertake a comparative tender.

Targeted and context-specific benchmarking

Underlying politico-economic and social factors should be accounted for in spectrum reserve price benchmarking. This is often done by choosing a sub-set of comparison countries based on the income level of the country under consideration, geographic proximity or by using other similar parameters. The income level is positively correlated to political and social state of the countries.[14,15,16] In addition, countries in the same region are expected to have similar political and social characteristics, and their economic growth is also expected to be impacted by each other due to regional spill over effects.[17,18]

While it is useful for developing countries to use spectrum reserve price benchmarks of countries at similar income levels and countries in their geographic region, it is important to be cautious while doing this – it is possible that many of these data points may be adversely impacted by the high reserve price values shown above. Ordinarily, excluding high value outliers may be sufficient, but this may not be the case where multiple values are on the higher end. An econometric analysis might also have the same upward trend in the values as the data set would be the same.

In such a case, all higher values would need to be investigated to understand the reasons for their value – and desk research should also be done on other data points to determine which of those did not have an upward push. Such data points should be shortlisted and then used for spectrum price benchmarking. It is possible that the recommended reserve price might not be the median value and could belong to the lowest quartile.

Comparative Tender

Even where price benchmarks are possible, and where adjustments can be made for the social and political environment, there is no guarantee that an auction will result in a socially beneficial outcome.

Given this, a comparative tender approach might be an option worth considering for developing countries. In a comparative tender, a bidder is not normally expected to pay market price for spectrum. Instead, the spectrum assignment is largely based

on a set of obligations that the bidder needs to fulfil within the licence term. These obligations could include network investment, scale of rollout, service quality, geographic coverage, or population coverage. The government would monitor the progress of the licence awardees and could also renege the spectrum licence if obligations are not fulfilled.

The main questions raised by this type of comparative tender are how to set the obligations – what is the socially optimal level of coverage and service quality? Analysis can be carried out on public and private demand functions to answer this question, meaning that a comparative tender is a means to actively account for specific political, economic, and social impacts of the spectrum award.

While comparative tenders might not provide the regulator with as much revenue in the short-term as an auction or direct assignment would do, they are expected to be more beneficial for the country in the long-term. According to a 2017 study[19], lost consumer surplus as a result of high spectrum prices outweighs the gain in auction revenues for the government. This is critical for all developing countries to understand: they need to think long term and not focus on immediate revenues.

However, in developing countries in particular, comparative tenders run the risk of political capture due to a lack of transparency. A comparative tender approach, if chosen in a developing country, should be designed in a manner that encourages transparency and accountability of the government.

Environmental impacts from spectrum policy

As discussed above, all three aspects of a country's structural organisation (politics, economics, and society) interplay with each other to impact economic growth and development of a country. The environment is the essential bedrock on which the above three domains sit. Therefore, no spectrum policy can be holistic without accounting for its environmental impact.

The growing interest in environmental impacts amongst the ICT industry should be further enhanced by incorporating it within the spectrum policy. Government and regulators should emphasise upon obligations of carbon offsetting for MNOs, a push for reduced carbon footprint in network infrastructure equipment, an emphasis on spectrum sharing and Software-Defined Access Networks (SDAN) over physical infrastructure and the importance of accounting for carbon costs in impact assessments and network cost or enterprise modelling.

Conclusions

Developing countries' governments must understand that spectrum not only impacts the economic structure of a country, but also its political and social make up. Similarly, these three factors influence the value of spectrum itself. Spectrum policy needs to be holistic so that it can account for all these factors, and also needs to take account of the wider operating environmental factors. Otherwise, it is likely that outcomes of spectrum awards will be sub-optimal.

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[1] "It's the economy, stupid" is a phrase used by James Carville as part of Bill Clinton's 1992 presidential campaign.
[2] Note that there are other approaches such as licence-exempt spectrum, light licensing and new sharing techniques.
[3] GSMA, 2018, Spectrum pricing in developing countries.
[4] World Bank's index of government effectiveness: this is used to evaluate the level of Institutional health. It is measured on a scale of -2.5 to 2.5 where negative values show poor state of institutional health. World Bank, 2020, Worldwide Governance Indicators.
[5] World Bank's control of corruption index: this is used to estimate the level of political capture in the countries. It is also estimated on a scale of -2.5 to 2.5 where negative values mean greater political capture while positive values imply less of it. World Bank, 2020, Worldwide Governance Indicators.
[6] Transparency International's corruption perceptions index is scored on a scale of 0 to 100, where 100 implies no corruption. Transparency International, 2019, Corruption Perceptions Index 2019.
[7] GSMA, 2018, Spectrum pricing in developing countries.
[8] Coleago, 2018, How to earn less from a spectrum auction and ensure slow mobile broadband speeds. A cautionary take from Bangladesh – will Thailand do better?
[9] Telecompaper, 2013, Operators slam high spectrum floor price.
[10] Many Possibilities, 2020, The Failure of Spectrum Auctions in Africa.
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[14] Econstor, 2014, Corruption, political instability and economic development in the Economic Community of West African states (ECOWAS): Is there a causal relationship?
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