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Understanding the cost and quality of networks across the G20



1. Background to the report

This report, commissioned by Rogers communications and completed by PwC, builds on PwC's 2019 report titled, *The importance of a healthy telecommunications industry to Canada's high-tech success*¹, in which PwC assessed the factors of production that contribute to the cost to build wireless networks in Canada compared to peer jurisdictions. The key findings of the report were:

- Canadian Mobile Network Operators (MNOs) have 2X higher capital expenditure (CapEx) per wireless subscriber;
- 3X higher spectrum costs; and
- 80% smaller scale, resulting in lower purchasing power.

This report expands the study to assess the factors impacting network costs for Canada compared to the G20 by building a network build cost index. PwC further expanded on the study by building a network quality index, which assessed network speed, 4G availability and video experience, and was modelled on PwC's report titled, *Understanding affordability of consumer mobile wireless services in Canada*.²

Using this analysis, this report assessed the network build cost index compared to the network quality index for the G20.³ This assessment helps compare the relative quality of telecommunication networks for consumers in the G20 as compared to the relative cost to build those networks. The analysis shows that Canada ranks the highest on the network build cost index amongst G20 peers. This is primarily driven by Canada's low population density (with high dispersion), high spectrum costs, and relatively smaller scale of MNOs. Notably, Canada also ranks the highest on the network quality index, leading the G20 nations in terms of network speed, and being among the top countries for 4G availability and video experience. This means that Canada has both the highest costs in the G20 to build wireless networks, while maintaining leading quality networks.

¹ PwC Canada, *The importance of a healthy telecommunications industry to Canada's high-tech success*, July 2020

² PwC Canada, *Understanding affordability of consumer mobile wireless services in Canada*, January 2020

³ Note that the G20 includes the European Union (EU). The EU as a block was not included in the analysis due to lack of country specific data. China was also excluded from the analysis due to lack of data availability.

2. Assessing cost and quality of Canadian networks compared to the G20: findings and results

2.1 Network build cost index - primary factors

To develop the network build cost index, PwC assessed three primary factors and four secondary factors that contribute to the cost of building wireless networks in Canada and in the G20 peer group. The three primary factors are population density, regulations and scale.

Countries with a lower population density, such as Canada, Australia and Russia, face a significant challenge in serving a smaller population across a large landmass, compared to denser countries that have smaller networks and less infrastructure. The analysis found that:

- Canada ranks as the second least densely populated country in the G20, only behind Australia.
- In contrast to Australia however, Canada has many more small towns dispersed across the country, which in part contributes to 50% more cell towers per capita, and 33% higher capital expenditure.

The cost of wireless spectrum is the main regulatory cost driver. Spectrum auctions are typically one-time fees paid to national governments for access to the network for a defined number of years. To assess regulation, PwC reviewed the auctions of mid-band 5G spectrum.⁴ Spectrum costs were compared on a per capita and per MegaHertz (MHz) basis, commonly referred to as the average price per MHz/pop.⁵ The analysis found that:

- The mid band spectrum auction that was completed in Canada in July 2021, resulted in a price of \$1.81 MHz/pop, the most expensive in the world, almost twice what the US paid at \$0.94 MHz/pop.⁶ Canadian National MNOs paid even more, at \$2.62 MHz/pop.⁷
- Canadian MNOs paid between 9.6X and 21.4X that of European peers. Germany, France and the UK paid \$0.19, \$0.16 and \$0.09 per MHz/pop respectively.

When comparing the largest MNOs in Canada to peer companies in the G20 nations, Canadian MNOs are generally smaller scale than other G20 countries. The analysis found that:

- Canadian MNOs are the sixth smallest compared to G20 peers. The smaller scale of Canadian MNOs results in lower bargaining power, less favourable contract terms and higher costs.
- AT&T, which represents the largest US firm, is more than fifteen times larger than Rogers. This demonstrates the notable scale differences between Canadian and other global MNOs.

⁴ For countries that have not auctioned mid-band 5G spectrum, a mid-point index score was assigned as a proxy for the purposes of calculating an overall score for the network build cost index. This approach was favourable to looking at data of past 4G spectrum auctions, as these were for different spectrum bands, fitting different operator needs over the past 10-12 years.

⁵ All calculations normalized in USD. Exchange rate used for US spectrum \$1 CAD = \$0.70 USD.

⁶ Canada Sets World Record for Prices of Mid-Band Spectrum Licenses, LYA, August 2021. Exchange rate used: Aug 2nd 2021, \$1 CAD = \$0.80 USD

⁷ TELUS secures critically important 3500 MHz spectrum licences, July 29, 2021. Exchange rate used, Aug 2nd 2021, \$1 CAD = \$0.80 USD

2.2 Network build cost index - secondary factors

PwC researched 4 secondary factors impacting network build costs: cost of labour, impact of weather, corporate tax costs and the cost of electricity. The analysis found that:

- Average wages in Canada are the fifth highest of the G20 peers, behind the US and Germany, and within ~\$500 of France and Australia.
- The extreme cold limits the construction industry to seasonal work in parts of Canada when the ground has thawed, limiting Canadian MNOs construction windows, while increasing ongoing maintenance costs.
- Canadian weather impacts MNOs through higher insurance costs, as events such as snowstorms and hailstorms mean Canadians pay the second highest non-life insurance premiums in the G20.
- Canadian MNOs benefit from relatively favourable corporate tax rates and electricity rates.

2.3 Network quality index

To build the network quality index, PwC assessed three main drivers; network speed, 4G availability and video experience.⁸ The analysis found that:

- Canadians benefit from the fastest networks in the G20 at 59.6 Megabits per second (mbps), slightly faster than South Korea, which is a significantly smaller geography country, and more than seven times faster than India (the slowest).
- Canada ranks fifth on 4G availability, with a connection rate of 93.5%, slightly behind Australia at 94.0%, India, the US and Japan. Japan has the highest availability at 98.5%.
- Canada ranks third amongst G20 nations on video experience, behind only Australia and Japan. Canada scored 74.8 compared to Japan's leading score of 77.6.
- To determine overall network quality, the analysis created an index of quality, equally rating the three factors. The index determined that Canada has the highest quality network of G20 nations.

⁸ Open Signal, The state of mobile network experience 2020: one year into the 5G era, May 2020

3. Network build cost index and network quality index

Figure 1: Network build cost index

High score = greater network cost

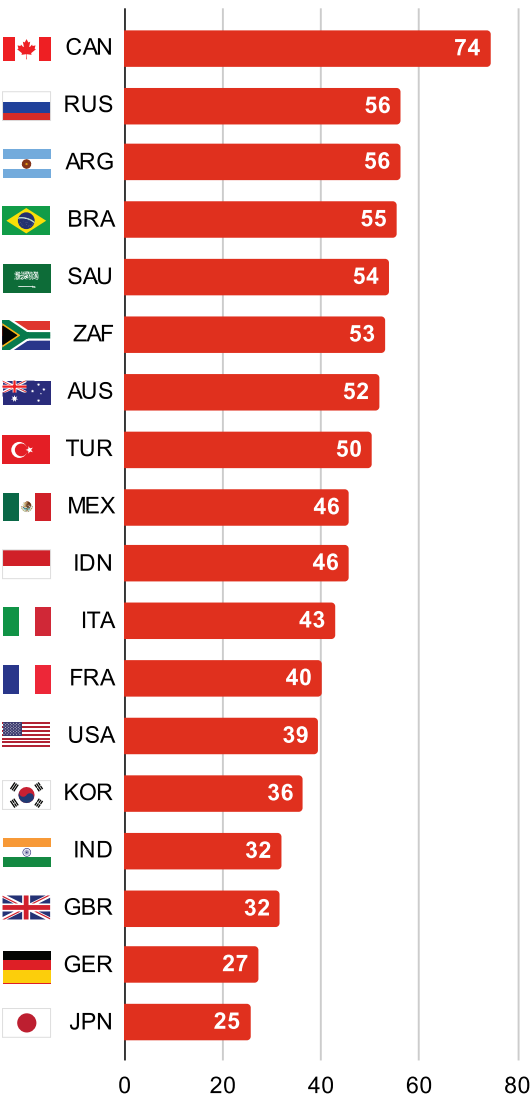
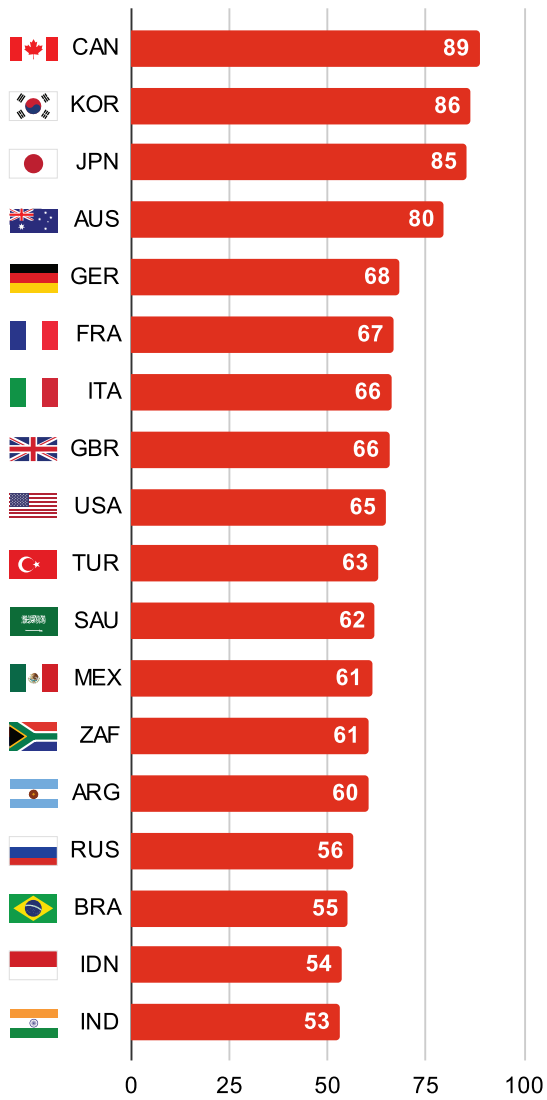
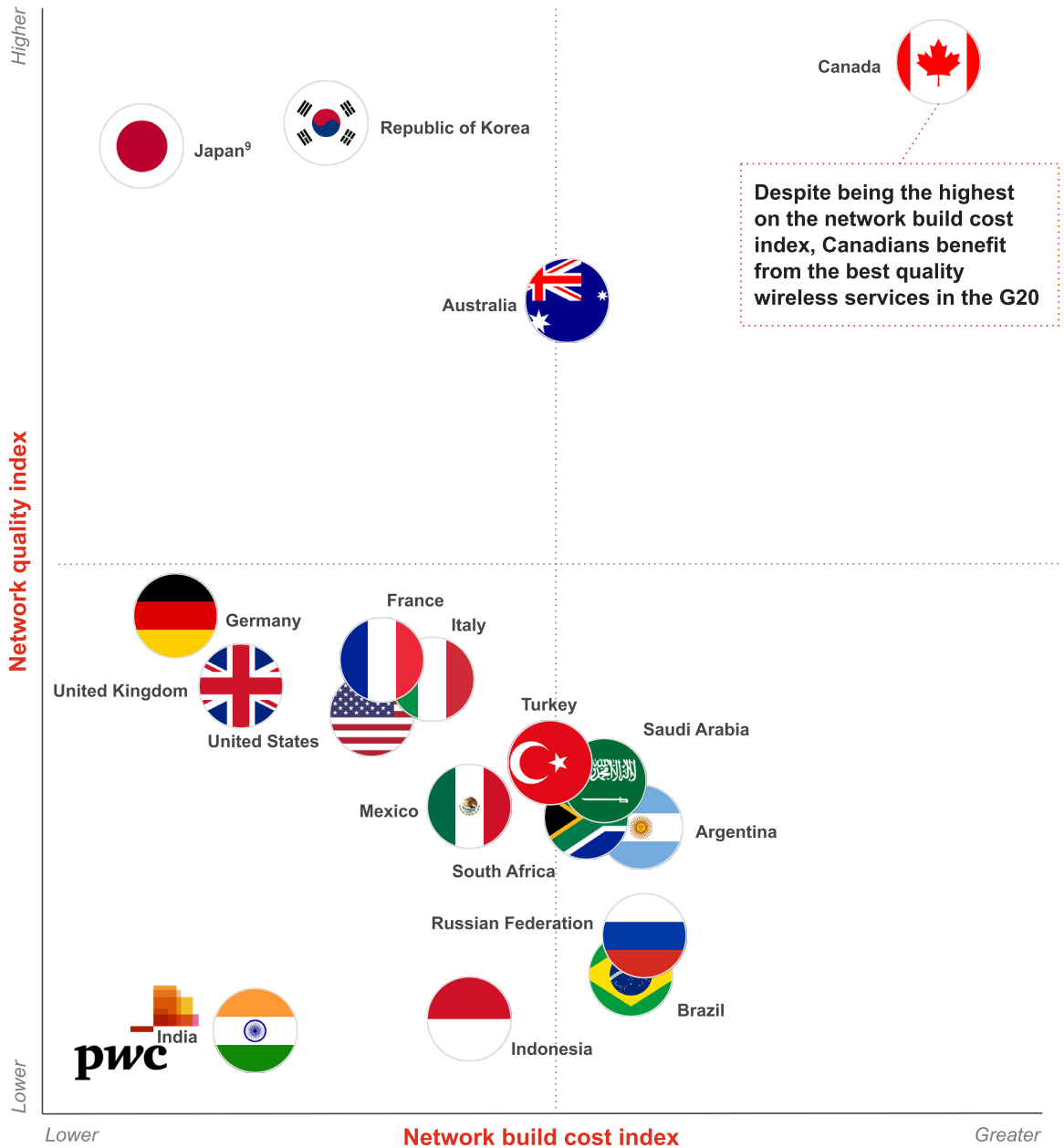


Figure 2: Network quality index

High score = higher network quality



4. Comparison of network build cost index and network quality index for the G20



⁹ Japan forgoes the traditional spectrum auction and awards spectrum licences at no cost provided that operators achieve coverage commitments within specific timelines



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