Colvin Consulting Group

Insight

What You Need to Know About 5G

Authors

John Colvin
Principal

Chloe Coorey
Research Assistant

Introduction

1G allowed us to talk to one another. 2G allowed us to send messages. 3G opened the gates for broad data and internet. 4G made it all a whole lot faster.[1]

Exposing many different industries to a host of new possibilities, the capabilities 5G boasts brings the world as we know it to the brink of massive change. Specifically, low latency and bandwidth intensive market segments such as e-health and autonomous transportation will experience a massive digital disruption.[21]

As 5G's capabilities will extend far beyond revolutionising the way in which we communicate, the way in which various sectors operate and the way in which individuals and businesses consume and use data will be changed.

This paper will focus on the impact of 5G on various industries as well as its socioeconomic implications on the broader economy.

Consider the following

- 5G is predicted by Qualcomm to boost global GDP by $2.1 trillion and generate more than 22.3 million jobs by 2035 just in building and maintaining the networks[2]
- IHS Markit estimates 5G will drive an extra $12 trillion global economic activity in 2035 shared across all industries[3]
- IHS Markit describes the changes 5G will bring about as on par with the disruptive effects of the printing press, steam engine and the discovery of electricity[3]
- IHS Markit forecasts for the 2020-35 period GDP growth at an average global rate of 2.9 per cent, of which 5G will contribute 0.2 per cent. To put it in perspective, this period of 5G will contribute to real global GDP growth equal to the current GDP of India[3]

What does it all mean?

Though frequently discussed in forums and threads in the future tense, the mass adoption of 5G-enabled technologies will bring technological advancements once penned as science fiction. Among the changes:

- Low latency
    - Low latency refers to the speed in which data is able to be transferred between devices.[4] Human reaction times average between 200-300 milliseconds and 4G 100-200 milliseconds. In comparison, 5G will have a latency of 1 millisecond.[1]
- Beam Forming
    - Beam forming refers to traffic-signalling technologies that are able to focus a signal to a specific direction, limiting wave interference for a stronger connection.[21]
- Massive multiple-input, multiple-output (MIMO)
    - MIMO refers to the use of multiple antennas for a user to simultaneously receive and transfer data to improve the efficiency and reliability of wireless transmissions.[21]
- Network Slicing
    - Network slicing is a form of virtualisation that will allow multiple networks to run atop of a shared physical network.[22] With network slicing, each horizontal slice will have its own independent virtual resources as opposed to our current mode of vertical slicing which requires resource sharing between different services and applications.[5] This increases network safety and allows for the sharing of a capital-intensive 5G network between many operators.[5]

- Multi-access edge computing
    - Edge computing is a variation of cloud computing that processes and stores critical data locally to reduce backhaul traffic to the central repository, making data collection and storage much faster, safer and efficient.[6]
- The Internet of Things
    - The Internet of Things (IoT) refers to the increasing network of devices that can be connected to and controlled via the internet. 5G will be able to fit up to one million 5G devices in one square kilometre.[7]

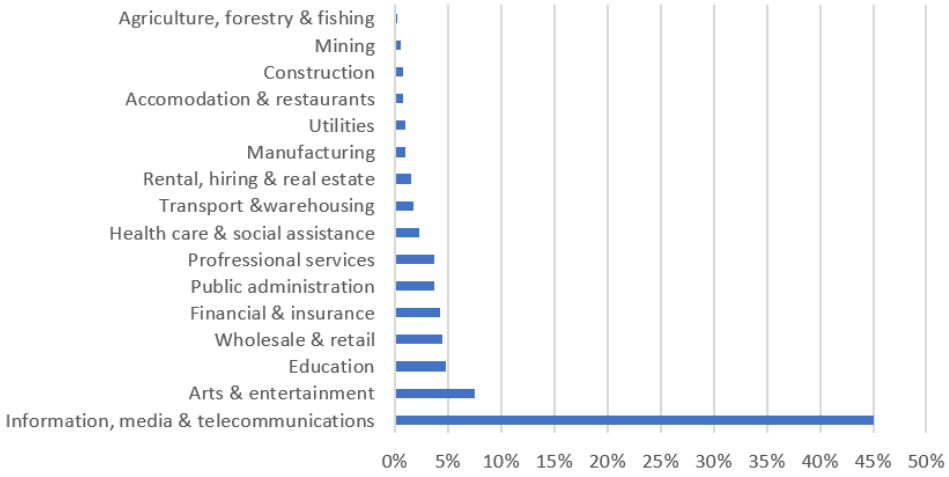
What does this mean for industries?

Regardless of the scale and pace of the rollout, 5G will likely generate benefits that will last beyond the short term. Touching upon our previous thoughts on IoT and wearable technology, industries will find themselves in the midst of a digital transformation with 5G. It will present huge opportunities for growth across a range of industries, allowing mobile to move beyond consumer and enterprise services into industry. Some examples:

- The Telecommunications Industry
    - Telecom infrastructure companies or cell tower real estate investment trusts (REITs), which own and rent out space in cell towers to network providers, will likely experience a boost in profitability as 5G entails a new wave of demand for infrastructure. On the other hand, the reduction of the cost and size of the necessary infrastructure by design might have the opposite effect as companies begin building their own independent 5G networks.[8]
- The IT Industry
    - The sudden, interconnected nature of a host of new devices through IoT will expose more individuals and businesses to the threat of cyber security breaches. Thus, the management of these devices and the protective measures in place will be integral to the reliability of the network. This will drive up the demand for automated, AI-driven management services like Microsoft Azure.[8]
- The Manufacturing Industry
    - The IoT capabilities of 5G will present new revenue opportunities as market entrants will be able to monetise ordinary objects in a bid to create 'smart cities'.[9] For example, with a smart sidewalk, Google maps can monitor how fast you are walking in comparison to others your age, gender, or race to provide rudimentary health analyses and more personalised route timing for its users.[9] Map functions will also be able to reduce congestion by tracking the movements of everyone and everything in a particular area.
    - The IoT capabilities of 5G will enable the creation of smart factories; namely, more dynamic and efficient production lines with a heightened level of connectivity. Many market leaders have started preparing for the integration of 5G. For example, Ericsson have developed a 5G-enabled smart factory prototype.[10]
- The Health Industry
    - The high reliability and low latency of 5G will allow for wireless, remote surgery with instantaneous feedback, robotics, telemetry from wearable devices and transmission of HD images.[11] Surgery will be able to be performed by robots at a higher level of precision or be manually controlled by doctors from international locations; eradicating time and distance as a hinderance to medical operations.[11]
    - 5G's higher quality and real-time video will enable remote health care services. Oulu Health is one of the first entities to test a remote health care solution, experimenting with 5G's high quality video connection to verify a patient's blood sugar measurements and provide diagnoses and treatment of sleep apnoea, snoring and bruxism. This will also lower transport costs and opportunity costs for patients.[11]

- The Transport Industry
    - 5G's low latency and IoT capabilities will provide the operational framework for autonomous vehicles to function. IoT will allow vehicles to communicate with each other and its surroundings while navigation decisions and route planning will be processed in the cloud.[12] 5G's low latency will allow for faster reaction times than a human, making autonomous transport safer than if one were to drive the car themselves. Many businesses have started planning for this reality, with Intel acquiring Mobileye in 2017 for their research and production of Advanced Driver Assistance Systems (ADAS) as well as their work on a full autonomous car model with companies such as Great Wall Motors in China.[13]
    - The rise of autonomous vehicles will revolutionise the delivery of goods and services. Human capital will no longer be required, replaced by robots to reduce fees and increase efficiency. However, regulatory restrictions and infrastructure costs such as reachable recharging stations may present a hurdle.[3]
- Emergency Services
    - The IoT 5G enables will lead to faster recognition of natural disasters, faster communication of life-saving information and better coordination of emergency responses. Relevant parties such as rescuers, firefighters and scientists will be able to draw upon a larger amount of data communicated by technologies in remote or at-risk areas in real time.[3]
- The Education Sector
    - Virtual reality (VR) learning requires high bandwidth and low latency to educate its audience effectively. While 4G struggles to maintain the traffic required for VR experiences, 5G will usher in a new seamless experience. The 5G VR system will remove the physical location constraint, improving the virtual delivery of education for students in higher education and in rural communities.[3]
    - Students with special needs will also benefit from an education with 5G-enabled technologies such as cloud-based robots. As children with special needs at times require more frequent care and assistance than a teacher is able to give, robots can assist teachers in the handling of administrative and interpersonal tasks.[3]

Figure 1: Telecommunications intensive industries are projected to be the biggest initial users of 5G



Source: BCAR estimates derived from ABS Input-Output data for 2014-15.

Business Applications

- Understanding consumers
    - The way in which businesses gather and analyse data will change. The widespread use and integration of 5G services will be the opportunity for instantaneous communications between customers and company employees. IoT will also allow companies to compile more consumer data for any given 5G-enabled product.[14]
- More efficient workspace
    - Advances in AI and machine learning made possible by 5G networks will diminish the need for white-collar workers to be engaged in repetitive or cognitive tasks such as accounting and data processing. Smart machines will not overtake entire professions but will instead perform tasks that are key parts of jobs. This will allow for the existing workforce to collaborate with intelligent machines to make more productive contributions.[15]
    - Faster download speeds and lower latency will improve business efficiency and bolster innovation in producing and delivering goods and services. As cloud computing advances, companies will benefit from better collection and analysis of big data which can lead to more real-time decision making.[14]
- Enhanced supply chain management
    - Companies will benefit from modernised tracking methods that will ensure the safety of firm products. Currently, companies rely on QR code scanning and radio-frequency identification (RFID) to track the location of their product. However, product logging is typically only done upon arrival and if damage has been sustained it is particularly difficult to pinpoint when it occurred. With 5G sensors installed on packages, supply chain stakeholders will be able to monitor the location, temperature, humidity, g-forces and moisture levels of a product in transit. Businesses will be able to receive real-time feedback on the status and condition of their packages.[16]
- Private networks
    - The integration of the 5G network has given rise to 5G private networks; you no longer need to be a nation-wide operator and can obtain spectrum licences on a local basis. This will allow factories and other businesses to deploy its own network entirely within their own facilities, allowing high levels of security and less interference from others sharing the network or from traffic generated from irrelevant sources.[17]

Productivity

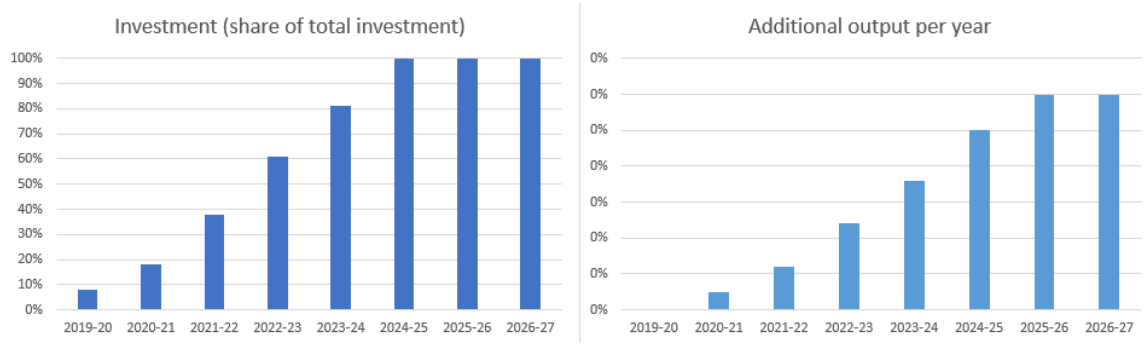
As 5G will increase productivity in the workplace, longer-term income growth will ensue. More specifically, about 80 per cent of per capita income in Australia over the past 30 years can be attributed to labour productivity growth.[3] Recently, productivity growth has been average or slower than average. This can be attributed to the ageing population detracting from income growth and the transition of the Australian economy to one more based on services, which characteristically have a lower level of productivity.[3] As Australia is unlikely to experience any boost to incomes comparable to what was experienced in the recent mining boom, new drivers of productivity must be found if income productivity is to improve in coming years.

5G will likely boost productivity not only in the productive sector of the economy but also as consumers and households use 5G to become more efficient. For example, the rise of smart cities will reduce congestion, shortening the travel time for individuals travelling to and from work, improving an individual's ability to supply labour to the economy whilst making transport services more efficient.[3]

Overall, 5G is poised to add $1300-$2000 in GDP per capita – a 1.6 to 2.5 per cent increase – after the first decade of the rollout according to the Australian Government Department of Communications of the Arts.[3] It is noted, however, that this was a conservative estimate that did not consider the consumer and non-market benefits not captured in economic statistics such as the indirect, positive spill-over effects on participation and productivity.[3]

As seen in Figure 2, productivity increases will be affected by the timing of 5G.

Figure 2: How investment and outputs evolved in the lagged timing cases

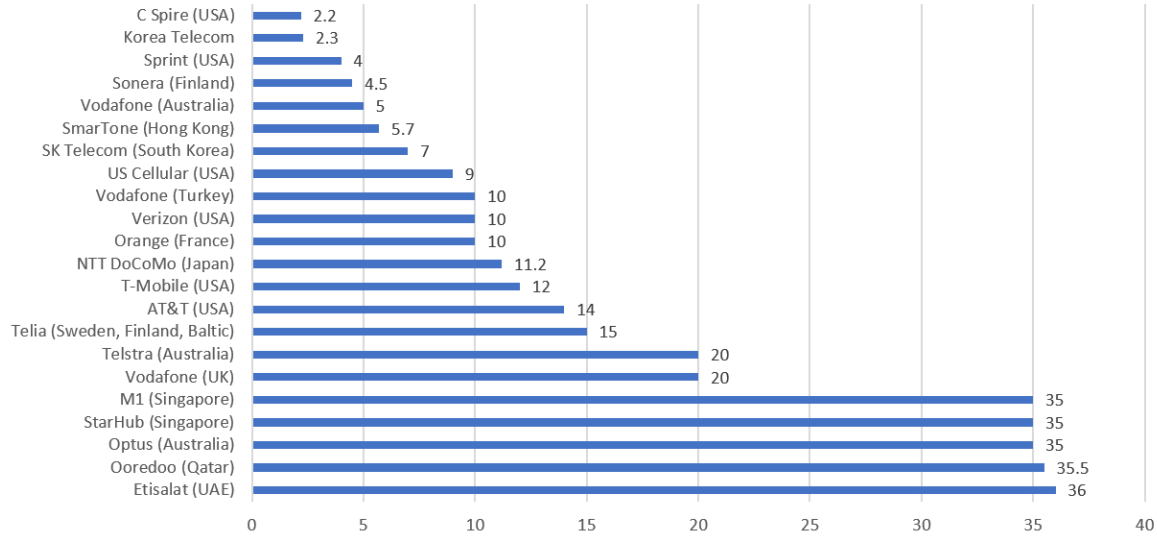


Source: BCAR estimates

Costs and Deployment

Various companies have been trialling 5G globally. Telstra, Optus and Vodafone have been conducting lab tests in Australia, with Telstra further undertaking field tests. Internationally, 5G was trialled at the 2018 Winter Games in Seoul and will be further trialled at the 2020 Tokyo Olympic games.[3]

Figure 3: Highest claimed data speeds reached during 5G trials (Gbps)



Source: Viavi (2017) The State of 5G trials

The 5G rollout in Australia is expected to be staggered. Rollout will be quicker in urban, concentrated areas with greater demand and slower in more rural and remote areas where there is less demand.[3]

Following its predecessors, the adoption of 5G technology is expected to grow slowly as new products that can support the new network are brought to the market. Its adoption rate hinges upon the commercial benefit suppliers who believe they can derive from an investment in 5G infrastructure. Decisions about investment will depend on a variety of factors, including the profitability of building a network to capture market share and bandwidth allocation for 5G services.[3]

Currently, Telstra is already beginning to sell its first 5G-enabled devices with the Galaxy S10 5G, the Galaxy Note 10+ 5G, the OPPO Reno 5G, LG V50 ThinQ, and the HTC 5G Hub portable hotspot.[18] Optus recently announced roughly 140,000 premises can now order its 5G home broadband service. Vodafone is set to follow in 2020. Optus is preparing to offer 5G-powered home wireless solutions as a viable alternative to the National Broadband Network (NBN). However, 5G will not replace the need for NBN due to the higher cost of data on mobile networks.[18]

Significant upfront investment is required to build an infrastructure that can support 5G. Network providers must account for the necessary upgrades to existing base stations, backhaul capacity and core networks. Costs also vary according to the concentration and size of the potential user pool.[3] Based on previous instances of deployment, each generation of a mobile network has cost more to deploy than previous generations. A study prepared for the European Commission estimated that the cost per capita of providing 5G would amount to

around 4.5 per cent more than the per capital deployment costs of 4G in its initial rollout in 2020 and 7.5 per cent higher in 2025.[3] Building the infrastructure to support the 5G network in Australia could cost anywhere between $2 billion to $27 billion.[3]

The Job-apocalypse?

The skills needed for the new jobs 5G will generate are not the skills currently possessed by those whose jobs will be rendered irrelevant through the 5G network. As mentioned, 5G will not take over and replace whole jobs but will instead perform tasks that are key parts of jobs. This will render certain worker skills and qualities obsolete, to be replaced by a new generation of more tech-savvy individuals.[19]

So how do we avoid this? As a society, we've been repeatedly negligent in imparting new skills to existing workforces in periods of disruption and upheaval. It is both the responsibility of the tech industry and companies themselves to ensure their employees know how to adapt to new positions even when they cannot invest in retraining themselves. Companies will need to teach existing workers the new skills needed in order to access the new jobs offered and stay relevant in the workforce.[19] Case in point, German companies like Daimler, Siemens, and Bosch invest in apprenticeships that include living expenses for workers while they learn.[20]

Over the coming years, workers who can collaborate with intelligent machines and/or have problem-solving and critical thinking skills will be of higher demand. As the cycle of change grows increasingly shorter and more dramatic with every tech disruption, individuals in the workforce will need to acclimate to a more tumultuous and uncertain work environment.[19]

What can boards do?

As 5G ushers in an exciting new era for anyone and anything that consumes data, boards must consider how they will adapt to such changes. Boards must first recognise the ways in which their industry will change and adapt their business model accordingly. This may include reorganising the internal structure of a company to better suit the market changes.

To fully utilise these opportunities, firms must also:

- Normalise the use of 5G in the company culture
- Ensure all employees are on the same page
- Ensure all employees are properly equipped with the tools to utilise 5G
- Ensure the firm's infrastructure can support 5G

All businesses alike will have the potential to their further their operations and increase productivity. However, this will not come easy. Rather, accessing such benefits requires investment in various resources. Whether that investment will be worth it is up to boards and the level of efficiency they want to operate with, the products they want to release and the relationship they want to have with consumers.

Conclusion

5G has the power to be extraordinary. Its transformative potential will depend on how quickly it is rolled out, how businesses decide to utilise the network and how governments attempt to regulate it.

5G presents exciting new opportunities for anyone who consumes data. However, the real advancements will be felt by businesses in the industrial, technology and health sectors as they face massive digital disruptions and new opportunities to expand and advance.

References

1: https://www.youtube.com/watch?v=MC_Sfkh5-zQ

2: https://www.qualcomm.com/invention/5g/economy

3: https://cdn.ihs.com/www/pdf/IHS-Technology-5G-Economic-Impact-Study.pdf

4: https://www.informatica.com/au/services-and-training/glossary-of-terms/low-latency-definition.html#fbid=jaXOZd7i1Yx

5: https://www.cablelabs.com/network-slicing-building-next-generation-wireless-networks

6: https://justmachinelearning.com/2019/01/03/what-is-edge-computing/

7: https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/

8: https://www.forbes.com/sites/miriamtuerk/2019/02/27/how-5g-networks-will-change-america/#17b8f19d11b5

9: https://medium.com/the-politicalists/the-political-and-ethical-problems-of-5g-internet-7c5ab0ba9458

10: https://www.ericsson.com/en/news/2017/2/ericsson-and-china-mobile-jointly-demo-the-5g-enabled-smart-factory-at-mwc-2017

11: http://ouluhealth.fi/transforming-healthcare-5g/

12: https://spectrum.ieee.org/telecom/wireless/the-car-in-the-age-of-connectivity-enabling-car-to-cloud-connectivity

13: https://www.sdxcentral.com/5g/definitions/top-5g-business-case/

14: https://smallbiztrends.com/2018/03/ways-5g-can-benefit-small-businesses.html

15: https://au.pcmag.com/business/46611/we-need-to-prepare-for-the-5g-jobs-apocalypse

16: https://www.techrepublic.com/article/new-iot-sensors-allow-companies-to-monitor-shipments-in-real-time/

17: http://techgenix.com/private-5g-networks/

18: https://www.whistleout.com.au/MobilePhones/Guides/5g-in-australia-what-you-need-to-know

19: https://au.pcmag.com/business/46611/we-need-to-prepare-for-the-5g-jobs-apocalypse

20: https://www.theatlantic.com/business/archive/2014/10/why-germany-is-so-much-better-at-training-its-workers/381550/

21: http://member.afraccess.com/media?id=CMN://3A507371&filename=20181206/TLS_02057286.pdf

22: https://www.idginsiderpro.com/article/3231244/what-is-the-difference-between-network-slicing-and-quality-of-service.html

Colvin Consulting Group

February 2020

www.colvinconsulting.com.au

jcolvin@johncolvin.com.au