



Global mobile industry trends

Implications for New Zealand

Non-Confidential Report

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Glossary of terms

ACCAN	Australian Communications Consumer Action Network
ACMA	Australian Communications and Media Authority
AI	Artificial Intelligence
APAC	Asia-Pacific
API	Application Programme Interface
AR	Augmented Reality
ARPU	Average Revenue Per User
BAT	Baidu Alibaba Tencent
BEREC	Body of European Regulators for Electronic Communications
BSS	Business Support System
BYOD	Bring Your Own Device
CRM	Customer Relationship Management
DOCSIS	Data Over Cable Service Interface Specification
EC	European Commission
EU	European Union
FANG	Facebook Amazon Netflix Google
FB	Facebook
FCC	Federal Communications Commission
FTTH	Fiber to the home
FWA	Fixed Wireless Access
GB	Gigabyte
GCHQ	Government Communications Headquarters (UK)
GPS	Global Positioning System
ICBC	Industrial and Commercial Bank of China
IMDA	Info-communications Media Development Authority (Singapore)
LPWAN	Low-Power Wide-Area Network
LRIC	Long-Run Average Incremental Cost
LTE-M	Long Term Evolution for Machines
MB	Megabyte
MIMO	Multiple-Input Multiple-Output
MVNA	Mobile Virtual Network Aggregator
MVNE	Mobile Virtual Network Operator
MVNO	Mobile Virtual Network Enabler
NB-IoT	Narrowband Internet of Things
NFL	National Football League
NFV	Network Function Virtualisation
NPS	Net Promoter Score
NRA	National Regulatory Authority
NZ\$	New Zealand Dollar
OEM	Original Equipment Manufacturer
OSS	Operational Support System
OTT	Over-The-Top
POS	Point-Of-Sale
RCS	Rich Communications Suite

SDN	Software Defined Networking
SD-WAN	Software-Defined Wide Area Network
SMP	Significant Market Power
SVOD	Subscription Video-On-Demand
TMT	Technology, Media and Telecommunications
UCC	Unified Communications and Collaboration
UK	United Kingdom
US/ USA	United States of America
VDSL	Very-high-bit-rate Digital Subscriber Line
VR	Virtual Reality

1. Introduction

1.1. Report objective

This report analyses the main trends in mobile markets across the globe to understand where the market is heading. The focus is on customer demand, technology, regulatory and competition trends.

This analysis is being undertaken to understand the trends which are relevant to the New Zealand market, and which of these trends are likely to affect competition. A set of considerations and recommendations have been identified to address opportunities and threats to the New Zealand market. As mobile has become an intrinsic part of customers lives, the overall objective is to ensure customers are provided with services in a fair manner to support their emerging lifestyle needs. These mobility needs extend from traditional communication to entertainment, security and productivity.

1.2. Analytical approach

When looking at the global mobile market, it is important to develop an underlying understanding of the drivers behind the emerging trends. A key challenge is to understand whether the influences are from the demand side, i.e. demand from customers, or the supply side i.e. development by operators and technology companies. In this analysis, we have started by explaining the major trends in customer demand as the purpose of this report is to understand the implication on customer choice. These customer drivers reflect both the technology innovations that have gained traction and behavioural changes.

We have then developed an understanding of trends which are taking place within operators and technology providers across the value chain made up of infrastructure, platform and services. These trends have been viewed as industry responses to the demand trends and address three main objectives: cost reduction, service delivery capability and innovation development.

We have drawn upon examples from countries from across the globe, which have similarities with New Zealand in terms of market maturity, demographics, technology trends and regulatory settings.

The major emerging global trends which are relevant to New Zealand have been identified and analysed further, leading us to a set of considerations against each of the trends.

It is worth pointing out that whilst this report focuses on the mobile industry, development in the fixed line infrastructure is relevant due to three reasons. Firstly, there is a fixed to mobile migration. Secondly, there is a trend in fixed and mobile convergence as described in Section 5.2. Thirdly, a predominant part of mobile calls is transited over the fixed line networks. Greater mobile data speeds and network functionality requirements impact the demand on fixed infrastructure.

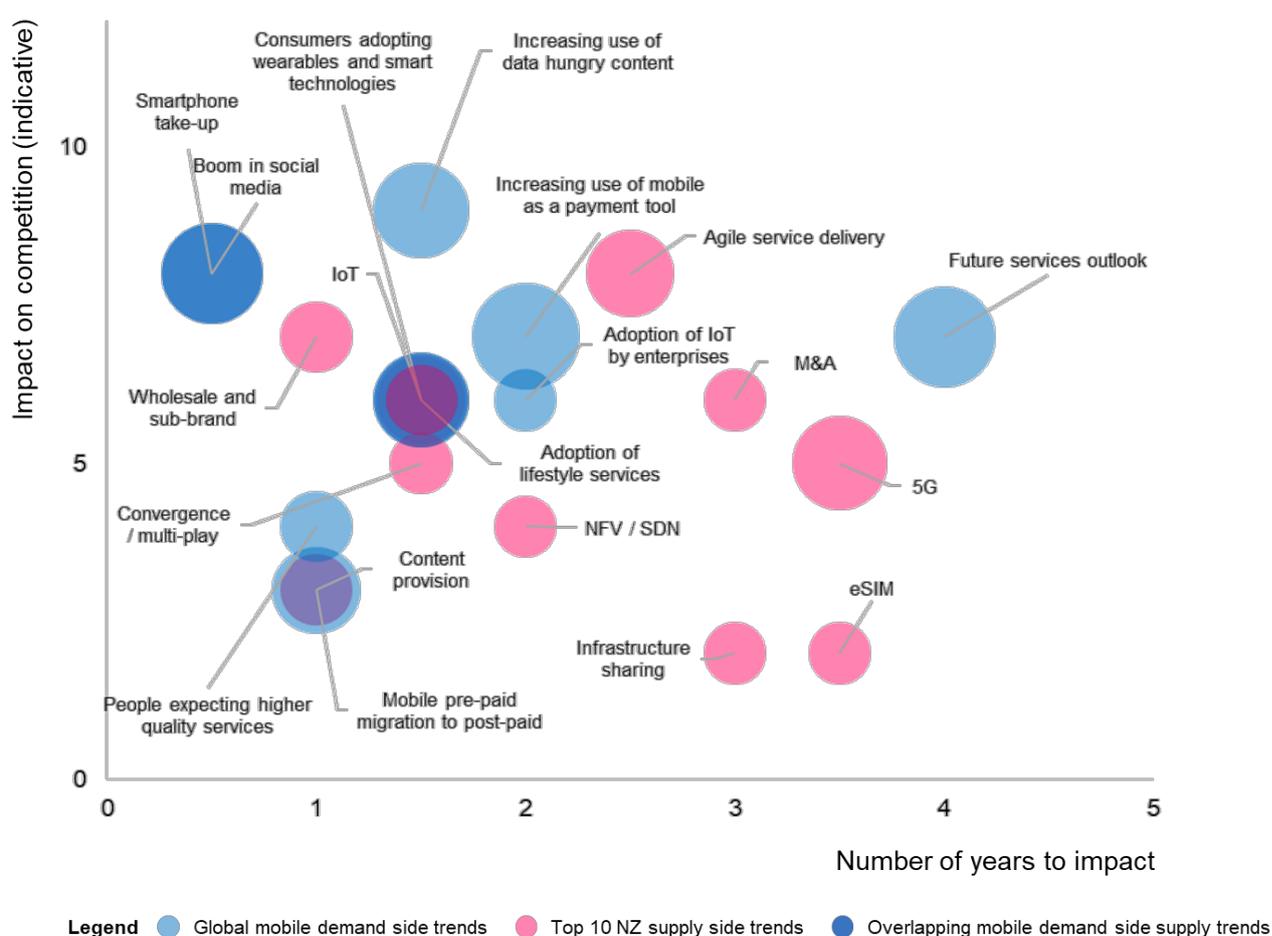
2. Executive Summary

The mobile market has moved at a phenomenal rate over the past 20 years and is certainly set to change rapidly over the next decade.

Identifying a set of trends that could impact the New Zealand market will always be subjective, particularly as new disruptive innovations can surface at any time – for example, the incredible growth in social media usage could never have been predicted until the advent of Facebook.

We have described the trends in customer behaviour leading to demand in mobile services in Section 4 and the industry’s response with technology developments at an infrastructure, platform and services level in Section 5. Focusing on the trends which impact New Zealand, we have plotted these in Figure 1 to highlight when these trends will reach significance, and what the impact on competition would be. The magnitude of these trends and their impact on customers is indicative and indicated by the size of the circles, which is a function of number of customers multiplied by the value per customer.

Figure 1 . Comparison of demand side drivers versus top 10 supply side mobile trends¹



¹ RDC analysis, 2019

The trends include demand side trends, explained in Section 4 and the supply side trends relevant to NZ, as described in Section 6.

Considering all the demand and supply side trends, some key over-arching themes have emerged from our research:

2.1. Airtime price erosion

The cost of voice, SMS and data has been falling at a rapid rate over the past 10 years. This will contribute to telco revenues being predicted to decline at an average annual rate of 10% from 2018 to 2023².

To understand the reasons for this price decline, we need to look at three factors: demand, supply and competition.

The demand for voice calling has grown steadily over the past 20 years due to substitution from fixed line, improved call quality and growth in mobile penetration. This growth is slowing down and in mature markets average revenue per user (ARPU) is in decline³. Traditional supply and demand-based economics would imply that this would have the effect of pushing prices up. However, the supply in terms of network capacity has more than compensated for this demand with the introduction of 3G and 4G plus network infrastructure developments and rollouts. Competition from new networks and wholesale players (MVNOs) has driven prices down. Perhaps the greatest driver on price erosion is competition from OTT players offering free messaging services, over Wi-Fi or using mobile data. Most notable applications include Skype, WhatsApp, WeChat and Facebook Messenger. These are on the path to making SMS almost redundant and offer the ability for free calling (charges are made if the consumer is out of Wi-Fi coverage and using data from the mobile network).

Mobile tariffs are moving towards offering unlimited voice and SMS, and a growth in the size of data bundles⁴.

2.2. New revenue streams

To compensate for voice and SMS prices falling, operators look to new revenue streams to replace their traditional revenue streams. However, operators have not been successful in capturing revenue from value added services, given their lack of innovation and capabilities in this area. Operators have developed basic services such as ring-back tones, picture messaging and location services, allowing OTT application providers to innovate and capture an increasing share of the customers spend on their mobile services. There has been an explosion in mobile apps facilitated by the smartphone developments over the last 10 years, the major categories being lifestyle (e.g. fitness, dating, music), social media (e.g. Facebook, Instagram), utility (e.g. reminders, scheduling), games and entertainment (e.g. Clash of Clans, Pokémon), productivity (e.g. Wunderlist) news and information (e.g. BuzzFeed, Reddit).

² Juniper Research, 2018

³ <https://blog.telegeography.com/wireless-services-subscribers-in-europe-2g-3g-4g-5g>

⁴ Most mobile operators in mature markets aren't attempting to monetise voice and SMS based on usage any longer; they have instead made these allowances unlimited and included them in a flat fee" <https://tefficient.com/wp-content/uploads/2018/11/tefficient-industry-analysis-3-2018-mobile-data-usage-and-revenue-1H-2018-per-country-preliminary-4-Dec.pdf>

An emerging area where additional revenue streams will be achieved is mobile payments. We estimate this to be NZ\$22.3bn in Europe alone by 2022 (6% of mobile payments spending in Europe)⁵. This would be 4 times higher than what telcos were making in 2017 from mobile payments in Europe (an estimated NZ\$5.7bn)⁶. Mobile operators have started to take a revenue share of content partners by bundling services into their tariffs (e.g. Spotify, Netflix). They are also utilising 'direct carrier billing' methods to charge small items to mobile phone bills (e.g. in Europe, NZ\$84 maximum spend per transaction and NZ\$504 maximum spend per month)⁷.

2.3. Digital transformation

Legacy operator platforms are fast becoming outdated and unable to support the creation of flexible tariffing and innovative value-added service. This has led to a surge in operators upgrading their BSS/OSS infrastructure and adding additional layers of service delivery functionalities which link into external environments such as social media, payment gateways and content platforms via APIs. Cost reduction is necessary as a response to falling voice and data prices which leads to a pressure on operators to develop automated processes – a significant area for this transformation is in customer care, where artificial intelligence is being used to cut down the reliance on expensive call centres. Customers are getting wiser and more accepting of finding answers themselves through on-line forum and chatbots, which incorporate sophisticated methods of responding to standard questions.

Another area of development lies in the intelligence embedded in networks, making them more efficient and functional. There are significant investments being made in SDN and NFV which replaces operator's legacy network equipment with virtualised assets that speed up service activation, with less human intervention. Mobile SD-WAN is a an SDN application, which could consist of multiple bearers (wireless networks) to support a single device running multiple applications and delivered as a single service (e.g. supporting a connected car, which may use 4G for video on-demand, LTE-M and satellite for tracking and emergency calls).

This more flexible technology environment has facilitated growth in mobile wholesale and MVNOs (see report MVNO Landscape: Global Perspectives and New Zealand Applications).

2.4. Data explosion

Fuelled by improved data speeds, smartphone adoption, flexible platforms and innovations in mobile applications, data usage is exploding. In 2017 the average smartphone user used 3.4GB of data per month, and by 2023 this is expected to be 17GB⁸.

The major drivers of data usage growth have been, and will continue to be, social media, picture and video messaging, on demand content and wearables. IoT will also drive up data usage, although IoT applications often do not involved significant data

⁵ RDC analysis, in ACI Worldwide 'The mobile payments opportunity for telcos', 2018

⁶ ibid

⁷ Payment Services Directive 2 (PSD2) legislation, 2018

⁸ <https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericsson-mobility-report-june-2018.pdf>

usage, as they also rely on alternative connectivity methods (e.g. Wi-Fi and alternative low power networks). There are some data hungry IoT application which will contribute to the surge in data usage, including connected cars and CCTV applications.

Improvement in network quality and the imminent introduction of 5G will be significant drivers in data usage.

2.5. Evolving value chain

Referring to Figure 1, and our simplified categorisation of infrastructure, platform and services, we are witnessing a consolidation of companies at the infrastructure and incumbent operator end, through M&A plus network sharing agreements. We are seeing a growth in the number of platform players and service delivery platforms, and a greater growth in the number of niche innovators and application development businesses. This has facilitated a growing number of brands through MVNO and sub-brands models. The effect of this is greater definition and demarcation of customer segments in terms of the service differentiation they can enjoy. For example, the ethnic segment is a customer group we are expecting to be better served in the next 5 years, driven by international migration and communication increases.

We expect there to be a consolidation in the platform level over the next 5-10 years (mobile operators acquiring platforms, or large platforms acquiring smaller platforms) – and in the last 2-3 years there have been several such acquisitions (e.g. Telecom Italia acquiring Noverca and Wireless Logic acquiring Cloud9). In the short term (2-5 years), we expect a growth in start-up application businesses and niche service innovators, followed by consolidation of these players.

2.6. Move from acquisition to retention

The mobile industry has experienced high churn in the last 10 years, driven by easier mobile number portability from a regulatory and technical perspective, fierce price competition and competition from challenger MVNO brands. Acquisitions costs have been considerably higher due to the need to subsidise handsets in a post-paid environment and to offer incentives to initiate a pre-paid relationship such as free bundles of minutes or a limited subsidy for handsets.

We are starting to see churn levels reduce as customers are increasingly purchasing tariffs separately from devices, therefore more likely to stay with their mobile provider when switching devices. For example, a small reduction can be seen in NZ, from 2.5% in 2011 to 2.3% in 2017⁹.

Where customers purchase a mobile tariff with their device on a post-paid plan, there is a trend for customers to retain devices for longer¹⁰. Operators are taking greater measures to retain customers, adopting more intelligent churn prediction models to assess the likelihood of a customer churning and offering appropriate incentives. Rewards programs are starting to gain traction such as O2 Priority offering discounts on products and events. Mobile operators have been poor at developing effective

⁹ Merrill Lynch Global Wireless Matrix, and Nera Economic Consulting, Competition in the New Zealand Mobile Market, Spark New Zealand, 26 October 2018; percentage represents monthly churn and excludes 2degrees data

¹⁰ <https://phys.org/news/2018-10-people-smartphones-longer.html>

loyalty programmes. Whereas other brands have started to include mobile services as part of their retention strategy. For example, Airtime Rewards (UK) provides airtime credit as a reward for shopping with its retail partners.

2.7. Future outlook

Many mobile operators have already experienced the commoditisation of voice and SMS, and data will follow a similar trend.

Data usage is set to explode even further and there needs to be a reconciliation between the supply and demand to ensure efficient use and fair allocation of spectrum.

Third party brands and content providers will push prices lower if they are able to offer free data whilst customers use their applications. An example of this is ICBC, a major bank in China, which zero-rates mobile data when a customer is using its services.

Customer spend over mobile is set to increase considerably, but unless operators take measure to avoid being disintermediated, they will lose out on revenue share potential to OTT players and retailers. Mobile operators are in a very strong position to take a greater share of the mobile payments pie, as they can understand customer profiles to provide tailored offers, recommendations and bill purchases to the mobile phone account. They are also able to offer special tariff incentives and loyalty programmes for use of their payment portals. Many OTT and content players have used the advertising model to generate revenues, but this an area mobile operators have not generally succeeded in. Opted in, tailored advertising could be a growth area for mobile operators, particularly as operators have trust, customer profile data and a billing relationship, although there are no significant signs of this yet¹¹.

In most analyses of the competitive and economic landscape, where the focus is in the customer's interests, considerations are skewed towards fair prices and access to services, in relation to tariffs, coverage and value adds. However, one important area often missed by industry influencers and regulators is that of social responsibility. Mobile technology is now an intrinsic part of customers lives and has such a profound impact on society. Huge concerns centre around customer data security, privacy, and safety for the youth. OTT providers remain largely unchecked, without proper controls to verify customers identity, age or credit worthiness. There is a growing concern amongst customer about personal data security and fraud: 86% of social media users agreed that "companies need to be more transparent with their practices around data use"¹² and 39% of them have increased privacy on their accounts following the Facebook data misuse scandal in 2018¹³. We recommend this as an area for further consideration.

¹¹ <https://www.techradar.com/uk/news/can-operators-compete-with-tech-giants-in-mobile-advertising>

¹² Consumer Survey, Who Do You Trust Most? Mobile Operators or OTTs? Openet Research Paper, 2018

¹³ *ibid*

3. The global mobile market snapshot

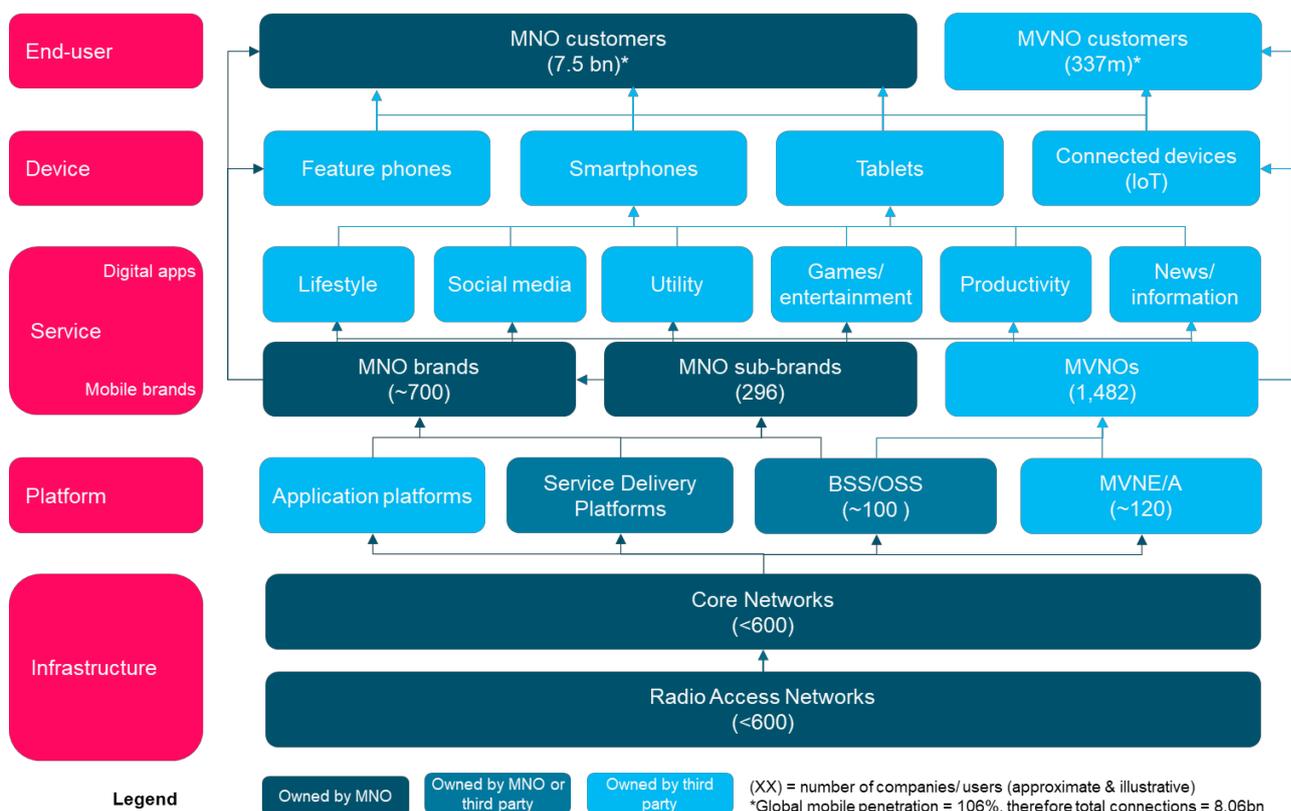
3.1. The mobile ecosystem

The scope of our analysis in this report is depicted in the ecosystem below (Figure 2). This shows how the industry participants interact with each other with the ultimate goal of providing mobile services to the end customer. We refer to devices only at a high level in our analysis and focus on the infrastructure, platform and service providers.

We are seeing a consolidation at the infrastructure layer and, in the short-term, a growth in the number of platform players. We have also been witnessing reasonable growth in the number of mobile service providers (specifically sub-brands and MVNOs) and a significant boom in the number of digital service providers via mobile apps.

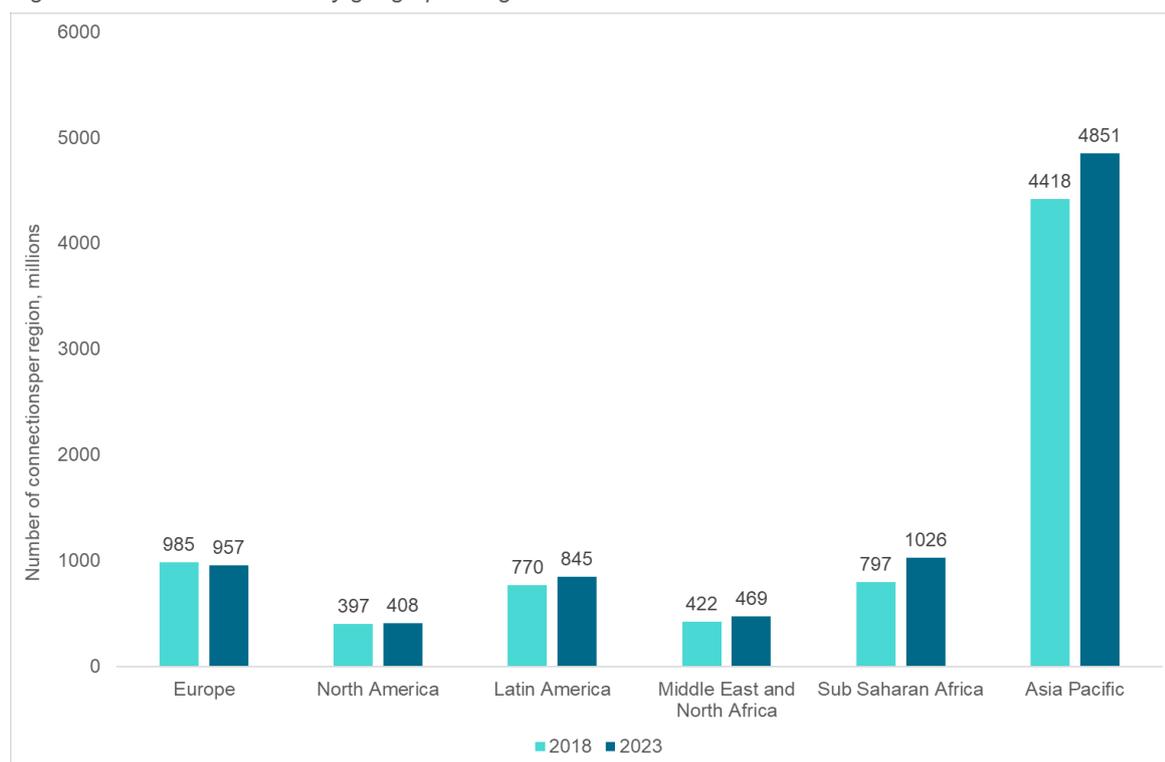
In the medium to long term, we expect a consolidation at the platform and service provider layer (both brands and apps).

Figure 2 Mobile ecosystem: interaction between main market participants¹⁴



¹⁴ RDC analysis, 2019

Figure 3 Mobile connections by geographic region¹⁵



In

Figure 3, we take a high-level view of mobile connections globally, per region, and estimate growth for the next five years.

Mobile connections will see a growth of up to 10% globally¹⁶, with the highest number of connections being added in Asia-Pacific and with the fastest growth rate being experienced in Sub-Saharan Africa (see

Figure 3). We will now look at these two markets in more detail.

Firstly, Asia-Pacific hosts more than half of the world's population, and with an estimated 106% mobile penetration rate¹⁷, it leads global mobile connections with around 4.4 billion connections, representing 57% of global connections¹⁸. Secondly, its 9% 5-year growth in mobile connections, leading up to almost 5 billion subscriptions in 2023, is driven by the high socio-economic growth of countries including China, India and Indonesia, where low-to-middle income distribution is shifting sharply, education levels are rising and medium-to-high income earners are spending increasingly more time and income on content streaming, OTT communication apps and mobile commerce.

Secondly, Sub-Saharan Africa will see the highest growth rate of all region in the next 5 years (29% from 2018 to 2023)¹⁹. Its main drivers are a growing young population and an increasing perception of mobile as an essential service. 60% of the population

¹⁵ RDC analysis, based on World Bank, World Trade Organisation and regional (e.g. ACMA) data, 2019

¹⁶ *ibid*

¹⁷ *ibid*

¹⁸ *ibid*

¹⁹ *ibid*

is under the age of 25²⁰ and we estimate by 2023 it will have more mobile connections than Middle East, North Africa and North America combined.

By contrast with APAC and Sub-Saharan Africa, Europe is experiencing saturation in mobile connections. We believe that Europe will be the only region to see a decline in total mobile connections (-2.8% from 2018 to 2023)²¹. The main factors influencing this trend are:

- Declining need to own multiple subscriptions per person, owing to market shifts such as Bring Your Own Device (BYOD), the roam-like-home legislation and consolidation across mobile operators
- Users retaining their mobile devices for longer.

²⁰ UN data, 2018

²¹ RDC analysis, 2019

4. Global mobile demand drivers

Whilst service providers²² often develop new innovations and services which consumers and enterprises have not thought of yet, they must evolve to address evolving customer demand. These demands influence service providers' strategy to invest in new technologies, reduce operating costs, acquire companies, form partnerships and launch new services. The principle global demand-side trends influencing service provider decisions are discussed in the following sections.

4.1. Smartphone take-up

At the end of 2018, 61% of the world's population had access to the mobile internet supported by a mix of 2G, 3G and 4G. The growth in migration from 2G and 3G to 4G may be slowing, but 4G will become the leading mobile network technology in 2019 (more than 3 billion connections)²³.

The launch of 5G services, started by Elisa in Finland and Estonia in Q3 2018, will result in a gradual migration of connections to 5G. Consumers will start clamouring for the latest handsets that just so happen to incorporate the latest 5G bearer technology. By 2025, 5G is expected to account for 14% of mobile connections worldwide. Smartphone penetration will reach 77% of connections in 2025, up from 57% globally in 2017²⁴.

The increasing adoption and use of smartphones, whilst starting in the mid-1990s, was popularised by the launch Apple iPhone in 2007. Today, many consumers would like their smartphone to incorporate the latest cameras technology, store 1TB of data, charge wirelessly, use face-recognition instead of passwords and high-quality screen. These demands are being incorporated in digital providers' cloud and AI solutions.

4.2. More pre-paid customers migrate to post-paid

In many countries there has been a shift from pre-paid to post-paid subscriptions²⁵. Pre-paid customers accounted for 64% of subscriptions in the UK at the end of 2007. Just ten years later, this reduced significantly to account for 30% of total subscriptions²⁶. Many other countries have experienced a similar shift to post-paid subscriptions, including France, Germany, Italy, Spain and USA²⁷.

²² Service providers include mobile operators, MVNOs, fixed-mobile operators and fixed-mobile service providers

²³ Excludes IoT connections <https://www.gsma.com/mobileeconomy/#techmigration>

²⁴ ibid

²⁵ Pre-paid: customers pay for mobile phone usage upfront. Post-paid: customers pay for mobile phone usage post use

²⁶ Page 57, Communications Market Report, Ofcom, 2 August 2018

²⁷ Research and Markets https://www.researchandmarkets.com/research/grht4m/tariff_trends?w=4

Consumers have shifted to post-paid for a variety of reasons, including handset subsidies (bundled handset with a tariff), lower cost per minute and data (per GB/MB) and gaining access to 'free' bundled content (e.g. Spotify).

In markets in which handsets were bundled with post-paid tariffs, there has been a shift to SIM-only tariffs (e.g. UK²⁸).

Consumers recognise that they pay over the odds for smartphones as part of a tariff bundle. They can purchase smartphones more cheaply separately from tariffs, either for a one-off charge or using financing. In the UK, the Citizens Advice Bureau identified that for almost three quarters of handset bundles it is cheaper to buy a mobile phone and tariff separately.²⁹ In many markets, handsets have never been 'subsidised' and purchased separately (e.g. Italy).

Irrespective of whether handsets are bundled with or unbundled from contracts, affordability of devices needs to be considered. Consumers should not pay over the odds if they must use financing to spread the cost over a 12, 24 or even a 36-month period, or continue to pay high monthly fees once the contract has ended.

4.3. Consumers adopting wearables and smart technologies

The number of mobile connections per capita will grow from 1.1 in 2016 worldwide to 1.5 in 2021³⁰. The take-up of wearables will account for some of the connection growth. Applications include child trackers, pet trackers and healthcare devices (using 4G, NB-IoT, LTE-M)³¹. Such devices will grow from 10.9 million connections in 2016 to 69 million in 2021. Connected cars will also contribute to mobile IoT connection growth.

The adoption of non-cellular wearables will be far more significant, reaching over 900m consumers in 2021³². They will also acquire a wider range of connected devices in the home, but they will rely on other radio technologies for connectivity, including Wi-Fi, Bluetooth, Z-Wave and ZigBee. Smart speakers, doorbells and security devices will account for a significant proportion of smart home devices and automation. Smart speakers have been installed at 100m homes globally in 2018 and expected to reach over 300 million units in 2022.³³

4.4. People expect higher quality services

Consumers not only expect more minutes and data for less, but they expect a better quality of experience (QoE). QoE does not just mean providing good mobile coverage, voice and data services. Delivery of good customer service is also important. In Australia, 14% of consumers switch mobile service providers because they are unhappy with customer service³⁴.

²⁸ https://www.theregister.co.uk/2018/09/06/phone_bundle_ccs/

²⁹ Reviewing Bundled Handsets, Citizens Advice Bureau, 2018

³⁰ Cisco VNI https://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/

³¹ Internet of Things (IoT). LTE-M (<10kbit/s) and NB-IoT (~100kbit/s) are 3GPP low power wide area network cellular technologies <https://www.i-scoop.eu/internet-of-things-guide/lpwan/>

³² Cisco VNI https://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/

³³ Canalsys Smart Speaker Analysis, May 2018

³⁴ <https://www.thinkwithgoogle.com/intl/en-aunz/consumer-insights/path-purchase-mobile-phones-swaying-australias-sticky-smartphone-customers/>

Looking beyond the purchase of mobile service, consumers are concerned about use of their personal data. Consumers have become aware about privacy and data security, as a result of data scandals affecting many consumers and organisations, including Facebook users and the US military.³⁵ Consumers trust mobile operators not to abuse their personal data, more so than digital service companies³⁶. The knock-on effect on consumers' purchasing decisions may mean they become more discerning. Not only influencing their use of mobile phones and services, but also wearables, apps and m-commerce.

4.5. Increasing use of data hungry content

Consumers have a growing appetite for mobile data, which shows little sign of abating. On average worldwide smartphones will consume 17GB of data in 2023 each month, up from 3.4GB in 2017³⁷. Increasing use of video-on-demand (VoD), listening to music, gaming and uploading user-generated video to social media from 4K, 8K, 3D video camera smartphones will drive data usage.

Consumers increasingly use mobile phones as their preferred device to watch short videos, as is the case for 34% of consumers in the Nordic region.³⁸ Streamed video content, catch-up TV and live TV are also watched more and more on mobile phones, but not to the same extent as short videos. Up to 7% of users watch this content on a mobile phone as their preferred device. These are likely to be using both Wi-Fi and mobile networks to access the content.

Globally, smartphone-only video is capturing more and more eyeballs. Smartphone-only video reached 50% of 'video starts' globally during Q2 2017, the first time this data point had been achieved³⁹. Even sports, which is mostly watched on devices with large screens (e.g. TVs), is experiencing increased viewing on smartphones. The National Football League (NFL) saw streaming to phones grow by 147 per cent, for matches over a four-week period in 2018 compared to 2017⁴⁰.

Video will account for an increasing proportion of mobile data traffic. At the end of 2017, video accounted for 56% of mobile data traffic and expected to reach 73% in 2023. Higher resolution video and its increasing consumption on mobile devices will contribute to increased data usage⁴¹.

4.6. Adoption of IoT by enterprises

Enterprises are expected to take-up 55% of IoT connections worldwide in 2025, up from 47% in 2018, equivalent to over 11.4 billion connections⁴². These IoT connections

³⁵ 'Personal' data collected by Facebook used by Cambridge Analytica <https://www.bbc.co.uk/news/technology-44793247> Military personnel using the polar fitness app helped identify 'secret' bases <https://www.fastcompany.com/90272858/how-our-data-got-hacked-scandalized-and-abused-in-2018> <https://www.pwc.com/gx/en/industries/consumer-markets/consumer-insights-survey/consumer-trust.html>

³⁶ Consumer Survey: Who Do You Trust Most? Mobile operators or OTTs? Sapio Research, Openet

³⁷ <https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericsson-mobility-report-june-2018.pdf> The average smartphone user in Western Europe will consume 25GB each month in 2023, up from a mere 4GB per month in 2017

³⁸ 2018 A Mobile World, A study on the Nordic mobile consumer behaviour, Deloitte

³⁹ "Video Starts measures the number of times that actual non-ad video content starts playing. Video Starts is only recorded if the user waits until the actual video starts playing back. Ooyala Global Video Index, Q2 2018

⁴⁰ <http://www.nfl.com/news/story/0ap3000000970424/article/nfl-fans-taking-advantage-of-additional-digital-access> NFL is a popular sport in the USA

⁴¹ Ericsson Mobility Report, June 2018

⁴² Global Mobile Trends 2018, GSMA; The Mobile Economy 2018, GSMA

will be supported by many cellular (2G, 3G, 4G, NB-IoT, LTE-M) and non-cellular technologies (e.g. Wi-Fi, ZigBee, Z-Wave). Licensed cellular may only account for 12% of all IoT connections in 2025, equivalent to 3.1 billion worldwide⁴³.

IoT applications supported by cellular connections include smart metering, emergency services, workforce trackers, telematics, asset tracking, smart lighting, smart parking, smart vending and many other use cases. Data collected from sensors includes speed, temperature, location, usage and many other metrics. Enterprises and organisations will increasingly combine these metrics with other datasets and analyse them to improve productivity, reduce costs, better fulfil service-level-agreements, deliver higher return-on-investments and many other benefits.

4.7. Boom in social media

Social networking and messaging/chat app platforms have come to facilitate communications and interactions between users and consume a growing share of their waking hours. The most successful social networking platform is Facebook, with over 2.1 billion monthly active users, and its messenger apps FB Messenger and WhatsApp each with 1.3 billion active users⁴⁴. WeChat (980 million) and QQ (843 million)⁴⁵ are very popular among users in the Asia-Pacific region.

The novelty of some social networking platforms may be on the wane, and some users have also decided stop using social media, due to privacy concerns and general unpleasantness and bullying from other users.⁴⁶ The use of messaging apps shows no sign of abating⁴⁷.

4.8. Increasing use of mobile as a payment tool

China is the world's leading mobile payments country. eWallets are used by consumers in almost two-thirds of online transactions and more than a third of point-of-sale (POS) spend⁴⁸. Globally, eWallets will be used in 47% of online payments in 2022, and 28% of POS payments. In Europe and North America eWallets will not experience the same amount of take-up, accounting for a maximum of 24% of transactions online and 9% in-store⁴⁹.

eWallets are also used for person-to-person (P2P) transfers. On average an active mobile money user makes USD188 worth of transactions, of which P2P accounts for 30% of transactions⁵⁰. Most of these transfers originate in Sub-Saharan Africa and South Asia.

An emerging form of mobile payments may not even require consumers to swipe a card or press a button. IoT payments from connected devices are expected to become commonplace. It is already possible for consumers to buy things using smart speakers and smart TV using their voice, but other connected devices will be capable of enacting

⁴³ ibid

⁴⁴ Monthly active users. Data correct to 27 January 2018, Hootsuite

⁴⁵ ibid

⁴⁶ <https://www.theverge.com/2018/10/30/18044468/facebook-q3-2018-earnings-report-growth-slows-down>

⁴⁷ <https://www.nexmo.com/blog/2018/08/16/mobile-messaging-moving-sms-ott-chat/>

⁴⁸ Global Payments Report 2018, WorldPay

⁴⁹ ibid

⁵⁰ State of the Industry Report on Mobile Money 2017, GSMA

payments. Connected cars are expected to account for 55% of the overall IoT payments market (e.g. automatic payment at the petrol pump), equivalent to 8.2 billion transactions by 2023⁵¹.

4.9. Adoption of lifestyle services

Consumers want tools that help manage their lives, make better use of their time, save money, increase their quality of life, be healthier and minimise spending time on mundane tasks⁵². Many consumers are excited at the prospect of artificial intelligence (AI) helping them with day-to-day tasks⁵³. Technology will remain integral to consumers keeping in touch with friends and family, pursuing personal interests and hobbies, shopping and other daily tasks. The flip-side is that they are also concerned how technology, including AI, may result in them becoming socially isolated (i.e. only interact using technology) and a loss of control over personal information⁵⁴.

4.10. Future services outlook

Emerging technologies, products and services will emerge that consumers will use and purchase in large volumes. These include the:

- Immersive and interactive entertainment that will be delivered as part either augmented, virtual or mixed realities⁵⁵
- Use of virtual assistants to help consumers and organisations automate tasks – using more advanced versions of Siri, Google Assistant etc.⁵⁶
- Take-up of innovative healthcare devices, for example the Owlet Band that can monitor a baby's heart rates⁵⁷
- Rollout of autonomous vehicles and delivery robots⁵⁸.

4.11. Key considerations for mobile operators

Smartphones have been a boon and a headache for mobile service providers. Bundling smartphone with voice and data tariffs for a monthly fee helped deliver an uptick in revenue for many mobile service providers. The emergence, however, of over-the-top (OTT) applications (e.g. WhatsApp, WeChat) have helped conspire to declining voice and SMS revenue⁵⁹. Strong price competition (from MVNOs and mobile operators⁶⁰) and slower subscriber growth have also contributed to declining

⁵¹ Consumer Connected Cards: Telematics, In-Vehicle Apps and Connected Car Commerce 2018-2023, Juniper Research

⁵² Intel Next 50 (years) Study August 2018 and <https://www.gartner.com/en/newsroom/press-releases/2018-09-12-gartner-survey-finds-consumers-would-use-ai-to-save-time-and-money>

⁵³ 41% of consumers are excited for AI tools that can help with their tasks. Intel Next 50 (years) Study August 2018

⁵⁴ Intel Next 50 (years) Study August 2018

⁵⁵ Ibid. 52% of consumers are excited about the prospect of virtual, augmented and/or mixed reality. Mixed reality places a user in a virtual world in context of the real, physical world that surrounds the user (i.e. there are 'digital' signposts/images to help prevent the user from bumping into objects etc.)

⁵⁶ Assistants will be found in smart speakers, other smart home devices (e.g. Google Home Hub) and smartphones <https://www.gartner.com/en/newsroom/press-releases/2017-08-17-gartner-releases-hype-cycle-for-the-digital-workplace-2017>

⁵⁷ <https://www.engadget.com/2019/01/11/owlet-band-baby-ecg-pregnancy/>

⁵⁸ <https://www.digitaltrends.com/cool-tech/robot-delivery-dog-ces-2019/>

⁵⁹ [https://www.juniperresearch.com/press/press-releases/mobile-voice-revenues-to-fall-by-\\$157-billion](https://www.juniperresearch.com/press/press-releases/mobile-voice-revenues-to-fall-by-$157-billion)

⁶⁰ For example Free has disrupted the mobile markets in France and Italy <https://www.fiercewireless.com/europe/iliad-s-free-continues-unstoppable-growth-france-s-mobile-market> <http://telecoms.com/490988/iliad-signs-up-1-million-italian-customers-in-50-days/>

voice and SMS revenue. Revenue from increasing data usage will not be enough to offset declining voice and SMS revenue, data is becoming a commodity⁶¹.

Mobile operators must balance customer demand with supply-side decisions. These decisions include making investments in new infrastructure, platforms and services to address changing customer demand, which may or may not include traditional core services (voice, data, SMS), as well as making decisions to reduce on-going costs (in infrastructure, platforms). Operators need to carefully consider what investments will deliver a return on investment, while their customers want lower prices/more for the same price, better quality services, more choice and innovation.

⁶¹ Worldwide, mobile revenue growth revenue growth is slowing to 1% (real terms) to 2025 – according to Global Mobile Trends, What's driving the mobile industry?, GSMA Intelligence, September 2018. At the same time mobile data usage will rapidly increase – price per GB/MB will fall.

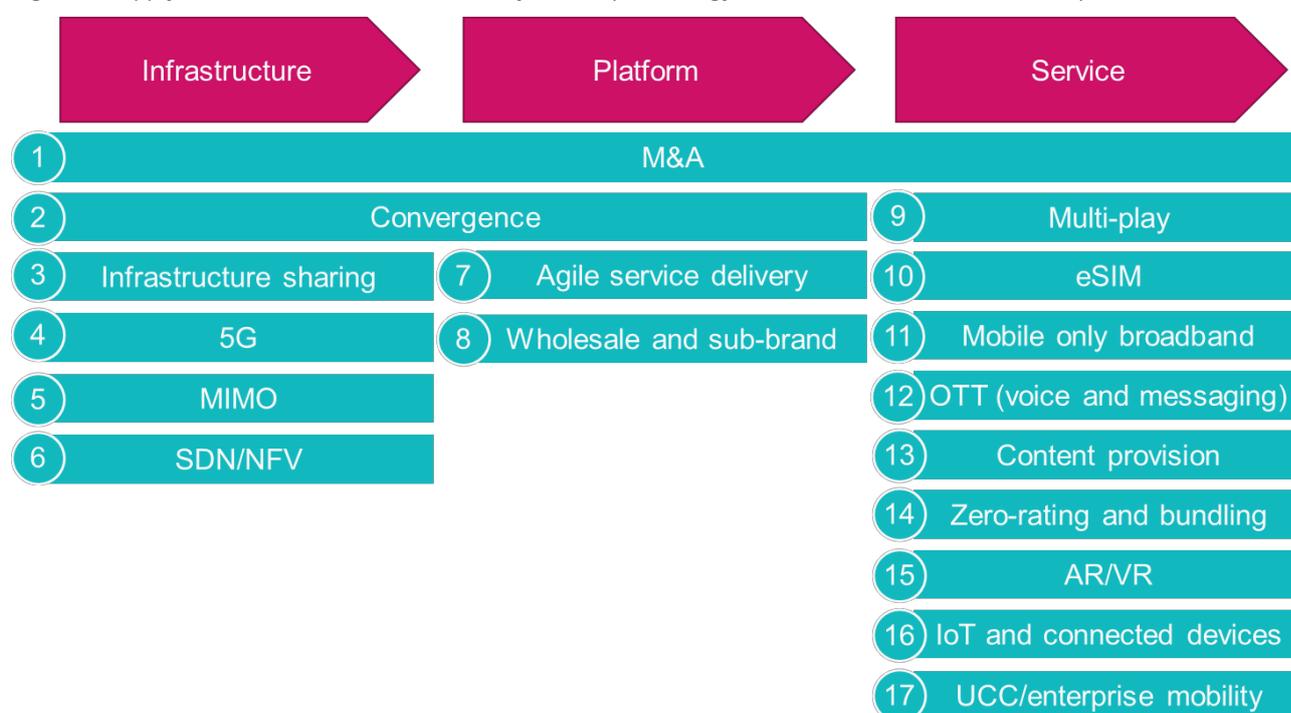
5. Global mobile supply-side trends

In this section we describe the supply-side trends of the mobile market. These trends have been split into three parts of a simple value chain: infrastructure, platform and service, as shown in Figure 4.

Each trend is introduced, and following questions considered from the point of view of the mobile market and companies that support the supply-side mobile value chain⁶²:

- What is the impact on customers?
- What is the impact on mobile operators and what are their objectives?
- What are the main issues (e.g. competition from OTTs)?
- Has anything been done by NRAs to improve competition, service creation (including time to launch), service quality or innovation? Example NRA interventions have been referenced.

Figure 4 Supply-side mobile value chain and key trends (technology, media and telecommunications)⁶³



⁶² Although the theme of this report is to concentrate on the trends affecting the competitiveness, innovation and regulations affecting the mobile market, there are overlaps with other parts of the telecommunications market. These include the provision of multi-play services (fixed and mobile), the ability for 5G mobile-only services to replace fixed-line services (i.e. fixed-mobile substitution).

⁶³ RDC analysis, 2019

5.1. M&A

The reasons why telecoms operators and service providers decide to acquire or merge with other companies are well known. These include: increasing market share, benefiting from increased economies of scale, adding new products and services to cross-sell to existing customers, targeting new customer segments, growing into new geographic territories etc. Competition from digital service providers⁶⁴, stagnating core telco revenue, new entrants (e.g. MVNOs⁶⁵, IoT MVNOs), other operators and service providers making acquisitions all contribute to the decision by operators, service providers and other non-telcos to merge or acquire other companies⁶⁶.

Telecoms operators and service providers may decide to acquire or merge with one of four broad company types (as defined by the TMT value chain):

1. Telecoms operators (infrastructure, platform and services)
2. Service providers (platform and services)
3. Platforms
4. Services

Telecoms operators

Many countries have experienced market consolidation of mobile operators, including Germany (O2 and E-Plus merger in 2014), Austria (Drei and Orange in 2013) and USA (proposed T-Mobile USA and Sprint merger 2019⁶⁷). Consumer groups, regulators and governments may view such consolidation (i.e. reduction from four to three mobile operators) with some suspicion. They may consider that a reduction in competition may result in less consumer choice and an increase in prices.

Regulators can ameliorate some of the 'negative' effects of market consolidation by attaching M&A obligations. Obligations typically used include:

- Making network capacity available to MVNOs (e.g. O2 and E-Plus merger, Germany)
- Divest spectrum and infrastructure (e.g. offered by Hutchison/3 Italia and Vimpelcom/WIND, Italy, to convince regulators to approve the merger).
- Commitment to support MVNO market entry (e.g. Drei and Orange in Austria)

Such interventions are market specific and undertaken on a case-by-case basis. One of the largest mobile operator mergers, which would create a market dominated by three operators, is the much-heralded Sprint/T-Mobile USA merger. If the merger is in

⁶⁴ Digital service providers include FANG companies (i.e. Facebook, Amazon, Netflix, Google), BATS (i.e. Baidu, Alibaba and Tencent) as well as many other companies that are infrastructure lite (i.e. do not own a telecommunications network) that deliver cloud or over-the-top services (OTT).

⁶⁵ Mobile virtual network operators (MVNOs),

⁶⁶ Some non-telcos are adding platforms to add new capabilities and compete with mobile operators and service providers.

Example acquisitions include NTT Comms' (an ICT solutions company and international communications business within NTT Group) acquisition of Transatel (MVNE) in December 2018, to provide it with MVNO and IoT capabilities; Tata Communications' acquisition of Teleena (MVNO) to enhance its IoT and mobility capabilities and Arm (chipset designer owned by conglomerate SofBank) acquired Stream Technologies in June 2018, to add IoT connectivity and device management capabilities to its IoT Cloud Services division <https://www.businesswire.com/news/home/20181220006029/en/NTT-Communications-Acquire-Stake-Transatel-Global-Connectivity><https://www.tatacommunications.com/press-release/tata-communications-acquires-mobility-and-internet-of-things-specialist-teleena/> <https://www.arm.com/company/news/2018/06/arm-expands-iot-connectivity-and-device-management-capabilities-with-stream-technologies-acquisition>

⁶⁷ At the end of December 2018 many regulators had approved the merger, but some investors, consumer groups and government officials still had concerns about potential negative impact on customer choice and prices <https://www.nytimes.com/2018/12/18/business/sprint-tmobile-approval-huawei.html>

the public's interest, i.e. does not create monopolies in certain locations, negatively affect pricing or service innovation⁶⁸, it will receive approval to proceed. To date no major mobile market has experienced consolidation from three to two operators.

Mobile operators that acquire fixed assets, and vice versa, may raise competition concerns. Vodafone's acquisition of Liberty Media (UPC/Unitymedia) in Germany, Hungary, Romania and the Czech Republic has been brought to the attention of the European Commission (EC). The EC is concerned that standalone services providers in the Czech Republic will be 'shut out', because of converged service provision (see Multi-play). A decision will be made in May 2019 (at the time of writing the EC was in the final stages of its review).

Service providers

MVNOs also take part in market consolidation. Mobile operators acquire MVNOs to diversify their target market segments (e.g. Orange's acquisition of Republica Movil, Spain) and, to a lesser extent, MVNOs acquire other MVNOs when they fail or to achieve scale⁶⁹. No MVNO acquisition has resulted in regulatory intervention, although they have been scrutinised. Telenet, a fixed broadband operator and MVNO in Belgium, acquired BASE (third largest mobile operator) in 2016. To anticipate regulatory interventions, Telenet implemented two pre-emptive decisions to satisfy competition authority approval. Base's sub-brand SIM Mobile and the 50% stake in the Viking Mobile MVNO were transferred to MEDIALAAN.

Mobile operators and service providers may acquire other service providers to add new technologies and capabilities. Such acquisitions do not tend to attract regulators' attention, since they do not have the potential to negatively affect the provision of core mobile services (i.e. reduced competition). Example acquisitions include:

- Vodafone's acquisition of Cobra Automotive Technologies in 2014⁷⁰
- Verizon's acquisition of Hughes Telematics and Telogis to help it create its Verizon Connect division⁷¹
- Telstra's acquisition of MTData, a GPS and telematics fleet management company⁷²

Acquisitions that are further away from 'core' telco services and add non-telco capabilities tend not to attract regulatory intervention.

Platforms

Platforms are also acquired by mobile operators and service providers to increase their capabilities and support new lines of business (e.g. IoT) or enhance existing lines of business (e.g. in support of wholesale services). Wireless Logic acquired Cloud 9

⁶⁸ <http://telecoms.com/494277/t-mobilesprint-merger-heads-towards-final-two-hurdles/>

⁶⁹ <https://www.telegeography.com/products/commsupdate/articles/2018/11/12/mvnomonday-mvnos-europe-special/>
<https://www.telegeography.com/products/commsupdate/articles/2018/12/03/mvno-monday-a-guide-to-the-weeks-virtual-operator-developments/index.html>

⁷⁰ <https://www.telematics.com/vodafone-confirms-cobra-acquisition/>

⁷¹ Fleet management and mobile workforce management solutions <https://techcrunch.com/2016/06/21/verizon-buys-telogis-to-drive-deeper-into-the-connected-vehicle-market/> <https://www.verizonconnect.com/uk/company/news/verizon-telematics-becomes-verizon-connect/>

⁷² <https://www.telstra.com.au/aboutus/media/media-releases/Telstra-bolsters-IoT-ecosystem-with-the-acquisition-of-MTData1>

in 2017 to add new features and capabilities to its IoT service portfolio, which is similar to Kore's acquisition of Aspider in late 2018⁷³. Platforms acquired by mobile operators and service providers include Telecom Italia's acquisition of Noverca⁷⁴ (MVNE) in 2016, which it uses to host its sub-brand, Kena (see Wholesale and sub-brands), and El Telecom's acquisition of Sister (MVNE), which it uses to support its MVNO businesses.

Acquisition of platforms are highly unlikely to catch NRAs' attention. They are unlikely to result in reduced customer choice and higher prices.

Services

Combining content, as part of pay TV packages, with fixed broadband packages is a common feature of fixed-only (e.g. UPC) and fixed-mobile operators (e.g. Deutsche Telekom). Operators use exclusive sports (e.g. BT in the UK), films and series to attract and retain subscribers, as well as develop original content (e.g. Orange, France). They also partner with OTTs, which may be one of three partnership models: marketing only, technical or service integration and a commercial agreement (see Content provision).

Operators have also acquired companies to include original content in their pay TV platforms, and to distribute this new content as on OTT service as well as via wholesale agreements. AT&T's acquisition of Time Warner in June 2018 and Comcast's acquisition of NBCUniversal are the largest of such acquisitions. Mobile-only operators have not acquired large original content developers.

Consumers will increasingly consume on-demand video (short-form/long-form, paid-for/free) on mobile devices. If access to exclusive content is restrictive, regulators may intervene. License holders to exclusive content may be required to reduce wholesale rates to promote choice and innovation. Interventions have not been applied to mobile specific content but have been applied to pay TV / multi-play service providers⁷⁵.

Operators that have acquired content rights holders have also come under regulator's spotlight. Swisscom acquired a majority stake in OTT service provider Teleclub, which owned the rights to show exclusive sports content.⁷⁶ Switzerland's Competition Commission fined Swisscom, because it was deemed to have abused its position as the dominant provider of sports content on live TV: UPC (a competitor) was unable to show all content from Swisscom's Teleclub Sport's package and another competitor, Sunrise's customers had to subscribe to Teleclub's movie package to be able to subscribe to Teleclub Sport.

⁷³ <https://www.iot-now.com/2017/10/05/68418-connectivity-infrastructure-platform-means-customers-feel-like-connectivity/>
<https://www.tatacommunications.com/press-release/tata-communications-acquires-mobility-and-internet-of-things-specialist-teleena/>
<https://www.channelpartnersonline.com/2018/12/12/kore-beefs-up-iot-capabilities-via-aspider-ngi-acquisition/>

⁷⁴ <https://www.fiercewireless.com/europe/telecom-italia-snaps-up-mvna-noverca-for-about-eu4-5m>
<https://www.reuters.com/article/telecomitalia-kena/telecom-italia-prepares-for-iliad-fight-with-no-frills-mobile-website-idUSL5N1H66ND>
<https://www.telegeography.com/products/commsupdate/articles/2018/03/19/mvno-monday-a-guide-to-the-weeks-virtual-operator-developments/>

⁷⁵ For example, in 2010 Sky (then BskyB) was requested by NRA Ofcom to reduce the wholesale price it sold its Sky Sports 1 and 2 channels to rivals. The intervention was removed in 2015, as Ofcom recognised that Sky had increased the number of commercial wholesale agreements with other pay TV service providers.

⁷⁶ <https://www.broadbandtvnews.com/2017/11/19/swisscom-takes-over-teleclub-operator-cinetrade/>

5.2. Convergence

Operators have been bundling fixed, mobile and other services as part of their provision of multi-play services for many years (see 5.9 Multi-play), which is a basic form of convergence. Fixed + mobile convergence involves the unification and optimisation of networks, marketing, sales, activation and customer care, which is discussed in this section.

Convergence of fixed and mobile networks goes far beyond OSS/BSS and extends to the fixed and mobile networks as well as to partners' platforms and solutions. Operators are having to implement new feature rich architectures to better able fulfil customer needs (also see Agile service delivery, which discusses in more depth the reasons mobile operators and service providers are transitioning to better fulfil customer needs). Many operators have already transformed their architectures, e.g. HKT (Hong Kong), KPN (The Netherlands)⁷⁷.

These needs differ by customer type. Wholesale and reseller partners require access to a unified portal to manage service activation, fulfilment, account management etc. The operator also needs a similar unified portal to manage its wholesale and reseller partners. Operators also need a unified portal to manage consumers that provides a single customer relationship management (CRM) portal, as well as the tools for consumers to manage and take control of their products and services (omni-channel customer experience and engagement and service delivery)⁷⁸.

The feature rich converged fixed and mobile architecture includes infrastructure automation, assurance and fulfilment, not just for core operator products and services, but also those of external partners and enablers. These partners and enablers can connect to operator fixed and mobile architecture using standardised APIs, connecting their applications and services⁷⁹.

The success of an operator's omni-channel customer experience should be reflected in a reduction in the number of calls to its customer contact centre and an improvement in its net promoter scores (NPS). If the opposite is true, customers may look to churn. But a 'converged' (multi-play) product makes it more difficult to do that. Restrictions may need to be monitored, to make sure customers are not unnecessarily tied to a contract, if they have valid reasons to leave.

5.3. Infrastructure sharing

Infrastructure sharing includes: 1) passive sharing that include masts, sites, cabinets, power and air conditioning 2) Active sharing that includes radio access network (e.g. antennas and radio network controllers. National roaming is a form of active sharing, as is spectrum sharing. Mobile operators use sharing to minimise capex and opex costs to provide coverage/services in underserved areas that may otherwise be uneconomic to serve, and in areas that are difficult to serve (e.g. local planning restricts the use of towers, lack of fibre backhaul), while striking a balance on their ability to deliver differentiated services.

⁷⁷ <https://www.developingtelecoms.com/telecom-business/telecom-reports-white-papers/7998-digital-transformation-for-business-growth.html> <https://www.gigabitmagazine.com/company/inside-kpns-journey-personalised-connectivity#>

⁷⁸ CRM portal includes campaign management, service ticketing, billing & invoicing etc. Consumer/end-user portal includes self-care, device management etc.

⁷⁹ May include payment gateways, social media, application platforms

In Europe sharing tends to be commercially driven, and not the result of regulatory intervention. Operators in South Korea and China are embracing commercial network sharing to accelerate 5G service deployment⁸⁰. Competition concerns arise if a national regulatory authority (NRA) expects sharing to cause operators to significantly reduce investment in their network. And the lack of investment results in fewer consumers receiving service coverage and/or benefit from higher quality services and service innovation.

The Body of European Regulators for Electronic Communications (BEREC) published an assessment of infrastructure sharing in Europe in June 2018. The report was written on the premise of providing a first step towards identifying best practices on mobile infrastructure sharing in Europe. None of the NRAs included in the report had intervened to address competition concerns (coverage and deployment and spread of new technologies). Fines have been used by some competition authorities, in some cases NRAs have imposed coverage obligations.

NRAs have intervened in sharing to encourage:⁸¹

- sharing as part of government policy or general regulation – e.g. in Norway the dominant mobile operator, Telenor, was subject to infrastructure sharing and national roaming obligations⁸²
- service coverage, by attaching obligations to spectrum awards – e.g. the NRA in Germany will require mobile operators to install a certain number of base stations by 2024, and deliver coverage to seaports, main waterways and minor roads⁸³
- new entrants – e.g. mobile operators in Belgium, Czech Republic and France are obliged to provide national roaming to new entrants, or share spectrum with operators that have ‘relatively’ less spectrum
- rollout to rural/harder to reach locations – e.g. in France, in rural locations with limited mobile coverage operators are required to share infrastructure and spectrum that applies to 2G, 3G and 4G
- in-building coverage – e.g. in Belgium, in-building coverage is based on regulatory intervention of passive sharing in large buildings.

Interventions are also used to (and to solve disputes):

- limit infrastructure sharing/encourage infrastructure rollout – e.g. The NRA in Austria will prohibit mobile operators from using active sharing in its three largest cities, as part of its 3.4 to 3.8GHz tender, apart from non-replicable active components⁸⁴
- and to solve disputes – some countries have procedures in place to solve sharing disputes, alternatively they are assessed on a case by case basis. In France, the NRA has the power to assess sharing agreements ex post. NRAs in Greece and Hungary will mediate in sharing agreement disputes.

⁸⁰ <https://www.mobileworldlive.com/asia/asia-news/korea-operators-to-build-shared-5g-infrastructure/>
<https://www.rcrwireless.com/20180501/5g/shared-infrastructure-key-to-5g-tag17-tag99>

⁸¹ Assessment of Infrastructure Sharing in Europe, BEREC, June 2018

⁸² <https://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf>

⁸³ <http://telecoms.com/493795/germany-green-lights-5g-plans-despite-industry-protest/> <https://www.rtr.at/en/pr/PI19092018TK>

⁸⁴ https://www.rtr.at/en/tk/TKKPositionInfrShare2018/Position_Paper_TKK_Infrastructure_Sharing_English_2018.p

The use of infrastructure sharing is likely to become more pertinent, with the use of small cells to support 5G networks. Mobile operators will also need easy access to fixed/wireless backhaul networks to support these densified networks (also see MIMO). Most NRAs in Europe expect infrastructure sharing to become more common to support network densification. Many NRAs anticipate that 5G sharing will be industry-led, but they will continue to monitor the situation in the context of 5G rollout. Operators that sign exclusive agreements with infrastructure owners, could impede rollout and hence have a negative effect on network rollouts. Australia's NRA has been vocal in its opposition to 5G infrastructure sharing. It believes that 5G infrastructure sharing would limit incentives to deploy 5G and differentiation.

5.4. 5G

The rollout of 5G is expected to enhance mobile operators' ability to support a wider variety of services e.g. IoT (see IoT and connected devices), and compete as fixed wireless service providers (e.g. fixed-mobile substitution) (see 5.9 Multi-play) services. Elisa in Finland and Estonia and Verizon Wireless were among the first mobile operators to launch 5G services in 2018.

5G will be able to satisfy consumers' increasing demand of high bandwidth services, in the home or on the move. The availability of 5G, and existing fibre-to-the-home (FTTH) and other high-speed fixed broadband networks, will also foster the development and take-up of new applications (e.g. AR, VR, see 5.15) and service innovation.

Operators need to invest in new networks, initially overlaying on top of existing 4G technology. But it will also involve the replacement of existing non-passive infrastructure. The rollout of 5G may include the increasing use of infrastructure sharing among operators (see 5.3 Infrastructure sharing). To make use of higher frequency bands, operators will need to also deploy small cells - network densification. Network densification will require the rollout of many new small cell sites, as well as access to adequate fibre and wireless backhaul.

The provision of higher bandwidth services and larger data bundles enabled through 4G, has not helped mobile operators to offset declining voice and SMS revenues. The same situation could materialise if operators do not innovate and develop new services. Selling bandwidth will not increase margins or transform operators' bottom line.

Network slicing is an innovation that will make use of 5G. It is a form of virtual networking architecture that makes use of SDN/NFV (see 5.6 SDN/NFV). This virtualisation enables the creation of distinct virtual, end to end network slices that can be tailored to specific use cases / customer requirements. These needs may consist of specific latency (e.g. 1ms), bandwidth (e.g. 10Gbit/s), coverage (e.g. 100%), network availability (e.g. five 9s⁸⁵) and enough propagation (e.g. in-building, underground) requirements. These requirements will vary by customer (e.g. emergency services) and use cases (e.g. connected cars). 5G network slicing should enable operators to develop a broader service portfolio and thereby diversify, expand and increase on-going revenue streams. Operators' ability to grow their revenues will

⁸⁵ Five 9s means network available 99.999% of the time

depend upon what customers will be willing to pay. As yet, many of the business models for 5G are still under development.

Mobile operators can also use network slicing to enable enterprises to purchase end to end virtual networks, as well as intermediaries that also support them (e.g. MVNOs, systems integrators, value added resellers, digital service providers (e.g. Google). Network slices could also be used to provide tiered services in the consumer market, which may raise net neutrality concerns if traffic is prioritised.

Each operator needs access to between 80-100MHz of contiguous spectrum to support 5G in the prime bands (e.g. around the 3.5GHz spectrum band). The important spectrum bands include around the 1GHz band, 3.5GHz band and above 24GHz⁸⁶.

Mobile operators also need fair access to fibre and wireless backhaul services to minimise the cost to support small cell networks. Ofcom has proposed placing new conditions on Openreach to ensure it facilitates requests for access to its duct and pole network, which can be used by mobile operators to support 5G⁸⁷. Access to contiguous amounts of spectrum will also be needed by operators to minimise costs associated with wireless backhaul (see 5.5 MIMO).

Accelerating 5G network rollouts can be achieved by:

- Attaching coverage obligations - e.g. Germany's NRA
- Helping to facilitate the entrance of new entrants - e.g. Germany's NRA has placed lighter conditions on new entrants, as national roaming requirements can be negotiated with the NRA. The mobile operators, however, consider that this will decrease their ability to invest
- Making more infrastructure available – e.g. the Federal Communications Commission's (FCC) reforms to make pole infrastructure more readily available for 5G deployment, called One-Touch Make-Ready⁸⁸
- Eradicate pricing rules for high bandwidth services – e.g. FCC⁸⁹
- Setting spectrum prices that encourage investment in networks and service development.

The provision of network slicing has significant implications for access by wholesale customers, digital service providers and consumers. On what terms will network slicing be made available to MVNOs and digital service providers? Will the terms be fair, when compared to other customers that do not compete with mobile operators? If consumers are offered virtualised networks, how will they be able to compare offers and make informed decisions. Price comparison sites do a good job of comparing voice, SMS and data bundles, but will these tools be able to consider a wider range of complex service features?

All customers may also need to verify whether service level agreements (SLAs) are achieved e.g. network availability, latency. Consumers may use price comparison sites, results from customer surveys and drive tests to make decisions about which service to select, but independently verifiable sources to check on-going service claims are not currently available. Specialist drive test companies (e.g. P3) and

⁸⁶ <https://www.gsma.com/spectrum/wp-content/uploads/2018/11/5G-Spectrum-Positions.pdf>

⁸⁷ <https://www.ofcom.org.uk/about-ofcom/latest/media-releases/2018/fibre-investment-bcmr>

⁸⁸ <https://www.fcc.gov/document/fcc-speeds-access-utility-poles-promote-broadband-5g-deployment-0>

⁸⁹ <https://www.fcc.gov/document/business-data-services-report-and-order>

crowdsourced (e.g. OpenSignal) provide on-going assessments of operators' performance, using a 'basket' of network slices.

5.5. MIMO

Multiple-input multiple-output (MIMO) consists of multiple antennas that can be linked in an array and controlled to increase network efficiency. Separate antennas can be used to transmit and receive signals. MIMO can be used to support an increased number of simultaneous active connections and deliver improved reliability. Massive MIMO has the potential to deliver 'unlimited' capacity⁹⁰.

Standard MIMO use two or four antennas, Massive MIMO uses many more antennas (e.g. 96 to 128). To function, MIMO requires higher frequencies, since the antennas at a base station need to be integrated into a small area. As a result, higher frequency spectrum becomes more valuable when compared to lower frequency spectrum (e.g. <1GHz) that has been used for its superior propagation and indoor penetration properties.

Massive MIMO is likely to be deployed in dense locations, where there is high connection and bandwidth demands, which requires significant backhaul capacities - or so-called fronthaul in the case of small cells. Infrastructure sharing is likely to be used by operators to support the rollout of 5G (see 5.3 Infrastructure sharing and 5.4 5G).

Backhaul capacities of 1Gbit/s may not be enough to support 5G fronthaul, 10 to 100Gbit/s may be necessary for aggregated sites in dense locations. Mobile operators will also need access to higher spectrum frequencies (70-80GHz) for microwave backhaul, to deliver enough capacity⁹¹. At locations where fibre is not available, and/or uneconomic to deploy, microwave backhaul will need to be used.

MIMO can also be used for mobile only operators to compete with fixed broadband operators, and potentially substitute fixed lines. It could also be used by multi-play (fixed-mobile) operators to complement their existing FTTH networks (which may be uneconomic to rollout in certain locations), using MIMO to support fixed wireless solutions (see Mobile only broadband).

5.6. SDN/NFV

Software defined networking (SDN)/network functions virtualisation (NFV) are solutions being adopted by operators as part of digital transformation projects. SDN/NFV enables operators to transform their networks from an inflexible resource, into a far more flexible tool and an array of tailored products and services (e.g. network slicing) – complemented by 5G (see 5G). These new flexible resources together with agile services (see Agile service delivery) can be turned on and off, scaled up and down efficiently and cost effectively. For customers it means operators can deliver almost any virtual service on-demand, if they have access to the cloud service, content or otherwise through a service gateway. Moreover, customers (enterprises, wholesale customers, SIs, digital service providers) conceivably can turn on and adapt their

⁹⁰ <https://ieeexplore.ieee.org/document/8094949>

⁹¹ https://www.ofcom.org.uk/data/assets/pdf_file/0009/113112/cartesian-business-connectivity-market-assessment.pdf

services using an application programming interface (API). Network resources can dynamically adapt to changing consumer and customer needs, the services they use, the time, their locations and the devices in use.

Fewer than 5% of operators are close to completing their network virtualisation projects, although around 30% are almost halfway towards project completion.⁹² More than 70% of the participants in telecoms market believes NFV is critical or important to their overall company strategy in the next five years⁹³. Other parts of telecom operators and service providers' digital transformation projects include digitalisation of internal processes, digitalisation of external interfaces and refreshing operational support systems (OSS) and business support systems (BSS) (see Figure 2).

Operators want to develop more agile services (see Agile service delivery), and make more efficient use of their infrastructure and platform resources to save on capex and opex expenditure. Implementing SDN/NFV is complex and many projects have not delivered anticipated costs savings or service agility. Problems affecting operators' ability to implement digital transformation projects include inadequate support for automation and integration with legacy systems is complex⁹⁴.

Some projects fail because a 'rip and replace' approach is adopted. Some of the issues include lead times being too long, the working assumptions may continue to change, and large investments are needed before any service is launched. Incremental, evolutionary project may be more appropriate. Vendor selection may also contribute to project failure, if an operator tries to identify one single supplier to fulfil all its transformation needs. Collaborating with traditional vendors and specialist SDN/NFV vendors, including those from the open source world, may help operators minimise project failure.

Best practices for deploying digital transformation projects should be considered by operators. Transformation projects are not just technical but functional as well. Five 9s network and service uptime requires end to end network design⁹⁵. The use of open APIs to integrate applications with network slices will assist operators to develop new TMT services, but also enable third parties, including digital service providers, to develop new innovative services (many of which are yet to be imagined).

5.7. Agile service delivery

All telecoms operators (fixed-mobile, mobile) and service providers need to be more agile to address customer need, be they wholesale partners, enterprises or consumers. They need to transform their infrastructure and platforms to be better able to support growing demand for digital services, as opposed to traditional telco services (e.g. voice, SMS, data).

Digital services include consumer IoT/smart home, enterprise IoT, multi-play services (including cloud services, gaming). Part of this transformation includes introducing AI and analytics to network optimisation and service delivery to improve customer QoE,

⁹² Survey of 1,500 telecom professionals. Digital Transformation: Are We There Yet? Openet Survey, 2018

⁹³ Survey of 1,500 telecom professionals (service providers, consultancies, VARs, mobile operators, software vendors, hardware vendors), Annual Industry Survey 2018, Telecoms.com Intelligence

⁹⁴ <https://cloudify.co/wp-content/uploads/2018/07/Why-seventy-percent-digital-transformation-fail-WP-2018.pdf>

⁹⁵ <https://www.gsma.com/futurenetworks/5g/migration-from-physical-to-virtual-network-functions-best-practices-and-lessons-learned/>

as well as the new feature rich architectures to deliver omni-channel customer experience and engagement and service delivery⁹⁶. During 2019, more than 30% of telecoms service providers will be involved in digitalisation of internal processes and external interfaces⁹⁷.

Many telecoms operators service agility is restricted by outdated, monolithic and disparate architecture and software systems, which were built in silos. Exacerbated by solutions from multiple vendors that in many cases require bespoke integrations. These restrictions have limited operators' ability to innovate. A basic example of innovation may be the inability to rapidly create and launch new mobile tariffs. The cost to support and maintain legacy systems is significant, providing added impetus to replace outdated architecture and software solutions.

Mobile operators (stand alone and fixed-mobile) can adopt one of four approaches to refresh legacy OSS/BSS:

1. Single transformation project – one large project that will upgrade all software systems at the same time. This approach is very risky and not advised
2. Greenfield – introduce new systems to support new product / service initiatives (e.g. enterprise IoT)
3. Phased – use a step-by-step approach to replace legacy systems with new digital solutions
4. Add-on – overlay new systems on top of legacy systems, then phase out legacy systems.

Most telecoms operators and service providers believe the last three approaches are best practice to upgrading legacy OSS/BSS⁹⁸

Many MVNOs and all major digital service providers are not hindered by legacy, disparate platforms. Instead they use infrastructure and platforms that are already agile (e.g. many MVNOs use a platform provided by an MVNE – see MVNO and Emerging Trends Studies report) and can deliver products and services that are: horizontally scalable, vertically scalable, partially/fully integrated and delivered efficiently, resiliently using automated, low-cost delivery provisioning and in-life tools and support. Competition from digital service providers in telecoms service providers' core markets and slowing/flat-lining revenues in core telecoms services are also forcing telecoms operators and service providers to become more agile – see OTT (voice and messaging) and Content provision.

Agile service delivery also requires plug and play support for customers and partners (e.g. to enable integration with applications from digital service providers), which can be supported by using standardised APIs. This approach should be adopted by telecoms operators to create new ecosystems of partners, so that they can provide a richer set of products and services (i.e. not traditional telco services).

Apart from reliance on legacy technology and processes and capex constraints, insufficient support from telco executives, general inertia and insufficient business case are the main reasons that telco service providers are not undertaking digital transformations⁹⁹. Learning best practices from telco service providers in other non-

⁹⁶ Digital Transformation Are We There Yet? Openet Telecom 2018

⁹⁷ ibid

⁹⁸ ibid

⁹⁹ ibid

competing markets may help identify new business cases, how to get buy in from executives and how best to approach and implement digital transformation projects.

5.8. Wholesale and sub-brands

The mobile wholesale market has been in operation since the launch of the first MVNO in 1999 (Virgin Mobile)¹⁰⁰. Many mobile operators chose a pro-MVNO strategy to win market share, KPN owned E-Plus (Germany) and Base (Belgium)¹⁰¹ and use MVNOs to target new segments that the mobile operator's master brand may not appeal to.

In many mobile markets, MVNOs have helped (see MVNO landscape: Global perspectives and New Zealand Applications, for more details):

- Increase competition
- Lower prices
- Stimulate service innovation (e.g. tariff implication)
- Serve underserved consumer segments (e.g. ethnic).

Most wholesale negotiations between mobile operators and MVNOs have been commercially driven, few NRAs have felt it necessary to intervene in countries in which MVNOs have been allowed to operate (see MVNO paper for more details). Negotiations are bespoke. The wholesale agreement (specifically cost per minute, SMS and MB) depends on many factors, influenced primarily on the number of subscriptions/usage/revenue that the MVNO will add to and operator's network.

To counteract increased competition from MVNOs, many mobile operators have launched sub-brands as part of a broader wholesale strategy. KPN owned E-Plus and Base were also keen supporters of sub-brands, although KPN launched the first sub-brand (Hi) in Netherlands in 1996¹⁰². Sub-brands enable mobile operators to win back control from MVNOs, launch new tariffs and product innovations, target underserved segments and increase customer choice, but without damaging the incumbent's brand and core business. At the end of 2018, there were around 290 sub-brands globally. Mobile operators are likely to continue to launch sub-brands.

Not all mobile operators that operate sub-brands have launched them. Some sub-brands are added to an operator when they acquire:

- a mobile operator and repurpose the newly acquired brand as a sub-brand (e.g. T-Mobile USA's acquisition of MetroPCS. The MetroPCS sub-brand was re-branded as Metro by T-Mobile in September 2018¹⁰³)
- a mobile operator that already operates sub-brands (e.g. Telefonica Deutschland's acquisition of E-Plus in Germany¹⁰⁴)
- an MVNO and adopt them as a sub-brand (e.g. Orange's acquisition of Republica Movil in November 2018¹⁰⁵).

¹⁰⁰ <https://blog.telegeography.com/5-things-you-didnt-know-about-the-uk-mvno-market>

¹⁰¹ Base went on to be acquired by Telenet and E-Plus by Telefonica Deutschland
<https://www.telefonica.de/fixed/news/5631/telefonica-deutschland-completes-acquisition-of-e-plus-group.html>

¹⁰² Hi was a brand focused on youth segment, which was incorporated into the KPN brand in 2015

¹⁰³ <https://www.t-mobile.com/news/metro-by-t-mobile> <https://www.fiercewireless.com/wireless/t-mobile-rebrands-metropcs-prepaid-service-as-metro-by-t-mobile>

¹⁰⁴ <https://www.fiercewireless.com/europe/report-telefonica-deutschland-to-drop-e-plus-base-and-simyo-brands>

¹⁰⁵ <https://www.telegeography.com/products/commsupdate/articles/2018/11/12/mvnomonday-mvnos-europe-special/>

Mobile operators' in the IoT market are coming up against competition from specialist MVNOs. IoT MVNOs include companies that have provided services for many years (including Aeris, Wireless Logic and Kore), as well as new, low cost entrants (including Twilio, 1NCE and Monogoto)¹⁰⁶. IoT MVNOs are winning contracts with high profile companies, for example Twilio serves Coca Cola and Airbnb and Wireless Logic serves John Deere and Siemens Traffic¹⁰⁷.

Mobile operators and MVNOs have tended to use a similar approach to negotiate wholesale agreements for both mobile and IoT services, which are conducted using bespoke agreements. A significant majority of IoT applications will use small amounts of data, and even less voice and SMS. The size of the IoT MVNO contracts for mobile operators will not be as lucrative when compared to deals made with MVNOs that service the mobile market. Mobile operators may need to consider adopting a new approach to negotiating wholesale agreements for the IoT market.

Specialist wholesale service providers could emerge to support 5G and IoT services, if companies are prepared to bid for spectrum licenses. AirSpan Group, for example, has acquired spectrum licenses in the 2.6GHz or 3.6GHz spectrum bands in six countries¹⁰⁸. It plans to use this spectrum to support 4G and 5G mobile network densification as a wholesale, neutral host. Such companies would provide new opportunities for MVNOs, gaining access to 5G services when launched. Some MVNOs have been slow to launch 4G, which may be due to reluctance by the MVNO to launch, or the mobile operator to provide access or the failure of both to reach a commercial agreement (e.g. as of January 2018, Lebara in Germany only provides 3G services. Its host operator, Deutsche Telekom launched 4G in 2011)¹⁰⁹.

Regulators may intervene to assist MVNOs and other service providers to access wholesale services. Germany's telecoms NRA, for example, includes in its auction for the 3.4 to 3.7 GHz bands the potential to attach wholesale obligations. The mobile industry believes such legal uncertainty may deter investment¹¹⁰. Many NRAs have attached coverage/rollout and sometimes minimum data download speed obligations to spectrum auctions. Attaching wholesale obligations is something of a departure, but some NRAs may follow Germany's lead.

Other behaviour that may restrict MVNOs ability to compete in the mobile market include:

- Some mobile operators delaying access to new network infrastructure. For example, Vodafone Germany did not make 4G available to Lebara until the beginning of 2019, having launched it in 2010. MVNO MovilDIA in Spain moved from Orange Espana to Vodafone Spain in December 2019 to add 4G, Orange launched 4G in 2013. Some sub-brands have also affected by similar delays to being able to offer 4G e.g. Telecom Italia's Kena Mobile, which launched 4G in October 2018 having operated since March 2017

¹⁰⁶ <http://www.analysismason.com/Research/Content/Comments/Twilio-IoT-connectivity-rdme0/>
https://customers.twilio.com/?_ga=2.134001101.2134892480.1547136084-1107391269.1547136084

¹⁰⁷ <https://www.wirelesslogic.com/case-studies/>

¹⁰⁸ <http://denseair.net/about-dense-air/#our-background>

¹⁰⁹ <https://www.telekom.com/en/media/media-information/archive/telekom-starts-4g-offensive---mobile-broadband-for-the-gigabit-society-353414>

¹¹⁰ <https://www.gsma.com/newsroom/press-release/gsma-welcomes-germanys-5g-spectrum-award-but-cautions-against-unnecessary-conditions/>

- MVNOs may not automatically receive revenue from in-bound termination of voice minutes. An MVNO may have to negotiate with the MNO to receive in-bound termination revenue
- Mobile operators not always providing access to real-time call detail records (CDRs), which are necessary to deliver up-to-date billing (essential for prepaid services). Without real-time CDRs, subscribers may exceed their tariff bundles but are still able to make calls/use data and result in billing issues for the MVNO
- Under circumstances where MVNOs are reliant on operators for tariff changes i.e. the light MVNO model, an MNO may be slow to respond to tariff change requests. The host operator may instead favour its own internal needs.

5.9. Multi-play

Service bundling (fixed telephony, fixed broadband, pay TV, mobile) is common feature of service provision throughout Europe, including Belgium, Netherlands, France and Switzerland. Quad-play bundles have also gain traction in many of these markets. At the end of 2017, 40% of Swiss households had subscribed to a quad-play. These bundles may or may not include post-paid or pre-paid mobile contracts and may be offered at a discount.

Converged fixed-mobile operators use bundling to engender loyalty/ reduce churn, as well as cross-sell and upsell to increase average revenue per household. If competitors offering standalone services are unable to compete against discounted bundles, it may be anti-competitive.

Fixed-mobile convergence is beneficial for consumers e.g. benefit from omni-channel customer experience and engagement, but also from discounts from adopting multi-play as opposed to standalone services. A fixed-mobile operator could use discounting / cross-subsidies to grow market share and market power. This could stymie competition if they gain an advantage over mobile-only operators/ service providers – but no NRA has, as yet, needed to intervene in relation to wholesale access to mobile.

In Europe, The European Commission may consider multi-play to be anticompetitive, where equally efficient competitors offering only some of the components cannot compete against the discounted bundle.¹¹¹ Quad-play operators, in theory, may cross-subsidise to gain a competitive advantage over mobile-only operators, or other multi-play services providers that rely on MVNO airtime agreements.

To date, no interventions have been necessary, since competitors with one product have been able to remain competitive. Some mobile-only competitors have been able to substitute fixed-line/quad-play for mobile-only services in Europe, which opens the way for single and double-play services (see Mobile only broadband).¹¹²

Not all consumers may be able to benefit from multi-play services. Lower value customers may not have the means to purchase multi-play services. Although all multi-play providers provide tiered TV, broadband and mobile packages to attract a broad range of households from different socio-economic segments. Fixed-mobile incumbents also offer lower cost multi-play services via sub-brands, e.g. Wingo in Switzerland, part of Swisscom), as well competitors.

¹¹¹ [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52009XC0224\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52009XC0224(01))

¹¹² <http://www.sipotra.it/wp-content/uploads/2018/09/EUROPEAN-TELECOM-SERVICES.-MAKE-UP-OR-BREAK-UP.pdf>

In Singapore the NRA (IMDA) operates a subsidised scheme that helps low-income households to access affordable fixed-broadband services, which can be bundled with a device. Similar schemes are used address digital divide in other markets, in which households may receive subsidised fixed broadband and mobile services (e.g. the Lifeline Program, USA¹¹³).

5.10. eSIM

eSIM can replace traditional SIM cards and soldered directly onto a device's circuit board. The small form factor of an eSIM means that they can be integrated into watches, wristbands and even ring-like devices. Customers that want to switch service providers using an eSIM no longer need to swap out a SIM. All network switching can be conducted over-the-air, or electronically if the service provider's SIM profile is registered on the eSIM.

Consumers are well versed in switching SIMs when they change mobile operator/service provider for handsets. The introduction of eSIMs should not negatively affect the migration process. If a consumer can turn on the new eSIM profile of their new service provider (e.g. any MVNO). The migration process for other devices seems more complex.

Consumers and operators are struggling with the finer details when it comes to transferring connected watches from one operator to another¹¹⁴. The process is far from simple. The process is made more complex when consumers try to sell an eSIM device on the second-hand market. They may be unable to resell a connected watch because the watch is tied to their mobile tariff. But the consumer may not have fully understood the implications that they may be stuck with the watch until the end of their mobile contract.

In Australia the Australian Communications Consumer Action Network (ACCAN) considers the use of eSIM to restrict users' access to service provider tariffs: "there are clear competition issues, with the e-SIM and Apple SIM models. In Australia, consumers can only select a plan with Optus, Vodafone and Telstra. Consumers cannot sign up for a service with any MVNOs"¹¹⁵.

The number eSIM devices could reach anywhere between 148 million to 420 million shipments in 2022¹¹⁶. Tablets and wearables such as the iPad Pro and Samsung Galaxy Gear smartwatches accounted for a majority of eSIM devices in 2017. Smartphones will contribute to nearly two-thirds of all eSIM device shipments by 2022. Despite such spectacular growth, less than 5% of smartphones sold globally in 2022 will be eSIM-compatible¹¹⁷.

Apple (iPhone XR, XS and XS Max) and Google (Pixel 2) are the only major OEM to include eSIMs in their smartphones (as of December 2018), which combine eSIM and

¹¹³ <https://www.fcc.gov/general/lifeline-program-low-income-consumers>

¹¹⁴ <https://community.ee.co.uk/t5/Other-phones-gadgets-tablets-and/Apple-watch-impossible-to-sell-and-to-use-it/td-p/698186>

¹¹⁵ https://consultation.accc.gov.au/communications-1/communications-sector-market-study-draft-report/supporting_documents/Communications%20Sector%20Market%20Study%20Draft%20Report.pdf

¹¹⁶ <https://ovum.informa.com/resources/product-content/esim-device-sales-forecast-smartphones-tablets-and-wearables-201722>
<https://www.abiresearch.com/press/esim-smartphone-shipments-exceed-400-million-2022-apples-new-smartphones-accelerate-market/>

¹¹⁷ <https://ovum.informa.com/resources/product-content/esim-device-sales-forecast-smartphones-tablets-and-wearables-201722>

a removable SIM card slot as part of a dual-SIM solution. eSIMs will also be incorporated into many IoT devices that rely on cellular bearers.

OEMs and digital service providers have already signed wholesale access deals with some MNOs (e.g. Google with T-Mobile USA, Sprint and US Cellular for Pixel 2). These and other companies may have large purchasing powers, but they are unlikely to want to act as service providers. They are unlikely to want to deal with coverage, billing, handset or any other customer service issue that mobile operators and service providers are used to dealing with¹¹⁸. The complexity of negotiating wholesale access deals for handsets and IoT devices will depend on the number of markets the devices could be shipped to. The greater the number of markets, the more negotiations and contracts that need to be signed. Unless a specialist airtime aggregator can provide a solution. Operators still hold the power to unlock access to their networks. If deals are not commercially viable, they won't be signed.

The use of eSIMs and eSIM migrations should be monitored, to understand the volume of any network switching issues consumers' experience. If consumers are prevented from switching, or the processes is cumbersome, some form of intervention may be required. Interventions may include nudging operators to improve the switching process. The market should also be monitored to ensure customer choice is not restricted when they chose eSIM devices. They should be given the opportunity to select from any tariffs (mobile operator or MVNO), but do they need to scroll through all the tariffs? Would they want to do that¹¹⁹?

The Infocomm Media and Development Authority (IMDA) launched a consultation on eSIMs in mid-2018¹²⁰. The consultation set out to capture industry views on no SIM-lock policy, eSIM business models and licensing. To date (December 2018), the NRA has only collected the responses and has not made any further announcements. Responses include approval and disapproval of a no SIM-lock policy in consumer devices (handset and IoT).

5.11. Mobile only broadband

Fixed-mobile substitution can be considered as mobile voice substituting fixed voice, and more commonly for mobile connections substituting fixed lines. In both cases, consumers have and continue to benefit from increased competition. The rollout of 5G should increase competition in the provision of high-speed broadband services.

Cannibalisation of fixed voice by mobile has been seen in all markets that had significant fixed-line penetration when mobile services first launched. In Europe, mobile voice traffic exceeded fixed line traffic in many countries by 2009¹²¹. Incumbent fixed-mobile operators and fixed-mobile service providers have responded to fixed voice substitution by offering multi-play services.

¹¹⁸ <https://disruptivewireless.blogspot.com/2014/10/apples-sim-card-less-of-gamechanger.html>

¹¹⁹ https://www.theregister.co.uk/2018/08/24/esim_interview/

¹²⁰ <https://www.imda.gov.sg/regulations-licensing-and-consultations/consultations/consultation-papers/2018/public-consultation-on-embedded-sim-technology>

¹²¹ In 2009, 75% of outgoing voice traffic originated from mobile networks in Austria, Bulgaria, Czech Republic, Lithuania, Romania and Finland. Across the EU, 51.6% of voice traffic originated from mobile networks. BEREC Report on Impact of Fixed-Mobile Substitution in Market Definition, 24 May 2012

No significant fixed-mobile connection substitution has been experienced in developed markets, since fixed broadband speeds and volume of data have far exceeded mobile. Wireless technologies have been used to complement fixed infrastructure, providing coverage to hard to reach households. LTE and FWA technologies have been used to deliver last mile connectivity to households e.g. in Sweden¹²² and National Broadband Network in Australia has used LTE-based directional beams¹²³.

The rollout of 5G provides new opportunities for fixed-mobile substitution, as well as competition in the fixed broadband market. Mobile only operators can use 5G FWA to compete with fixed broadband providers. Fixed operators (including fixed-mobile) can also use 5G FWA to extend their reach, providing access to households not passed by their FTTH, DOCSIS 3.1, VDSL2+ networks¹²⁴. Verizon (a fixed-mobile operator) has already launched a mmWave FWA service to complement its existing FiOS FTTH network¹²⁵. The mmWave product aims to deliver up to 300Mbit/s, compared to cable operators that can deliver between 60Mbit/s up to 2Gbit/s.

5G-FWA may be cheaper for operators to deploy when compared to FTTH, despite needing truckrolls to deploy external antennas to a proportion of households but may be more expensive to maintain. The business case for deploying 5G-FWA in dense population areas may stack-up but may not in suburban areas.¹²⁶ Even if 5G-FWA substitutes an existing fixed line, is it really be substituted? In the same way that a FTTH service could be substituted by a DOCSIS 3.1 service, or similar 'substitutions'.

Threats of SMP may need to be monitored, if existing fixed-mobile operators use FWA to dominate a fixed broadband market. But likewise, mobile-only operators have an opportunity to use FWA to compete head-to-head with fixed-only and fixed-mobile operators. They could also begin to offer multi-play services, by bundling 5G-FWA with 4G/5G mobile.

New multi-play opportunities can also be considered by mobile-only and fixed-mobile operators. 5G FWA could be bundled with mobile 4G/5G services, as well as content as part of multi-play services.

5.12. OTT (voice and messaging)

OTT voice and messaging apps have provided consumers with new ways to communicate with friends, families and colleagues. The contribution of the Internet and OTT services is estimated to contribute between EUR2,600 and EUR3,700 per connected consumer to the European economy¹²⁷. Their use has helped contribute to

¹²² <http://www.eib.org/en/infocentre/press/releases/all/2016/2016-233-investeu-eib-loan-to-tele2-to-bring-more-high-speed-broadband-to-sweden-and-the-netherlands.htm>

¹²³ <https://www.nbnco.com.au/learn-about-the-nbn/network-technology.html>

¹²⁴ https://www.juniper.net/documentation/en_US/junos/topics/concept/vdsl2-pim-security-interface-technology-overview.html
<https://www.cablelabs.com/innovations-old/docsis3-1>

¹²⁵ mmWave facilitates MIMO and beamforming, which means that it can deliver equivalent bandwidth provided by fixed broadband services. mmWave is typically in frequencies above 24GHz <https://www.gsma.com/futurenetworks/5g/fixed-wireless-access-economic-potential-and-best-practices/> <http://www.threemediacentre.co.uk/~media/Files/T/Three-Media-Centre/documents/5g-wireless-home-broadband-predicted-to-double-internet-speeds-for-uk-households.pdf>
<https://www.rcrwireless.com/20160815/fundamentals/mmwave-5g-tag31-tag99>

¹²⁶ <http://www.threemediacentre.co.uk/~media/Files/T/Three-Media-Centre/documents/5g-wireless-home-broadband-predicted-to-double-internet-speeds-for-uk-households.pdf>

¹²⁷ BCG, Reforming Europe's Telecoms Regulation to enable the Digital Single Market, 2014.

declining mobile voice and SMS¹²⁸. The features and functionality of these apps have resulted in WhatsApp, and many others, topping the app download charts.

To what extent OTT apps substitute mobile voice and SMS is perhaps a moot point, since many mobile data tariffs in developed markets include unlimited voice and SMS. In addition, the use of OTT contributes to data usage, although the data used will be insignificant when compared to video.

Mobile operators have tried to compete with OTT by developing their own apps, as part of the GSMA's Rich Communications Suite Initiative (RCS)¹²⁹. Despite high hopes and the interoperability as a feature of the service, it has not been a significant success. In April 2018, the GSMA announced it had 165 million active monthly RCS users¹³⁰, but is somewhat lacking when compared to WhatsApp's 1.3 billion monthly users¹³¹.

Even if the RCS was/is a success, all it means is that mobile operators are put in charge of their own cannibalisation. In many markets, mobile operators bundle and zero-rate OTT messaging apps into tariffs (see Zero-rating and bundling). Such bundles are used to persuade consumers in emerging markets to migrate from SMS to data use, as well as migrate from basic to feature phones to smartphones. In developed markets, such bundles are used to appeal to specific target customer groups and stand out from a crowded, competitive market (e.g. Vodafone's sub-band in the UK, Voxi, offers zero-rated use of Facebook, WhatsApp, Facebook Messenger, Twitter and other social media sites and apps).

Mobile operators may consider that OTT voice and messaging apps receive somewhat of an unfair advantage, since they do not need to obtain operating licenses, pay for spectrum, fulfil coverage obligations, etc. The telecoms industry and some regulators have some misgivings about OTTs' about their impact on operators and consider some form of regulatory response:

- Germany's telecoms NRA is seeking to develop a regulatory framework to strike balance between the obligations imposed on telecoms service providers and those of OTT service providers (e.g. Google's Gmail, Facebook Messenger, WhatsApp). The European Court of Justice is reviewing the case.¹³² In the EU, telephone number-based OTT services are regulated like traditional telecoms service providers. None telephone number OTTs are not regulated as telcos¹³³.
- India's telecoms NRA launched a consultation in November 2018, titled 'Regulatory Framework for OTT Communications Services'. Stakeholders are being asked whether OTT services that are like voice calls and SMS should be treated as a telecoms service¹³⁴.

¹²⁸ [https://www.juniperresearch.com/press/press-releases/mobile-voice-revenues-to-fall-by-\\$157-billion](https://www.juniperresearch.com/press/press-releases/mobile-voice-revenues-to-fall-by-$157-billion) In the UK the number of outbound SMS & MSS sent each month per subscription was 162 in 2012 and 82 in 2017. Communications Market Report, Ofcom 2018

¹²⁹ <https://www.gsma.com/futurenetworks/rcs/global-launches/>

¹³⁰ <https://www.gsma.com/futurenetworks/digest/gsma-business-messaging-labs-continue-to-grow-the-rcs-ecosystem/>

¹³¹ RCS has been available in one form or other since 2008, WhatsApp launched in 2009.

<https://techcrunch.com/2018/01/31/whatsapp-hits-1-5-billion-monthly-users-19b-not-so-bad/>

¹³² <https://www.technologylawdispatch.com/2018/03/in-the-courts-are-ott-services-telecommunications-services-german-court-asks-european-court-of-justice-for-preliminary-ruling-gmail-case/>

¹³³ <https://www.lexology.com/library/detail.aspx?q=9737b40b-a274-4271-b628-1d02857f29e7>

¹³⁴ <https://www.trai.gov.in/consultation-paper-regulatory-framework-over-top-ott-communication-services>

- The Commonwealth Telecommunications Organisation (CTO) published a study in June 2018. It asks regulators to adapt telecoms regulations to address OTT services, to deliver ‘a level playing field’¹³⁵.

An alternative viewpoint is that the decline in mobile voice and SMS revenues is a result of competition among operators, and not just due to competition from OTTs. IDATE DigiWorld forecasts that the OTT global communications market will only account for 3.1% of the total communications market in 2020. It considers that OTTs have not adversely affected mobile operators’ revenue. Intra telco competition, regulations and economic performance are thought to be more influential factors¹³⁶. In France, prior to the introduction of WhatsApp, competition among mobile operators had contributed to all three launching unlimited SMS in their tariffs and voice revenue had already seen declines. The launch of a fourth mobile operator in 2012 also contributed to increased competition, sparking a price war¹³⁷.

5.13. Content provision

Consumers have access to a huge variety of short form and long form video, music and gaming content, which is either free (e.g. YouTube) legal and not legal, and paid for (e.g. Spotify, Netflix). Mobile operators and service providers are an important part of the ecosystem to help distribute this content. Operators can extend their role in the TMT value chain by choosing from four content strategies: build, buy, acquire (see M&A and partner. Build (develop original content) and buy (e.g. acquire exclusive rights to sports) strategies are mostly used by fixed and fixed-mobile operators. Fixed-mobile operators make their built or bought content available to both fixed and mobile customers.

Fixed-mobile and mobile operators/service providers can distribute built or bought content using four approaches, and make it available:

1. to subscribers’ mobile devices – extending Pay TV service (e.g. Sky Go)
2. as a paid add-on service to existing subscribers, who do not subscribe to pay TV (e.g. AT&T Watch)
3. as a paid add-on service to consumers outside its subscription base (e.g. Now TV)
4. as a paid add-on service to consumers outside its subscription base in other countries (e.g. PCCW’s Viu, Singtel’s Hooq)

A variation to approaches 2 and 3 is an ad-funded model, which was used by Verizon Wireless’s now defunct Go90 service¹³⁸.

In addition to content that is built, bought or acquired, many mobile operators have partnerships with digital service providers. These partnerships are used to increase data usage, build loyalty/attract subscribers and generate incremental revenues (by selling content). Broadly, partnerships with digital service providers can be segmented into three options:

¹³⁵ <http://www.itwebafrica.com/ict-and-governance/523-africa/244465-africa-grapples-with-ott-regulation-conundrum>

¹³⁶ OTT Communication Services, IDATA Digiworld 2017

¹³⁷ http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3265 <https://www.ft.com/content/7cc58228-3b72-11e1-bb39-00144feabdc0>

¹³⁸ <https://www.theverge.com/2018/6/28/17516266/verizon-shutting-down-go90-original-video-content-app>

- simple marketing alliance – no commercial relationship, no investment, no billing integration or inclusion in the operator’s user interface
- limited partnership – marketing relationship, limited investment, billing integration, no integration in the operator’s user interface
- integrated partnership – marketing relationship, limited investment, billing integration and integration into the operator’s user interface

Other mobile service providers (MVNOs, sub-brands) have also created partnerships, but to a far lesser extent. Mobile operators either bundle the content for no additional fee (as part of a tariff) for a period or sell the content as an add-on. Vodafone’s Red post-paid tariffs, throughout Europe, typically include bundled content at no extra cost in its larger value, 12-month tariffs (e.g. includes Spotify in its GBP25, 25GB tariff).

Many mobile operators and service providers are unlikely to invest in original content, buy content rights or acquire content originators. Partnerships with digital service providers, for most, will be their entrance into the content market. These partnerships are unlikely to have a significant impact on mobile operator’s or service providers’ bottom line. Mobile data usage will grow in many markets, irrespective of these partnerships and the sale of add-on content is likely to be incremental rather than transformative. For many mobile operators, these partnerships will help attract subscribers and build loyalty. These partnerships can also be viewed as co-operative, and not cooperation as would be the case with messaging and voice OTTs.

5.14. Zero-rating and bundling

Zero-rating is the use of specific online services by users that do not count towards their mobile data usage, whether pre- or post-paid. Many consumers in developed and emerging markets have benefited from zero-rating. There are two forms of zero-rating:

- paid subscription-based content – subscriber pays for content outside the mobile service provider’s billing system
- tariffs bundled with a specific content. The content is free (websites, messaging apps, social media apps), and tends to be lower bandwidth

In emerging countries, zero-rating can encourage the use and take-up of mobile data and the content bundled with the zero-rating. Such an approach persuades subscribers (mainly pre-paid) to use new applications and services, migrate towards more sophisticated devices, and ultimately use more data (as opposed to SMS/voice)¹³⁹. In developed markets, mobile service providers also zero-rate certain content bundled with a tariff (e.g. Vodafone’s Voxi sub-brand in the UK). Such an approach is taken to stand out from a crowded market and attract subscribers.

Zero-rating paid-for content is also used by mobile operators as a tool to attract and retain subscribers. T-Mobile USA trailblazed the use of zero-rating as part of its ‘un-carrier’ strategy¹⁴⁰. It launched zero-rating in 2014, called Music Freedom, which enabled post-paid and pre-paid subscribers to use streaming music services without using their data bundles¹⁴¹. T-Mobile has gone on to enable users to add streaming video to its zero-rated strategy (e.g. Amazon Video, HBO Now and Netflix). Zero-rating

¹³⁹ For example, TrueMove Thailand’s pre-paid ‘Free Data’ tariff that provides unlimited use of 14 social media apps for 30 days

¹⁴⁰ <https://www.t-mobile.com/our-story/un-carrier-history>

¹⁴¹ <https://www.t-mobile.com/news/binge-on-music-freedom-new-services>

has also been implemented by some MVNOs (e.g. Virgin Mobile and FreedomPop in the UK)¹⁴².

Zero-rating has caught the attention of many NRAs, due to net-neutrality laws. Zero-rating is not prohibited in many countries, if zero-rated traffic is not prioritised over other traffic, in others it is outlawed:

- In Germany the NRA requested Vodafone to make adjustments to its zero-rates tariff. It requested that zero-rating be made available to its subscribers when travelling to EU countries, as part of EU roaming regulations¹⁴³.
- India's telecoms NRA banned zero-rating in 2016¹⁴⁴
- The telecoms NRA in Norway considers that zero-rating is a violation of net-neutrality¹⁴⁵.

Any mobile operator or MVNO that decides to launch a zero-rated service is likely to face scrutiny of an NRA.

5.15. AR/VR

The AR/VR market is expected to grow by tens of billions of dollars by 2023¹⁴⁶, consisting of hardware, software and services. These immersive technologies were brought to worldwide attention with the release of Pokémon Go in July 2016. They are more than just games and new forms of entertainment, and being used in the health care sector, for architectural and interior designs, in retail, marketing and many other industry applications¹⁴⁷.

Many mobile operators sell headsets and smartphones that support VR/AR applications and services and provide the connectivity to support them. To grow new revenue streams and generate higher margins, some telecom operators have already started to invest in AR/VR:

- Verizon acquired VR content production company RYOT in April 2016. It produces 360-degree films and documentaries part of Verizon's Media Group.¹⁴⁸
- AT&T has created an edge computing testbed to experiment with AR and other technologies and applications that require low latency and packet jitter¹⁴⁹. The telecoms giant has invested in Magic Leap in July 2018, becoming an exclusive distributor of its 'mixed reality' headsets in the USA¹⁵⁰.
- SK Telecom launched its mobile media platform, oksusu, in January 2016. This platform offers a wide range of films and VoD channels, which now also

¹⁴² <https://www.capacitymedia.com/articles/3582369/FreedomPop-launches-zero-rated-WhatsApp-packages-in-UK>
<https://www.engadget.com/2017/10/20/vodafone-passes-zero-rating/>

¹⁴³ <https://www.broadbandtvnews.com/2018/06/15/german-regulator-brakes-vodafones-zero-rating-service/>

¹⁴⁴ <https://www.developingtelecoms.com/business/Categories/regulation/6340-trai-bans-zero-rating-facebook-asserts-commitment-to-india.html>

¹⁴⁵ <https://eng.nkom.no/topical-issues/news/net-neutrality-and-charging-models>

¹⁴⁶ Forecasts range from USD55 billion in 2022 to USD65 billion and USD94.4 billion in 2023

<https://www.idc.com/getdoc.jsp?containerId=prUS43860118> <https://globenewswire.com/news-release/2018/05/29/1512971/0/en/AR-and-VR-Market-Size-Forecasted-to-Reach-94-4-Billion-by-2023-P-S-Market-Research.html>
<https://www.businesswire.com/news/home/20180227005719/en/Global-Augmented-Reality-Mixed-Reality-Market-Outlook>

¹⁴⁷ <https://www.digitalhealth.net/2018/02/vr-ar-transform-health-sector/>

¹⁴⁸ <https://techcrunch.com/2016/04/20/verizons-aols-huffington-post-acquires-virtual-reality-studio-ryot/>

<https://www.zdnet.com/article/verizons-oath-brand-to-be-killed-off-in-2019/>

¹⁴⁹ https://about.att.com/story/2018/edge_update.html

¹⁵⁰ <https://policyforum.att.com/innovation/ar-vr/>

supports interactive experiences to users of its Social VR app. The app enables VR headset users to participate in virtual rooms, as an avatar, while watching sport, films or other content¹⁵¹. Media companies can also use its oksusu platform to distribute content (VoD, live, VR, ad insertion)¹⁵².

The parts of the TMT value chain that telecoms operators can easily commoditise include the sale of data, content distribution as well as the sale of devices. Some operators, as highlighted above, have begun investing in AR/VR content, which is an extension to core communications services and can be packaged and sold to consumers.

Many digital service providers are competing for consumer spend and eyeballs, including Apple, Google and Facebook, who have invested in AR/VR headset companies, as well as providing access to platforms and tools to help developers create content for these devices¹⁵³. The mobile industry, however, is trying to collaborate to develop VR/AR business models and research into virtualisation technologies, low latency codec compression, graphics processing unit rendering and leverage their investments in 5G¹⁵⁴. These technologies can be packaged into network slices (see 5G), but the higher margin market opportunities for AR/VR are likely to move more quickly than any industry organisation's ambitions.

The ecosystems to support different vertical industries' AR/VR needs have already emerged¹⁵⁵. To become more than just bit-pipes and providers of generic horizontal content distribution platforms, operators need to develop vertical AR/VR solutions for the enterprise market – which means building, buying, acquiring or partnering and adopting (as discussed in M&A, Content provision and IoT and connected devices). Mobile operators could use network slicing (see 5G) to support AR/VR applications, which would be appropriate for multi-player games.

5.16. IoT and connected devices

Consumer IoT

The explosion in consumer IoT connections, which is expected to reach 11.4 billion in 2025¹⁵⁶, which include cellular connections and non-cellular (including Wi-Fi, Z-Wave, Zigbee). Many devices in the home do not use cellular bearers, including home audio/visual devices, white goods, home security. Cellular connections are used to support children/pet/bike trackers and wearables. On average, connectivity only accounts for five per cent of the IoT market¹⁵⁷.

¹⁵¹ http://www.koreatimes.co.kr/www/news/tech/2016/01/133_196444.html <https://telecomdrive.com/sk-telecom-unveils-oksusu-social-vr-mobile-social-vr-app/>

¹⁵² <https://developers.sktelecom.com/content/product/Platform>

¹⁵³ <https://www.macrumors.com/roundup/apple-vr-project/> <https://www.cnbc.com/2017/10/11/facebook-2-billion-bet-on-oculus-not-paying-off-commentary.html> <https://www.roadtovr.com/google-appears-to-be-ramping-up-rd-efforts-for-new-and-novel-ar-vr-lenses/> <https://next.reality.news/news/nr30-augmented-reality-investment-leaders-2018-0186091/> <https://themanifest.com/virtual-reality/companies>

¹⁵⁴ <https://www.gsma.com/futurenetworks/digest/gsma-launches-new-forum-to-support-5g-cloud-based-ar-vr/>

¹⁵⁵ <https://venturebeat.com/2018/07/12/ar-companies-have-grown-50-since-the-end-of-2017/> <https://www.digi-capital.com/news/2018/04/ar-vr-startups-raise-record-3-6-billion-in-last-12-months-as-market-transition-accelerates/>

¹⁵⁶ Up from 5.4 billion in 2018; Global Mobile Trends, GSMA Intelligence September 2018

¹⁵⁷ Revenues include connectivity, platforms, applications and services. Global IoT Connections and Revenue Forecasts, GSMA May 2018

Mobile operators are unlikely to generate significant revenues by supporting the small proportion of consumer IoT devices that rely on cellular connectivity. Most of the value of consumer IoT is the sale of devices¹⁵⁸. Although for a select few consumer IoT applications, the tasks associated with managing, collecting and analysing data from devices will also account for a significant proportion of overall revenue (e.g. healthcare). Mobile operators that want to move along the IoT value chain need to build, buy or acquire expertise to move beyond connectivity.

OEMs or other companies incorporating IoT in the services provided to consumers can purchase cellular airtime (voice, SMS, data – the mix will depend on the IoT use case) from mobile operators or MVNOs (e.g. Twilio) (see Wholesale and sub-brands).

The performance of cellular networks may have a significant impact on delivering IoT services to consumers. Most consumers may expect child/pet trackers and healthcare devices to always be on and monitorable. They only work if there is a cellular connection¹⁵⁹. As long as consumers understand any limitations of the service, there are no potential mis-selling issues. Of more concern is how personal data is collected and shared. Many consumers don't believe that they have little or no control over the data that is collected and are concerned about privacy invasions¹⁶⁰. Making IoT devices and services secure is also a challenge to protect consumers' data, as well as protect them against cybercrime¹⁶¹.

IoT devices and services need to be designed to be secure and capable of being upgraded using software updates to thwart cyberattacks. Consumers may need to be made aware of the IoT privacy and security issues when buying devices and help them make informed purchasing decisions. They may also require assistance to respond to cyberattacks, assurances that their device/service is adhering to its SLAs and their data privacy and security is being fulfilled.

A multi-stakeholder approach may be required to inform and protect consumers, in response to the increasing take-up of IoT devices. Special rules already apply to certain telco services¹⁶², which could be extended to IoT services if high levels of service (e.g. availability) are required.

Some government organisations and NRAs have developing policies to safeguard personal data and manage cyber threats, including

- the IMDA in Singapore will work with the IoT industry to develop policies to safeguard personal data and manage cyber threats¹⁶³.
- California's State Senate introducing a Bill to mandate that manufacturers of IoT devices must include "reasonable" security features, "designed to protect the device and any information contained therein from unauthorized access, destruction, use, modification, or disclosure"¹⁶⁴.
- The EU's General Data Protection Regulation (GDPR) also applies to connected devices and the data they collect, but its administration is complex

¹⁵⁸ Includes the communications hardware

¹⁵⁹ Trackers also require a GPS signal

¹⁶⁰ What the Internet of Things means for consumer privacy, The Economist Intelligence Unit, 2018

¹⁶¹ https://www.theregister.co.uk/2018/10/15/iot_security_gchq_ncsc/

¹⁶² In Australia, people with life threatening diseases receive priority connection and fault repair for fixed-line telephone services <https://www.acma.gov.au/Industry/Telco/Carriers-and-service-providers/Universal-service-obligation/priority-assistance-carriers-service-providers-acma>

¹⁶³ <https://www.imda.gov.sg/sqdigital/tech-pillars/internet-of-things>

¹⁶⁴ <https://iot.eetimes.com/california-to-regulate-security-of-iot-devices/>

since the data is analysed and used by many participants in the IoT value chain¹⁶⁵.

- The UK's security and intelligence organisation, Government Communications Headquarters (GCHQ), introduced a code of practice that includes recommendations and standards to IoT companies on how to bake in security into their devices¹⁶⁶.

Such frameworks apply to all IoT devices, not just those connected to cellular networks, and need a standardised approach to build privacy and security into IoT devices, including the ability of users to review privacy statements, control access to their data, automatically reconfiguring devices to foil new cyber threats etc. Industry-led organisations are collaborating to address IoT security concerns, adopt best practice and increase user confidence (e.g. IoT Security Foundation)¹⁶⁷.

Enterprise IoT

The use of IoT is assisting enterprises to improve service operations, increase visibility into operations, developing new business models and building new product and service offerings. Positive impacts include reduced operating costs, increased service reliability, increased service uptime. By 2025, 13.7 billion enterprise IoT connections are expected to have deployed¹⁶⁸, including cellular and non-cellular connections. Cellular IoT connections are expected to total 4.1 billion in 2024¹⁶⁹.

Connectivity accounts for the smallest portion of revenue in IoT value chain. It is a commodity. Mobile operators compete with local and global MVNOs to provide cellular connectivity to enterprise IoT applications. The revenue per IoT connection will fall, due to the growing scale of specialist global IoT MVNOs¹⁷⁰. Mobile operators along with mobile operators provide airtime and device management solutions to many other participants in the IoT value chain, including system integrators, original equipment manufacturers and digital service providers. It is also conceivable that the same MVNOs that specialise in IoT connectivity will also offer 5G network slicing (see 5G).

Mobile operators may reach beyond the connectivity portion of the value chain, and provide applications, application management services and professional services¹⁷¹. Most enterprise IoT applications require specialist vertical sector knowledge, which necessitates service providers to adopt a build, buy, acquire or partnership strategy. Some mobile operators may concentrate on providing capabilities across the value chain, but not provide end-to-end solutions for specific verticals (e.g. KPN, The Netherlands), while others provide end-to-end solutions for specific verticals (e.g. Vodafone's fleet management and connected card solutions).

The relatively low cost of rolling out low power wide area networks (LPWANs) has resulted in the emergence of new service providers that support specific enterprise

¹⁶⁵ <https://www.pwc.co.uk/issues/data-protection/insights/the-internet-of-things-is-it-just-about-gdpr.html>

¹⁶⁶ <https://www.gov.uk/government/publications/secure-by-design/code-of-practice-for-consumer-iot-security>

¹⁶⁷ <https://www.iotsecurityfoundation.org/our-members/>

¹⁶⁸ Up from 3.7 billion in 2018; Global Mobile Trends, GSMA Intelligence September 2018

¹⁶⁹ Cellular IoT connections include 2G, 3G, 4G (including NB-IoT and Cat-M1) and 5G. Ericsson Mobility Report, November 2019

¹⁷⁰ <https://www.ericsson.com/en/mobility-report/reports/november-2018/iot-connections-outlook>

¹⁷⁰ MVNOs that provide global or extensive regional coverage include Moganix, Hologram, EMnify and GlobalM2MSIM

¹⁷¹ Including data collection, storage and analysis

IoT applications¹⁷². These include smart city (e.g. lighting), utilities (e.g. smart meters) and industrial applications (e.g. asset tracking).

Some government organisations and NRAs have developed initiatives to promote the development of IoT in their respective countries, examples include:

- the IMDA in Singapore is helping to develop IoT: facilitating partnerships and create enhance the current IoT ecosystem¹⁷³.
- Future Cities Catapult is a government initiative in the UK to help define, develop and test products and services for the cities of ‘tomorrow’¹⁷⁴.

5.17. UCC/enterprise mobility

Unified communications and collaboration (UCC) combine multiple communications services and solutions accessed using a single user interface. Services include voice, click-to-dial, videoconferencing, email, instant messaging, presence, videoconferencing etc. Employees use UCC to collaborate with co-workers from multiple teams, across many different projects, across several time zones and multiple locations. UCC can be used as a stand-alone application and integrated with many business software applications and solutions (e.g. Salesforce, Oracle, SAP, Google Cloud) to improve team collaboration, increase productivity and support flexible working.

Competition in the market is varied. Market participants include pure providers such as Avaya, 8x8, and Unify and software companies, such as Microsoft, Cisco (includes Broadsoft), Slack, Verizon and ALE, as well as a broad range of intermediaries providing UCC services and solutions, including telecoms operators, UCC service providers, value added resellers (VARs) and system integrator. The market is very competitive.

UCC has had to adapt to the increasing shift to web-based services, the prevalence of bring-your-own-device (BYOD), integrate OTT UCC services with hardware and premise-based UCC solutions. APIs and software development kits are commonly used to enable enterprises to integrate a rich set of business applications, web-based services or mobile apps.

Enterprise mobility includes solutions that support remote working and solutions that support ‘mobile’ workforces, which includes on-site (e.g. large factories) and off-site (e.g. field engineers). Solutions enable enterprises and organisations to operate more efficiently, improve productivity and improve workforce flexibility.

Important enterprise mobility trends include supporting BYOD, delivering business specific cross-platform mobile apps, integration with cloud services, managing an increasing array of mobile devices (i.e. IoT) and ensuring multi-layered security¹⁷⁵.

¹⁷² e.g. WND Central America uses Sigfox https://www.theregister.co.uk/2018/08/15/lpwan_runners_and_riders/
<https://partners.sigfox.com/companies/sigfox-operator>. Conceivably an operator could roll out a network using licensed spectrum
<https://www.gsma.com/iot/news/mobile-iot-nbiot-range-telstra/>

¹⁷³ <https://futurecities.catapult.org.uk/about/> <https://futurecities.catapult.org.uk/project/things-connected/>

¹⁷⁵ <https://mobilebusinessinsights.com/2018/03/global-trends-in-enterprise-mobility-whats-next/>
<https://www.businesswire.com/news/home/20180322005958/en/Global-Unified-Endpoint-Management-Market-2018-Type>

Many enterprises do not have the resources and expertise to manage enterprise mobility solutions, which means outsourcing and managed services are increasingly popular¹⁷⁶.

A diverse range of system integrators, professional services companies, software vendors, service providers and mobile operators provide enterprise mobility solutions and services, the market is very competitive. Major market participants include: Cisco, Microsoft, BlackBerry, Infosys, IBM, Tata Consultancy Services Limited, VMware, Citrix, MobileIron, Tech Mahindra, Smartbridge, AltexSoft, AT&T, BT Global Services, Orange Business Services and Telefonica Business Solutions. Many mobile operators partner with companies that provide them a full range of enterprise mobile capabilities (e.g. Orange and MobileIron, Check Point, Pulse secure and others)¹⁷⁷

¹⁷⁶ <https://insights.samsung.com/2018/06/06/the-state-of-enterprise-mobility-in-2018-five-key-trends/>

¹⁷⁷ <https://www.orange-business.com/en/products/device-management-premium>

6. Mobile trends in New Zealand

6.1. Mobile market summary

Our analysis shows that NZ is adapting to global mobile trends to varying degrees. The main driver of industry change seems to be large digital service providers entering the market, offering content streaming, cloud service propositions and IoT solutions, which stimulates domestic players to develop competing offers.

6.2. Demand drivers

New Zealanders have a growing appetite for digital services, both from the consumer and the enterprise segments. For example, Netflix's video streaming service served 40% of the NZ population in mid-2018, a 36% increase from 2017¹⁷⁸. Enterprises are beginning to implement IoT and expected to deliver significant growth and economic benefits¹⁷⁹.

In Section 4, we analysed the global demand side drivers. In Figure 5, we have identified some specific demand considerations relevant to the NZ market over the next 5 years.

Figure 5 NZ mobile market demand drivers¹⁸⁰

Demand considerations	Data point	Mobile trend responses
Low geographic coverage	An estimated 50% of landmass ¹⁸¹ and 1.5% of the population ¹⁸² are yet to be covered by any of the three mobile operators	Infrastructure sharing, 5G, M&A*
Low customer satisfaction	46% of mobile users were unsatisfied with their existing provider in 2018 ¹⁸³	M&A*, convergence, agile service delivery, wholesale, sub-brands
Increasing digital streaming	81% of NZ population aged 14+ has access to pay TV/ VoD services ¹⁸⁴	Content provision
Appetite for smart devices	81% of NZ adults use a smartphone and 11% use a wearable tech device ¹⁸⁵	IoT, 5G, eSIM
Digital transformation in enterprise and government organisations	61% of enterprises in New Zealand anticipate deploying software-defined wide area network (SD-WAN) by 2020 and may be complemented by mobile SD-WAN (including network slicing) ¹⁸⁶	5G, NFV/SDN, convergence, agile service delivery, eSIM

* M&A is helpful if MNOs have different rural footprints, and one MNO has a better customer service than the other.

¹⁷⁸ Roy Morgan data, 2018

¹⁷⁹ Only 14% of businesses in New Zealand had deployed an IoT solution by mid-2017, although 70% of businesses anticipate that IoT will be transformational to their strategic business <https://iotalliance.org.nz/resources/sector-report/>

¹⁸⁰ RDC analysis, 2019

¹⁸¹ NZIER data, commissioned by Spark, 2016

¹⁸² Spark, Vodafone NZ, 2degrees official websites, 2018

¹⁸³ Consumer NZ, 2018

¹⁸⁴ RDC analysis, based on Roy Morgan and Indexmundi data, 2019

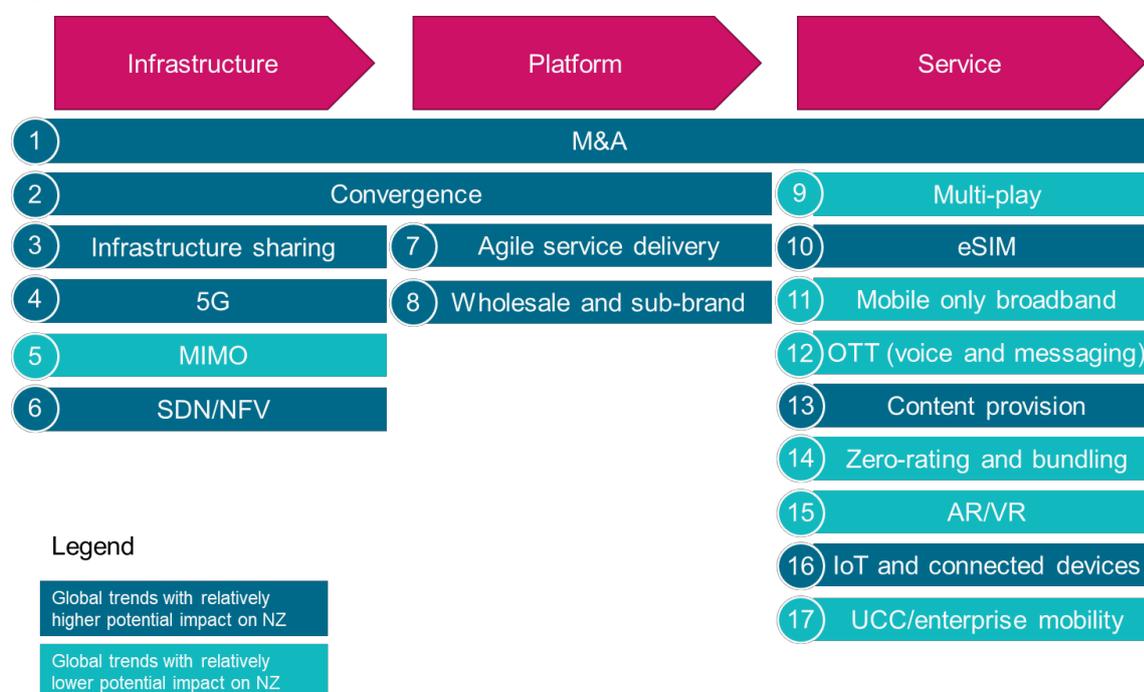
¹⁸⁵ Hootsuite, We Are Social data, 2018

¹⁸⁶ <https://www.computerworld.co.nz/article/648273/sd-wan-deployments-set-surge-nz/> mobile SD-WAN involves bonding together various bearers (mobile, Wi-Fi, satellite), for example Wi-Fi on board passenger trains combines multiple LTE radios and maybe satellite <https://www.telit.com/blog/cellular-in-sd-wan-why-it-matters/> <https://www.sdxcentral.com/5g/definitions/5g-network-slicing/>

6.3. Mobile trends in New Zealand

We have identified 10 main trends that have high potential to influence the NZ mobile market in the next 5 years, as shown in Figure 6. The figure identifies top 10 supply side trends are highlighted in dark blue.

Figure 6 Top 10 NZ mobile market trends: Selection from global trends¹⁸⁷



We take each of these 10 trends in order and explain their potential impact, with examples from the NZ market and best practices from global markets.

M&A (1)

M&As are likely to take place in New Zealand. Mobile operators and service providers are likely to be involved in building economies of scale or adding new capabilities to move along the TMT value chain. Recent notable M&A examples in New Zealand include:

- Fixed, MVNO and energy utility: Vocus and Switch Utilities. The wider Tasman merger between Vocus and M2 led to Vocus adding sub-brands CallPlus, 2talk, Orcon, Slingshot and Flip (fixed + mobile wholesale)
- Fixed and mobile: Spark's acquisition of business telco Digital Island, 2degrees' acquisition of Snap (fixed ISP) and Vodafone Australia's acquisition of TelstraClear
- Mobile (spectrum): Dense Air's acquisition of Blue Reach and Cayman Wireless. Dense Air now owns 70MHz of 2.6GHz spectrum and is expected to roll out an open-access wholesale network to support by small cells
- Mobile, fixed wireless broadband, satellite: Vodafone NZ acquisition of Farmside, rural broadband and satellite provider in 2017

¹⁸⁷ RDC analysis, 2019

- Vodafone NZ and Sky attempted merger between 2016-2017. This was overruled by the NZ Commerce Commission due to competition threats to mobile and broadband markets.

Consolidation may also be influenced by service providers seeking to exit the mobile market.

Convergence/multi-play (2)

Multi-play is a popular strategy in New Zealand's consumer and enterprise segments, including not only telco services but also services such as utilities. We believe this has high growth potential in the future, especially if companies make significant investment in exclusive content and content delivery, e.g. Spark's Lightbox VoD or Sky's Champions League sports rights. While Sky is not a mobile operator, we believe it is relevant to oversee all major opportunities to multi-play in the service provider market – merger attempts like Vodafone and Sky's (2016-2017) are likely to emerge in the near future.

All three New Zealand MNOs have multi-play services (mobile, landline and broadband offerings). Vodafone New Zealand also offers Vodafone TV (via wholesale from Sky) and Spark offers its own VoD, Lightbox. Vodafone and Spark also resell Netflix as an add-on to their services.

In a multi-play scenario, operators are not only competing for users' purchasing power. They are also competing for their time:

- 5h 59m: average daily time spent using the internet, via any device¹⁸⁸
- 1h 53m: average daily time spent using social media, via any device¹⁸⁹
- 2h 48m: average daily TV viewing time (including broadcast, streaming and VoD)¹⁹⁰

That is almost 11h a day that New Zealand multi-play operators have the opportunity to engage with customers. The traditional KPIs, including network speed and reliability, as well as emerging ones, such as quality of 'unlimited data', are valid measures to track customer satisfaction. However, more advanced analytics are necessary to identify points in the customer journey where operators can boost loyalty in existing services or create new ones. For example, a multi-play operator can ensure a seamless transition from mobile to TV services.

We also see potential in operators bundling in non-telco services such as utilities. This can be particularly lucrative for MVNOs, who face significant barriers to entry due to low scale potential (see RDC MVNO landscape paper). Companies like Vocus (which bought Switch Utilities) sell mobile (via MVNO agreement), fixed and energy. This solves a growing customer need for a one-stop-shop and it incrementally raises ARPU for the provider.

In terms of technical integration of fixed and mobile networks, we recommend further analysis to be done with NZ operators to understand the level of convergence and

¹⁸⁸ Hootsuite, We Are Social data, 2018

¹⁸⁹ ibid

¹⁹⁰ ibid

resulting benefits. This will be included in Section 7 Considerations and recommendations.

Infrastructure sharing (3)

Inherent features of the NZ market will drive the need to increase the sharing of mobile infrastructure, including small population size, low population density and high concentration in disparate urban areas.

Figure 7 below shows a high-level view of Spark's coverage in NZ. Vodafone and 2degrees have similar coverage maps in terms of geographical reach.

Figure 7 Spark mobile coverage in New Zealand, 2019¹⁹¹



In addition to mobile operators' network rollout plans, two broad initiatives in New Zealand are being funded to improve coverage:

- Rural Broadband Initiative 2 and the fund includes the sharing of all three mobile network operators, including radio access equipment and antennae built by the Rural Connectivity Group¹⁹²
- Similarly, the Mobile Black Spots Fund aims to improve population coverage from 95 to 98% and geographic mobile coverage from 50 to 70-80%¹⁹³

All mobile operators use co-location on mobile sites, which has helped them expand coverage, and believe they will continue to use infrastructure sharing to support the rollout of 5G¹⁹⁴. The extent to which sharing will be used depends on the technologies they use, the use cases/ business cases and demand for 5G services. There is an appreciation that sharing will be needed for small cells.

¹⁹¹ NPERF, January 2019

¹⁹² <https://www.thercg.co.nz/>

¹⁹³ <https://www.crowninfrastructure.govt.nz/blackspots/what/>

¹⁹⁴ According to Mobile Market Review submissions by each mobile operator to New Zealand's Commerce Commission in October 2018

5G (4)

All New Zealand's operators have plans to deploy 5G networks, although they are not well defined:

- Spark plans to launch 5G services from 2020, having already tested the technology, and is in the process of mapping 5G cell site densities.¹⁹⁵ Data carried across its 4G network is doubling every year. 5G will increase its network capacity¹⁹⁶.
- As of late 2018, Vodafone began preparations for its 5G service launch, commencing a network upgrade with Ciena and is expected to launch 5G services in 2021¹⁹⁷
- The rollout of 5G networks may be affected by the Government Communications Security Bureau's (GCSB) decision on whether or not Huawei can be used as a supplier¹⁹⁸.

SDN/NFV (6)

Spark and Vodafone have begun investing in SDN/NFV:

- Spark: invested in a single platform to collect, analyse and visualise network performance¹⁹⁹
- Vodafone: launched its Ciena SDN network in late 2018²⁰⁰
- 2degrees: no announcements have been made about its investment in SDN/NFV.

Agile service delivery (7)

Spark and Vodafone have also begun to enhance their respective service delivery capabilities:

- Spark: has invested NZ\$1.25 billion in digital platforms since 2014 (in collaboration with Ericsson), initiatives to improve customer experience²⁰¹. It also uses i-New's platform to host its Skinny sub-brand
- Vodafone: has collaborated with Ciena for agile service delivery, IBM to automate customer service delivery²⁰²
- 2degrees: 2degrees has partnered with ASPIDER-NGI (now part of Kore) for its MVNE platform, which can be used to support MVNOs.

¹⁹⁵ <https://www.sparknz.co.nz/news/Spark-outlines-5G-network-intentions/>

¹⁹⁶ <https://www.sparknz.co.nz/content/dam/SparkNZ/pdf-documents/5G%20Briefing%20document.pdf>

¹⁹⁷ <https://www.stuff.co.nz/business/industries/102631234/vodafone-wont-rush-to-beat-competitors-in-5g-roll-out>

<https://www.vodafone.co.nz/5g/> <https://www.zdnet.com/article/vodafone-nz-preps-network-for-5g/>

¹⁹⁸ <https://www.lightreading.com/mobile/5g/new-zealand-blocks-huawei-from-5g-deal-with-spark/d/d-id/747848>

¹⁹⁹ <https://www.sevone.com/customer-story/spark-new-zealand-ignites-growth-and-innovation-network-visibility>

²⁰⁰ <https://www.computerworld.co.nz/article/649327/vodafone-debuts-ciena-based-sdn/>

²⁰¹ <https://www.sparkdigital.co.nz/aboutus/about-us/> <https://www.cio.co.nz/article/634646/how-spark-refused-let-legacy-norms-hold-back-digital-transformation/> <https://www.ericsson.com/en/press-releases/2014/10/ericsson-powers-spark-new-zealands-it-transformation>

²⁰² <https://www.ciena.com/about/newsroom/press-releases/Vodafone-New-Zealand-Creates-Agile-and-Programmable-Network-with-Ciena.html> <https://www.computerworld.co.nz/article/644258/vodafone-taps-ibm-digital-transformation/>

Wholesale and sub-brand (8)

Our analysis in the MVNO Landscape report for the NZ Commerce Commission shows that the NZ MVNO market has some scope for growth, but this scope is limited. This market is unlikely to sustain many MVNOs or a high proportion of MVNO subscribers. A low capacity to scale, combined with MNOs' high bargaining power on wholesale prices, predicts low profitability for any individual MVNO.

However, this inherent disadvantage could be offset by a high degree of service differentiation, with likely success rates in the bundled or retail MVNO segments, as demonstrated by existing players.

NZ has a population of 4.8 million people and about 6 million mobile subscribers²⁰³. From a global perspective, MVNOs are less likely to gather scale in New Zealand due to high start-up costs relative to potential returns. Furthermore, countries like the UK and the Netherlands have shown that when a leading MNO pursues an active wholesale strategy, it sets the tone for a thriving MVNO and sub-brand landscape. To some extent, Spark is settling into that role, selling network capacity on a wholesale basis (hosts Vocus and to host Trustpower in 2019) as well as sub-branding through Skinny, the country's fourth largest mobile service provider, with around 3% market share²⁰⁴. 2degrees hosts New Zealand's largest MVNO Warehouse Mobile and actively pursuing MVNO opportunities. Kogan Mobile will launch on Vodafone's network in 2019.

New Zealand currently hosts 1% of mobile connections through MVNOs, which is 3 percentage points below global average. Based on analysis of similar markets, we believe the MVNO market share can reach up to 10-15% in NZ in the next 5-10 years²⁰⁵, if key conditions are met, including: increased MNO adoption of wholesale customers, more competitive propositions in segments such as bundling, retail and youth, and network slicing of 5G for specialised services.

eSIM (10)

eSIM is not supported by NZ operators at the present time. However, global progress between OEMs, MNOs, SIM vendors and the GSMA will create the standard best practice in the long run. 2degrees, Spark and Vodafone have all indicated that they plan to support eSIMs²⁰⁶.

Content provision (13)

Investment by New Zealand's service providers is not mobile centric, as is commonly found in other country markets. Many on-demand streaming services are available in New Zealand including: Prime Video (Amazon), Netflix, TNZ On Demand and Fan Pass²⁰⁷. A summary of content ownership and provision is as follows:

- Spark: Spark's in-house development of Lightbox VoD service, founded in 2014, includes popular shows such as Suits and Modern Family. Spark also

²⁰³ RDC analysis, based on World Bank and World Trade Organisation data, 2018

²⁰⁴ RDC analysis, based on NZ Commerce Commission data, 2018

²⁰⁵ RDC analysis, 2018

²⁰⁶ https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12130793

²⁰⁷ <https://www.finder.com/nz/internet-tv>

partners with iStreamPlant to deliver streaming live sport and has invested in the rights to show the International Hockey Federation services that includes local games (it will also produce the content together with NEP, a specialist outside broadcaster)²⁰⁸. It also has the rights to show the UK's Premier League (football) and the rights to show the 2019 Rugby World Cup²⁰⁹

- Sky has exclusive access to All Blacks games²¹⁰
- Vodafone and 2Degrees do not own any exclusive content.

Mobile operators bundle content as part of their post-paid and pre-paid tariffs, as shown in Figure 8.

Figure 8 Content add-ons to mobile services, October 2018²¹¹

	Post-paid			Pre-paid		
	Spark	Vodafone	2degrees	Spark	Vodafone	2degrees
Carry over data	✓		✓	✓	✓	✓
Social data		✓ ^a		✓ ^b		
Bonus data	✓ ^c		✓ ^d	✓ ^e		✓ ^f
Wi-Fi	✓			✓		
Data sharing	✓ ^g	✓ ^h	✓ ⁱ			
Spotify	✓			✓ ^j		
Lightbox	✓					
Netflix		✓ ^k				
Handset subsidy	✓ ^l	✓ ^m	✓ ⁿ			
Misc. deals (movie discounts etc.)	✓	✓	✓	✓	✓	✓

Source: Spark, Vodafone and 2degrees websites

Note:

- Plans below \$79 get bonus social data, plans \$79 and over get bonus social, video, music and chat data
- 1 GB bonus socialiser data on \$20 and \$40 data lovers plans
- Bonus data on all plans
- Double data for first 3 months for plans \$40 and over
- Bonus data on \$29 and \$49 plans
- Double data for first 3 months for plans \$29 and over
- Data sharing with other devices is available on a 'share leader' plan of which plans \$59 and over are eligible to be
- Non-unlimited plans \$59 and over can share data
- On all plans users can share data with another user. Plans \$55 and over are able to be purchased as a shared plan between two or more people
- 50% off Spotify premium
- Plans \$79 and over get free Netflix for a year
- For certain phones different discounts on pay monthly plans if paid off over 24 months
- On certain phones, size of discount is linked to plan
- Some discount for some phones (more limited than Spark and Vodafone offers)

IoT and connected devices (16)

All three mobile operators in New Zealand have developed IoT propositions:

- Spark: identifies asset tracking, smart sensing, agriculture, smart cities as some of its IoT specialisms²¹². In addition to 3G/4G, it also operates two LPWANs, one using LoRaWAN technology and the other LTE-M (nationwide rollout underway)²¹³.

²⁰⁸ https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12155764

²⁰⁹ <https://www.sparknz.co.nz/news/Spark-expands-in-sports-media-market/>

²¹⁰ <https://www.radionz.co.nz/national/programmes/mediawatch/audio/201804404/a-sporting-free-for-all-for-viewers>

²¹¹ NERA Competition in the New Zealand Mobile Market, Public Version, Spark New Zealand, 26 October 2018

²¹² <https://www.sparkdigital.co.nz/solutions/iot/solutions/>

²¹³ <https://www.reseller.co.nz/article/635321/spark-launches-new-iot-network-nationally/>

<https://www.sparkdigital.co.nz/solutions/iot/connectediot/>

- Vodafone: it has also rolled out an LTE-M and Narrowband IoT networks (LPWAN) to support low power devices (higher and lower bandwidth) alongside its support for 2G, 3G and 4G IoT devices²¹⁴
- 2degrees: supports 3G and 4G IoT devices, including support BUPA care services (alarm monitoring on wearable pendants) and support smart environmental meters²¹⁵
- Use cases in government and business, including: smart cities (vehicles, rubbish collection, car parks), enterprise (machinery) and agriculture (livestock)

Many other service providers are competing with the mobile operators to support IoT services in New Zealand, including:

- IoT MVNOs: Twilio, Moxanix (part of Tata), Hologram, Emnify, GlobalM2MSIM, m2mone and others
- Network-based providers: KotahiNet (LoRaWAN) and Thinxtra (Sigfox) have rolled out LPWANs. Chorus has tested LPWAN in Auckland, as a proof of concept²¹⁶.

²¹⁴ <https://www.vodafone.co.nz/iot/>

²¹⁵ <https://www.2degreesmobile.co.nz/enterprise/solutions/m2m/>

²¹⁶ <https://www.rakon.com/2012-08-30-23-45-30/mar-iot-2/422-sart-up-thinxtra-is-raising-20m-to-take-on-telstra-with-national-iot-network> <https://kotahi.net/> <https://www.computerworld.co.nz/article/633326/nz-spoilt-choice-lpwan-options-says-idc/>

7. Considerations and recommendations

In this section a set of considerations and recommendations are provided for the Commerce Commission that could be used to stimulate competition (price, service delivery and service innovation) in New Zealand. In this report, competition includes increasing customer choice, competitive pricing, improvements to service delivery and service innovation. Considerations and recommendations are provided for each of the top ten identified supply side trends. Example NRA interventions have been included to illustrate many of these considerations and recommendations. For those considerations and recommendations that lack case examples, a certain amount speculation has been applied and open to further debate.

M&A

Any M&A involving one of New Zealand's principle mobile operators or telecoms service providers would be assessed to understand the impact on competition by the Commerce Commission (a merger clearance regime is under Part 3 of the Commerce Act). It is unlikely that the Commission would need to intervene if a mobile operator or service providers acquire an MVNO²¹⁷, a platform or another type of service provider. The Commission may consider how it could consider stimulating service innovation and delivery by encouraging the mobile operators to develop content partnerships (e.g. with OTTs – Vodafone and Netflix), and perhaps invest in start-ups (e.g. Singtel's innov8 fund) to broaden their range of services and capabilities. Care will need to be taken to avoid a situation where there is onerous significant market power created within an operator from an M&A deal.

Convergence / multi-play

Linked to the M&A considerations, market dominance by large converged players offering multi-play should be avoided as this may have a detrimental effect on pricing and a disincentive for such players to offer high levels of customer care.

The potential of cross-subsidisation should be monitored to avoid putting single-play service providers at a disadvantage. Companies converged at a technical level, for example fixed and mobile infrastructure, will have a greater advantage over companies who are converged at a commercial level only, through service bundling. Advantages include the ability to develop bespoke services, combining fixed and mobile, e.g. single numbering, and the ability to offer more competitive tariffs due to greater efficiencies.

Infrastructure sharing

All three mobile operators already share infrastructure and believe sharing will be used to support their 5G services, which is very likely to support small cell networks. Most

²¹⁷ No MVNO acquisition has resulted in regulatory intervention. MVNOs that have been acquired by MNOs have not given an MNO SMP. Although some acquisitions have been scrutinised e.g. Telenet, a fixed broadband operator and MVNO in Belgium, acquired BASE (third largest mobile operator) in 2016

NRAs in Europe expect 5G sharing to be industry led, but Australia's NRA is opposed to infrastructure sharing. The Commerce Commission may consider:

- Encouraging network sharing for 5G small cell networks. Some NRAs (Germany, Greece, Hungary) express a general need to share small cell infrastructure. Others (France) are concerned that exclusivity agreements among site owners and one mobile operator might impede 5G rollout.
- Identifying best practices for 5G network sharing, by reference to countries where 5G services have already launched or will launch ahead of operators in New Zealand
- Whether lower spectrum bid fees should be offered to mobile operators that agree to build new networks in rural and underserved locations – although these may be adequately covered by the Rural Broadband and the Mobile Black Spots Fund, which incorporate network sharing.

5G

To encourage the rollout and success of 5G services, the Commission may consider:

- How to make more infrastructure available, which will be very important to support small cell networks – e.g. USA's Federal Communications Commission's (FCC) implemented reforms to make pole infrastructure more readily available for 5G deployment, called One-Touch Make-Ready²¹⁸
- Evaluating access to fibre-based backhaul. Mobile operators need fair access to fibre and wireless backhaul services to minimise the cost to support small cell networks. Any outdated pricing rules for high bandwidth services that may inhibit the migration to IP services could also be reviewed – e.g. as per the FCC²¹⁹
- That each operator needs access to between 80-100MHz of contiguous spectrum to support 5G (important spectrum bands include around the 1GHz band, 3.5GHz band and above 24GHz). Access to contiguous amounts of spectrum will also be needed by operators to minimise costs associated with wireless backhaul
- Advising the Radio Spectrum Management (RSM) in New Zealand to set spectrum prices that encourage investment in networks and service development
- Identifying and sharing global best practice 5G use cases with operators and service providers in New Zealand, including network slicing
- How customers using 5G network slices will be able to compare operators' service performance, as well as check that SLAs are achieved
- How neutral-host networks could be used to provide in-building coverage.

SDN/NFV

Identifying global best practices for deploying digital transformation projects, which includes SDN/NFV²²⁰, should be considered operators. These best practices could be useful for adoption by operators in New Zealand. Five 9s network and service uptime

²¹⁸ <https://www.fcc.gov/document/fcc-speeds-access-utility-poles-promote-broadband-5g-deployment-0>

²¹⁹ <https://www.fcc.gov/document/business-data-services-report-and-order>

²²⁰ SDN – software-defined networking, NFV – network functions virtualisation

requires end-to-end network design.²²¹ The use of open APIs to integrate applications with network slices will assist operators to develop new TMT services, but also enable third parties, including digital service providers, to develop new innovative services (many of which are yet to be imagined).

Agile service delivery

Learning best practices from telco service providers in other non-competing markets may help identify new business cases, how to get buy-in from executives and how best to approach and implement digital transformation projects. We recommend understanding the capabilities of technology providers which can serve the NZ market and stimulate awareness and communication between the players. Consideration should be given to ensure there is standardisation around API development to ensure innovation is not hindered.

Wholesale and sub-brand

In order to stimulate MVNO growth in New Zealand, we recommend three sets of actions: further analysis to validate and size the market, develop a set of tools to be used to foster a healthy market and introduce regulatory measures. The first two actions could be implemented prior to introducing regulatory measures.

1. Validate the MVNO Market

In order to understand size of the MVNO market and where specific opportunities lie, we recommend a set of commercial analyses, to determine the level of effort to be undertaken and where this effort should be prioritised:

- Analyse segments: Perform a segmentation analysis of the NZ market to understand which sectors are underserved and which ones are likely to emerge. These segments should be matched to operating model options (i.e. joint venture to light MVNO), depending on scale and functionality requirements
- Calculate the approximate number of subscribers required to breakeven using the business models and segments identified
- Perform a deeper drill on IoT and enterprise segment needs to identify additional requirements which need to be supported by MNOs or MVNOs
- Assess interest: Discuss willingness to offer wholesale services with MNOs and appetite of large potential MVNOs, including companies that:
 - Decided against launching
 - Failed to agree an MVNO contract
 - May not have considered launching, but own a unique asset, brand or capability that would help them succeed as an MVNO.

²²¹ <https://www.gsma.com/futurenetworks/5g/migration-from-physical-to-virtual-network-functions-best-practices-and-lessons-learned/>

2. Develop reference tools

To stimulate MVNO business in NZ, we recommend developing a set of guidelines based on global best practice. These measures will not require significant investment.

- Establish a fair wholesale price: This can be done by understanding the margin requirements under each of the proposed business models, conducting retail benchmarks and considering costs by well understood methods such as LRIC (long run incremental costs). IoT will require a different set of principles based on varying SLAs such as for throttling. Once a model for calculating costs has been established, this can be used as a regulatory tool or as guidance to make it easier for new entrants to come to an agreement with the network host
- Develop a reference contract: Create a framework agreement which acts as a checklist to ensure a healthy relationship is set between an MNO and an MVNO. This will include margin protection provisions, exit conditions, support management, SLAs, competition clauses, exclusivity etc.
- Develop best practice guidelines: Review global successes, and provide a set of recommendations to ensure MVNO success including pricing, on-boarding, platform set up, service roadmap, distribution options, and non-restriction of services offered by the host MNO
- Develop platform recommendations: Analyse MNO platforms to provide guidance on flexibility. Compare this to relevant vendors (MVNEs) which can serve the NZ market. Provide independent guidance on vendor's capabilities to provide services for the segments identified and costs expectations

3. Develop regulatory measures

Whilst we do not propose heavy handed regulation, we recommend some regulatory measures to help drive the MVNO market:

- Analyse MTRs: Develop a cost and price elasticity model to assess whether providing asymmetric MTRs (i.e. higher inbound revenue to smaller new entrants) is a feasible mechanism to assist MVNO growth
- Consider offering spectrum on a local level to support 5G applications e.g. for specialist IoT wholesale service providers. The feasibility of the Airspan Group model as a neutral host network can be assessed
- As mentioned above under reference tools, the Commerce Commission may consider creating a pricing model which can be used to regulate the underlying wholesale airtime network price. From this reference price, the 'mark-up' by the operator will be left to negotiation between the operator and MVNO depending on the business model being adopted
- Consider making supporting MVNOs mandatory for networks when they are allocated 5G spectrum. This option requires ascertaining interest and business cases from prospective MVNOs and IoT players. NZ MNOs will need to be prepared for the potential condition in spectrum allocation and MVNEs can be identified that could support prospective MVNO services.

eSIM

The Commerce Commission should consider encouraging mobile operators and service providers supporting eSIM IoT devices to adopt network switching best practices. Following best practices will be important to prevent consumers' experiencing cumbersome network switching issues. The market should also be monitored to ensure customer choice is not restricted when they choose eSIM devices and tariffs. Technology standardisation will be important to ensure market efficiency.

Content provision

Many subscription video on-demand (SVOD) services are available in New Zealand, but Sky controls much of the exclusive sports content. In markets in which a service provider has significant market power, NRAs have intervened²²². Note that such interventions are not specific to mobile services but pay TV. The Commission may consider mobile service providers to identify and form new partnerships, using one of three options:

- Simple marketing alliance – no commercial relationship, no investment, no billing integration or inclusion in the operator's user interface (e.g. Vodafone UK and Amazon Prime)
- Limited partnership – marketing relationship, limited investment, billing integration, integration in the operator's user interface (Swisscom and Sky, Switzerland)
- Integrated partnership – marketing relationship, limited investment, billing integration, integration into the operator's user interface and revenue share (e.g. Proximus and Alchimie's Watch It, Belgium).

The Commission should also monitor the use of zero-rating by mobile service providers, which could be used to gain and maintain significant market power.

IoT and connected devices

Consideration could be given to encourage a multi-stakeholder approach to inform and protect consumers (including data and privacy), in response to the increasing take-up of IoT devices. The Commission could consider collaborating with the NZ IoT Alliance to provide nudges to the industry and help identify global best practices.

New IoT use cases appropriate for NZ can be considered and the Commerce Commission can collaborate with NZTech and NZ IoT Alliance to encouraging partnerships and development of NZ's IoT ecosystem.

Final thoughts

Whilst these recommendations address competition, we must recognise that there is a risk that as voice and data becomes commoditised, operators become 'dumb pipes', if they are not able to capture the huge opportunity from growing activity and hence spend over mobile. There is also the risk that by focusing on economics and

²²² Ofcom introduced regulation in 2010 to promote choice and innovation by requiring Sky to provide its sports channels to competitors on a wholesale basis <https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2015/wmo-statement>

competition, the industry misses its social responsibility obligations. We recommend that the Commerce Commission seriously considers concerns around customer data security, privacy and safety for the youth.

---- END OF REPORT ---