Study for ComReg

The role of MVNOs in evolving mobile markets

- non-confidential -

Authors:
Ilsa Godlovitch

Julian Knips
Dr Christian Wernick
Dr Christin Gries
Stefano Lucidi
Menessa Ricarda Braun

WIK-Consult GmbH
Rhöndorfer Str. 68
53604 Bad Honnef
Germany

Bad Honnef, September 2021

wik CONSULT

Imprint

WIK-Consult GmbH
Rhöndorfer Str. 68
53604 Bad Honnef
Germany
Phone: +49 2224 9225-0
Fax: +49 2224 9225-63
eMail: info@wik-consult.com
www.wik-consult.com

Person authorised to sign on behalf of the organisation

General Manager	Dr Cara Schwarz-Schilling
Director	Alex Kalevi Dieke
Director Head of Department Networks and Costs	Dr Thomas Plückebaum
Director Head of Department Regulation and Competition	Dr Bernd Sörries
Head of Administration	Karl-Hubert Strüver
Chairperson of the Supervisory Board	Dr Daniela Brönstrup
Registered at	Amtsgericht Siegburg, HRB 7043
Tax No.	222/5751/0926
VAT-ID	DE 123 383 795

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I. Executive summary

In 2014, Three Ireland acquired O2, resulting in the consolidation of the mobile market from 4 to 3 players. Approval of the merger was subject to commitments made by Three to set aside capacity for two MVNOs.[1]

Several years have passed since the merger and there have been a number of developments in mobile markets both in Ireland and beyond. These include the exit of iD-mobile, one of the MVNOs which had benefited from the merger commitments, and the rapid expansion of new mobile applications and services including industrial applications and applications linked to the Internet of Things (IoT). The coming years will see the further expansion of 5G and associated applications, the migration of mobile voice and messaging towards all-IP platforms as well as the introduction of eSIM to the consumer market.

In this report, we reflect on how the Irish mobile market has evolved, with a particular focus on the role that MVNOs have played and are likely to play in the market going forwards, and consider the implications of new technological and commercial developments on market players in Ireland and beyond. The study concludes with recommendations to facilitate the ongoing competitiveness of the mobile retail market in Ireland, as well as recommendations to support competition in the important IoT segment across Europe as a whole. A summary of the key findings follows.

I.I MVNO business models and the conditions for success

A variety of MVNO business models are possible. MVNOs may target different markets with a focus e.g. on expats, cost-conscious customers, IoT or data offers. At the same time, different MVNO deals are characterized by different degrees of technological and operational control (as shown in the following diagram).

1 See https://ec.europa.eu/commission/presscorner/detail/en/IP_14_607.

Figure I-1: The MVNO ladder of investment

Source: WIK based on Red Dawn Consulting (2019), Nereo (2014), Nereo (2010), PWC (2019) (with modifications).

Taking control of more levels of the value chain offers greater prospects for service differentiation, but also comes with greater risks for the MVNO, which must invest in the relevant platforms, operational and business support systems, despite potentially having a relatively small customer base.

Alongside the degree of technological independence, the conditions for wholesale pricing strongly affect the degree to which MVNOs can differentiate their offers from those of their hosts and whether they can viably compete in high volume data offers. Capacity-based offers, involving upfront payments for access to a given capacity provide the greatest potential for differentiation alongside the ability to offer high volume data bundles.[2] Retail minus also provides the potential for MVNOs to match any unlimited volume deals offered by their host, but offers limited scope for competitive differentiation in the mobile service provided. However, most MVNO wholesale tariffs

2 A flat-rate price per customer – independent of volume consumption – would in theory provide the greatest scope for MVNOs to compete in the high volume data segment, but would involve passing all usage-based risk to the host.

are based on usage / volumes, which significantly limits the potential for MVNOs to engage in the provision of high volume / unlimited data packages.

In turn, the depth of access available and wholesale pricing structure influences the degree to which MVNOs can in practice drive customer benefits in retail mobile markets such as innovation in pricing structures, bundles etc.

The scope for innovation from IoT MVNOs is also likely to be greater than that which is possible from retail MVNOs, since in the context of IoT, much of the innovation in terms of hardware, software and platform development come “on top” of the connectivity, and a limitation of access to connectivity could restrict the number and nature of players that have the potential to engage in such innovation.

The terms which are available to MVNOs on a commercial basis are affected by the incentives of MNOs to engage with MVNOs. Incentives to provide access on attractive terms are likely to be limited where (i) the MNO is already in a relatively strong market position, and does not need additional marketing support from MVNOs; and/or (ii) the MVNO is new or has a limited customer-base; and/or (iii) the MVNO might directly compete with the MNO and therefore cannibalise its customer-base. Equally, the reverse is true i.e. it might be possible for MVNOs to negotiate attractive commercial deals where: (i) they are operating in a niche which is not in actual or potential competition with the host; and/or (ii) they have a large customer-base and there is risk that this customer-base could be migrated to a competitor; and/or (iii) the MNO is in a weak retail market position and requires support to strengthen its presence in the market.

The bargaining position of specialist MVNOs such as those operating in the IoT segment may be different from that of retail MVNOs, since at least for some MNOs, IoT traffic may be additive rather than competing.

I.II Technological and commercial developments and the implications for MVNOs and service providers

Technological developments such as IoT, 5G (and network slicing), eSIM and the migration to all-IP solutions for voice and messaging, present both challenges and opportunities for MVNOs, with the opportunities mainly presenting to MVNOs and service providers engaged in the IoT business and the challenges applying more to MVNOs operating in the retail market.

For IoT-focused mobile service providers, technological developments provide an opportunity to enter new market segments including industrial applications, innovate in IoT services and platforms, and benefit from the remote provisioning capabilities offered by eSIM, which enables IoT service providers to deploy services to multiple devices “in the field”. However, these opportunities could be undermined if service providers do not

have timely access to 5G or the capabilities that it offers (such as the potential to tailor the nature of the transmission and associated quality-assurance).

Retail MVNOs may not reap significant benefits from the industrial and IoT use-cases supported by 5G as they are typically focused on the consumer market segment, but at the same time they are likely to need access to 5G to be able to compete on quality with their hosts. Thus 5G, as well as IP-based calls and messaging may present more of a threat to these MVNOs, as they are likely to necessitate investments in new platforms and may require a renegotiation of contract terms with their hosts if existing terms do not cover 5G access or do so on unattractive terms. Expected increases in data usage coupled with the current per unit wholesale pricing practices, and challenges in achieving a premium for 5G data offers, are likely to limit the commercial viability of 5G for many MVNOs.

Consumer applications of eSIM may also present a threat to existing broad-based retail MVNOs if they increase the risk of churn. eSIM may also present a risk for MNOs as well as many MVNOs by virtue of the fact that they give control over this "gateway" to equipment manufacturers, which could in theory play a greater role in steering the process of obtaining and maintaining mobile subscriptions.

I.III The competitive situation, threats and future opportunities for mobile services in Ireland

The Irish mobile market consolidated from 4 to 3 network operators, following the merger between O2 and Three in 2014. Approval of the merger was made subject to commitments that the merged company would conclude capacity-based MVNO agreements with two service providers (Virgin Media and iD Mobile). At the time these commitments were made, ComReg expressed reservations that they would be insufficient to preserve competition in the Irish mobile market.

Concerns over the sufficiency of the MVNO merger commitments as a means of facilitating the entry and expansion of new challengers in the market seem to have been supported by the subsequent exit of iD Mobile and the limited role played in the market by Virgin Mobile today.[3] At the same time, other MVNOs active in the market have not significantly expanded their market shares, or indeed have experienced declining shares. One possible reason may be that the terms (and in particular wholesale pricing conditions) of MVNO agreements which were concluded outside the scope of the Three/O2 merger commitments, may limit MVNOs from competing in the provision of unlimited data packages, which is an important and expanding segment within the Irish market. While the MVNOs now all offer unlimited packages, this appears to be possible only due to fair use clauses and/or at a higher price point than for the MNOs and their

3 See https://www.irishtimes.com/business/technology/mvnos-fail-to-shake-up-mobile-market-1.3142918.

sub-brand offers. In turn, the conditions for commercial MVNO access may have been constrained by the limited degree of competition amongst the three MNOs in the provision of MVNO access, and difficulties for potential entrants or existing players to achieve similar terms as those offered under the merger commitments. As unlimited data offers become increasingly important to the consumer market segment, a trend which is likely to accelerate with the move towards 5G and all-IP, the exit of one or more of the existing MVNOs in Ireland seems possible or even likely, especially if the conditions on the wholesale market are not adapted. The sale of Virgin Media could also lead to the exit of Virgin Mobile as an MVNO, for example if Virgin Media is acquired by another entity which already operates mobile services, although the impact of such an acquisition on competition may be assessed in the context of merger approval proceedings.

However, notwithstanding the limited scope for data competition from MVNOs which do not benefit from the merger commitments, and marginal role played by Virgin Mobile in the mobile consumer market, Ireland's mobile market today is characterized by intense competition, especially in the high end unlimited data segment. The offer from the Eir sub-brand GoMo has played a particularly important role in this regard, and has triggered a response from Three's sub-brand 48 as well as the newly established Vodafone sub-brand Clear Mobile. Thus, as far as retail competition (at least on prices) is concerned, the market appears currently to be serving customer needs, especially in data-oriented offers.[4]

These positive developments may stem from the role that is being played by Eir (and its shareholder Iliad), which may be influenced by the fact that it has a lower market share than its rivals, and therefore may have incentives to "catch up". Research by WIK conducted for the European Commission in 2018 also highlights the role that smaller mobile operators or entrants such as Iliad have played in supporting competition in other mobile markets.[5] However, some research suggests that more concentrated markets may not be achieving optimal outcomes in non-price factors such as investment and download speeds[6], and Ireland is also behind other European countries in support for eSIM[7] and thus consumers and industry may be missing out on innovative services that rely on eSIM support. WIK's research as well as academic studies[8] also note that competition in three player mobile markets has proven to be

4 On the other hand, the Irish market seems less well-served than other European countries when it comes to certain aspects of innovation, such as support for eSIM and associated services.

5 WIK (2018) for the EC "Review of the SMP Guidelines" https://op.europa.eu/en/publication-detail/-/publication/6eebf7b9-4833-11e8-be1d-01aa75ed71a1/language-en.

6 See Ofcom (2020): Market structure, investment and quality in the mobile industry, Economics Discussion Paper Series, Issue Number 1, 22 December 2020, available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0036/209799/market-structure,-investment-and-quality-in-the-mobile-industry-discussion-paper.pdf.

7 According to a May 2021 GSMA presentation, all MNOs support eSIM for smartphones in Germany, Spain, France and the UK, while such support is only provided by Vodafone in Ireland today.

8 See for example Porter & Green Noncooperative Collusion under Imperfect Price Information. https://www.jstor.org/stable/1911462?seq=1.

unstable in general – and that, especially in the absence of disruption from one of the players, such markets can tend towards oligopolistic outcomes which fail to deliver competitive prices and innovation to the detriment of consumers.

Thus, even if the market is delivering positive outcomes for Irish consumers in some respects today, it cannot be guaranteed that the degree of dynamism in the market will be maintained over the medium term. Moreover, if MNOs fail to directly provide such dynamism, there seems to be limited scope for MVNOs to disrupt the high end data segment of the market, due to the underlying conditions of wholesale access. Moreover, while Virgin Media benefits from more attractive wholesale conditions for data provision than other MVNOs, stemming from the merger commitments, it will cease to benefit from these conditions in 2024 and may not be able to secure conditions which are as favourable thereafter.[9] For example, Drillisch in Germany reported challenges in obtaining favourable terms for MVNO access, following the expiry of the merger remedies.[10]

Thus, while there appears to be adequate competition as regards the consumer segment of the Irish mobile market today, there are medium term risks that should be assessed and, if necessary addressed by the regulatory authority.

Concerning the IoT segment, interviews with market participants suggest that there is considerable scope for innovation in this segment, but that due to the multi-national nature of many IoT/M2M services, solutions to any problems should be found at European rather than national level. IoT players generally report fewer challenges in obtaining access to MNO networks than in the retail market (due to the additive rather than competing nature of their service). However, future innovation in the segment will depend on timely access to 5G networks, guaranteed QoS and network slicing capabilities, as well as addressing challenges over the interpretation of M2M (as opposed to personal) communication services, and associated barriers to the use of permanent roaming. Respondents interviewed for this study as well as a previous study on this subject conducted by WIK-Consult for the European Commission[11] did not observe specific problems related to IoT innovation in Ireland, but noted that barriers elsewhere in Europe were impeding the potential for specialist players to develop and implement pan-European IoT offers.

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9 The possible change in ownership structure of Virgin Media Ireland increases the uncertainty over their future mobile offerings, especially after 2024.

10 An unexpected wholesale price increase in July 2020 for the five-year extension of the MVNO contract that was based on merger remedies let 1&1 Drillisch's stock price fall by more than 25%, see https://www.reuters.com/article/us-1-1-drillisch-telefonica-de-idUSKCN26C0NL.

11 WIK (2019) for the EC Technological developments and roaming, https://op.europa.eu/en/publication-detail/-/publication/7c74b70b-b4d8-11e9-9d01-01aa75ed71a1/language-en/format-PDF/source-167728233.

I.IV Available regulatory tools and their effectiveness

In circumstances where there is insufficient competition in retail mobile markets amongst MNOs alone, for example due to the persistence of a tight oligopoly with an absence of disruptive offers, it may be necessary to rely on access obligations to introduce additional sources of competition into the market. Such obligations can be applied through ex ante regulation (via a finding of joint SMP), through obligations attached to spectrum licenses or in the context of merger proceedings. Specific guidelines or legislation requiring MNOs to provide MVNO access on specific terms, have also been used in Japan and are under consideration in Canada,[12] although this type of intervention may be less relevant in an EU context.

International benchmarks and case studies show that under certain circumstances, MVNOs can provide disruptive competition in the mobile data segment. However, the presence of MVNOs as disruptive players tends to depend on the dynamism of the specific companies concerned, and their ability to secure (through regulated or commercial means) wholesale access terms which permit them to compete in the data segment. The small size and geographic challenge associated with some markets may make them less attractive to potential dynamic MVNO entrants. However, there is also evidence that MVNOs can have a positive impact even in relatively small and geographic diverse markets such as Austria.

Experience from international case studies suggests that, in circumstances where MVNO access obligations are needed to support competition in mobile markets, intervention is most effective where:

- Access is available to a wide range of potential service providers and no attempt is made to “pick winners”
- Detailed provisions are made concerning the terms under which wholesale access is provided and the pricing mechanism, taking into account the need for MVNOs to be able to compete in the high volume data segment e.g. through capacity-based deals
- Access is available to the latest available mobile technologies.

As regards support for innovation in IoT, interviews for this study, coupled with 2019 research undertaken by WIK-Consult for the European Commission,[13] suggest that, in view of the typically cross-border nature of these services, action to ensure appropriate wholesale access would best be pursued through amendments to EU-wide international roaming regulations. While the market is relatively dynamic today, IoT specialists cite

12 See https://www.cbc.ca/news/politics/wireless-cellphone-fees-1.5484080.
13 WIK (2019) for the EC Technological developments and roaming, https://op.europa.eu/en/publication-detail/-/publication/7c74b70b-b4d8-11e9-9d01-01aa75ed71a1/language-en/format-PDF/source-167728233.

challenges with the use of permanent roaming in certain countries (although not Ireland), while specific issues for the future include ensuring that:

- roaming is made available to 5G and subsequent upgrades of the network; and
- access is made available on a QoS guaranteed basis, which may vary according to different service requirements.

There are also questions around whether, if a negotiated settlement cannot be reached, access may be needed to specific functionalities associated with mobile roaming (such as location data), which could support innovation in service provision e.g. in the context of fraud detection.

I.V Recommendations for action in the Irish market

As Irish consumers currently benefit from relatively attractive retail offers, especially in high value data intensive services, there does not seem to be an immediate need for intervention by ComReg in the mobile market.

However, in view of the unstable nature of competition in 3 player markets as well as the impending expiry of MVNO access associated with the merger commitments and emergence of 5G-based services, it may be advisable for ComReg to monitor the market closely. Concerns may in particular arise if:

- Choice and value in high volume data offers declines relative to other markets and/or in relation to the potential performance and capacity of the underlying networks; and if
- There is evidence that MNOs collectively will not agree to terms and conditions for MVNO access that permit MVNOs to offer and effectively compete in the provision of high volume data bundles, including in a 5G context; and/or if MNOs fail to engage with MVNO to enable them to support eSIM-based services.

If there are sufficient concerns in the above areas to warrant a review of the market, the review should be concluded prior to the expiry of the O2/3 merger commitments, so that any potential resulting regulatory obligations could be imposed in a manner that provides continuity and certainty to the MVNO benefiting from those commitments as well as other current or potential MVNO players in the Irish market.[14]

14 An exit of the MVNO benefiting from those commitments (Virgin Media) from the mobile market or the acquisition of this business by an existing MVNO or MNO, would also warrant a review.

I.VI Recommendations at EU level

While maintaining competition in retail mobile markets is largely a matter for ComReg, support innovation and competition in the IoT segment is likely to require intervention on at least a pan-European level.

Some steps have already been taken to address issues identified by IoT specialists such as access to numbers specific to IoT/M2M, which could be used in principle for permanent roaming.

For example article 93(4) of the EU Electronic Communications Code provides that: "Each Member State shall ensure that national regulatory or other competent authorities make available a range of non-geographic numbers which may be used for the provision of electronic communications services other than interpersonal communications services, throughout the territory of the Union."

However, interviews for this study, as well as the study conducted by WIK-Consult for the EC on "Technological developments and roaming" suggest that the issue covers not just the availability and acceptance of specific number ranges for IoT, but also the definition of what is meant by interpersonal vs IoT/M2M, as it is possible for MNOs to reject a request for permanent roaming if IoT/M2M is defined narrowly and there are elements of the service that might involve human interaction e.g. in relation to automotive applications such as a mapping system on the dashboard.

Meanwhile, restrictions on the sale of retail services based on non-national numbers as has been reported in certain countries, could prevent an IoT provider based outside that country from selling a data bundle for IoT/M2M services such as automotive connectivity, directly to end-users.

There may be scope in the review of the Roaming Regulation to address issues such as these by establishing a definition for services which can make use of IoT/M2M numbering ranges (and benefit from permanent roaming), which takes into account ancillary services or customer interaction which is associated with the operation of the IoT/M2M service and does not involve communication between individuals. Permanent roaming, on the basis of access rights established under the Roaming Regulation could be expressly allowed for services fulfilling that definition.

In addition, potentially in the context of future reviews of the Roaming Regulation, concerns over access to upcoming technologies and QoS guaranteed services or other inputs required to support innovation could be addressed through:

- Requiring access to 5G and IP-based voice in the context of the Roaming Regulation;

- The recognition of a standardised set of QoS-guaranteed services for which access based on international roaming should be provided.

- Enabling the Commission supported by a specialist body to propose adaptations to or adding to the list of services which should be standardised for roaming purposes and supplied on request, based on comitology procedures. This list could include not only QoS-guaranteed services, but potentially specific functionalities typically provided in the context of roaming such as location data.

As regards wholesale roaming pricing for the purposes of IoT, care may be needed to avoid a one size fits all solution that may not be viable for specific types of IoT provision. While some very “light” IoT applications involve limited data and thus incur very low connectivity costs, others such as Connected Automotive Mobility could potentially involve very high data volumes and be highly sensitive to any volume-based charges.

Finally, although there are no records of problems in this area thus far, it is important for European authorities to monitor how equipment manufacturers and providers of Operating Systems make use of their capability – via eSIM - to steer or promote the use of specific mobile connectivity offers. If problems arise in this area, there may be scope to ensure that they are addressed through the Digital Markets Act, which is currently under consideration by the European Council and Parliament.

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1 Background and introduction

In 2014, Three Ireland acquired O2, resulting in the consolidation of the mobile market from 4 to 3 players. Approval of the merger was subject to commitments made by Three to set aside capacity for two MVNOs. Several years have passed since the merger and there have been a number of developments in mobile markets both in Ireland and beyond. These include the exit of iD-mobile, one of the MVNOs which had benefited from the merger commitments, and the rapid expansion of new mobile applications and services including industrial applications and applications linked to the Internet of Things (IoT). The coming years will see the further expansion of 5G and associated applications, the migration of mobile voice and messaging towards all-IP platforms as well as the introduction of eSIM to the consumer market.

In the context of the Multi-Band Spectrum Award, ComReg[15] noted that there would be benefit in conducting a study that considers the current and future role of MVNOs in the Irish mobile market. This study fulfils that objective. In particular, we reflect on how the Irish mobile market has evolved, with a particular focus on the role that MVNOs have played and are likely to play in the market going forwards, and consider the implications of new technological developments on market players in Ireland and beyond.

- In Chapter 2, we describe different MVNO business models, and consider the factors influencing the success of these business models as well as analysing the drivers behind and potential barriers to commercial MVNO agreements. The chapter concludes with a discussion of the impact that MVNOs may have on consumer welfare from a theoretical perspective.

- Chapter 3 discusses technological developments impacting mobile markets and the likely effects on MVNOs in the IoT and retail segments. The chapter includes consideration of developments in IoT, 5G and network slicing, eSIM, OTT and the development of IP-based managed voice and messaging communications on mobile networks.

- In Chapter 4, we consider the evolution of mobile market structures and changes in commercial strategies, and analyse the impact of these developments on competition and consumer outcomes. In this context, we explore the role of tower companies and network sharing strategies in unlocking capital and reducing cost, as well as looking at how digital sales channels are replacing physical stores in the wake of COVID-19 and eSIM deployment.

- In Chapter 5, we discuss developments in the Irish mobile market from the early 2000s to the present day, and examine the impact of the 2014 consolidation of the market to 3 players on competition and consumer outcomes including prices

15 Document 19/124, Section 7.7 and Document 20/122, Section 8.7.

and quality. The perspectives of mobile operators, current and prospective MVNOs and service providers in the Irish market are also discussed.

- In Chapter 6, we present the results of a benchmark of approaches to MVNO access and market outcomes in 5 countries – namely Austria, Germany, Japan, New Zealand, and Spain, and discuss potential lessons for the Irish market.
- Conclusions and recommendations are provided in chapter 7.

2 MVNO business models

Mobile Virtual Network Operators (MVNOs) have been defined in many ways, but for the purpose of this study we define an MVNO as:

> *A mobile operator, which does not have its own spectrum and radio access network (RAN), but uses the spectrum, RAN, and - depending on its business model - other facilities and/or services of one or more host MNOs to offer mobile services to end customers.*

In this chapter, we present the four most common MVNO business models. Our starting point is how MVNO business models differ from a technical perspective – see section 2.1, based on the functions and services the MVNO provides and controls compared with those for which it relies on its host MNO.

Differences in the business models are associated with specific economic effects and risks, based on the investments and operational expenditure associated with those business models. These are discussed in section 2.2.

Wholesale access pricing is a crucial factor which influences the degree to which efficient competition is possible between vertically integrated MNOs and competing MVNOs. Thus, we explore different wholesale pricing models in section 2.3.

MVNOs that enter the market and are successful in maintaining their position usually focus on specific niche or target markets. These are described in section 2.4 while the broader conditions which tend to support the market entry and expansion of MVNOs are discussed in section 2.5.

The chapter concludes with a discussion of the welfare effects associated with the presence of MVNOs based on a literature review (see section 4.5.3).

Key findings are highlighted below.

KEY FINDINGS

- We define an MVNO as a mobile operator which does not have its own spectrum and radio access network, and uses the spectrum, RAN, as well as potentially other facilities – from a host MNO.
- A range of different business models for MVNO access are possible. In this study, we identify 4 distinct types; namely (i) branded resellers; (ii) service providers; (iii) light MVNOs and (iv) full MVNOs. In addition, some MNOs operate sub-brands with offerings that may be similar to MVNO offers, but as they are not independent from the MNO, these do not constitute MVNOs. Mobile Virtual Network Enablers (MVNEs) offer services such as operational support which facilitate the entry of MVNOs. Mobile Virtual Network Aggregator (MVNAs) may aggregate the demand from smaller service providers to negotiate better terms with a host MNO.
- From a technical perspective the different models vary in terms of the degree of operational independence from the host MNO. Full MVNOs build their own core network elements, and have their own number ranges (enabling independent interconnection and roaming agreements) and SIM cards. This provides significant scope for service differentiation, but also entails significant capital expenses as well as operational costs.
- Wholesale pricing models play an important role in providing commercial flexibility for MVNOs to compete at the retail level. Retail minus limits the degree of divergence from the hosts' pricing, but limits risks associated with changing usage patterns. Price per unit offers more flexibility, but may not enable MVNOs to compete in high volume or unlimited offers. Capacity-based pricing should in principle provide the greatest scope to support differentiation.
- MVNOs can target specific customer groups that may be underserved by MNOs (such as immigrants, cross-border workers, low cost), provide synergies with other services (such as broadband, retail), or seek to support technological innovations e.g.in relation to IoT. The discount business model is currently the largest segment, but is in decline. Specialist data players are expected to play a greater role as MVNOs in the coming years. Technological and service innovation are likely to be important in supporting the expansion of the sector.
- MNOs may have incentives to reach MVNO agreements in cases where the MVNO customers do not compete with their core business, where they are small in scale and need such agreements to expand network utilitisation, or where an MVNO has a significant customer base and failing to reach agreement would result in the loss of these customers to another MNO. Conversely, MVNOs which are small in scale and seeking to compete in core mobile markets e.g. for high volume data, may struggle to secure attractive commercial MVNO offers.

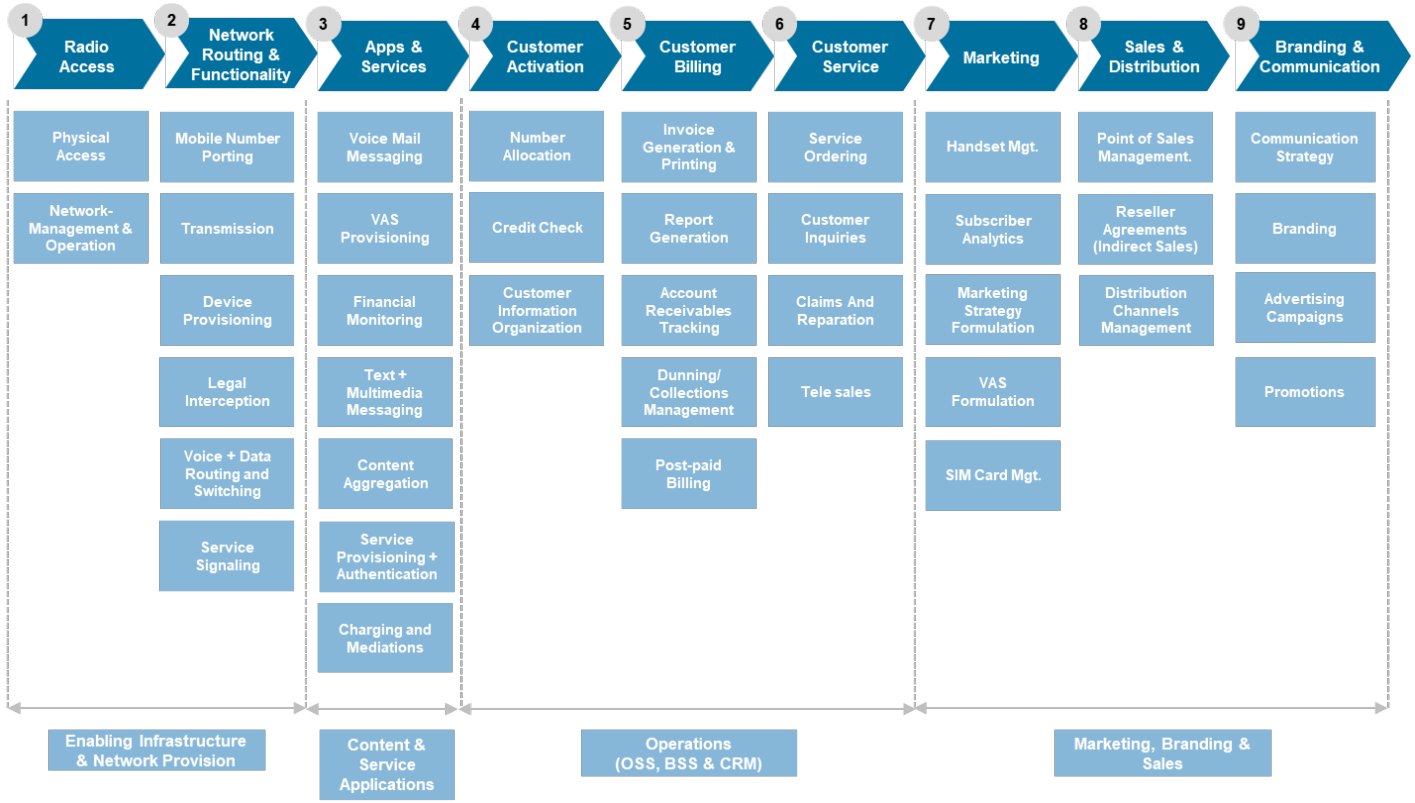
2.1 The basic MVNO business models from a technical perspective

As shown in the following diagram, the mobile service value chain encompasses (i) enabling infrastructure; (ii) content and applications; (iii) operational aspects including billing; and (iv) marketing, branding and sales.

These elements can be further broken down into the following activities:

1. Radio Access
2. Network Routing & Functionality
3. Apps & Services
4. Customer Activation
5. Customer Billing
6. Customer Service
7. Marketing
8. Sales & Distribution
9. Branding and Communication.

Figure 2-1: Mobile Service Delivery Model



Source: WIK based on Booz & Company (2009) in PWC (2019) (with modifications).16MVNOs only manage certain parts of the value chain. Different MVNO business models can be distinguished depending on how many functions the MVNO controls..

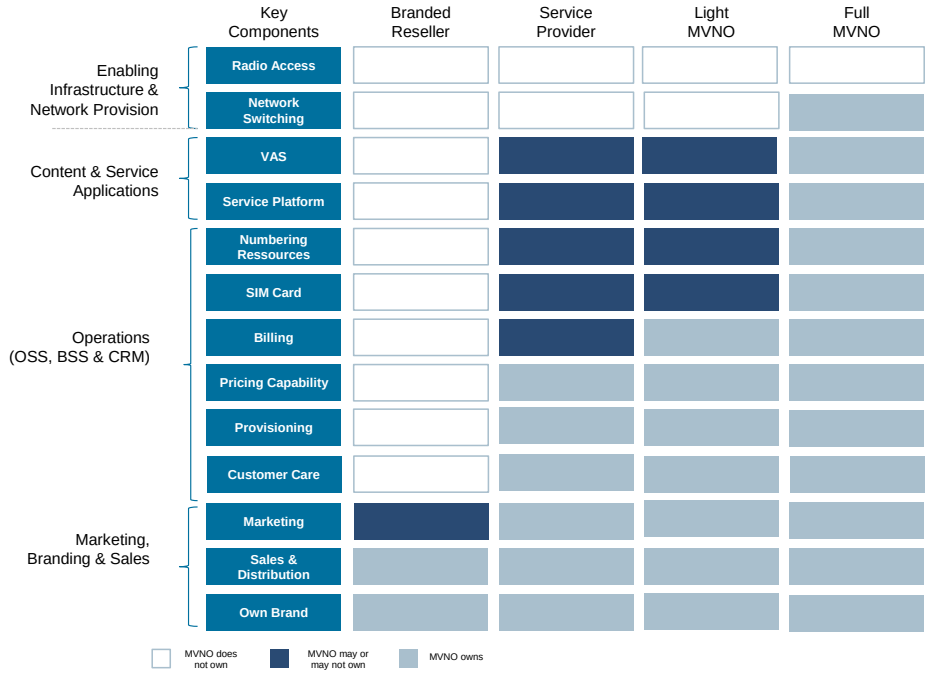
16 See: Booz & Company (2009): MVNE Business Model Analysis in: PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 16, http://gncc.ge/uploads/other/4/4485.pdf.

For this study, we have identified four common categories of MVNO, namely:

1. Branded reseller
2. Service provider
3. Light MVNO
4. Full MVNO.

The following figure gives an overview of how these four MVNO business models are situated in the value chain.

Figure 2-2: MVNO business models: key components



Source: WIK based on Red Dawn Consulting (2019), Nereo (2014), Nereo (2010), PWC (2019) (with modifications).[17]

17 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 11, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF; PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 16, http://gncc.ge/uploads/other/4/4485.pdf; Nereo (2014): MVNO Business Essentials, p. 11, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf, Nereo (2010): MVNO Business Essentials, p. 12.

We describe each of these categories[18] in the following sections. It should be noted however that not every host MNO offers the complete range of possible business models and that the offers made by MNOs and those preferred by MVNOs may differ.

2.1.1 Branded Reseller[19]

Branded resellers are usually companies with a strong brand and well-established distribution channels. A branded reseller does not offer its own mobile services, but distributes the services of the host MNO under its own brand or co-branded with the brand of the host MNO.[20] Branded resellers often offer mobile services in bundles with their own core services, which may belong to another sector such as retail.

The branded reseller is the lightest and most basic MVNO business model from a technical perspective, as its responsibility is limited to branding, sales, distribution and marketing (see Figure 2-2).[21] In some cases, aspects of marketing are also provided by the host MNO. SIM cards, infrastructure and end customer belong to the host MNO.[22][23]

Typically, under this business model wholesale pricing is implemented on a retail-minus basis (see chapter 2.3).[24] Branded resellers therefore have only very limited design options and control over the tariff structure and pricing.[25]

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18 Discussion of different types of MVNO elsewhere in the report refer to the business models described here.

19 It should be noted that the definition for MVNO definition used in this study is very wide and includes all companies that provide mobile communications services to end customers but are not MNOs and are therefore potential competitors on the mobile communications market. Using a narrower definition would not classify branded resellers as MVNOs.

20 See European Commission (2014): COMMISSION DECISION of 2.7.2014 addressed to: Telefónica Deutschland Holding AG declaring a concentration to be compatible with the internal market and the EEA agreement (Case M.7018 - TEF DEUTSCHLAND/ E-PLUS), p. 42, para. 189 ff., http://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf.

21 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/reseller-mvno-branded-reseller, European Commission (2014): COMMISSION DECISION of 2.7.2014 addressed to: Telefónica Deutschland Holding AG declaring a concentration to be compatible with the internal market and the EEA agreement (Case M.7018 - TEF DEUTSCHLAND/ E-PLUS), p. 42, para. 189 ff., http://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf.

22 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/reseller-mvno-branded-reseller; Nereo (2014): MVNO Business Essentials, p. 11, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf.

23 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

24 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 11, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

25 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/reseller-mvno-branded-reseller.

2.1.2 Service Provider

Like resellers, service providers (SP) operate under their own brand or co-branded with the brand of the host operator.[26] However, in this case, the SP may provide customer care and own the billing relationship with the customer. The SPs can also own SIM cards, but the numbering range belongs to the host MNO.[27] Service providers thus cannot enter into their own roaming agreements.

SPs do not own any core network infrastructure, but usually operate their own business support services (BSS), including customer care processes, customer relationship management (CRM), customer support, billing processes and billing platform.[28] Furthermore, SPs can operate their own service platforms (see Figure 2-2).

SPs can design tariff bundles and packages independently from the end-customer tariffs of the host MNO.[29] However, pricing flexibility may in practice be limited by the wholesale pricing arrangement the SP has with its host. A price per unit pricing is often used as the wholesale pricing model for service providers (see section 2.3).

Although this business model provides limited technical and operational independence, it can provide opportunities for later expansion, as, once a critical mass of customers has been reached, SPs can take over further elements from the host MNO and gradually integrate more elements into their proposition.[30] The involvement of SPs with customer relationship management including billing and customer care, may support their ability to "climb up" to a higher level of operational engagement.

2.1.3 Light MVNO

The Light MVNO[31] is the most common MVNO business model.[32] In comparison to SPs, light MVNOs control more of the operational elements in the value chain, which

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26 See PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 17, http://gncc.ge/uploads/other/4/4485.pdf.

27 See Nereo (2014): MVNO Business Essentials, p. 12, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf.

28 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/service-provider-mvno.

29 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/service-provider-mvno, See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

30 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

31 Also referred to as Enhanced Service Provider in some publications.

32 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

enable them to develop their own value-added services (such as apps, data, content and payment services) and thus differentiate themselves from competitors.

In theory, light MVNOs have a high degree of control and independence from their host MNO in terms of tariff structure, price setting and services offered. However, the degree to which this can be exercised in practice, may depend on the structure of wholesale services and tariffs.

2.1.4 Full MVNO

A full MVNO is the most deeply integrated form of MVNO access. However, it is also the least common MVNO business model. According to a report published by the OECD, as of 2014, there was no full MVNO in the market in around half of the OECD countries. The report notes that in some countries, this may be due to the fact that local regulations do not allow full independence.[33][34]

With the exception of radio spectrum, that the full MVNOs leases from the host MNO, full MVNOs are responsible for the whole infrastructure and value chain. They control all the technical and sales operations of the business and have full control over the technical infrastructure.[35]

Full MVNOs build their own core network elements (e.g. Gateway Mobile Switching Centre (GMSC) or Home Location Register (HLR)) and have full control over all services offered and the flexibility to develop and enable new services.[36]

Full MVNOs have their own number ranges and SIM cards.[37] Due to ownership of the Mobile Network Code (MNC), they are able to conclude interconnection and roaming agreements with other national and international network operators.[38] Maintaining their own network-switching infrastructure enables full MVNOs to collect the revenues from inbound traffic (interconnection revenues). Full MVNOs have full control over all

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33 See OECD (2014): Wireless Market Structures and Network Sharing, OECD Digital Economy Papers, No. 243, OECD Publishing. DOI: 10.1787/5jxt46dzl9r2-en, p. 8.

34 According to the definition used in this study however, as of 2020, there were a number of full MVNOs operating in Ireland.

35 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S. ; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 54, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html; http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/full-mvno.

36 See Computaris (2016): How MVNOs can take the path towards business success, Whitepaper, p. 6, http://www.computaris.com/wp-content/uploads/2016/04/WP-How-MVNOs-can-take-the-path-towards-business-success.pdf.

37 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/full-mvno.

38 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S.; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 55, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html.

services offered, including the design and deployment of new services.[39] Therefore they can react to changing user requirements and add their own applications without waiting for the host MNO to upgrade to provide these services themselves. Full MVNOs can also route information through their own monitoring gateways and record information about user behavior that can be used for targeted offers[40].

The technical capabilities of established full MVNOs also influence their negotiating power with potential hosts. Because they operate their own SIM cards and HLR, full MVNOs can change their host MNO without their customers having to change SIM cards.[41] This reduces their dependence on the host MVNO compared to other business models and increases their negotiating power vis-à-vis the host MNO to secure attractive prices. However, the strength of their negotiating power also depends to a large extent on how high the threatened loss of revenue for the host MNO is if it loses the MVNO as a customer to another MNO,[42] and thus applies to established MVNOs with a large customer base, rather than those which are at an earlier phase of market development.

2.1.5 MVNE/A

In addition to the MVNOs described above, which are active in the B2C sector, so-called Mobile Virtual Network Enablers (MVNEs) have emerged, which have specialized in the B2B sector and act as an intermediary between the MVNOs and the MNOs. MVNEs manage business processes for MVNOs, which MVNOs do not want to or cannot handle themselves.

MVNEs offer various operational support system (OSS) and business support system (BSS) services, such as billing, provisioning and CRM. This enables MVNOs to launch their business quickly, even in the absence of technical know-how.[43]

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39 See Computaris (2016): How MVNOs can take the path towards business success, Whitepaper, p. 6, http://www.computaris.com/wp-content/uploads/2016/04/WP-How-MVNOs-can-take-the-path-towards-business-success.pdf, http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/full-mvno.

40 See Copeland, Rebecca; Crespi, Noël (2012): Modelling Multi-MNO Business for MVNOs in their Evolution to LTE, VoLTE & Advanced Policy, p. 3, https://servicearchitecture.wp.imtbs-tsp.eu/files/2012/04/1569439581.pdf.

41 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S. ; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 54, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html.

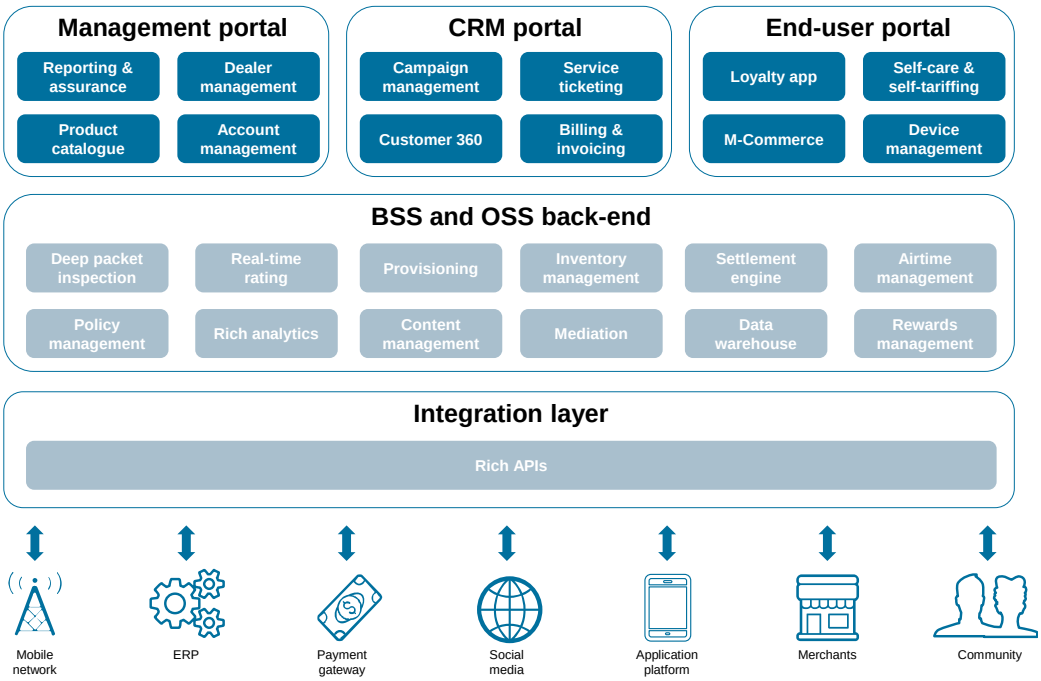
42 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S. ; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 132; https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html, RTR (2018), ANHANG 2 zur Konsultation zum Vergabeverfahren 700/1500/2100 MHz, Wettbewerbssichernde Maßnahmen, Wien, am 20. Dezember 2018, p. 28 f., https://www.rtr.at/de/inf/konsult700-1500-2100-mhz/Konsultation_Vergabe_700_1500_2100_MHz_20122018_Anhang_Wettbewerb.pdf, OECD S. 71 f.

43 See https://telecoms.adaptit.tech/blog/mvne/; See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019,

MVNEs can also provide value-added service platforms such as app stores and mobile applications for end-users e.g. related to billing or content.[44] Due to declining voice and data prices, value-added services are becoming increasingly relevant to protect against revenue declines and distinguish service offerings. MVNEs can also enable integration with systems and third party services such as social media, payment gateways, ERP systems, etc.[45]

An example of an MVNE service portfolio is shown in the diagram below.

Figure 2-3: A typical MVNE service portfolio



Source: WIK based on RDC (2019).[46]

MVNEs usually offer their services on a variable cost basis and charge a set-up fee for entering the system and a monthly fee per subscriber. This reduces the initial costs required to enter the market as an MVNO.[47]

Authors: Arun Dehiri; Gareth Williams, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

44 See https://telecoms.adaptit.tech/blog/mvne/.

45 Rdc p. 14 f.

46 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 15.

MVNEs that also provide airtime from the host MNO are called Mobile Virtual Network Aggregators (MVNAs).[48] The MVNA aggregates many small MVNOs into a single MVNO, which enters into wholesale agreements with the host MNO. This is more cost-effective for the host MNO than a partnership with many different smaller MVNOs.[49] By bundling the demand of smaller MVNOs, better conditions can usually be negotiated with the host MNO, which also reduces the entry barriers of MVNOs.[50]

MVNE/As can seek to develop MVNO relationships with host MNOs across multiple countries in order to offer cross-border wireless connectivity for connected devices such as laptops and tablets, sensors or connected cars.

2.1.6 Sub-brands

A sub-brand may represent a commercial strategy pursued by MNOs to address and serve segments that cannot be reached with the MNO´s main brand, and may be used by MNOs to segment their customer-base e.g. in relation to price-sensitivity and quality. Sub-brands can be, but are not necessarily operated via a legally distinct subsidiary. The emergence of sub-brands, has led to the need to distinguish between independent MVNOs and operator owned MVNOs.[51] In practice, in order to capture the true competitive conditions in a market, it may be more accurate not to classify sub-brands as MVNOs, but rather as extensions of their hosts. Sub-brands are sometimes distinguished from branded resellers with reference to their "independence" or otherwise from the MNO.

2.2 Financial implications of different MVNO business models

Different business models confer different degrees of technical independence and product design freedom (see chapter 2.1), but these degrees of freedom also have impacts on the financial requirements to establish and operate an MNO including:

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47 See https://telecoms.adaptit.tech/blog/mvne/; See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 13, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

48 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 15, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

49 See https://www.onlinechargingsystem.com/blog/mno-mvno-mvna-mvne/; https://blog.3g4g.co.uk/2014/04/mno-mvno-mvna-mvne-different-types-of.html.

50 See Valoris (2008): Viewpoint Telecom Practice, October 2008, p. 3 f., http://www.valoris.com/docs/MVNO_basics.pdf.

51 See e.g. Nera Economic Consulting (2019): An Examination of the Regulatory Framework for Mobile Virtual Network Operators and Other Wholesle Mobile Services, Expert Report of Christian M. Dippon, Ph.D. On behalf of Telus Communications Inc., May 15, 2019; NERA Economic Consulting (2019): Review of Red Dawn Consulting report – "MVNO landscape: Global perspectives and New Zealand Applications", Spark New Zealand, 28 June 2019, https://comcom.govt.nz/__data/assets/pdf_file/0021/158412/NERA-report-for-Spark-Submission-on-mobile-market-study-preliminary-findings-28-June-2019.PDF.

- **CAPEX** (Capital expenditures, in particular set-up cost)
- **OPEX** (Operational expenditures)
- **Revenues** (Revenues can be generated for outgoing traffic and are collected at retail level from the subscribers (end customers). They can also be collected for incoming traffic (interconnection revenues) on wholesale level (see Figure 2-7 - Figure 2-8).
- **Gross Margin**.

In general, it can be said that the entry costs and other investments for an MVNO increase the deeper it is integrated in the value chain, i.e. the more stages of the value chain it serves. Since each stage is associated with specific operating costs, operating costs also increase with each additional stage in the value chain. The higher the MVNO's contribution to value creation, the lower the share of wholesale costs as a proportion of the retail revenues generated. Accordingly, the gross margin should also increase with increasing integration.

Against this background, we discuss the financial implications of different MVNO types in the following sections.

2.2.1 Branded Reseller

Branded resellers' start-up costs are very low, as they do not invest in their own infrastructure. The OPEX are limited to the costs of marketing, sales and distribution[52] and are therefore comparatively low.

Only the host MNO receives revenues from incoming traffic (interconnection revenues). The MVNO receives a fixed share of the retail revenues as well as a commission per customer acquired/sold tariff[53] (see Figure 2-7).

This is accompanied by typically low gross margins of around 10-20%.[54]

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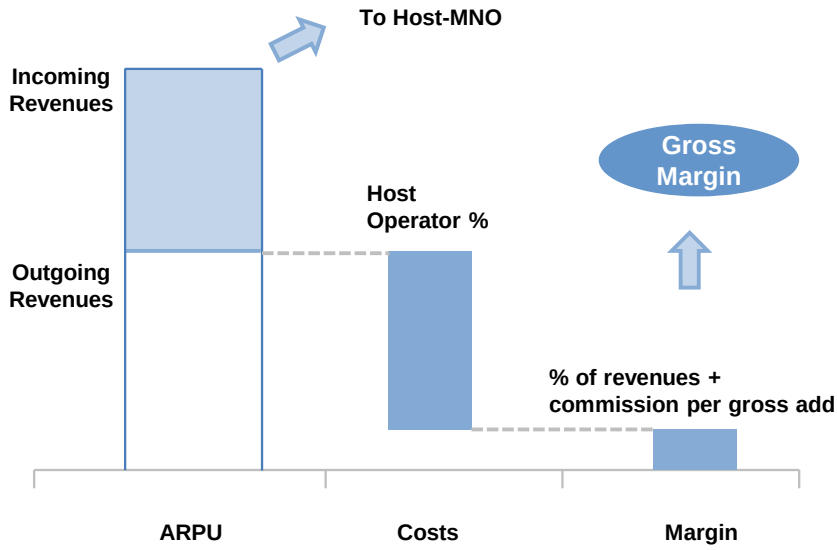
52 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/reseller-mvno-branded-reseller.

53 Nereo (2014): MVNO Business Essentials, p. 14, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf; http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/reseller-mvno-branded-reseller.

54 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

Figure 2-4: Economics associated with a Branded Reseller´s business model



Source: WIK based on Nereo (2010).[55]

2.2.2 Service Provider

In addition to the costs in the reseller model (branding, sales, distribution), service providers (SP) must cover the costs of wholesale charges and the OPEX and CAPEX of the IT platforms.[56]

SPs only collect revenues from outbound traffic. The revenues from inbound traffic (interconnection) belong to the host MNO.[57] The margin is calculated on the basis of retail revenues minus the wholesale charge (Leg A) billed by the MNO. The typical gross margin in this model ranges between 20%-35%.[58]

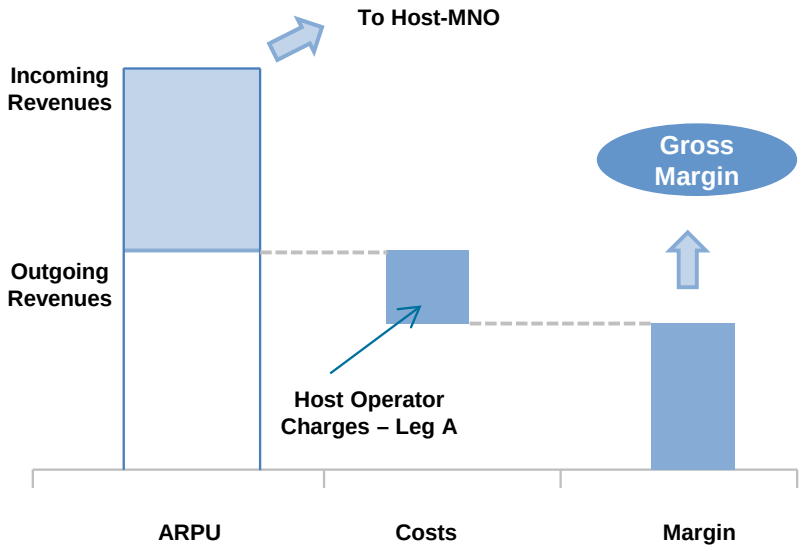
55 Nereo (2010): MVNO Business Essentials, p. 12.

56 See McKinsey&Company: Virtually mobile: What drives MVNO success, By: Jukka Lehikoinen, Pierre Pont, Yannick SentMcK, p. 5, https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Telecoms/PDFs/February%202015%20-%20Recall%20papers/Virtually_Mobile_2014-06.ashx, http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/service-provider-mvno.

57 See McKinsey&Company: Virtually mobile: What drives MVNO success, By: Jukka Lehikoinen, Pierre Pont, Yannick SentMcK, p. 5, https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Telecoms/PDFs/February%202015%20-%20Recall%20papers/Virtually_Mobile_2014-06.ashx and http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/service-provider-mvno.

58 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

Figure 2-5: Economics associated with a Branded Reseller´s and Light MVNO´s business model



Source: WIK based on Nereo (2010).[59]

2.2.3 Light MVNO

The setup costs are correspondingly higher than those of a SP and can be high.[60] The OPEX are also higher, as the light MVNO makes a greater contribution to value creation.

As with the SP business model, the revenues for light MVNOs come only from outbound traffic. The revenues from inbound traffic (interconnection) belong to the host MNO (see).[61]

However, the typical gross margin is higher than the gross margin of an SP and may lie between 35%-55%.[62]

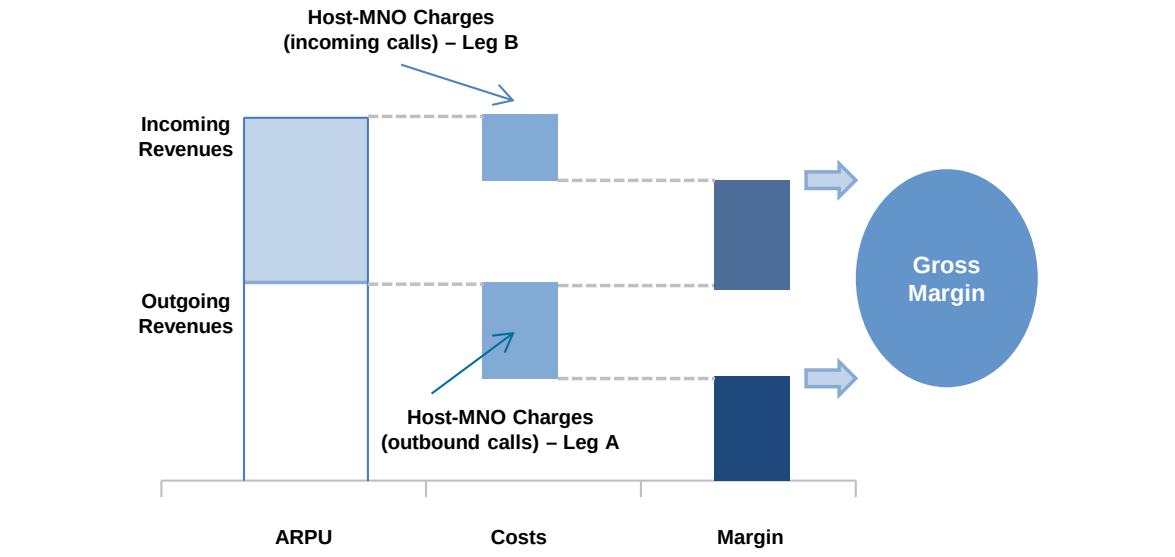
59 Nereo (2010): MVNO Business Essentials.
60 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 12, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.
61 Nereo (2014): MVNO Business Essentials, p. 12, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf.
62 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 13, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

2.2.4 Full MVNO

In addition to OPEX and CAPEX incurred by the light MVNO, full MVNOs also incur OPEX and CAPEX for network elements.[63]

As full MVNOs have their own network-switching infrastructure and negotiate their own interconnect agreements, full MVNOs generate revenues not only from outgoing traffic, but also for incoming traffic (interconnection revenues).[64]

Figure 2-6: Economics associated with a full MVNO´s business model



Source: WIK based on Nereo (2010).[65]

The gross margin of the full MVNO is therefore calculated as follows (see Table 2-2).

Revenue for outgoing traffic + Revenue for incoming traffic – Wholesale charge billed by the host MNO (Leg A) – Interconnection charge billed by the host MNO for incoming traffic (Leg B).

However, the benefits from control over interconnection are diminishing over time as MTR rates are falling globally. Typical gross margins under the full MVNO model range between 45%-70%.[66]

63 See Nereo (2014): MVNO Business Essentials, p. 13, http://www.nereoconsulting.com/pdf/MVNOBusinessEssentials.pdf.
64 See http://www.yozzo.com/mvno-wiki/mvno-types-and-operational-models/full-mvno.
65 See Nereo (2010): MVNO Business Essentials.

2.3 Wholesale pricing models

The degrees of freedom with regard to product design and pricing flexibility are determined not only by the technical characteristics or the integration of the MVNO in the value chain, but also, to a significant extent, by the wholesale pricing model applied and the associated conditions specified in the contract with the host MNO. The selection of the wholesale pricing model is closely related to the business model that an MVNO chooses or is able to pursue. In addition, the pricing model selected affects the costs and risks incurred by the MVNO, as discussed below.

Historically, mobile wholesale services are typically reimbursed under one of the following three pricing models, each of which is associated with specific advantages and disadvantages:

1. **Retail-minus pricing**: Under a retail-minus pricing regime, wholesale prices are based on retail prices of the respective MNO.

2. **Price per unit pricing**: Under a price per unit pricing, MVNOs pay a fixed price per telephone minute, SMS and MB consumed by its end customers.

3. **Revenue or gross margin sharing**: The gross margin or revenue sharing model can be interpreted as a special form of retail-minus pricing. Under this model, wholesale compensation for MVNOs can be based on the MNO's retail prices, while the concrete level depends on the achievement by the MVNO of certain sales targets.

More recently, reinforced by remedies introduced in the context of merger proceedings, a new model has emerged:

4. **Capacity based pricing**: Under the capacity based pricing model, the MVNO buys a certain percentage of the network capacity of the network operator at a fixed price. Payment is however not necessarily all up-front, and there may be a combination of an upfront fee and ongoing charges.

2.3.1 Retail-minus pricing

Under a retail-minus pricing regime, wholesale prices are oriented towards the retail prices of the respective MNO. This model is particularly suitable for branded reseller business models, but is not necessarily limited to this kind of business.

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66 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 13, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

The retail minus approach is based on the premise that the MVNO's focus lies in sales & distribution. These costs for sales & distribution are avoided by the host MNO, and thus the wholesale price should subtract the cost of that function, leaving the service provider to obtain compensation for sales and distribution from the retail prices it sets. The retail minus pricing rule is based on the formula:

$$P_{WS} = P_{RT} - C_{RT} + C_{WS}$$

P_{WS}: Wholesale price

P_{RT}: Retail price of the host MNO

C_{RT} Host MNO´s (avoided) costs of the sales level (costs incurred by the MVNO)

C_{WS}: Host MNO´s additional costs at wholesale level (costs incurred by the MVNO)

In practice, pricing in the retail-minus model is usually handled as shown in the following figure.

Figure 2-7: Calculation of the wholesale price in the retail-minus pricing model based on MNO´s list price

Source: WIK.

Furthermore, the MVNO may receive additional payments from the MNO, e.g. in the form of bonuses and other incentive payments in addition to the retail margin. Through these payments, network operators may seek to stimulate the acquisition of new customers or the achievement of certain sales targets. Bonus and incentive payments may also be designed so as to prioritize the choice of certain tariffs or products through the MVNO sales channel.

Even though in principle, MVNOs operating under retail minus pricing are free to set their own retail prices, the retail minus discount establishes a de facto boundary for its potential to discount retail prices, and tends to result in pricing and bundling practices shadowing the practices of the host. Thus, this pricing model offers limited scope for innovation in bundling and pricing.

The advantage of this pricing model for the MVNO is, that the wholesale products are typically offered at a fixed and volume-independent price, which means that they are not sensitive to usage trends. The economic risk of intensive use and thus increasing costs is carried by the MNO and not by the MVNO.[67]

With a sufficiently high retail-margin MVNOs may develop a profitable business with low distribution costs. Another advantage for the MVNO is that, providing the wholesale agreement allows replication of all retail offers, wholesale prices do not have to be renegotiated every time there is a change in order to offer a competitive retail product. This could be important, if for example, there is a trends towards more inclusive/flat-rate bundles.

One difficulty in applying a retail-minus wholesale model arises from discounts granted by the MNO to end customers on list prices in regularly placed promotions.[68] As a result, the actual monthly retail price of the MNO is sometimes far below its list price. If the MVNO wants to compete on price here, it must also set its retail price below the MNO's list price. As a result, the MVNO's retail margin is reduced. This raises the question of how the retail minus price rule should react to this practice of retail pricing so that efficient competition between MNOs and MVNOs is possible even under these market conditions. Two options that can address this challenge are:

1. The (discounted) retail prices and not the MNO's list prices form the basis of the retail-minus pricing rule.

2. The retail minus rule is based on the MNOs' list prices, but the MVNO is granted a higher retail margin, which also includes the usual market difference between the list price and the MNO´s effective retail price.

In the first case, the MVNO pays a wholesale price whose structure corresponds exactly with the structure of the network operator's retail price. In this case, the MVNO is a pure reseller of the same service as the host MNO and has only minimal scope for design and differentiation in competition.

The possibilities to differentiate are greater when the second approach is applied. Here, the MVNO is much more free to decide on its sales activities, its discount structure and thus ultimately its pricing policy. Accordingly, this variant will lead to more intense competitive pressure.

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67 See European Commission (2014): COMMISSION DECISION of 2.7.2014 addressed to: Telefónica Deutschland Holding AG declaring a concentration to be compatible with the internal market and the EEA agreement (Case M.7018 - TEF DEUTSCHLAND/ E-PLUS), p. 44, para. 189 ff., http://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf.

68 E.g. reduction or cancellation of the one-time connection fees, or the monthly basic fees in the first months of a new contract, premiums at the conclusion of the contract, the offer of subsidized devices, etc.

A further problem with the retail-minus pricing model is, that it works only for relatively simple services. If the MNO sells its mobile service predominantly in bundles with other services, it is difficult to isolate the host MNO´s retail price for the mobile service. This gives the MNO the possibility to manipulate its retail price and therefore also the wholesale price. This risk could be avoided by purchasing a wholesale version of the complete package on a retail minus basis, but this would leave little scope for the MVNO to differentiate itself from the MNO.[69]

2.3.2 Price per unit pricing

When applying a price per unit pricing model, the wholesale prices to be paid by the MVNO are invoiced on the basis of the aggregated actual consumption of data capacity, SMS and voice minutes.

MVNOs are generally free to structure their own retail products. Thus, they can differentiate themselves from the MNOs with regard to the pricing structures and advertised bundles. However, MVNOs´ freedom to design their own tariffs can be limited in practice as the MVNO bears the risk of intensive use by its end customers. Since its wholesale costs are based on the volumes actually used, precise estimates of the actual (not the marketed) volumes must be made. Unless wholesale tariffs are very low, the sensitivity to the actual usage makes it particularly difficult to compete with MNOs in the premium segment with high inclusive data volumes or unlimited tariffs.

This applies in particular against the background that MVNOs business cases are more sensitive towards the incremental additional wholesale costs per gigabyte of data in comparison to MNOs with their own infrastructure.

In addition, this purchasing model is in general not dynamic and therefore does not react to price changes on the retail market. Against this background, from the viewpoint of the MVNO there is a regular need for adjustment of wholesale conditions given the continuously increasing inclusive volumes at constant prices.

2.3.3 Revenue or gross margin sharing

The revenue/gross sharing model can be interpreted as a modified retail-minus approach. Wholesale prices are not fixed, but depend on the achievement of specific agreed sales targets.

The starting point for the determination of the wholesale prices are the list prices that are marketed to retail customers of the respective MNO. The so-called gross margin is calculated on the basis of the number of contracts on the network of the host MNO and

69 See https://mvnoseriesblog.wordpress.com/2015/03/18/mvno-wholesale-pricing-models-by-mike-conradi-partner-dla-piper/.

the list prices. The concrete level of wholesale prices for the individual contracts is calculated as a percentage of the list prices for the respective products. The percentage rate in turn depends on the achievement of certain marketing or sales objectives, e.g. in form of a graduated price model. The mechanism can be illustrated by a simple example:

It is agreed, for example, that a gross margin of 60% applies regardless of sales success, i.e. the MVNO must pay the MNO a price corresponding to 60% of the retail price for a specific product. If the MVNO succeeds in acquiring 10,000 new customers in the year in question, the gross margin drops to 50%, i.e. the MVNO only has to pay 50% of the list price. If the MVNO succeeds in acquiring 15,000 new customers in the year in question, the gross margin drops to 40%, i.e. the MVNO only has to pay 40% of the list price. This model creates an incentive for the MVNO to grow on the MNO's network.

As with the price per unit model, the revenue or gross margin sharing model allows the service provider to freely (within limits) design and adapt its pricing structure for retail tariffs if market conditions change. This enables the MVNO to remain competitive in the long term without the need for constant review and renegotiation of wholesale prices.[70]

However, the host MNO must also ensure - usually through appropriate contracts - that the MVNO does not set prices so low that they are below cost or cause network congestion.[71]

When applying the revenue sharing model, the risk of intensive use by the respective end customer lies with the host MNO.

2.3.4 Capacity based pricing

More recently, reinforced by remedies introduced in the context of merger proceedings (e. g. in Ireland and Germany), a new model has emerged based on capacity charging, whereby an MVNO contracts to have the right to use a fixed amount or proportion of an MNO’s network data capacity. This variant may also offer a path towards market entry as an MNO. The network capacity is sold at a capacity-based fixed price. This price structure creates explicit incentives for MVNOs to increase their customer base comparatively quickly in order to achieve efficient utilization of the network capacities - and thus rapidly decreasing average costs. The MVNO thus has a cost structure more comparable to that of an MNO than that associated with other MVNOs, that purchase the network capacity they need on a variable basis according to the number of their

70 See https://mvnoseriesblog.wordpress.com/2015/03/18/mvno-wholesale-pricing-models-by-mike-conradi-partner-dla-piper/.

71 See https://mvnoseriesblog.wordpress.com/2015/03/18/mvno-wholesale-pricing-models-by-mike-conradi-partner-dla-piper/.

customers and their usage behavior. In general, in addition to the fixed capacity-based costs, MVNOs must also pay variable costs per minute, MB and SMS under this model. The costs per unit are lower, however, in comparison to the pure price per unit pricing model.

These arrangements, analogous to some risk sharing and IRU-based deals in the fixed broadband segment, provide a significantly higher degree of flexibility in price setting than other MVNO business models. Full MVNO business models also allow MVNOs to become independent from their host in providing voice and messaging, as these services could be provided by the MVNO itself using the data capacity. However, the upfront investment required commit the MVNO to taking on a higher degree of risk, and may require the MVNO to reach a given scale to break even.

2.3.5 Price models against the background of a strongly increasing data demand

The price structure of wholesale services plays a major role in determining the degree and nature of competition that is possible through MVNO access. Linear volume-based billing of MVNO wholesale services significantly restricts the MVNO's product and price structure and will only increase competitive pressure to a limited extent.[72] This is particularly true against the background of a strong increase in mobile data use, e.g. through video and audio streaming, gaming services, and the exponential growth in the number of IoT devices.

The introduction of new technologies and the release of new frequencies has led to an increase in network capacity for MNOs. Despite considerable initial (fixed) investments, this has reduced the unit costs of MNOs for the transmission of voice and data. This enables MNOs to offer increasingly larger data bundles.[73]

Volume-based pricing however may not offer the same dynamics for an MVNO. If the wholesale unit prices to be paid by the MVNO are not reduced to the same extent as the host MNO´s unit costs, an MVNO becomes less and less competitive as network capacity and data demand increase and network unit costs decrease.[74]

With capacity-based pricing, the total capacity offered automatically increases as the host MNO's network capacity increases, (as capacity agreements are for a fixed proportion of network capacity), which also reduces the MVNO's unit costs.[75] This enables the MVNO to respond to the market demand for increasingly larger data

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72 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S.; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 55 f., https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html.

73 See https://www.analysysmason.com/About-Us/News/Insight/secure-the-future-for-mvnos-Nov2017/.

74 See https://www.analysysmason.com/About-Us/News/Insight/secure-the-future-for-mvnos-Nov2017/.

75 See https://www.analysysmason.com/About-Us/News/Insight/secure-the-future-for-mvnos-Nov2017/.

packages at a constant retail price and allows it to pursue a more aggressive pricing behaviour.[76]

However, price competition by MVNOs is also possible in non-capacity-based pricing models if there are adjustment mechanisms or regular price adjustments and if (retail minus) margins are high enough.

2.4 MVNO Value Creation and Target Markets

The target audience and value proposition for MVNO services tends to vary depending on the focus of the MVNO provider.

For example, some MVNOs target specific market segments that they consider may be underserved by traditional network operators such as immigrants, border-workers etc.

Meanwhile other MVNOs have been established to complement and/or complete the service offering of their parent company. For example, MVNO access has been used in several countries to enable broadband and TV providers to extend their services to cover mobile.

Another example where MVNO provision can complement an existing business, is where companies have a strong brand and/or extensive distribution and customer support channels that can be used to provide a mobile service. This is the case for example with retail providers and supermarkets that have entered the market as MVNO providers.

Finally, a relatively new, but expanding category of MVNOs are those which seek to leverage technological innovation e.g. in the field of IOT and/or combine mobile service provision with innovation in the field of platforms and applications.

Examples of some of these players are shown in the table below.

76 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S.; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 153, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html, https://www.analysysmason.com/About-Us/News/Insight/secure-the-future-for-mvnos-Nov2017/.

Table 2-1: MVNO Value Propositions

Value Propositions	Founded on	Examples
Audience Driven	Specific audiences' needs, language (actual or marketing) and/or lifestyles – immigrants, youth, elderly, travellers, communities, industries, etc.	
Synergistic Diversification Driven	Expanding an existing business into mobile communications while leveraging synergies with the current business – an existing customer base, national point-of-sale (PoS) presence, adjunct service bundling, or interfacing product lines.	
Technology Driven	Characteristics of specific technology – whether as the enabler of the service (e.g. FreedomPop) or the consumer of the service (e.g. IoT).	

Source: WIK based on Optiva (2020).[77]

GSMA Intelligence (GSMA) has further segmented MVNOs into 8 types depending on their target market and objectives.

Table 2-2: GSMA MVNO segmentation

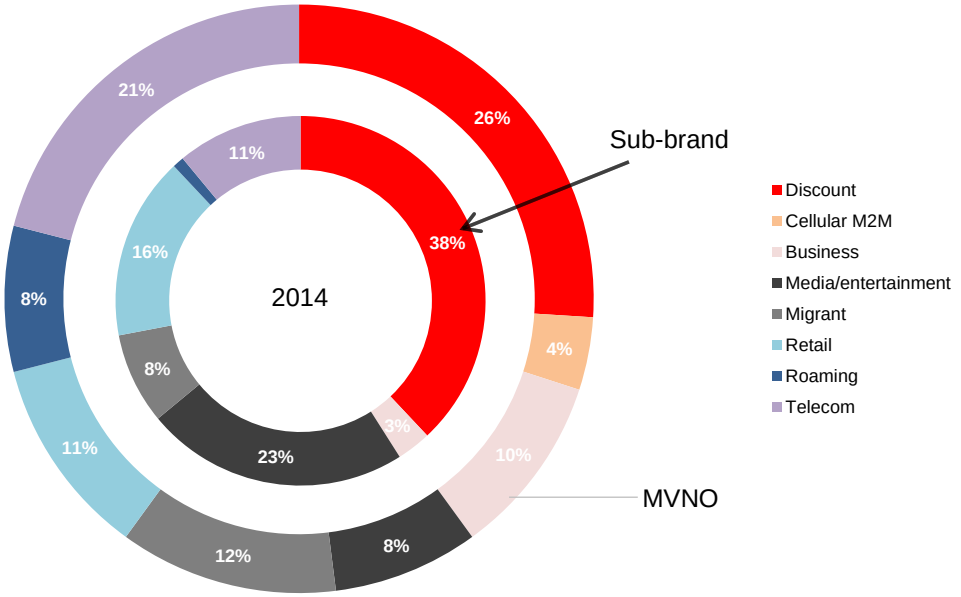
Sub-brands differ from MVNOs in that they are wholly-owned and operated by their MNO parent, despite being marketed independently of that MNO		
Discount An MVNO whose main proposition is low-cost services	**Migrant** An MVNO whose primary offering focuses on international voice services	**M2M** An MVNO that supports (embedded) machine-to-machine services
Telecom An MVNO whose offering forms part of a range of telecom services such as fixed-line phone and broadband internet	**Retail** An MVNO associated with the consumer retail industry	**Roaming** An MVNO whose offering is typically targeted at international travelers through roaming agreements with MNOs across multiple markets
Media/Entertainment An MVNO associated with the media or entertainment industries	**Business** An MVNO whose primary offering targets business customers	

Source: WIK based on GSMA intelligence.

77 See https://optiva.com/mvno-value-propositions-foundations-mvno/.

GSMA reported that as of 2014, the shares of the different target groups for MVNOs and sub-brands were distributed as shown in the following chart.

Figure 2-8: Market segmentation by category, MVNOs and sub-brands, global, 2014



Source: WIK based on GSMA intelligence (2015).[78]

The most significant segments were "Discount" (26%) and "Telecom" (21%), together accounting for 47% of the global MVNO market.[79] Specialized MVNOs focused on Business" (10%), "Migrant" (12%) "Roaming" (8%) and "M2M" (4%)[80] accounted for 34% of the market. The remaining 19% of the market is accounted for by companies from related industries, such as retailers, banks, television or media companies. Many

78 Figure found at: https://www.mobileworldlive.com/featured-content/home-banner/global-mvno-footprint-changing-environment/.

79 Discount MVNOs target cost-conscious customers, while Telecom MVNOs are active in other segments of the telecom market such as fixed broadband and are making use of MVNO access to complement their offer.

80 Business MVNOs develop services targeted towards business customers, "migrant" services are tailored towards expats e.g. through attractive call prices to destinations outside Europe. Roaming MVNOs offer alternative data (and sometimes voice) roaming packages or target services at cross-border workers, while M2M MVNOs develop services specialised for the IoT/M2M segment.

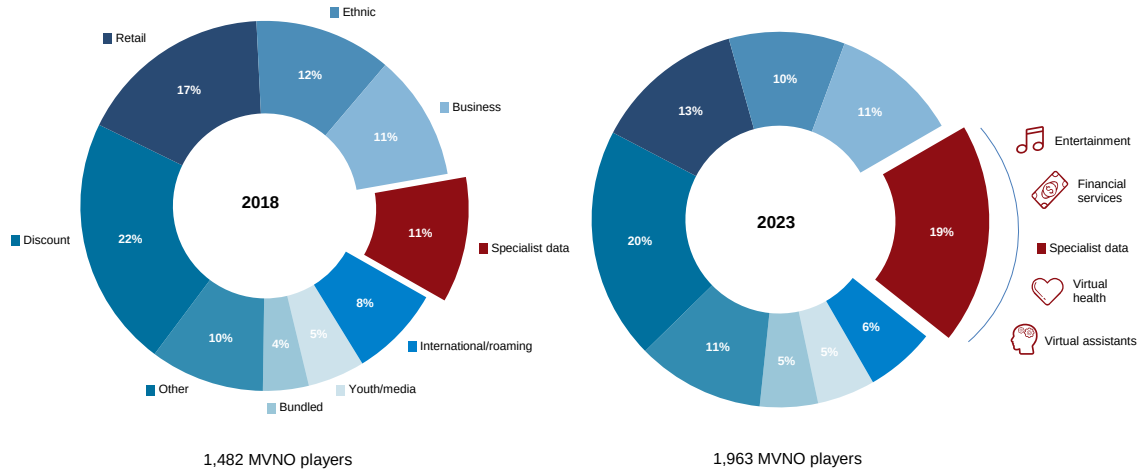
MVNOs for media/entertainment operate under well-known brands that reach beyond the telecommunications industry.[81]

The sub-brand market is dominated by the segments "discount" (38%), "media/entertainment" (23%) and "retail" (16%).[82]

A more recent study by RDC (2019) uses a similar segmentation to the GSMA. However, the M2M/IoT segment is excluded from the analysis. The study authors considered that this segment should be analyzed separately from B2C services, but was seen as having considerable potential for growth.[83] The authors also define two further segments: “specialist data” and “others”.

A total of 9 key customer segments are defined (see Figure 2-9).

Figure 2-9: MVNO players by segment type, global, 2018 vs. 2023



Source: WIK based on RDC (2019).[84]

81 See: https://www.mobileworldlive.com/featured-content/home-banner/global-mvno-footprint-changing-environment/.

82 See: https://www.mobileworldlive.com/featured-content/home-banner/global-mvno-footprint-changing-environment/.

83 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 33, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

84 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 22, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

1. Discount: The largest segment is the discount segment. In 2018, 22% of MVNOs were active in this segment. Due to the low prices charged to customers, low distribution costs and scalability options are particularly important success factors. A slight decline to 20% is expected for 2023.

2. Specialist data: The "specialist data" segment not included in the GSMA analysis refers to MVNOs founded by companies such as Google in order to provide their services to the companies` data-intensive services (Google Maps, YouTube, etc.). This segment is seen as having the greatest potential for growth from 11% in 2018 to 19% in 2023.

3. Retail: At 17%, the retail segment will be the second largest segment in 2018, with a decline to 13% expected in 2023. Retail includes the operation of MVNOs by companies such as Tesco.

4. Immigrant: MVNOs such as Lycamobile and Lebara offer low-cost rates to countries with a significant immigrant population. This segment accounted for 12% of MVNOs in 2018 and is expected to decline slightly to 10% in 2023.

5. Business: In 2018, 11% of MVNOs were active in the business segment. This share is expected to remain constant in 2023. In contrast to MNOs, MVNOs here tend to focus more on SMEs, for which they implement customised services.

6. International/roaming: This segment, which is also included in the GSMA segmentation, is expected to decline by 2% from 2018 to 2023. One example of an MVNO operating in this segment is Truphone. Using several international numbers on one SIM, customers can make calls at local rates in their target country.

7. Youth/media: Youth/media MVNOs focus in particular on the highly digitised needs of the younger generations. This includes offering self-produced content and zero-rating tariffs (e.g. for the use of social media and digital content) as well as cooperation with streaming services. A constant share (2018-2023) of 5% of the MVNOs active in this segment is assumed.

8. Bundled: The bundled segment largely corresponds to the GSMA's "telecom" segment, but also includes other players such as electricity companies who wish to offer mobile services together with those already offered. This segment is expected to grow slightly from 4% in 2018 to 5% in 2023.

9. Other: The segment "other" comprises several smaller segments, such as ": data only, charity, device, freemium/adfunded, the elderly, high-value

subscribers, telecoms, multi-segment and emerging segments". This is expected to increase slightly from 10% in 2018 to 11% in 2023.[85]

The following figure shows some examples of some of the larger scale European MVNOs, highlighting their different ownership, aims and target groups.

85 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, p. 22 ff., https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

Table 2-3: MVNOs in Europe

	Euro Information Telecom Country: France Founded: 1999	The MVNO partners with Orange, SFR and Bouygues Telecom. EI Telecom is a 95% owned subsidiary of the French banking group Crédit Mutuel-CIC. It sells pre- and post-paid packages under three main brand names: NRJ Mobile, Crédit Mutuel Mobile and CIC Mobile, in particular through the group's 4500 bank branches.
	Cubic Telecom Country: 180 countries Founded: 2005	The fully licensed MVNO and M2M platform provider focused on enabling global connectivity solutions for the IoT and enterprise customers. The company works with tablet and notebook manufacturers, retailers, and M2M and automotive companies.
	Lycamobile Country: 23 countries Founded: 2006	Since 2006 Lycamobile has become one of the most successful MVNO operator to focus on cheap international calls to over 15 million customers across 23 countries including Australia, Belgium, United Kingdom, Russia, Ukraine and more. Lycamobile provides pay-as-you-go SIM cards and develops distinct business structures such as MVNA arrangements in different countries.
	The Freenet group Country: 180 countries Founded: 2005	The Freenet Group is an MVNO that offers services on mobile voice and TV markets. The company also develops applications that relate to home automation and security, health, data security. The Freenet group operates on Vodafone, Telefónica and Deutsche Telekom's networks through three light MVNOs – Mobilcom-an, Klarmobil and Callmobile.
	Voiceworks Country: Netherlands Founded: 1994	Full MVNO for the business market, providing mobile, fixed and fixed-mobile convergence solutions.
	PosteMobile Country: Italy Founded: 2007	PosteMobile is MVNO serving more than 3.300.000 clients and is a branch of the postal and banking services company Poste Italiane.
	Mobile Vikings Country: Belgium Founded: 2008	The MVNO was the first Belgian provider to offer specific tariff plans focused on mobile internet. Mobile Vikings have been using Orange's network since the spring of 2019.
	Transatel Country: global Founded: 2000	Transatel is a European MVNE/A and has over 170 MVNOs. The company offers cellular solution for global, multi-local data connectivity with eSIM capabilities, to address the IoT market of connected devices, such as laptops, tablets, trackers, as well as cycles, vehicles and aircraft.
	Ventocom Country: Austria Founded: 2013	Ventocom is an MVNE who owns "HoT" and "Allianz SIM" brands. Ventocom, as an independent service provider, supplies the development of mobile products and tariffs, CRM, Customer Service, Billing, and Logistics.
	Sky Country: UK Founded: 2016	Sky is Europe's leading entertainment company. The MVNO offers mobile as part of its bundles of TV, home phone and broadband services. It leases wireless telephone and data spectrum from major carriers EE, O2, Three, and Vodafone for resale.

Source: WIK based on MVNO Europe in: PWC (2019).[86]

86 See: PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 21f., http://gncc.ge/uploads/other/4/4485.pdf.

2.5 Conditions for the entry and expansion of MVNOs

2.5.1 Incentives for voluntary granting of MVNO access

Cooperation with an MVNO can have both advantages and disadvantages for an MNO.

MVNOs are most common in mature markets where market penetration (based on connections) has exceeded 100 percent.[87] In these markets, MVNOs can be an instrument to reach previously under-served segments, or to increase market share (for smaller MNOs). By specializing in new market segments and niche markets that are unprofitable for MNOs, MVNOs can increase the subscriber base of MNOs. A company from a different industry that founds an MVNO can also use its brand and existing subscriber base to reach customers that the MNO could not reach. In addition, the MVNO can achieve price differentiation on the market that the MNO alone could not achieve.[88] MVNOs can increase the network utilization of the MNO and lower operational cost due to an increase in economies of scale.[89] Furthermore, the MNO generates additional revenues through wholesaling.[90]

However, hosting an MVNO also involves numerous risks for the MNO. An MVNO can cause a competitive constraint on the MNO if it loses customers to the MVNO (market share cannibalisation). MVNOs can use aggressive pricing strategies and force MNOs to lower their prices as well, thus reducing their profitability. The presence of MVNOs and associated offers may also encouraged increased awareness by consumers of alternatives, and increase switching. In addition, the brand of the MNO may suffer if the MVNO provides a poor service that the customer associates with the brand of the MVNO.[91]

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87 See https://www.mobileworldlive.com/featured-content/home-banner/global-mvno-footprint-changing-environment/.

88 See Banerjee, Aniruddha; Dippon, Christian M. (2009): Voluntary relationships among mobile network operators and mobile virtual network operators: An economic explanation; in: Information Economics and Policy, Volume 21, Issue 1, 72-84.

89 See Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM) (2008): Mobile Virtual Network Operators (MVNO) The Redefining Game, p. 3; https://www.mcmc.gov.my/skmmgovmy/files/attachments/Mobile_Virtual_Network_Operators.pdf; PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 8., http://gncc.ge/uploads/other/4/4485.pdf.

90 See Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM) (2008): Mobile Virtual Network Operators (MVNO) The Redefining Game, p. 3; https://www.mcmc.gov.my/skmmgovmy/files/attachments/Mobile_Virtual_Network_Operators.pdf.

91 Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM) (2008): Mobile Virtual Network Operators (MVNO) The Redefining Game, p. 14; https://www.mcmc.gov.my/skmmgovmy/files/attachments/Mobile_Virtual_Network_Operators.pdf; PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 15, http://gncc.ge/uploads/other/4/4485.pdf.

In general, it can be said that an MNO will only grant access to an MVNO on a voluntary basis if it expects the agreement to increase its profits. An important element in this decision may be the degree of product differentiation of the MVNO and whether this compensates for competitive effects or cannibalisation.[92] However, even if there is a risk of cannibalisation, the MNO may still have an incentive to offer the MVNO access to its network, if the MVNO has or is expected to acquire a large customer base, and the MNO is in competition with other MNOs and there is a risk that the MVNO would enter into a contract with another MNO. In this case, the cannibalisation effects would be even greater, as they would not be compensated through wholesale revenues.[93] However, even in the case of competition between MNOs, there is no business case for an MVNO if the MNOs are able to serve the niches targeted by the MVNO through their existing brands or by creating sub-brands. The MNO has the opportunity to increase its profits by hosting an MVNO if the MVNO offers a differentiated offering or addresses a previously untapped segment.[94] It is possible that in situations where offering MVNO access would not be an optimal strategy, MNOs may nonetheless offer MVNO access, but on terms which would not allow its competitor to become an effective and credible competitor.

In summary, MNOs may have an incentive to offer MVNO access if:

- The MVNO operates in a different market segment to its retail arm
- The MNO has a low market share in a mature market, and faces challenges increasing its customer base
- The MVNO is large in scale, and refusing to grant access would risk losing customers to a competitor.

A voluntary agreement is less likely to be offered if:

- The MVNO is small in scale or new to the market;
- The MVNO could compete with the MNO and cannibalise its retail business

92 See Dewenter, Ralf; Haucap, Justus (2006): Incentives to licence virtual mobile network operators (MVNOs), p. 13, https://www.infraday.tu-berlin.de/fileadmin/fg280/veranstaltungen/infraday/conference_2006/papers_presentations/paper---dewenter_haucap.pdf.

93 See Nera Economic Consulting (2018): Competitive effects of MVNOs and assessment of regulated MVNO acceess, Spark New Zealand, 26 October 2018, p. 3, https://comcom.govt.nz/__data/assets/pdf_file/0019/104248/Spark-NERA-Competitive-effects-of-MVNOs-and-assessment-of-regulated-MVNO-access-Submission-on-the-Issues-Paper-26-October-2018.PDF.

94 Nera Economic Consulting (2018): Competitive effects of MVNOs and assessment of regulated MVNO acceess, Spark New Zealand, 26 October 2018, p. 5, https://comcom.govt.nz/__data/assets/pdf_file/0019/104248/Spark-NERA-Competitive-effects-of-MVNOs-and-assessment-of-regulated-MVNO-access-Submission-on-the-Issues-Paper-26-October-2018.PDF.

- The MNO considers that it does not need the assistance of an MVNO to grow its business.

MNOs may also seek to offer terms which restrict the ability of MVNOs to compete with its retail business, such as pricing conditions that do not allow the MVNO to replicate certain products which the MNO offers (e.g. unlimited data).

2.5.2 Conditions required for successful entry by MVNOs

Mass-market MVNOs have an incentive to enter into the market if the size of the targeted segment is large enough to reach economies of scale and a critical mass of customers in order to achieve the break-even point. In addition, there must be sufficient demand for services beyond those supplied by the MNOs (i.e. a gap in the market), and MVNOs must have the relevant credentials to exploit and fill that gap.[95]

Credentials supporting entry into the market by mass-market MVNOs include the use of existing assets such as a strong brand, existing customer relationships and distribution channels etc.[96] Being able to rely on central functions (e.g. finance, marketing, human resources) of an already established parent company from another sector (e.g. retail, fixed broadband) can also help to reduce costs and reach break-even with a smaller customer base. Meanwhile, specialist MVNOs (e.g. in the IOT/M2M segment) may bring supplier relationships (e.g. with equipment manufacturers or industrial contacts) and technological knowhow and innovation in downstream applications.

For companies considering MVNO access as a means to provide coverage for cross-border services e.g. for IoT or roaming, factors which may influence the decision to become an MVNO include the ease of reaching agreement, and relative flexibility enabled (for pricing and quality of service) by MVNO access compared with roaming agreements.

Importantly, alongside revenue-based factors, a necessary condition for MVNO entry for all business models is that access is available on reasonable terms and that the wholesale contracts permit a sufficiently high gross margin.

As already described, business models such as the branded reseller, service provider and light MVNO involve lower capital expenditure and operating costs than the full MVNO. As a result, the barriers to entry and the problem of reaching critical mass are lower than for the full MVNO. In the absence of technical know-how, MVNEs can

95 See Red Dawn Consulting (2019): MVNO landscape: Global perspectives and New Zealand Applications, Non-Confidential Report, May 14th 2019, Authors: Arun Dehiri; Gareth Williams, https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.

96 See Medudula, Murali Krishna; Sagar, Mahim; Gandhi, Ravi Parkash (2016): Telecom Management in Emerging Economies, p. 107.

facilitate market entry and reduce capital expenditure and time to market for smaller players. Thus, the presence of MVNEs may also be an enabling factor.

In most cases, MVNOs rely on commercial conditions for wholesale access, and their potential for entry may depend on whether MNOs have incentives to reach favourable agreements, which may depend on the number of players in the market, imbalances in market shares, and the willingness of MNOs to pursue MVNO access as a strategy for expansion. In cases where commercial agreements on fair terms are not forthcoming, regulation can open new markets for MVNO activities and promote market entry. Regulation has in some cases played a key role in enabling and promoting the MVNO market.[97]

Regulation to mandate MVNO access can be applied for example in the context of:

- Conditions for mergers
- Allocation of frequencies as a licensing requirement
- Regulation of dominant players.[98]

GSMA found in 2014, that the number of MVNOs had grown strongly worldwide due to regulation focused on strengthening competition. At that time, regulatory authorities had been active in this space, especially in Europe. This included intervention by the European Commission to apply conditions for MVNO access in the context of approving mergers between mobile network operators (MNOs).[99]

The following table provides an overview of the presence of MVNO access regulation and the market share of independent (not MNO owned) MVNOs in the 36 OECD countries as of 2018.

97 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. 1, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

98 See OECD (2014): Wireless Market Structures and Network Sharing, OECD Digital Economy Papers, No. 243, OECD Publishing. DOI: 10.1787/5jxt46dzl9r2-en, p. 71f.

99 See: https://www.mobileworldlive.com/featured-content/home-banner/global-mvno-footprint-changing-environment/.

Table 2-4: MVNO Access Regulation in OECD Countries and IO MVNO Share

Country	Access obligations	Reported IO MVNO Share
(1)	(2)	(3)
Chile	**Yes**	**1.9%**
Czech Republic	**Yes**	**6.7%**
Japan	**Yes**	**2.9%**
Turkey	**SMP – One Carrier (Expires in April 2019)**	**n/a**
Slovenia	**SMP – One Carrier**	**2.7%**
Norway	**SMP – One Carrier**	**6.3%**
South Korea	**SMP – One Carrier**	**4.4%**
Ireland	**Conditional – Merger**	**<2%**
Austria	**Conditional – Merger**	**8.3%**
Germany	**Conditional – Merger**	**23.7%**
Poland	**Conditional – Spectrum Auction**	**1.2%**
France	**Conditional – Spectrum Auction**	**9.5%**
Israel	**Regulatory Backstop**	**2.9%**
Finland	**No**	**n/a**
Mexico	**No**	**1.1%**
Iceland	**No**	**2.0%**
Lithuania	**No**	**n/a**
Portugal	**No**	**2.2%**
Greece	**No**	**n/a**
Hungary	**No**	**1.0%**
New Zealand	**No**	**0.4%**
Slovakia	**No**	**0.0%**
Estonia	**No**	**n/a**
Luxembourg	**No**	**n/a**
Latvia	**No**	**0.0%**
Australia	**No**	**6.6%**
Belgium	**No**	**11.6%**
Italy	**No**	**10.7%**
Sweden	**No**	**0.9%**
United States	**No**	**9.8%**

Spain	**No**	**6.8%**
United Kingdom	**No**	**8.0%**
Netherlands	**No**	**9.1%**
Switzerland	**No**	**8.5%**
Canada	**No**	**n/a**
Denmark	**No**	**1.8%**

Source: WIK based on TeleGeography, GlobalComms database, March 2019 in Nera Economic Consulting (2019).[100]

In 24 of the 36 OECD countries MVNO access is reported as not being regulated.

3 countries have imposed an obligation on all MNOs to provide MVNO access: Chile, the Czech Republic[101] and Japan. However, market shares of independent MVNOs in these countries are reported to be low at 1.9% in Chile, 6.7% in the Czech Republic and 2.9% in Japan (see Table 2-4).

In Spain, it was decided to abolish regulation in 2014. In Turkey, the MVNO regulation expired in April 2019.

Israel has explicitly decided against regulatory intervention and in favour of commercial negotiations and will only intervene if these fail due to market forces.

Some countries have MVNO regulation targeted at specific operators:

- In Slovenia, Norway and South Korea, one provider (considered to have SMP) is regulated.
- In Austria, Germany and Ireland, the European Commission has imposed access to MVNOs in the context of merger proceedings.

The provisions of the ex-ante or merger obligations as well as market developments after obligations were imposed are discussed in detail in Chapters 4 and 6.

100 See Nera Economic Consulting (2019): An Examination of the Regulatory Framework for Mobile Virtual Network Operators and Other Wholesle Mobile Services, Expert Report of Christian M. Dippon, Ph.D. On behalf of Telus Communications Inc., May 15, 2019, p. 11.

101 An obligation on MNOs' to grant regulated access on the basis of a reference offer was imposed in the context of the 4G spectrum allocation https://www.ctu.cz/sites/default/files/obsah/stranky/223526/soubory/cz-2019-218920adopteden redacted.pdf.

2.5.3 Expansion strategies for MVNOs

According to Telespierence's MVNO Market Review 2015-2016, 50% of MVNOs considered setting low prices to be their go-to-market strategy.[102]

This strategy is considered a good market entry strategy for mass customer acquisition. However, it does not guarantee long-term viability and sustainable growth.[103]

This is because, the wholesale prices of MNOs limit the possibility of lowering retail prices continuously in order to remain profitable, while competitors' responses can lead to a situation in which low prices are no longer a sufficient differentiation criterion.[104] Furthermore, MNOs are increasingly offering targeted offerings for specific market segments through sub-brands. This increases price and competitive pressure and underlines more than ever the need for MVNOs to innovate and differentiate themselves in terms of value proposition and cost structure,[105] rather than relying on a low-price strategy alone.[106]

Surveys confirm that MVNOs themselves see the need to move away from a low-cost only strategy. For example, Telesperience asked 100 MVNOs in 2015 and 50 MVNOs in 2016 which factors were most important for them to differentiate themselves in the market and how they intended to grow.

72% of the MVNOs rated “better customer service” as their key differentiator, followed by “added value” (64%), “cheaper prices” (38%), “innovative offers and pricing” (54%), “product range” (38%), “understanding and meeting customer needs better” (52%) and “branding and marketing” (38%) (see Figure 2-10).

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102 See: https://www.tweakker.com/news-updates/new-mvno-tool-automate-customer-engagement-services/.

103 See: See Medudula, Murali Krishna; Sagar, Mahim; Gandhi, Ravi Parkash (2016): Telecom Management in Eemerging Economies, p. 108; https://www.tweakker.com/news-updates/new-mvno-tool-automate-customer-engagement-services/; Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. iii, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

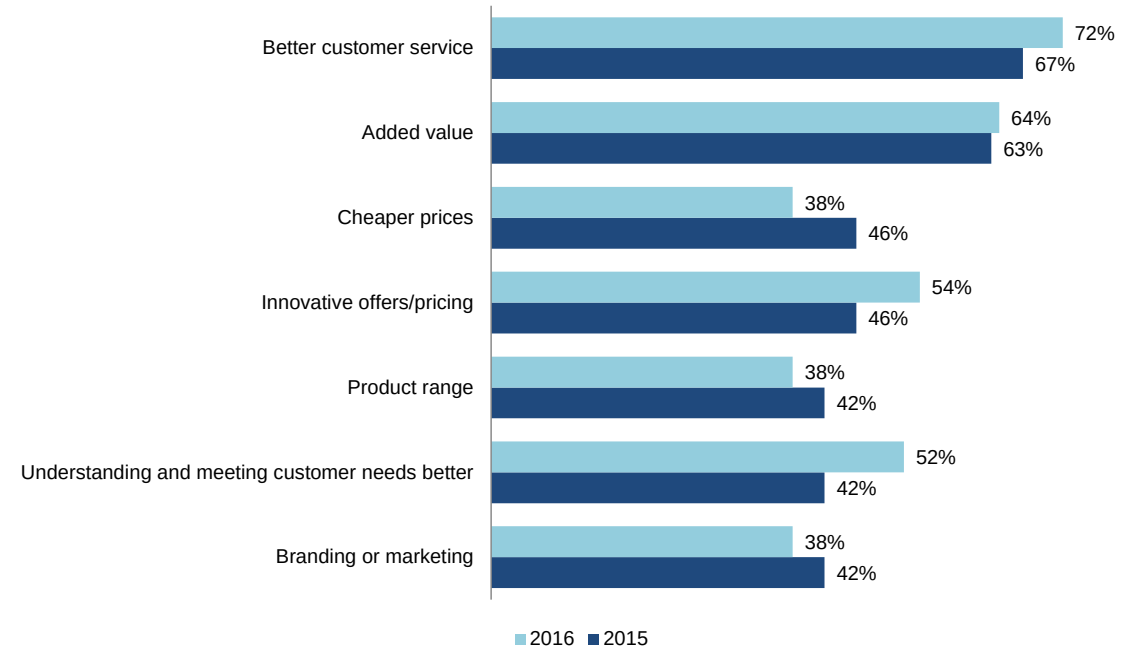
104 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. iii, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

105 See https://www.strategyanalytics.com/strategy-analytics/blogs/service-providers/mobile-operators/service-providers/2018/09/06/top-5-trends-in-mvnos-in-an-era-of-new-opportunities-and-challenges.

106 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. iii, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

The greatest increase in importance of +10% compared to the previous year was in "understanding and meeting customer needs better". The importance of "cheaper pricing" has decreased significantly (-8%) (see Figure 2-10).[107]

Figure 2-10: Key differentiators for MVNOs 2015-16 compared to 2016-7



Source: WIK based on Telesperience (2016).[108]

Rather, in order to continue to operate successfully in the market, literature and experience suggests that MVNOs will need to differentiate through innovation and redefine their value proposition for digitally-savvy customers. This means they have to change from a “traditional MVNO” (which may be focused on voice and value-based services) to a "digital MVNO", having greater focus on data and/or M2M.[109]

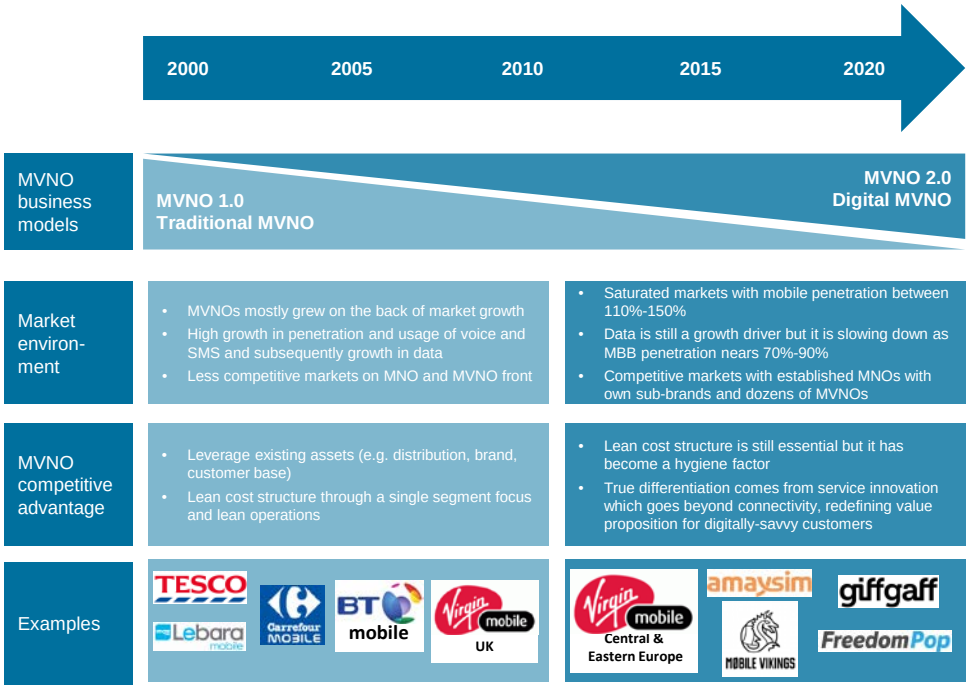
The following figure shows this development from a traditional MVNO to a digital MVNO.

107 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. 11, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

108 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. 12, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

109 Delta Partners (2016): MVNO 2.0: MVNO of the digital age, Nino Vashakidze – Vice President, Private Equity, 10 February 2016, p. 4, https://www.deltapartnersgroup.com/sites/default/files/MVNO%20digital%20age.pdf.

Figure 2-11: MVNO evolution timeline



Source: WIK based on Delta Partners (2016).[110]

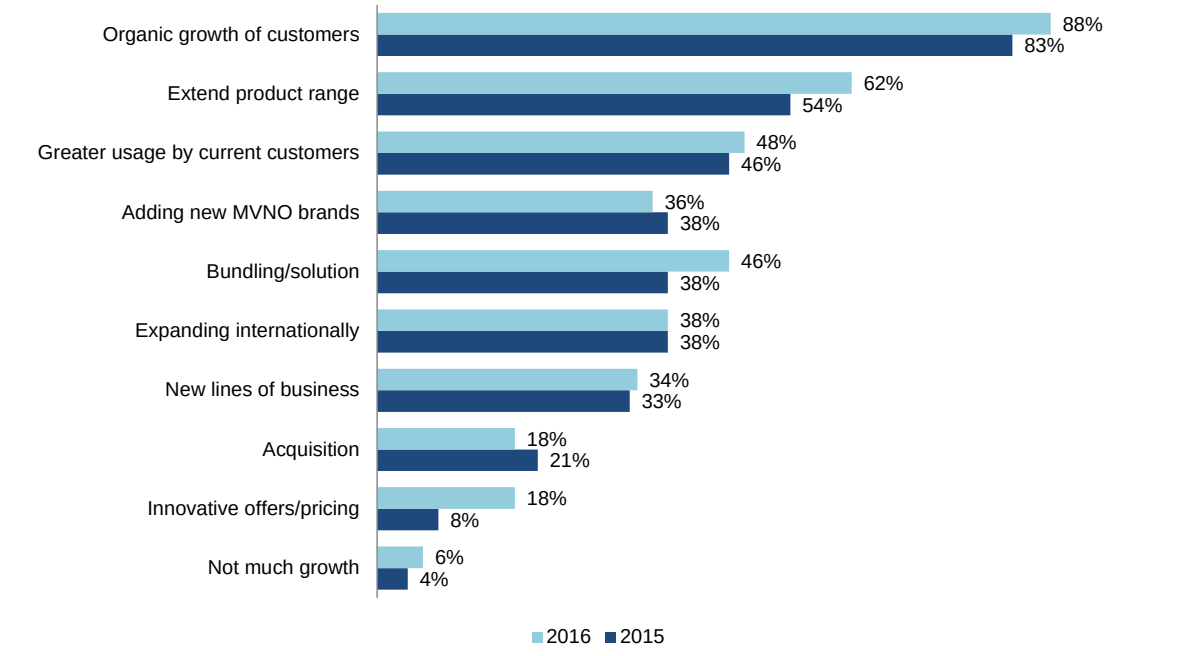
Examples of innovations are app-based pricing or third-party sponsored data. Some successful MVNOs (such as FreedomPop and Virgin Mobile CEE) even provide free basic packages and market value-added services in a freemium model. MVNOs, providing a superior end-to-end customer experience to digitally savvy customers, are not only able to grow in saturated and stagnating telecommunications markets, but also to be profitable.[111]

However, while attention to innovation has grown significantly, surveys suggest that it is a key focus for only a minority of MVNOs. In the 2016 Telesperience survey, 88% of companies saw “organic customer growth” as their key growth driver, followed by “extending product ranges” (62%), “greater usage by current customers”, “adding new MVNO brands” (36%), “bundling and solutions” (46%), “expanding internationally” (38%) and “adding new lines of business” (34%). Innovative offers and pricing were cited as key growth strategies by 18% of respondents (see Figure 2-12).

110 Delta Partners (2016): MVNO 2.0: MVNO oftof tofthe digital age, Nino Vashakidze – Vice President, Private Equity, 10 February 2016, p. 4, https://www.deltapartnersgroup.com/sites/default/files/MVNO%20digital%20age.pdf.

111 Delta Partners (2016): MVNO 2.0: MVNO oftof tofthe digital age, Nino Vashakidze – Vice President, Private Equity, 10 February 2016, p. 4, https://www.deltapartnersgroup.com/sites/default/files/MVNO%20digital%20age.pdf.

Figure 2-12: How MVNOs expect to grow, 2015-2016 compared to 2016-2017



Source: WIK based on Telesperience (2016).[112]

112 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. 11, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

3 Technological developments shaping mobile markets

In the coming years, the markets in which MVNOs operate will be affected, not only by the continuing evolution in trends towards mobile data consumption, but also by market evolutions linked to the deployment of 5G and associated IoT/M2M developments as well as developments such as eSIM and the deployment of successor technologies to traditional mobile voice and SMS services.

In this chapter, we summarise key upcoming developments in the mobile market and consider the implications for MVNOs.

KEY FINDINGS

- The IoT segment is expanding in Europe and worldwide. IoT solutions typically involve specialists in the various fields and sectors affected and provides significant scope for entry and innovation by multi-national MVNOs and service providers specialized in this field.
- eSIM provides an important enabler to MVNOs and specialized service providers supporting remote provisioning of connectivity for IoT. 5G offers further opportunities for innovation in industrial use cases and specific sectors. However, these opportunities could be undermined if IoT service providers do not have timely access to 5G or cannot fully utilitise its capabilities.
- Retail MVNOs will also need access to 5G and IP-based interconnection (for voice and messaging) in order to be able to maintain competitiveness with MNOs. However, next generation technologies offer fewer advantages to retail MVNOs (as such MVNOs are often focused on the consumer segment), and may rather present a threat as they may involve operational adjustments, investments and may require a renegotiation of MVNO contracts.
- Consumer applications of eSIM may present a threat to existing larger-scale MVNOs (as well as MNOs) due to the risk of churn, and thus these players may have incentives to influence standard-setting to limit switching capabilities. There are also concerns amongst MNOs that eSIM could enable equipment manufacturers to steer traffic.
- The popularity of OTT is contributing to the increasing importance of mobile data in relation to voice, and may serve to limit the market potential for international voice markets which have been a core focus for some MVNOs.

3.1 Internet of Things (IoT)

The Internet of Things (IoT) refers to objects/devices that are connected via different kinds of networks.[113] However, there are different views on the definition of the term and its differentiation from machine-to-machine services (M2M). In its initial statements, BEREC considered that IoT and M2M were synonymous. However, BEREC defined IoT as a wider concept than M2M after a public consultation in 2018/2019.

M2M is defined under the EECC as "services involving an automated transfer of data and information between devices or software-based applications with limited or no human interaction".[114] When defining IoT, BEREC took account of the fact that IoT services depend on different connectivity technologies, have different spectrum usage and require different degrees of network performance. As a result, it segmented IoT between wide area IoT and short range IoT with a further distinction of the Wide Area IoT between "massive M2M devices" (which are not sensitive to latency or network speeds) and "critical IoT applications" (which require high reliability and low latency connectivity).

The IoT market has been evolving for around ten years. In June 2019, around 300 million SIM cards in the OECD were assigned to M2M (see Figure 3-1).[115] As regards M2M penetration (M2M cards per 100 inhabitants) Sweden takes the leading position, followed by Austria and Italy. Ireland is slightly above the OECD average. However, this data is subject to some uncertainties, as national regulatory bodies may report numbers indifferent ways. While some countries might cover only those M2M SIM-cards sold and activated in the country, others may include M2M SIM-cards sold worldwide by operators from this country.[116]

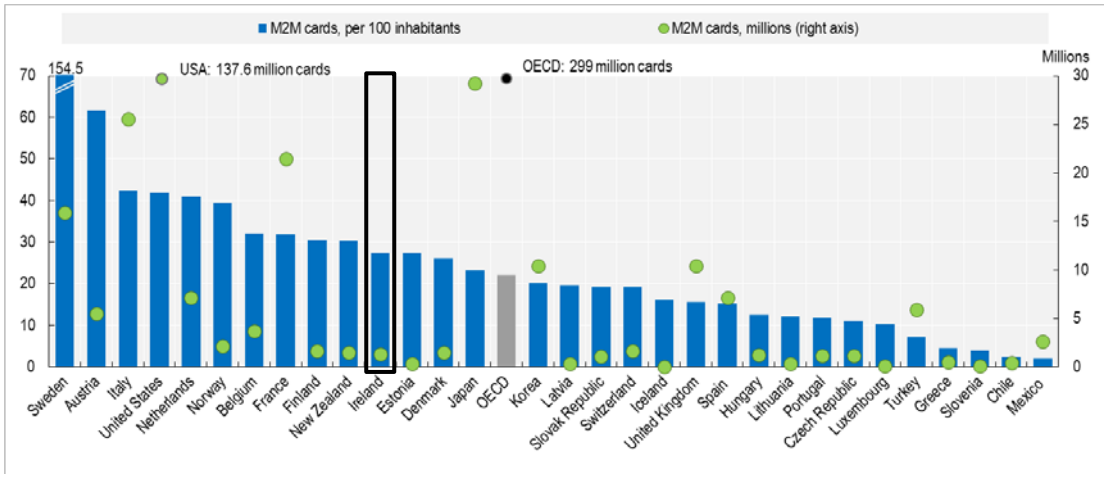
113 See for definition and concept of the IoT BEREC (2019): Internet of Things indicators, BoR (19) 25, 07 March 2019, available for download under https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8464-be%20rec-report-on-internet-of-things-indicators, page 12-16.

114 See BEREC (2019): Internet of Things indicators, BoR (19) 25, 07 March 2019, available for download under https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8464-be%20rec-report-on-internet-of-things-indicators, page 12.

115 See OECD (2019): OECD Broadband statistics, 1.12. M2M/embedded mobile cellular subscriptions, June 2019, available for download under https://www.oecd.org/sti/broadband/broadband-statistics/.

116 According to the Swedish telecommunications regulator PTS, 70% of the reported M2M SIM-cards are sold by Telenor Connexion to equip large industrial users and car manufacturers (e.g. Volvo) worldwide, see: https://statistik.pts.se/en/the-swedish-telecommunications-market/tables/mobile-call-services-and-mobile-data/table-18-machine-to-machine-m2m/ and https://www.telenor.com/wp-content/uploads/2018/05/Handelsbanken-Cellular-IoT-Day-Telenor-Connexion.pdf.

Figure 3-1: M2M penetration (June 2020)



Source: OECD (2021).[117]

It is important to note that SIM cards in M2M do not cover the whole spectrum of IoT in the sense of connected devices or objects, as devices could be connected via various technologies (e.g. WiFi, Bluetooth).[118]

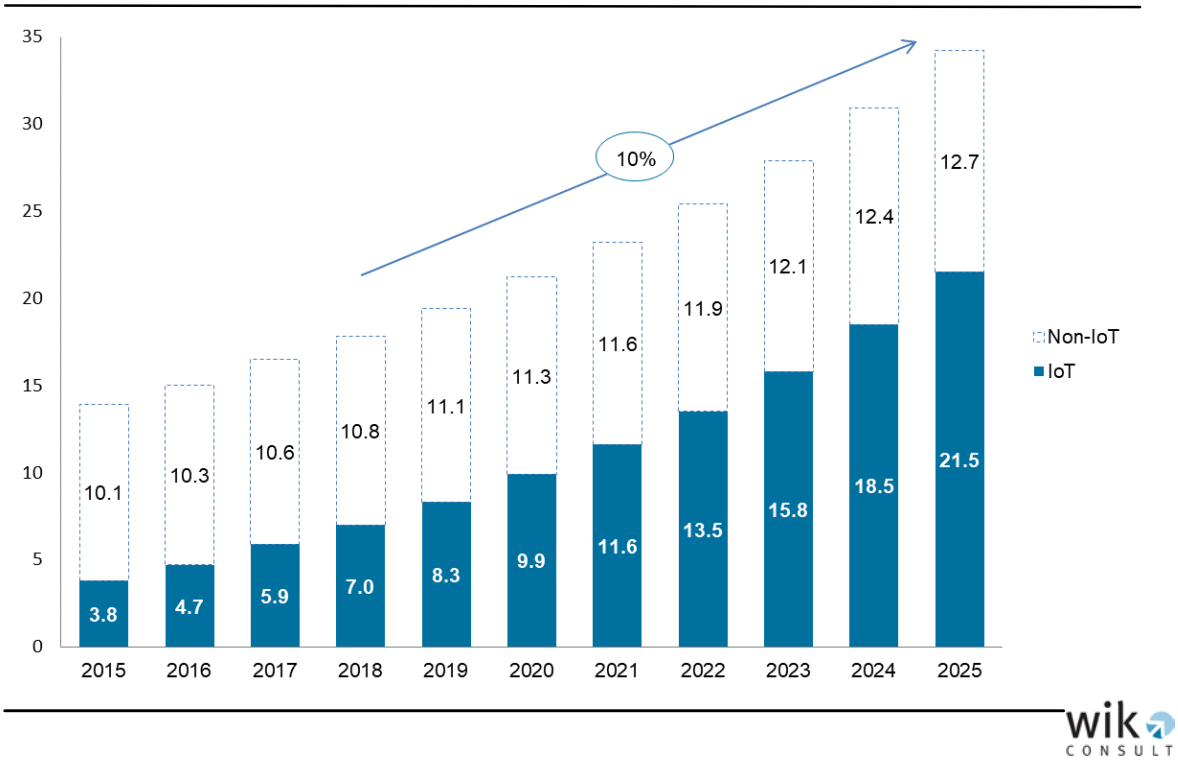
Long-term forecasts of IoT development rely on many uncertain influencing factors and apply various assumptions that might lead to overestimating the future IoT market potential.

According to IoT Analytics, in 2020 around 10 billion connected devices were in use worldwide. Around the same number of connected devices can be regarded as "non-IoT", i.e. smartphones, tablets, laptops (see Figure 3-2). IoT Analytics expects that the number of IoT devices will exceed the number of non-IoT-devices in 2022. The forecast of IoT Analytics is plausible compared to some other predictions.

117 See OECD (2021): OECD Broadband statistics, 1.12. M2M/embedded mobile cellular subscriptions, June 2020, available for download under https://www.oecd.org/sti/broadband/broadband-statistics/.

118 See in more detail Gries, C.; Knips, J.; Wernick, C. (2019): Mobilfunkgestützte M2M-Kommunikation in Deutschland – zukünftige Marktentwicklung und Nummerierungsbedarf (Dezember 2019), WIK-Diskussionsbetirag Nr. 455 (available in German language only), https://www.wik.org/index.php?id=diskussionsbeitraegedetails&L=0&tx_ttnews%5Bcat%5D=4&tx_ttnews%5Byear%5D=2019&tx_ttnews%5BbackPid%5D=93&tx_ttnews%5Btt_news%5D=2274&cHash=c6bc157188060dd68171fd2d45eec8c6.

Figure 3-2: IoT forecast: number of active device connections worldwide (2015-2025)



Note: Non-IoT includes all mobile phones, tablets, PCs, laptops, and fixed line phones. IoT includes all consumer and B2B devices connected - see IoT break-down for further details.

Source: WIK based on IoT Analytics (2018).[119]

IoT solutions tend to be complex and include various components such as IoT platforms, data analytics and security solutions. Due to the variety of skills required for the implementation of IoT, many different players with different company backgrounds and business models are involved in the IoT market.

IoT offers substantial potential for new revenue sources, e.g. in the area of cloud and hardware, platforms, applications, services, analytics and big data software.[120] Thus the total revenue opportunity from IoT is expected to be significant.

119 See IoT Analytics (2018): State of the IoT 2018: Number of IoT devices now at 7B – Market accelerating, 8 August 2018, https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/.

120 See GSMA (2019): The IoT Big Data Revenue Opportunity for Mobile Operators – study prepared by PwC, October 2019, https://www.gsma.com/iot/wp-content/uploads/2019/10/The-IoT-Big-Data-revenue-opportunity-for-operators_GSMA_IoT.pdf.

However, connectivity represents a relatively small share of the overall IoT revenues,[121] and ARPUs from connected devices are very low compared with those used for personal communications. Moreover, traffic behaviour, device scale, security, billing and provisioning of connected devices require specific solutions for the IoT, which require investments and adaptations of existing cost structures.

Available figures suggest that the share of mobile revenues attributable to IoT are relatively low and may account for as little as 1% of total revenues.[122] Nonetheless, MNOs worldwide have started to develop strategies to generate revenues in the IoT segment.[123]

Estimates of the portion that might be captured by telecom operators vary widely, but a PwC analysis on behalf of GSMA suggests that, the global addressable market for MNOs in the broader field of IoT and related Big Data services could reach 386 billion USD in 2025 (see Figure 3-3). PwC estimates that the revenue growth opportunity in IoT beyond connectivity will be 5-15 times that available from connectivity for IoT itself.[124]

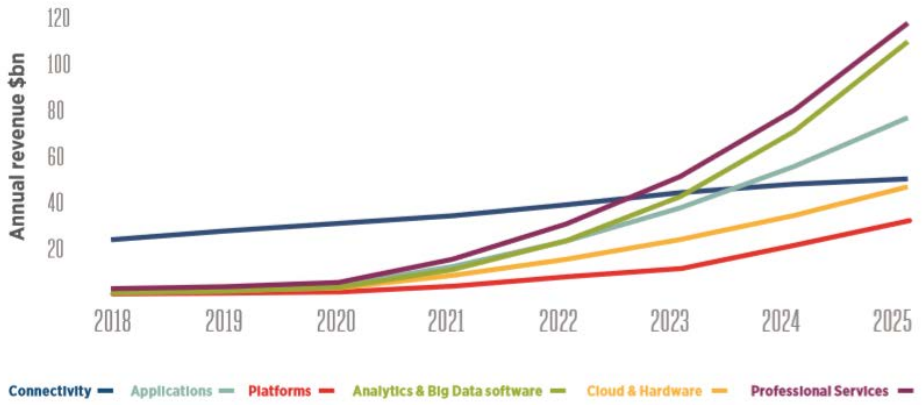
121 See BEREC (2019): Internet of Things indicators, BoR (19) 25, 07 March 2019, page 5, available for download under https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8464-be%20rec-report-on-internet-of-things-indicators.

122 See https://iotbusinessnews.com/2020/07/24/94717-berg-insight-says-top-ten-mobile-operators-have-85-percent-market-share-in-cellular-iot/.

123 See GSMA (2019): The IoT Big Data Revenue Opportunity for Mobile Operators – study prepared by PwC, October 2019, page 19, https://www.gsma.com/iot/wp-content/uploads/2019/10/The-IoT-Big-Data-revenue-opportunity-for-operators_GSMA_IoT.pdf.

124 See GSMA (2019): The IoT Big Data Revenue Opportunity for Mobile Operators – study prepared by PwC, October 2019, page 8, https://www.gsma.com/iot/wp-content/uploads/2019/10/The-IoT-Big-Data-revenue-opportunity-for-operators_GSMA_IoT.pdf.

Figure 3-3: MNO addressable market across the IoT Big Data value chain (in billion USD)



Source: GSMA (2019).[125]

The specific requirements of IoT-based services, cross-border connectivity needs and potential for synergies with specialized platforms and services provide an opportunity for established global MVNOs that serve multiple business segments to profit from the growing IoT market. For example, Transatel launched “Ubigi” in October 2018 as a new brand dedicated to wireless services for the IoT service segment.[126] In March 2019, NTT acquired a majority stake in Transatel.[127]

There is also potential for start-up companies in the MVNO segment such as 1NCE, a German-based global IoT carrier founded in 2017 with access to the Deutsche Telekom network. It offers an IoT Flatrate at 10 Euro per device for 10 years (inc. 500 MB and 250 SMS). In February 2020, the company announced a partnership with China Telecom Global.[128]

125 See GSMA (2019): The IoT Big Data Revenue Opportunity for Mobile Operators – study prepared by PwC, October 2019, page 8, https://www.gsma.com/iot/wp-content/uploads/2019/10/The-IoT-Big-Data-revenue-opportunity-for-operators_GSMA_IoT.pdf.

126 See Transatel (2018): Transatel launches Ubigi, a global cellular service for the Internet of Things, press release, 3 October 2018, https://www.transatel.com/press-releases/retail-brands/transatel-launches-ubigi-a-global-cellular-service-for-the-internet-of-things/.

127 See Transatel (2019): NTT Communications Completes Acquisition of Majority Stake in Transatel, a global connectivity solution provider for the MVNO and IoT markets, 1 March 2019, https://www.transatel.com/press-releases/ntt-communications-completes-acquisition-of-majority-stake-in-transatel-a-global-connectivity-solution-provider-for-the-mvno-and-iot-markets/.

128 See 1NCE (2020): 1NCE partners with China Telecom Global to provide worldwide IoT connectivity, 13 February 2020, https://1nce.com/en/post/1nce-partners-with-china-telecom-global/.

However, MNOs and established/traditional MVNOs without a strong existing background in IoT may face some challenges in gaining a foothold in this market.

Firstly, connectivity providers compete with many other players in the IoT ecosystem and struggle to achieve a large share of the overall IoT revenues. Studies suggest that IoT projects are often implemented through specialised IT consulting companies, systems integrators and service providers which can offer IoT projects from a single source - network operators often rank behind these specialists from a customer's perspective.[129] Therefore, MNOs might only generate revenues with connectivity, but may not be able to exploit the extensive potential in the wider IoT ecosystem, while MVNOs without any specific focus in this area would have little to add.

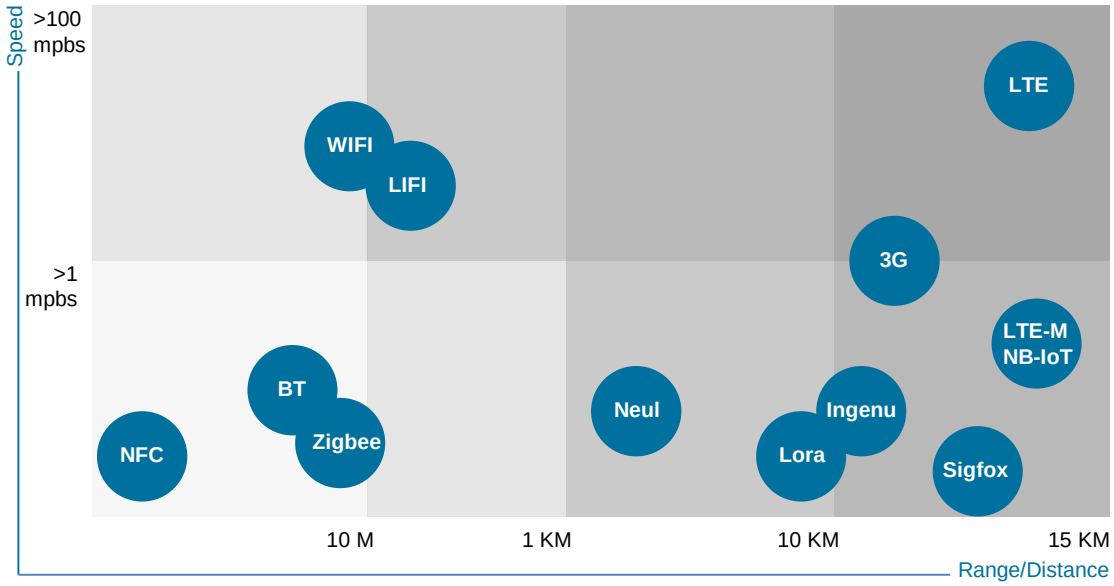
Moreover, not all IoT solutions rely on public mobile networks. A wide range of transmission technologies and standards is available for connected devices. These are based on different specifications, which vary in terms of speed and range/distance (see Figure 3-4) as well as other relevant criteria such as latency, battery life and security. There is no one-size-fits all solution for connected devices, as different IoT projects have different needs.[130] A significant share of IoT solutions are not especially sensitive to delay, send only a small amount of data and can accept slower delivery for a reduction in cost.[131] For these IoT applications, dedicated standards have been developed via low-power wide area networks (LPWAN).

129 See e.g. for Germany: Telefónica (2019): Studie Internet of Things 2019, prepared by IDG, page 21, available (in German language only) under: https://iot.telefonica.de/wp-content/uploads/2018/11/IoT-Studie-2019-Key_Findings.pdf.

130 "For example, an application that monitors the storage conditions of medical samples doesn't need to send lots of data, but reliability is critical. One which tracks the location of individual parcels doesn't need to send updates every second, but it needs to be cost-effective.", See Vodafone (2019): Your IoT-driven future – Our IoT Barometer 2019. The future is exciting. Read?, February 2019, page 19.

131 See Vodafone (2019): Your IoT-driven future – Our IoT Barometer 2019. The future is exciting. Ready?, February 2019, page 19, available for download under https://www.vodafone.com/business/news-and-insights/white-paper/vodafone-iot-barometer-2019#form-content.

Figure 3-4: IoT - Transmission technologies



Source: WIK based on Frost & Sullivan.[132]

While the LPWAN is currently in an early stage, most market experts expect high growth rates for the future.

IoT Analytics (2018) predicts more than 2 billion devices to be connected through LPWAN in 2025 globally (see Figure 3-2). LPWAN can be realised via cellular networks (LTE-M, NB-IoT) or in unlicensed spectrum (e.g. Lora, Sigfox).

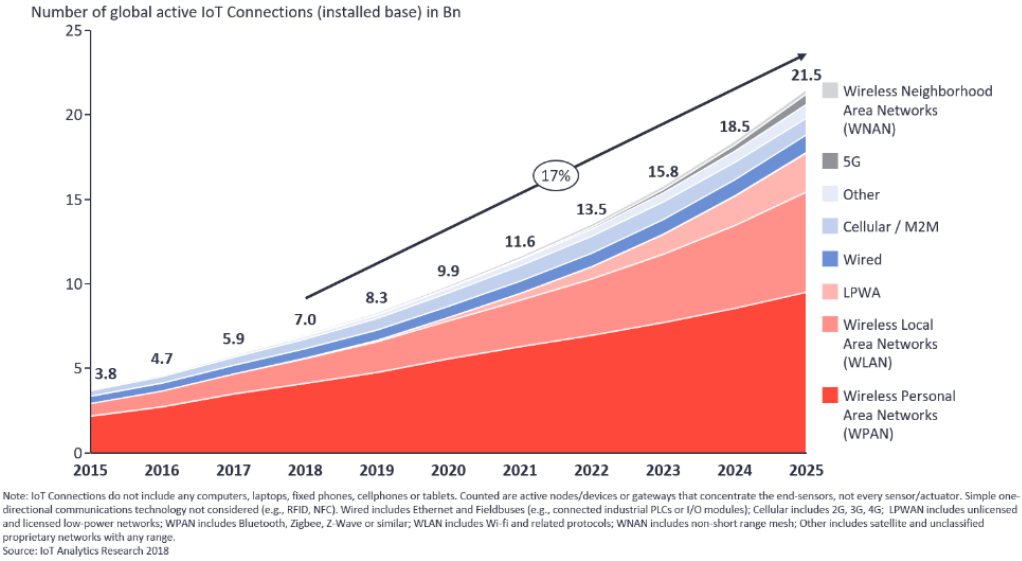
A small share of all connected devices will be delivered via 5G. These are the most critical applications in the IoT market with outstanding quality requirements (e.g. autonomous driving).

Today, most IoT devices are connected by Wireless Local Area Networks (WLAN) or by short-range technologies (WPAN, Wireless Personal Area Networks) such as Bluetooth or Zigbee (see Figure 3-5).

A forecast of expected evolution in the use of different types of technology is shown in the figure below. However, any predictions are based on uncertain factors and will need to be continuously reviewed during the coming years.

132 See Frost & Sullivan (2016): Growing Industry Applications of LPWAN Technologies, page 6, https://rfdesignuk.com/uploads/9/4/6/0/94609530/murata_lpwan_study.pdf.

Figure 3-5: IoT connections by technology (2015-2025)



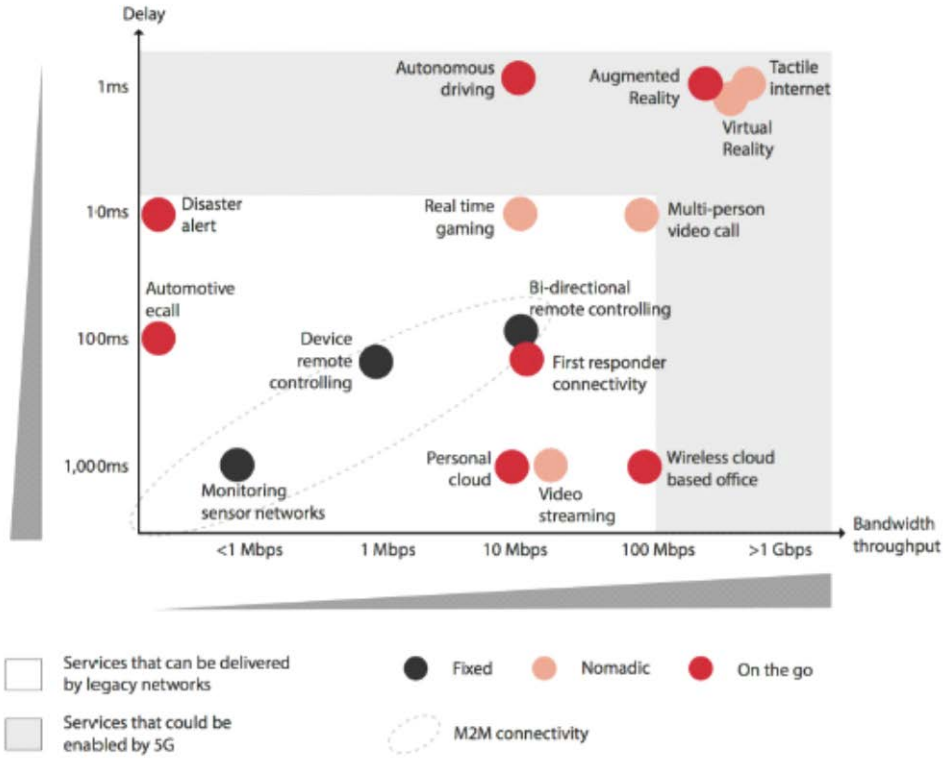
Source: IoT Analytics (2018).[133]

IoT and M2M applications are often cross-border in nature, either by virtue of the mobility of the devices concerned, such as connected cars, or due to the potential to distribute connected devices widely across Europe and beyond (e.g. in the case of connected household goods, sensors etc). This cross-border nature, coupled with the potential for innovation in the associated hardware, operating system, software and applications, presents an important opportunity for companies specialised in different segments of the IoT value chain to play a role in this market segment. Such players may act as MVNOs and/or make use of international roaming agreements to provide the underlying (often cross-border) connectivity needed to support the service, and may have an advantage over MNOs, which are not active in the IoT space, as value may be associated with the platform rather than the connectivity component of an IoT service.

The type of wholesale (MVNO or roaming) access required by IoT players varies depending on the service. While sensors may require low bandwidth (and except for specific applications), have limited reliability needs, bandwidth, latency and reliability required for autonomous driving may be significantly greater. Figure 3-6 illustrates the different requirements of M2M and other applications and highlights in this context, services which could be enabled by 5G.

133 See IoT Analytics (2018): State of the IoT 2018: Number of IoT devices now at 7B – Market accelerating, 8 August 2018, https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/.

Figure 3-6: Bandwidth and delay requirements of different applications



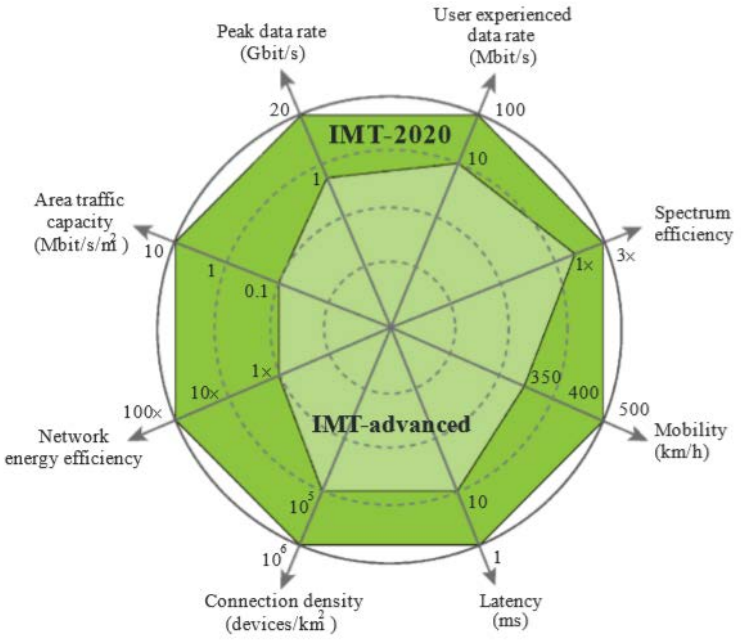
Source: Garba (2016).

3.2 5G and network slicing

5G, the next generation mobile communications technology, has been designed for the operation of advanced communication networks to enable safe and reliable connections in all sectors in order to support a wide range of innovative applications. As shown in the following chart (see Figure 3-7), 5G (IMT 2020) is expected to provide significant improvements in performance compared to the existing 4G (IMT advanced) technologies, e.g. with regard to peak data rate (Mbit/s), network energy efficiency and latency (ms). These technical capabilities will contribute to enhancing the speeds available via mobile broadband, massive device connectivity and mission-critical services as well as high availability and dense coverage.[134]

134 See e.g. PwC (2020): See e.g. PwC (2020): Securing 5G's future - Why cybersecurity is key to realising the full promise of 5G networksnetworks, https://www.pwc.de/de/technologie-medien-und-telekommunikation/pwc-securing-5gs-future.pdf, page 5.

Figure 3-7: Enhancement of key capabilities from IMT-Advanced (4G) to IMT-2020 (5G)



Source: ITU.[135]

The ability to provide “real-time” communication, i.e. very low latency (down to one millisecond) is often seen as the essential capability of 5G. This requirement applies to a variety of use cases ranging from autonomous vehicles to smart health to smart agriculture. These latencies are significantly enabled by (mobile) edge computing (MEC), i.e. the use of small data centers in the network that can process data directly at the location of the application and forward it quickly. MEC has the potential to significantly reduce latency by reducing the need for data to travel longer distances through the entire network.[136] However, edge computing requires substantial infrastructure costs.[137]

Competitive developments will depend on how commercial 5G deployments will evolve.

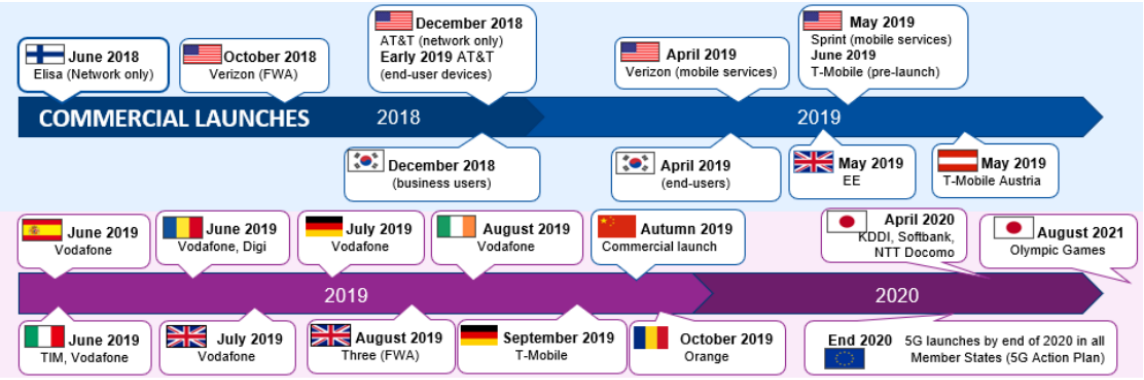
135 See ITU (n.d.). IMT-2020 BACKGROUND, available at: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Documents/060R1e.pdf.

136 See Luber, M. & Donner, A. (2019): Was ist Multi Access Edge Computing (MEC)?, available at: https://www.ip-insider.de/was-ist-multi-access-edge-computing-mec-a-830163/.

137 See Godlovitch, I. et al. (2019): Analysis of the Danish Telecommunication Market in 2030, Study for the Danish Energy Agency, December 2019, https://www.wik.org/fileadmin/Studien/2020/Analysis_of_the_Danish_TK_Market_in_2030.pdf, page 78.

European operators began to plan and build their 5G networks in 2018 and started to launch commercial services in 2019 (see Figure 3-8). The progress of 5G deployments and all related developments in the EU member states is continuously monitored in the European 5G observatory.[138] Progress in 5G deployment by selected European and other operators up to March 2020 is shown in the following figure. In Ireland, Vodafone launched 5G services in August 2019 and covered selected areas of five Irish cities.[139] Eir followed in early December 2019 with the launch of 5G services in ten towns and cities,[140] While Three Ireland launched 5G in September 2020.[141]

Figure 3-8: 5G: Commercial Launches (until March 2020)



Source: European Commission (2020).[142]

More recently 5G launches have accelerated, such as that as of March 2021, at least one MNO offered 5G in all Member States apart from Lithuania, Malta and Portugal, while all MNOs were offering some form of 5G commercial service in 13 countries.[143]

138 See https://5gobservatory.eu/market-developments/5g-services/. Latest developments are summarized in IDATE (2020): 5G Observatory Quarterly Report 7 Up to March 2020, a study prepared for the European Commission, http://5gobservatory.eu/wp-content/uploads/2020/04/90013-5G-Observatory-Quarterly-report-7.pdf.

139 See https://5gobservatory.eu/market-developments/5g-services/.

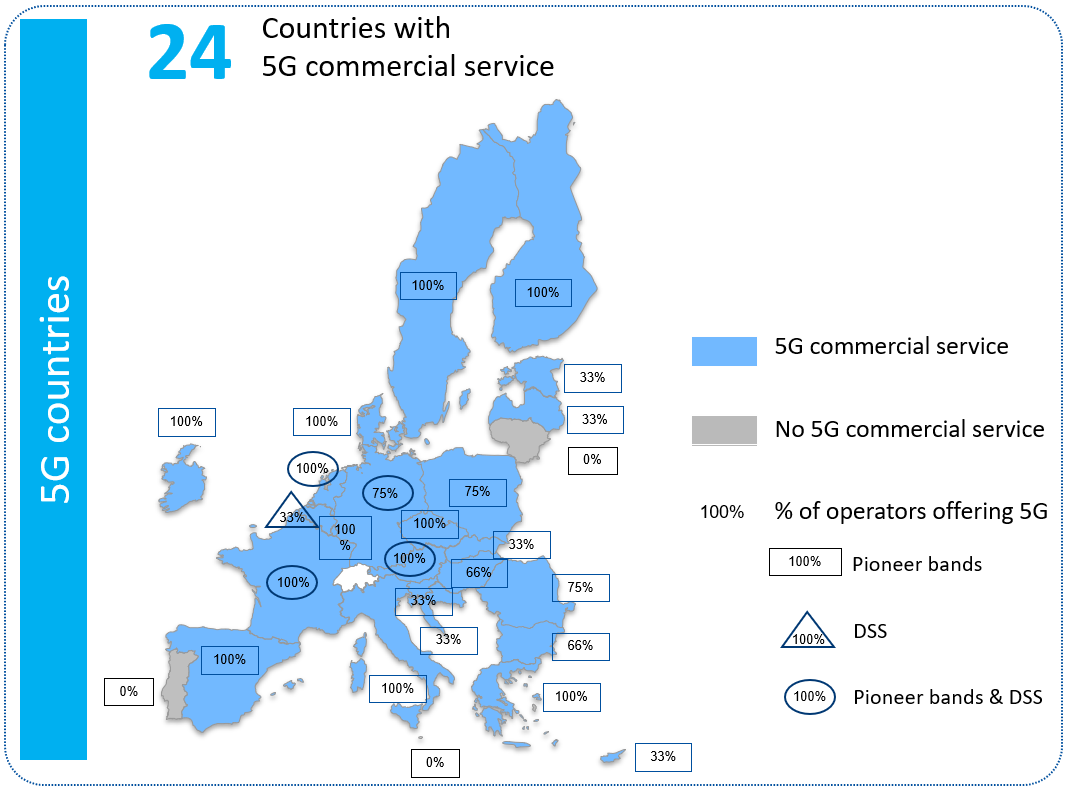
140 See Eir (2020): https://www.eir.ie/5G/.

141 See https://www.ericsson.com/en/news/3/2020/ericsson-and-three-launch-5g-in-ireland.

142 See European Commission (2020): International scoreboard, March 2020, http://5gobservatory.eu/observatory-overview/5g-scoreboards/.

143 In addition, in Germany, all MNOs apart from the new entrant 1&1 Drillisch, where the network infrastructure is still in development, offered 5G.

Figure 3-9: 5G service in EU countries, March 2021



Source: IDATE DigiWorld.[144]

However, the 5G service offerings in Europe are mainly limited to enhanced mobile broadband and 5G FWA.

The effective capability of 5G strongly depends on a range of key technologies.[145] Among them, Software Defined Networking (SDN) and Network Functions Virtualization (NFV) play a major role. These complementary and interdependent technologies support the virtualization and software based approach to operating networks. While SDN is intended to manage the network dynamically and enables networks-as-a-service, NFV focuses on the virtualization of resources and providing network functions for higher-layer network services.[146] It can be expected that SDN and NFV will be instrumental in the development and roll-out of innovative services, applications, and

144 See European 5G Observatory: https://5gobservatory.eu/observatory-overview/5g-scoreboards/.
145 See Godlovitch, I. et al. (2019): Analysis of the Danish Telecommunication Market in 2030, Study for the Danish Energy Agency, December 2019, https://www.wik.org/fileadmin/Studien/2020/Analysis_of_the_Danish_TK_Market_in_2030.pdf, page 77 ff.
146 See ETSI (2019). Network Functions Virtualisation (NFV), available at: https://www.etsi.org/technologies/nfv.

products as well as in facilitating major trends with substantial economic and societal impact. In addition, virtualization offers cost-saving potential in network operation and usage.[147] In addition to saving cost, SDN and NFV might improve the flexibility and automatization involved in operating networks.

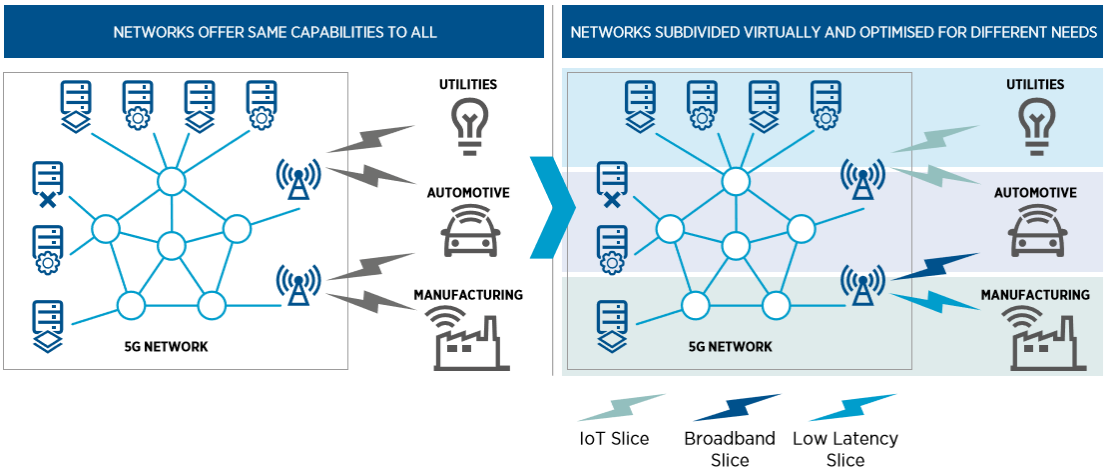
Network Slicing is another key technology with high relevance for 5G, as it enables the creation of two or more virtual networks with different performance parameters over a single physical network infrastructure.[148] Each virtual network can be dedicated to a specific use case to meet the related requirements (see Figure 3-10). Therefore, network slicing has a significant potential for some important use cases (e.g. intelligent mobility, smart city) and offers opportunities for business models in these areas.[149]

147 E.g. Virtual Network Platform as a Sevice (VNPaaS) is expected to achieve savings up to 7.1% in total telco costs for companies. Savings enabled by the virtualization of mobile core networks may range from 3.7% to 5% of the total costs of telecommunication providers, see Godlovitch, I. et al. (2019): Analysis of the Danish Telecommunication Market in 2030, Study for the Danish Energy Agency, December 2019, https://www.wik.org/fileadmin/Studien/2020/Analysis_of_the_Danish_TK_Market_in_2030.pdf, page 77.

148 See ITU (n.d.). IMT-2020 BACKGROUND, available at: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Documents/060R1e.pdf and GSMA (2019): The 5G Guide – a reference for operators, https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf page 188.

149 See GSMA (2018). Network Slicing Use Case Requirements, available at: https://www.gsma.com/futurenetworks/wp-content/uploads/2018/07/Network-Slicing-Use-Case-Requirements-fixed.pdf.

Figure 3-10: Concept of network slicing



Source: GSMA (2019).[150]

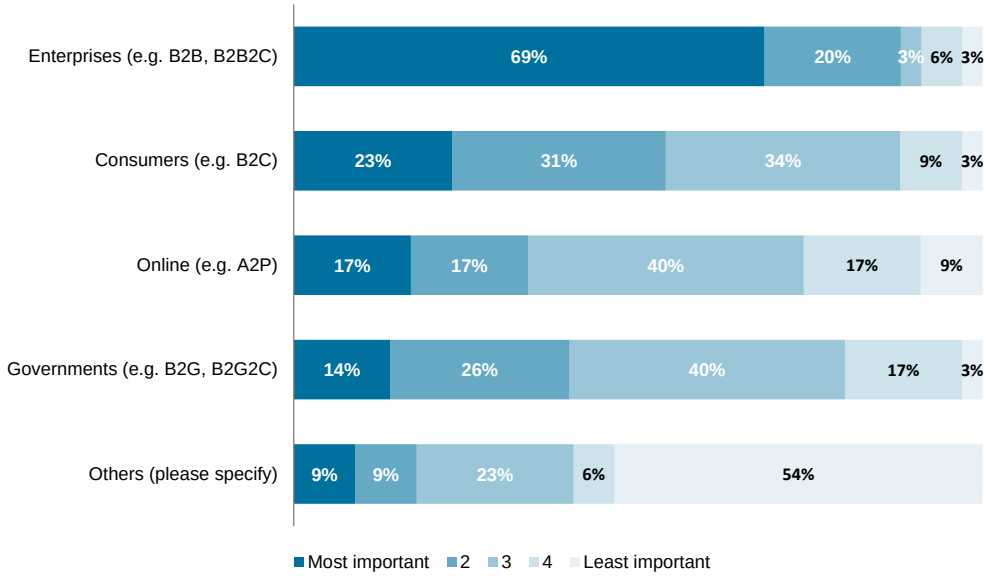
In total, GSMA expects incremental revenues enabled by Network Slicing to reach $300 billion by 2025.[151]

The most significant opportunities can be expected in the Enterprise segment (B2B, B2B2C) through the provision of customized service levels for different enterprise verticals. According to a GSMA survey among 750 operators, the enterprise segment is likely to be by far the most important contributor to incremental revenues associated with 5G (see Figure 3-11).

150 See GSMA (2019): The 5G Guide – a reference for operators, https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf, page 188.

151 See GSMA (2018): Network Slicing Use Case Requirements, available at: https://www.gsma.com/futurenetworks/wp-content/uploads/2018/07/Network-Slicing-Use-Case-Requirements-fixed.pdf, page 18.

Figure 3-11: 5G: Revenue opportunities by customer segment



Source: GSMA (2018).[152]

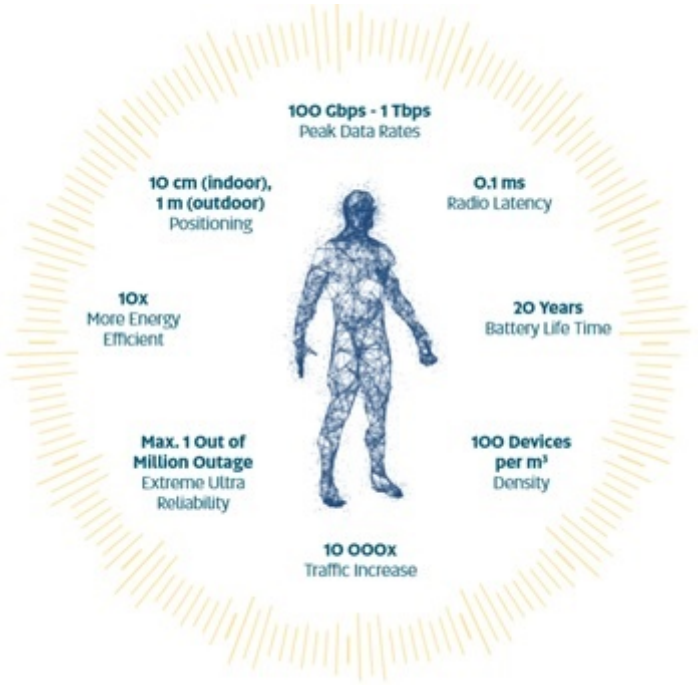
While 5G is still at an early stage with regard to deployment, 6G is already being developed, with plans for it to be made available from about 2030.[153] Under current plans, 6G will retain the current architecture of mobile networks, but aims to provide an even better level of quality of service such as determined latency. Thus, 6G will be designed to meet the expectations of e.g. AI inspired applications. Proposed Key performance indicators for 6G are shown below (see Figure 3-12).[154]

152 See GSMA (2018): Network Slicing Use Case Requirements, available at: https://www.gsma.com/futurenetworks/wp-content/uploads/2018/07/Network-Slicing-Use-Case-Requirements-fixed.pdf, page 13.

153 See Pouttu, A. (2018): 6Genesis – Taking the first steps towards 6G, available at: http://cscn2018.ieee-cscn.org/files/2018/11/AriPouttu.pdf.

154 See 6G Flagship (2019): Key Drivers and Research Challenges for 6G Ubiquitous Wireless Intelligence, available at: http://jultika.oulu.fi/files/isbn9789526223544.pdf.

Figure 3-12: Next generation mobile - 6G Key Performance Indicators



Source: 6G Flagship (2019).[155]

5G and subsequent technological developments in mobile present both an opportunity and a threat to MVNOs. On the one hand, the capabilities that 5G has for network slicing provide opportunities for innovation in the fields of IoT, and industrial applications, which could be leveraged by specialised companies relying on MVNO or roaming access.

However, the potential for MVNOs to innovate in this way depends on having effective access to network slices and the freedom to adapt the characteristics of the connectivity offered to meet the needs of the service concerned.

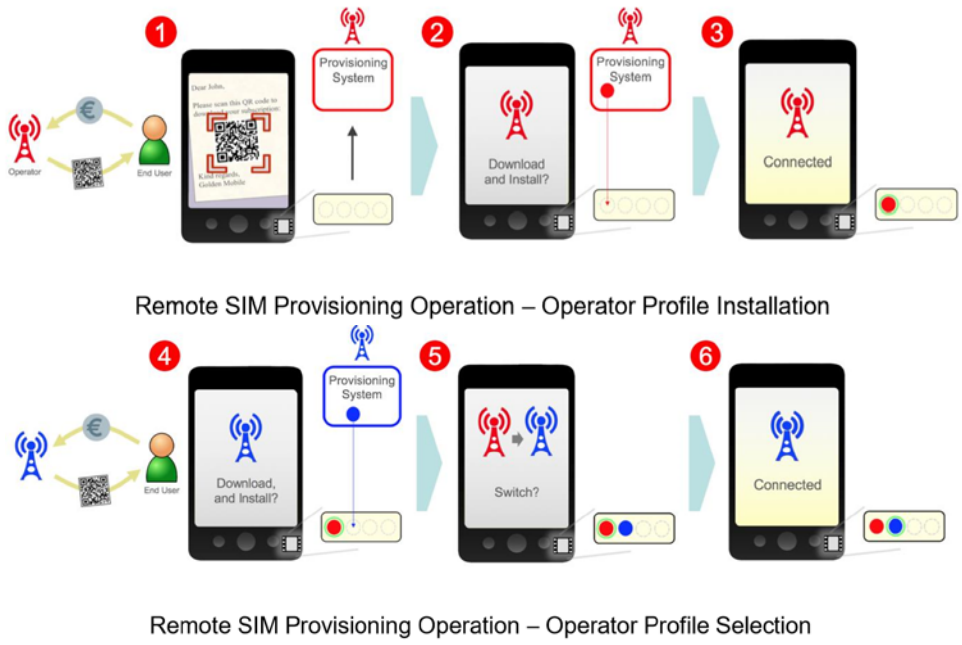
5G may also present a threat to MVNOs providing customer connectivity, as it requires new investments and MVNOs may not be able to compete effectively in 5G-based data offers, if they are not offered 5G access at the same time or under the same conditions as their host.

155 See 6G Flagship (2019): Key Drivers and Research Challenges for 6G Ubiquitous Wireless Intelligence, available at: http://jultika.oulu.fi/files/isbn9789526223544.pdf.

3.3 Embedded SIM (eSIM)

The embedded SIM (eSIM)[156] can be distinguished from traditional SIM cards mainly by its capability for remote SIM provisioning which allows operator switching without changing the SIM card (see Figure 3-13).

Figure 3-13: Remote SIM provisioning operation process (for consumer solutions)



Source: GSMA (2018).[157]

Remote provisioning is a software component that defines how operator and subscription profiles are delivered and managed on a SIM. The form factor of the eSIM can range from soldered to removable SIMs. The latest developments include the iSIM (integrated SIM) with the SIM functionality integrated into an existing chipset and the resulting chipset with SIM capabilities being implemented alongside other use cases (e.g. secure storage).[158]

156 Often also referred to as eUICC, i.e. Embedded Universal Integrated Circuit Card which is in a narrower sense the secure element in the eSIM solution, see GSMA (2018): eSIM Whitepaper - The what and how of Remote SIM Provisioning, March 2018, https://www.gsma.com/esim/wp-content/uploads/2018/06/eSIM-Whitepaper-v4.11.pdf, page 6.

157 See GSMA (2018): eSIM Whitepaper - The what and how of Remote SIM Provisioning, March 2018, https://www.gsma.com/esim/wp-content/uploads/2018/06/eSIM-Whitepaper-v4.11.pdf, page 5-6.

158 See Sealy, Phil (2019): The true value proposition of the eSIM, study published by ABIreserach and TATA Communications,

Each eSIM contains the operator and subscriber data that would otherwise have been stored on a traditional SIM card.[159] Profiles are downloaded remotely over-the-air. They remain the property of the operator as it contains items "owned" by them, e.g. IMSI, security algorithms, and are supplied under the related licence. While the general concept of eSIM is simple, its implementation process is complex and requires extensive resources to enable mobile connectivity providers to test and adopt the related business processes.[160]

Standardisation processes for eSIM date back to 2011 and have been mainly driven by the GSMA (GSM Association).[161] The GSMA members include around 800 mobile network operators and 300 companies worldwide (e.g. from mobile-related hardware and software sectors). A first architecture for eSIM in M2M was published by the GSMA in December 2013.[162] A separate specification for the consumer sector was released in October 2016.[163] Meanwhile, uniform technical architectures and interfaces have been developed for both areas. However, the GSMA specification is constantly evolving.[164]

eSIM offers the same capabilities in relation to traditional data, voice and SMS services as traditional SIM. Some market experts interviewed for a former WIK study indicated that the eSIM might involve more security risks than the traditional SIM due to the remote programming requirement.[165]

However, eSIM has some distinct advantages over traditional SIM. For M2M use cases, eSIM offers new options for device construction and use cases. eSIM is most useful for applications which require a remote update of settings. For these reasons, the deployment of eSIM for M2M has proven to be very efficient in solving logistics issues, and in allowing devices to cross borders seamlessly without disruption for the end

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https://www.tatacommunications.com/wp-content/uploads/2019/09/The-True-Value-Proposition-of-the-eSIM-3Q-2019-1.pdf, page 3-4.

159 See for any further details with regard to the GSMA definition GSMA (2018): eSIM Whitepaper - The what and how of Remote SIM Provisioning, March 2018, https://www.gsma.com/esim/wp-content/uploads/2018/06/eSIM-Whitepaper-v4.11.pdf, page 5.

160 See Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf, page 22 ff.

161 See Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf, page 24.

162 See GSMA (2014): Benefits Analysis of GSMA Embedded SIM Specification on the Mobile Enabled M2M Industry, https://www.gsma.com/iot/wp-content/uploads/2014/10/Benefits-Analysis-GSMA-Embedded-SIM-Specification.pdf, page 3.

163 See GSMA (2015): RSP Technical Specification Version 2.0 14 October 2016, https://www.gsma.com/newsroom/wp-content/uploads/SGP.22_v2.0.pdf.

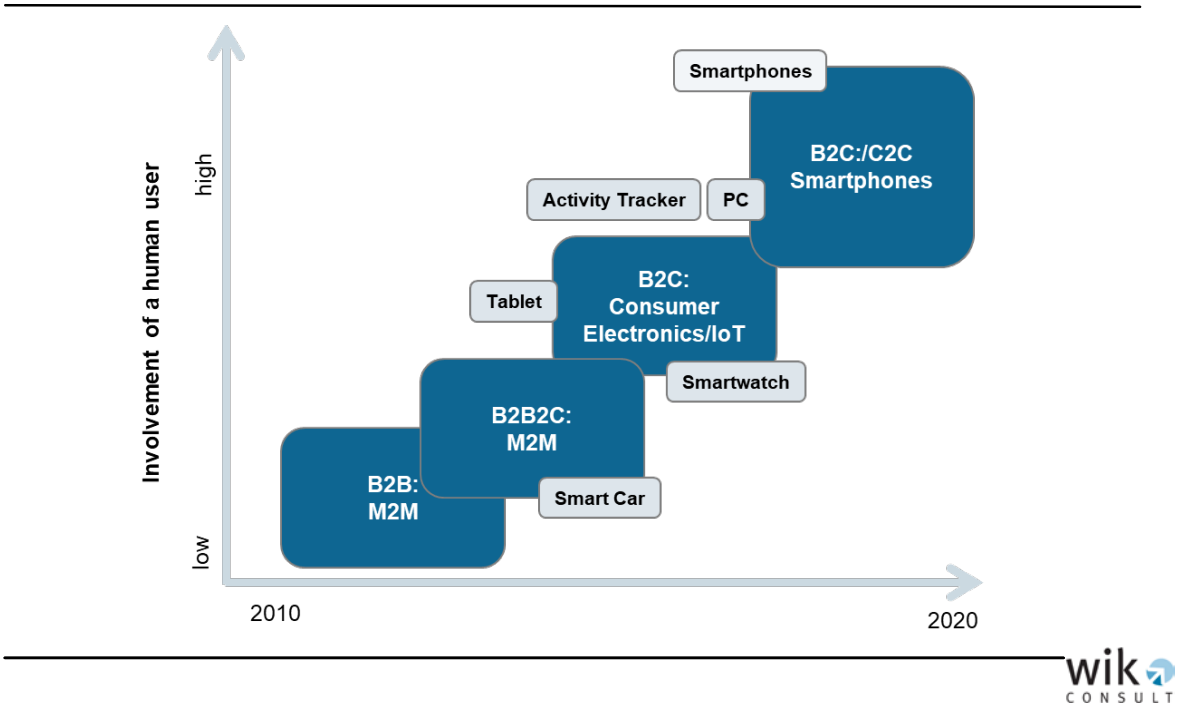
164 The current GSMA specification in version 2.2.1 of December 2018 is available at https://www.gsma.com/newsroom/all-documents/sgp-22-technical-specification-v2-2-1/.

165 See Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf, page 24.

user.[166] eSIM also enables direct connectivity for small devices in the consumer segment such as smart watches, fitness bands, personal trackers and portable health systems. Multi-device-contracts might be developed to offer a single contract for several devices. Moreover, remote provisioning offers the potential to significantly reduce switching barriers. For M2M/IoT use cases, eSIM is in some cases essential to be able to switch operators while maintaining the same devices, as swapping out physical SIMs is often not feasible. This advantage might be relevant in specific use cases such as roaming.[167] Here, eSIM might facilitate the use of alternative offers compared with traditional SIM cards (e.g. the use of local operators in a visited country).

eSIM products were launched around ten years ago in the M2M-segment (see Figure 3-14) and slowly moved into the consumer segment via implementation in consumer equipment such as connected cars.

Figure 3-14: eSIM: product launch phases from M2M to Consumer



Source: WIK.

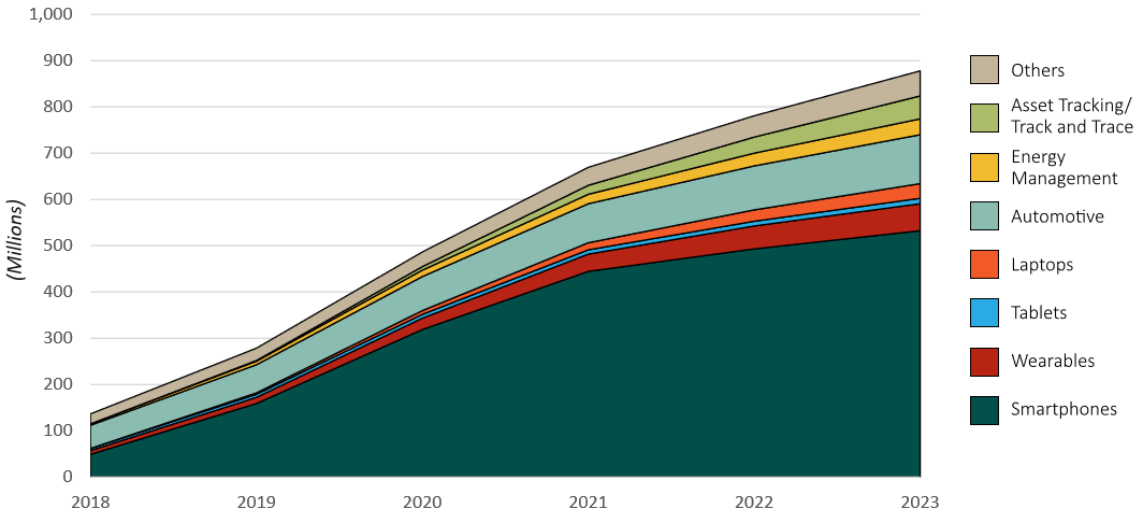
The development of eSIM for personal equipment in the consumer segment has been primarily driven by manufacturers such as Apple and Samsung.

166 See e.g. Spanjaard, T. (2018): Consumer eSIM not likely to happen soon!, 1 May 2018, in: Smart Insights, https://www.smartinsights.net/single-post/2018/05/07/Consumer-eSIM-not-likely-to-happen-soon.

167 For a detailed analysis of the relevance of eSIM for roaming see Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf.

- Apple first introduced the iPad in 2010 and launched its tablet iPad Air 2 with an Apple SIM embedded in 2013.
- The next stage of consumer eSIM was the launch of wearables, especially smartwatches (e.g. the Samsung Gear watch in November 2016 and the Apple watch in September 2017). Overall, SIM-equipped smartwatches are still "niche" products and seem to be less popular than smartwatches without SIM.
- A major step in the consumer segment was taken by the launch of eSIM in smartphones. Google launched its first eSIM-capable smartphone Google Pixel in 2017, but its reach was quite limited. Apple first implemented the eSIM in some iPhone models in September 2018. Huawei and Samsung followed later. Abi Research expects more than 500 eSIM smartphone shipments in 2023 (i.e. about 30% of the total handset market) (see Figure 3-15).[168]

Figure 3-15: Total eSIM shipments by ddevice/application, worldwide, forecast by ABI Research 2018 to 2023



Source: ABI Research quoted by Tata Communications (2019).[169]

168 See Sealy, Phil (2019): The true value proposition of the eSIM, study published by ABIreserach and TATA Communications, https://www.tatacommunications.com/wp-content/uploads/2019/09/The-True-Value-Proposition-of-the-eSIM-3Q-2019-1.pdf, page 8.

169 See Sealy, Phil (2019): The true value proposition of the eSIM, study published by ABIreserach and TATA Communications, https://www.tatacommunications.com/wp-content/uploads/2019/09/The-True-Value-Proposition-of-the-eSIM-3Q-2019-1.pdf, page 6.

For **MNOs**, eSIM has a higher potential downside in the consumer than in the M2M/IoT business. While eSIM in the IoT segment offers potential for incremental revenues (see 0.), it might increase competition from alternative providers in the consumer segment. Therefore, MNOs were reluctant to promote eSIM for consumers following its introduction into this segment by manufacturers.

MNOs' reluctance to promote eSIM for consumer use is evidenced inter alia by the fact that:

- MNOs were important drivers behind the GSMA specification which includes some restrictions with regard to a flexible switching process, e.g. only one profile can be activated at the same time.[170]

- The on-paper QR-code-based activation process, which is still the used activation process of many MNOs seems to be too complex to provide ease of use and to be convenient for addressing the mass market, especially if the QR code is sent via post.

- Certain MNOs do not encourage their customers to activate the eSIM in the respective devices.[171] Most European MNOs still provide a physical SIM card as default when signing a new contract and offer eSIM only upon request. eSIM is often not actively promoted on MNOs websites.[172]

- Finally, some competitive issues have arisen even at this early stage of eSIM market development. In the US, the Department of Justice opened a probe into alleged coordination by AT&T, Verizon and the GSMA which were accused of slowing down the adoption of eSIM standards. It was rumoured that the investigation had been initiated by Apple.[173] After an almost two-year long investigation, the Justice Department concluded that GSMA had influenced the

170 It has been reported that the iPhone 13 will feature dual eSIM support for the first time - https://9to5mac.com/2021/09/14/iphone-13-and-iphone-13-pro-feature-dual-esim-support-for-the-first-time/. However, it is not clear whether this support involves using a different specification from that established by the GSMA (SGP.22 v.2.3 (June 2021), page 200ff) or relies on the installation within the phone of two eSIMs.

171 For example, in its FAQ for consumers, Deutsche Telekom points out that the advantage of the eSIM is the possibility to use two different contracts on a smartphone. Regarding the use of the iPhone with a single contract, Telekom recommends its customers to prefer a physical SIM. It explains to them that the physical SIM-card can be simply inserted into another device, when the battery is empty (and no charger at hand) and claims that an eSIM profile is not easily transferred from one device to another, See FAQ https://www.telekom.de/hilfe/geraete-zubehoer/handy-smartphone-tablet/apple/iphone/iphone-xs-iphone-xs-max/vorteile-esim-beim-iphone?samChecked=true.

172 This is also reflected in a survey by Mobile World Live on behalf of Truphone conducted in 2021 among 371 MNOs, consumer device manufacturers and M2M manufacturer around the globe. More than 70% of respondents somewhat or strongly agreed with the statement "operators are holding back the potential of the eSIM market". See Mobile World Live (2021): How eSIM is transforming connectivity for consumers and enterprises, page 9, available upon request at https://www.mobileworldlive.com/truphone_esim_transforming_connectivity.

173 It is rumoured that the investigation had been initiated by Apple., See e.g. Spanjaard, T. (2018): Consumer eSIm not likely to happen soon!, 1 May 2018, in: Smart Insights, https://www.smartinsights.net/single-post/2018/05/07/Consumer-eSIM-not-likely-to-happen-soon.

design of eSIM technology in mobile devices in a way that would limit disruptive competition. In response to a Business Review Letter from the Justice Department, the GSMA agreed to adopt new procedures and implement the required changes into the standard-setting process.[174]

In Singapore, a public consultation was initiated in Summer 2018 to address the proposal of extending Singapore's current "no SIM-lock" policy[175] to eSIM-enabled devices. It was proposed to forbid operators and MVNOs from locking devices imported into or sold in Singapore. Other proposals include a "light touch" licensing approach where device manufacturers, importers and sellers are only required to register eSIM devices with the IMDA and to obtain a telecoms dealer's (class) license.[176]

eSIM offers new potential for **MVNOs** due to its remote programming capabilities. eSIM is very likely to provide significant advantages for multi-national MVNOs that sell services directly to end-users or MVNEs/As that offer mobile connectivity to mobile resellers or industries engaging in IoT.[177] In recent years, this business model has expanded as MVNO succeeded in winning important contracts with large automobile manufacturers to provide in-car connectivity (e.g. Truphone's with Kia, Cubic with Audi).[178] Players such as Transatel have also increasingly moved into the IoT space. Analysys Mason estimated in 2018 that at least 20 firms (excluding MNOs) are offering worldwide or regional IoT connectivity. The potential to use a secondary data connection for roaming through eSIM also provides scope for MVNO/As to gain more of a foothold in the consumer roaming market. MVNO/As such as Truphone and Gigsky have taken advantage of this opportunity.[179]

174 See US Department of Justice (2019): Justice Department Issues Business Review Letter to the GSMA Related to Innovative eSIMs Standard for Mobile Devices, 27 November 2019, https://www.justice.gov/opa/pr/justice-department-issues-business-review-letter-gsma-related-innovative-esims-standard.

175 "The No SIM-lock policy was introduced in 1997 in a physical SIM card and Consumer device only world. This policy states that mobile operators are not allowed to SIM-lock devices (i.e., lock the device to a specific mobile operator), such as mobile phones, tablets and wearables (e.g., smart watches) that are imported and sold in Singapore. This policy aimed to remove the barrier for end users to switch mobile operators, so as to facilitate competition and provide end users the freedom to choose and switch between mobile operators without the need to change their Consumer devices." See IMDA (2018): Consultation Paper issued by IMDA, 6 June 2018, https://www.imda.gov.sg/-/media/imda/files/inner/pcdg/consultations/consultation-paper/public-consultation-on-embedded-sim-technology/consultation-document-for-esim.pdf?la=en, page 5.

176 See IMDA (2018): Consultation Paper issued by IMDA, 6 June 2018, https://www.imda.gov.sg/-/media/imda/files/inner/pcdg/consultations/consultation-paper/public-consultation-on-embedded-sim-technology/consultation-document-for-esim.pdf?la=en.

177 See for a detailed analysis with reference to case studies Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf, page 62 f.

178 See Analysis Mason (2017): Predictions for IoT: investments in NB-IoT, LTE-M and new capabilities prepare operators for an active 2018, 18 December 2017, http://www.analysysmason.com/predictions-2018-iot-rdme0.

179 See Mackenzie, M.; Rebbeck, T. (2018): Contract wins by IoT MVNOs mean they should not be ignored by MNOs, February 2018, http://www.analysysmason.com/IoT-MVNO-contracts-RDME0/.

Future Outlook

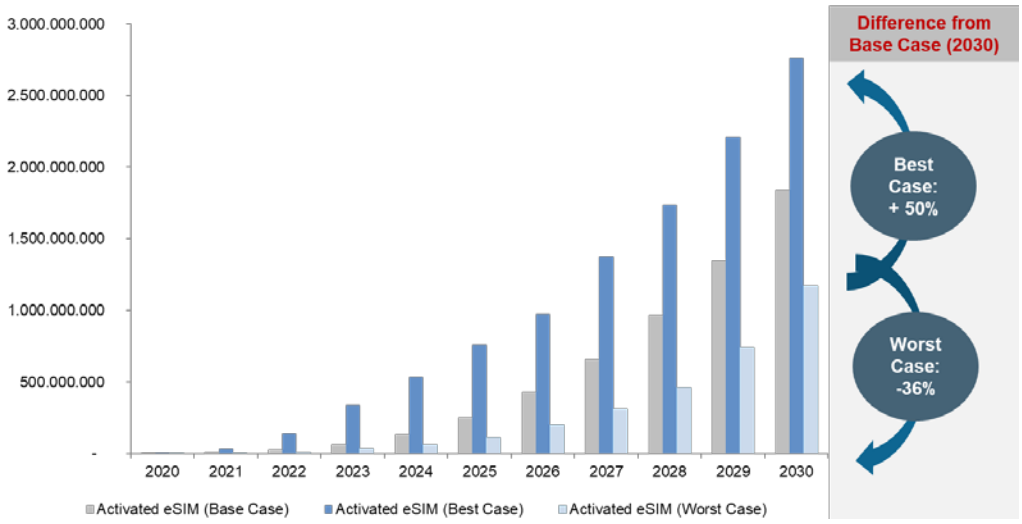
WIK has estimated the future development of eSIM for Europe and Ireland in the context of a 2021 study for ComReg concerning “Over-the-air provisioning”. In the context of that study, we concluded that in a base case scenario,[180] about 1.9 billion devices in Europe will support eSIM by 2030 with around 1.8 billion activated eSIM in the EU in 2030. These projections are founded on the assumption that:

- eSIM will gain importance in both consumer products and enterprise and IoT devices.
- A significant growth of various eSIM equipped devices can be expected, ranging from smartphones to wearables (i.e. smartwatches, smartglasses, etc.), smart speakers, smart TVs, PCs and connected cars.
- Within the M2M segment, connected cars will continue to be among the most important applications for eSIM, but the lack of a champion might hold back this segment from meeting its full potential.
- eSIM growth in the consumer market is likely to be primarily driven by the initiative of equipment manufacturers. In the medium term, more eSIM only models can be expected. However, traditional SIMs are likely to persist as not all devices will be eSIM only, and MNOs will need to continue to support previous generations of devices.

Projections on activated eSIMs in the EU are shown in the following figure.

180 In our forecast, around 90% of eSIM equipped devices will be activated in a base case scenario by 2030. The share of eSIM-enabled devices that are not activated is assumed to be mainly in the laptop and tablet segment (Microsoft Windows 10 App).

Figure 3-16: Total number activated eSIM in the EU, different scenarios (2020-2030)



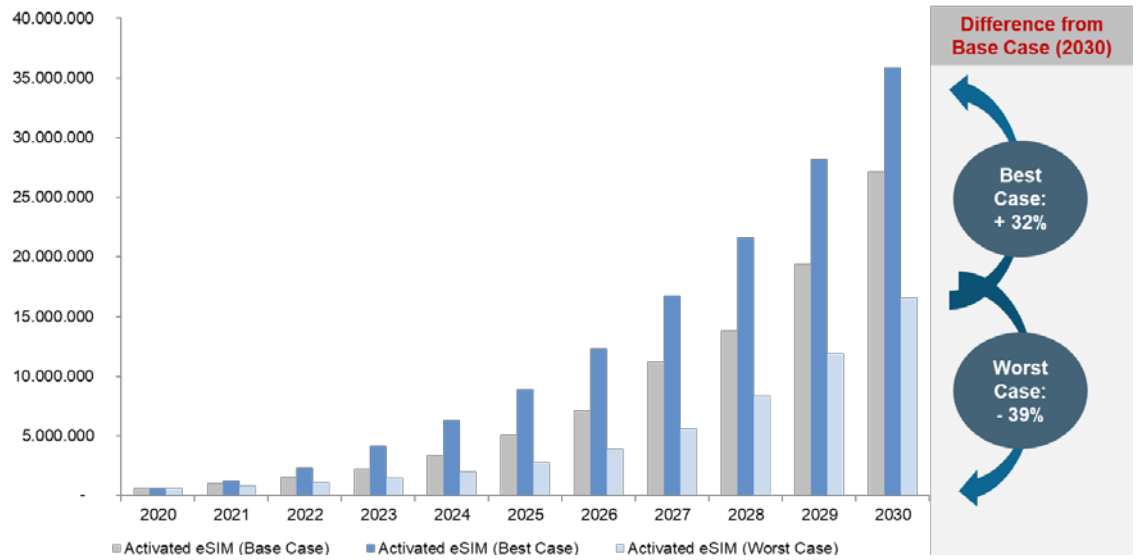
Source: WIK.

The study concludes that SIM availability in Ireland is likely to be and remain relatively high compared with other European countries. Based on consumer usage patterns, around 15% of smartphones may be eSIM-compatible, and more than 10% of vehicles are likely to support eSIM in Ireland. eSIM is also being used to support smart metering deployment by the ESB (750k in 2020).

However, we note that MNO reluctance and a lack of consumer awareness may hold back eSIM take-up in Ireland. In particular, MNOs have been slow to support eSIM, with only Vodafone making it available for a range of smartphones (but not companion devices), while Three has focused on eSIM implementation in the context of smart meters.

In a base case scenario we forecast that around 28.3 million devices in Ireland will be equipped with eSIM in 2030, and 27 million will have been activated. The results of the analysis are shown in the following chart.

Figure 3-17: Total number of activated eSIM in Ireland, different scenarios (2020-2030)



Source: WIK.

Implications for competition and impact on MVNOs

eSIM has played an unambiguously positive role in facilitating the entry and expansion of MVNOs specialized in IoT, connected devices and specialized roaming services. The ability of eSIM to support remote provisioning has been especially important in this respect. However, it is still relatively early days for the development of this segment, and it is possible that challenges may arise e.g. in relation to switching.

The opportunities from eSIM are likely to arise in particular for MVNOs serving specific niches. One beneficiary is likely to be the travel MVNO, an MVNO that is focused on providing a (potentially data-only) eSIM profile potentially for a time-limit period to those seeking to avoid roaming charges during vacations or business travel. These MVNOs have a very fluid (potentially global) customer base, and rely on a lean digitized business model. Examples are Ubigi (brand of Transatel), Sim Local or Truphone. Some of these players have a focus specifically on business customers. MVNOs that have contracts with more than one MNO within a country and use automatic switching technology to provide customers with the most reliable connection where they are at could also become more common with eSIM.[181] Another business model relying on eSIM could involve automatically assigning users to an MNO based on which of the

181 This would be a business model comparable to Google Fi in the US, see https://fi.google.com/about/faq/.

operators currently has the least network load (and thereby potentially offers the lowest wholesale price).[182]

The impact of eSIM on competition and the ability for MVNOs to exploit it to gain entry and expand in the traditional domestic consumer segment is harder to predict, and the effects may differ for different players. If eSIM is implemented in consumer devices in a way which facilitates switching, this could be beneficial for MVNOs with smaller customer bases or which have just entered the market, but could equally be detrimental to more established consumer MVNO providers which could risk losing customers e.g. to sub-brands targeting similar markets. When eSIM becomes widespread in the consumer space, it will also require full MVNOs to make investments to support this technology. While eSIM support by MVNOs is not absolutely necessary from the moment that eSIM becomes available, it will become essential as soon as eSIM-only devices, especially handsets, launch and gain a foothold in the market. Moreover, in the absence of eSIM support, MVNOs would effectively be foreclosed from offering eSIM support to customers with flagship handsets which, after a period of time, could entail a significant portion of the Irish market, especially as the innovations which are currently specific to premium handsets are integrated into more mass-market products.

Notwithstanding potential negative effects for specific MVNOs and MNOs of improved switching capabilities, support for switching is likely to be a key benefit to consumers (and industrial users) of mobile devices. Continued monitoring and if necessary intervention by competition authorities and regulatory bodies will be needed to ensure that, as they evolve, standards are set in a manner which facilitates switching. The intervention of the US Justice Department provides an important example of this kind of action. Monitoring and intervention at EU level may also be important.

The inclusion of the SIM functionality within the hardware also presents an important potential threat to both MNOs and MVNOs, as it could increase the potential for hardware manufacturers to control or steer customers towards specific connectivity solutions. This issue may be relevant in the context of the development of proposals to regulate digital platforms via a potential competition tool or ex ante regulation, in cases where platform owners may be in a position of market power or can act as gatekeepers.

3.4 Developments in messaging services

In addition to new generations of network technologies and SIMs, there are also developments that aim to support increased functionality in voice and messaging services provided via mobile phones.

182 See Meukel, M.; Schwarz, M., and Winter, M. (2016): E-SIM for consumers – a game changer in mobile telecommunications, 1 January 2016, available at: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/e-sim-for-consumers-a-game-changer-in-mobile-telecommunications.

3.4.1 Rich Communications Services (RCS)

Rich Communications Services (RCS) is the approach of the MNOs and other members of the GSMA to further develop messaging services. Like mobile telephony and SMS, it is designed to be interoperable across mobile networks.

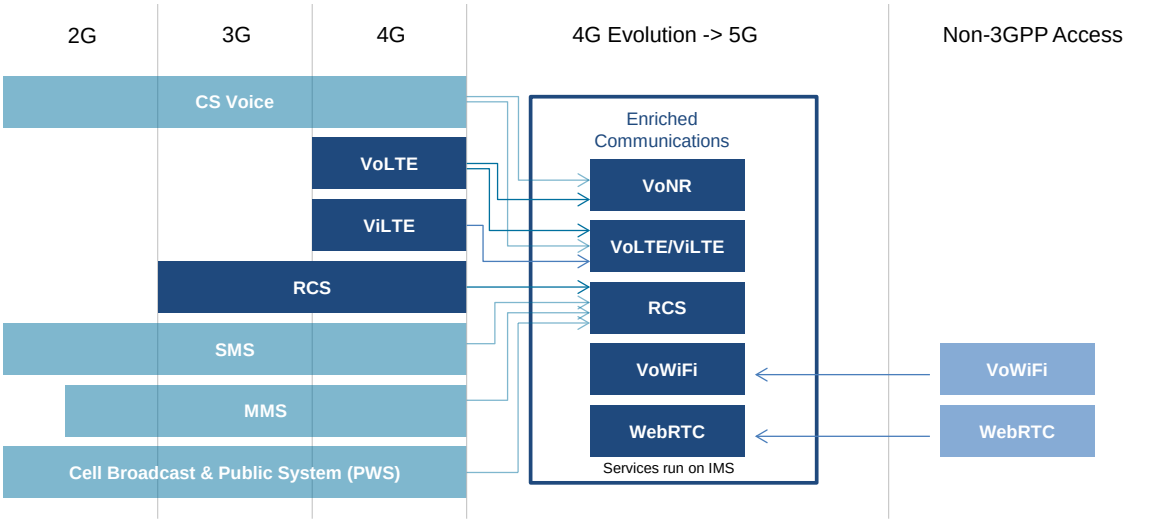
It is based on the GSMA universal profile specification as an industry standard for advanced communications. According to GSMA, 47 MNOs, 11 manufacturers and 2 operation system providers have committed to support the standard.[183]

Rich Communications Services (RCS)[184] was originally conceived as the evolution of SMS. RCS was developed within GSMA towards the end of the 2000s[185] as an advanced messaging service based on the IP Multimedia Subsystem (IMS). While the first introduction of RCS by various mobile operators around 2012 was not successful, Google's recent push to introduce RCS as "Chat" on Android devices may be a more promising attempt to establish RCS as a new 'default' messaging service.

RCS forms part of a range for enriched communications (see Figure 3-18). For RCS to function both the sender as well as the recipient need to have a device which is RCS ready, to have an RCS client installed, and to be subscribed to an operator enabling RCS. If one of these requirements is not met, RCS messages cannot be sent or received, which is likely to hamper the swift adoption of this technology.

183 See GSMA (2020): https://www.gsma.com/futurenetworks/universal-profile/.
184 GSMA. 2018. RCS Universal Profile Service Definition Document - Version 2.3. Note: RCS are also known as "joyn", "message+", "SMS+" or "advanced messaging".
185 Release 1 of the Rich Communication Suite was in 2008.

Figure 3-18: Evolution of RCS in the context of other communication services



Source: GSMA (2019).[186]

The available releases of the specification will enable two steps towards future messaging by MNOs:

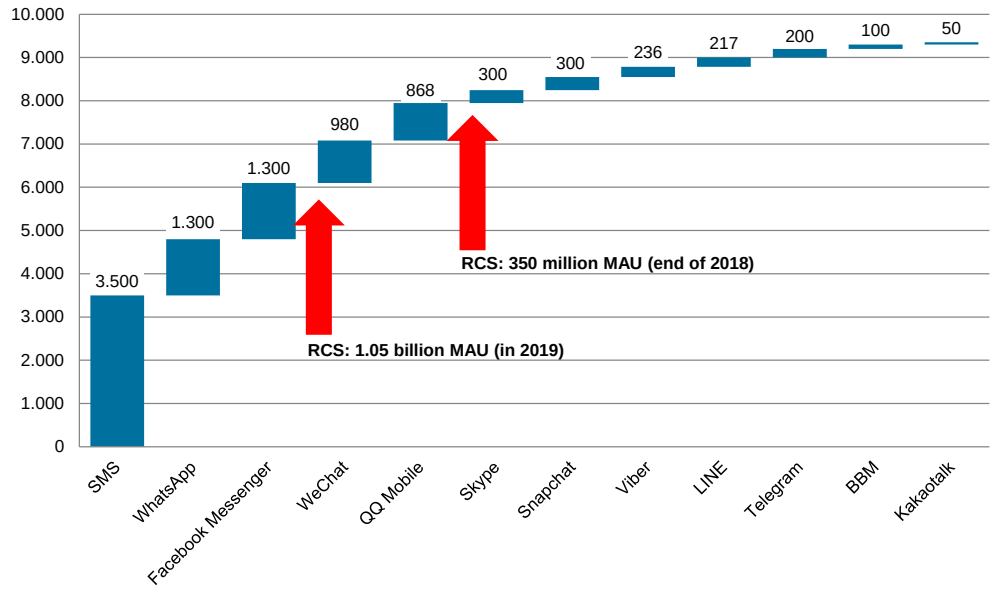
- Release 1 includes core features such as capability discovery which will be interoperable between regions, chat, group chat, file transfer, audio messaging, video share, multi-device, enriched calling, location share and live sketching.
- Release 2 (available now) introduces the key enablers for Messaging as a Platform (MaaP). It supports Application-to-Person messaging, Rich Cards, privacy control and spam protection to open up an A2P RCS business worth an estimated $74bn* by 2021.

RCS is intended to provide additional functionality compared with traditional voice and message services available on mobile phones in order to compete with the expanding OTT video-calling and messaging segment. In some cases the new functionality may mirror the functionalities available via OTT applications and should facilitate the migration from traditional network structures to all-IP networks as well as the convergence of mobile and fixed services.

186 See GSMA (2019): The 5G Guide – a reference for operators, https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf, page 58.

As can be seen in Figure 3-19, SMS still plays a significant role in the worldwide messaging market (in 2018 about 70% of all messaging app users used SMS).[187]

Figure 3-19: RCS, SMS and Messaging Apps (2018)



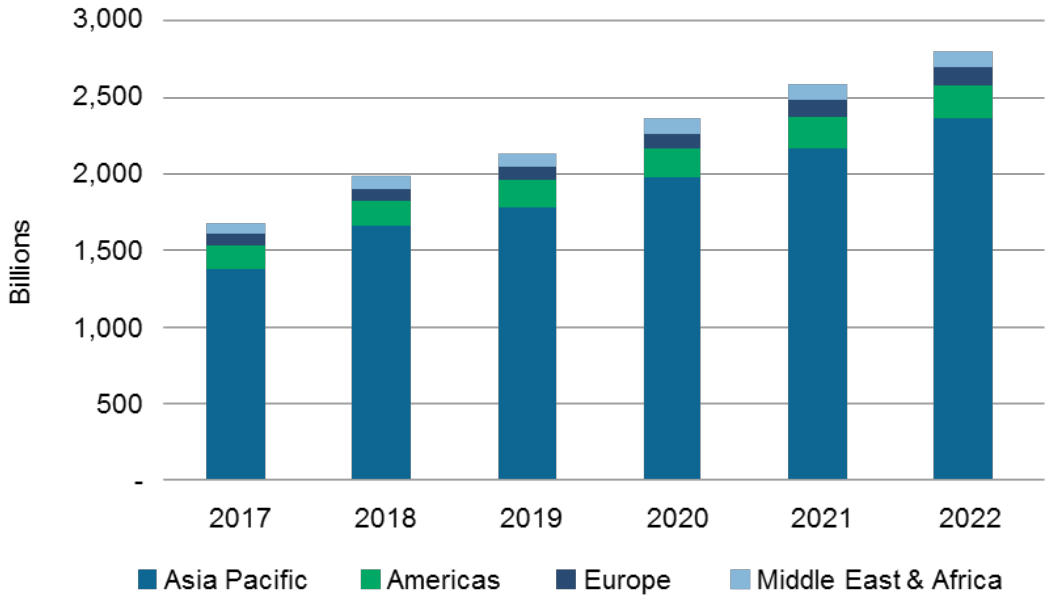
Source: WIK based on Dudley (2018).[188]

However, take-up of alternative messaging solutions including RCS has started to play a more significant role.

An important role of RCS for MNOs is its ability to deliver Application-to-Person (A2P)[189] messaging, which is currently still mostly operated using SMS. WhatsApp (WhatsApp Business) and Viber have recently begun to offer competing services. The volume of A2P messages has been growing globally. Analysts expect this growth to continue, as the additional functions of RCS offer a more attractive customer interaction than previous options available via SMS.

187 See Dudley, S. (2018): RCS: If We Build It, Will They Come?, 14 February 2018, https://www.digitalistmag.com/digital-economy/2018/02/14/rcs-if-we-build-it-will-they-come-05840073.
188 See Dudley, S. (2018): RCS: If We Build It, Will They Come? , 14 February 2018, https://www.digitalistmag.com/digital-economy/2018/02/14/rcs-if-we-build-it-will-they-come-05840073.
189 GSMA. 2017. Messaging as a Platform - The Operator Opportunity.

Figure 3-20: Total global A2P SMS messages by region (2017-22)[190]



Source: Mobilesquared (2018).[191]

3.4.2 OTT voice and messaging

OTT voice and messaging services are provided by alternative providers and have been very successful in competing with the traditional voice and messaging services of MNOs and established MVNOs. For specific use cases including calling and messaging while abroad, OTT services have significant relevance.[192]

The OTT voice and messaging segment was mainly shaped by Skype (focus on voice) and by WhatsApp (focus on messaging).

- WhatsApp was developed by former Yahoo employees in 2009 as a messaging app for smartphones. After instant success, additional features (e.g. voice calling, video calling, group calls, WhatsApp Business) have been added to the

190 The analysts at mobilesquared expect RCS on (only) Android devices "to remove 194.34 billion messages from white-route A2P SMS traffic in in 2022, while RCS clients on all smartphones would reduce total white traffic volume by 237.99 billion." (see https://mobilesquared.co.uk/2018/02/18/global-a2p-traffic-growth-by-2022/)

191 See Mobilesquared (2018): GLOBAL A2P SMS TRAFFIC TO GROW FROM 1.7 TRILLION TO 2.8 TRILLION MESSAGES BY 2022, February 18, 2018, https://mobilesquared.co.uk/2018/02/18/global-a2p-traffic-growth-by-2022/.

192 See e.g. Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf.

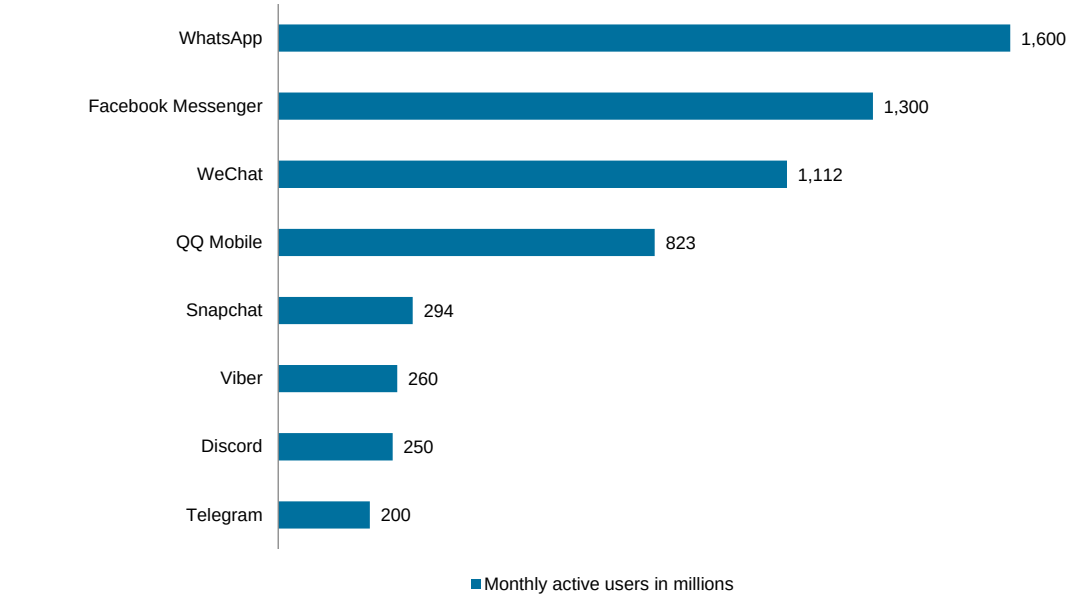
initial messaging services. By October 2011, one billion WhatsApp messages were sent each day.[193] In February 2014, WhatsApp was acquired by Facebook. While WhatsApp can still be seen as the World's leading messenger service, alternatives are available (Facebook messenger, Wechat as market leader for Chinese users, Viber, see Figure 3-21).

- Skype was leading the VoIP application with first releases in August 2003. It was an instant success. In September 2005, Skype was bought by eBay. In 2012, Microsoft acquired Skype and implemented some important changes, not only with regard to new features, but also by integrating it into its Office suite of software applications.

Since then, the technology has matured and various competing services have been launched. Today, OTT services are no longer restricted to phone calls, but extend to video. The segment is traditionally shaped by a variety of free offers (e.g. WhatsApp for voice and video call, Zoom for video conferencing). However, paid options offering better quality and additional features have been gaining importance.

193 See Iqbal, Nsoor (2020) WhatsApp Revenue and Usage Statistics (2020), https://www.businessofapps.com/data/whatsapp-statistics/.

Figure 3-21: Top Global Messenger Apps by monthly users (July 2019)



Source: WIK based on Bucher (2020).[194]

At the early stage, OTT services were used mainly by consumers. However businesses have started to use it as an alternative for traditional calls and video conferences, and the role of these services as an alternative to traditional voice for businesses has been further entrenched as a result of the requirement for virtual “meetings” during the Coronavirus epidemic.

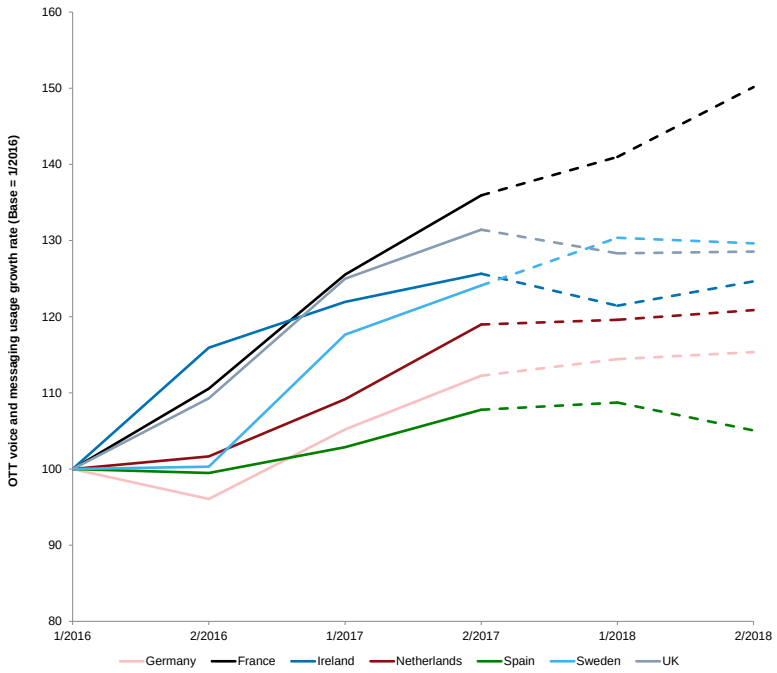
The high relevance of OTT services was also reflected in a WIK study in Germany. In 2017, 26% of national calls and even 32% of international calls by consumers were conducted using an OTT communications service. The share of messages sent via OTT services by German consumers was 73%.[195]

However, data on the usage of the most popular OTT services for interpersonal communication across a sample of countries shows that a stagnation in the usage of these services started in or after the second half of 2017 (see figure below). This may suggest that the limits of usage and substitution of OTT services with traditional telephone and messaging services may have been reached.

194 See Bucher, Birgit: WhatsApp, WeChat and Facebook Messenger Apps – Global Messenger Usage, Penetration and Statistics, February 12, 2020, https://www.messengerpeople.com/global-messenger-usage-statistics/.

195 Referring to consumers. Source: Arnold, René, & Anna Schneider. 2018. Oops, I texted again. Bad Honnef, Cologne: WIK and Fresenius University of Applied Sciences.

Figure 3-22: OTT voice and messaging usage growth rate, 2016-2018 (Base = 1/2016), percentage of all internet users



Source: WIK estimates based on data provided by the GWI on usage of Facebook Messenger, Instagram, Snapchat and WhatsApp for interpersonal communication.[196]

3.4.3 Implications for MVNOs

Although customers continue to rely on managed voice for certain use-cases (and there remains a residual proportion of customers without smartphones), a significant proportion of communication is now taking place via OTT applications transmitted via the data connection. MVNOs which historically may have relied on revenues from voice and SMS are likely to find that their niche is increasingly diminishing. At the same time, unless they have access to wholesale data on terms which support high usage, MVNOs may be less well placed than MNOs to serve customers with bandwidth-intensive communication requirements.

The move to VoLTE and RCS may have negative implications for (especially full) MVNOs, requiring investment in new capabilities and the renegotiation of interconnection agreements. Thus far, these challenges may have been avoided by

196 See Godlovitch, I. et al. (2019): Technological developments and roaming, final report, a study prepared for the European Commission, 2019, page 10, https://www.wik.org/fileadmin/Studien/2019/FinalReportSMART20180012.pdf.

relying on analogue voice, but as 5G accelerates trends towards all-IP, MVNOs may no longer be able to avoid the challenge of migration. The move to all-IP and associated cost efficiencies could also be associated with different approaches to retail tariffing, which may disrupt the business models of MVNOs which may have relied on limited bundles or per minute based charges.

Although the main concern of IoT players is likely to be access to data rather than voice, integration with IP-based mobile voice and messaging may be required in the provision of integrated bundles e.g. for in-car communications.

Thus, access to IP-based mobile voice and messaging may also become important in the context of roaming, as well as for the provision of voice and messaging services by MVNOs offerings services at the national level.

3.5 Conclusions concerning implications of technological developments for MNOs and MVNOs

The dynamics of technological developments in different interdependent areas such as. 5G, IoT, eSIM and messaging might affect the role of MNOs in the wider mobile value chain.

However, MNOs can be expected to stay in the centre of the value chain and will continue to maintain their key role in providing connectivity, as the overall effect of different technological and market trends is a rising demand for connectivity. MNOs services are provided through the assignment of certain rights of use to various spectrum bands and infrastructure that is a precondition for the wide range of smart services for private households, enterprise and public use.

Moreover, MNOs have attractive options to move down the value chain by adding content to their services and by supporting IoT applications.[197] In this respect, the business model can be enhanced and incremental revenues can be generated. At the same time it is very likely, that other players in the mobile ecosystem also take advantage of technological developments and exploit opportunities in the IoT segment.

The level of competitiveness of a specific MNO will depend on its potential to invest and expand in attractive business fields, its local market share, its position in the enterprise segment and its readiness for IoT as well as its international or global network reach.

MVNOs with different business models and strategies have opportunities to provide services enabled by IoT, 5G and eSIM. Companies such as Transatel or Cubic Telecom specialise in achieving widespread (even global) coverage via a mix of access agreements with MNOs in different countries and roaming agreements in other cases.

197 See for example Vodafone engagement in connectivity for the automotive sector https://www.vodafone.com/business/iot/end-to-end-solutions/automotive.

Such global connectivity is important for connected things such as cars, other connected devices that might be in use cross-border as well as for for connected laptops and tablets mainly used by business travellers. eSIM is an important enabler for MVNOs acting in the global IoT market. The network slicing capabilities of 5G and SDN/NFV more generally could also give full MVNOs increased scope to differentiate their offers and target services to address a broader range of market segments in addition to the consumer segment, including commercial applications in, for example, the automotive industry, healthcare and many other sectors. However, the ability for MVNOs to innovate in this area will be dependent on access to underlying 5G wholesale network slices (via MVNO access or roaming) on terms which enable them to provide the requisite quality at a cost-effective price. Sustained competition in eSIM-based IoT services may also (for certain applications) be dependent on effective remote switching capabilities.

Technological developments present more of a threat to retail-based MVNOs as they require investment and may necessitate the renegotiation of contracts with host MNOs to secure access to the latest technologies and/or terms which enable competition in more data-rich 5G services as well as IP-based voice and messaging. Moreover, increased reliance on OTT may have a disproportionate impact on MVNOs which rely for the majority of their revenue-base on calls and messaging rather than data. eSIM, if implemented in a manner that facilitates switching may also pose a challenge to existing retail MVNOs, if it facilitates the migration of their customers to competitors, including potentially sub-brands.

However, as switching provides important benefits to consumers and industrial users of mobile devices, competition authorities and regulators should follow standard-setting developments and intervene if commercial standards fail to support the full switching potential of eSIM technology.

The integration of the SIM within hardware also presents a potential challenge for both MNOs and retail MVNOs in that it may give greater control or steering ability to hardware manufacturers. The potential for hardware manufacturers which have market power to abuse such control may be worth considering in the context of the development of a potential competition law tool and/or ex ante regulation applying to digital platforms.

4 Commercial developments in mobile markets and implications for competition and consumer welfare

The technological developments shaping mobile markets may also have an impact on the business models and strategies pursued by MNOs and MVNOs. In this chapter, we consider how investment pressures linked to 5G deployment and the evolving mobile value chain are affecting the business strategies of mobile operators and service providers. Key trends we examine include the emergence of tower companies, the expansion of MNOs into neighbouring markets, including fixed broadband, content, and IoT-based services and the trend towards digital sales channels and software-based services.

KEY FINDINGS

- The high investment requirements associated with 5G may accelerate trends towards offloading towers (which is less developed in the EU than the US) and pursuit of active network sharing.
- Operators may also seek to recover their expenses by exploiting economies of scope through fixed mobile convergence and bundling at the retail level. These synergies may create further pressure towards mergers between fixed and mobile players.
- Entry in the IoT space may become more important for consumer MNOs and MVNOs as personal IoT such as smartwatches become more prevalent. Business-oriented MNOs may also seek to gain a role the provision of connectivity for industrial IoT. Domestic telecom operators may have a greater opportunity in serving domestic IoT clients, while international / mobile IoT provides opportunities for specialist MVNOs and global MNOs.
- The move to digital sales can help network providers to save cost while converting customers to the more profitable postpaid business. App-based providers with a very lean tariff and service structure can occupy profitable niches. This trend will be further accelerated by the popularization of eSIM, and may benefit some kinds of MVNOs at the expense of others, which rely on physical presence.
- The trend towards TowerCos could reduce cost and support viability of covering more rural areas. However, there is a risk that it could undermine competition in coverage and quality. The effects of market consolidation remain unclear with differing findings highlighting the challenge of building robust datasets to compare price and quality. Remedies which are often linked to consolidation may also affect the results.
- Available literature suggests that MVNOs can plan a significant role as innovators in the IoT segment, but that their impact on retail markets may be limited e.g. to specific niches. However, the ability of MVNOs to drive consumer welfare in retail markets may also depend on the access conditions under which they operate as well as the dynamism of the companies concerned.
- Device manufacturers could drive significant developments in technological progress and competition in the coming years. Device manufacturers are likely to determine the time frame in which 5G and eSIM are adopted by customers. Growing demand, e.g. for eSIM-based smartwatches, could also increase the pressure on operators to implement solutions for them. Device manufacturers and application providers could also play a role in steering customers to specific connectivity providers, especially in the context of IoT.

4.1 Structural changes to reduce cost and unlock capital

Spectrum auctions provide an opportunity for new entry in the market e.g. to expand the number of MNOs from 3 to 4. However, new entry on the basis of 5G has occurred in only a few countries (such as Germany and Japan, see chapter 6).

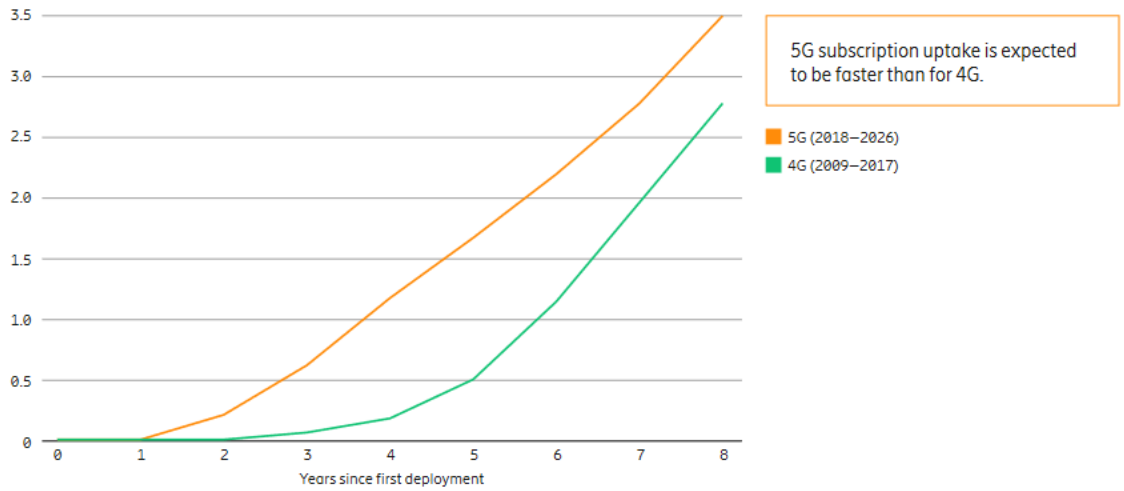
Conversely, there are a number of factors which may tend towards consolidation in connection with the deployment of 5G. Key pressures in this regard are the expenses associated with 5G including the cost of acquiring spectrum in the 700Mhz and 3.5GHz bands (although existing spectrum can be repurposed), as well as the cost of deployment.

The total cost of ownership (TCO)[198] of a 5G network has been estimated by the GSMA to be between 23% and 71% more than the cost associated with a 4G network.[199] In addition, there has been strong pressure towards rapid deployment, requiring significant upfront investments. Deployment of 5G has been more rapid than 4G in many countries, (as can be seen for the EU in chapter 3.2), and the coverage of 5G networks is expected to reach 60% world population coverage by 2026, and equipment manufacturers are expecting rapid take-up by consumers (see below).

198 This concept tries to incorporate both CapEx and OpEx cost into one value but does in this case have a lesser focus on short term CapEx.

199 See GSMA (2019): 5G-era Mobile Network Cost Evolution, August 2019, available at: https://www.gsma.com/futurenetworks/wiki/5g-era-mobile-network-cost-evolution/.

Figure 4-1: 4G and 5G subscriber uptake in the first years after launch



Source: Ericsson Mobility Report June 2021.[200]

The general trend of increasing data traffic will also likely be fuelled further by the fast rollout and take-up of 5G. Ericsson estimates an increase in data traffic from 11 GB per smartphone per month in Western Europe in 2020[201] to 47 GB in 2026, a growth rate of 28%. This is likely to be another driver of cost increases, as it compels MNOs to upgrade backhaul, and in time, densify the network.

Pressures to unlock capital for investment have contributed to a rise in the business of TowerCos (see chapter 5.2.4 for a discussion of their influence in Ireland), independent providers of, typically passive, mobile infrastructure on a wholesale only basis. According to a study by EY-Parthenon, 20% (83k) of mobile sites in Europe were controlled by independent TowerCos[202] in 2020. While there is an increasing trend, this is still a low number compared with other regions such as the US where the share is as high as 90%. The sale of towers yields a capital boost for network operators that can be utilized for investments such as the 5G roll-out. As sites managed by TowerCos utilize co-location more often, fewer towers are needed in a given area, which makes them

200 See Ericsson (2021): Ericsson Mobility Report, June 2021, p. 5, available at: https://www.ericsson.com/assets/local/mobility-report/documents/2021/june-2021-ericsson-mobility-report.pdf.

201 Ireland stood at 9 GB per subscription per month in 2019 (i.e. pre-pandemic) according to the OECD, see https://www.oecd.org/sti/broadband/broadband-statistics/.

202 This does not include TowerCos that are separate companies but controlled by one MNO (e.g. Vantage Towers, which was at that point already separated from Vodafone but not publicly listed yet).

more economically efficient and environmentally friendly.[203] On the other hand, disadvantages of this model for MNOs may include relinquishing the potential to block competitors from accessing strategically valuable sites as well as the opportunity cost associated with not being able to sell the towers at a later date, when they may be worth even more.[204] In some respects, this strategy mirrors developments in fixed infrastructure, where are trends towards wholesale-only models and/or the spin-off of "Fibre Cos".

Network sharing is another strategy that MNOs may engage in to cut costs, including active network sharing, which has hitherto often met resistance from competition authorities. Sweden and Denmark provide examples of countries which have supported 4 MNOs with the aid of active network sharing.[205] According to McKinsey, the sharing of the active mobile network can lead to more than 40% reduction of 5G-related access network cost.[206] Entering a network sharing deal makes most sense before rolling out a new technology (e.g. 5G) so that there are no redundant mobile sites after the sharing deal takes place. It can also make sense for MNOs to collaborate with players that wish to build their own local (campus) networks.[207]

4.2 Exploiting synergies with fixed broadband

Alongside cost-cutting strategies, MNOs may also seek to achieve economies of scope and boost revenues by engaging in fixed mobile convergence, both at the network level (via shared use of fibre backhaul for fixed and wireless services) and in the provision of services.

Spain provides an example of a market where bundles of fixed and mobile calls + broadband + pay TV more than doubled from the beginning of 2015 to the end of 2019, while fixed-mobile bundles without pay TV remained constant.[208] The trend towards bundles in Spain was mirrored in the strategies of telecom operators to complement their existing services. Following a series of acquisitions and organic network

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203 See EY-Parthenon (2020): The economic contribution of the European tower sector, a report for the European Wireless Infrastructure Association (EWIA), November 2020, available at: https://assets.ey.com/content/dam/ey-sites/ey-com/es_es/news/2021/02/ey-parthenon-and-ewia-report-on-european-mobile-tower-sector-v2.pdf.

204 The latter being especially relevant if the future increase in tower value is larger than the returns the business has from investing the money it gains from selling them today.

205 See WIK (2019) Competition and investment in the Danish mobile market https://ens.dk/sites/ens.dk/files/Tele/final_mobile_report_denmark_clean_non-confidential.pdf.

206 Calculated on a total cost of ownership (TCO) level, see Grijpink, F. et al (2018): Network sharing and 5G: A turning point for lone riders, February 23 2018, available at: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/network-sharing-and-5g-a-turning-point-for-lone-riders.

207 See Taga, K.; Peres, G.; Dimitrov, V. (2020): Network sharing in the 5G era – Choosing the right sharing model to maximize efficiency of 5G rollout, November 2020, available at: https://www.adlittle.com/en/insights/report/network-sharing-5g-era.

208 See https://www.statista.com/statistics/462589/quarterly-bundle-subscriptions-spain/.

deployment,[209] all four of Spain's MNOs are present in both fixed (FTTH) and mobile markets. Similar developments have occurred in France.[210]

Providing fixed mobile retail bundles can also be achieved by operating as an MVNO (for fixed broadband providers), or by utilising regulated or commercial wholesale broadband offers (for MNOs). However, these types of wholesaling strategies are often temporary, pending more permanent entry by acquisition or deployment. This can be seen for example in the strategy of Virgin Media in the UK or Telenet in Belgium (both owned by Liberty Global), which entered firstly as MVNOs before acquiring MNOs. It is also notable that the MVNO Drillisch in Germany merged with a fixed broadband operator and then entered as an MNO in the context of 5G spectrum auctions. It is possible that these strategies may have been prompted in part by the challenges in competing for high-end offers on the basis of wholesale access (see chapter 6), as well asa desire to exploit synergies between the fibre deployments required for fixed and mobile networks.

On the other hand, for MNOs without a fixed business (or without complete fixed network coverage), Fixed Wireless Access can provide an opportunity for MNOs to penetrate the fixed broadband market.[211] This could become more prevalent with the increased speeds available via 5G FWA alongside reduced costs for the specific routers needed. While it is not heavily marketed by all operators, FWA is already a relatively common offering. In Western Europe 93% of operators offered FWA in April 2021, compared with 49% in December 2018.[212]

For MVNOs, FWA offers fewer opportunities, as it requires a degree of demand to justify the investment in backend systems, and customer service training, which may not be present, in view of the low market shares of MVNOs in the mobile segment. Moreover, MVNOs relying on a price per unit wholesale scheme cannot realistically offer FWA, as these offers require high or unlimited data allowances and there is a likelihood of high usage, which is likely to render this service unviable.

MVNOs which base their marketing around physical outlets may also not target the areas where FWA may be in high demand, which include rural areas which may not benefit from high quality fixed broadband infrastructure.

Another dynamic which favours larger integrated players when it comes to offering fixed broadband or bundles is the role in some countries of TV in bundled offers. For

209 Orange aquired fixed broadband operator Jazztel, while Vodafone acquired cable operator ONO. Masmovil – previously an MVNO – acquired 4th MNO Yoigo and developed its fixed operations via a combination of fibre deployment and commercial access arrangements.

210 Iliad entered as the 4th MNO, complementing its fixed broadband business. Mobile operator SFR acquired the cable operator Numericable to boost its fixed presence.

211 One example for this would be Three in Ireland, which offers 4G and 5G home broadband, the latter even with the possibility to have an external antenna installed by a technician, see https://www.three.ie/buy/broadband.html.

212 It is assumed, that in this case by "operator", only MNOs are meant. See Ericsson (2021): Ericsson Mobility Report, June 2021.

example, in France, Spain and the UK, many telecom operators establish a platform for entertainment to distinguish their offers from those of rivals, and engage in purchasing exclusive sports rights or rights to movies and TV shows as well as (in some cases) producing them themselves. As 5G paves the way towards increased video usage on mobile devices, telecom operators with exclusive content may be able to leverage this advantage into the mobile sphere as well.

On the other hand, there is a countervailing trend amongst some consumer types (including younger consumers) and in some countries towards online content distribution e.g. via Netflix, Amazon Prime or Disney+, which may reduce the demand and need for telecom operators to excel in the content space. Sweden provides one example of a country in which fixed broadband is often sold as a standalone service (without TV or telephony), because consumers prefer to mix and match the content and voice services they use.[213] Operating as a standalone MNO or MVNO is likely to be more sustainable in such cases than in countries where bundles (including fixed mobile offers and exclusive content) prevail.

4.3 Expansion into IoT, software and consulting

The evolution of mobile services provides additional opportunities (and in some cases imperatives) for expansion into new business areas or partnering with players active in other segments of the ICT space.

On the consumer side, until now, it was possible for players in some markets (such as Ireland) to ignore certain kinds of consumer IoT devices, including smartwatches with an eSIM, such as some models of the Apple Watch, by simply not supporting cellular connectivity for these devices. However, when these devices become more prevalent and extend to all smartwatches or even beyond watches, MNOs that support eSIM will have an advantage, especially if their competitors do not. This may also widen the gap between MNOs and traditional full service consumer MVNOs, which may take longer than their hosts to support eSIM.

However, eSIM can also provide an opportunity for specialist MVNOs to gain ground in niche segments within consumer (and business) mobile markets. Specialist travel services are a key example where MVNOs could thrive. For MNOs it can be more profitable to offer relatively expensive but convenient travel packages for their existing user base to absorb the higher willingness to pay from their premium customers. More price-sensitive customers could then obtain a SIM card (or with eSIM a SIM profile) from a specialized travel MVNO, which has a deal with an MNO in the country the person wants to travel to.

213 See WIK (2017): A tale of 5 cities, available at: https://stokab.se/download/18.52d820ca1732323a3ca4eb/1594711942698/A%20tale%20of%20five%20cities:%20The%20implications%20of%20broadband%20business%20models%20on%20choice,%20price%20and%20quality%20(2017),%20WIK-Consult..pdf.

IoT also offers opportunities for MVNOs which are specialized in this field, especially for applications which involve cross-border connectivity. Cross-border applications such as connected cars as well as freight tracking need connectivity from different MNOs in different countries to function properly. Cross-border connectivity as well as expertise in the applications themselves could be provided by specialist MVNOs. Sizable international MNOs may also build this expertise in-house and compete with specialized MVNOs e.g. for contracts from large car manufacturers. MNOs and MVNOs could also consider working together with equipment manufacturers for consumer IoT devices which are connected independently from the smartphone (e.g. tracking devices) often via a bundled device and connectivity contract. This gives the manufacturer the possibility to receive exposure through the M(V)NO's store and helps the operator gain monthly revenues.[214]

Another avenue for (especially) MNOs in terms of business connectivity is building local 5G-based networks for smart factories or other geographically restricted applications. Besides smart factories, there could also be a variety of other use cases such as hospitals, cities or farms. MNOs have the frequency spectrum that needs to be utilized for these networks as well as the know-how in building and administrating the networks, potentially together with a network equipment manufacturer.

The increasing use of eSIM in industrial IoT may also provide an opportunity for MNOs to offer consulting and implementation services to business customers, with a view to potentially offsetting the investments the MNO will need to make in building or buying eSIM support infrastructure.

Software is another related area into which MNOs could expand. One example could be to provide easy solutions for business customers to manage the devices of their employees, e.g. to allow bulk switching of eSIM profiles on all employee handsets without having them returned to the company IT department.

More generally, even if they do not sell this expertise to clients, MNOs and MVNOs are also likely to need to increasingly engage in software development internally to provide applications for customers to manage their plans, enter changes in their personal data, potentially do necessary KYC measures and to check their data/call/texting usage. While it is unlikely that a customer will choose an operator solely because of its app, it may affect the ongoing customer experience and support customer retention. Such applications are likely to become even more integral to the sign-up and switching process as support for eSIM grows.

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214 One such example are the "Combi" tracking devices, e.g. for tracking dogs that are manufactured by Alcatel and sold in Germany through Deutsche Telekom for a one-time fee of 1 € with a 12 month contract for 4.95 € per month, see: https://www.telekom.de/smarte-produkte/iot/gps-tracker-hunde.

215 As the fiscal year of Vodafone does not match the calendar year, the year 2021 in this case is the year from April 2020 to March 2021, i.e. the one likely to be most affected by the Covid-19 pandemic.

4.4 Digital channels to market

Whereas subscribing to a new service plan may previously have involved visiting a shop and selecting a new smartphone, COVID-19 and the associated lock-down measures have fuelled a shift towards digital sales channels. The share of digital sales increased during the Covid-19 pandemic, especially for operators that mainly sold in retail before, as they had more room for growth of the segment. This increase was confirmed by market experts in interviews for this study. The picture painted in the official reporting of the telecommunications companies is however more varied. For example, Vodafone did report an increase from 9% of sales in Europe being made digitally in 2017 to 26% in 2021[215], but the increase from 2019 to 2020 and from 2020 to 2021 was not substantially larger than previous increases, thereby suggesting that, at least for this operator, it was the continuation of an ongoing long-term trend [216]

A common tactic within several countries, that appears to also have been successful in Ireland, is the launch of MNO sub-brands that only operate digitally through a website, without stores and with a reduced customer service intensity (e.g. only via chat on the website or through messenger service, not by phone). These operators often operate with simple "one-plan" models, so that questions about changing plans or other available plans do not arise, which likely also simplifies backend procedures. In some countries, providers with such a business model do not even sell their products through a website but only via an app, with the website providing only complementary information. In Germany, several such operators with an app to activate, check and (if available) switch plans have emerged. Payments are only possible via PayPal. These players operate as sub-brands of established MNOs or MVNOs.[217]

This trend towards digital sales will likely increase further with the introduction of eSIM and the possibility to subscribe and change operators without swapping out a SIM card.

In turn, the move to digital sales channels may also accelerate the trend towards SIM-only contracts, i.e. contracts without an included phone, that is also prevalent in the Irish market.

On the positive side for mobile operators, digital sales could help to convert prepaid to postpaid customers as prepaid offers are typically sold in classical retail stores. Postpaid customers are typically higher in revenue, cannot easily "sit out" a month with

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215 As the fiscal year of Vodafone does not match the calendar year, the year 2021 in this case is the year from April 2020 to March 2021, i.e. the one likely to be most affected by the Covid-19 pandemic.

216 See Vodafone annual reports 2020 and 2021, at https://investors.vodafone.com/sites/vodafone-ir/files/vodafone/annual-report/vodafone-annual-report-2020.pdf and https://investors.vodafone.com/sites/vodafone-ir/files/2021-05/vodafone-annual-report-2021.pdf.

217 The MVNO freenet has launched two offers with two to three plans each, with different host MNOs (freenet FLEX on the Vodafone network and freenet FUNK on the Telefónica Deutschland network). MNO Deutsche Telekom has launched its sub-brand fraenk with only one available plan.

paying very little or even nothing and tend to switch less often.[218] This trend could also lower the cost for potential market entrants as they may not need to rent stores to gain a foothold in the market. However, for established MVNOs coming from the classical retail business (e.g. based on grocery store outlets or post offices), this trend could further limit their client-base to focus on customers which may still demand non-online prepaid offers and physical support.

4.5 Implications for competition, investment and consumer welfare

4.5.1 Impact of TowerCos

The emergence of TowerCos could have positive effects on the cost of deploying and maintaining mobile networks, as well as reducing environmental impacts of tower construction. Sharing the costs of infrastructure, by relying on tower companies or sharing of physical infrastructure could increase viability for deployment of 5G in remote areas and support the economic case for the deployment of small cells, in a similar manner to the role played by wholesale only networks in the context of fibre deployment.[219] If lower costs associated with facility sharing are passed onto consumers, the emergence of the TowerCo model could also help to reduce retail prices.

However, if all operators collaborate rather than competing in the deployment of tower or other mobile infrastructure, this this could limit competition between network operators on coverage and quality, limiting the differentiation of offers both at the retail level, and to MVNOs.

This might be a particular issue in the earlier stages of network deployment, since competition between different operators can contribute (alongside coverage obligations associated with spectrum awards) to more widespread coverage. Issues might also arise in the long term, if the existing access agreements between TowerCos and MNOs expire and there are no readily available alternatives that would help to ensure that access conditions continue to be fair and reasonable. This highlights the benefits of ensuring – from a competition perspective – that there are different tower companies or small cell specialists competing for the market (with other specialists or MNOs).

4.5.2 Impact of network consolidation

Focusing at the network level, the process of market concentration in mobile network providers has been studied extensively, especially in the context of proposals to

218 See Mobile World Live and upstream (2020): Physical no more – the case for shifting to digital sales channels. An MNO guide for the post-Covid era, Whitepaper.

219 For further discussion on the implications of network sharing on competition see WIK (2019) Competition and Investment in Danish mobile market, available at: https://ens.dk/sites/ens.dk/files/Tele/final_mobile_report_denmark_clean_non-confidential.pdf.

consolidate from 4 to 3 MNOs, although EU Commissioner Margrethe Vestager claimed in 2016 that there is no "magic number".[220]

Recently, the debate has been reignited after the decision by the European Commission of May 2016 not to allow the merger of O2 and Three in the UK was annulled by the General Court of the European Union in May 2020. The EC justified its decision on the basis of reduced customer choice in a three MNO market and potentially higher prices and lower service quality. In addition, the Commission cited concerns around reduced competition in wholesale access. The General Court overturned the ruling on the basis that the Commission had not provided sufficient proof regarding their claims about the negative effects of the merger and had not reflected the potential positive effects on customers which might result from passing on efficiency gains.[221]

However, the conclusion that consumers might benefit from efficiency gains from consolidation that outweigh other negative effects is challenged by the findings of a recent study from the UK NRA Ofcom.

In its 2020 analysis Ofcom[222] used a panel data analysis to estimate the relationship between mobile market structure and investment and quality for 30 European countries in addition to analysing the merger cases individually. They found that country-level investment was lower in the more highly concentrated markets. While lower investment might also result from greater network efficiency, they find no evidence for the hypothesis that the networks are more efficient in the analysed markets. The main focus of the retail analysis was on network quality (in the form of 4G download speeds). They did not find any positive effects of market concentration on download speeds in the panel data analysis.[223] They also found that the growth rate of download speeds in post-merger Ireland was smaller than in a synthetic control group. Ofcom also challenged the conclusions reached in a study conducted by the GSMA[224] that suggested that the Austrian 4 to 3 merger had resulted in an acceleration in 4G network coverage and an increase in network speeds, noting that the GSMA study had

220 See https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_16_1713.

221 See General Court of the European Union (2020): The General Court annuls the Commission's decision to block the proposed acquisition of Telefónica UK by Hutchison 3G UK in the sector of the mobile telephony market, Press Release No 65/20, 28 May 2020, available at: https://curia.europa.eu/jcms/upload/docs/application/pdf/2020-05/cp200065en.pdf.

222 Ofcom uses a synthetic control method for analysing the mergers. The details are described in the technical annexes to the study, available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0032/209993/Technical-Annexes-Market-structure,-Investment-and-Quality-in-the-Mobile-Industry.pdf.

223 They did even find negative indirect effects of higher market concentration on download speeds, i.e. higher concentration leading to less investment which leads to slower download speeds. The authors do however note that these findings need to be taken with caution due to a smaller dataset for the analysis of the relationship between concentration and download speed than for the relationship of concentration and investment.

224 See GSMA (2017): Assessing the impact of mobile consolidation on innovation and quality – An evaluation of the Hutchison/Orange merger in Austria, 2017, available at: https://www.gsma.com/publicpolicy/wp-content/uploads/2017/07/GSMA_Assessing-the-impact-of-mobile-consolidation-on-innovation-and-quality_36pp_WEB.pdf.

underestimated improvements in quality that could have been expected to occur in the absence of the merger.

Ofcom's findings also call into question findings by GSMA Intelligence in 2020,[225] which suggested that three-player markets in Europe had provided higher download speeds for end-users than four-player markets. The GSMA also found that Capex per Operator was higher in three-player markets, but these findings have been subject to a critique about the lack of certain control variables and invalid instrumental variables.[226] The recent Ofcom and GSMA research focused primarily on efficiency of investment and quality. However, in a 2018 study, BEREC also found[227] that there was some evidence of retail prices increasing in all three countries in which mergers occurred in the period 2012-2014.[228] In Austria, significant price increases within the first two years after the merger were found. However, prices subsequently reduced potentially as a result of competitive pressure from MVNOs. BEREC found that in Ireland and Germany, there were also price increases but the effects were less robust across different usage baskets. Network quality was analysed for Austria and Germany and the authors concluded that there were negative effects in the short to medium term. However the authors noted that there are challenges associated with measuring network quality.

More generally conflicting results from regulatory authorities and the industry concerning the impact of consolidation highlight the fact that there are challenges in identifying objective criteria to measure and judge network quality as well as ensuring that datasets of pricing data include not only pricing from MNOs but also MVNOs and sub-brands from every country. It is also possible that there may be subtle effects which work in different directions and outcomes might be impacted by which prevail. For example, while concentration might allow MNOs to increase prices, it is possible that a portion of the higher revenues resulting from higher prices might also be used for increased investment and higher quality. However, equally, more concentrated markets may lack the impetus for innovation and competition on quality that might be triggered by a challenger. It should also be noted that 4 to 3 mergers in Europe have typically been accompanied by remedies, which may have partly counteracted negative effects that might otherwise have occurred. This makes it hard to provide "proof" of the effects that consolidation may have in the absence of regulatory intervention.

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225 See GSMA (2020): Mobile market structure and performance in Europe – Lessons from the 4G era, February 2020, available at: https://www.gsma.com/publicpolicy/wp-content/uploads/2020/01/GSMA-Mobile-Market-Structure-and-Performance-in-Europe_February20.pdf.

226 The details of this critique can be found in the technical annexes (A1) of the Ofcom study.

227 See BEREC (2018): BEREC Report on Post-Merger Market Developments - Price Effects of Mobile Mergers in Austria, Ireland and Germany, BoR (18) 119, 15 June 2018, available at: https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8168-berec-report-on-post-merger-market-developments-price-effects-of-mobile-mergers-in-austria-ireland-and-germany and Ofcom (2020): Market structure , investment and quality in the mobile industry, Economics Discussion Paper Series, Issue Number 1, 22 December 2020, available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0036/209799/market-structure,-investment-and-quality-in-the-mobile-industry-discussion-paper.pdf.

228 BEREC used two different statistical approaches, a differences-in-differences approach and a synthetic control group.

4.5.3 Effects of access-based competition (MVNOs)

There are a variety of opinions on whether or not and to what extent the presence of MVNOs has a welfare-enhancing effect on the market and therefore contributes to more innovation, price competition and investment in downstream services. Some studies suggest that the presence of MVNOs does not increase competition and welfare at all or has negative effects, while others attribute such effects only to full MVNOs. Still others consider that there are welfare-enhancing effects regardless of the business model.

Positive effects of MVNO access on mobile prices are suggested in a 2016 study of 20 EU countries by Calzada & Martínez-Santos (2016) which concluded that competition and the presence of MVNOs are associated with lower mobile broadband prices.[229] The Austrian MVNO HoT provides a concrete example of how MVNOs as well as non full MVNOs can also contribute to falling prices on the market. It entered the mobile communications market as a light MVNO in 2015 and had already achieved a market share of 4.4% in 2017. According to RTR, the market entry of HoT has led to price reductions on the mobile communications market.[230]

However, the Austrian example involved a supporting role for regulation.[231] Based on a two-stage Cournot model, Kalmus & Wiethaus (2010) conclude that in the absence of access regulation, MNOs only host MVNOs that do not exert competitive pressure on MNOs' retail outlets, and in this case it is very unlikely that the presence of MVNOs will lead to a decrease in consumer prices.[232]

Regarding other aspects of consumer welfare, a study by Nera Economic Consulting (2019) on behalf of Spark (one of New Zealand's MNOs)[233] showed no statistically significant correlation between

- penetration and "MVNO market share" for OECD countries
- monthly mobile data use and "MVNO market share" for OECD countries and
- mobile data download speed and higher "MVNO market shares".[234]

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229 See Calzada, J.; Martínez-Santos, Fernando (2016): Pricing strategies and competition in the mobile broadband market; May 2016, p. 4; http://diposit.ub.edu/dspace/bitstream/2445/107806/1/668398.pdf.

230 See RTR (2015): RTR Telekom Monitor Jahresbericht 2014, p. 18, https://www.rtr.at/de/inf/TKMonitor_2014/TM_Jahresbericht_2014.pdf.

231 MVNO access in Austria was regulated in the context of a merger. However, HoT has not used H3A's regulated wholesale product, which indicates that the bargaining power of HoT is such that it has been able to negotiate even better wholesale conditions than the regulated product offers.

232 See Kalmus, Philip; Wiethaus, Lars (2010): On the competitive effects of mobile virtual network operators, Telecommunications Policy, Volume 34, Issues 5–6, 262-269.

233 See NERA Economic Consulting (2019): Review of Red Dawn Consulting report – "MVNO landscape: Global perspectives and New Zealand Applications", Spark New Zealand, 28 June 2019, p. 7, https://comcom.govt.nz/__data/assets/pdf_file/0021/158412/NERA-report-for-Spark-Submission-on-mobile-market-study-preliminary-findings-28-June-2019.PDF.

This insignificance also applies when NERA considers only the "Independent MVNO market share" (as opposed to MVNO market shares including shares of sub-brands). There are also non-significant results for the relationship between 4G uptake and "Independent MVNO market share".[235]

Another study by Nera Economic Consulting (2019) on behalf of Telus Communications Inc. also finds no correlation between MVNO subscriber shares and measurements of market performance, such as download speeds, churn rates, etc., in the statistical analyses conducted. Furthermore, the study suggests there are limited effects from MVNOs on competition as the study suggests that MVNOs focus on niche markets and therefore do not compete on the wider market.[236]

However, other studies point to the contribution of MVNOs to consumer welfare not necessarily in terms of lower prices overall, but through broadening and deepening the market by serving niche markets and alternative distribution channels and by offering innovative services to consumers.[237] Analysys Mason notes that as MVNOs target group-specific and differentiated products, this increases the variety of offerings and consumer choice. The intensification of competition increases the incentives for MNOs and MVNOs to offer attractive and innovative tariffs and bundles, discounts, and additional services.[238]

Positive effects on innovation and service differentiation have also been cited in a study by Telesperience, which suggests that MNOs often do not have the incentive to innovate and that innovation cycles are slower in markets with a small number of MVNOs than in markets with a high number of MVNOs.[239] Innovation benefits are also highlighted in a study by Analysys Mason, which notes that the investments made by MVNOs at the retail layer (e.g. investing in their own billing systems, retail channels

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234 See NERA Economic Consulting (2019): Review of Red Dawn Consulting report – "MVNO landscape: Global perspectives and New Zealand Applications", Spark New Zealand, 28 June 2019, p. 3-7, https://comcom.govt.nz/__data/assets/pdf_file/0021/158412/NERA-report-for-Spark-Submission-on-mobile-market-study-preliminary-findings-28-June-2019.PDF.

235 See NERA Economic Consulting (2019): Review of Red Dawn Consulting report – "MVNO landscape: Global perspectives and New Zealand Applications", Spark New Zealand, 28 June 2019, p. 9, https://comcom.govt.nz/__data/assets/pdf_file/0021/158412/NERA-report-for-Spark-Submission-on-mobile-market-study-preliminary-findings-28-June-2019.PDF.

236 See Nera Economic Consulting (2019): An Examination of the Regulatory Framework for Mobile Virtual Network Operators and Other Wholesle Mobile Services, Expert Report of Christian M. Dippon, Ph.D. On behalf of Telus Communications Inc., May 15, 2019, p. i.

237 See Katsarakis, Michalis; Fortetsanakis, Georgios; Charonyktakis, Paulos; Kostopoulos, Alexandros, Papadopouli, Maria (2014): On User-Centric Tools for QoE-Based Recommendation and Real-Time Analysis of Large-Scale Markets, in: IEEE Communications Magazine, September 2014, p. 37-43, p. 42, https://projects.ics.forth.gr/mobile/publications/ComMag14.pdf.

238 See Analysys Mason (2018): Final report for Trustpower, MVNO aspects of the Commission's mobile market review, 25 October 2018, Ian Streule, Janette Stewart and Audrey Bellis, Ref: 2015048-414, p. 16, https://comcom.govt.nz/__data/assets/pdf_file/0018/104238/TrustPower-Appendix-2-Analysys-Mason-Submission-on-the-Issues-Paper-26-October-2018.PDF.

239 See Telesperience (2016): MVNO Opportunities and strategies, An Insight Paper by telesperience Sponsored by Amdocs Optima, p. 3, https://amdocsoptima.com/wp-content/uploads/2018/04/MVNO-Opportunities-and-Strategies.pdf.

etc.) may provide incentives for MNOs to also make investments on this layer and thereby contribute to increasing service differentiation.[240]

Interviews conducted for this study also provide evidence of service innovation by MVNOs, such as in-person customer service and provision of mobile services in exchange for points, which are offered by some retail-oriented MVNO operators. Another example of a service innovation is the 1&1 Exchange Service in Germany, which promises that a broken smartphone will be replaced within 24 hours.[241] A 2019 WIK study also highlights the role played by a combination of MVNO access and roaming agreements in supporting innovation in cross-border services such as IoT, and roaming services.[242]

The degree to which innovation is possible beyond innovations at the service level, may however also depend on the nature and depth of MVNO wholesale agreements. For example, the OECD (2015) considers that the technical and commercial independence of MVNOs from MNOs is a necessary condition for MVNOs to be able to offer consumers meaningful choice and to restrict potentially anti-competitive behaviour.[243] WIK notes in a 2016 study that, due to the high dependence on the host MNO, resellers or service providers can only exert very limited competitive pressure on mobile network operators.[244] The WIK study concludes that, for MVNOs to play a significant role in increasing competitiveness, it is important to enable full MVNOs to enter the market, as they have the highest degree of independence from mobile network operators.[245]

The need for greater independence and full MVNO access might suggest that regulatory intervention may be warranted, in circumstances where the market alone does not lead to the provision of these forms of access.

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240 See Analysys Mason (2018): Final report for Trustpower, MVNO aspects of the Commission's mobile market review, 25 October 2018, Ian Streule, Janette Stewart and Audrey Bellis, Ref: 2015048-414, p. 20, https://comcom.govt.nz/__data/assets/pdf_file/0018/104238/TrustPower-Appendix-2-Analysys-Mason-Submission-on-the-Issues-Paper-26-October-2018.PDF.

241 See https://hilfe-center.1und1.de/vertrag-und-lieferung-c85327/lieferung-und-umtausch-c84791/1und1-austausch-service-a797365.html.

242 See WIK (2019) Technological developments and roaming, https://ec.europa.eu/digital-single-market/en/news/technological-developments-and-roaming-smart-20180012-0.

243 See OECD (2015): Wireless Market Structures and Network Sharing, 08-Jan-2015, p. 6, https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2014)2/FINAL&docLanguage=En.

244 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S.; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 131, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html.

245 See Neumann, K.-H.; Plückebaum, T.; Strube Martins, S. ; unter Mitwirkung von Dr. Werner Neu (2016): Network Sharing im Mobilfunk und Festnetz-Mobilfunk-Konvergenz in der Schweiz, Studie für das Bundesamt für Kommunikation und die Eidgenössische Kommunikationskommission, p. 132, https://www.comcom.admin.ch/comcom/de/home/themen/mobilfunknetz/network-sharing.html; OECD (2015): Wireless Market Structures and Network Sharing, 08-Jan-2015, p. 71 f., https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2014)2/FINAL&docLanguage=En.

However, some studies warn that regulatory interventions might have negative effects on investment by mobile operators hosting MVNOs. Kim et al. have investigated the effects of MVNO access regulation on the investment behaviour of MNOs using company level data for 58 MNOs in 21 OECD countries over the period 2000-2008. The authors conclude that regulated access leads to lower MNO investments and that voluntary access granting has no effect.[246] Various other studies also conclude that mandated access has a negative impact on infrastructure investments and that the long-term losses in dynamic efficiency due to lower investment exceed the short-term efficiency gains from lower prices.[247] Potential negative consequences of regulated access for investment in 5G are suggested in a 2018 study by Bauer & Bohlin (2018), which states that:

> *"Mandating a regulated reference offer for MVNO access has asymmetric effects on MNOs and the players seeking access. It reduces the ability of the MNO to negotiate custom commercial agreements and consequently the ability to appropriate returns from investment and innovation in network infrastructure. Other things being equal, this will reduce the incentives of MNOs to invest in network deployment and upgrades and incentives to innovate in network differentiation. It is possible that standardized access reduces the transaction and adaptation costs of MVNOs and improves their business model in the short run. In the context of 5G services, such limited effects will have to be weighed against the negative effects on innovation dynamics and MNO investment, which likely outweigh them."*[248]

Other studies however point to potential positive effects from MVNO access on the financing of MNO's network deployment and operations. For example, MVNOs can increase the network utilization of the MNO, give MNOs the opportunity to sell their excess capacity and lower operational cost due to an increase in economies of scale.[249] MVNOs may also contribute to the financing of the MNOs' networks through their wholesale payments[250], thereby supporting network investments of the MNOs.[251]

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246 See Kim, Jihwan; Kim, Yunhee; Gaston, Noel; Lestage, Romain; Kim, Yeonbae; Flacher, David (2011): Access regulation and infrastructure investment in the mobile telecommunications industry, in: Telecommunications Policy, Volume 35, Issue 11, 907-919.

247 For a literature review on this topic see for example: Nera Economic Consulting (2018): Competitive effects of MVNOs and assessment of regulated MVNO access, Spark New Zealand, 26 October 2018; and Bauer, Johannes M.; Bohlin, Erik (2018): Roles and Effects of Access Regulation in 5G Markets, September 4, 2018, https://ssrn.com/abstract=3246177.

248 Bauer, Johannes M.; Bohlin, Erik (2018): Roles and Effects of Access Regulation in 5G Markets, September 4, 2018, p. 29 f., https://ssrn.com/abstract=3246177.

249 See Suruhanjaya Komunikasi dan Multimedia Malaysia (SKMM) (2008): Mobile Virtual Network Operators (MVNO) The Redefining Game, p. 3; https://www.mcmc.gov.my/skmmgovmy/files/attachments/Mobile_Virtual_Network_Operators.pdf; PricewaterhouseCoopers Advisory, s. r. o. (2019): Recommendations document on national roaming access terms and conditions, as well as MVNO access terms and conditions, Based on Agreement No 2407/01, Final, document prepared for the Georgian National Communications Commission, p. 8., http://gncc.ge/uploads/other/4/4485.pdf, Analysys Mason (2018): Final report for Trustpower, MVNO aspects of the Commission's mobile market review, 25 October 2018, Ian Streule, Janette Stewart and Audrey Bellis, Ref: 2015048-414, p. 20,

The WIK (2018) study "Technological Developments and Roaming",[252] highlights that MVNOs can also make an important contribution to competition and innovation in fields such as IoT/M2M, connected devices and specialised services aimed at roaming consumers, businesses and professionals with cross-border activities.

In summary, literature suggests a relatively significant role for innovation by MVNOs in specific fields (including IoT and M2M). As regards consumer-oriented services, there is some evidence of potential positive effects on innovation and price competition, but this may be limited in scope and focused on service innovation (e.g. synergies with retail activities, customer service innovation). In markets where MVNOs play a limited or niche role, their presence may not have a significant impact on competition or consumer welfare more widely. However, it is not necessarily the case that one could conclude from this that MVNO cannot have a positive impact on consumer welfare, as this impact may depend on the degree to which the wholesale conditions enable MVNOs to mount an effective competitive challenge to MNOs (alongside the dynamism of the companies concerned). In similar vein, studies looking at the impact of bitstream on innovation and price competition have generally not found that there was a significant impact. However, Local Loop Unbundling (a deeper form of access generally available on cost-oriented terms and allowing flexibility for access seekers) has been found to support increased quality of service in broadband markets.[253]

4.5.4 The impact of device manufacturers

Besides infrastructure providers and the (virtual) network providers themselves, there are other participants in mobile markets that affect competitive dynamics.

An important example is device manufacturers. For example penetration of 5G is crucially dependent not only on the deployment of 5G networks, but on the take-up of 5G-enabled phones, which for the moment are focused in the premium segment. Another area where the market is steered extensively by device manufacturers is eSIM (see chapter 3.3 for how eSIM works). eSIM was specified by the GSMA with input from mobile network operators and device manufacturers. It is however up to the manufacturers of these devices where and when to implement eSIM and if they want to

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https://comcom.govt.nz/__data/assets/pdf_file/0018/104238/TrustPower-Appendix-2-Analysys-Mason-Submission-on-the-Issues-Paper-26-October-2018.PDF.

250 See https://www.teltarif.de/service-provider-dienstanbieter-freenet-5g-lizenz/news/74039.html?page=all.

251 See Analysys Mason (2018): Final report for Trustpower, MVNO aspects of the Commission's mobile market review, 25 October 2018, Ian Streule, Janette Stewart and Audrey Bellis, Ref: 2015048-414, p. 20, https://comcom.govt.nz/__data/assets/pdf_file/0018/104238/TrustPower-Appendix-2-Analysys-Mason-Submission-on-the-Issues-Paper-26-October-2018.PDF.

252 See https://ec.europa.eu/digital-single-market/en/news/technological-developments-and-roaming-smart-20180012-0.

253 See Nardotto et al (2015) Unbundling the Incumbent: evidence from UK Broadband https://onlinelibrary.wiley.com/doi/full/10.1111/jeea.12127.

implement solely an eSIM or a dual SIM system with an eSIM and a physical SIM slot. When major manufacturers such as Apple and Samsung[254] decide to launch smartphone that only has an eSIM, this could potentially segment the market between eSIM-ready MNOs and operators which focus on digital service provision at the expense of consumer MVNOs based around physical stores whose support for eSIM may come at a later stage.

Device manufacturers and/or application providers could also play a role in providing mobile connectivity themselves (as MVNOs) or steering consumers towards certain network operators. Apple's first foray into global connectivity was the Apple SIM, which was installed in 2014 in the iPad Air 2 and iPad Mini 3 and targeted towards in the UK and US. Apple coupled the technology with an MVNO platform which allowed wireless network operators to bid for the right to provide their services to Apple. Certain Smartwatches[255] are also now sold with connectivity pre-installed, while the Volkswagen Group sells cars with connectivity and applications from Cubic telecom.

The potential for these players to act as marketing agents and potential gatekeepers for the provision of connectivity services and their ability to monetise access provided by others, could impact competition. As there are multiple providers of devices and the involvement of device manufacturers has in practice often enabled entry by newer or smaller connectivity providers which did not previously have a significant share in connectivity, the effect today is likely to increase competition. However, concerns might arise in future, if consumers and/or industrial customers face lock-in.

254 Technically the Motorola Razr was 2019 the first and up to mid-2021 only smartphone that was eSIM only. It did not however achieve major success in the market. See https://www.androidauthority.com/motorola-razr-esim-only-1054255/.

255 For example SpotterGPS, available at: https://www.spottergps.com/fr/wp-content/uploads/sites/2/2018/12/Spotter-GPS-Watch-Manuel-FR-V01.pdf.

5 The Irish mobile market

In this chapter, we describe the Irish mobile market, its history and the role played by MVNOs.

KEY FINDINGS

- There are 3 mobile network operators and 4 MVNOs in the Irish market. Total revenues were €1.57bln in 2020, with a subscriber-base of 5.5m (including 0.3m data only and without M2M subscriptions). The market went through significant structural change as a result of the merger between 3 and O2 in 2014.
- Approval of the merger was made subject to commitments for the merged company to provide capacity-based MVNO access to two players. However, one of these MVNOs exited the market, and the other (Virgin Mobile) has remained small in scale. The largest MVNO in Ireland, with around 8% market share, is Tesco Mobile.
- Irish mobile offers are dominated by high-volume data. Attractive offers have been made in this segment by Eir through its GoMo sub-brand, Three (through its sub-brand 48), and more recently Vodafone. International benchmarks show that Irish consumers are relatively well served in the high-end data segment, and ARPUs have recently declined, potentially as a result of competition from these players.
- Interviews suggest that competition in the provision of MVNO access is limited and that MVNOs struggle to access attractive terms on a commercial basis that would allow them to compete in the high volume mobile data segment. Nonetheless MVNOs now also make these offers available, but typically with greater constraints than are offered by MNOs e.g. in terms of fair usage.
- At the end of June 2021, it was reported that Liberty Global was seeking a purchaser for the Irish Virgin Media business (fixed + mobile), valuing the business at up to €1.5bln. While there is still uncertainty around the potential sale, there are some scenarios that could result in the wind-down of Virgin's MVNO business including purchase by an MNO
- In mid-2020, 42% of Irish mobile sites were controlled by independent TowerCos. This figure did not yet include the purchase of CK Hutchison's towers by Cellnex, which is likely to raise the figure to around 50%. However, towers in Ireland are under the ownership of 3 separate companies.
- The market for M2M/IoT in Ireland has grown rapidly from around 340,000 subscribers in 2013 to 1.6m subscribers at the end of 2020 (~33 M2M subscriptions per 100 population). However, the IoT penetration is lower than in Sweden, which had 147 subscriptions per 100 population, Italy at 40 and Germany 36 in 2019. Three leads this segment, ahead of Vodafone, with Eir playing a very limited role.
- Innovation in the IoT segment is not a leading objective for the MNOs and MVNOs currently active in the Irish market. However, Ireland provides the Head Office for Cubic, a multinational supplier of IoT solutions, primarily in the automotive sector. Cubic relies on roaming rather than MVNO access in the Irish market, and has not experienced specific challenges in this regard. However, wider issues have been highlighted by IoT service providers concerning barriers to permanent roaming in some EU member states, and the need to ensure access to 5G capabilities on a forward-looking basis.

5.1 Operators active on Mobile markets

5.1.1 Mobile network operators (MNOs) in Ireland

Ireland has three mobile network providers that own and operate their own network infrastructure.

Vodafone Ireland

Vodafone Ireland is a mobile phone network and broadband provider in Ireland. It was created when, in 2001, the Vodafone Group bought Eircell, the mobile arm of Telecom Éireann. The company operates voice, SMS, MMS and mobile data services using 2G, 3G and 4G. Vodafone Ireland offers a full range of prepaid and postpaid services, including mobile telephony and mobile broadband.[256] Vodafone Ireland was the first Irish mobile network operator to launch 5G in August 2019.[257] Vodafone was the last MNO in the Irish market to introduce a sub-brand, with the launch of Clear Mobile in early 2021.[258]

Three Ireland

Three Ireland is a telecommunications and internet service provider operating in Ireland as a subsidiary of CK Hutchison. The company launched in July 2005 (as a fourth mobile operator behind Vodafone, O2 and Meteor (now Eir) providing 2G, 3G and 4G mobile phone services. Services were initially offered as post-paid only. Since 2008 a pre-paid mobile broadband service, known as 3Pay, has also been made available.[259] In June 2013 Three acquired O2 Ireland, and O2 was fully merged into the operations of Three in March 2015.[260] In October 2020 Three stated that it had the largest 5G network in Ireland, covering 35% of the population.[261] In addition to its own brand, Three operates the sub-brand “48”, which was first launched by O2 in 2012 targeting the youth market.[262]

Eircom

Eircom (marketed as Eir) is the largest fixed, mobile and broadband telecommunications company in Ireland and was born from the former state-owned

256 See https://n.vodafone.ie/en.html.
257 See https://www.independent.ie/business/technology/vodafone-switches-on-5g-mobile-in-ireland-cities-first-rural-later-38399480.html.
258 See https://www.bonkers.ie/blog/broadband-phone/vodafone-takes-on-gomo-with-launch-of-clear-mobile/.
259 See https://www.three.ie/plans/mobile-broadband/prepay/.
260 See https://ec.europa.eu/commission/presscorner/detail/en/IP_14_607; https://press.three.ie/press_releases/three-to-acquire-o2-ireland/.
261 See https://www.three.ie/business/insights/blog/ciara-o-reilly/talking-about-a-revolution-5g-connectivity-and-change.html.
262 See https://48.ie/.

monopoly telecommunication provider Telecom Éireann.[263] In 2001, Eircom had sold its mobile subsidiary Eircell to Vodafone. Then in early 2005, Eircom re-entered the mobile market by acquiring Meteor Mobile Communications, which was the third operator at the time. Eir operates a national mobile network both under its own Eir brand and GoMo, a value-focused, online-only sub-brand that was launched in October 2019. The network provides 4G, 3G and 2G services and ancillary services such as WiFi Calling. Since October 2019 Eir has also begun offering 5G services.[264] Eir provides both postpaid and prepaid plans.

An overview of the MNOs present in Ireland is shown in the following table.

Table 5-1: Overview of MNOs present in Ireland as of June 2021

MNO	Market entry	Current Owner	Technology	Brands
Vodafone Ireland	2001	Vodafone Group	2G, 3G, 4G, 5G	• Vodafone • Clear Mobile (sub-brand)
Three	2005	CK Hutchison	2G, 3G, 4G, 5G	• Three • 48 (sub-brand)
Eircom Limited (eir)	2005	Iliad SA	2G, 3G, 4G, 5G	• Eir • GoMo (sub-brand)

Source: WIK.

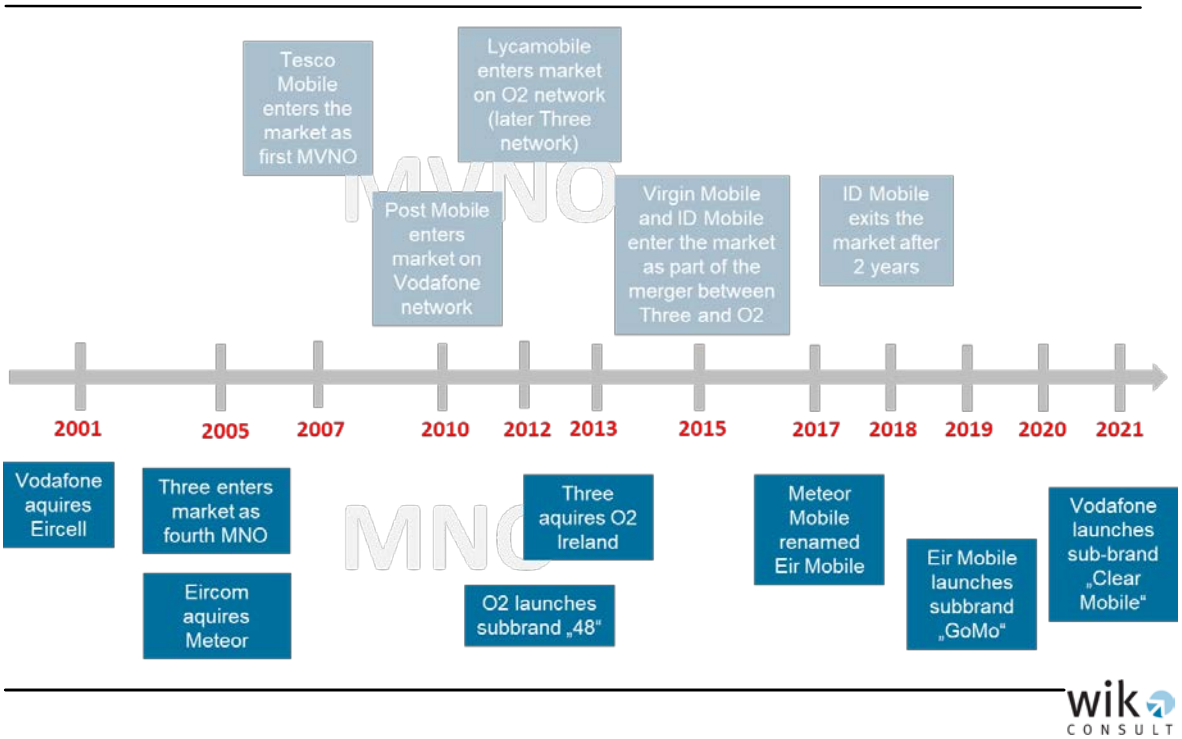
5.1.2 Mobile Virtual Network Operators (MVNOs) in Ireland

There are a number of MVNOs in Ireland that operate mobile services using one of the MNOs networks. Prior to the merger between Three and O2, there were 4 MVNOs.

263 Eir is currently majority owned by Xavier Niel's Illiad SA and his Paris based NJJ Telecom Europe investment fund. https://www.independent.ie/business/media/niel-raises-iliad-stake-to-tighten-eir-grip-38687631.html.

264 See https://www.ericsson.com/en/news/2019/10/eir-5g.

Figure 5-1: Timeline of Irish Mobile market



Source: WIK.

Following the merger, two new mobile virtual network operators (MVNOs) Virgin Media and iD Mobile, entered the market in August 2015, bringing the total number of MVNOs to 6.

MVNOs have remained small in scale compared to the three larger players in the market and their market shares in terms of subscribers and revenues are decreasing (see Figure 5-6). Moreover, some MVNOs have disappeared or downscaled. In 2018 iD was forced to exit the market.[265] In 2020 Comcast Business completed the acquisition of BlueFace, an MVNO present in the market between 2012 and 2017 and which today provides B2B solutions.[266]

An overview of the current MVNOs present in Ireland is shown in the following table.

265 See https://www.idmobile.ie/liquidation.html.
266 See https://www.blueface.com/about-blueface/.

Table 5-2: Overview of MNVOs present in Ireland as of June 2021[267]

MVNO	Type of MVNO	Market entry	Network provider	Market share
Tesco Mobile	Full	2007	Three	~8%
Post Mobile	Light	2010	Vodafone	<2%
Lycamobile	Full	2012	Three	<2%
Virgin Mobile	Full	2015	Three	2.3%

Source: WIK.

An Post Mobile

Post Mobile is a "light" MVNO,[268] which entered into a commercial arrangement with Vodafone in 2010.[269] Post Mobile offers pre-paid mobile services only with a simple pricing plan[270], mainly addressing elderly people. A key driver for An Post to enter the Irish mobile market was the opportunity to expand their suite of products and leverage the An Post Retail network and customer footfall. Initially, Post Mobile's ambition was to reach 5% market share, which was not achieved. Post Mobile's market share lies below 2%. [✂] Vodafone controls and manages Post Mobile's wholesale activities.[271] The Post Mobile brand was re-launched under the An Post master brand identity in 2015.[272]

Tesco Mobile

Tesco Mobile is a full MVNO, which entered into a MVNO agreement with O2 (now Three) in 2007. Up until 2017, Three owned a 50% share of Tesco's mobile business, and the wholesale contractual model is understood to have been based on a revenue sharing agreement. In 2017 Tesco Ireland reached an agreement with Three to take over its 50% share and take full ownership of the business.[273] [✂] Today, Tesco can determine its own wholesale commercial terms and conditions associated with its supply of mobile voice and call termination.[274] Tesco Ireland is the largest MVNO in Ireland with over 400 thousand customers. Tesco offers both prepaid and postpaid mobile services.

267 Market shares in subscribers of voice and data services as of Q1 2021 (not including mobile broadband only and M2M subscriptions). The IoT connectivity provider Cubic Telecom is headquartered in Ireland, but does not operate as an MVNO in Ireland, and relies instead on roaming agreements for its Irish connectivity.
268 Reseller of their host's minutes, with no infrastructure or billing capability.
269 See https://www.anpost.com/Mobile.
270 See https://www.anpost.com/Mobile/Standard-rates.
271 See ComReg 19/47, p. 79.
272 See https://irelandstechnologyblog.com/an-post-to-relaunch-postfone-as-post-mobile-25c2984f0e39.
273 See https://www.independent.ie/business/tesco-ireland-is-to-buy-out-3-irelands-50pc-stake-of-tesco-mobile-ireland-35871337.html.
274 See ComReg 19/47, p. 80.

Lycamobile

Lycamobile is a full MVNO, which entered into a commercial agreement with O2 (now Three) in 2012. Lycamobile has its own switching infrastructure based in the UK, determines its own wholesale commercial terms and conditions, and can set and control its mobile termination rates.[275] Lycamobile is active in 23 countries as an MVNO targeting customers within expatriate and immigrant markets that want to make international calls. Lycamobile offers SIM-only prepaid services [✂].

Virgin Mobile

Only one of the MVNOs that were created as a result of the O2/Three merger, Virgin Mobile, still exists. Virgin Mobile is a full MVNO. Its wholesale contractual agreement is based on capacity-based charging due to the merger remedies.[276] The mobile voice and call termination services provided by Virgin are not currently subject to regulation.[277] Virgin is Liberty Global's telecommunications operation in Ireland. Virgin first entered the market as a cable company. The strategy behind becoming an MVNO was mainly motivated by the aim of selling more products to cable-base customers and to grow the customer lifetime value. Today, Virgin has 387,000 broadband customers and 124,000 mobile customers in Ireland, resulting in a mobile market share of a little over 2% in the mobile market.[278] Virgin's mobile target group consists of private customers and small SMEs. At the end of June 2021, it was reported that Liberty Global was seeking a purchaser for the Irish Virgin Media business (fixed + mobile), valuing the business at up to €1.5bln.[279] While there is still uncertainty around the potential sale, there are some scenarios that could result in the wind-down of Virgin's MVNO business, e.g. a purchase by an MNO or by a private equity firm that prefers to focus on the fixed business.

Cubic Telecom

Cubic Telecom is a specialist player that was founded in 2005 and who develops mobility solutions for IoT, M2M and device-manufacturing companies. Cubic is registered as an MVNO in a number of territories but its EU operations are predominantly supported via its MVNO in Liechtenstein. In Ireland, Cubic is not registered as an MVNO. In Ireland and other countries, where there is no regulatory or MNO restriction on permanent roaming, Cubic uses its Liechtenstein numbering range in order to connect to the local network partner.[280] An important element of Cubic's

275 See ComReg 19/47, p. 79.
276 See https://www.irishtimes.com/business/technology/mvnos-fail-to-shake-up-mobile-market-1.3142918.
277 See ComReg 19/47, p. 80.
278 See https://www.virginmedia.ie/press-hub/.
279 See https://www.thetimes.co.uk/article/liberty-offload-virgin-media-ireland-uk-merger-o2-2f3gr3z5f.
280 In countries where there is a restriction on the Cubic Liechtenstein numbering range they use the Orange France 901 international numbering range (e.g. countries with non-geo number access such as Germany or Belgium).

business strategy is the capability to make use of permanent roaming solutions, whereby its devices can use international numbers while remaining permanently in a given jurisdiction). Cubic has not had any difficulties operating in the Irish market on this basis. For service providers such as Cubic, roaming is often the most straightforward means of providing service in a territory, although this solution entails the following costs and challenges:[281]

- Costs for data, voice and SMS are often higher than for MVNOs.
- No SLAs are provided.
- There is regulatory uncertainty about permanent roaming.
- May not have access to national roaming agreements.
- Commercially not always the most favourable compared to being an MVNO.

5.1.3 Regulation in the mobile market

The only regulatory obligations currently concerning MVNO access in Ireland stem from the commitments made in connection with the 2014 approval by the European Commission of the merger between Three and O2. However, MVNO access obligations via SMP regulation as well as spectrum licenses have been proposed or introduced in the past.

MVNO obligations in the context of spectrum licences

In Ireland, the 2002 3G Licence Award provided for the possibility of a MVNO by including a MVNO obligation on the “A-Licence” which required the successful Applicant to offer MVNO Access on a specified “Retail minus X” basis as part of the Application.

The A-Licence also had a lower spectrum access fee of €50.7m compared to €114m of the B-licence. Three won the “A-Licence” and a “Retail minus at least 35%” provision is included in the MVNO obligation in its 3G licence. However, no MVNO entry occurred from these 3G A-Licence provisions.

Previous joint SMP finding[282]

In 2004, in its analysis of the market for mobile access and origination (former market 15 in the original EC Recommendation on relevant markets susceptible to ex ante regulation), ComReg found that Vodafone and O2 were collectively dominant (and not singularly dominant), while the third entrant Meteor and the new entrant, ‘3’, were each

281 Interview conducted June 2020.

282 This section draws on material from the WIK-Consult (2018) study for the EC: Support for the Review of the SMP Guidelines.

not dominant. In ComReg's view a number of *structural characteristics* within the Irish relevant market were considered to be conducive to coordinated behaviour between Vodafone and O2.[283] Furthermore, ComReg identified *behavioural characteristics* which served to reinforce the relevant structural market characteristics. In the view of ComReg, Vodafone and O2 were tacitly colluding on the basis of data on price trends, absolute price levels, high level of profitability of the two MNOs and the existence of pent up demand as a consequence of denial of wholesale network access.[284] This finding was not challenged either by the European Commission in the context of the article 7 notification proceedings or by the Irish Competition Authority, which had been consulted by ComReg in the context of the market review process.

However, the Irish Communications Appeal Tribunal annulled ComReg's Decision on procedural grounds.[285] Specifically, the Appeal Panel questioned the decision on the basis that while the outcome observed in the market was consistent with tacit collusion, it could have been equally consistent with non-cooperative/competitive behaviour by the two MNOs which were deemed to be jointly dominant. In the opinion of the Appeal Panel[286], ComReg failed to establish that prices were above the competitive level and that the market shares were similar enough for tacit collusion not to be questionable. Furthermore, ComReg's analysis on wholesale network access agreements with potential MVNOs was flawed since the lack of existence of such agreements could have also been attributed to the fact that it was not in the parties' best interest to conclude such agreements.

No further market analyses on mobile access and origination were issued by ComReg after the Irish Communications Appeal Tribunal annulled ComReg's Decision in 2005. In 2007 the Commission removed the market for mobile access and call origination from its revised list of markets recommended for ex ante regulation. Thus, no further market analyses were conducted on this market by ComReg.

MVNO obligations in the context of merger proceedings

In 2014, the European Commission cleared the proposed merger between Hutchison 3G and Telefonica Ireland (O2). Approval of the merger was conditional upon a commitments package which was submitted by Three and included ensuring the short-term entry of two MVNOs and the possibility for one of them to opt to become a full mobile network operator by acquiring spectrum at a later stage.[287]

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283 See Bernaerts, I. and S. Kramer (2005), First collective dominance cases under the European consultation mechanism on electronic communications, Competition Policy Newsletter, no 2.
284 See BEREC, BoR (15) 195.
285 See Larouche, P. and M. Visser (2006), The Triangular Relationship between the Commission, NRAs and National Courts Revisited, Communications & Strategies, No 64.
286 See Decision No 08/05 of the Electronic Communications Appeal Tribunal in respect of Appeal Numbers ECAP6/2005/03, 04, 05, 06, 07 and 08.
287 See https://ec.europa.eu/commission/presscorner/detail/en/IP_14_607.

Under the terms of DG Competition's clearance of the merger, MVNO agreements were required to be based on a "capacity-based" MVNO model, whereby the two new entrants could obtain a dedicated pipe for voice and data traffic.[288] Specifically:

- Three committed to offer wholesale network access under a capacity-based MVNO model. Telefónica (O2 Ireland became a subsidiary of Telefónica in 2006) committed to conclude two such capacity agreements. Under the agreement each of the two MVNOs could increase their initial capacity allocation up to a maximum cap of 15% each of Three's network capacity (i.e. a total of 30%). The duration of the two capacity agreements was set for five years, with an option to extend the term of the agreement for another five years.

- Three committed to divest spectrum to either of the two MVNOs (but not to both), on request and on certain conditions being fulfilled, in order to enable either one of these MVNOs to develop into an MNO. Telefónica committed to divest two blocks of 1800MHz spectrum and two blocks of 2100 MHz spectrum. The obligation to divest the 2100 MHz spectrum expires in 2022. In addition, Three committed to divest one block of 900MHz spectrum. The option for the MVNOs to acquire this spectrum is valid for 10 years from 1 January 2016. This option has not yet been taken up by the only remaining MVNO (Virgin Mobile).

- Three committed to amend and strengthen Eircom's existing network sharing agreement with O2. Three committed to join the agreement and its terms would be revised, among others to increase the pace of site consolidation.

The final MVNO commitment was concluded for a minimum capacity (in %) for a fixed price. The Commission expected that an agreement would be reached with at least one MVNO. The aim was to have a second MVNO enter on the same terms. If no second MVNO had agreed to enter the market, a divestiture trustee would have offered a minimum capacity allocation to potential MVNO entrants, on behalf of Three, at a specified (capacity unit) price of the pro rata price payable under the terms of the capacity agreement with the Upfront MVNO in years 1-5.[289]

288 See Para 52 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=uriserv:OJ.C_.2014.264.01.0006.01.ENG.

289 See https://ec.europa.eu/competition/mergers/cases/decisions/m6992_20140528_20600_4004267_EN.pdf.

5.2 Mobile network deployments

5.2.1 Spectrum assignment

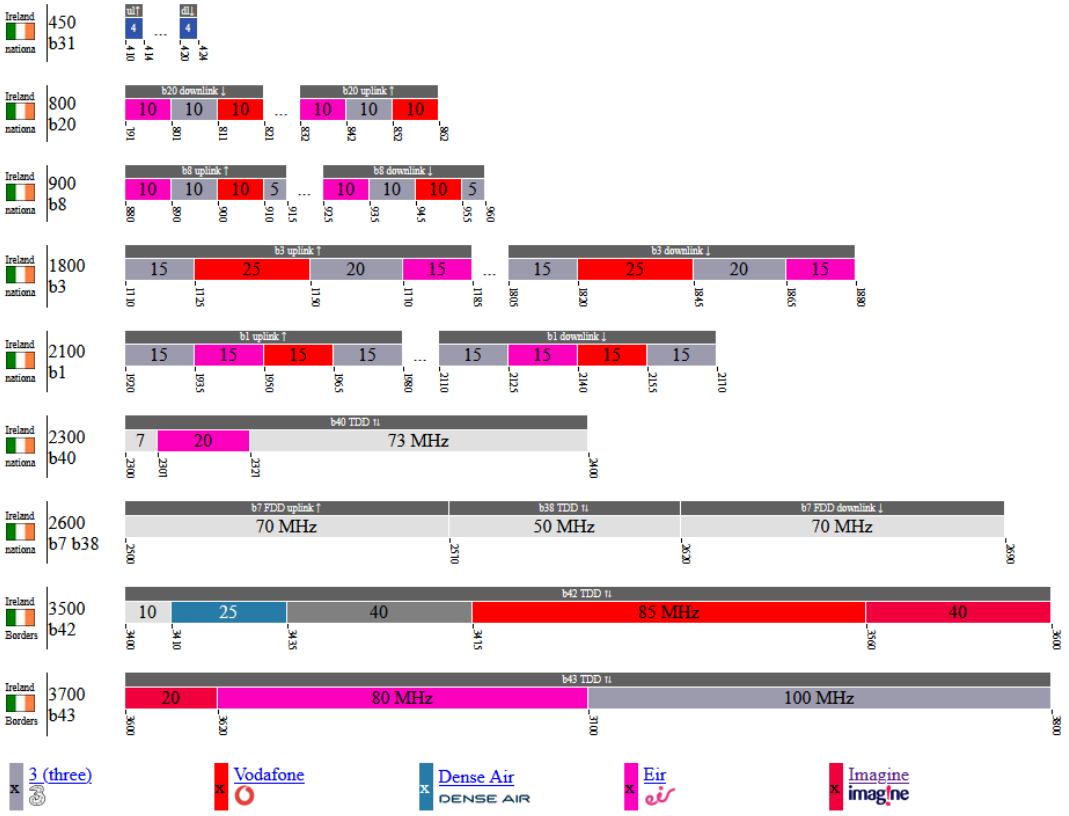
In mid-2002 Ireland assigned four 3G licences (2100 MHz) to 3 bidders (Hutchison (Three), Vodafone and O2).[290]

On November 15th 2012, ComReg announced the results of its multi-band spectrum auction (primarily for 4G (LTE)).[291] This auction awarded spectrum rights of use in the 800 MHz, 900 MHz and 1800 MHz bands in Ireland from 2013 to 2030. The winners of spectrum were Three, Meteor (wholly owned subsidiary of Eir), O2 Ireland and Vodafone.[292] The auction of the 3.6 GHz band, which is primarily used for 5G services already took place in 2017, earlier than in a lot of other European countries, with total cost of about €78m for the operators.[293]

The following figure shows the spectrum bands used by different operators band for their respective services. The figure shows the status as of July 2021. In addition to the spectrum assigned to MNOs, spectrum was also assigned to Imagine and Dense Air, smaller players that offer 5G FWA and small cells.

290 See https://www.irishtimes.com/news/irish-beauty-contest-for-3g-gets-under-way-1.407826 and OECD Economic Outlook, Volume 2003 Issue 1.
291 See https://www.comreg.ie/csv/downloads/PR15112012.pdf.
292 See https://www.comreg.ie/media/dlm_uploads/2015/12/PR15112012.pdf.
293 See https://www.comreg.ie/five-winning-bidders-comregs-3-6-ghz-band-spectrum-award/.

Figure 5-2: Irish Mobile Frequencies (Status: July 2021)



Note: Not included in the above figure is the 3,6 GHz spectrum assignment, divided into rural and urban areas (other than Dublin).
See https://www.comreg.ie/publication/results-3-6-ghz-band-spectrum-award-2/.

Source: spectrummonitoring.com (2021).[294]

5.2.2 Mobile network coverage

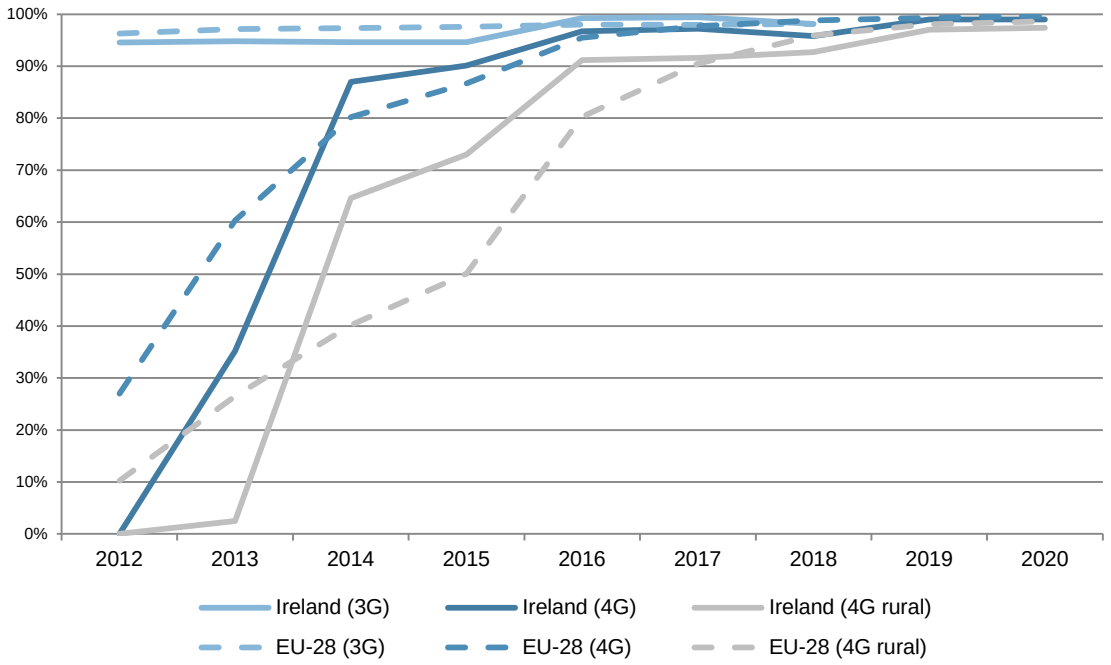
With respect to coverage obligations, the rules of the multi-band auction for 4G licences required existing MNOs to reach 70% of the population within 3 years of the licence commencement date.[295]

The coverage obligations were met by the operators as can be seen in Figure 5-3. By 2014 the coverage levels in terms of population were above 80%. Today, 4G coverage

294 See https://spectrummonitoring.com/frequencies.php?market=IRL.
295 See https://www.thejournal.ie/mobile-auction-4g-licence-675344-Nov2012/.

has reached 99% of the population, although coverage levels are lower in rural areas.[296]

Figure 5-3: Development of mobile network coverage 3G/4G in Ireland, 2012-2020 (3G only available until 2018)



Source: WIK based on European Commission.

Vodafone and Eir were the first operators to launch commercial 5G in Ireland's major cities in 2019.[297] Eir's 5G deployment currently covers 268 towns and cities and over 57% of the population.[298] Vodafone announced that it expected to cover 30 % of the population across 11 counties by March 2021.[299] Three also launched its 5G network in

296 See https://digital-strategy.ec.europa.eu/en/library/broadband-coverage-europe-2019 and EC digital agenda key indicators: https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations. For more information on mobile coverage see https://www.comreg.ie/publication/future-mobile-connectivity-in-ireland.

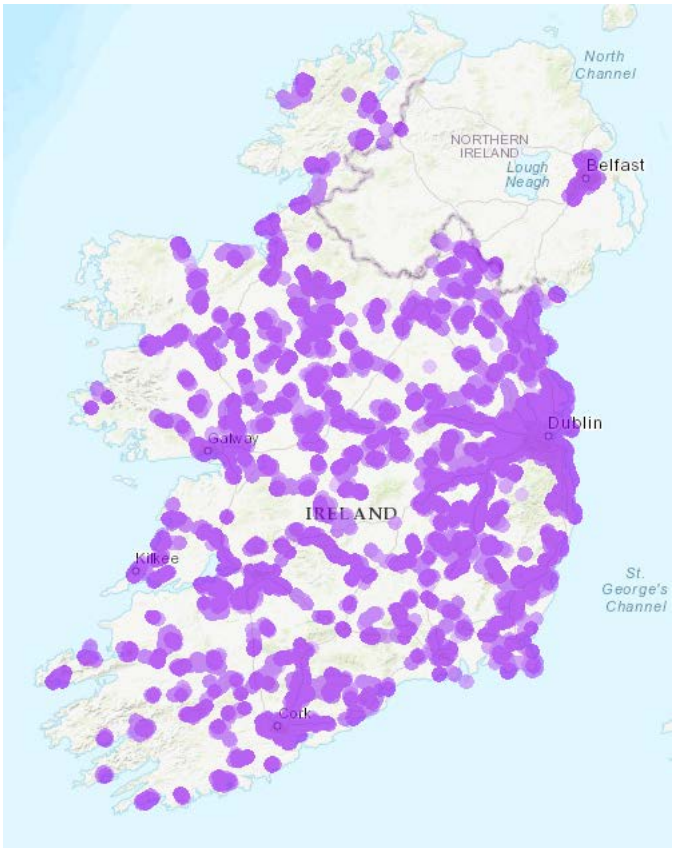
297 See https://n.vodafone.ie/aboutus/press/vodafone-ireland-switches-on-first-5g-network-in-five-cities.html#:~:text=17%20September%202019&text=Tuesday%2013th%20August%202019%3A%20Vodafone,Ireland%20to%20launch%20commercial%205G.&text=Live%20across%20locations%20inCork%2C%20Limerick,Ireland%20over%20the%20coming%20months.

298 See https://www.eir.ie/5G/.

299 See https://www.siliconrepublic.com/comms/vodafone-5g-ireland-ericsson-dss.

September 2020 and had a population coverage of about 47% as of May 2021.[300] The following figure illustrates the distribution of 5G coverage in Ireland.

Figure 5-4: 5G rollout Ireland, status June 2021



Source: nPerf (2021).[301]

Geographic and demographic factors create important challenges in securing widespread coverage by mobile networks in Ireland, and may also affect the viability of operating multiple networks in parallel. Ireland has a population density of 70.9 people per km^2, which is considerably lower than the EU28 average of 118.0 people per km^2.[302] According to data from the Census[303] 37% of the population lives in rural areas, 3% of the population lives in 28% of the total land area while 70% of the population lives in 3% of the total land area.

300 See https://www.comreg.ie/media/2021/06/ComReg-2170c.pdf
301 See https://www.nperf.com/de/map/5g.
302 Eurostat, 'Population density', http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tps00003, accessed 26. October 2020.
303 See https://www.cso.ie/en/index.html, accessed 26. October 2020.

According to stakeholder interviews conducted for this study, the low population density coupled with the small size of the Irish market can create significant barriers to entry, as well as presenting challenges to distribution and marketing in rural areas, which may disproportionately impact MVNOs relying on physical outlets. The cost of serving rural areas can also be high, impacting coverage, network quality and competition in the most remote regions. According to a 2018 study conducted by Oxera for ComReg,[304] the cost of mobile coverage rises exponentially after reaching a certain level (around 95%) due to the dispersed population distribution and high proportion of the population living in rural areas. Calculations based on different scenarios indicate that the investment costs for upgrading a mobile network from 99% to 99.5% coverage and at least 30 Mbps would be €102 million, while upgrading coverage from 97% to 97.5% would be comparatively cheap and cost only €24 million.

In addition, the population characteristics in Ireland mean that geographical mobile coverage is significantly more expensive than population coverage. According to the Oxera results, reaching 99% geographical coverage is around 3.8–5.1 times more costly than targeting population coverage (depending on the speeds provided).

5.2.3 Network sharing agreements

Mobile network sharing is an operator-driven decision, which is generally pursued to save costs.[305] With regard to network sharing between mobile network operators ComReg has the following view:[306]

> *Recalling that there are many forms of collaboration and, further, that the benefits and drawbacks of each collaboration will depend on the specifics of the proposed collaboration, ComReg maintains that it cannot have a firm view on spectrum rights sharing (or pooling) and network sharing other than that it would look more favourably on agreements that would not unduly restrict competition and would deliver demonstrable benefits that are shared with end-users.*
>
> *Further, ComReg remains of the view that interested parties should be in a position to identify for themselves the types of potential issues and concerns (e.g. competition law) that could be raised by a proposed collaboration agreement.*

304 Oxera 2018 Future mobile connectivity in Ireland https://www.oxera.com/wp-content/uploads/2018/12/ComReg-Future-mobile-connectivity-in-Ireland.pdf.

305 For Mobile network sharing in Ireland also see https://www.comreg.ie/publication/future-mobile-connectivity-in-ireland.

306 See ComReg (2017), 'Radio Spectrum Management Strategy 2016 to 2018', 21 June, para 7.21–7.22.

Network sharing agreement between Eircom and O2[307]

The first mobile network sharing arrangement in Ireland was concluded in 2011 between Eircom and O2. Both parties operated around 3,500 sites at the time. The network sharing agreement did not involve any transfer of assets or sharing of spectrum. The negotiations took place after the Post-2008 economic downturn in Ireland. At the time, both companies found it difficult to retain customers and maintain revenues. In connection with the merger between O2 and Three, the Commission stated that the so-called Mosaic network agreement should not be terminated post-merger in order to ensure Eircom's ability to compete in the market.[308] The Mosaic agreement was prolonged until 2030.

Network sharing agreement between Vodafone and Three[309]

In 2012 Vodafone and Three created a joint venture company, in which each company has an equal share. The joint venture is responsible for the execution of the network infrastructure consolidation plan, the consolidated transmission network, the operation and maintenance of all sites and building of new sites.[310] The agreement was terminated in 2014.

Network sharing agreement between Eircom and Three Ireland[311]

After the merger between Three and O2 the Commission had concerns that Three could frustrate or terminate the network sharing agreement that Eircom at the time had with O2 Ireland. In that context, Three committed offering Eircom to continue the network sharing agreement on improved terms. By the end of August 2014 Eircom and Three had agreed a key network sharing deal that involved the two operators sharing existing mobile infrastructure and split the cost of deploying new cell sites through 2030. The network sharing deal did not cover the transfer of spectrum or other assets.

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307 See https://www.irishtimes.com/business/retail-and-services/eircom-o2-sign-deal-to-share-networks-1.565397.

308 See https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=uriserv:OJ.C_.2014.264.01.0006.01.ENG.

309 See https://www.irishtimes.com/business/technology/vodafone-and-3-in-joint-venture-deal-1.535929.

310 See https://press.three.ie/press_releases/13-jul-12-vodafone-ireland-and-three-ireland-announce-strategic-partnership-to-share-network-infrastructure/; https://www-origin4-vp.vodafone.com/content/index/media/vodafone-group-releases/2012/vodafone_three_network.html.

311 See https://www.fiercewireless.com/europe/eircom-agrees-long-term-network-sharing-deal-three-ireland. According to both parties the consolidation of existing cell sites and the joint deployment of new sites would lead towards a shared network comprising at least 2,000 sites within three years of the agreement. https://www.3gca.org/eircom-3-sign-network-sharing-agreement/.

Table 5-3: Overview network sharing agreements

Operators involved	Date of agreement	Duration	Shared elements	No. of shared sites
Eircom and O2	07.04.2011	10 years	• site equipment, • power supply, • towers and • transmission	3,500
Vodafone and Three (joint venture)	13.07.2012	Not known	• site equipment, • power supply • towers and • transmission	2,000
Eircom and Three	29.08.2014	Until 2030	• site equipment, • power supply, • towers and • transmission	2,000

Source: WIK.

In the context of the 5G rollout, Vodafone Ireland is currently trialing OpenRAN. Open RAN standards and technical specifications define open interfaces between radios, hardware and software so that networks can be deployed using multiple vendors.[312]

5.2.4 Influence of TowerCos

There have been recent developments concerning the ownership of mobile towers and sites in the Irish market. In May 2020 Eir announced plans to sell their tower company Emerald Tower with 650 sites to the US infrastructure company Phoenix Tower International[313] for €300m.[314]

In addition, Cignal, in the Irish telecoms infrastructure company formed in 2015, was acquired by the Spanish infrastructure company Cellnex in November 2019. Cellnex took over the 546 tower sites across Ireland and has committed to invest €60m to build 600 new sites by 2026.[315] The deal was reportedly worth €210m.[316] At that point,

312 See https://www.siliconrepublic.com/enterprise/fiona-sheridan-vodafone-ireland-covid-19; https://www.vodafone.com/news-and-media/vodafone-group-releases/news/vodafone-joins-open-ran-policy-coalition-in-global-supply-chains.
313 Phoenix Tower's operations are mainly in South and Central America.
314 See https://www.mobileworldlive.com/featured-content/top-three/eir-to-sell-tower-company-for-e300m.
315 See https://cellnextelecom.ie/wp-content/uploads/2019/11/PR-for-Irish-Media-Use-Cellnex-Infravia-Cignal-Final.pdf.
316 See https://www.irishtimes.com/business/technology/irish-telco-cignal-acquired-by-spain-s-cellnex-in-210m-deal-1.4013554.

Cellnex already operated more than 45,000 towers across a number of European countries. In the course of their expansion, Cellnex bought the mobile towers and sites of CK Hutchison in Europe in late 2020/early 2021 for €10bln.[317] As CK Hutchison is the mother company of the Irish MNO Three, this included 1,150 towers and sites in Ireland, which were worth around €600m, according to media reports.[318]

The third Irish MNO, Vodafone, did not sell their tower business. However, the 1,300 sites have been transferred, together with the sites of Vodafone in other European countries, to the newly formed company Vantage Towers. This company held an IPO in 2021, but the Vodafone Group still held 81% of the value of the company as of June 2021.[319]

In total, in mid-2020, 42% of Irish mobile sites were controlled by independent TowerCos.[320] This figure did not yet include the purchase of CK Hutchison's towers by Cellnex, which would have raised the figure to around 50%. Further concentration in the control of towers could give rise to competitive concerns, as has been highlighted in the UK.[321] In the event that an MVNO seeks to enter as an MNO, it would also be important to ensure that contracts for the lease of towers did not impede the entry of a new player.

5.3 Competitive developments

5.3.1 Evolutions in market share

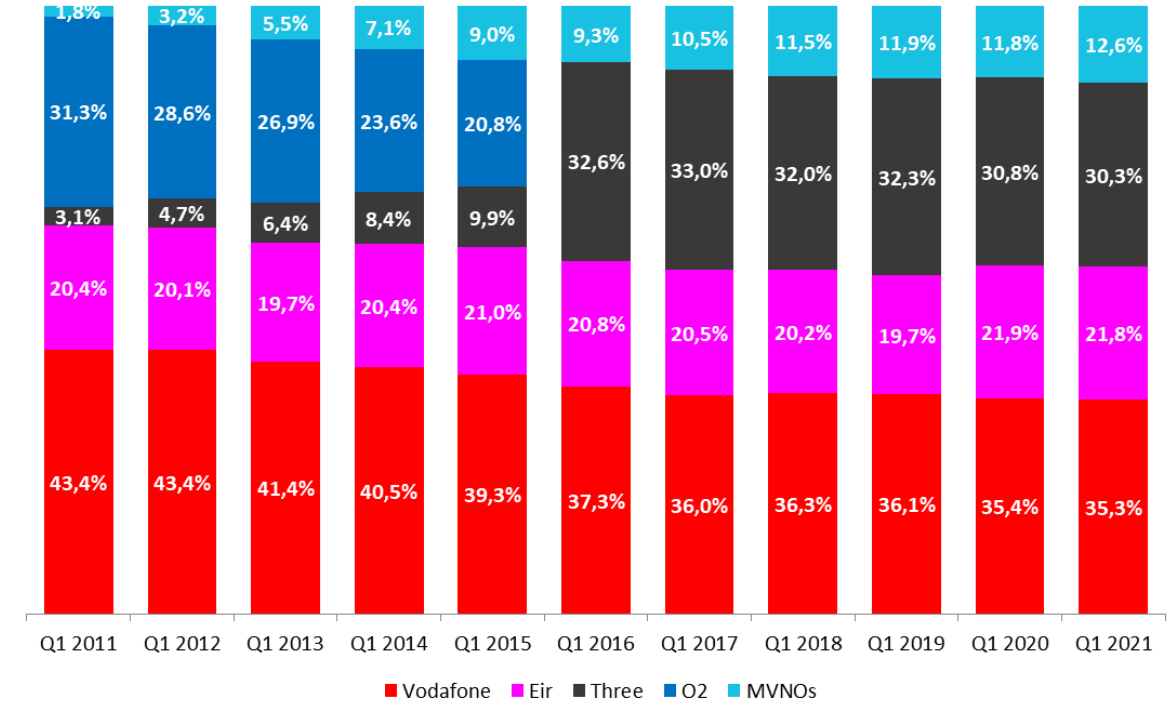
The key developments affecting infrastructure competition in the Irish mobile market have been the entry of a fourth mobile operator in 2005, and the merger between Three and O2, which led to the consolidation of the market to 3 operators in 2015. While the European Commission (EC) decided to approve the merger on the basis of commitments put forward by Three in response to the competition concerns identified by the EC, ComReg remained concerned fearing the commitments would not adequately address the competition concerns and consumer harm identified by the EC.[322]

Since the completion of the merger, there has been no significant movement in market shares (based on subscriptions that include voice, messaging and data, i.e. excluding

317 See https://www.cellnextelecom.com/en/cellnex-closes-the-acquisition-of-ck-hutchisons-assets-in-austria-ireland-and-denmark/.
318 See https://www.irishtimes.com/business/technology/cellnex-purchases-three-s-telecoms-towers-for-600m-1.4495273.
319 See https://www.vantagetowers.com/.
320 See EY-Parthenon (2020).
321 See https://www.gov.uk/government/news/cellnex-and-ck-hutchison-deal-raises-competition-concerns.
322 See ComReg 14/53, Information Notice.

data-only and M2M subscriptions) amongst the MNOs, which could indicate reduced competition in the market. Vodafone and Three each have around one third of the market, Eir has had a relatively stable market share of just over 20%. However, recently, Eir has gained ground, especially compared to Three, potentially due to the launch of their sub-brand GoMo.[323] The share taken by MVNOs increased in the first years following the merger but that increase has slowed down in recent years[324].

Figure 5-5: Development of market shares in terms of subscriptions in Ireland, Q1/2011-Q1/2021



Source: WIK based on ComReg QKDR.

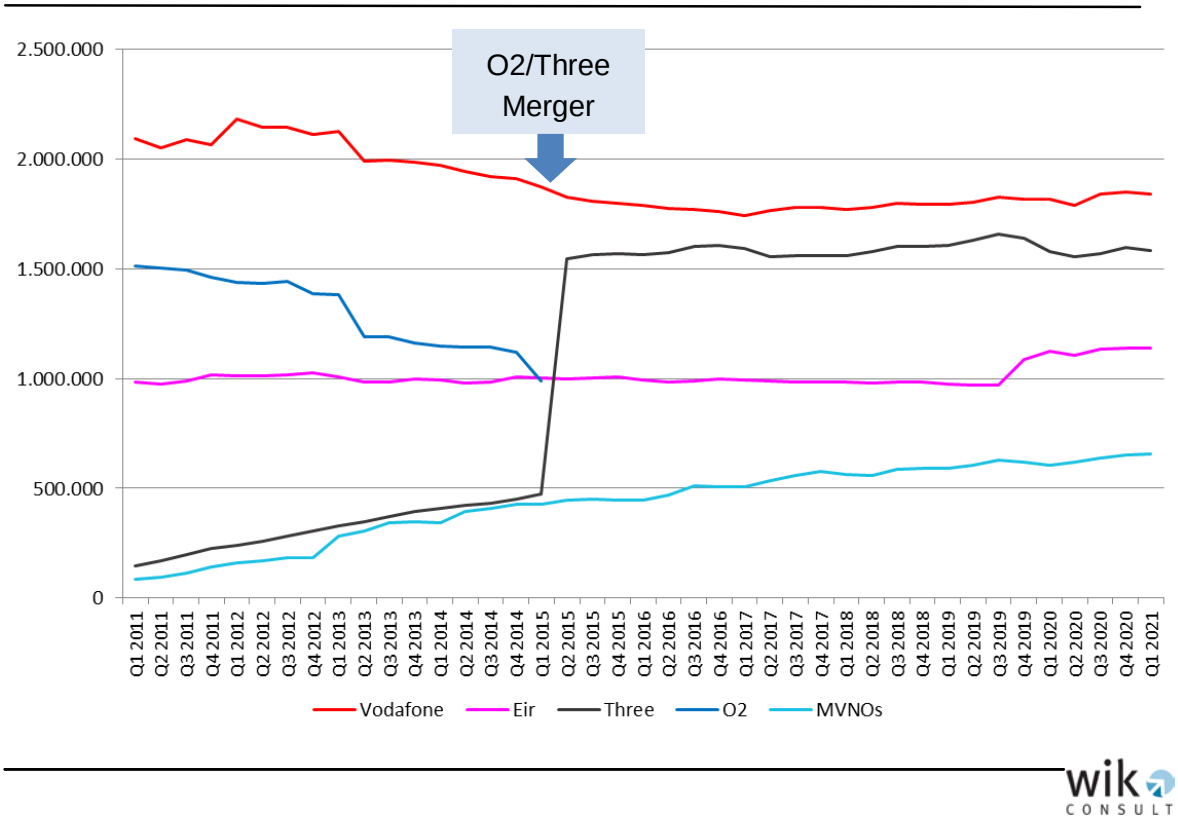
Figure 5-6 shows the development of the number of subscribers of mobile operators in Ireland since 2011 without data-only and M2M SIM cards. Since the merger in 2015 the number of subscribers increased by around 9%. The figures show that the subscriber-base of Three and Vodafone has been relatively stable since the merger, but a small decline can be seen between 2019 and 2020. This may be due in part to the launch by

323 See ComReg QKDR.
324 See ComReg QKDR.

Eir of GoMo in Q3 2020, which had achieved more than 100,000 subscribers by Q1 2020.[325]

The number of SIM cards allocated to MVNOs did expand have increased at a steady pace and currently lie at around 650,000 subscribers.

Figure 5-6: Development of subscribers by operators, Q1 2011-Q1 2021



Source: WIK based on ComReg QKDR.

One method that is used to provide a proxy for levels of competition in the market is the Herfindahl-Hirschman Index (the sum of the squared market shares, multiplied by 10.000[326]). The HHI is calculated on the basis of subscriber numbers (including voice, messaging, data).[327] The merger between Three and O2 led to an increase of the HHI by around 500 points in 2015 when considering market shares including data-only and

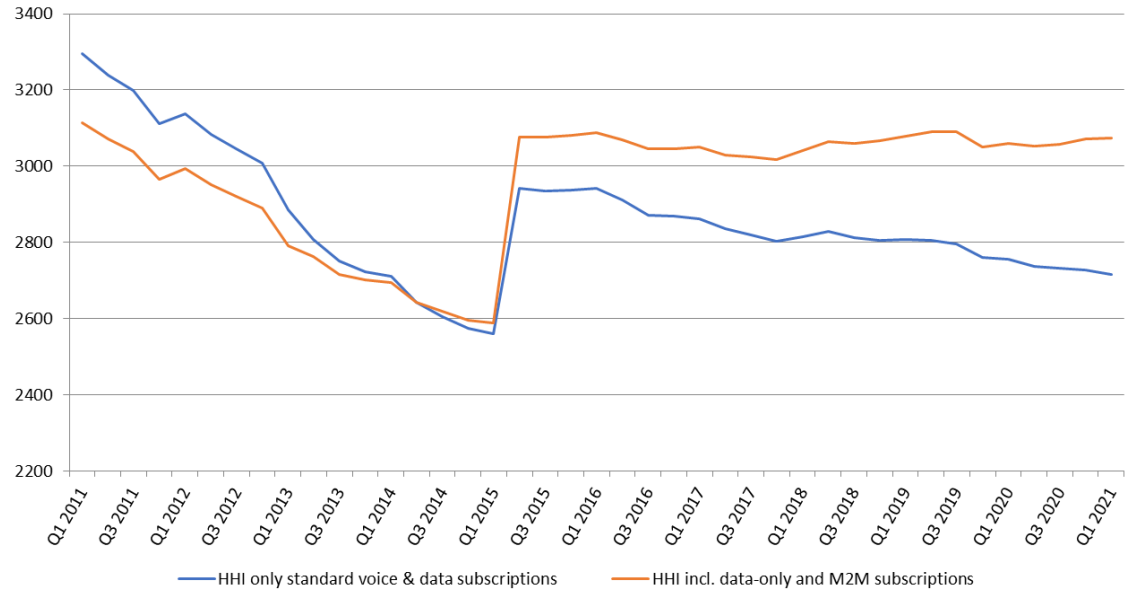
325 See https://www.eir.ie/pressroom/eir-announces-second-quarter-and-half-year-FY20-results-to-31-December-2019/.

326 Thereby the HHI gives proportionately greater weight to the market shares of the larger firms.

327 The closer a market is to a monopoly, the higher the market's concentration and the level of the HHI and the lower its competition. According to the US Department of Justice markets with an HHI of less than 1,500 are considered to be a competitive marketplace, markets with an HHI of 1,500 to 2,500 to be a moderately concentrated marketplace, and markets with an HHI of 2,500 or greater to be a highly concentrated marketplace. https://www.sciencedirect.com/topics/economics-econometrics-and-finance/concentration-ratio.

M2M. Since then the HHI remained steady at a high level, especially relative to the HHI in countries with 4 MNOs. This HHI includes subscriber market shares of MNOs and MVNOs. The orange line incl. M2M and data-only subscriptions is higher due to Irish retail MVNOs de facto not serving this market segment. If M2M and mobile broadband only subscriptions are excluded, the increase in concentration resulting from the merger appears less significant and, under this measure, the HHI declined in subsequent years to a level between the pre-merger and the immediate post-merger situation.

Figure 5-7: Herfindahl-Hirschman-Index (HHI) based on subscriber market shares in the Irish mobile market 2011-2021[328]



Source: WIK based on data from ComReg.

5.3.2 The role of MVNOs

In addition to the service competition provided by the vertically integrated MNOs (see above), MVNOs have a retail market share of 12.5% in terms of subscribers (voice, messaging, data)[329], which is comparable to MVNO shares in other EU countries.

The following figure shows the distribution of the 660,000 (Q1/2021) subscribers among the MVNOs.[330] MVNOs have benefited from a steady increase in subscribers following

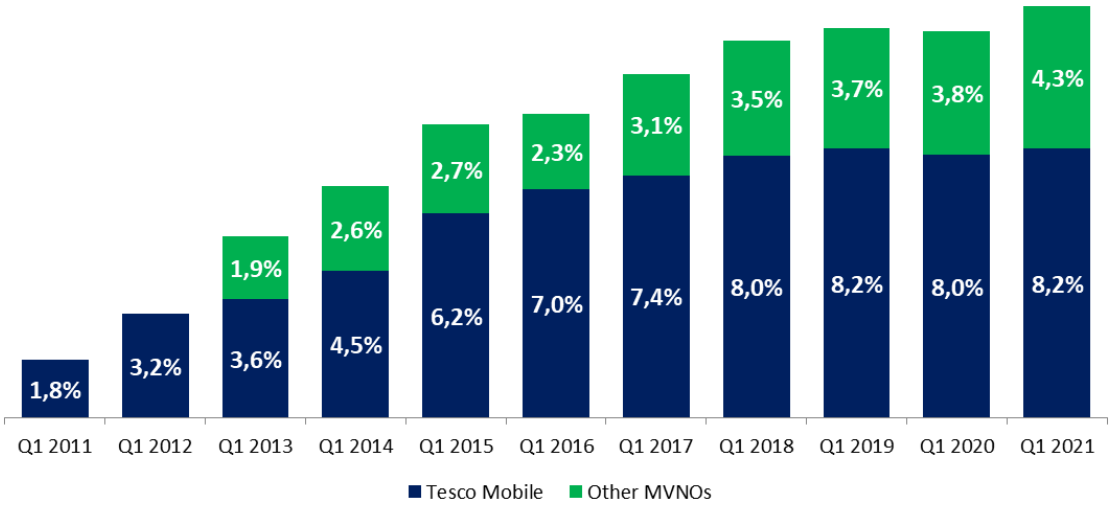
328 Until Q3 2017, Tesco Mobile Ireland was a joint venture of Tesco Mobile and O2 (respectively Three after the Three/O2 merger). Tesco Ireland then acquired sole control of Tesco Mobile Ireland and the operator became a completely independent MVNO. The displayed HHI figures consider the market shares of O2/Three and Tesco Mobile independently for the whole observation period.

329 See ComReg QKDR.

2011 and together increased their subscriber base from around 100,000 in early 2011 to more than 650,000 in early 2021.[331] However, subscriber growth and especially MVNO market share growth has slowed down in recent years, and the distribution of customers among the MVNOs is very uneven, with Tesco maintaining a leading position in this market segment. As noted in section 5.4.1, revenues from MVNO subscribers are also for the most part lower than revenues from MNO subscribers.

As of mid-2021 there were 4 MVNOs. Tesco is the only MVNO to have reached a material scale with a market share of over 8% but its market share has been stable since 2018. The only other MVNO to have achieved a market share of above 2% is Virgin Mobile. [✂]

Figure 5-8: Development of MVNO market shares in terms of subscriptions in Ireland, Q4/2011-Q1/2021



Source: WIK based on ComReg QKDR.

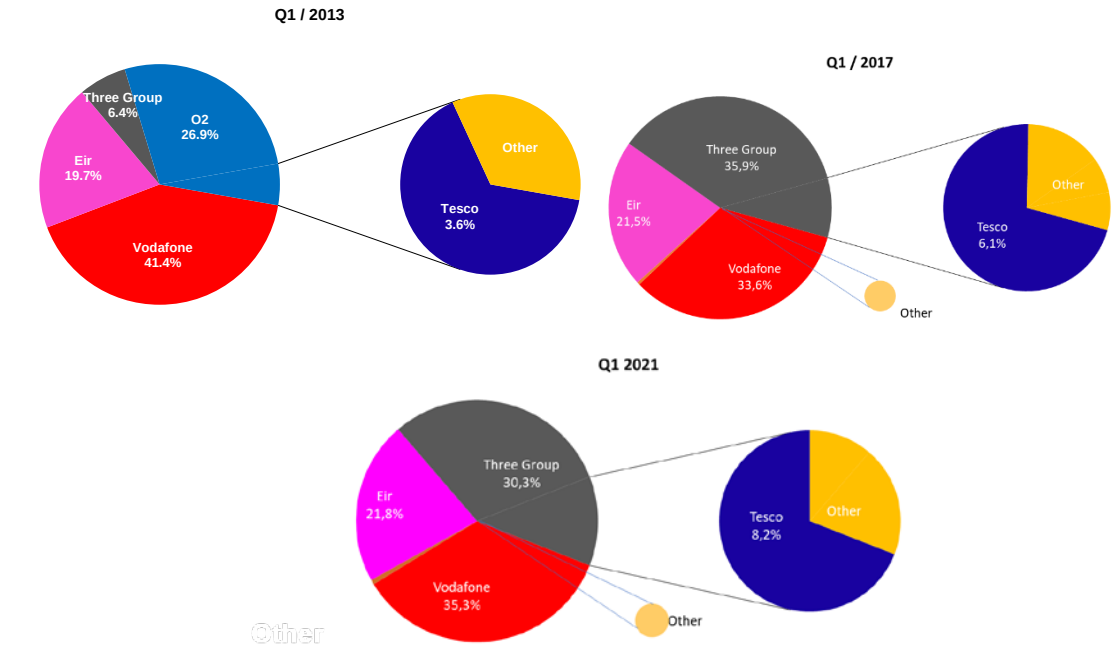
A focus on the MVNOs which entered as a result of the Three/O2 merger shows that, despite MVNO access on regulated terms the two entrants, iD Mobile and Virgin Mobile, have had limited success in breaking into the market. Both MVNOs started late with their respective commercial offers. Since then Virgin Mobile has been moderately

330 See ComReg QKDR.
331 During the same period MNOs were able to increase their customer base from around 5 million to 6.3 million subscribers. ComReg QKDR.

successful, but with more limited growth in recent years. iD Mobile exited the market in 2017, after achieving limited subscriber growth. [✂]

Figure 5-10 illustrates how MVNOs on the different MNO platforms fared in terms of market shares in 2013, 2017 and 2021. At the beginning of 2013, prior to the merger, there were 4 MNOs active in the Irish market and only two MVNOs, both using O2 as network host. In 2017, after the merger of O2 and Three there were 5 MVNOs in the market, of which two were dependent on the MVNO obligations arising from the merger and another, Post Mobile, had formed a commercial arrangement with Vodafone. A similar market structure can be seen in 2021, but with the exit of iD.

Figure 5-9: Market shares MNOs and MVNOs



Source: WIK based on ComReg QKDR.

With regard to the distribution of postpaid versus prepaid contracts, MNOs have traditionally secured more postpaid customers than MVNOs. The share of postpaid customers has also increased over time for all MNOs ([✂]). Conversely, Tesco Mobile and Post Mobile have a high share of pre-pay customers which may stem from their strategy of marketing via physical outlets (supermarkets and post offices). The exception among MVNOs seems to be Virgin Mobile, which only has postpaid customers. In general, maintaining a higher proportion of postpaid customers has several advantages for operators. For example, ARPUs are generally higher than for

prepaid customers, which can also be observed in Ireland (see Figure 5-15). Moreover, postpaid customers tend to have lower churn rates.

[✂]

5.3.3 The role of sub-brands

Since 2019 there has been an increasing focus on sub-brands in the Irish market, with MNOs launching these sub-brands to compete especially in the lower price segment. This strategy has increased competitive pressure on MVNOs, which typically focused on the value segment. In addition to competing on price, the sub-brands have also sought to compete on quality, e.g. by offering higher fair use data caps than MVNOs.

In October 2019, GoMo, a sub-brand of Eir, launched with unlimited data[332], calls and texts for €9.99 a month (+ a one-time €9.99 connection charge) for the first 100,000 customers to sign up for their services. The offer also included 10 GB of data for EU roaming and the promise that a customer not cancelling the service would have access to this price forever.[333] These 100,000 customers were signed up around Christmas 2019, and the offer was changed in January 2020 to cover the same services (with an increase in the "fair use" volume to 120 GB) but for a price of €12.99/month.[334] In April 2021, after acquiring more than 250,000 customers, GoMo increased the price further to €14.99/month for new customers, while maintaining the promise to not increase prices for existing customers under the previous pricing schemes.

48, the sub-brand of Three that was relaunched in 2020[335] with two monthly membership plans (subscriptions) of €9.99 and €14.99 offering 300 minutes, unlimited texts and respectively 20 GB or 40 GB of data. The service could be tried for free with 1 GB of data preloaded on a SIM. Customer service was available only through online channels with no in-store or telephone customer support.[336] 48 restructured its product portfolio in September 2020 to include 100 GB of data, unlimited texts and calls for €7.99 a month.[337] In February 2021, the price of this offer was increased to

332 While being advertised as unlimited, due to a „fair use" clause, GoMo reserved the right to limit the data service after a monthly data usage of more than 80 GB and if other customers were likely to be adversely affected by the heavy user, see: https://gomo.ie/wp-content/uploads/mobile_pt12.2-3.pdf; The reduced speed after excessing the fair use volume appears to still yield data rates from 3 to 5 Mbps, see https://www.bonkers.ie/blog/broadband-phone/gomo-to-end-its-12-99-a-month-for-life-offer/.

333 See https://www.independent.ie/business/technology/news/new-gomo-mobile-operator-launches-in-ireland-38596539.html.

334 See https://www.bonkers.ie/blog/broadband-phone/gomo-to-end-its-12-99-a-month-for-life-offer/.

335 The original launch was in 2012.

336 See https://www.irishexaminer.com/business/arid-31003333.html.

337 See https://www.rte.ie/news/business/2020/0908/1164006-48-increases-mobile-market-competition-with-7-99-offer/.

€10.99/month.[338] Similarly to GoMo, 48 has committed to maintaining the initial price offer for as long as customers maintain their subscription.

In January 2021, the third MNO, Vodafone, launched the sub-brand Clear Mobile. Their initial offer included unlimited calls, texts and data for €12.99/month. There was also a connection fee of €12.99. Instead of resorting to a "fair use" clause or a hard data cap, the data included really is unlimited. However, the speed of the mobile connections are capped to 5 Mbps from the start.[339] In June 2021 the monthly price and activation fee were increased to €14.99.[340] Since launch, an ongoing promotion gave the first month free for the first 25,000 customers to sign up to the brand, which implies that this threshold had not been reached as of mid-June 2021. In the summer of 2021 they differentiated their offer further and offered different prices for their plan depending on the operator customers are porting their number from. With a new number or a port from Three, Eir or GoMo, the price is at €12.99/month, while porting from all other operators/brands (incl. 48) leads to a price of €14.99/month. This can be interpreted as an attempt to gain customers specifically from the other MNOs.[341]

There are various rationales to the strategy to start with a low price point and to increase the rate after gaining traction in the market, which was utilized especially by GoMo and 48:

- Increasing the price while guaranteeing a "lock-in" of the old price for existing customers helps to reduce churn. Customers cannot simply take advantage of a competing offer from another operator and switch back into the old conditions when they see fit.

- The low starting price at launch guarantees media coverage and is often accompanied by large marketing campaigns.

- With the low starting price point, there is still scope for the operators to increase prices while maintaining a less expensive offer than the mother brands and the price level before the sub-brand launch in general.

Irish MVNO's have not yet established their own sub-brands, a strategy that has been pursued by MVNOs in some other countries. It is notable that no MVNO has lost a significant number of subscribers since the sub-brands entered the market. One potential cause are price reactions by the MVNOs. All MVNOs now offer unlimited data (with a fair use clause) and lowered their overall price level to compete with the sub-brands as described in chapter 5.5.2.

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338 See https://48.ie/legal/price-plan-details.
339 See https://www.bonkers.ie/blog/broadband-phone/vodafone-takes-on-gomo-with-launch-of-clear-mobile/.
340 See https://clearmobile.ie/content/dam/clear/terms/Clear_Mobile_1499_Price_Plan_Terms.pdf.
341 Targeting customers from specific competitors is yet rare in mobile markets, Vodafone did however also launch the sub-brand SIMon mobile in Germany in 2021, which follows a similar strategy.

The inexpensive offers with large data allowances by the sub-brands lead to the offers of the MNO's main brands mainly being attractive for users interested in using the newest technology (5G) and/or having a subsidized smartphone included in their plan as the sub-brands are currently only offering SIM-only contracts on 4G networks. The degree of customer service is also higher for the main brands of the MNOs, as the sub-brands only offer digital-only customer service.

5.3.4 The IoT/M2M segment

The IoT/M2M market has grown from nearly 340,000 subscribers in 2013 to over 1.6 million subscribers in early 2021.

Concentration can be observed in this segment, with the market being increasingly served only by the two providers Vodafone and Three.

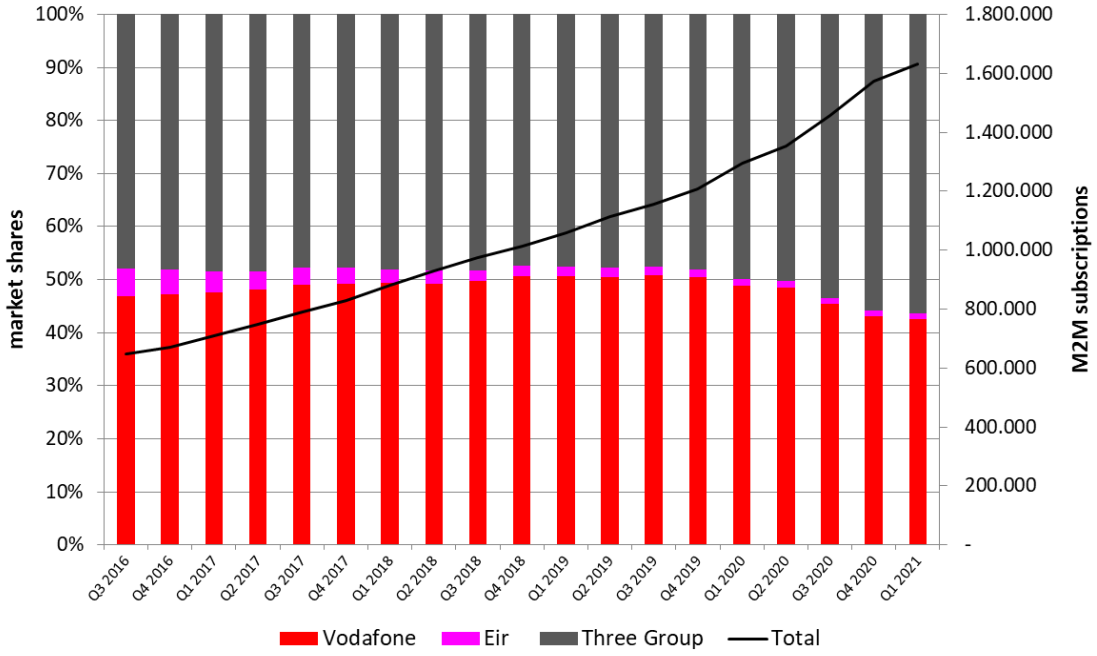
Eir always had a single-digit market share in M2M, with declining subscriber numbers since 2016. One reason could be Eir's strong focus on the consumer segment as opposed to the IoT/M2M market. By the first quarter of 2021, Eir's market share in this segment had decreased to around 1% with less than 20,000 subscriptions.[342]

Between 2016 and 2021, Vodafone expanded its subscriber base in this segment from about 300,000 to almost 700,000. Its market share has fluctuated and is now at 43%, reaching a peak of more than 50% in late 2019.

Three had almost no subscribers in this segment before the acquisition of O2. However, with the acquisition of O2 in 2015, their market share increased to over 50% overnight. Since then, Three has been able to increase the absolute number of subscribers steadily, with market shares declining to a little under 50%. Since the second half of 2019 there has been a big push in their IoT business, with an increase from 550,000 subscriptions to more than 900,000. This big increase over a short timespan may have been fueled by Three being selected as the connectivity provider for the big smart meter rollout in Ireland by ESB Networks, which will involve providing 2 million eSIM profiles over the next few years.[343] This means that today there are in fact only two providers with a focus on this segment, Vodafone and Three, with the latter having a project in place that will keep them in first place for the foreseeable future.

342 See ComReg QKDR.
343 See https://www.smart-energy.com/industry-sectors/smart-meters/irish-utility-to-deploy-2-4-million-smart-meters-using-eib-funding-esb-networks/.

Figure 5-10: Development of M2M subscriptions in Ireland, Q3/2016-Q1/2021



Source: WIK based on ComReg Quarterly Reports 2016-2021.

MVNOs present in the Irish market today are focused on the consumer market rather than IoT/M2M, and have a significant focus on voice and SMS as opposed to data. Although there is increasing volume in this market segment, interviews with MVNOs in the market suggest that revenues per M2M SIM are too limited to justify the cost of M2M provision. This is also shown when comparing ARPUs of different mobile services (see Table 5-4).

Table 5-4: Monthly Average Revenue per User by Mobile Service, Q1 2019-Q1 2021

All operators	Q1 2019	Q1 2021	Q1'19 – Q1'21 change
Mobile Phone Service - Prepaid	€13.96	€13.71	-1.8%
Mobile Phone Service – Postpaid	€32.54	€28.63	-12.0%
Mobile Phone Service - Blended	€23.06	€21.23	-7.9%
Mobile Broadband - Prepaid	€15.37	€13.66	-11.2%
Mobile Broadband - Postpaid	€19.54	€18.21	-6.8%
Mobile Broadband - Blended	€19.18	€17.92	-6.6%
Machine-to-Machine	€1.51	€1.11	-26.3%

Source: WIK based on ComReg QKDR data portal.

The margins on M2M services are comparatively low and these margins have declined more than in other segments over the last years. In order to offer M2M services profitably, a high number of units and high investment costs are necessary.[344] In a comparatively small market like Ireland, such a business model is only profitable if the provider in question also offers M2M services at a pan-European or even global level. This is also demonstrated by Eir's strategy, which has been to gradually reduce its share in this market segment. Eir is only active in Ireland, while Vodafone and Three also offer M2M/IoT services in other markets, which allow synergy effects. MVNOs such as Lycamobile are active in a number of markets, but focus on specific consumer segments rather than M2M.

Ireland is home to a significant cross-border competitor in the M2M segment, Cubic Telecom, which mainly implements connectivity in cars shipped worldwide (see chapter 0). However, Cubic is not an MVNO in the classic sense and its influence on the domestic market in Ireland is limited.

5.4 Financial performance

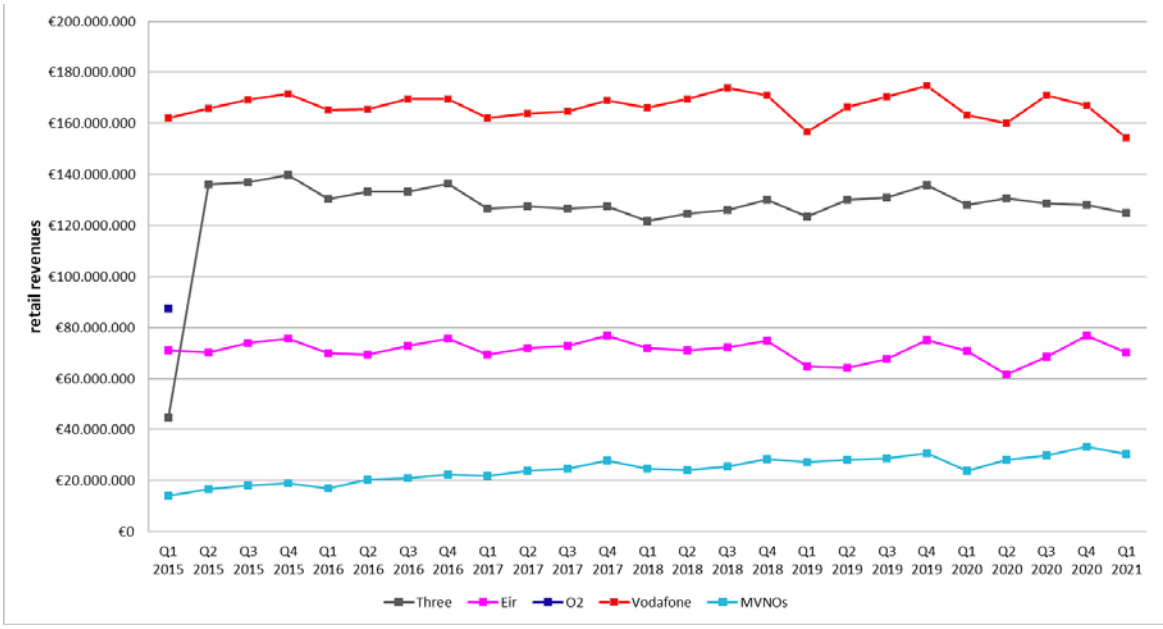
5.4.1 Revenues

Revenues in the Irish mobile communications market have remained largely constant in recent years with only minimal fluctuations in the total market. At the beginning of 2015, they amounted to 393 million euros per quarter and in the beginning of 2021 they stood

344 See https://smallbusiness.chron.com/lowmargin-business-vs-highmargin-23272.html.

at 380 million euros per quarter after reaching 405 million euros in late 2020. This is also shown by the revenue developments of the three MNOs individually (see Figure 5-13).

Figure 5-11: Quarterly mobile revenues, Q1/2015-Q1/2021



Note: The above revenues are retail revenues and include: Revenue on Device and Handset Sales, Connection and Rental Revenues, Domestic Traffic Revenues; Roaming Voice Revenues; International Call Revenues; Revenue from Premium Rate Service calls; SMS and MMS revenues (including Machine to Machine Messaging Revenue); Roaming revenues for SMS and MMS; Recurring revenues from usage of Mobile Broadband handsets, Dongles and other broadband enabled devices; Data add ons to existing packages and Roaming Data Revenues.

Source: WIK based on ComReg QKDR.

MVNOs were able to double their revenues in the same period (see Figure 5-14). However, as that doubling came from a low starting point, their revenues remain limited compared with the three large MNOs. [✂]

The low revenues in most of the MVNO businesses are also reflected in significantly lower ARPUs. [✂].

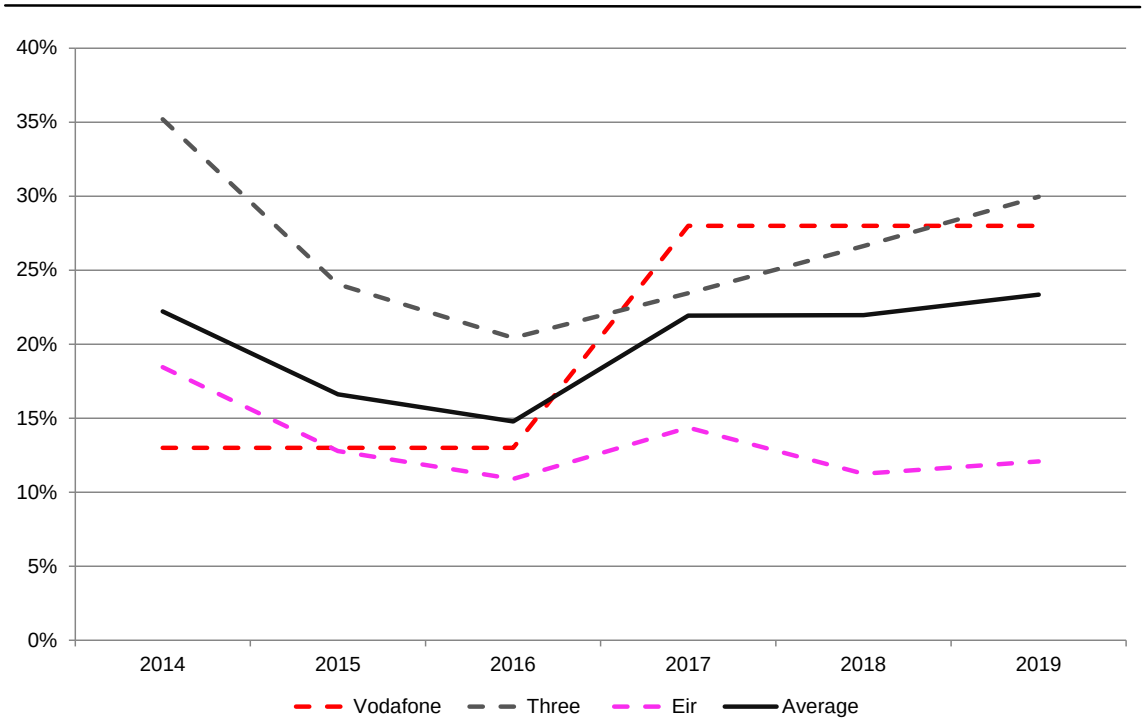
5.4.2 A decline in ARPUs can also be seen for certain of the MVNOs. Investments

Investment is typically reported through the CAPEX/revenue ratio and CAPEX per subscriber. CAPEX figures must be interpreted with care, as CAPEX measurements in

different countries may be based on different methodologies, in particular as regards to the treatment of spectrum acquisitions. Moreover, CAPEX comparisons between MNOs or between countries may be misleading if limited to a single year. CAPEX follows a cyclical pattern, since technological change is implemented in successive generations of technologies. CAPEX is closely correlated to periods in which there are network deployments and upgrades. Finally, it is useful to relate CAPEX to subscribers or revenue, in order to adjust for different market sizes in international comparisons.

Figure 5-17 shows that investments by all providers initially declined after the O2/Three merger in 2014. However, since 2016, CAPEX/revenues of MNOs have been increasing, following network upgrades and enlargement of their 4G footprint.[345] Increases in investment from Vodafone are particularly marked, while investments by Eir have remained at a relatively constant and comparatively low level since 2016. Although CAPEX levels by Three have increased in recent years, they have yet to reach the levels reported in 2014 at the time of the merger.

Figure 5-12: CAPEX/revenue ratios of MNOs in Ireland, 2014-2019



Source: WIK based on Statista GmbH.

345 See for example https://www.irishtimes.com/business/technology/vodafone-to-invest-500m-over-next-three-years-in-ireland-1.2998543.

5.4.3 Profitability

Profitability is measured by the EBITDA to revenues ratio (EBITDA margin):

$EBITDA\ margin = \frac{EBITDA}{Revenues}$, where

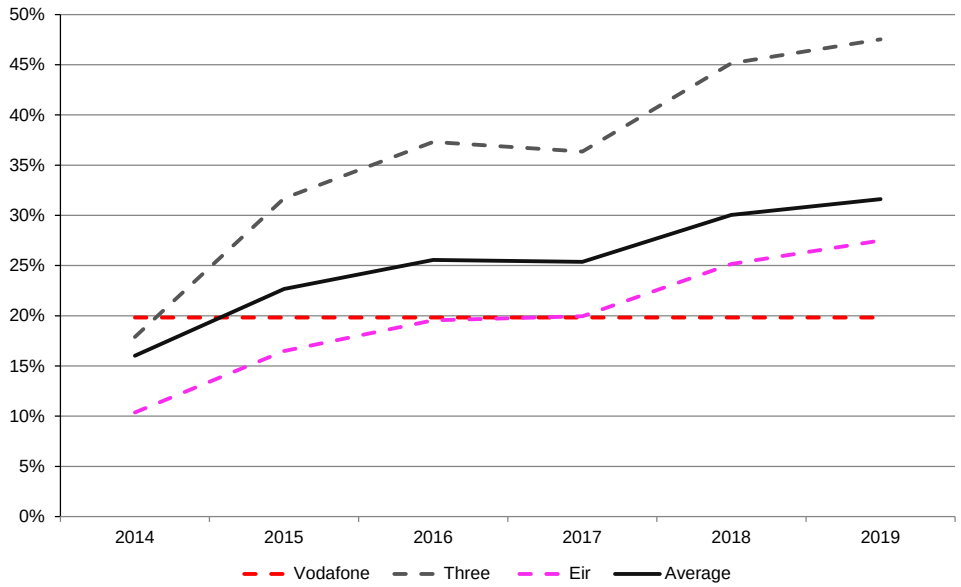
$EBITDA = \ Earnings\ before\ Interest, Tax, Depreciation\ and\ Amortisation$

$Revenues = \ Retail\ and\ wholesale\ revenues, incl.\ from\ sales\ of\ terminal\ equipment$

Estimates from Statista[346] based on available data suggest that, in the aftermath of the merger, both Three, and to a lesser extent Eir, were able to increase their EBITDA margin to a significant degree. Statista estimates that EBITDA margins for these two players increased from an average of 14.1% in 2014 to 37.5% in 2019, with margins for Three consistently exceeding those of the smaller operator Eir. Eir's profitability has overtaken Vodafone's in recent years. In the event that consumer outcomes stagnate or deteriorate, increasing levels of profitability might signal a cause for concern. However, it should be noted that the estimates pre-date the launch of the sub-brands, and thus would not reflect any possible reductions in profitability that may have resulted from price competition from these offers.

346 Research by Statista commissioned by WIK 2020. Figures sourced from financial and other public statements and estimates

Figure 5-13: EBITDA margin of MNOs in the Irish mobile market, 2014-2019



Source: WIK based on Statista GmbH.

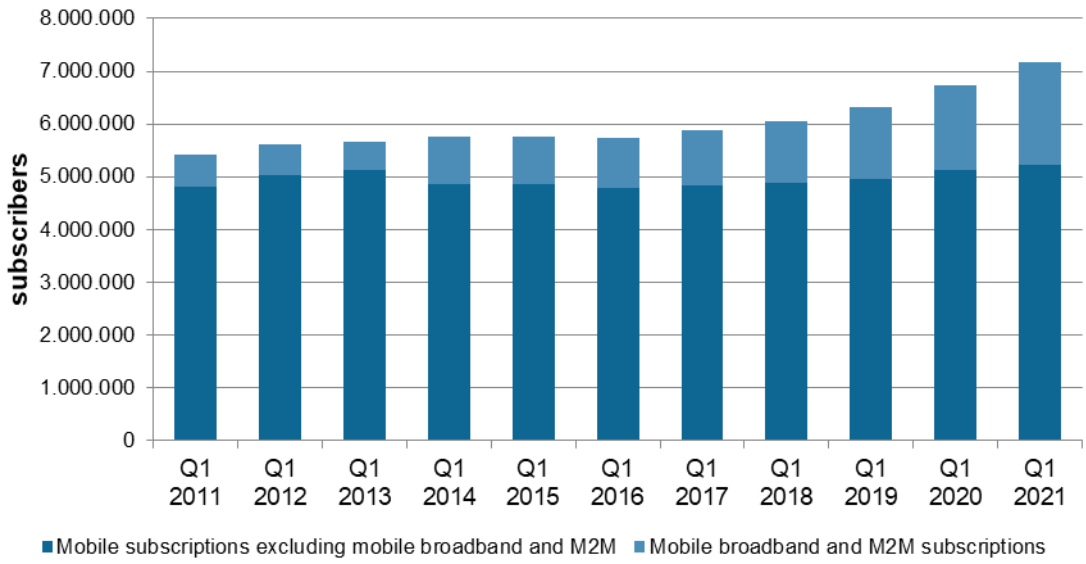
5.5 Retail outcomes

5.5.1 Take-up and usage

Total mobile subscriptions amounted to 7.2 million in the first quarter of 2021, of which around 330,000 were dedicated mobile broadband subscriptions (MBB[347]) and 1.6 million M2M subscriptions.[348] Compared with the beginning of 2011, the total number of mobile subscriptions has increased by 33%, while MBB have decreased by 44%. M2M subscriptions, on the other hand, have made a great leap forward, more than quadrupling since 2014, and thereby acting as the main driver in the increasing number of subscriptions in recent years.

347 According to ComReg, the mobile broadband subscription numbers reported do not include internet access over mobile handsets (such as smartphones).
348 See ComReg , QKDR

Figure 5-14: Development of mobile subscriptions in Ireland, Q1/2011-Q1/2021

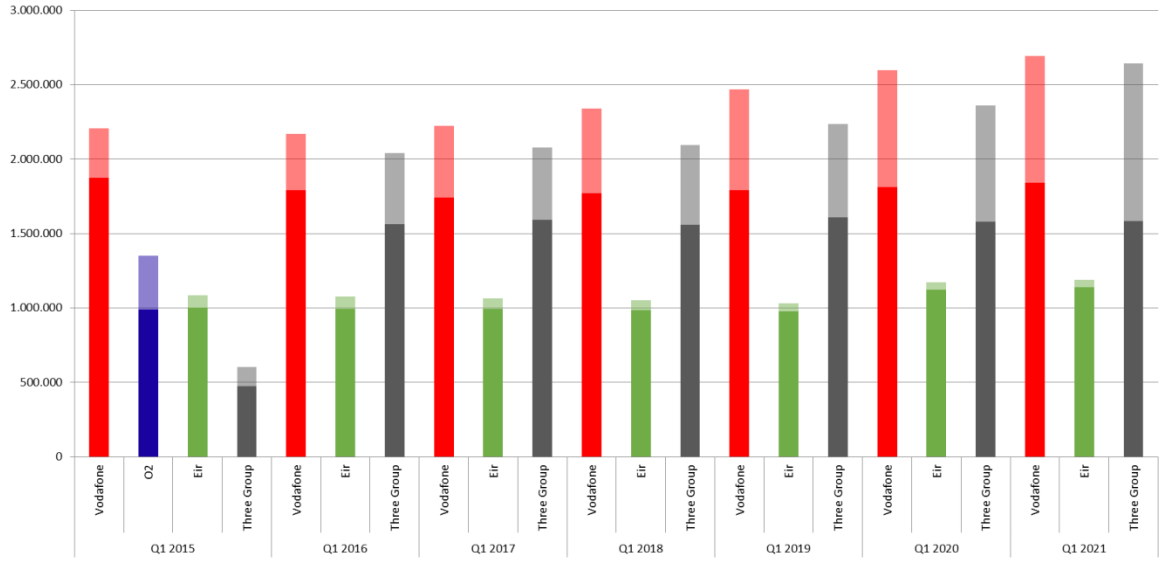


Note: By Q1/2021, the share of smartphone users amounted to 4.87 million users, which is equivalent to 93,4% of all mobile subscriptions. This is an increase of 2.7 million users and the number of smartphone users has more than doubled compared to 2012.

Source: WIK based on ComReg Quarterly Reports 2011-2021.

The following figure shows the distribution between traditional mobile subscribers and MBB/M2M subscribers by operator. It can be seen that Vodafone and Three in particular are expanding in the non-traditional and particularly the M2M segment, while Eir is focusing exclusively on traditional mobile subscribers.

Figure 5-15: Development of subscribers by MNOs, Q1/2015-Q1/2021

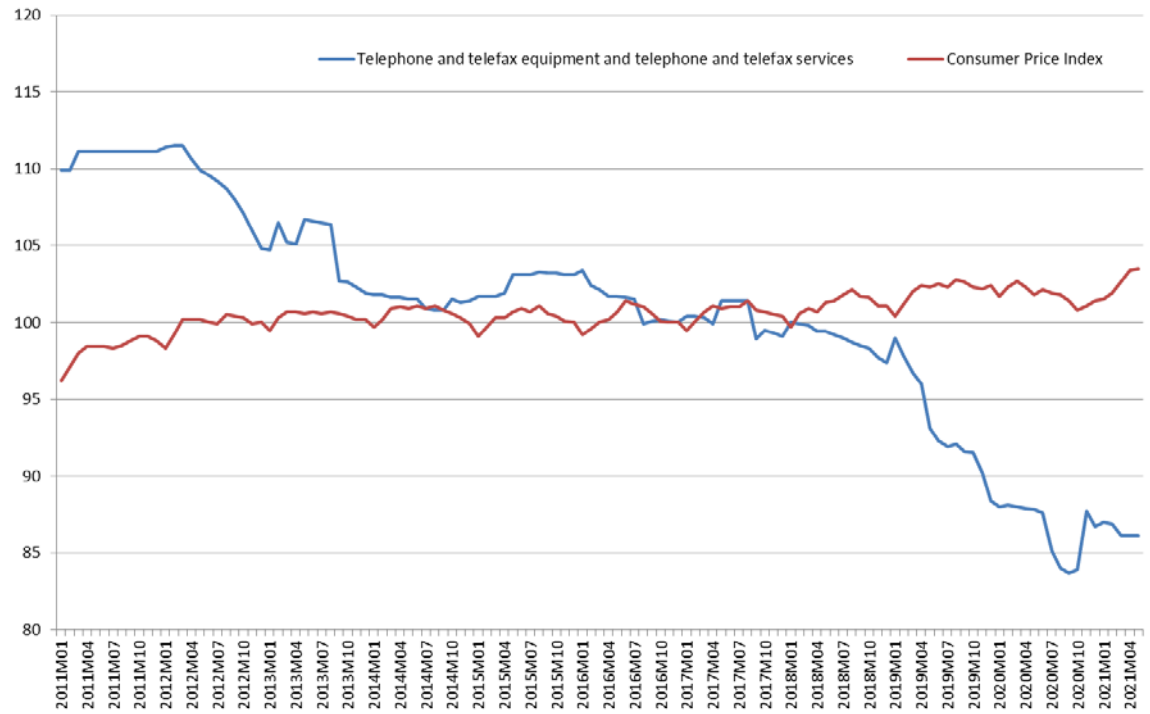


Source: ComReg.

5.5.2 Prices

According to the latest Price Index figures from the Central Statistics Office, communication prices have decreased by 14 percentage points between 01/2018 and 04/2021, while the overall consumer price index increased by almost 4 percentage points in the same period (see Figure 5-21). It should be noted that the communication prices here include more than only mobile prices.

Figure 5-16: Consumer Price Index and Communications Sub-component (December 2016 = 100) from 01/2011 to 05/2021

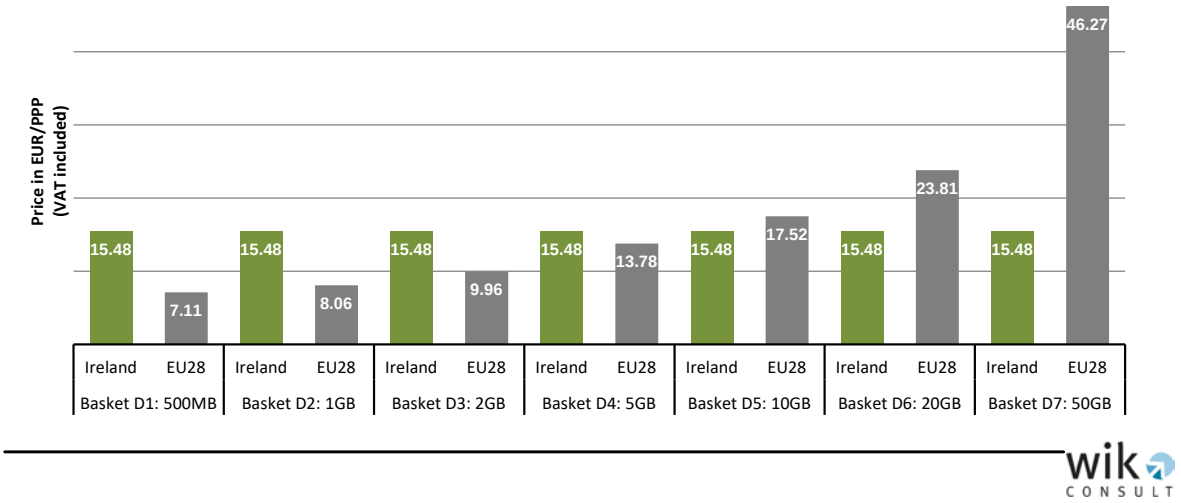


Source: Central Statistics Office.

According to the latest Commission studies on Mobile Broadband Prices in the EU[349], based on data collected in February and October 2019, Ireland is one of the more expensive countries in the EU, when comparing the OECD usage baskets.[350] However, the Commission also notes, that the averaging technique applied gives a greater weight to low-end usage baskets. When comparing the higher-end usage baskets Ireland is one of the more inexpensive countries in the EU, as the Irish MNOs offer reasonably priced tariffs for unlimited data, voice and messaging. This is shown in Figure 5-22. For small data packages, Ireland is above the EU average in terms of prices, while for large data packages, Ireland is well below the EU average. It should however be noted, that only two operators are included in the price benchmark, Vodafone and Three, i.e. not even all three MNOs. MVNOs and sub-brands are not included for any country.

349 See https://digital-strategy.ec.europa.eu/en/library/mobile-broadband-prices-europe-2019 and https://digital-strategy.ec.europa.eu/en/library/mobile-and-fixed-broadband-prices-europe-end-2019.
350 See Ibid. p.18.

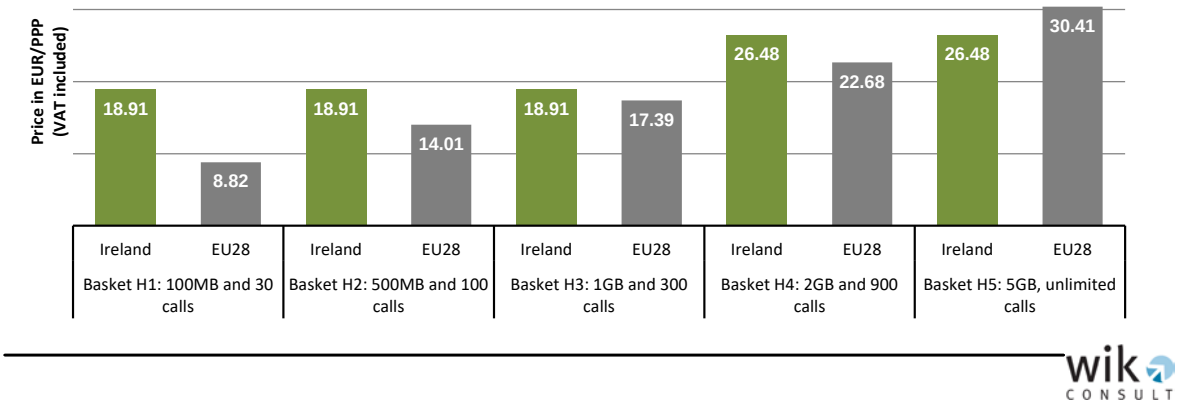
Figure 5-17: Comparison of least expensive data only offers in Ireland and EU average, Feb. 2019[351]



Source: WIK based on European Commission.

A similar picture is shown when comparing the handset-based offers. Here, the smaller packages in Ireland are comparatively expensive, while the largest package with more data volume is cheaper than the EU average (see Figure 5-23).

Figure 5-18 Comparison of least expensive handset offers in Ireland and EU, Feb. 2019



Source: WIK based on European Commission.

351 See https://digital-strategy.ec.europa.eu/en/library/mobile-broadband-prices-europe-2019.

Table 5-5: Mobile prices 2015, 2017, 2019 (in USD PPP)

	2015	2017	2019
Basket 1 (100 MB, 30 calls)	17,5	18,6	18,91
Basket 2 (500 MB, 100 calls)	20,1	18,6	18,91
Basket 3 (1GB, 300 calls)	20,1	18,6	18,91
Basket 4 (2 GB, 900 calls)	44,9	27,8	26,48

Source: WIK based on European Commission.

When comparing the offers of individual providers with each other, there is a wide price range between the offers. The following Figure 5-24 shows the monthly price for SIM-only postpaid products with unlimited voice, messaging and data[352] included. To ensure the comparability of the offers - some providers offer discounts in the first months - we assume that a user commits to a plan for 12 months[353]. The corresponding monthly costs are compared in the figure. The shaded part is the monthly price after the 12 months in case it is higher than the average price on a 12 month basis.

While the offers are almost all advertised as “unlimited”, most of them offer a “fair use” clause, i.e. there are some restrictions in case of heavy usage. While these thresholds are so high for voice and messages that they are not relevant in practice, the fair use threshold for data can play a role for the customer and differs from operator to operator. 48 has a hard data cap of 100 GB/month, the fair use thresholds for the other operators are at 50 GB (Post Mobile), 60 GB (Lycamobile and Tesco Mobile) or 120 GB (GoMo and Eir). After that, most operators throttle speeds but potentially there can also be a per-data charge (€0.01 per MB at Tesco Mobile). Clear Mobile and Vodafone have no data cap but cap network speeds at 5 Mbps or 10 Mbps respectively. Vodafone also has a contract with unlimited speeds available for a surcharge of €10/month. Virgin Mobile had a fair use threshold of 80 GB but removed it during the Covid-19 pandemic until at least Mid-July 2021.[354] Three has no data threshold for fair use at this point.

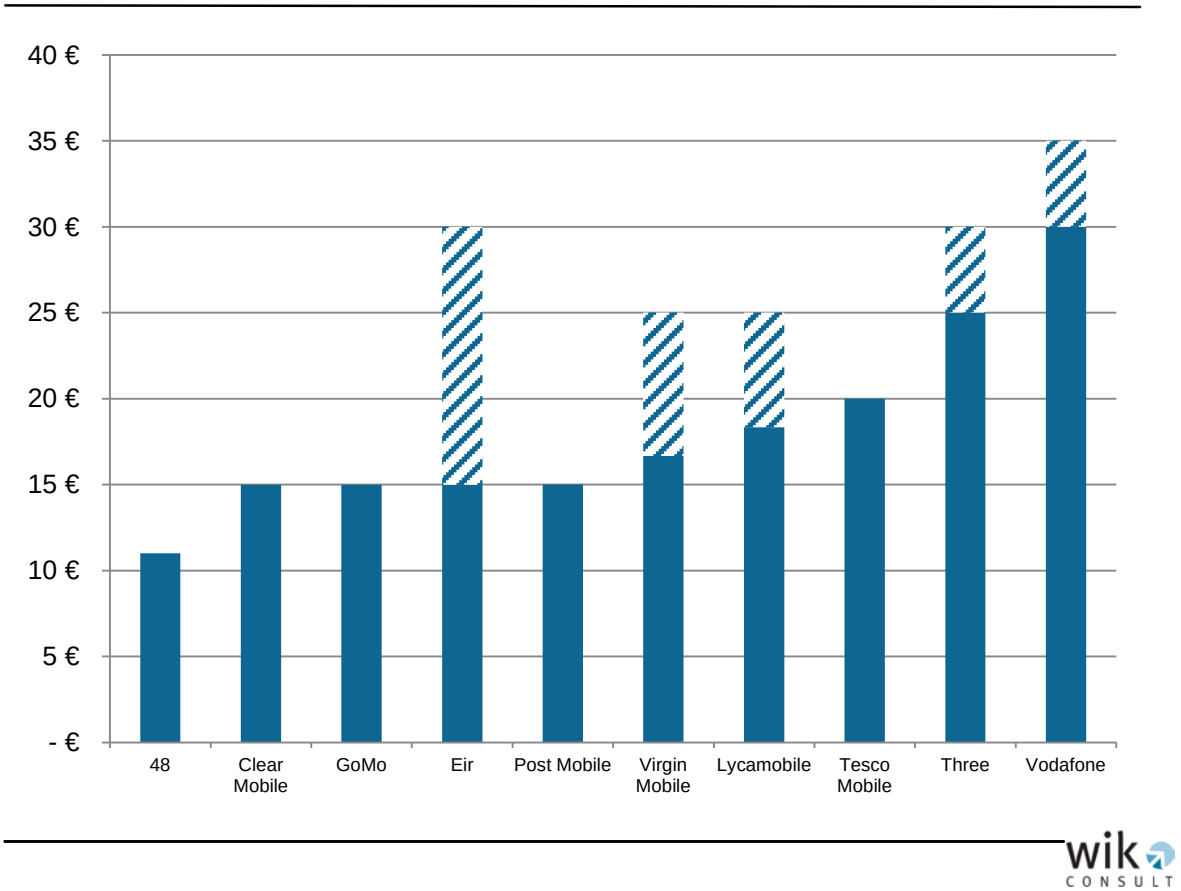
When looking at the prices it can be seen that the price of the cheapest provider (48) is less than half that of the most expensive provider (Vodafone). The sub-brands 48, GoMo and Clear Mobile are the least expensive options, followed by the MVNOs and then subsequently the MNOs. Eir is a slight exception as they offer their product for

352 The offer from 48 is the only one not advertised as unlimited but with a large data allowance of 100 GB/month. In practice, most offers have a “fair use” clause as detailed below.
353 The plans by Three and Vodafone are 12 month contracts, the rest is month-by-month.
354 See https://www.breakingnews.ie/business/virgin-mobile-to-provide-unlimited-data-to-all-customers-until-july-1078999.html.

€14.99 in the first 12 months and for €29.99 thereafter, i.e. matching their sub-brand first and then increasing the price to about the level of the other MNOs.

The MNOs also offer prepaid plans with unlimited data that are cheaper than the price offered after the initial rebate period in postpaid plans. They do however come with some caveats. They are all on a 4 week / 28 days top-up instead of a monthly basis. The offers from Three and Vodafone also do not include unlimited calls to other networks but only provide a certain allowance in offers that are substantially cheaper than its post-pay counterparts.

Figure 5-19: 4G SIM-only comparison by operator (unlimited minutes, messages and data, postpaid/bill-pay contract if available), June 2021

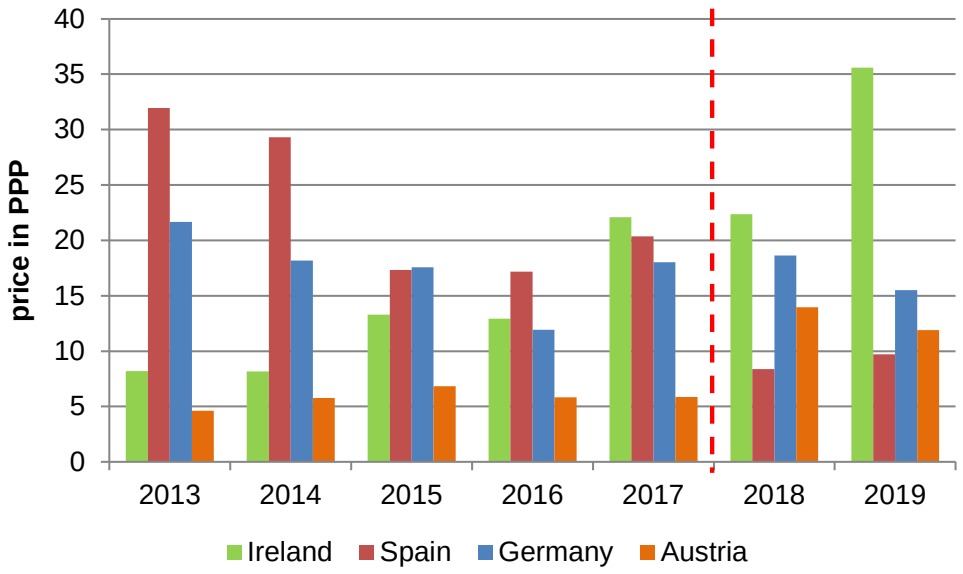


Source: WIK based on Company Websites.

While sub-brands and MVNOs currently do not offer 5G, the way it is offered by the MNOs differs. Eir includes 5G in a plan that costs €5/month more than the one in the figure. The plan also includes additional international minutes and texts and more EU data. At Three, 5G access is also available for a €5/month surcharge. At Vodafone, 5G is included but as the speed of the plan is capped, the benefits may only be realized when purchasing the offer that costs €10/month more.

As regards data-only bundles, Figure 5-25 shows a price comparison between the EU countries covered in this study over the period 2013-2019 (in PPP). It can be clearly seen that Ireland's prices are rising over time and that the price level in 2019 is significantly higher than in all other countries. By contrast, data-only prices in Spain steadily decreased between 2013 and 2019.

Figure 5-20: Price comparison data-only mobile broadband (1.5 GB), 2013-2019



Note: 2013-2017 data refer to a mobile-broadband basket, postpaid computer-based with a monthly data allowance of 1 GB. 2018 and onwards data refer to a revised data-only mobile broadband basket with a monthly data allowance of 1.5 GB.

Source: WIK based on ITU.[355]

Notwithstanding apparent absolute trends in prices, when assessing the effects of a merger, it is important to assess changes in prices compared with a hypothetical situation in which the merger did not occur. It should be noted in this context that prices for low, medium and high mobile users increased during the 18 months after the

355 See https://www.itu.int/net4/ITU-D/ipb/#ipbrank-tab. The data-only mobile-broadband basket 55 is based on a monthly data usage of a minimum of 1.5 GB. For plans that limit the monthly amount of data transferred by including data volume caps below 1.5 GB, the cost for the additional bytes is added to the basket. The minimum speed of a broadband connection is 256 kbit/s. The data-only mobile-broadband basket is based on the most common contract modality (prepaid or postpaid) in the economy in question, i.e. if more than 50 per cent of subscriptions are prepaid, then prepaid is selected. Otherwise, a postpaid plan is selected.

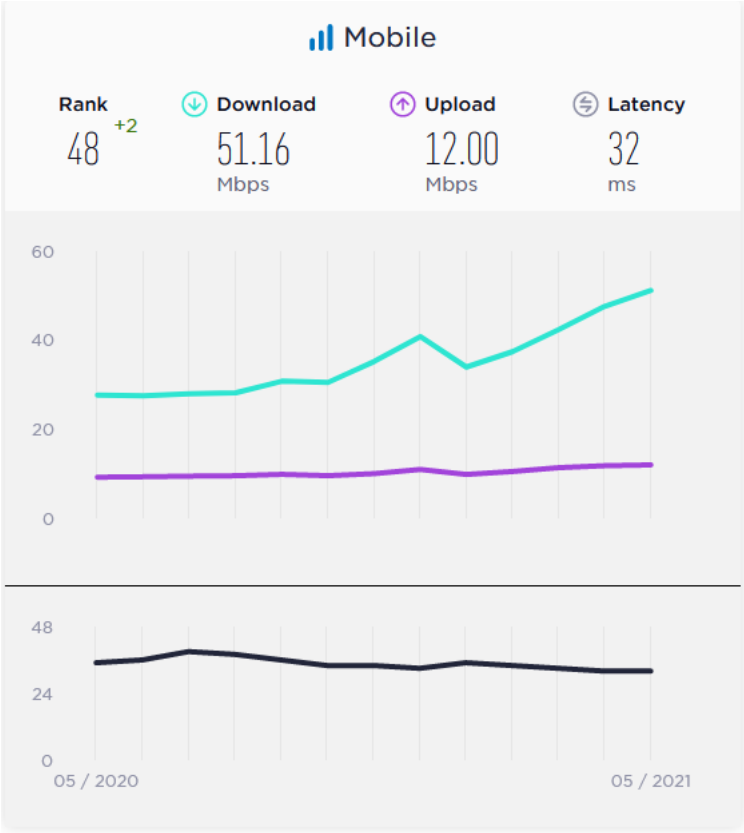
O2/Three merger,[356] and according to research conducted by BEREC mobile prices increased by 20% in the first half of 2015 compared to a state without the merger. The BEREC research also found that the effect on pricing outcomes of the virtual operators that were established on the Three network was small.[357]

5.5.3 Quality

According to a survey by Ookla, Ireland's mean mobile download speed amounts to 51.16 Mbps in May 2021, while the mean upload speed was 12.00 Mbps.[358] The speeds almost doubled compared to a year before as the download speed was only 27.70 Mbps in May 2020 with the upload speed at 9.24 Mbps. This increase has likely been stimulated by the deployment of 5G networks. Ookla also observes the effect of Covid-19 restrictions on movement, noting that mobile network speeds increased on average by 10% between January 2020 and March 2020 and again by that much between March 2020 and July 2020. Median speeds only increased marginally, which shows that the mean increase is mainly driven by outliers that achieve significantly higher speeds than before.[359]

356 See https://www.rte.ie/news/business/2018/0703/976009-mobile-user-prices/.
357 See https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/8168-berec-report-on-post-merger-market-devel_0.pdf.
358 See https://www.speedtest.net/global-index/ireland.
359 See https://www.speedtest.net/insights/blog/tracking-covid-19-impact-global-internet-performance/.

Figure 5-21: Mobile speedtest in Ireland May 2021



Source: Ookla Speedtest.[360]

5.5.4 Innovation

A key product development from Ireland's MNOs has been the introduction of very high volume and unlimited data offers. Unlimited data offers are now offered by all MVNOs (despite initial interviews with MVNOs suggesting that wholesale pricing conditions make such offers challenging (see below)) and a key innovation from MVNOs has been to offer a limited number of plans, thereby simplifying the marketing proposition. Post Mobile goes as far as only offering one plan.[361]

Eir sub-brand GoMo, has combined the strategies of unlimited packages with simplicity, by offering a single tariff of "€14.99 a month for life" for all data, calls and text, as well as

360 See https://www.speedtest.net/global-index/ireland.
361 See https://www.anpost.com/Shop/Products/Post-Mobile-Products/Keep-Number-All-You-Need-SIM-Only-Sim-Card.

EU roaming. All MNO main brands, sub-brands and the MVNOs now offer comparable plans, differing only in the amount of EU roaming data, the fair use clauses within Ireland and the presence or otherwise of commitments not to increase charges for consumers which remain on those offers.

Tesco mobile has also leveraged synergies from its grocery business by providing increased prepay data allowances for users of the Tesco clubcard.[362]

Virgin Mobile also offers the potential to swap between different packages without penalty, and offers handset subsidies (as does Post Mobile). However, although it has the potential to offer multi-play fixed mobile bundles, converged offers do not appear to be a core focus of Virgin's product strategy.[363] The other large convergent player in the market, the incumbent Eir, does offer mobile/fixed-bundle products but only with a large increase in prices after the initial contract duration of 12/24 months.

MVNOs such as Lycamobile target niche segments (in this case immigrants) with a low cost strategy, in a similar manner to services offered in other countries. They do however also offer plans with unlimited data with prices around the same level as other market players.

5.5.5 Consumer priorities and satisfaction

In a 2017 consumer survey conducted on behalf of ComReg, [364] consumers noted that the most important reasons for choosing their supplier were the price of calls, text and data allowances (31% of respondents). However, the importance of pricing had declined when a similar question was asked in the context of the 2019 consumer survey (21% of respondents), with a relatively higher weighting given to "reputation" (27%) and the presence of friends and family (31%) on the network. [365]

This focus on reputation may provide part of the explanation of the continued strength of operators such as Vodafone and Three, despite their higher prices. The mobile provider with the highest rate of complaints provided to ComReg in 2018 was Eir, followed by Tesco Mobile. A significantly lower number of complaints was reported for Three and Vodafone as a proportion of their customer base.[366] Similar rankings applied for 2019, with a significant increase in complaints reported for Eir between the last quarter of 2018 and first quarter of 2019.[367]

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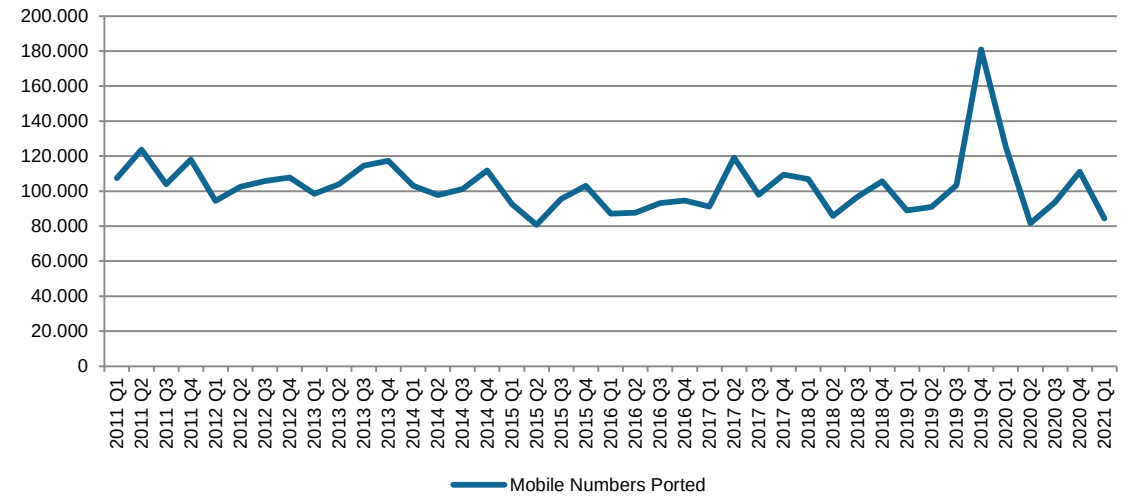
362 See https://www.tescomobile.ie/prepay-plans.aspx.
363 See https://www.virginmedia.ie/bundles/broadband-tv-mobile/.
364 See https://www.comreg.ie/publication/mobile-consumer-experience-survey/.
365 See https://www.comreg.ie/publication/mobile-consumer-experience-survey-2019.
366 See https://www.comreg.ie/consumer-information/consumer-care/consumer-statistics/.
367 See https://www.bonkers.ie/blog/broadband-phone/customer-service-report-three-best-in-mobile-virgin-media-best-in-broadband-eir-last-in-both/.

Looking at mobile phone number portability shows that the churn between operators in the Irish market has been almost constant from 2011 to 2021 with between 80,000 and 120,000 numbers ported per quarter. The only significant deviation is the fourth quarter of 2019, with about 180,000 ported numbers, which coincides with the launch of the Eir sub-brand GoMo and their low price offer (see chapter 5.3.3). This shows the market disruption caused by the market introduction of this sub-brand offer.

Figure 5-22: Mobile numbers ported in Ireland by quarter, Q1 2011-Q1 2021



Source: WIK based on ComReg QKDR.

During interviews with market players, while market participants observed a certain hesitancy to switch amongst Irish consumers (not only for mobile phone contracts), it was also noted that there is a relatively mobile group of customers that switches operators relatively often. These customers have historically often been on prepaid plans by any operator that made them a good offer but may now have switched to post-pay offers from sub-brands that can be cancelled monthly. Due to the lock-in strategy of the sub-brands that offer a “price for life” as long as you do not cancel, some customers from this group may now be more reluctant to switch than in the past.

5.6 Perspectives of mobile operators and service providers concerning the Irish mobile market

Between June and September 2020 and again in June-July 2021, WIK-Consult conducted interviews with Ireland’s three mobile network operators, four current or prospective MVNO providers and a specialist in M2M provision operating in the Irish market.

The interviews suggest that while MNOs consider that the Irish mobile market is characterized by intense competition and is functioning well in terms of choice and value for consumers (including value-based offers from the MNOs themselves), MVNOs consider that the market dynamics are worsening and that there is a risk that smaller players may be marginalized, undermining the prospects for competition and consumer welfare in the medium term.

Specifically, MVNOs claim that the terms of their MVNO agreements will not permit them to compete in unlimited data packages, which are now prevalent on the market, because they link charges to specific volumes of capacity (whether up front or per GB). Furthermore, they view sub-brands of MNOs such as GoMo as presenting a significant threat to their business models. MVNOs see that significant investments may be needed to support 5G, eSIM and VoLTE in order to maintain their market position. However, MVNOs fear that they will either face contractual delays in accessing 5G or where they have access, be unable to exploit it due to wholesale charges which deter high consumption of data. Because of these factors, 5G appears not to be a priority for MVNOs as long as the lack of access does not result in the loss of customers. Concerns in this area are greater as regards consumer-facing services than for M2M services, where specialist service providers in the M2M field consider that commercial negotiations are more likely to yield adequate results. However, the need for redundancy in connectivity could pose challenges in M2M-based access. The MVNOs in the Irish market that have their focus on the traditional consumer market do not see M2M/IoT as a realistic avenue to explore due to set up cost, a strong market position by Vodafone, Three and specialized players, combined with low ARPUs.

Interviews suggest that there are limited options to switch between alternative host MNOs, which may serve to limit the bargaining power of players seeking to enter as MVNOs or existing players seeking to renegotiate contracts in the consumer market.

Although some MVNOs – notably Tesco Mobile – have introduced innovations such as bundling strategies with their core business, MVNOs currently present in the Irish market appear to be pursuing defensive rather than aggressive business and marketing strategies. Although some prospects for entry are also possible, with a focus on data markets and IoT, according to interviews, this would require more attractive wholesale terms. The prospects for MVNOs to “climb the ladder of investment” to enter as MNOs are limited, and entry of a fourth market entrant by other means is considered by most interviewees to be unlikely and probably unviable.

Wholesale conditions in the Irish market are compared unfavourably to other markets with a larger number of players, where MNOs are considered more open to reaching MVNO agreements. The prevalent price per unit model in Ireland for MVNOs not benefiting from the capacity-based access granted as a result of merger remedies, are also contrasted with JV models in other countries, where profits are shared and there are no payments for access to the distribution network, enabling more flexibility in the

pricing and design of offers and bundles. While different pricing models each have advantages and disadvantages, the per unit pricing model is cited as being a barrier to MVNOs being able to replicate and compete directly with the sub-brands of the MNOs. Although in recent months, MVNOs on a price per unit model have started offering unlimited data packages, these offers have been made at a higher price and/or with more limited fair use clauses than the sub-brand offerings.

The Covid-19 pandemic and associated lockdown measures has led to more sales coming via online channels. MNOs and MVNOs observe however that as of mid-2021 there has been some return to the classic retail business. The pandemic did however leave its mark on the market in another way, as several market players pointed out that they were negatively affected when the retailer Carphone Warehouse, which sold contracts from different MNOs and MVNOs as an independent retailer, closed down their more than 80 stores for good in April 2021.[368]

5.7 Conclusions

Ireland is a market with relatively high prices (and few options available) for low-end offers with low cost calls and limited data allowances. In this context, there should in theory be room for price competition in this segment from MVNOs. However, operators targeting the low cost calls segment such as Lycamobile are in decline, suggesting limited demand in this segment.

Rather, consumer preferences seem to be leaning more towards quality, reliability and high volume, particularly unlimited, data packages, which are areas in which MVNOs' capacity to compete is limited, due to the price per unit wholesale models which predominate.

Virgin Mobile is in a position to provide unlimited data offers with greater ease than the other MVNOs, supported by the capacity-based charging model that it secured in the context of the merger.[369] While the ability of iD to build a strong market position was in more doubt, Virgin Media's position in the broadband market should in theory have provided a springboard to gain market share in the mobile market, while its upfront payment to Three provided an incentive for Virgin to do so. It is a matter of speculation as to why it did not achieve the success that may have envisaged at the outset, but marketing and pricing strategies, and the lack of an impetus for fixed mobile converged retail offers in the Irish market may have contributed to its limited market share gains.

Market dynamics and economics suggest there may be limited prospects for new entry by a 4th MNO, and – due to the fact that, at this stage, there seems to be limited

368 See https://www.irishtimes.com/business/retail-and-services/carphone-warehouse-to-exit-republic-cutting-almost-500-jobs-1.4543393.

369 Virgin Mobile and iD Mobile benefitted from the merger remedies as confirmed e.g. here: https://www.comreg.ie/media/dlm_uploads/2016/12/ComReg-16112.pdf.

competition in the provision of MVNO hosting services, and there is significant interest by MNOs in offering unlimited data packages directly – prospects for the entry of an MVNO that would aggressively target the data segment, also seem poor.

Technological developments such as 5G and the trend towards VoLTE may also pose a threat to existing MVNOs as they may require a renegotiation of access conditions and may necessitate investments on the part of MVNOs to integrate the new services. 5G is also likely to lead to higher data consumption, which negatively affects the business case of MVNOs that are on price per unit wholesale deals.

Notwithstanding the relatively limited role historically played by MVNOs in the high volume data segment, attractive offers have emerged in this segment – notably from sub-brands "48" and GoMo, with their low price offers, which have disrupted the market, impacting market shares and ARPUs. MVNOs have had to follow suit to stay competitive in the market, even though higher data consumption at the same or lower revenues reduced their margins significantly. Thus, Irish consumers appear to be well-served, for the moment. However, it remains unclear what would happen, if the combination of unfavourable wholesale conditions[370], higher data consumption and aggressive pricing and marketing strategies from sub-brands, drives one or more MVNOs out of the market.

The market for M2M connectivity in Ireland is expanding, and M2M service providers suggest that, in contrast to consumer-facing MVNOs, they have been able to secure adequate wholesale access. However, with only two players active at the wholesale level, and the need in some cases for M2M connectivity to be "redundant", it is unclear whether the market will still function well once it has reached a higher level of maturity.

At the same time, interviews suggest that Irish MNOs are for the most part prioritizing consumer-facing aspects of 5G and that less focus is being given currently to other applications including industrial use cases.

370 The MVNO with the most favourable wholesale conditions due to the capacity-based deal, Virgin Mobile, has this deal running out in 2024 (5 years initial contract + 5 years extension as explained in the merger remedies, see https://ec.europa.eu/competition/mergers/cases/decisions/m6992_20140528_20600_4004267_EN.pdf). There is also the potential for them exiting the market even earlier depending on which company, if any, purchases their business from Liberty Global.

6 Impact of regulation on MVNO competition and outcomes: Evidence from international case studies

In this chapter we turn to data analysis and international case studies to evaluate the impact of MVNOs on market outcomes and discuss the role played by regulation (if any) in supporting positive outcomes.

The countries studied are Austria, Germany, Spain, Japan and New Zealand. Some information is also included from Denmark, and comparisons are made in each case with the situation in the Irish market.

KEY FINDINGS

- MVNO access regulation has been applied on all 3 MNOs in Japan, and via merger remedies in Austria and Germany. The SMP-based MVNO access regulation in Spain was removed in 2017. There is no MVNO regulation in New Zealand, and MVNOs play a limited role.
- In those countries where MVNOs have played a more active role in driving competition and innovation in retail markets, regulation is typically a factor (especially in 3 player markets), alongside the dynamism of the MVNOs concerned and willingness of MNOs to engage in negotiations.
- MVNOs have stimulated innovation in IoT/M2M platforms and applications.
- MVNOs have triggered price competition following regulatory intervention in Austria and other countries. However, in many cases, MVNOs struggle to compete in unlimited data offers due to the structure of the underlying wholesale tariffs.
- The regulatory approaches which have been associated with the highest levels of flexibility and innovation from MVNOs have been based on Reference Offers and/or detailed conditions concerning pricing and non-discrimination e.g. Austria, Japan. MVNO access obligations in these cases were not limited to specific companies.
- MVNOs which have entered as MNOs (Germany, Japan) have acquired some degree of scale, supported by regulation, and have investments in other segments of the telecom sector or digital industries. The decision of these players to act as MNOs may have been influenced in part by challenges in competing in the high volume data segment as MVNOs. However, deployments are expected to be gradual and future prospects for these MNOs are unclear. As both Germany and Japan are large relative to Ireland, it is not possible to use these examples to draw conclusions about the viability of a fourth player in Ireland.

6.1 Policy and regulatory strategies pursued towards MVNOs

Concerns over the level of competition in mobile markets (e.g. following mergers), have led some authorities and/or NRAs to mandate MVNO access.

At the same time, some authorities view MVNOs as important contributors to price and service competition in their own right, and have sought to introduce measures which encourage all operators to negotiate for or ensure the provision of MVNO access.

A summary of the different regulatory approaches is shown in the table below.

Table 6-1: Regulatory approaches to MVNO access

	Merger remedies	Ex ante regulation	Licence obligations
Austria	Applied in 2012: MVNO access on the basis of Reference Offer approved by the Commission to up to 16 MVNO and a max 30%.	None	None
Denmark	No merger, but MVNO access required as condition of 3G Telia/Telenor network sharing agreement in 2012.	None	None
Ireland	Applied in 2013: Capacity-based MVNO access to two players, each having access to 15% capacity.	None	None
Japan	Not relevant	2007 Guidelines on MNO/MVNO rights and obligations + dispute resolution procedure. 2014 Guidelines reduced mobile wholesale charges, 2017 Guidelines clarify powers re non-discrimination.	None
Germany	Applied in 2014: O2 sells up to 30% capacity to 1-3 MVNOs. Based on bitstream access under a two part tariff (capacity + usage). Obligation to continue existing wholesale contracts and grant access to LTE.	None	2G/3G licences only
New Zealand	Not relevant	None	None
Spain	Not relevant	MVNO access obligations on the basis of fair and reasonable terms via joint SMP remedies. Introduced in 2006 and removed in 2017	None

Source: WIK.

Austria, Ireland and Germany all provide examples of cases where MVNO access has been imposed as a result of merger controls following the consolidation of the market to 3 players.[371] MVNO access was also mandated as a condition of the approval of the 3G network sharing scheme between Telenor and Telia in Denmark in 2012.[372] Obligations imposed in connection with merger proceedings or network sharing inevitably apply only to the parties concerned.

Conversely, MVNO obligations have been applied more widely in Japan (via legislation and Guidelines)[373] and Spain (via SMP regulation following a finding of "joint SMP" in 2006).[374] Obligations to provide or negotiate the provision of MVNO access have also been present historically in 2G and 3G spectrum licences granted to mobile operators in Germany.

The nature of the MVNO access obligations differs in each case. In recent years, the focus has been on "capacity-based" solutions in the context of remedies applied to individual companies in the context of a merger, while pay per usage or retail minus obligations (sometime applied in the context of dispute resolution) have been more prevalent when MVNO access is imposed as a result of ex ante regulation. Meanwhile, more flexible obligations on all players to "negotiate" access have been applied in the context of spectrum awards. Examples of how regulation has been applied in these different contexts is provided below.

6.1.1 Obligations associated with mergers

Over the course of 2013-2014, mergers occurred between mobile operators in Austria, Ireland and Germany, which resulted in the reduction in the number of mobile network operators from 4 to 3 and the imposition of MVNO access remedies by the European Commission, DG Competition. Although the remedies were imposed around the same time, there are differences in the details of the measures, and the numbers and types of players that could benefit from the remedies. Details of the remedies in each case are described below.

It should be noted that remedies applied and/or commitments made as a result of mergers have resulted in some of the strongest forms of MVNO access that have been mandated on MNOs, and typically offer more favourable terms and flexibility than MVNO conditions that have been reached on a commercial basis. A key reason for this may be that merging operators can be put under significant pressure to conclude agreements with specific players in a relatively short timeframe as a condition of the approval of the merger. For example, in Ireland, conclusion of the second MVNO

371 Respectively in 2012, 2013 and 2014.
372 See section 2.3 https://ens.dk/sites/ens.dk/files/Tele/final_mobile_report_denmark_clean_non-confidential.pdf.
373 See https://www.lexology.com/library/detail.aspx?g=90922879-1624-4ef4-b00a-97ade74844ec.
374 See ES/2005/0330.

agreement was required to avoid the merger being unwound. Thus, there would have been strong incentives for the MNO to reach an agreement. On the other hand, as can be seen in the cases discussed below, requirements to reach specific deals as a condition of merger approval, give MNOs the flexibility to select the potential MVNOs with whom they will negotiate, and may thus introduce incentives to choose applicants which the MNO may consider present a reduced threat of competition. This may for example have been the case in Germany where Telefónica decided to choose Drillisch as upfront MBA MVNO, despite the fact that Drillisch was at the time of the merger, the smallest of the three German MVNOs. Similarly in Ireland, MVNO arrangements were made with new entrants into the MVNO segment rather than with MVNOs which were already established at the time, such as Tesco Mobile.

6.1.1.1 Austria

In 2013 Hutchison Drei Austria (H3G) merged with Orange, leaving three remaining mobile operators – with the others being Magenta Telekom (T-Mobile Austria) and Telekom Austria's A1. The conditions imposed by the European Commission on the merger between H3A and Orange in December 2012 included an:

1. Obligation to **grant access** to an MVNO at the time of the merger on the basis of a **reference offer** approved by the European Commission.

2. Obligation to **provide access to up to 16 MVNOs** on the basis of the same reference offer. The upper limit of the obligation is 30% of H3A's network capacity and is limited to 10 years.

3. Obligation to **divest frequencies** to supplement the frequencies reserved for new entrants in the multi-band frequency auction in 2013.[375]

The availability of a Reference Offer specified at a high level of detail is a key distinction between the remedies pursued in Austria compared with the remedies applied in Ireland and Germany (discussed below). The H3G Reference Offer specifies inter alia that:

- Wholesale access services are provided using the same technology that H3G uses to provide services to its customers. Developments of new mobile technologies and/or new products that are realized over existing technologies must be made available to the MVNO within a reasonable period of time and within a specified time frame after H3G has launched the service.[376]

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375 See European Commission (2012): Case M.6497 Hutchison 3G Austria Holdings GmbH, Commitments to the European Commission, 11 November 2012, p. 113 ff., https://ec.europa.eu/competition/mergers/cases/decisions/m6497_20121212_20600_3210969_EN.pdf.

376 See European Commission (2012): ASE COMP M.6497 H3G / ORANGE COMMITMENTS TO THE EUROPEAN COMMISSION 11 NOVEMBER 2012, p. 18, https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf.

- H3G offers a diverse range of pricing models, including per-unit charges for circuit-switched services, SMS and packet-switched data services (with a choice between a fixed per-unit charge or volume-based charges for packet-switched data services), revenue-based discounts and a -25% retail-minus option for SIM-only data tariffs.[377]
- The prices are subject to retail price indexing, which is to be agreed upon individually.[378] The set-up fee for MVNO access is a maximum of €200,000. H3G is subject to a non-discrimination obligation.[379] H3G shall offer a contract for a period of up to 10 years.

If the parties cannot agree on the terms of the MVNO agreement within 5 months, the matter can be referred to an independent dispute resolution body. In February 2013, the Commission appointed a Monitoring Trustee to monitor Hutchison 3G Austria's compliance with the obligations under the European Commission's decision of 12 December 2012 and report to the European Commission.[380] Further details are included in the Annex to this report.

6.1.1.2 Germany

In July 2014 the European Commission approved a merger between Telefónica Deutschland and E-Plus leaving 3 operators in the German market (the others being Deutsche Telekom and Vodafone).

MVNO access commitments were required as a condition of the merger. However, in contrast to the public Reference Offer approach applied in Austria (see above), in Germany, the remedies aimed to secure commitments for a strong form of MVNO access with a more limited number of players. The merged entity (TEF/ePlus) was required to sell up to 30% of its network capacity of the merged entity to one to three MVNOs, which were termed Upfront Mobile Bitstream Access MVNOs (MBA MVNOs). In contrast to conventional wholesale pricing models such as retail-minus, price-per-unit or revenue sharing models, the MBA MVNO pricing model consists of two components. The upfront MBA MVNO(s) pay a fixed price for access to specific capacity on the merged entity's consolidated network. In addition, voice, data and SMS are invoiced on

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377 See European Commission (2012): ASE COMP M.6497 H3G / ORANGE COMMITMENTS TO THE EUROPEAN COMMISSION 11 NOVEMBER 2012, p. 31 f., https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf, https://www.drei.at/media/common/pdf/info/wholesale/zusammenfassung-deutsch.pdf.

378 See European Commission (2012): ASE COMP M.6497 H3G / ORANGE COMMITMENTS TO THE EUROPEAN COMMISSION 11 NOVEMBER 2012, p. 20, https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf.

379 See European Commission (2012): ASE COMP M.6497 H3G / ORANGE COMMITMENTS TO THE EUROPEAN COMMISSION 11 NOVEMBER 2012, p. 21, https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf.

380 See European Commission (2012): ASE COMP M.6497 H3G / ORANGE COMMITMENTS TO THE EUROPEAN COMMISSION 11 NOVEMBER 2012, https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf, https://www.drei.at/media/common/pdf/info/wholesale/zusammenfassung-deutsch.pdf.

a usage basis. In combination, this pricing model was designed to create incentives for MVNO's growth and to split the risk between the merged company and its MBA MVNO partner. However, the specification of remedies in Germany was less detailed than in Austria, which resulted in disputes between the parties and TEF.

TEF also committed to continuing existing wholesale contracts with the TEF and E-Plus contractors until 2025, and to grant MVNOs on their network access to 4G (LTE).[381] However, unlike in Austria, MVNOs other than those benefiting from capacity-based agreements did not have access on the basis of regulated conditions.

6.1.1.3 Ireland

As discussed in more detail in chapter 5, In May 2014, the European Commission approved a merger between Three Ireland and Telefonica, leaving 3 MNOs, with Eir and Vodafone as the other operators.

The remedies adopted as a condition of the approval of the merger in Ireland are in some ways similar to those in Germany, and focused on the entry of two MVNOs with an option for one of them to become a full mobile network operator by acquiring spectrum at a later stage.[382] As in Germany, these MVNO agreements were required to be based on a "capacity-based" MVNO model, whereby the two new entrants could obtain a dedicated pipe for voice and data traffic.[383] The maximum capacity allocation for the two MVNO providers was set at 15% of the merged company's network capacity for each of the MVNOs.

It should be noted that ComReg expressed reservations about the commitments, noting at the time of the completion of the European Commission's investigation into the merger that "ComReg remains of the strong view that the behavioural commitments are insufficient to address the structural competition deficit identified as likely to result from the Proposed Acquisition."[384]

6.1.2 Ex ante obligations under law

Japan[385] has adopted detailed ex ante regulation concerning MVNO access via binding Guidelines. In 2007, the Japanese Communications Ministry MIC, adopted Guidelines to clarify the rights and obligations applying between MVNO and MNOs, and

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381 See European Commission (2014): COMMISSION DECISION of 2.7.2014 addressed to: Telefónica Deutschland Holding AG declaring a concentration to be compatible with the internal market and the EEA agreement (Case M.7018 - TEF DEUTSCHLAND/ E-PLUS), http://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf.

382 See https://ec.europa.eu/commission/presscorner/detail/en/IP_14_607.

383 Para 52 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=uriserv:OJ.C_.2014.264.01.0006.01.ENG.

384 ComReg Information Notice concerning the completion of the EC investigation into the proposed acquisition by 3 of Telefonica Ireland https://static.rasset.ie/documents/business/comreg1453.pdf.

385 See https://m.lw.com/thoughtLeadership/technology-media-telecommunications-review-2015-japan.

established a dispute settlement procedure. In 2013, there was another amendment in the MVNO guidelines that clarified the extent to which MNOs could request information regarding MVNO business plans when granting access to their networks. A subsequent key provision was the introduction in 2014 of guidelines for the operation of Type II designated telecommunication facilities, which included a change in the calculation method to set wholesale charges for MVNO access.

The Guideline[386] notes that:

- MNOs must offer wholesale access
- MNOs must file a notification concerning the wholesale contract with the relevant Minister
- Where agreement is not reached following negotiation, either party may apply to the Minister for an order to start negotiations or for settlement Application to a dispute settlement body for mediation is also available
- MNOs may be instructed to amend their business practices, where these are not considered appropriate
- MVNO must have the freedom to interconnect on their own behalf with other electronic communication providers. MNOs and MVNOs should conclude contracts concerning telephone numbers.

The adoption by the MIC of Guidelines later in 2014 requiring MNOs to address requests for SIM unlocking also aimed to support competition by facilitating switching, including to MVNOs. In October 2019, the Ministry also unveiled plans to amend the SIM unlocking guidelines to require immediate SIM unlocking on the request of customers, in place of previous guidelines which allowed SIM locking up to a maximum of 100 days, to prevent users from defaulting on their monthly subscriptions.[387]

More recently, in 2017, further Guidelines were issued to clarify that MIC is authorised to issue "business improvement" orders to MNOs which discriminate against MVNOs as regards network access conditions.[388]

Japan is one of very few countries to have imposed mandatory access obligations on all players. Others include the Czech Republic and Chile (see chapter 2).

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386 See https://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/Releases/Telecommunications/pdf/news020412_4_01.pdf.

387 See https://www.japantimes.co.jp/news/2019/09/21/business/tech/japan-require-carriers-immediately-unlock-sim-cards-smartphones/.

388 See https://www.lexology.com/library/detail.aspx?g=90922879-1624-4ef4-b00a-97ade74844ec.

6.1.3 Obligations based on joint SMP

A weaker form of MVNO access was applied by the **Spanish** NRA CMT in the context of its finding that the largest three operators in the market (out of four) had joint SMP. Specifically, in its 2006 Decision, CMT required the three MNOs to:

- Grant MVNO access when receiving reasonable requests; and
- Apply reasonable wholesale charges for MVNO access.

In anticipation of likely conflicts, CMT also set out how it would assess the reasonableness of requests.

SMP obligations on single mobile operators to provide MVNO access have also been imposed in Slovenia, Norway and South Korea.

6.1.4 MVNO obligations in spectrum licences

German spectrum licences contain a weaker form of MVNO access obligation known as the "service provider obligation". The obligation is linked to the acquisition of frequency usage rights or licences and is independent of market power.

These obligations were applied to MNOs acquiring 2G and 3G spectrum. There is no clear service provider obligation linked to the award of spectrum for LTE.[389] However, as discussed above, 4G access conditions were imposed in the context of the merger of Telefónica Deutschland and E-Plus in 2014, and thus apply to the merged company.

In the run-up to the 5G auction, there was a debate about coverage, national roaming and service provider obligations. 1&1 Drillisch in particular requested service provision and national roaming obligations. Although no obligation was included in the licences, all providers are subject to a negotiation requirement and a non-discrimination principle.[390]

6.1.5 Regulatory forebearance/removal of obligations

New Zealand provides the single case in this study of a country with 3 network operators in which no MVNO access obligations have been applied. It thus provides a useful counter-example to the other cases. It should also be noted that the two countries analysed which have 4 network operators, Denmark and Spain, no longer

389 See https://www.t-online.de/digital/id_84432204/meinung-was-passieren-muss-damit-5g-ein-erfolg-wird.html.

390 See https://www.handelsblatt.com/technik/it-internet/5g-ausbau-1und1-drillisch-treibt-mobilfunk-plaene-durch-neue-allianz-voran/25617310.html?ticket=ST-2002989-odzQ9qPNPaHLI7h2fMdb-ap3.

have MVNO access obligations in place. The obligations originally applied in Spain were withdrawn by the NRA in 2017 on the basis that there was the potential for competitive developments in the market for mobile access and origination and thus the 3 criteria test was no longer met.

6.2 Market structures and the role of MVNOs

All of the countries studied feature 3 MNOs, with the exception of Spain, which has been a four player market over the past decade.

In Austria, Ireland and Germany, the mobile market went from 4 to 3 players due to consolidation in the period 2012-2014, while Japan and New Zealand have been 3 player markets over at least the past decade.

MVNOs in Germany, Spain and Japan have gained access to the MNO market as the fourth largest operators. In Spain, this was through acquisition of Yoigo by Masmovil in 2016, whereas in Germany and Japan, the leading MVNOs have acquired 5G spectrum and plan to enter as MNOs through deploying their own networks in combination with access arrangements.

Table 6-2: Number of MNOs, history of market entry and exit/merger

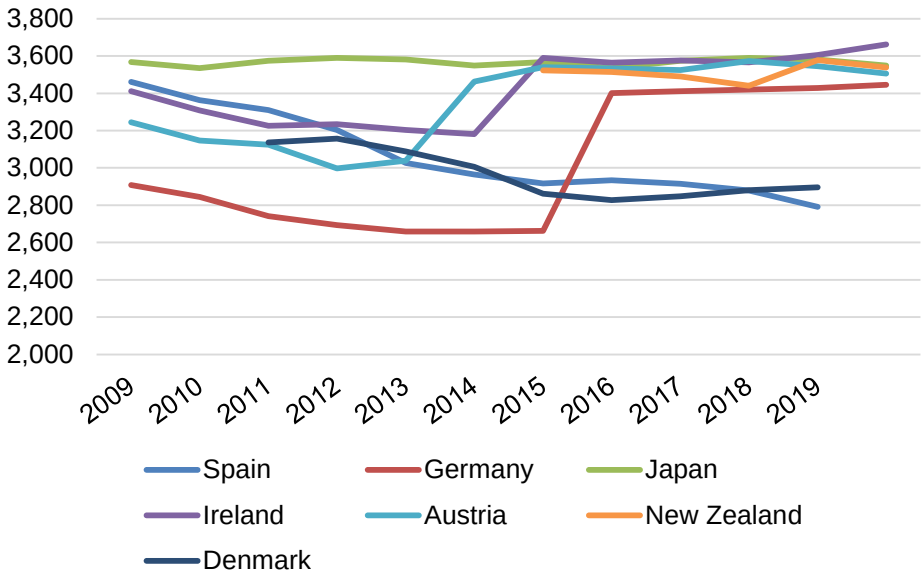
	MNOs	History of MNO entry/exit	Main Independent MVNOs	Main Subbrands of MNOs
Austria	A1 Telekom Austria, T-Mobile Austria, Hutchison Three Austria	4 to 3 merger in 2013: Hutchison Drei Austria (H3G) merged with Orange.	Ventocom with brand HoT; Mass Response with brand Spusu	Yesss!, eety
Ireland	Eir, Vodafone, 3	4 to 3 merger in 2013. 3 merged with O2	Tesco Mobile, Lycamobile, Virgin Mobile, Post Mobile	GoMo, 48, Clear Mobile
Japan	NTT, KDDI, Softbank	No recent merger activity, Rakuten plans entry as 4th MNO 2020 based on 5G	Rakuten, IIJ	UQ Communications
Germany	Vodafone, Deutsche Telekom (T-Mobile), Telefónica (O2)	4 to 3 merger in 2014: Telefónica merged with E-Plus, 1&1 Drillisch plans entry as 4th MNO 2021 based on 5G	1&1 Drillisch, Freenet	Congstar, otelo, Blau
New Zealand	2degrees, Vodafone and Spark	Spark emerged from the company Telecom, which in 1987 built the first mobile phone network in New Zealand. Vodafone entered the market in 1998. 2degrees entered the market with the launch of its GSM network in 2009	Vocus, Warehouse Mobile, Compass, Kogan Mobile, Trustpower	Skinny, Digital Island
Spain	Movistar, Orange, Vodafone, Masmovil	Masmovil (former MVNO) acquired 4th operator Yoigo in 2016	Market fragmented following exit of MVNOs such as Masmovil, Jazztel, Lycamobile, Carefour movil	Vodafone Yu, Amena, Tuenti

Source: WIK.

Trends in concentration levels in the analysed markets can be seen in the figure below. These concentration levels reflect the market shares of MNOs only, and thus represent an indicator of the degree of infrastructure (as opposed to service) competition. The effects on concentration levels of the mergers in Germany, Ireland and Austria between 2012-2014 can be clearly seen. Concentration levels have remained high and stable since the mergers in those countries. Concentration levels are also high in Japan and New Zealand, which have been characterised by 3 MNOs throughout the period analysed.

In contrast, falling concentration levels can be seen in Denmark and Spain, which benefit from 4 MNOs, although HHI levels in those countries have been relatively stable since 2014.

Figure 6-1: Trends in HHI based on revenue market shares (MNO revenues including revenues from hosted MVNOs)



Source: WIK based on Statista.

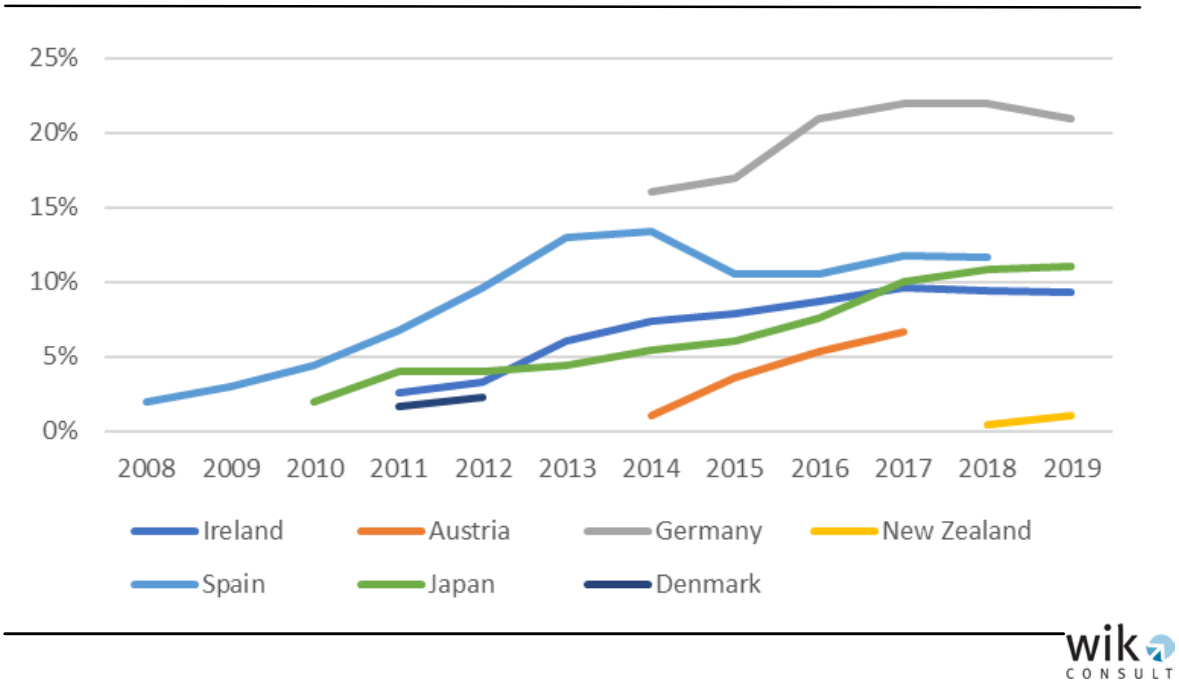
Of the countries analysed, MVNOs play the most significant role in Germany, with a market share of 21% revenues (25% subscribers) in 2019. This share has increased since 2014, but has been in decline in recent years, and is expected to decline further with the entry of 1&1 as an MNO.

Increases in the market share of MVNOs from a low base can also be seen in Austria (where the share increased from just 1% in 2014 to nearly 7% in 2018), and in Japan, where the share increased from around 4% in 2012 to around 11% today.

In contrast, the market share of MVNOs in Ireland has been relatively stable since 2014, with a slight decline from 2017 when it peaked at 10%. Stable shares of around 10% can also be seen in Spain and Denmark in recent years. MVNO providers in New Zealand have a very limited market share, although further entry is expected, as discussed below.

A slowing in the growth rate for MVNO market shares can be seen in several countries from 2016 onwards, including Austria, where MVNO market shares appear to have stabilized around 7% of subscribers. The reasons are unclear, but could relate to the increasing popularity of unlimited data plans and the challenges for MVNOs to compete in that market segment.

Figure 6-2: Trends in MVNO share of mobile market



Source: WIK based on data from NRAs, Cocom.

The nature and dynamics associated with the MVNO providers in the different countries varies to a significant degree. Key players from the countries studied are shown in the following table.

Table 6-3: Main MVNOs and selected sub-brands, target customer groups/service offerings and classification (partly [✂])

	Name of MVNO/E or sub-brand	Target market	Type of MVNO e.g. branded reseller, SP, light or full MVNO	Host MNO	Share of mobile retail market
Austria	Ventocom with brand HoT	Retail	Light MVNO	T-Mobile Austria	4.4% (3rd quarter 2017)
	Mass Response with brand Spusu		Full MVNO	H3G	NA
Ireland	Tesco Mobile	Retail/discount	Full MVNO	Three	~8%
	Post mobile	Retail/discount	Light MVNO	Vodafone	[✂]
	Lycamobile	International/discount	Full MVNO	Three	[✂]
	Virgin Media	Bundled	Full MVNO	Three	[✂]
	GoMo	Discount	Sub-brand	Eir	4.8%[391]
Japan	Rakuten	Retail/Digital		NTT	Circa 2%
	UQ Mobile	TV	Sub-brand	KDDI	Circa 1%
	IIJ	MVNE, Enterprise, IOT	Full MVNO		Circa 1.5%
Germany	1&1 Drillisch	Retail/discount/bundles mainly via online distribution	Between light and full MVNO	Vodafone, Telefónica	9% (2019 estimates)
	Freenet	Retail/discount	Between light and full MVNO	Deutsche Telekom, Vodafone, Telefónica	10% (2019 estimates)

391 In Q4 2019, based on 250,000 subscribers (https://www.joe.ie/tech/gomo-announces-reached-250000-subscribers-706156) out of a total subscriber base (excl. mobile broadband and M2M) of 5.16m, see ComReg QKDR.

New Zealand	Vocus	Bundled/Business	Between Service Provider and Light MVNO	Spark	N/A
	Warehouse Mobile	Retail	Licensed Reseller	2degrees	N/A
	Compass	Bundled/Business	Between Service Provider and Light MVNO	Spark	N/A
	Skinny	Discount	Sub-brand	Spark	N/A
	Digital Island	Business	Sub-brand	Spark	N/A
	Kogan Mobile	Retail		Vodafone	N/A
	Trustpower	Bundled		Spark	N/A

Source: WIK.

A more detailed analysis of developments within the countries indicates that regulation has played an important role in sustaining competitive MVNO segments in 3 player mobile markets. Specifically, expansion is still ongoing in Austria, while leading MVNO players in Germany and Japan are set to "climb" the ladder of investment to launch certain MNO services. However, the roll-out of 1&1 Drillisch's own infrastructure is still in its infancy and will take time to deploy. Moreover, it is reported that, once it was no longer constrained by the wholesaling requirements associated with the merger, Telefonica sought to discontinue ongoing price reductions, which it had previously applied for the provision of MVNO access to Drillisch.[392]

These markets are all the subject of relatively comprehensive regulatory obligations, which require the provision of full MVNO access by some or all of the parties. Conversely, the MVNO access segment in Spain, which was subject to lighter regulation that has subsequently been removed, is in decline, and MVNOs play a very limited role thus far in the New Zealand market.

The case studies also highlight the fragility of the MVNO segment, with acquisitions by or mergers with MNOs limiting the size of this segment in Spain and Japan in particular. This highlights the importance of merger regulation as a tool to ensure proper scrutiny of the competitive effects of consolidation in this sector.

A synopsis of the main features of the MVNO segment in each of the markets assessed is provided below.

Austria

Growth in the MVNO market in Austria has been driven not only by the regulated Reference Offer that resulted from the merger commitments, but also by commercial propositions from the other two operators that were likely stimulated as a result of the merger obligations. [393] For example, the largest MVNO in Austria HoT, has entered into a wholesale agreement with TMA. Meanwhile, the second largest MVNO Spusu uses the regulated offer from H3A. Another factor stimulating competition in the Austrian mobile market has been the entry in 2013 of an MVNE, Ventocom, which has provided supporting services to a number of MVNOs including the insurance company Allianz SIM as well as HoT. Other players with links to the retailing industry such as Lidl Connect and yesss! have also entered the Austrian market as sub-brands, respectively of H3A and A1. It was recognised in the 2018 Decision by DG Competition concerning the merger of UPC and T-mobile, that a key factor supporting the continued competition in the Austria mobile market was that the Reference Offer provided by H3A as part of its

392 See https://telecoms.com/506573/11-drillisch-shares-plunge-after-it-reveals-elevated-telefonica-charges/.

393 See BEREC (2018): BEREC Report on Post-Merger Market Developments -Price Effects of Mobile Mergers in Austria, Ireland and Germany, p. 17, https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8168-berec-report-on-post-merger-market-developments-price-effects-of-mobile-mergers-in-austria-ireland-and-germany. See https://www.rtr.at/de/pr/PI14032016TK.

commitments is open to all MVNOs.[394] Spusu and H3A have confirmed that the contract will be in place beyond 2022 (when the legal obligations resulting from the merger expire) and 5G offers by MVNOs are likely in the near future.[395]

Japan

The success of MVNOs in the Japanese market (a long-standing three player market) can similarly be attributed to access regulation applying to all MNOs, and the associated provisions concerning pricing and availability of a dispute resolution mechanism. Although MVNO access provisions in Japan are long-standing, it seems likely that the introduction of Guidelines concerning the application of applicable legislation in 2014, and the adoption of principles for non-discrimination and wholesale tariff regulation, are likely to have supported the development of this market segment. In January 2016, there were 49 MVNOs in Japan with more than 30,000 subscribers and 503 with less than 30,000 subscribers. By January 2019, this had increased to 70 and 933 respectively.

The Japanese market supports a wide variety of MVNOs with different business models. Launching in 2014, the largest independent MVNO is Rakuten, a major e-commerce, fintech and media company within Japan. Rakuten leverages synergies with its core business, for example by offering points to customers switching to its mobile service. They also launched their own line of smartphones, with reduced prices for their mobile customers.[396] Rakuten acquired 5G spectrum in the recent auctions and launched MNO-based services in September 2020.[397] They reached 80% population coverage with their 4G network in March 2021 and had secured 4 million customers as of May 2021.[398]

IIJ is another major MVNO in the Japanese market. Originally launching its MVNO service in 2008, IIJ became a full MVNO in March 2018, supported by the Government's Guidelines requiring MVNOs to be able to conduct interconnection agreements independently.[399] IIJ brings a more technological and engineering focus to the market, drawing on its experience as one of the first ISPs in the Japanese market. A key focus for the company is the corporate segment, and it also plans to provide international roaming options and develop SIMs that are specialised for installation

394 See Paragraph 313 https://ec.europa.eu/competition/mergers/cases/decisions/m8808_792_3.pdf.
395 See https://www.derstandard.at/story/2000124426457/vereinbarungen-laufen-aus-spusu-dementiert-drohendes-aus and https://www.derstandard.de/story/2000126839886/drei-ceo-rudolf-schrefl-da-geht-es-um-mehrere-milliarden.
396 See e.g. the Rakuten Hand, released in December 2020: https://corp.mobile.rakuten.co.jp/english/news/press/2020/1208_02/.
397 See https://global.rakuten.com/corp/news/press/2020/0930_02.html.
398 See https://global.rakuten.com/corp/news/press/2021/0513_02.html.
399 See IIJ: The introduction of Japanese MVNOs.

within devices (chip SIMs).[400] IIJ was the first player to launch the eSIM service in the Japanese market in July 2019.[401]

Two other large MVNOs UQ Communications and Biglobe focus on the Japanese consumer segment, but Biglobe was acquired by KDDI in 2017, while KDDI also has a minority shareholding in UQ Communications and plans to transfer subscribers by October 2020. Thus, it should be noted that Japan's flourishing MVNO market has been subject to acquisitions and consolidation.

Many of the remaining players are very small in scale, and include several MVNOs focusing on M2M/IoT. The importance of the IoT segment is underlined by the acquisition of the French MVNE/IoT MVNO Transatel by NTT in March 2019.[402]

Germany

Germany is another market in which independent MVNOs have flourished. This may have been supported by the "tradition" of MVNO access which was established through the introduction of mandatory MVNO access obligations in spectrum licences for 2G and 3G. However, other country-specific factors are also like to have played a role, including the large scale of the market. In addition, commercial interest in MVNOs in Germany may have been supported by the fact that competition amongst MNOs for mobile telephony services was not intense and prices for mobile telephony services were relatively high. In this climate, MVNOs were able to establish a position for themselves, especially among price-sensitive customers, which may not have been the case had there been more targeted offers by the MNOs to these customer groups. However, despite the apparent success of the German MVNO segment, it should be noted that MNOs succeeded in limiting the scope for MVNOs to compete in the high value segment. Even the merger obligations did not significantly change this situation. Notices from the European Commission also suggest there may have been challenges in enforcing the remedies associated with the merger commitments in Germany.[403]

There were three large, independent service providers, Freenet, 1&1 and Drillisch. However, since the acquisition of Drillisch by 1&1 in 2017, the independent service provider segment has consolidated around Freenet and 1&1 Drillisch. Although the leading German MVNOs have some capacity to innovate, they are not full MVNOs from a technical perspective.

In contrast with the other countries, mobile service providers in Germany mostly act as network operator-independent mobile communications providers. Under this model,

400 See https://www.iij.ad.jp/en/news/pressrelease/2018/0315-2.html.
401 See https://www.iij.ad.jp/en/news/pressrelease/2019/0704-2.html.
402 See https://www.transatel.com/press-releases/ntt-communications-completes-acquisition-of-majority-stake-in-transatel-a-global-connectivity-solution-provider-for-the-mvno-and-iot-markets/.
403 See https://ec.europa.eu/commission/presscorner/detail/en/IP_19_1371.

service providers do not form exclusive partnerships with one network operator, but market mobile communications services of various network operators, while offering their own value-added services and devices through their own sales organizations and distribution channels.

Freenet offers rates in the premium segment through subsidiary mobilcom-debitel. Freenet also has several discount brands, such as klarmobil, freenet Mobile, and callmobile. Through their discount brand freenet FUNK they were the first MVNO in the German market to offer unlimited data in May 2019.[404]

The premium brand mobilcom-debitel (MD) provides its mobile telecommunications services via the network infrastructure of all three German MNOs. MD's mobile communications business covers the resale of the network operators' original mobile communications rates, coupled with the sale of its own MD tariffs.

1&1 Drillisch provides its mobile services on the networks of Telefónica Deutschland (TEF) and previously also through Vodafone, although services for new customers through Vodafone ended in January 2021.[405] 1&1 Drillisch follows a multibrand strategy with two segments. Through the 1&1 brand, the company offers high quality tariffs with high-end service to compete with the main brands of the MNOs. The discount segment is served with the various brands that belonged to Drillisch before the companies merged.[406] While Freenet focuses on mobile services, 1&1 has started to offer bundled services as they also offer fixed services, mainly through access to the fixed network of the incumbent (xDSL technology). Following the acquisition of spectrum in the 2GHz and 3.6GHz range in 2019, and the conclusion of an agreement to lease spectrum from TEF, 1&1 is planning to deploy its own 5G network in 2021, and will thus over time transfer its MVNO customer-base onto its own infrastructure, reducing the size of the MVNO segment in Germany.

In February 2021, 1&1 Drillisch struck a deal with TEF for national roaming, which means that customers using the 5G network of 1&1 Drillisch after its launch will use 2G/3G and 4G from TEF. Customers still handled through the MBA MVNO deal will also be served 5G by TEF until they are migrated onto 1&1's own network. The wholesale pricing scheme for national roaming will be comparable to the MBA MVNO contract, with gradually decreasing prices. The national roaming agreement runs until the middle of 2025 with the one-sided right for 1&1 Drillisch to extend the contract until 2029 and

404 The offer includes unlimited data for €0.99/day, only payable through PayPal and managed through an app. A plan for €0.69/day for 1 GB of data is also available. See https://www.freenet-group.de/presse/freenet-funk-freenet-startet-ersten-rein-digitalen-mobilfunktarif--appbasiert-und-taeglich-kuend-und-pausierbar_7207544_4496444.html.

405 See https://www.inside-digital.de/news/1und1-streicht-alle-vodafone-tarife-klare-botschaft.

406 See https://www.teltarif.de/1und1-drillisch-netzausbau-4g-5g-roaming-lte-vodafone-o2/news/77636.html.

after that even to 2034.[407] 1&1 Drillisch AG also rebranded in May 2021 to 1&1 AG, thereby removing references to Drillisch from their name.[408]One could view the strategy by 1&1 to "climb the ladder" to act as the fourth MNO as a positive outcome influenced by the remedies imposed at the time of the merger. However, this view fails to take into account, that 1&1's entry as an MNO may have been made necessary as a result of the limitations of the MVNO model in competing in the premium segment, which is increasingly characterised by flat rate data bundles. Share price developments since the announcement that 1&1 would acquire spectrum also suggests that many investors are skeptical about 1&1's capability to make adequate returns through this strategy, and thus that it may not have been considered an ideal solution. Suggestions that, once released from its merger Commitments, Telefonica sought to pursue a more aggressive negotiating strategy towards providing MVNO access[409] to 1&1 may also support the idea that 1&1 may have opted for full MNO status in anticipation that MVNO conditions might deteriorate, following the removal of regulation. While these concerns did not materialise, it is unclear what would have happened had 1&1 not acquired spectrum and thus signaled that they were serious about becoming an MNO.

Alongside the independent MVNOs, the three MNOs have launched sub-brands targeting price sensitive customers, most notably Congstar by Deutsche Telekom, otelo by Vodafone and Blau by Telefónica Deutschland. The MNOs have also formed partnerships with major retailers (Aldi Talk, Lidl Connect, and others).

Spain

Spain provides an example of a market in which MVNOs previously played a significant role with the support of ex ante SMP regulation. Carrefour Movil was an early entrant into the MVNO segment following the imposition of access obligations in 2006.[410] However, the MVNO segment in Spain has been in decline in recent years, through mergers and exit. Masmovil, previously the largest MVNO in Spain acquired the fourth largest MNO Yoigo in 2016.[411] Masmovil itself was taken private in November 2020 as it was acquired by the private equity companies Cinven, KKR and Providence for €5.3bln.[412] Similarly the acquisition of MVNO and fixed broadband provider Jazztel by Orange, brought another MVNO into the MNO fold in 2014.

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407 See https://www.telefonica.de/news/corporate/2021/02/national-roaming-telefonica-deutschland-etabliert-langfristige-partnerschaft-mit-11-drillisch.html and https://www.1und1-drillisch.de/presse/read/1562.

408 See https://www.1und1-drillisch.de/presse/read/1516.

409 See https://telecoms.com/506573/11-drillisch-shares-plunge-after-it-reveals-elevated-telefonica-charges/.

410 See https://www.criticalmarkets.com/europe-the-ascension-and-fall-of-mvnos-in-spain/.

411 See https://www.grupomasmovil.com/wp-content/uploads/2016/10/06102016_MASMOVIL-completes-its-acquisition-of-yoigo.pdf.

412 See https://www.cinven.com/media/news/cinven-kkr-and-providence-complete-the-acquisition-of-spanish-telecommunications-operator-masmovil/.

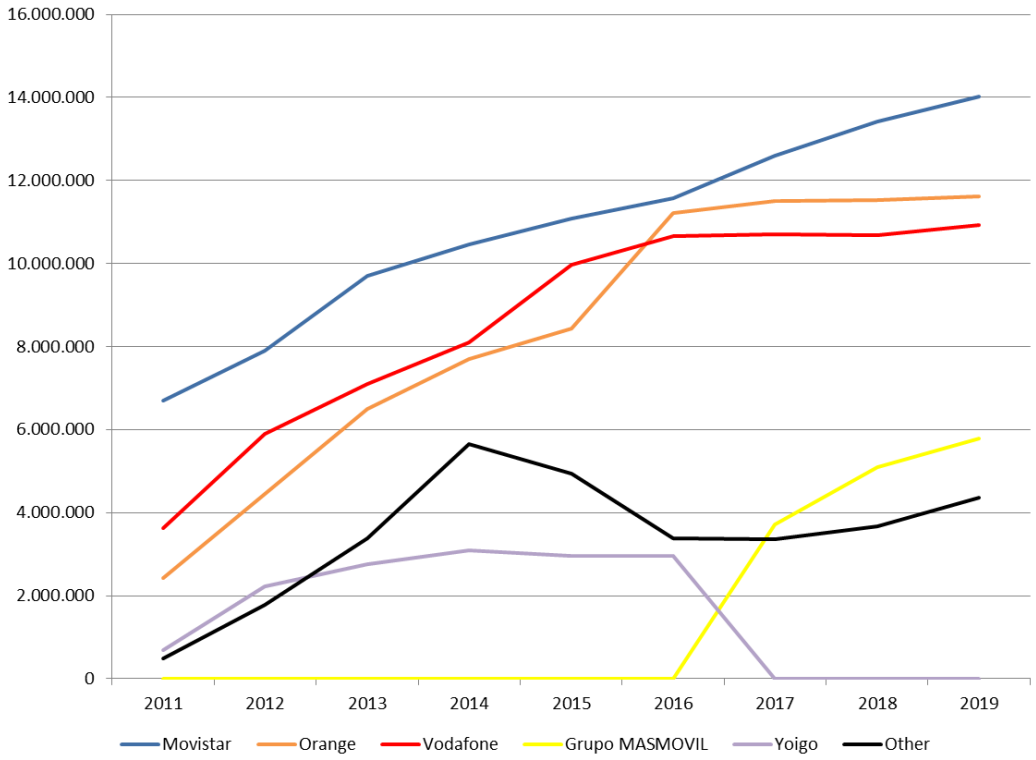
A key driver of the decline in MVNO access in Spain has been the perceived need to acquire infrastructure to compete on the basis of fixed mobile converged offers, a formula which is prevalent in the Spanish market. Wholesale access conditions (for fixed broadband as well as mobile) have been seen as insufficiently favourable to support convergent offers, especially for smaller players.[413]

Data from the NRA (see following chart) shows that MVNOs' ability to acquire customers declined from 2013 onwards. Although the decline predates it, the removal of regulatory obligations in 2017 is likely to have accelerated a shift by those which had previously engaged in MVNO provision in Spain away from an MVNO-based strategy. Carrefour Movil exited the market in December 2017, citing the impossibility of offering convergent services.[414] It offered portability for its customers to its host operator Orange. The acquisition of Lycamobile Spain by the fourth MNO (and former MVNO) Masmovil in 2020[415] also suggests that conditions may not have been supportive of the MVNO business model in recent years.

Other broadband infrastructure operators such as Adamo continue to rely on MVNO access to provide fixed mobile converged services.[416] However, this may be a defensive strategy in a market characterised by bundling. The remaining MVNOs are mostly small in scale, and target the "no frills" segment or local communities.[417]

413 See https://www.xatakamovil.com/omvs/carrefour-movil-cierra-sus-puertas-el-31-de-diciembre-ve-preparando-la-portabilidad.
414 See https://www.xatakamovil.com/omvs/carrefour-movil-cierra-sus-puertas-el-31-de-diciembre-ve-preparando-la-portabilidad.
415 See https://www.finsmes.com/2020/03/masmovil-acquires-lycamobile-spain-for-e372m.html.
416 Adamo launched its MVNO services in 2015.
417 See https://www.telecompaper.com/research/mvno-list/spain.

Figure 6-3: Number of subscribers (voice + data) per mobile operator in Spain, 2011-2019



Source: CNMC.

Notwithstanding the decline of independent MVNOs in Spain, MNOs continue to operate a number of "sub-brands", including brands of MVNOs previously acquired. For example, Orange operates 31 brands and sub-brands on its network.[418] Further MVNOs may become sub-brands e.g. Ahi+, as acquisitions by MNOs continue.[419] Some market observers have suggested, that MVNO-friendly regulation in Spain contributed to MNOs' strategy to counter the offers of new entrants with inexpensive sub-brand offers but market observers suggest that in turn the premium brands of the

418 See http://telecomvibe.com/spain-telecom-operators-and-mvno-sell-mobile-plans-with-much-variations/.

419 See https://www.telecompaper.com/news/masmovil-interested-in-buying-mvno-ahi-for-eur-130-mln-report--1333392.

MNOs then increased the prices for existing customers that are known to be reluctant to switch operators.[420]

The most recent MVNO that was bought by an MNO is Euskaltel, which was acquired for €2bln in June 2021 by Masmovil, a decision that was likely prompted by the strong presence of Euskaltel as a fixed provider in some areas of Spain.[421] The MVNO offerings of Euskaltel had until then been hosted on the Orange network. Further market consolidation is expected by the operators.[422]

New Zealand

MVNO access has not been imposed as an obligation in New Zealand. In practice, MVNOs play a very small role in the market today, with around 1% market share. Examples include Compass and Vocus, which use MVNO access to supplement their fibre-based offers, including business-focused services. A report for the NZ Commerce Commission on MVNO access[423] noted that the market was expanding, in part due to the entry of the third operator 2degrees into the wholesale market, providing competitive stimulus for others to respond. Recent entrants include the online retailer Kogan. Energy companies, such as Trustpower and Nova, which are already active in fixed broadband markets have also sought to supply mobile services on the basis of MVNO access. The commercial agreements are understood to be in the form of light MVNO or reseller arrangements. No full MVNOs are present in the NZ market. MVNOs such as Vocus claim that wholesale conditions have not allowed them to expand, and have called on the regulator to take action to regulate MVNO access.[424] However, other factors such as small scale and limited population density may also have affected market dynamics. The NZ Commerce Commission has concluded that no regulatory action is needed at this stage due to positive price developments and potential new entry. It will nonetheless monitor the market and associated outcomes on an ongoing basis.[425]

6.3 Financial implications

In the frequent cases where MVNOs are operated by larger groups pursuing a bundling strategy or marketing mobile services as an add-on to an existing consumer brand

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420 See https://english.elpais.com/economy-and-business/2021-06-22/why-spains-telecoms-slap-price-hikes-on-their-best-customers-and-reward-everyone-else.html.
421 See https://www.mobileworldlive.com/featured-content/top-three/masmovil-euskaltel-clearance.
422 See e.g. by Orange Spain here: https://telecoms.com/509478/orange-mulls-its-spanish-predicament/.
423 See https://comcom.govt.nz/__data/assets/pdf_file/0025/146680/RDC-MVNO-landscape-14-May-2019.PDF.
424 See https://www.reseller.co.nz/article/661675/mobile-market-working-consumers-except-large-users-data/.
425 See https://comcom.govt.nz/__data/assets/pdf_file/0022/177331/Mobile-Market-Study-Findings-report-26-September-2019.PDF.

(such as retailing), very limited information is available about the financial performance of the MVNO segment. It is even possible that this segment might be operated at a loss in order to support market positioning and the sale of bundles including more profitable elements.

However, some information is available for the MVNOs operating on a more standalone basis.

Table 6-4: Financial results, sample MVNOs

MVNO	Country	Monthly ARPU	Profitability
Rakuten	Japan	€25[426]	Loss-making
IIJ	Japan	€10	Gross profit 15% for mobile division
Freenet	Germany	€18	EBITDA margin 15%
Ventocom (MVNE)	Austria	€4.50	

Source: Financial statements, news reports.

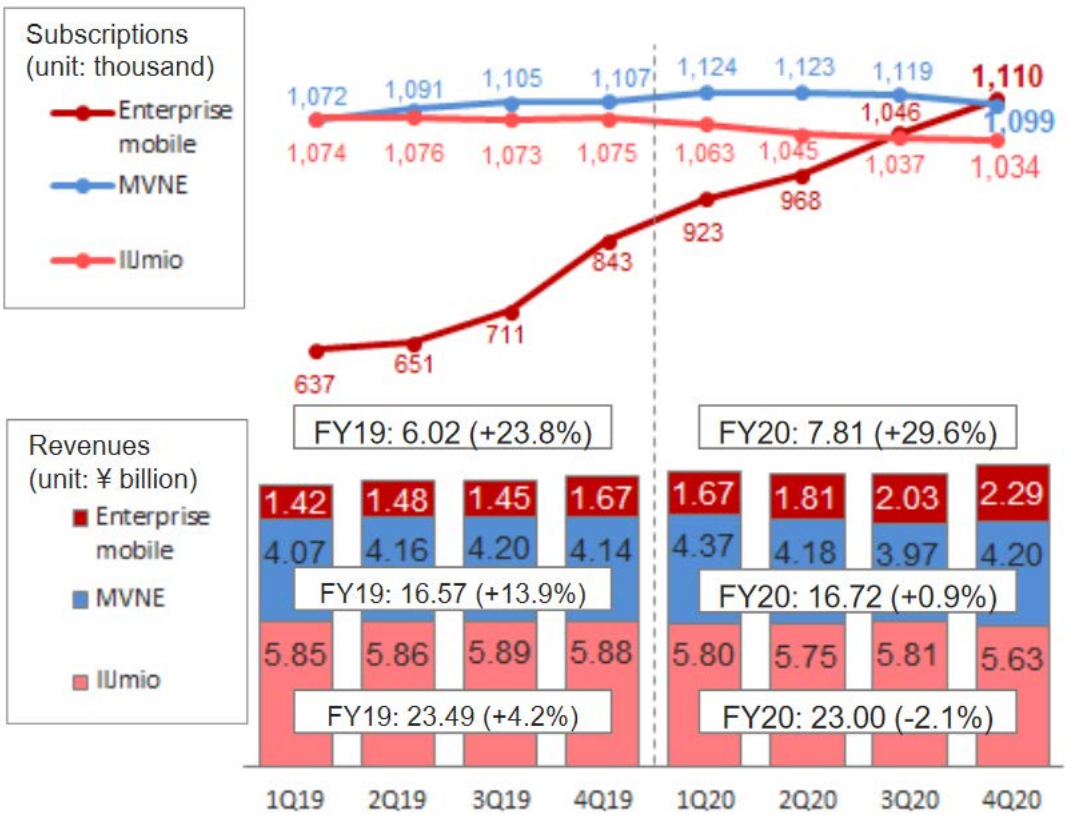
Revenues of the largest MVNO in Japan, Rakuten Mobile reached JPY119.8bln (€990m) at the end of 2019,[427] an increase of a third on the previous year. However, these include revenues from Viber alongside its MVNO operation. The total customer base was 2.3m subscribers, implying an ARPU of €36 per month. Analyst estimates put the mobile specific ARPU closer to €25 per month.[428] The business remains loss-making, with a loss of JPY60bln in 2019, also reflecting its recent investments in mobile infrastructure as they become an MNO. This trend continued further in 2020 with a revenue of JPY227bln[429] (€1.7bln) which is an increase of 34% year-on-year, but alongside an equivalent loss of JPY227bln due to the ongoing investment into the mobile network.[430] In the first quarter of 2021, the losses increased even further.[431]

426 See https://www.mobileworldlive.com/asia/asia-blogs/blog-why-are-rivals-not-worried-by-rakuten-strategy/.
427 See https://www.telecomtv.com/content/4g-lte/rakuten-mobile-turns-over-1bn-before-mno-service-launch-37682/.
428 See https://www.mobileworldlive.com/asia/asia-blogs/blog-why-are-rivals-not-worried-by-rakuten-strategy/.
429 This segment revenue is not directly comparable to the one reported in 2019, as some businesses have been moved between segments within Rakuten. Because of the transfer of businesses that operate digital content sites from the “Internet Services” to the “Mobile” segment, revenue was increased in the latter segment. The 34% increase is the increase if the businesses new to the segment would have been included previously.
430 See Rakuten Financial results 2020, available at: https://global.rakuten.com/corp/investors/documents/results/2020.html.
431 See https://www.fiercewireless.com/operators/rakuten-mobile-losses-rise-to-887-million-q1.

The Japanese Internet and mobile provider IIJ reports[432] that in 2019 it achieved total mobile revenues of JPY46.1bln (€380m), an increase of 10%. With a subscriber base of just over 3m, this represents an ARPU of €125 per year (or €10 per month). Revenues derived from activities based on its full MVNO operation (launched in 2018) were reported at JPY1.4bln. In 2020, subscriptions rose by 7.3%, while total revenue only increased by 3.1%. The full-MVNO business is growing rapidly with a 54.3% revenue increase.[433]

The source of revenues was split between IIJ's MVNE business, and the direct sale of enterprise mobile and consumer mobile services, as shown below. The relatively low ARPUs may reflect the importance to IIJ's business model of MVNE offers and IoT subscriptions.

Figure 6-4: IIJ sources of mobile revenue



Source: IIJ Financial presentation FY 2020.

432 See https://www.iij.ad.jp/en/ir/library/financial/pdf/IIJ4Q19E_presentation.pdf.
433 See https://www.iij.ad.jp/en/ir/library/financial/pdf/IIJ4Q20E_presentation.pdf.

As regards costs, IIJ reports that the growth in full MVNO services (from JPY 0.66bln in 2018 to JPY 1.41bln in 2019) absorbed the fixed cost of operating as a full MVNO. This fixed cost was reported at JPY0.3bln per quarter from March 2018. However, IIJ financial reports also show the significance of unit-based charges in supporting a positive business case. IIJ reports that the calculation method for the unit-based charges is cost-oriented (data communication cost + profit)/demand, and that the cost assessment which was previously based on actual costs, would move to future cost predictions from 2020.

IIJ's gross profit ratio for the division which includes the provision of MVNO-based services stood at 15% at the end of 2019.

Financial data specifically concerning the mobile segment of German MVNO (and soon to be MNO) of 1&1 is not available. However, the financial statements of the other German MVNO Freenet show that it secured mobile revenues of €2.3bln for FY2020[434], a decrease of 1.2% from FY2019.[435] and secured ARPUs in the postpaid segment of just below €19 per month. These figures are comparable with the ARPUs achieved by Vodafone, and are higher than those secured by O2/Telefónica Deutschland. [436]

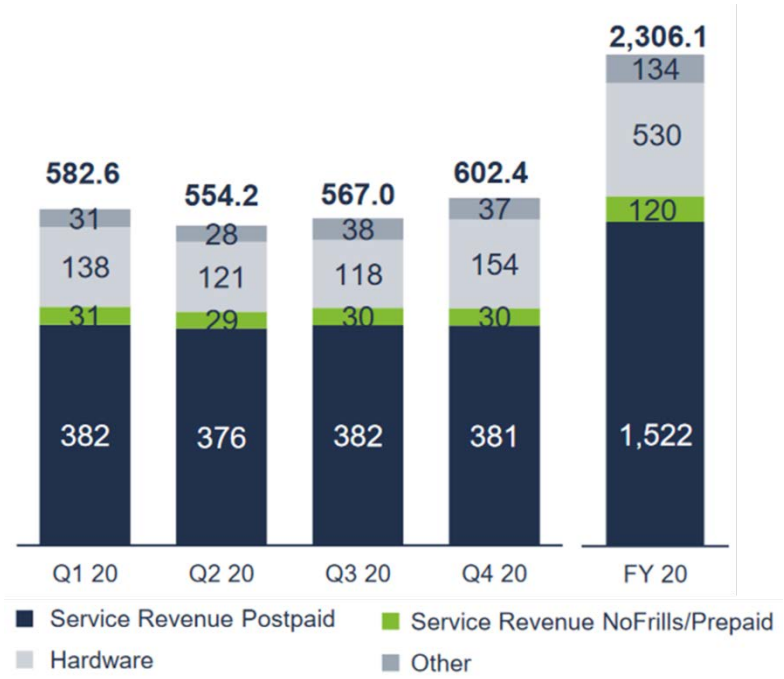
The following figure shows the split of revenues, with the majority coming from postpaid services and hardware, with only a limited portion on the basis of the "no frills/prepaid" service.

434 See https://blob.freent.de/contentblob/8210448/2/data/20210224analyst-pres-prelim-2020.pdf.

435 See https://blob.freent.de/contentblob/7771600/2/data/20200504-management-presentation-on-results-q1-2020.pdf.

436 The ARPU by Telefónica Deutschland stands at €13.2/month in early 2021, which is however influenced by lower-price resale models e.g. through the large retail chain ALDI. The ARPU of the main/premium brand O2 is higher but not specified by the company. See Telefónica Deutschland Investor Presentation May 2021.

Figure 6-5: Freenet mobile revenue split (excluding motion TM)



Source: Freenet financial presentation Q1 2020.

Freenet reported gross profit margins for its mobile business of 30% in Q1 2021 and EBITDA margins of 17%. These figures have been largely stable over the past year, despite a decline in revenue of almost 6% from Q1 2020 to Q1 2021. This decline was due to lower hardware revenues and associated low margins.[437]

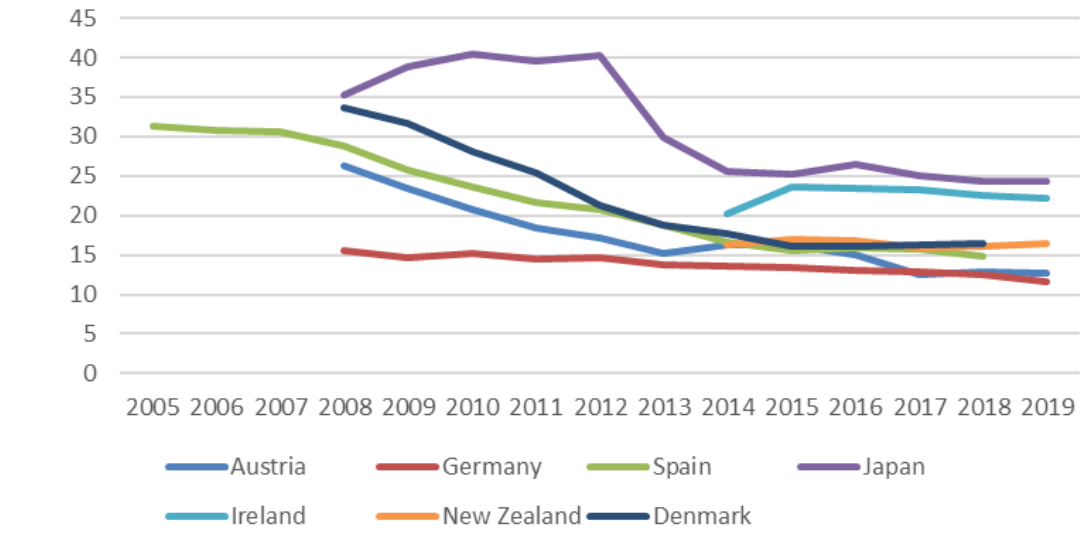
Ventocom, the MVNE which launched in Austria in 2015 following the 4 to 3 merger, and supports 5 mobile brands in Austria and Slovenia, including the leading Austria MVNO HoT, reported group revenues of €53.45m in 2017,[438] and 1m subscribers,[439] implying a monthly ARPU of around €4.50.

As regards the impact of MVNOs on the wider sector, in theory, pricing pressure from MVNOs (and any dillution of retail with wholesale revenues), especially in the larger consumer segment, may be visible in MNO ARPUs.

437 See https://blob.freent.de/contentblob/7771600/2/data/20200504-management-presentation-on-results-q1-2020.pdf.
438 See https://www.europarl.europa.eu/cmsdata/157555/Michael%20Krammer%20-Ventocom%20-%20Effects%20of%20RLAH%20for%20an%20MVNO.pdf.
439 See https://www.telecompaper.com/news/hot-reaches-900000-subscribers--1311011.

Data from financial statements shows a clear demarcation for most countries between the period prior to 2014, when mobile ARPUs in most countries were declining, and the subsequent period which is characterised by increased stability.

Figure 6-6: Trends in MNO ARPU: selected countries

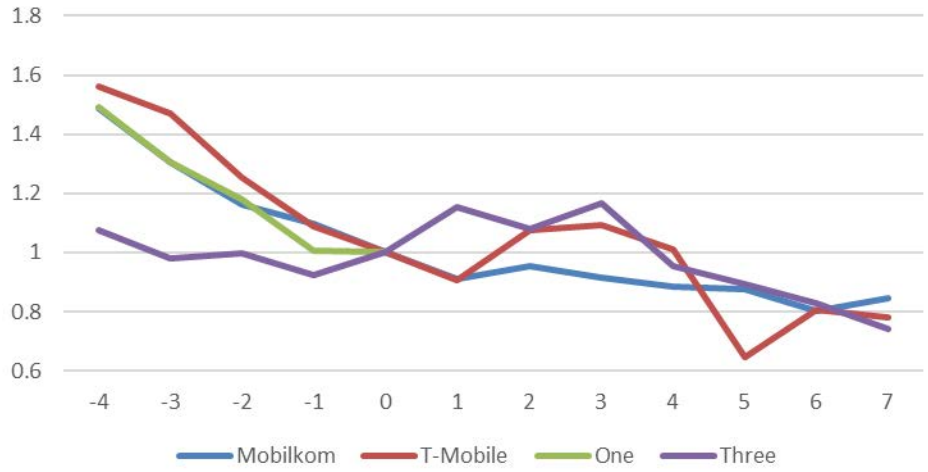


Source: WIK based on New Street, Statista.

One country which did not follow this trend is Austria, where ARPUs appear to have increased for a period following the merger, and then subsequently declined.

An illustration of the ARPU developments prior to and following the merger is shown in the following chart. The chart shows declining ARPUs amongst Mobilkom, T-mobile and One prior to the merger, followed by a period of higher or stagnant ARPUs which lasts until 4 years after the merger (2016), at which point a continued decline can be seen, potentially stimulated by the entry of aggressive MVNOs such as HoT.

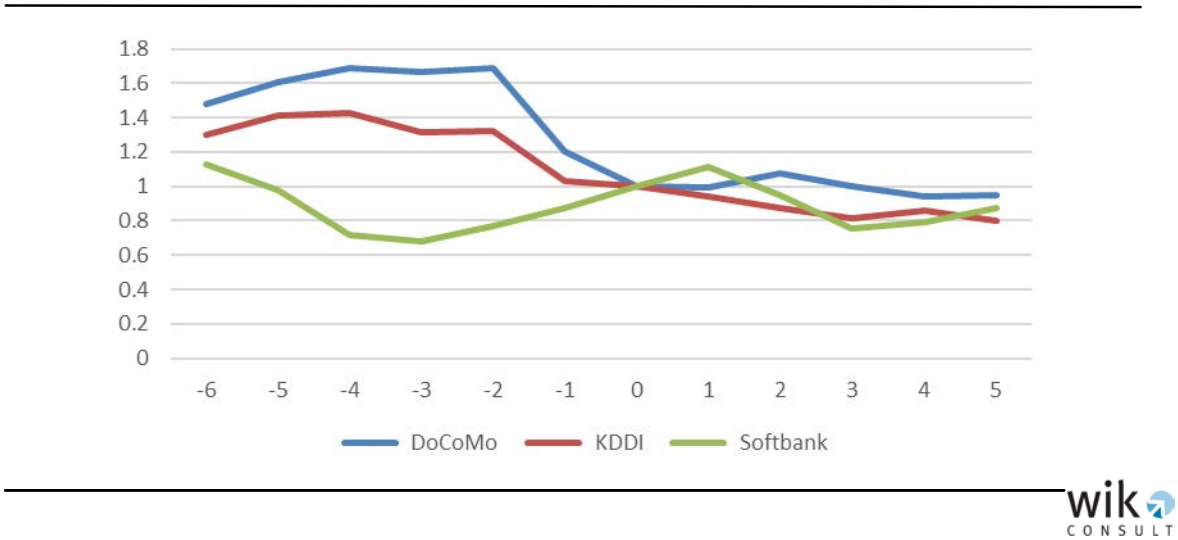
Figure 6-7: ARPU evolution pre and post merger in Austria



Source: WIK based on New Street, Statista.

An examination of the evolution of ARPUs in Japan, also shows distinct patterns in the periods prior to and following the adoption of the reinforced MVNO Guidelines and launch of Rakuten as an MVNO. However, it is notable that ARPUs for the two leading players declined sharply after 2012 (prior to the entry of Rakuten) before stabilising at a lower level. It is possible that anticipation of low cost MVNO entry may have been a factor, although other reasons cannot be ruled out.

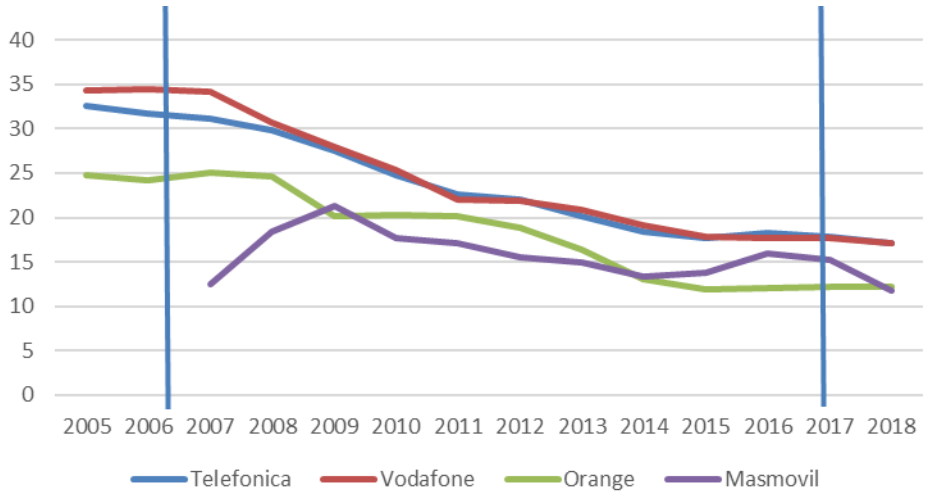
Figure 6-8: Mobile ARPU evolution pre and post Guidelines/Rakuten launch in Japan



Source: WIK based on New Street, Statista.

Two regulatory events shaped developments in the Spanish mobile market – the introduction of MVNO access obligations in 2006, and their removal in 2017. An examination of ARPU trends shows that the entry of MVNOs following regulatory intervention, may have impacted ARPUs, but it is difficult to distinguish this effect from the effect of the expansion of Yoigo (later Masmovil), the fourth MNO. A stagnation in ARPUs occurs around 2015. This is prior to the approval of the removal of MVNO access regulation in April 2017. However, it is possible that strategies were influenced by the consultation process preceding the final decision. ARPUs could also have been influenced by the consolidation in the mobile market arising with the merger between Jazztel (formerly an independent MVNO) and Orange in 2015.

Figure 6-9: Mobile ARPU evolution in Spain



Source: WIK based on New Street, Statista.

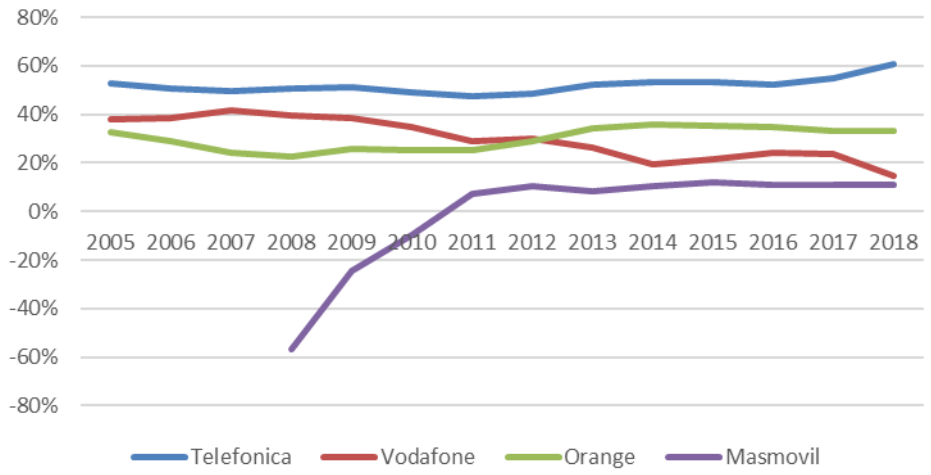
It is notable that, in contrast with Austria, ARPUs in Germany, which were already relatively low, continued their steady decline following the merger in 2014. It is possible that competitive pressure from the prospect of MVNO-based entry coupled with pre-existing MVNO regulation connected with 2G and 3G spectrum licences may have supported continued pricing pressure in the market.

No significant downward trend can be seen in Ireland following the merger however, notwithstanding the MVNO obligations that had been linked to approval of the merger.

ARPUs in New Zealand (3 player market) and Denmark (4 retail MNOs, but 3 networks) have remained stable since 2014. ARPUs for these countries lie in the mid-range amongst those studied. Independent MVNOs do not play a significant competitive role in either market.

Reliable data on EBITDA margins and Capex ratios which is specific to mobile markets is not readily available. Estimates prepared by New Street Research, suggest that the launch of MVNOs in the Spanish market does not appear of itself to have affected EBITDA margins of the largest MNOs, with the possible exception of Vodafone. It is interesting to observe however that EBITDA levels vary with relatively high margins for the leading firm, and considerably lower margins for Vodafone and the smallest player and most recent entrant Masmovil, which reported negative margins for the years immediately following its launch, potentially reflecting start-up costs.

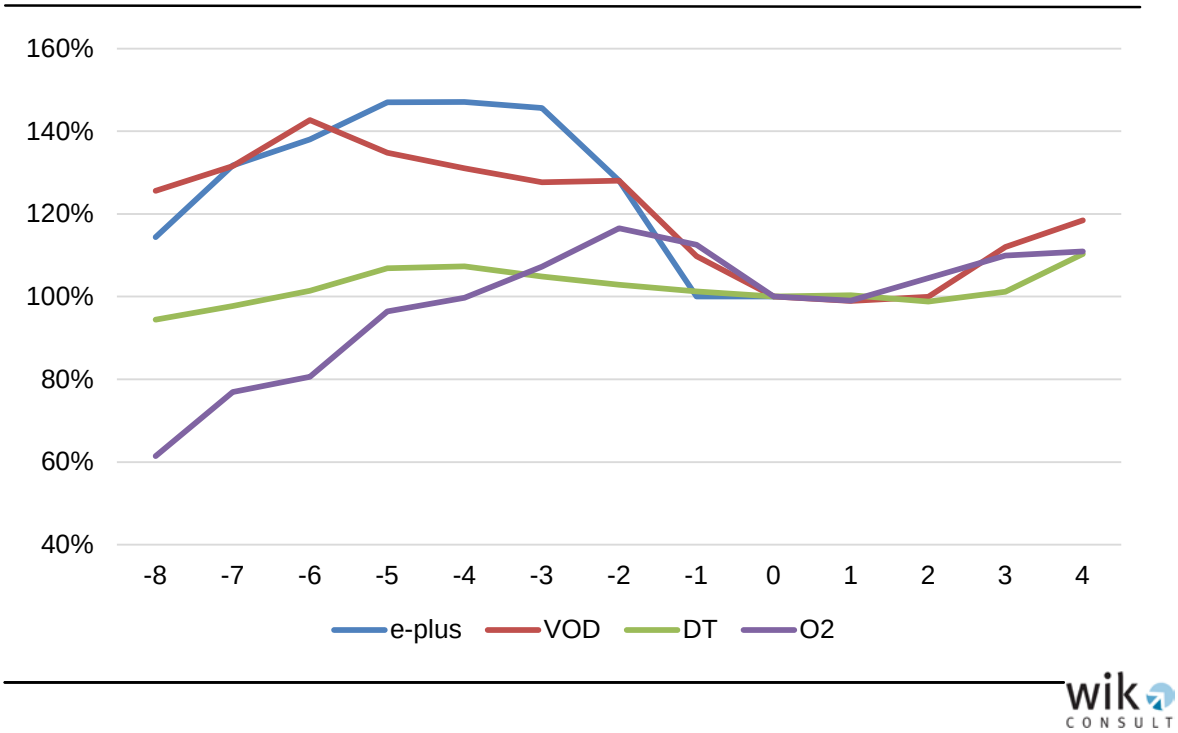
Figure 6-10: Trends in estimated mobile EBITDA margins – Spain



Source: WIK based on New Street, Statista.

For the German market, data from New Street suggests that EBITDA margins had been increasing prior to the merger and introduction of the capacity-based MVNO, but stabilised at a lower level subsequently, shortly before the merger was concluded. However, there have been signs of renewed increases in EBITDA margins since 2017. In absolute terms, DT was reported to have the highest mobile EBITDA margins (52% in 2018), with O2 at 33% during that year, and Vodafone at 41%.

Figure 6-11: Trends in estimated mobile EBITDA ratios in Germany pre and post merger



Source: WIK based on New Street, Statista.

The pattern of EBITDA margins tracking the scale of the customer base of the different mobile operators, with a significantly higher margin for the incumbent is also reflected in estimates for mobile EBITDA margin provided by Statista for New Zealand and Ireland.

6.4 Outcomes for the mass-market

In principle, additional competition via MVNO access should, if effective, result in increased retail price competition and variety in service offers. As (in contrast with physical unbundling of fixed infrastructure) MVNOs do not have control over network functions, increases in quality as a result of MVNO-based competition are unlikely to be seen. However, comparisons of quality between MVNOs and their hosts may help to indicate to what extent there may be discrimination by MNOs favouring their own downstream providers in comparison with MVNOs on their networks.

6.4.1 Effects on pricing

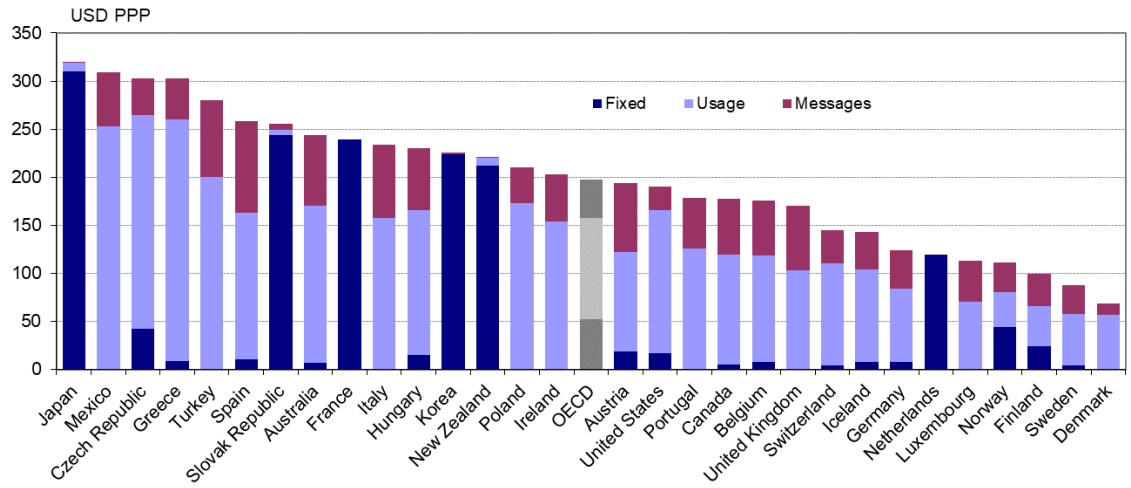
Evidence from the case studies suggests that stronger forms of regulation have been an important enabling factor in supporting the MVNO segment. In turn, certain more aggressive MVNOs appear to have had an impact on pricing in the market (in a similar

manner to the effects seen by some “maverick” mobile entrants).[440] However, the most marked effects have been in calls, and more recently, low end data markets. MVNOs have struggled to make a significant impact on higher end data markets.

For example, the arrival of MVNOs in Spain, which followed action by the NRA to mandate number portability and mandate MVNO access around 2005/6, led to marked price reductions. One of the most popular MVNOs (Carrefour Móvil) became known for a single fee of 15 cents a minute when at the time the usual fee for a voice call minute was 21 cents. The market entry of MVNOs not only led to lower prices, but also new pricing policies (flat rates, 24 hour tariffs, tariffs per second instead of minutes, etc.) which led to adjustments also by the established MNOs.

Data from the OECD from the period when MVNO regulation was imposed in Spain, shows that while in 2006, mobile tariffs in Spain were amongst the most expensive in the OECD (the 6th highest for low and medium user baskets and 3rd highest for high user baskets), by 2010, in the years following the imposition of MVNO regulation, prices in Spain had fallen below the OECD average for the low user basket (see figures below). However, in addition to the influence of MVNO entry, it is likely that these price reductions were also supported by the expansion of the 4th MNO in Spain Yoigo.

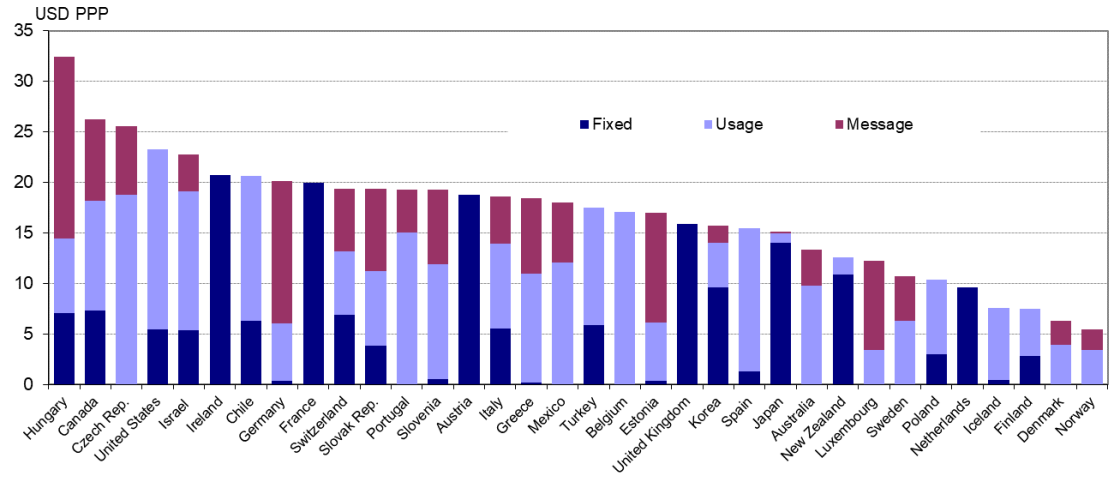
Figure 6-12: OECD Mobile low user basket, August 2006 and 2010, VAT included, annual prices



Source: OECD.

440 The impact of specific “maverick” players in mobile markets is also highlighted in the context of the WIK (2018) study concerning the Review of the SMP Guidelines.

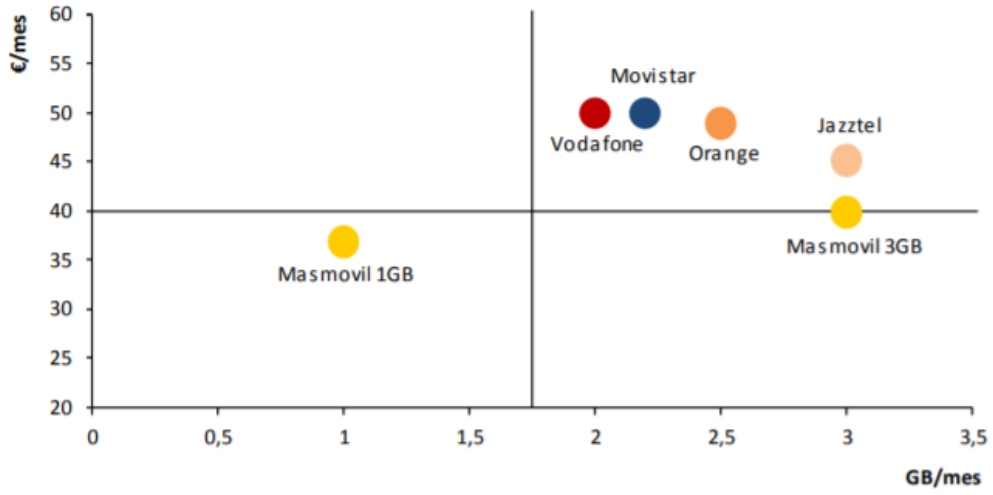
Figure 6-13: OECD Mobile medium user basket, August 2006 and 2010, VAT included, monthly prices



Source: OECD.

Whereas effects from MVNO access may have largely impacted the low end of the market, the effect of aggressive competition from a fourth MNO appear to have impacted the high end data market. The figure below compares basic fixed-mobile offers in Spain in 2017, after Másmóvil had become an MNO. Másmóvil was the only operator to offer a limited bundle of 1 GB under 40 €, and was cheaper than the competition in the high-end data segment.

Figure 6-14: Pricing strategy Másmóvil as MNO, 2017

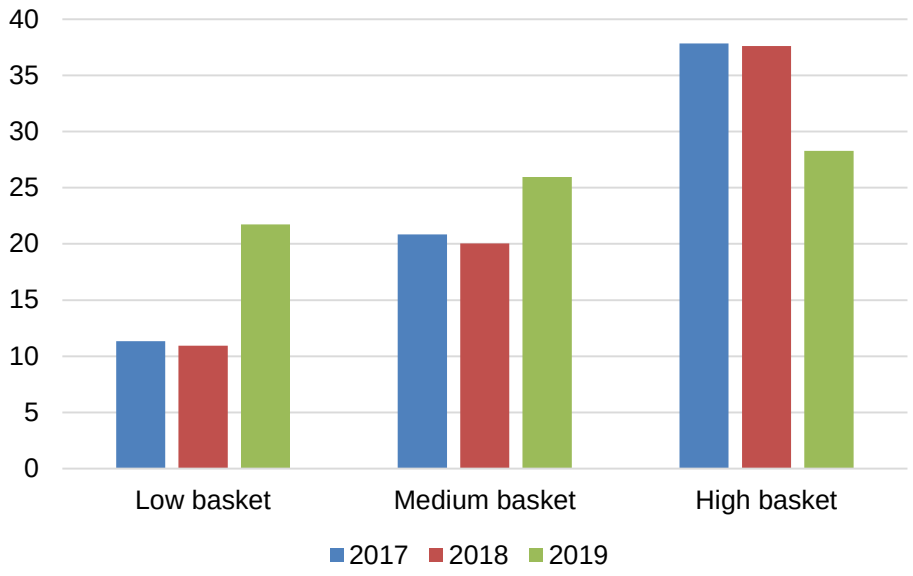


Source: Intermoney Valores.[441]

EU comparisons also show falling prices between 2017-2019 for the data intensive "high basket" in Spain. However, prices for the low and medium baskets are reported to have increased over this period, potentially reflecting more limited competitive pressure from the low cost MVNO segment, following the exit of Masmovil (and other MVNOs) from that segment as well as the removal of regulatory safeguards. These trends contrast with other countries examined, where low and medium user prices mostly fell during this period.

441 See https://www.grupomasmovil.com/wp-content/uploads/2016/05/Masmovil_Febrero2017_COMPRAR.pdf.

Figure 6-15: Evolution in mobile basket prices 2017-2019: Spain, cheapest price including VAT in €/PPP

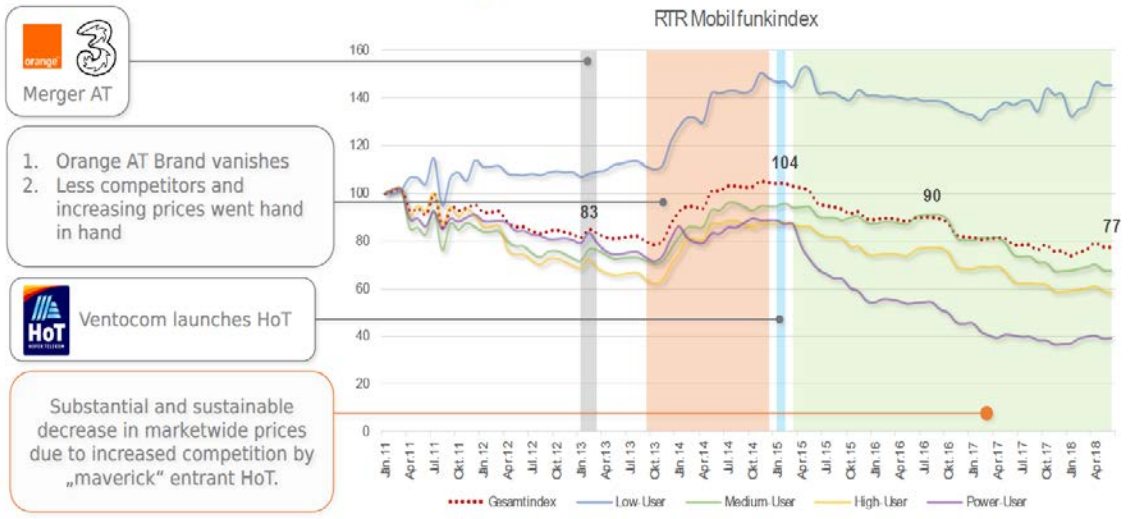


Source: European Commission.

MVNO regulation in Spain was not focused on data, and was limited to fair and reasonable terms and conditions. It is therefore relevant to examine the degree to which more recent MVNO obligations, mandated in the context of merger proceedings affected pricing in the market.

Data from the Austrian NRA, shows how, with the aid of a regulated offer which had a greater focus on data, MVNOs were able to exert price competition in the data segment. Specifically, the following chart suggests that the entry of MVNOs following the 4 to 3 merger, may have contributed to the decline in prices for mobile bundles from 2015 onwards. The two year delay in this effect following the merger (during which time mobile prices in Austria increased), can be viewed as an implementation delay.

Figure 6-16: Evolution in mobile prices in Austria pre and post merger Source: Ventocom based on RTR mobile pricing index (€)



Source: Ventocom based on RTR mobile pricing index.

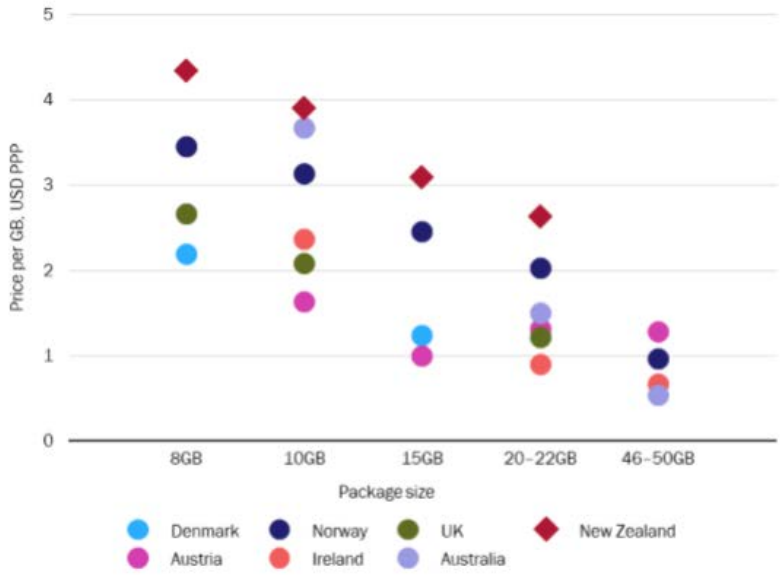
According to RTR's annual report (2015), this price decline was in part stimulated by the market entry of HoT in January 2015. The established discount brands Yesss!, Bob and Ge.org! reacted with price reductions.[442] Yesss!, Bob und Ge.org! are sub-brands of A1.[443] In 2015 the overall index fell by 14.8%. There was a price reduction for all user types.[444] At the same time in 2015, infrastructure investments by operators increased again, reaching a level not seen since 2008.[445]

Data from 2019, shows that for data only offers, Austria's price levels lie below the EU average for every basket except the highest use basket. When comparing least expensive handset-based offers, Austria is far below the EU28 average, except for the lowest basket (100 MB and 30 calls). In the largest basket (20 GB, unlimited calls), Austria, at 14.26 €, is 68% below the EU28 average of 44.51 €.

An illustration of Austria's positioning in international benchmarks for mobile data pricing per GB, including New Zealand and Ireland, is shown below, for the year 2018.

442 See RTR (2015): RTR Telekom Monitor Jahresbericht 2014, p. 18, https://www.rtr.at/de/inf/TKMonitor_2014/TM_Jahresbericht_2014.pdf.
443 See https://www.rtr.at/de/tk/TKKS_BetreiberMN.
444 See RTR (2016): RTR Telekom Monitor Jahresbericht 2015, p. 25, https://www.rtr.at/de/inf/TKMonitor_2015/TM_Jahresbericht_2015.pdf.
445 See RTR (2016): RTR Telekom Monitor Jahresbericht 2015, p. 25, https://www.rtr.at/de/inf/TKMonitor_2015/TM_Jahresbericht_2015.pdf

Figure 6-17: Comparison of mobile data package pricing per GB, excluding VAT, USD PPP



Source: Analysys Mason (2018).[446]

It confirms Austria's position as one of the lowest price countries in data packages. However, Austria's position is not so strong in the pricing of the highest use data packages. One possible reason might be the more limited role played by MVNOs in this area. Our review of the available packages confirms the regulators' observation that MVNOs do not have any significant relevance when offering mobile flat rate tariffs or those with the largest data volumes on the retail market. As of December 2018, no MVNO was in a position to negotiate a wholesale offer beyond the Reference Offer that would allow additional products such as flat rates or zero-rating offers to be offered.[447] In contrast to MNOs, HoT as the largest MVNO still does not offer extensive data

446 See Analysys Mason (2018): Final report for Trustpower, MVNO aspects of the Commission's mobile market review, 25 October 2018, Ian Streule, Janette Stewart and Audrey Bellis, Ref: 2015048-414 p. 18, https://comcom.govt.nz/__data/assets/pdf_file/0018/104238/TrustPower-Appendix-2-Analysys-Mason-Submission-on-the-Issues-Paper-26-October-2018.PDF.

447 See RTR (2018), ANHANG 2 zur Konsultation zum Vergabeverfahren 700/1500/2100 MHz, Wettbewerbssichernde Maßnahmen, Wien, am 20. Dezember 2018, p. 10, https://www.rtr.at/de/inf/konsult700-1500-2100-mhz/Konsultation_Vergabe_700_1500_2100_MHz_20122018_Anhang_Wettbewerb.pdf.

packages. As of July 2021, their biggest data allowance consists of 17 GB/month + 13 GB/month "data reserve" for €14.90.[448]

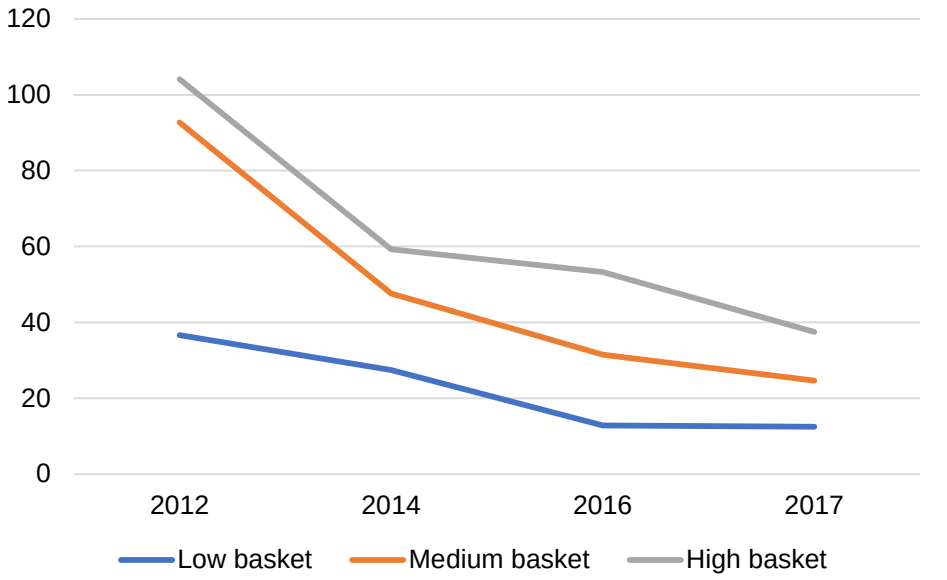
In contrast, it is notable that Ireland has a strong position in the pricing of the largest data bundles, which are playing an increasingly important role in the market (see also section 5.5.2). As in Austria, the MVNOs in Ireland have not played a significant role in high volume bundles, but attractive offers have been made in this space by MNOs and their associated sub-brands. The chart also highlights that when the size of data packages are taken into account, pricing in New Zealand is high in comparison with Ireland as well as the other countries benchmarked, and there is a lack of packages at the highest levels. It is possible that the lack of competition from a fourth operator or full MVNO might play a role (amongst other factors) in these outcomes. This might support a conclusion that 3 player markets can experience differing outcomes depending on the conduct of the players involved, making competition unstable in these settings. However, equally, other factors such as higher cost levels may have influenced pricing levels relative to the other countries considered. It is difficult to gauge the reason for the relatively high pricing levels in New Zealand in the absence of any change in the competitive situation in New Zealand.

On the other hand, as 5 years have passed since the merger, it should be possible to evaluate what impact the capacity-based MVNO obligations had on pricing in the German market. Benchmarks from the OECD indicate a slowing in the level of price declines following the merger, which might indicate that the capacity-based MVNO remedies were insufficient to offset the effect of the reduction in MNOs. BEREC's study on the effect of mergers is also suggestive of price stagnation following the merger in Germany.[449]

448 The "data reserve" is free of charge but has to be activated separately. It is assumed that the workaround with the "data reserve" was chosen, so that the reserve does not count for calculating the EU roaming data allowance. For the HoT plans, see https://www.hot.at/tarife.html.

449 See https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8168-berec-report-on-post-merger-market-developments-price-effects-of-mobile-mergers-in-austria-ireland-and-germany.

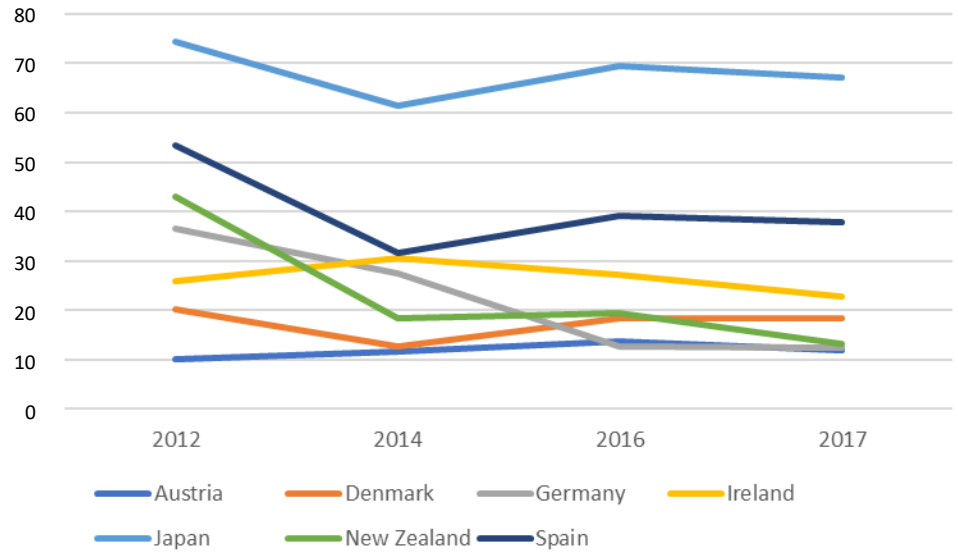
Figure 6-18: Germany, development in mobile prices – OECD baskets USD per month PPP



Source: OECD.

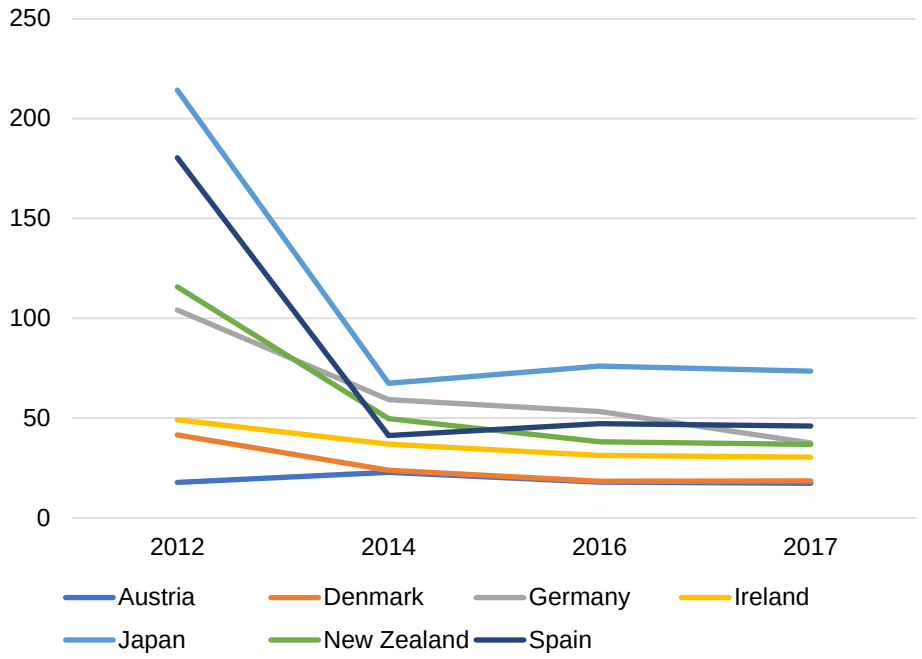
However, it should be noted that low use benchmarks have not included pricing from MVNOs and sub-brands which are prevalent in the German market, and low use basket prices in Germany are already low according to international comparisons (see Figure 6-19). Thus, the data has not reflected the impact of competition from MVNOs in the low cost segment. On the other hand, prices for high user baskets in Germany, for which there was less competition from MVNOs or sub-brands at the time the data was collected by the OECD, remain higher in relation to international benchmarks, especially amongst the two largest MNOs (see following charts).

Figure 6-19: Price evolution selected countries: OECD low basket USD PPP 100 calls + 500MB



Source: WIK based on OECD.

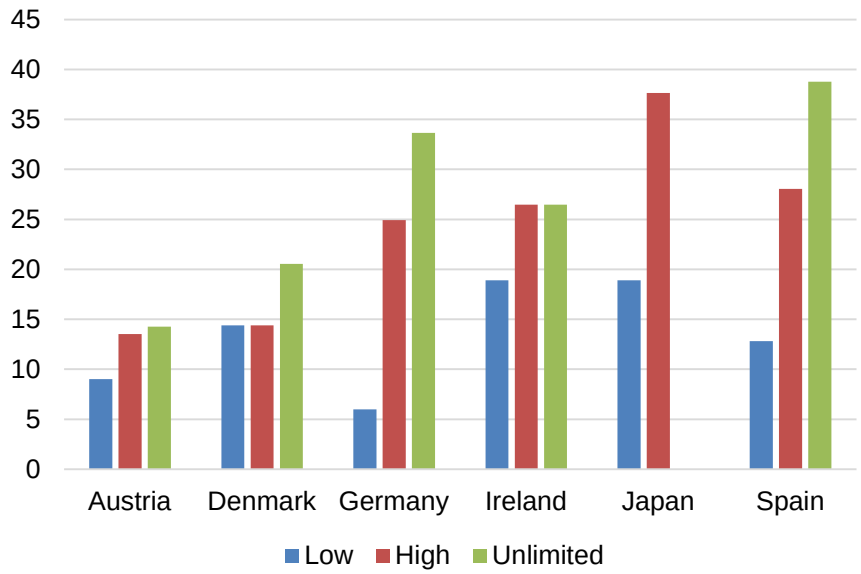
Figure 6-20: Price evolution selected countries: OECD high basket USD PPP 3=900 calls + 2GB



Source: WIK based on OECD.

A snapshot of mobile prices in 2019, gathered by the European Commission (see following chart), further illustrates the high pricing levels of high and unlimited data plans in Germany and the stark contrast between the pricing levels for low and high/unlimited packages, which may indicate differences in the competitive conditions.

Figure 6-21: Cheapest price baskets, including VAT in €/PPP 2019



Source: European Commission.

There are some indications from offers available from 1&1, which operates mainly (and now solely) on the basis of the capacity-based MVNO offer on the Telefónica network, that it may have faced difficulties competing in the high-end market, especially as regards unlimited bandwidth, which has become increasingly popular.

As regards the MVNOs, at the beginning of February 2020, 1&1, like the 3 MNOs, had also included an Allnet flat rate with unlimited LTE data volume in its rate portfolio with the "All-Net-Flat LTE XXL". Since the beginning of April 2020, this rate was no longer available for new customers.[450] However, the offer has been made available again since late March 2021, showing that it was likely complicated to offer it sustainably from a commercial point of view but a solution was found,[451] potentially in connection with 1&1's market entry as an MNO and the roaming agreement with Telefonica Deutschland. By July 2021, the largest data volume of mobilcom-debitel, the premium brand of the other German MVNO Freenet stands at 60 GB/month. They do however offer unlimited plans of O2 in a resale model and also unlimited data through contracts of their sister brand freenet FUNK.

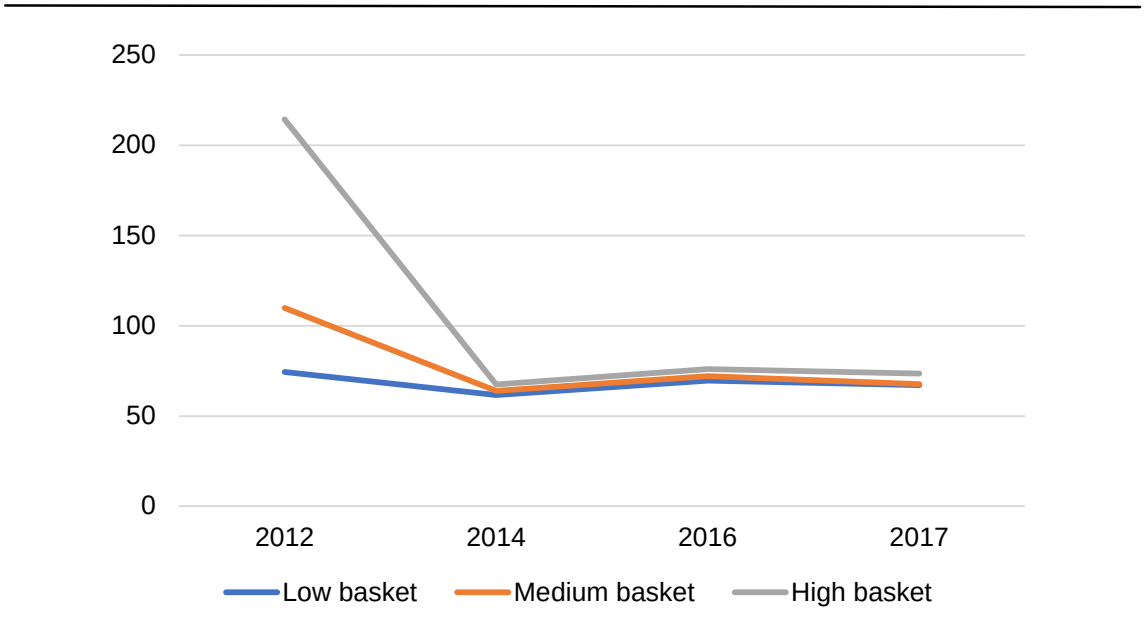
450 See https://www.onlinekosten.de/news/1-1-unlimited-lte-tarif-nicht-mehr-erhaeltlich_222099.html.
451 See https://winfuture.de/news,121979.html.

Japan provides another example of a regulated market in which MVNOs seem to have boosted competition in the data market, but where the impact has primarily been seen at the low end of the market.

When it launched as an MVNO in 2014, one of Rakuten's key strategies was to drive the adoption of smartphones, which had achieved a penetration of only 58% of the Japanese population at the end of 2013. Its service was aimed at price conscious customers (with an option for limited voice and data starting at JPY 2,200 (€18.20 per month). Rakuten also developed a range of mobile and online content, which aimed to stimulate increased data use.[452]

Although prices for mobile plans in Japan are high compared with international comparisons (and remain high), benchmark data from the OECD indicates that pricing strategies by the MNOs may have changed to accommodate more data within the same price following the launch of Rakuten.

Figure 6-22: Japan: development in mobile prices (OECD baskets) USD per month PPP



Source: OECD.

452 See https://technology.informa.com/515091/rakuten-expands-mobile-strategy-with-new-japanese-mvno.

As seen in Figure 6-21, Japan maintains a high price gap between low end services (where competition from MVNOs may be more intense) and medium baskets. As of 2019, unlimited services were not yet reported as available in the market.

Reports suggest that the entry of Rakuten as an MNO may be about to change that, with Rakuten planning to introduce a single unlimited data plan with free service over 12 months for the first 3 million customers, for a cost of JPY2,980 (around €25 per month) + taxes, around half the rate charged for high data packages by its rivals.

6.4.2 Implications for quality

There is limited data available about how bandwidths offered via MVNOs compare with their hosts. However, Opensignal has published a report[453] illustrating such comparisons for the German market. Opensignal's figures show that, on the Vodafone and Deutsche Telekom networks, which are not subject to 4G MVNO access obligations, the download speeds achieved were respectively 28% and 24% lower for downloaded traffic and 25% and 22% lower for upload traffic. There may be two reasons for this: on the one hand, MNOs often do not offer MVNO partners unlimited LTE speeds, so that higher bandwidths are made available to their own retail customers. On the other hand, it is also conceivable that the proportion of price-sensitive customers using older smartphones that may not yet support LTE tends to be higher with MVNOs.

6.4.3 Effects on service development and innovation

Although there has been a strong focus on price as an indicator of the impact of MVNO access (and other measures) on competition, the impacts of MVNOs may also extend to other aspects of service provision and innovation.

In an interview with MVNO Europe conducted for this study,[454] examples given of MVNO-based innovation included:

- Service levels: for example MVNOs in Italy with a presence e.g. in retailing may provide physical helpdesks, which may not be so widely available for services provided by MNOs,
- Tariff transparency and simplicity of tariff structures, providing more confidence to consumers about their spend, and

453 See https://www.opensignal.com/2019/10/25/comparing-the-mobile-experience-between-germanys-mvnos-and-the-major-operators.

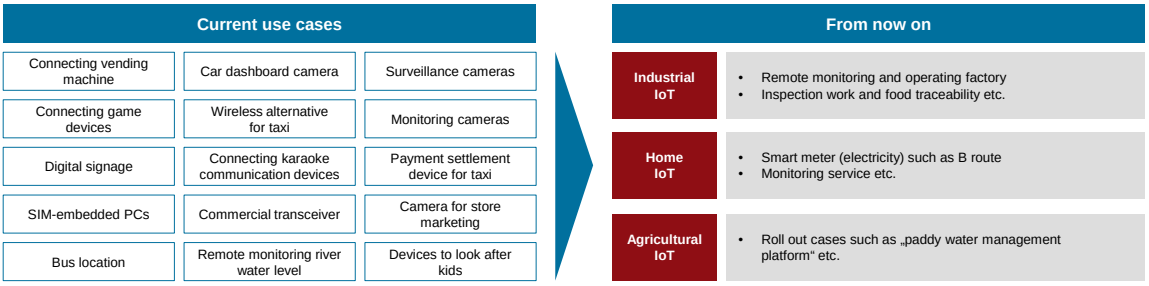
454 See MVNO Europe interview July 2020.

- Benefits, points and vouchers in relation to the MVNO's main business e.g. in the case of MVNOs supplied by retailers.

These kinds of benefits can be provided even by resellers and light MVNOs, and may appeal to and extend the reach of mobile services to specific customer groups.

In addition, there is significant potential for full MVNOs, with control over their own SIM cards to innovate from a technical and service perspective. For example, through its enterprise mobile and IoT business, Japanese MVNO IIJ is supporting applications such as monitoring and surveillance cameras, remote monitoring of river water levels, car dashboard cameras, digital signage and bus location applications. Future targets for growth lie in industrial IoT (remote monitoring, inspection and tracing), Home IoT (including smart meters) and agricultural IoT.

Figure 6-23: Current and future use cases for enterprise mobile and IoT services



Source: WIK based on IIJ Presentation Consolidated Financial results FW 2019 – delivered May 2020.

The ability to secure MVNO access and roaming across multiple countries is also important in supporting innovation in cross-border IoT services such as connected automotive mobility (CAM) and the provision of connectivity for laptops and other devices which are distributed worldwide. Transatel (now a subsidiary of NTT) and Cubic Telecom are active in these markets. Transatel provides connectivity through a set of more than 100 agreements covering 140 countries with comprehensive coverage especially in America, Asia and Europe.[455] The agreements reached constitute MVNO access from a regulatory perspective, and Transatel must comply with local regulations in this capacity. However, the agreements make use of roaming as a technical solution, to benefit from the high degree of standardisation.

Key clients for Transatel's global connectivity solutions include car manufacturers such as Jaguar Landrover in the UK. Airbus also uses Transatel SIMs for predictive maintenance of planes while Easyjet and Delta planes are also equipped with Transatel

455 For further details see WIK (2019) Technological developments and roaming.

SIMs. Transatel SIMs are also provided in Microsoft tablets and the company has agreements to provide SIMs for laptops manufactured by Lenovo and Asus.

Meanwhile, the automotive industry is a key focus for Cubic.[456] Connectivity is not its core business, but provides an enabler for innovation in its main area of specialism, which is to develop platforms and software for connected cars. They offer a full spectrum of services for connected driving ranging from telematics to in-car infotainment. Services to aid drivers include navigation and locating available parking spots, as well as charging stations for electric cars. However, the most popular services are music streaming and digital radio, which is often used to continue listening to national stations when customers leave their radio spectrum coverage area. In January 2019, Cubic reported that more than 2m cars were using its connectivity technology.[457]

The ability for MVNOs to negotiate their own interconnection and roaming arrangements can also be important in enabling innovation in specific segments of the mobile market. For example, Truphone is a full service provider in the enterprise customer market. It was founded in 2006 and has coverage via MVNO agreements in 8 countries including several within Europe. Until recently, it did not play a significant role in the consumer segment. However, the launch of eSIM on the iPhone and iPad enabled Truphone to make a play for the consumer market by offering 'applications' for competitive roaming offers, which offer a considerably more user-friendly solution to bypass the host operator than was possible in the past.[458] The ability of players such as this to gain a foothold in the roaming market and constrain the conduct of MNOs in the provision of roaming service to their captive customer-base, will be an important factor in determining whether retail roaming rates could be deregulated in future.[459]

MVNO access also provides the potential for innovation in the development of convergent offers by players whose primary business lies in content or fixed broadband access. The experience of Spain shows that, especially in countries where bundling is prevalent and attractive to consumers, MVNO access may be considered essential by broadband operators without a mobile arm to compete effectively in the retail market. In these cases, MVNO access can also provide a stepping stone towards entry into the mobile market. In other countries, such as Germany, regional fixed broadband providers have also cooperated with MNOs to use (potentially branded) resale offers in the mobile segment to offer users a convergent experience without the need to build any technical infrastructure.

456 See Ibid.
457 See https://www.siliconrepublic.com/machines/cubic-telecom-connected-cars-ego-european-ev-fleet.
458 For further details see WIK (2019) Technological developments and roaming.
459 See Ibid.

6.5 Emerging business models, challenges and opportunities

Interviews with MVNOs in the context of this study as well as the 2019 study by WIK on "Technological developments and roaming"[460] highlight a number of common themes around MVNOs' place in the mobile markets of the future, and associated challenges and opportunities. Priorities and views tend to differ between IoT MVNOs and those targeting personal communications.

For IoT MVNOs, which often have limited scale in individual countries, but specialize in cross-border provision of connectivity and specialised applications:

- eSIM provides important opportunities for MVNOs to innovate, especially in the IoT segment and for the provision of alternative roaming services, but there are concerns that development and application of the standard could limit the ease of switching and use of secondary services,
- By enabling quality differentiation, 5G and network slicing, should support the development of specialised applications for various industries, which could facilitate further innovation in these applications and platforms e.g. for CAM; however access to these functionalities for MVNOs may be delayed, and a lack of standards and interoperability may present challenges for cross-border provision,
- Quality differentiated roaming may become important, but may also suffer from challenges in access and standardisation, and
- Differing rules in different countries or different approaches by operators to permanent roaming could affect the potential to deploy IoT services across the single market.

For MVNOs targeting personal communications:

- There are opportunities to further leverage synergies with their core business to improve the service offering to customers and shift the competitive differentiating features beyond price,
- MVNOs see growing trends towards unlimited bundles, but find that wholesale access conditions for data may not support their ability to compete in this segment,
- There are widespread concerns that, in the absence of a requirement to negotiate, access to 5G will be delayed, putting them at a disadvantage in terms

460 See https://ec.europa.eu/digital-single-market/en/news/technological-developments-and-roaming-smart-20180012-0.

of quality of service compared with their hosts. In general, transitions to new generation technologies are viewed as threats,

- Sub-brands are a key mechanism through which MNOs are seeking to win back customers attracted by MVNO offers, and
- RCS and eSIM are considered less critical to their business.

6.6 Lessons from case studies

The case studies provide a number of important insights on the conditions which have supported MVNO entry and expansion and the benefits that can accrue:

- The case studies and data analysis suggest that, especially in three player markets, detailed regulation, which is not limited to specific service providers, seems to have been an important enabler for the expansion of MVNOs in the data segment. This is particularly true of personal communications markets, where the MVNO's business may be in direct competition with that of its host. Size and geographic scope of the market may also play a role in expanding or limiting market potential, but it is notable that one of the markets in which there has been relatively successful data on MVNO entry is Austria, a mid-size market. The dynamism of the specific operators concerned, and the degree of innovation in their marketing or proposition has also been an important factor.
- The most successful regulatory models pursued thus far, in terms of their ability to support a growing MVNO market appear to be models based on Reference Offers with detailed conditions regarding pricing and non-discrimination (e.g. as pursued in Austria in the context of merger conditions and Japan through Guidelines). In both these cases, the potential to apply detailed rules was facilitated by the targeted nature of the intervention i.e. via merger proceedings in Austria and specific ministerial guidelines in Japan. Rules which are more vague, apply weaker conditions or attempt to pick winners may have less chance of success. Obligations imposed in the context of spectrum licences have generally been less specific, and therefore potentially less effective as a means of facilitating MVNO access.
- MVNOs typically have ARPUs which are significantly lower than MNOs. Amongst MVNOs, service providers targeting the mass-market with data have the highest ARPUs. Lower ARPUs apply for MVNOs with a focus on IoT and MVNE services as these are naturally business with low cost per SIM for the user.
- MVNOs can contribute to innovation, not only in the structure and pricing of their offers, but in complementary services, and technical and service innovation,

especially in the fields of IoT and cross-border services. MVNOs can act as mavericks if the underlying wholesale conditions provide scope for them to do so.

- Information about offers provided and interviews with the MVNOs concerned, suggests that the pricing structure at the wholesale level for many MVNOs does not support provision of unlimited data. This mirrors feedback in the Irish market. MVNOs generally consider that changes would be needed to wholesale access conditions for data in order for them to be able to compete in unlimited offers.

- Differences in speeds between MVNOs and their hosts in some cases raise questions about potential differences concerning the quality of services offered to MVNOs compared with the host MNO.

- Access to new technologies as they are deployed (and for IoT players quality-specified services) will be an important factor in sustaining access-based competition during network deployment. This is the case for 5G and will also apply for subsequent technological evolutions.

- MVNOs which have taken steps to climb the ladder of investment to become MNOs through direct investment have acquired scale through their operation as an MVNO. In the two cases explored in this study (1&1 Drillisch and Rakuten) the companies had made investments in other segments of the telecom sector or digital industries which provide synergies with their mobile operations. Companies which operate an MVNO as an add-on to an unrelated business may be less likely to make network investments. It is likely that shortcomings in the market potential of MVNOs e.g. in the data segment, may have incentivised MVNOs to become or acquire MNOs. Thus, in a market where further entry (beyond 3 players) is viable, there may be a trade-off between promoting access-based mobile competition and incentivising the development of infrastructure competition, which could potentially boost competition in high use data offers. It remains to be seen however, to which degree MVNOs entering the market as MNOs are able to achieve the required coverage and scale needed to sustain profitable operation in the market. It is notable that the plans of both Rakuten and 1&1 Drillisch are based on gradual deployment strategies.

- New technologies such as 5G and eSIM offer opportunities for MVNOs to innovate especially in the IoT/M2M segment. It is important to ensure that these technologies are deployed in a manner which allows their potential to be exploited as widely as possible. Attention may also be needed in the coming years regarding standardisation of network slices, the introduction of quality-assured roaming, and the implementation of the eSIM standard in a manner which enables switching.

7 Conclusions and recommendations to support competition in the Irish mobile market

In this concluding chapter, we draw together the lessons learned from previous chapters and present recommendations aimed at sustaining competition in the Irish mobile market. Certain recommendations concern Ireland alone. However, cross-border issues are relevant in relation to competition in IoT markets, and thus we also provide recommendations for the development of policy and legislation at EU level in this context.

7.1 MVNO business models and the conditions for success

A key lesson from the analysis of MVNO business models in chapter 2 is that a high degree of technological and operational independence (i.e. full MVNO access) is needed to support the potential for MVNOs to engage in technological innovation, while the conditions for wholesale pricing determine the degree to which MVNOs can differentiate their offers from those of their hosts and/or can viably compete in high volume data offers. Capacity-based offers, involving upfront payments for access to a given capacity provide the greatest potential for differentiation alongside the ability to offer high volume data bundles.[461] Retail minus also provides the potential for MVNOs to match any unlimited volume deals offered by their host, but offers limited scope for competitive differentiation in the mobile service provided. However, most MVNO wholesale tariffs are based on usage / volumes, which significantly limits the potential for MVNOs to engage in the provision of high volume / unlimited data packages.

In turn, the depth of access available, and wholesale pricing structure influences the degree to which MVNOs can in practice drive customer benefits in retail mobile markets such as innovation in pricing structures, bundles etc. It is thus not possible to gauge the potential (as opposed to the actual) impact of MVNOs on consumer welfare, without considering (i) the *potential* for MVNOs to innovate and differentiate their service offerings, in light of the wholesale access conditions; and (ii) the *likelihood* of innovation, taking into account the dynamism of potential actors in this segment. For example, conclusions that MVNOs operate only in niche segments might be affected by poor access conditions which constrain MVNOs from competing directly with MNOs. There may be a lack of innovation from MVNOs even in the presence of attractive wholesale terms (e.g. where those have been made available on a regulated basis) if the companies benefiting from those terms are not actively engaged in providing innovative solutions and marketing them effectively.

461 A flat-rate price per customer – independent of volume consumption – would in theory provide the greatest scope for MVNOs to compete in the high volume data segment, but would involve passing all usage-based risk to the host.

The scope for innovation from IoT MVNOs is also likely to be greater than that which is possible from retail MVNOs, since in the context of IoT, much of the innovation in terms of hardware, software and platform development come “on top” of the connectivity, and a limitation of access to connectivity could restrict the number and nature of players that have the potential to engage in such innovation.

The terms which are available to MVNOs on a commercial basis are affected by the incentives of MNOs to engage with MVNOs. Incentives to provide access on attractive terms are likely to be limited where (i) the MNO is already in a relatively strong market position, and does not need additional marketing support from MVNOs; and/or (ii) the MVNO is new or has a limited customer-base; and/or (iii) the MVNO might directly compete with the MNO and therefore cannibalise its customer-base.

On the other hand, it might be possible for MVNOs to negotiate attractive commercial deals where: (i) they are operating in a niche which is not in actual or potential competition with the host; and/or (ii) they have a large customer-base and there is risk that this customer-base could be migrated to a competitor; and/or (iii) the MNO is in a weak retail market position and requires support to strengthen its presence in the market.

The bargaining position of specialist MVNOs such as those operating in the IoT segment may be different from that of retail MVNOs, since at least for some MNOs, IoT traffic may be additive rather than competing.

7.2 Technological and commercial developments and the implications for MVNOs and service providers

Technological developments such as IoT, 5G (and network slicing), eSIM and the migration to all-IP solutions for voice and messaging, present both challenges and opportunities for MVNOs, with the opportunities mainly presenting to MVNOs and service providers engaged in the IoT business and the challenges applying more to MVNOs operating in the retail market.

For IoT-focused mobile service providers, technological developments provide an opportunity to enter new market segments including industrial applications, innovate in IoT services and platforms, and benefit from the remote provisioning capabilities offered by eSIM. However, these opportunities could be undermined if service providers do not have timely access to 5G or the capabilities that it offers (such as the potential to tailor the nature of the transmission and associated quality-assurance). eSIM provides an important enabling mechanism for IoT service providers to deploy services to multiple devices “in the field”.

Retail MVNOs may not reap significant benefits from the industrial and IoT use-cases supported by 5G as they are typically focused on the consumer market segment, but at

the same time they are likely to need 5G access to be able to compete on quality with their hosts. Thus 5G, as well as IP-based calls and messaging may present more of a threat, as they require investments in new platforms and may necessitate renegotiation of contract terms with their hosts. Given existing price per unit wholesale conditions and a small, if any, 5G retail price premium, the likely increase in data consumption from users using the 5G network is likely to undermine the commercial viability of 5G for many MVNOs.

Consumer applications of eSIM may also present a threat to existing broad-based retail MVNOs if they increase the risk of churn. eSIM may also present a risk for MNOs as well as many MVNOs by virtue of the fact that they give control over this "gateway" to equipment manufacturers, which could in theory play a greater role in steering the process of obtaining and maintaining mobile subscriptions.

7.3 Recap of the competitive situation, threats and future opportunities for mobile services in Ireland

As discussed in chapter 5, the Irish mobile market was subject to a consolidation from 4 to 3 network operators, following the merger between O2 and Three in 2014. Approval of the merger was made subject to commitments that the merged company would conclude capacity-based MVNO offers with two service providers (Virgin Media and iD Mobile).[462] At the time these commitments were made ComReg expressed reservations that they would be insufficient to preserve competition in the Irish mobile market.

Concerns over the sufficiency of the MVNO merger commitments as a means of facilitating the entry and expansion of new challengers in the market seem to have been supported by the subsequent exit of iD mobile and the limited role played in the market by Virgin Mobile today. Indeed, a study conducted by BEREC found that the market concentration in Ireland was likely to have resulted in increased prices compared with a situation where the companies had not merged.[463]

At the same time, other MVNOs active in the market have not significantly expanded their market shares or indeed have been in decline. Interviews with market participants suggest (and the pattern of available retail offers tends to confirm) that the terms under which MVNO offers have been made outside the context of the merger commitments does not allow MVNOs to compete in the provision of unlimited data packages, which is an important and expanding segment within the Irish market. While the MVNOs all now offer unlimited packages, this appears to be possible only due to fair use clauses and/or

462 See https://www.irishtimes.com/business/technology/mvnos-fail-to-shake-up-mobile-market-1.3142918.

463 See BoR (18) 119 BEREC Report on Post Merger Market Developments – Price Effects of Mobile Mergers in Austria, Ireland and Germany, https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8168-berec-report-on-post-merger-market-developments-price-effects-of-mobile-mergers-in-austria-ireland-and-germany.

at a higher price point than for the MNOs and their sub-brand offers. Moreover, there is limited competition amongst the three MNOs in the provision of MVNO access, and difficulties for potential entrants or existing players to achieve similar terms as those offered under the merger commitments. As unlimited data offers become more prevalent, and this trend accelerates with the move towards 5G and all-IP, the exit of one or more of the existing MVNOs in Ireland seems possible, especially if the conditions on the wholesale market stay as they are. The sale of Virgin Media could also under some scenarios result in the exit of VM as an MVNO.

Notwithstanding the limited scope for data competition from MVNOs which do not benefit from the merger commitments, and marginal role played by Virgin Mobile in the mobile consumer market, Ireland's mobile market today appears to be competitive, especially in the high end unlimited data segment. The offer from the Eir sub-brand GoMo has played a particularly important role in this regard, and has triggered a response from Three's sub-brand 48 and by 2021 also from the newly established Vodafone sub-brand Clear Mobile. Thus, as far as retail competition is concerned, the market appears currently to be serving customer needs, especially in data-oriented offers.

These positive developments may stem from the role that is being played by Eir (and its shareholder Iliad) as a price leader, which may have been influenced by its relatively low market shares compared with rivals. Research by WIK conducted for the European Commission in 2018 also highlights the role that smaller mobile operators or entrants such as Iliad have played in supporting competition in other mobile markets.[464] However, WIK's research as well as academic studies[465] also note that competition in three player mobile markets has proven to be unstable in general and that, especially in the absence of disruption from one of the players, such markets can tend towards oligopolistic outcomes which fail to deliver competitive prices and innovation to the detriment of consumers.

Thus, while the market appears to be delivering positive outcomes for Irish consumers today, it cannot be guaranteed that the degree of dynamism in the market will be maintained over the medium term. Moreover, if MNOs fail to directly provide such dynamism, there seems to be limited scope that MVNOs would be in a position to disrupt the high end data segment of the market, due to the underlying conditions of wholesale access. Moreover, while Virgin Media benefits from more attractive wholesale conditions stemming from the merger commitments, it will cease to benefit

464 See WIK (2018) for the EC "Review of the SMP Guidelines" https://op.europa.eu/en/publication-detail/-/publication/6eebf7b9-4833-11e8-be1d-01aa75ed71a1/language-en.

465 See for example Porter & Green Noncooperative Collusion under Imperfect Price Information, https://www.jstor.org/stable/1911462?seq=1.

from these conditions in 2024, and may not be able to secure conditions as favourable thereafter.[466]

Thus, while there appears to be adequate competition as regards the consumer segment of the Irish mobile market today, there are medium term risks that should be assessed, requiring ongoing monitoring of the market.

Concerning the IoT segment, interviews with market participants suggest that there is considerable scope for innovation in this segment, but that due to the multi-national nature of many IoT/M2M services, solutions to any problems should be found at European rather than national level. IoT players generally report fewer challenges in obtaining access to MNO networks than in the retail market (due to the additive rather than competing nature of their service). However, future innovation in the segment will depend on timely access to 5G networks, guaranteed QoS and network slicing capabilities, as well as addressing challenges over the interpretation of M2M (as opposed to personal) communication services, and associated barriers to the use of permanent roaming. Respondents interviewed for this study as well as a previous study on this subject conducted by WIK-Consult for the European Commission[467] did not observe specific problems related to IoT innovation in Ireland, but noted that barriers elsewhere in Europe were impeding the potential for specialist players to develop and implement pan-European IoT offers.

7.4 Available regulatory tools and their effectiveness

In circumstances where there is insufficient competition in retail mobile markets amongst MNOs alone, for example due to the maintenance of a tight oligopoly with an absence of maverick offers, it may be necessary to rely on access obligations to introduce additional sources of competition into the market. Such obligations can be applied through ex ante regulation (via a finding of joint SMP), through obligations attached to spectrum licenses or in the context of merger proceedings. Specific guidelines or legislation requiring MNOs to provide MVNO access on specific terms, have also been used in Japan and are under consideration in Canada,[468] although this type of intervention may be less relevant in an EU context.

As discussed in chapter 6, international benchmarks and case studies show that under certain circumstances, MVNOs can provide disruptive competition in the mobile data segment. However, the presence of MVNOs as disruptive players tends to depend on

466 The possible change in ownership structure of Virgin Media Ireland does only increase the uncertainty over their future mobile offerings, especially after 2024, which is when the extension of the merger-related conditions runs out, see https://ec.europa.eu/competition/mergers/cases/decisions/m6992_20140528_20600_4004267_EN.pdf.

467 See WIK (2019) for the EC Technological developments and roaming https://op.europa.eu/en/publication-detail/-/publication/7c74b70b-b4d8-11e9-9d01-01aa75ed71a1/language-en/format-PDF/source-167728233.

468 See https://www.cbc.ca/news/politics/wireless-cellphone-fees-1.5484080.

the dynamism of the specific companies concerned, and their ability to secure (through regulated or commercial means) wholesale access terms which permit them to compete in the data segment. The small size and geographic challenge associated with some markets may make them less attractive to potential dynamic MVNO entrants. However, there is also evidence that MVNOs can have a positive impact even in relatively small and geographic diverse markets such as Austria, while the role currently played by Eir, shows that dynamic and disruptive mobile offers can be made, even in small markets such as Ireland.

Experience from international case studies suggests that, in circumstances where intervention in the form of MVNO access obligations are needed to support competition in mobile markets, intervention is most effective where:

- Access is available to a wide range of potential service providers and no attempt is made to "pick winners",
- Detailed provisions are made concerning the terms under which wholesale access is provided and the pricing mechanism, taking into account the need for MVNOs to be able to compete in the high volume data segment e.g. through capacity-based deals, and
- Access is available to the latest available mobile technologies.

As regards support for innovation in IoT, interviews for this study, coupled with 2019 research undertaken by WIK-Consult for the European Commission,[469] suggest that, in view of the typically cross-border nature of these services, action to ensure appropriate wholesale access would be best pursued through amendments to EU-wide international roaming regulations. While the market is relatively dynamic today, IoT specialists cite challenges with the use of permanent roaming in certain countries (although not Ireland), while specific issues for the future include ensuring that roaming:

- is made available to 5G and subsequent upgrades of the network; and
- access is made available on a QoS guaranteed basis, that may vary according to different service requirements.

Some service providers also argue that functionalities held by MNOs which form a subset of those which would be provided in the context of roaming, such as location data, may support innovation in service provision e.g. in the context of fraud detection, and thus that access should be provided to these functionalities in cases where MNOs refuse to supply them on a voluntary basis.

469 See WIK (2019) for the EC Technological developments and roaming https://op.europa.eu/en/publication-detail/-/publication/7c74b70b-b4d8-11e9-9d01-01aa75ed71a1/language-en/format-PDF/source-167728233.

7.5 Recommendations for action in the Irish market

As Irish consumers currently benefit from relatively attractive retail offers, especially in high value data intensive services, there does not seem to be an immediate need for intervention by ComReg in the mobile market.

However, in view of the unstable nature of competition in 3 player markets as well as the impending expiry of MVNO access associated with the merger commitments and emergence of 5G-based services, it may be advisable for ComReg to monitor the market closely. Concerns may in particular arise if:

- Choice and value in high volume data offers declines relative to other markets and/or in relation to the potential performance and capacity of the underlying networks; and if
- There is evidence that MNOs collectively will not agree to terms and conditions for MVNO access that permit MVNOs to offer and effectively compete in the provision of high volume data bundles, including in a 5G context.

If there are sufficient concerns in the above areas to warrant a review, the review should be concluded prior to the expiry of the O2/3 merger commitments, so that any potential resulting regulatory obligations could be imposed in a manner that provides continuity and certainty to the MVNO benefiting from those commitments[470] as well as other current or potential MVNO players in the Irish market.

7.6 Recommendations at EU level

While maintaining competition in retail mobile markets is largely a matter for ComReg, support innovation and competition in the IoT segment is likely to require intervention on at least a pan-European level.

Some steps have already been taken to address issues identified by IoT specialists such as access to numbers specific to IoT/M2M, which could be used in principle for permanent roaming.

For example article 93(4) of the EU Electronic Communications Code provides that: “Each Member State shall ensure that national regulatory or other competent authorities make available a range of non-geographic numbers which may be used for the provision of electronic communications services other than interpersonal communications services, throughout the territory of the Union.”

470 An exit of the MVNO benefiting from those commitments (Virgin Media) from the mobile market or the acquisition of said business by an existing MVNO, should also warrant a review.

However, interviews for this study, as well as the study conducted by WIK-Consult for the EC on "Technological developments and roaming" suggest that the issue covers not just the availability and acceptance of specific number ranges for IoT, but also the definition of what is meant by interpersonal vs IoT/M2M, as it is possible for MNOs to reject a request for permanent roaming if IoT/M2M is defined narrowly and there are elements of the service that might involve human interaction e.g. in relation to automotive applications such as a mapping system on the dashboard.

Meanwhile, restrictions on the sale of retail services based on non-national numbers, could prevent an IoT provider based outside that country from selling a data bundle for IoT/M2M services such as automotive connectivity, directly to end-users.

There may be scope in the review of the Roaming Regulation to address issues such as these by establishing a definition for services which can make use of IoT/M2M numbering ranges (and benefit from permanent roaming), which takes into account ancillary services or customer interaction which is associated with the operation of the IoT/M2M service and does not involve communication between individuals. Permanent roaming, on the basis of access rights established under the Roaming Regulation could be expressly allowed for services fulfilling that definition.

In addition, potentially in the context of future reviews of the Roaming Regulation, concerns over access to upcoming technologies and QoS guaranteed services or other inputs required to support innovation could be addressed through:

- Requiring access to 5G and IP-based voice in the context of the Roaming Regulation;
- The recognition of a standardised set of QoS-guaranteed services for which access based on international roaming should be provided; and
- Enabling the Commission supported by a specialist body to propose adaptations to or adding to the list of services which should be standardised for roaming purposes and supplied on request, based on comitology procedures. This list could include not only QoS-guaranteed services, but potentially specific functionalities typically provided in the context of roaming such as location data.

As regards wholesale roaming pricing for the purposes of IoT, care may be needed to avoid a one size fits all solution that may not be viable for specific types of IoT provision. While some very "light" IoT applications involve limited data and thus incur very low connectivity costs, others such as Connected Automotive Mobility could potentially involve very high data volumes and be highly sensitive to any volume-based charges.

Finally, although there are no records of problems in this area thus far, it is important for European authorities to monitor how equipment manufacturers make use of their

capability – via eSIM - to steer or promote the use of specific mobile connectivity offers. If problems arise in this area, there may be scope to ensure that they are addressed through the potential competition tool or ex ante regulation applied to gatekeeper platforms, which are in the process of being elaborated by the European Commission.

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