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Digitalisation in Austria: Progress, Broadband Infrastructure and Open Access Networks

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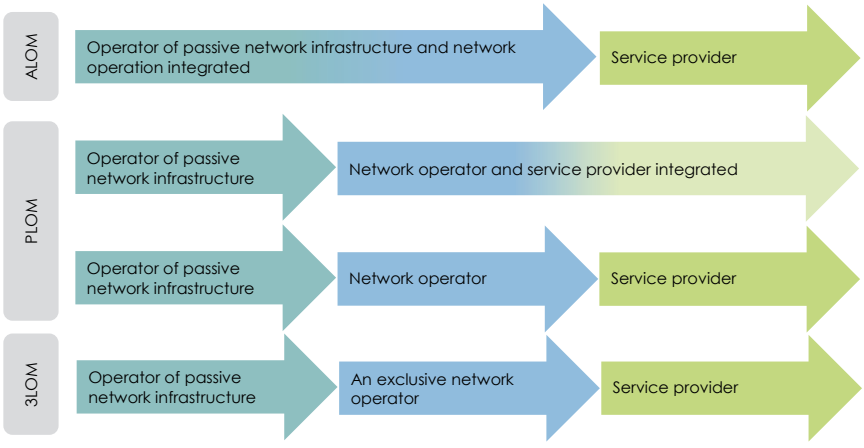
- Compared to other EU countries, Austria has a lot of catching up to do when it comes to using ultrafast broadband internet (100 Mbit/s and above), despite the low prices.
- The political goal of nationwide provision of ultrafast broadband internet has not been achieved. So far, it is only available for about three quarters of all Austrian households. This puts Austria below the EU average.
- In terms of the availability of particularly high-performance fibre-optic infrastructures, Austria lags far behind in the EU comparison.
- The use of new digital technologies in companies is only increasing comparatively slowly in this country.
- Open Access Networks (OAN), which allow multiple use of existing network infrastructures, can help to drive the expansion of gigabit-capable access networks quickly and efficiently.
- The great heterogeneity of products and processes in Austria hinders the development of the potential of OAN. Standardisation and coordination are therefore urgently needed.

"Open Access Network (OAN) models in comparison



Three main variants of OAN models are distinguished: Active Layer Open Model – ALOM, Passive Layer Open Model – PLOM and 3-Layer Open Model – 3LOM (source: based on Neumann et al. (2021), WIK-Consult based on European Commission (2015), WIFO).

"The competitive use of infrastructure via open network access models efficiently drives broadband expansion."

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The present monitoring of selected indicators on various aspects of the digital transformation of the economy and society shows that Austria still only ranks in the middle of the EU 27. The gap in the availability of particularly high-performance fibre-optic infrastructures in an EU comparison could be efficiently reduced by open network access models that allow multiple use of existing network infrastructures. This would bring the nationwide availability of gigabit-capable access networks a decisive step closer.

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1. Introduction

Due to the COVID-19 pandemic and the containment measures, many previously on-site activities shifted to the digital space. At the same time, previously unused or hardly used formats such as e-commerce, remote work or distance learning suddenly gained in importance. A secure, stable and fast broadband infrastructure was crucial for companies, public institutions, schools and private households to be able to use such digital formats. In the broadband sector, Austria was quite well prepared for the pandemic in terms of network coverage ("breadth"). In terms of the speed ("depth") of broadband connections, however, there is still a need to catch up in an EU comparison.

Open Access Networks (OAN) can play an important role in making up for Austria's lag in the availability of particularly high-performance glass fibre infrastructures quickly and efficiently. These offer open access to network infrastructures. The advantage of such models is that competition between providers can take place both at the level of services and at the level of active infrastructure. Infrastructure-related barriers to market entry are thus structurally removed.

After a general overview of the state of the digital transformation process in Austria, this article provides insight into different OAN business models, addresses barriers to the use of fibre networks and outlines the benefits of a standardisation process in the field of OAN.

2. Digitalisation in Austria – an overview

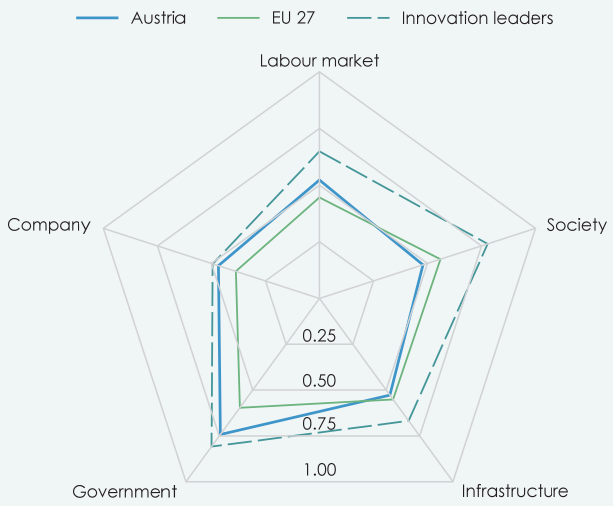
In order to document the current status of the digital transformation process in Austria, a comparison was made with the average of all EU countries on the one hand and with the average of the innovation leader countries within the EU on the other hand, as was

already done in the previous annual reports on the progress of digitalisation in Austria (Bock-Schappelwein et al., 2020, 2021). The selection of innovation leader countries is based on the European Innovation Scoreboard (EIS) of the European Commission. In 2021, Sweden, Finland, Denmark and Belgium were among the group of innovation leaders (European Commission, 2022)[1]. The analysis on the status of the transformation process is based on three indicators each in five dimensions: 1. provision and use of digital public services (government), 2. nature of digital infrastructure (infrastructure), 3. digital transformation at company level (companies), 4. societal (society) and 5. labour market-related aspects of digitalisation (labour market).

Figure 1 summarises the five dimensions mentioned[2]. As the illustration makes clear, Austria is above the EU average in some dimensions of the digital transformation but performs consistently worse than the innovation leader countries. The gap is greatest in the two dimensions of "society" and "infrastructure", where Austria is even below the average of the EU member countries. This is mainly due to Austria's weak performance in the provision and actual use of ultrafast broadband by private households. The gap to the innovation leader countries in the EU is smallest in the area of the digital transformation of companies. Austria also performs significantly better than the EU average in the "government" dimension and comes relatively close to the innovation leader countries. In the following, the five dimensions are examined in more detail in order to work out Austria's relative strengths and weaknesses on the basis of the underlying sub-indicators.

Figure 1: **Austria's position in the digital transformation process**

Last available year



Source: DESI 2021, Eurostat, WIFO calculations. The individual sub-indicators of the five dimensions (see chapters 2.1 to 2.5 in this issue) were made comparable using min-max normalisation. An average value was calculated for each dimension, which is plotted in the Figure above. The last available year differs by indicator and has been shown separately for each indicator in the figures below.

2.1 The provision and use of digital public services

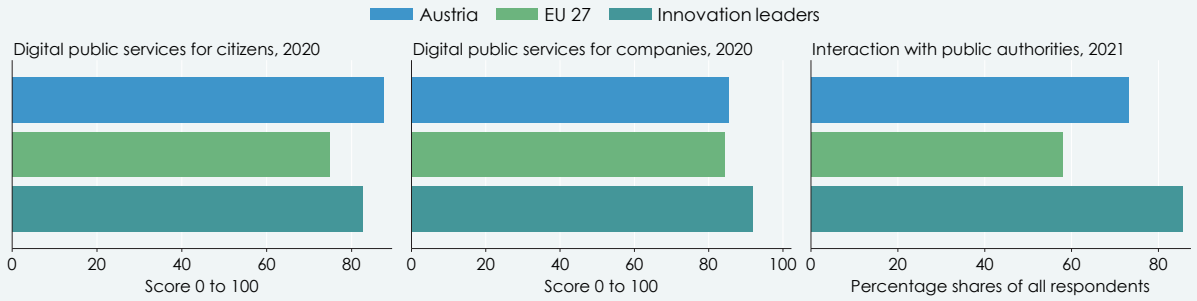
In international comparison, Austria already has a well-developed range of digital public services. In terms of the extent to which various steps in dealing with public administration can be handled completely online, Austria has been performing very well for years: measured by the index of digital public services for citizens (with values between 0 and 100), Austria ranked 5th in the EU in 2020 with a value of 87.5. Among the innovation leader countries, only Sweden (88.2) was just ahead of Austria. In the index of digital public services for businesses, on the other hand, Austria only just surpassed the EU average (2020: 85.4 compared to 84.4) and remained significantly behind innovation-strong countries such as Denmark (96),

[1] When making comparisons with the previous year, it must be taken into account that the composition of the innovation-leader countries can change annually. In 2020, Denmark, Finland, Luxembourg, the Netherlands and Sweden were among the innovation leaders.

[2] The individual sub-indicators of the five dimensions were min-max normalised in order to make the different units or scales comparable and to summarise them.

Sweden (94) or Finland (92.5)[3]. The demand for digital public services in Austria in 2021 was hardly higher than in the previous year. With a value of 73 percent (2020: 72 percent), Austria was still noticeably below the average of the innovation leader countries (86 percent), but clearly above the EU average (58 percent).

Figure 2: **Provision and use of digital public services**



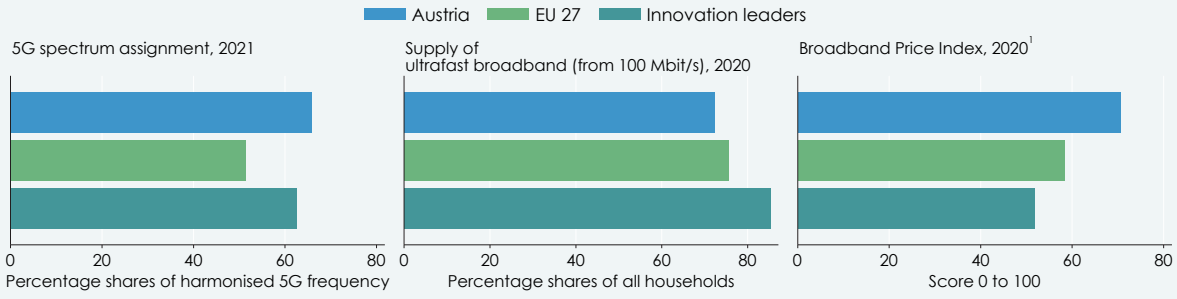
Source: DESI 2021, Eurostat, WIFO calculations.

The supply of ultrafast broadband internet in Austria continues to be below average. However, Austria scores in terms of low prices for fixed and mobile services and is recording progress in the introduction of the 5G mobile standard.

2.2 The digital infrastructure

The conditions for comprehensive coverage with ultrafast broadband internet are average to good in Austria. The prices of fixed-network and mobile services in this country are significantly lower than the EU average. In 2020, Austria ranked 6th cheapest country in the EU according to the Broadband Price Index (2019: 7th place). Broadband internet is also significantly more expensive on average in the innovation leader countries than in Austria. However, in terms of ultrafast broadband internet coverage, Austria, with 72 percent of households (2020), is 3 percentage points below the EU average and 13 percentage points below the average of innovation leader countries. Compared to 2019, coverage could be increased by 7 percentage points (2019: 65 percent), but the infrastructure offer was also improved in most other EU countries, so that Austria's gap to the EU average narrowed only slightly by 4 percentage points despite massive public subsidies via the first "broadband billion" (Broadband Austria 2020). In contrast, preparations for the introduction of the 5G mobile communications standard are comparatively far advanced in Austria. In 2021, 66 percent of the total harmonised 5G radio frequencies had already been allocated, slightly more than the average of the innovation leader countries (63 percent) and significantly more than the EU average (51 percent). Compared to the previous year, Austria thus made significant progress (2020: 33 percent). However, the gap between Austria and the leading EU countries Germany, Croatia (100 percent each), Finland and Denmark (99 percent each) shows that there is still room for improvement.

Figure 3: **Digital infrastructure**



Source: DESI 2021, European Commission (2021), WIFO calculations. – [1] Higher index values imply a low price.

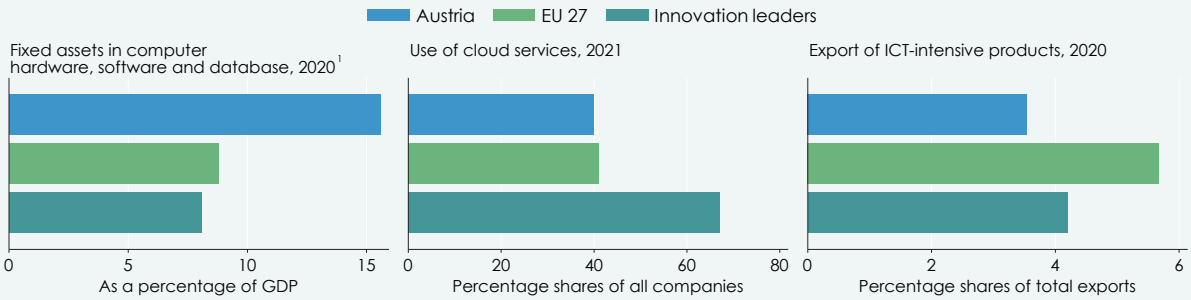
[3] Up to and including 2019, the indicator only took into account basic national and cross-border services. Since 2020, extended services have also been included. Therefore, a direct comparison with the previous year is not meaningful for the time being.

2.3 The digital transformation at company level

The stocks (capital stock) of fixed assets in the area of equipment with computer hardware, software and databases increased in Austria in 2020 by just under 2 percentage points compared to the previous year to almost 16 percent of GDP. This put Austria 7 percentage points above the EU average (9 percent) and also above the average of the innovation leader countries (8 percent). In terms of the application of new digital technologies in companies, however, Austria continues to perform only mediocre. The share of companies[4] using cloud computing services could only be increased comparatively weakly (by 2 percentage points from 38 percent in 2020 to 40 percent in 2021) and was most recently just below the EU average (41 percent; +5 percentage points compared to 2020) and clearly below the average of the innovation leader countries (67 percent; +8 percentage points compared to 2020). On the output side, with a share of ICT-intensive products in total exports of 3.5 percent in 2020, Austria lagged behind both the innovation leader countries (4.2 percent) and the EU average (5.7 percent).

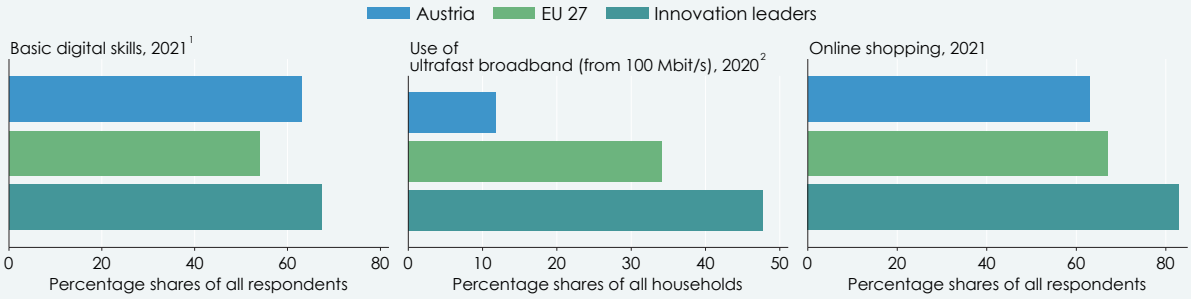
In Austria, the enterprise use of cloud services has increased significantly weaker since 2020 than in the EU average or in the group of innovation leader countries.

Figure 4: **Digitalisation at company level**



Source: BACI, Eurostat, WIFO calculations. – [1] 2019: Bulgaria, Cyprus, Estonia, France, Hungary, Ireland, Latvia, Poland, Portugal and Romania. Values not available: Spain, Sweden and Denmark.

Figure 5: **Digitalisation and society**



Source: DESI 2021, Eurostat, WIFO calculations. – [1] People who overall have at least basic digital skills in all five sub-indicators: information gathering, communication and collaboration, digital content creation, internet safety, problem solving. – [2] Data of the indicator have been revised by the Austrian authorities since the publication of the DESI 2020.

2.4 Social aspects of digitalisation

In 2021, not even two-thirds of the population in Austria (63 percent) had at least basic digital skills. The EU average was almost 10 percentage points lower (54 percent), but in the innovation leader countries an average of 67 percent of the population had basic digital skills in 2021, in Iceland even 81 percent. The application areas of digital skills are diverse. For example, 63 percent of the Austrian population used their digital skills for online shopping in 2021, 3 percentage points lower than in 2020, putting Austria below the average of innovation leader countries (83 percent) and even below the EU average (67 percent). Austrian household demand for fast internet increased in 2020 compared to the previous year, but was still below the average of the innovation

[4] This indicator is only available for the population of enterprises with 10 or more employees.

Despite comparatively low prices for fixed-network and mobile services, the demand of private households for fast internet connections in Austria is significantly lower than the EU average.

leader countries: despite the comparatively low broadband price level in this country (see chapter 2.2), only 12 percent (2019: 8 percent) of Austrian households used a broadband connection with a download rate of more than 100 Mbit/s. Across the EU, it was more than 34 percent, in the innovation leader countries already almost 48 percent of households.

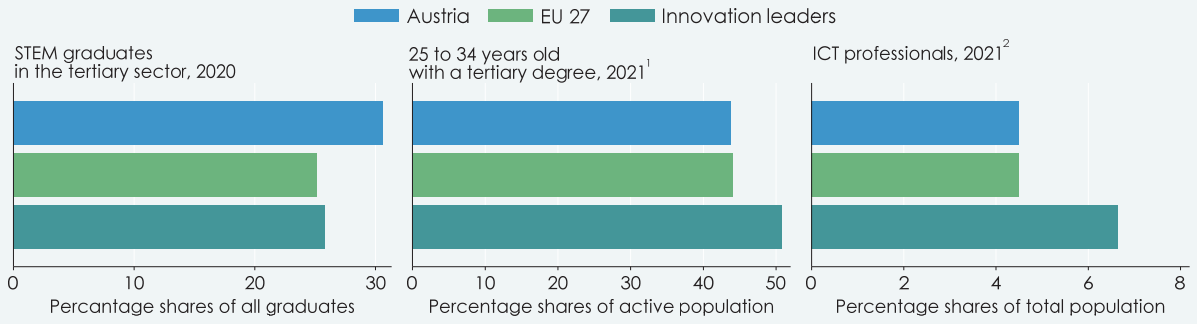
2.5 Labour market-related aspects of digitalisation

The comparatively low share of the labour force with a tertiary degree and an only average share of ICT professionals in total employment inhibit Austria's digital transformation.

In 2020, 31 percent of all tertiary graduates in Austria had a degree in STEM subjects (mathematics and statistics, computer science, natural sciences and engineering). This means that Austria basically has sufficient human capital with the key skills needed for the digital transformation. Within the EU, only Germany (36 percent) had an even higher share in 2020. In comparison, the EU average was 25 percent. In the innovation leader countries, the share of STEM degrees was also significantly lower at 26 percent, even though it increased by 3 percentage points compared to 2019.

As far as the share of the labour force with a tertiary degree is concerned, however, Austria performs only mediocre in an EU comparison (19th place). After 41 percent in 2016, just under 44 percent of the labour force aged 25 to 34 had a tertiary degree in 2021. This share corresponds to the EU average (44 percent) and is clearly below the average of the innovation leader countries (51 percent). The share of ICT-specialists in total employment in Austria in 2021 was also in line with the EU average (4.5 percent), but significantly lower than in the innovation leader countries (6.7 percent). In Austria, the corresponding share has increased by only 0.3 percentage points since 2016, compared to an average of 1 percentage point in the innovation leader countries. Within the EU, Sweden (8 percent) and Finland (7.4 percent) led the country ranking in 2021.

Figure 6: **Digitalisation in the labour market**



Source: Eurostat, WIFO calculations. – [1] Labour force: persons in active employment and unemployed. – [2] Total employment: all persons who worked for pay or profit for at least one hour during the reference week or were temporarily absent from such work.

3. Broadband infrastructure and the role of open access networks

This section on open access networks summarises parts of a study by WIK-Consult and WIFO commissioned by the Federal Ministry of Agriculture, Regions and Tourism (BMLRT; Neumann et al., 2021). It reflects the status in May 2021.

3.1 Broadband infrastructure and broadband funding in Austria

In the future, the realisable transmission rate ("depth") of broadband connections will be more important than the further improvement of nationwide availability ("breadth").

As described in chapter 2, the offer of ultrafast broadband (download speeds from 100 Mbit/s) already reached 72 percent of Austrian households in 2020, 3 percentage points less than the EU 27 average. The expansion of the fibre-optic network creates the opportunity to further improve the offer, especially with regard to speed ("depth"), which still has room for improvement in Austria in an international comparison, while there is less need to catch up in terms of network coverage ("breadth"). In an EU comparison, Austria lags significantly behind in the availability and use of particularly high-performance fibre-optic infrastructures (Fibre to the Premises – FTTP)[5]. In 2020, only 20.5 percent of all Austrian households had access to FTTP infrastructure. The coverage rate was thus less than half the EU 27 average (2020: 42.5 percent). The objective of the current Austrian broadband strategy (Broadband Austria 2030) to achieve nationwide availability of fibre-optic internet by 2030 in order to ensure Austria's attractive-

[5] FTTP (Fibre to the Premises) is a collective term for broadband connections where the fibre optic line is "close to the locality (property boundary)" (BMLRT, 2019). FTTP also includes FTTH (Fibre to the Home) – fibre to the wall socket in the home – and FTTB (Fibre to the Building) – fibre to the building (basement).

ness as a business location and centre of life in the long term is consequently ambitious.

Open access networks (OANs) are a central component of the subsidised broadband expansion. From an economic point of view, these have the advantage that they (can) offer all interested market participants open access to network infrastructures. In this way, intensive competition can develop even without extensive investment in the expansion of parallel networks, which generates positive economic effects. In order to specifically promote these open network access models in Austria, the Federal Ministry of Agriculture, Regions and Tourism (BMLRT) launched the "Open Net"[6] funding programme.

OAN business models

The passive infrastructure provider (PIP) at layer 1 owns the passive infrastructure (ducts, cables, etc.) and is responsible for its maintenance.

The network provider (NP) at layer 2 operates the network, e.g. by renting dark fibre in the case of a fibre network; it installs and operates the active technology (such as routers, switches, etc.).

The service provider (SP) at layer 3 provides the digital services (such as internet, telephony, etc.) and markets them to end customers.

Depending on the chosen business model, one or more suppliers are active on these three levels. A vertically integrated provider covers all three levels, i.e. the entire value chain. In addition, it can enable competitors to access its networks by offering active and/or passive wholesale services. A wholesale-only provider, on the other hand, does not operate its own retail business. It operates either only on layer 1 or integrated on layers 1 and 2. Layer 3 is then taken over by one or more third-party providers who purchase wholesale services from the wholesale-only network operator. It is also conceivable that layer 2 is operated by one or more third-party providers.

If the roles are separated and the infrastructure is available to interested market players on equal terms, it is called an open access network (OAN). OANs can be created by a state-imposed or voluntary structural separation of an existing vertical provider or as a start-up. Depending on whether the passive infrastructure provider (PIP) is only active at layer 1 or also acts as a network operator at layer 2, three different forms of open access models can be distinguished:

- **Active Layer Open Model (ALOM):** The integrated passive infrastructure provider (PIP) is at the same time the network operator (NP) and operates the passive and active network layers from a single source. Layer 3 is operated by pure service providers (SP).
- **Passive Layer Open Model (PLOM):** The network owner is only active as a PIP at layer 1. The passive broadband infrastructure is open to all market players, both those who operate the active network layer and at the same time offer the service as integrated active network and service operators, and specialised active network operators who sell connectivity to pure service providers.
- **3-Layer Open Model (3LOM):** In this model, the roles of passive network operator (PIP), active network operator (NP) and service provider (SP) are strictly separated. In contrast to the PLOM, the contract to take over the role of the active network operator is awarded to only one company. It is also possible to award the active network operation to one company per geographical region. In order to ensure fair and non-discriminatory conditions for all service providers (SP), the active network operator (NP) may not itself provide services to end customers.

3.2 OAN business models

Open network access models (OAN models) are characterised by the fact that independent players can operate on all three levels ("layers"; see box "OAN business models" and Figure 7). The infrastructure of the respective layer of the network is available to all market participants under the same conditions. This open approach of a "3-Layer Open Model" is also recommended in the European Commission's Broadband Investment Guide (European Commission, 2015).

3.3 Open network access models in the Austrian fibre market

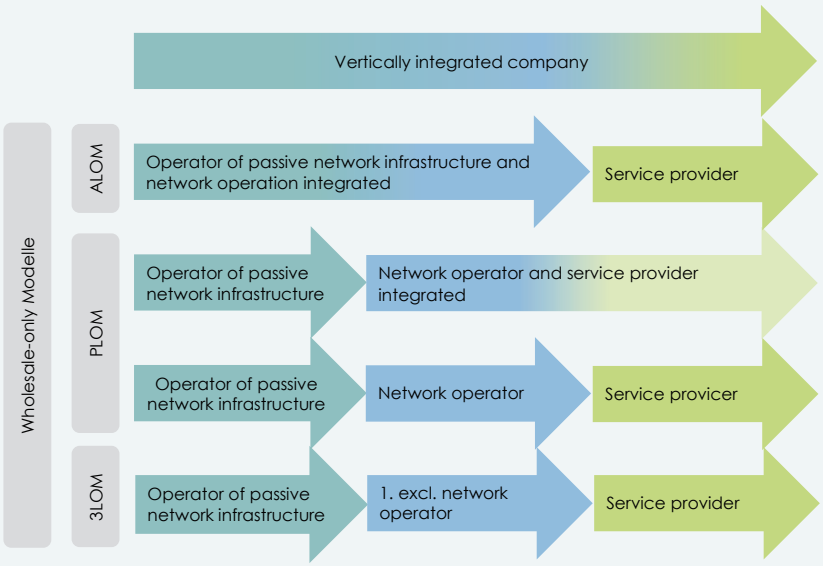
In November 2020, municipalities and telecommunications companies that are active in FTTH (Fibre to the Home) expansion were surveyed as part of the "Open Access Networks for Austria" project jointly worked on by WIK-Consult and WIFO and commissioned by the BMLRT (Neumann et al., 2021). 51 companies and 49 municipalities participated in the online survey. The response rate was a high 45 percent overall, and as high as 55 percent among the companies.

Standardised interfaces and cross-regional intermediaries are key factors for the success of open network access models.

The majority of responding participants, 29 municipalities and 28 companies, stated that they were part of an open access network (Figure 8). The responses reflect the diversity of the Austrian FTTH market. This is due to historical path dependencies, the extent of self-supported roll-outs, different roll-out costs and different broadband policy approaches at the provincial level.

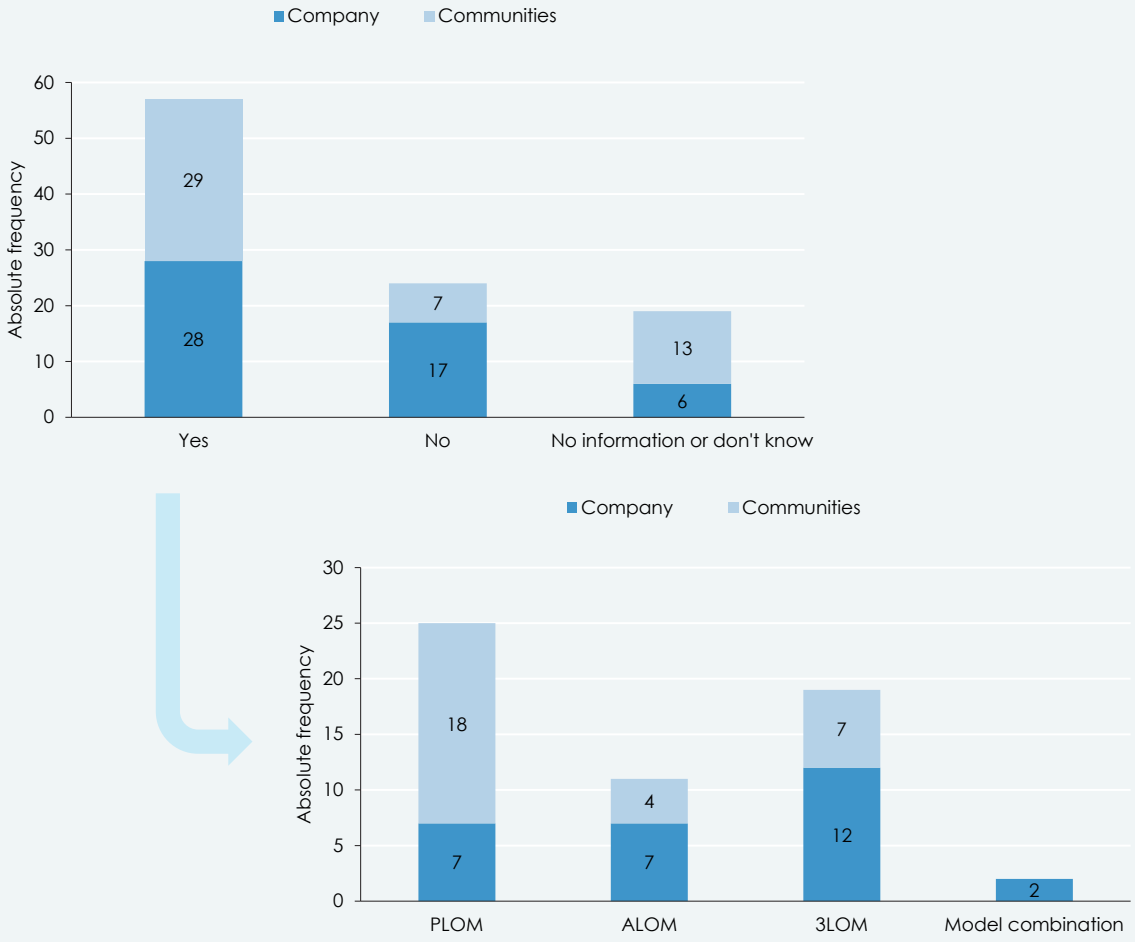
[6] See https://info.bmlrt.gv.at/themen/telekommunication-post/breitband/breitbandfoerderung/breitbandaustria2030/opennet.html.

Figure 7: **Comparison of the three Open Access Network (OAN) models with a vertically integrated company**



Source: Based on Neumann et al. (2021), WIK-Consult based on European Commission (2015), WIFO. ALOM . . . Active Layer Open Model, PLOM . . . Passive Layer Open Model, 3LOM . . . 3-layer Open Model.

Figure 8: **Participation in an "Open Access Network" network**



Source: Online survey by WIK-Consult and WIFO. Question: "Are you part of an "Open Access Network"? " N = 100. valid N = 81. PLOM . . . Passive Layer Open Model, ALOM . . . Active Layer Open Model, 3LOM . . . 3-Layer Open Model.

The differences in response behaviour are striking, albeit unsurprising. While the municipalities act predominantly as passive infrastructure providers (PIP) in PLOM models, mostly in subsidised expansion, the companies take on different roles and are more strongly distributed among the various OAN business models.

At the time of the survey, OAN models were particularly important in Upper Austria, Lower Austria and Tyrol. In Styria and Carinthia, corresponding network infrastructures were only under construction, and in Vorarlberg, Salzburg, Burgenland and Vienna, OANs did not yet play a role at the end of 2020. The best-known OAN is the Niederösterreichische Glasfaserinfrastrukturgesellschaft (nöGIG), which was founded back in 2015 as the first provincial infrastructure company[7]. The nöGIG was set up as a classic 3LOM model. After the pilot phase, a private investor, the Allianz Group, was won for the planned expansion of the network infrastructure. In the second phase, about 100,000 households are to be supplied with FTTH by 2022. With the entry of the private investor, the original 3LOM model de facto became an ALOM model, as the private investor also controls the active network operator.

Tyrol is pursuing a substantially different approach. Here (almost) every municipality builds the local fibre network itself and takes on the role of a passive infrastructure provider (PIP) in a PLOM model. All interested (national or regional) market participants are given access to the fibre networks. This model proves to be particularly attractive for nationally operating providers, as can be seen from the fact that A1 Telekom Austria AG and Magenta use local fibre networks in a large number of municipalities and Hutchinson is preparing to use one. Sharing backhaul solutions facilitates and supports network operators' access to community access points. Uniform access and contract conditions are ensured by the specifications accepted by the municipalities of the Broadband Service Agency Tyrol accepted by the municipalities.

The OAN landscape in Austria has developed dynamically since the inventory of May 2021. Only one year later (as of May 2022), öGIG (Österreichische Glasfaser Infrastruktur Gesellschaft, 2022) was already operating projects in four federal provinces (10 projects in Styria, 9 projects in Carinthia and 4 projects each in Upper Austria and Burgenland). öGIG sees itself as a "nationwide technology and infrastructure company" (öGIG, 2022); it offers an "open access" platform in the field of fibre optic networks, which it actively operates itself.

3.3.1 Barriers to the use of the (FTTH-)network by active network operators or service providers

When asked about possible obstacles to the use of their own networks, most of the active network operators and service providers referred to a low number of customers that could be reached (24 mentions). An important role was also played by the lack of uniform process interfaces throughout Austria (19 mentions) and uniform service descriptions of whole sale products nationwide (15 mentions). Less frequently, too high wholesale prices (12 mentions) and a lack of integration of active network operation and service provider business (7 mentions) were cited. From the point of view of the municipalities surveyed, the small number of customers that could be reached was by far the most important obstacle (11 mentions). For the companies, the lack of uniform process interfaces throughout Austria was the most important obstacle (13 mentions each), in addition to the too small number of customers.

3.3.2 Standardisation

Institutional and organisational challenges arise in "open access network" models, as the services on the three levels of passive network infrastructure, active network infrastructure and services are provided by different players. In particular, the interplay between the different partners can cause transaction costs which, in extreme cases, can deter potential players from entering the market at the two levels downstream of the passive network infrastructure. This would call into question the contestability of the markets and impair competition.

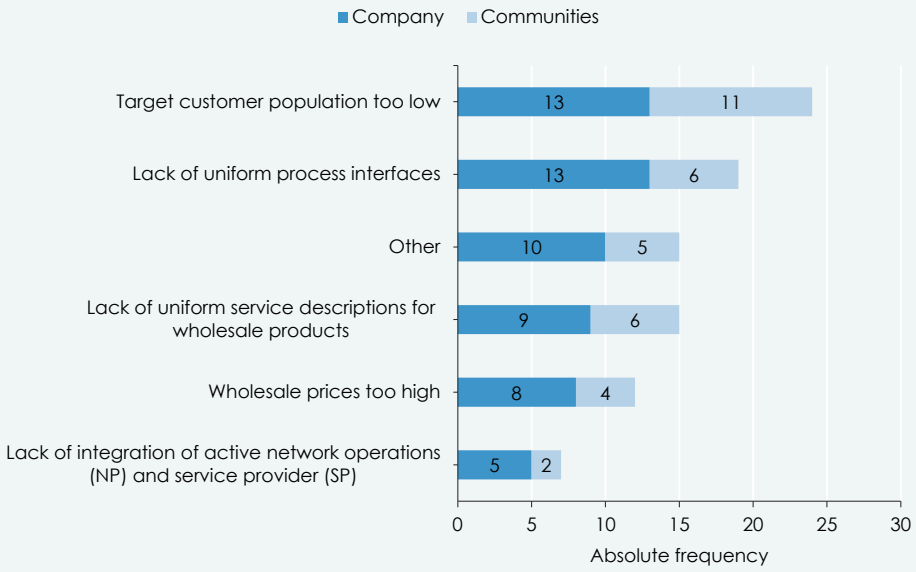
Against this background, the issue of standardisation is gaining in importance. The more standardised the products, processes and interfaces are on the market, the lower the transaction costs and entry barriers. This increases the intensity of competition, demand, take-up rates and thus indirectly the attractiveness of investments in FTTH expansion in Austria (Neumann et al., 2021).

The importance of standardisation for the long-term success of OAN is certainly recognised by the Austrian market participants. 48 percent of the companies and municipalities surveyed assessed efforts aimed at standardising product definitions and process interfaces concerning OAN access as rather or very necessary, for only 8 percent

[7] After initial financing by the province of Lower Austria, nöGIG is now financed to a relevant extent from federal funding programmes.

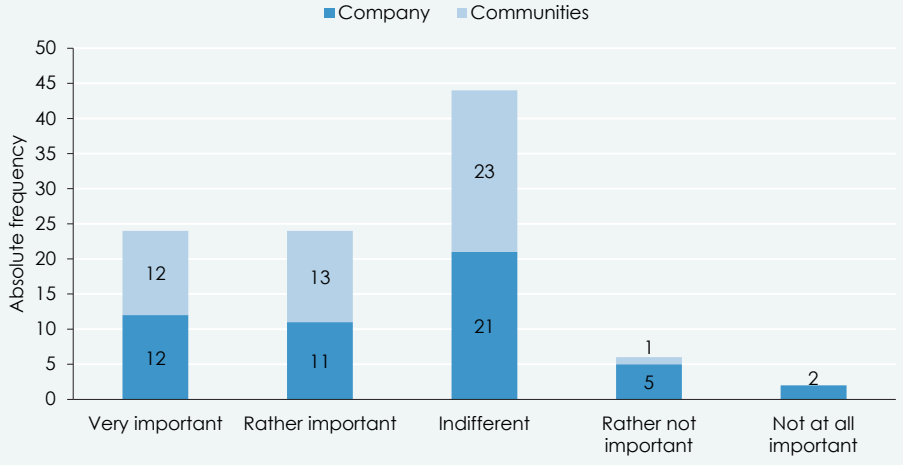
such efforts were rather not or not at all necessary, 44 percent were indifferent (Figure 10). The response behaviour of the municipalities and companies is similar, but the municipalities tend to attach greater importance to standardisation.

Figure 9: **Barriers to the use of the (FTTH-)network by active network operators or service providers**



Source: Online survey by WIK-Consult and WIFO. Question: "What barriers to the use of your (FTTH) network by (other) active network operators or service providers (SP) are you aware of for your network? "Valid N = 55 (without "no answer" or "don't know" N = 45). Multiple answers were possible.

Figure 10: **Assessment of the importance of a standardisation process for "Open Access Network" access**



Source: Online survey by WIK-Consult and WIFO. Question: "How do you rate efforts towards a standardisation process on uniform product definitions and process interfaces concerning access to OAN? " N = 100.

The large number of providers increases the heterogeneity of products and processes. This has a negative effect on the development of the Austrian FTTP market as a whole. In order for "Open Access Network" models to develop their full potential, uniform standards are just as indispensable as intermediaries accepted by as many market participants as possible. In its last evaluation report, the BMLRT also took up the issue of standardisation. In the future, it will be of great importance that "fibre optic networks

are planned, constructed and operated in such a way that their accesses are uniformly designed". It is therefore necessary to "define uniform technical and organisational interfaces by means of corresponding agreements and to establish binding minimum quality requirements between all potential operators" (BMLRT, 2021, 18).

4. Summary and conclusion

Austria continues to be in the middle among EU countries in terms of progress in the digital transformation. The gap to the European frontrunners, the innovation leader countries Sweden, Finland, Denmark and Belgium, is in part considerable, both in terms of infrastructure and demand for ultrafast broadband internet, as well as in terms of the supply of ICT specialists, which in Austria is still expandable.

The provision of high-performance digital infrastructure is a basic prerequisite for maintaining international competitiveness. In an EU comparison, however, Austria lags far behind in the availability of particularly high-performance fibre-optic infrastructures (Fibre to the Premises – FTTP). In order to accelerate the closing of the gap, open network access models (Open Access Networks – OAN), among other things, are an option that allow efficient multiple use of existing network infrastructures. The Austrian federal government therefore supports the expansion of OANs within the framework of the "Broadband Strategy 2030" through its own funding line ("Open Net").

After nöGIG was able to successfully establish itself as a pioneer provider of a regional OAN, the provider landscape in Austria is developing increasingly dynamically. However, the large number of providers increases the heterogeneity of products and processes, which has a negative impact on the development of the Austrian FTTP market as a whole. In order for open network access models to develop their full potential, uniform standards and intermediaries accepted by as many market participants as possible are indispensable.

In the meantime, the Open Fiber Austria Association (OFAA), an association supported by telecommunications companies and OAN provincial companies, has been established to promote open fibre networks. A solution to the standardisation and coordination problem initiated by the industry, such as the OFAA, is in any case preferable to a coordination mechanism imposed by the public authorities. The implementation of nationwide and reliable coverage with a symmetrical, gigabit-capable access network has thus taken an important step forward.

5. References

Bock-Schappelwein, J., Firgo, M., & Kügler, A. (2020). Digitalisierung in Österreich: Fortschritt und Home-Office-Potential. *WIFO-Monatsberichte*, 93(7), 527-538. https://monatsberichte.wifo.ac.at/66198.

Bock-Schappelwein, J., Firgo, M., Kügler, A., & Schmidt-Padickakudy, N. (2021). Digitalisierung in Österreich: Fortschritt, digitale Skills und Infrastrukturausstattung in Zeiten von COVID-19. *WIFO-Monatsberichte*, 94(6), 451-459. https://monatsberichte.wifo.ac.at/67254.

European Commission (2015). *Leitfaden für Investitionen in Hochgeschwindigkeits-Breitbandnetze* (Version 1.3). https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=12887.

European Commission (2021). *Broadband Coverage in Europe 2020. Mapping progress towards the coverage objectives of the Digital Agenda*. https://digital-strategy.ec.europa.eu/en/library/broadband-coverage-europe-2020.

European Commission (2022). *European Innovation Scoreboard (EIS) 2021*. https://ec.europa.eu/info/research-and-innovation/statistics/performance-indicators/european-innovation-scoreboard_de.

Federal Ministry of Agriculture, Regions and Tourism – BMLRT (2019). *Breitbandstrategie 2030 – Österreichs Weg in die Gigabit-Gesellschaft*. Bundesministerium für Verkehr, Innovation und Technologie, Breitbandbüro, Stabstelle Informations- und Kommunikationsinfrastruktur. https://info.bmlrt.gv.at/service/publikationen/telekommunikation/breitbandstrategie-2030.html.

Federal Ministry of Agriculture, Regions and Tourism – BMLRT (2021). *Breitband in Österreich – Evaluierungsbericht 2020*. https://info.bmlrt.gv.at/service/publikationen/telekommunikation/breitband-evaluierungs bericht-2020.html.

Neumann, K.-H., Plückebaum, T., Böheim, M., & Bärenthaler-Sieber, S. (2020). *Evaluierung der Breitbandinitiative BMLRT 2017/2018*. WIK-Consult, WIFO. https://www.wifo.ac.at/wwa/pubid/66807.

Neumann, K.-H., Wernick, C., Plückebaum, T., Braun, M.-R., Tenbrock, S., Schäfer, S., Böheim, M., & Bärenthaler-Sieber, S. (2021). *Open-Access-Netze für Österreich*. WIK-Consult, WIFO. https://info.bmlrt.gv.at/service/publikationen/telekommunikation/open-access-netze-fuer-oesterreich.html.

Österreichische Glasfaser Infrastruktur Gesellschaft – öGIG (2022). https://oegig.at (retrieved 11. 5. 2022).