

The deployment of the **5G** technology on metropolitan scales



Main findings of
the Metropolis
City Managers
Community 2021

metropolis ●

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Introduction

The Metropolis **City Managers Community** is a project funded by the Metropolitan Area of Barcelona (AMB), which every year brings together a select group of senior public managers who are in charge of the day-to-day operation of major cities and metropolitan areas, providing them with the opportunity to meet and learn from each other on topical issues. Initiated in 2016 as a session of the Habitat III summit, since 2018 the Metropolis City Managers Community meetings have been organised with a specific thematic focus – public finances in 2018, digitalisation in 2019, and green infrastructure in 2020. Since the last year, given the circumstances of the COVID-19 pandemic, all the activities were held remotely.

In 2021, the City Managers Community was focused on **the deployment of 5G technology in metropolitan scales**. Metropolis members exchanged their experiences with the opportunities and challenges arising from the deployment of 5G technology, regardless of the stage they are in. Part of the programme this year was designed to also foster engagement between our members and technology companies leading innovation in the sector. The proven methodology of previous editions has been jointly shaped with partners, forming the basis and road-map of our activities in 2021, starting in June (with the 5G Metropolitan Portrait survey) and ending with a public event on 17 November within the framework of the online program of the Smart Cities World Expo Congress (SCWEC21).

This final report describes and offers the background for the conduct of the 6th edition of the Me-

ropolis City Managers Community, including its methodology and road-map, an updated information concerning its thematic focus and respective international stage of play, as well as an assessment thereof. It also outlines the main findings and key take-aways of the exchanges that took place throughout this year between top leaders from the Metropolis membership who are in charge of 5G in their metropolises, and senior representatives from technology companies involved in the processes of 5G implementation in major urban areas of the world.



The **Metropolitan Area of Barcelona (AMB)** is studying the possibilities of providing 5G connectivity for companies located on industrial estates of the metropolitan territory, seeking to improve their logistics operations, efficiency and productivity. *Source: Economic Development Agency/AMB*

Road-map of the Metropolis City Managers Community in 2021

Methodology and road-map of Metropolis City Managers Community 2021

 <p>Milestone</p>	<ul style="list-style-type: none">○ Communication to all Metropolis members to announce the theme for 2021○ Promotion of the online survey “5G Metropolitan Portrait”○ Collection of survey results, analysis, processing and identification of common first trends and challenges	<p>June</p>
 <p>Milestone 2</p>	<ul style="list-style-type: none">○ Webinar with representatives who filled out the survey to set the scene, learn state-of-affairs, and discuss first impressions.○ Delimitation of burning questions○ Promotion of a sense of community belonging	<p>7 July</p>
 <p>Milestone 3</p>	<ul style="list-style-type: none">○ Celebration of a private workshop between public and private stakeholders for 5G deployment, to share inspiring experiences, difficulties and pressing doubts	<p>20 October</p>
 <p>Milestone 4</p>	<ul style="list-style-type: none">○ Public session, as part of the Digital Program of the Smart City Expo World Congress 2021, to share with a broad audience the main findings of the exchanges between leaders from the Metropolis membership and senior representatives from technology companies involved in the processes of 5G	<p>17 November</p>

An assessment of the current 5G state of affairs

5G technology is arising as a great source of innovative solutions to tackle many of the challenges our urban society is facing today, and depends primarily on infrastructure located in public space managed by city governments and metropolitan authorities. 5G technology allows network response time in telecommunications to be drastically reduced with respect to 4G, going beyond mobile data. Its deployment will entail a technological transformation of services and infrastructure, ideally reduce the digital divide and create opportunities for the next generations.

Although many 5G initiatives still constitute pilot cases, they can provide concrete examples of the application of this technology across a diverse range of public services. So far, most public strategies for the development of 5G have been led at national scale, mainly due to spectrum regulation being produced at the national level. Still, the subnational governments that operate in metropolitan spaces could and should play a key role in the implementation of 5G network, such as boosting and facilitate its deployment, and ensuring that it has practical and direct positive impacts on quality of life.

COVID-19 restrictions and lockdowns have caused some delay in the 5G roll-out. Testing has not ceased, however, and is moving forward internationally. When the adoption of a technology requires new infrastructure, national states tend to be its principal catalyst, investing in said infrastructure, legislating around its use, and signalling commitment to the market, thereby attracting investment. 5G adoption is thus unfolding into commitment and planning within the public sector at the national level.

South Korea and the USA (with the leadership of wireless company Verizon) were the first nations to adopt 5G, in April 2019. This can take the form of a novel utilisation of existing infrastructure (with ranges of 300 MHz to 3 GHz in the north American case), or of the construction of a nearly new grid (usually bands of 25–30 GHz and higher). Using existing infrastructure seems to be the direction in which the USA is moving. The reason for this is that this country is less urbanized and less densely populated than east Asia. The per capita benefit represented by a country-wide roll-

out of new infrastructure would be inferior in the US than in, for example, South Korea.

The South Korean model is particularly worth highlighting, given that this is, at present, the country with the most 5G users per capita. Here, 5G roll-out is proceeding from national-level directives and is being implemented by semi-public corporations, focusing on urban theatres. Several South Korean ministries have worked together to develop a 5G strategy. The Ministry of Science and ICT is particularly prominent in this respect. Further, the government has earmarked the equivalent of US \$133 billion for 5G development by 2025, much of which has been injected into Seoul .

It is at this stage that the **Seoul Metropolitan Government** stepped in, hosting special tech-visas to attract foreign information and communication technology (ICT) talent and facilitating the operation of start-ups in their territories. This is also where public service delivery becomes most relevant, as the local governments provide a host of services, from free public Wi-Fi to a parking system that alleviates congestion and informs drivers as to where they can find a free parking space near them.



Network of **Seoul's** Smart Poles, which provide services such as free public Wi-Fi, intelligent CCTV and charging electric vehicles and drones. Free public Wi-Fi is also available in the majority of buses that circulate across the metropolis. *Source: Seoul Metropolitan Government*

Asian interest and dominance in the field are observable, as well, in China and Japan, both of which are pursuing more thorough changes in infrastructure. These nations are quite advanced in terms of testing 5G, with Japanese trials going back as far as 2014. However, both have faced significant logistical challenges. Japan seemed to be downplaying the likelihood of imminent country-wide roll-out. In the Chinese case, both Huawei and ZTE have struggled with making their 5G trials a success. Some experts consider Chinese leadership in the field probable, but unlikely to emerge before 2025.

The **People's Government of Guangzhou Municipality**, represented by the staff of its Foreign Affairs Office at the Metropolis City Managers Community webinar on 7 July, stressed the importance of working hand-in-hand with technology companies. With a consolidated action plan for 5G implementation, Guangzhou showed itself to be more advanced than many other local partners in the region.

On the other hand, the European model is likely to contrast with Asian macro-sites, focusing instead on increasing the density of the access network and upgrading the transmission network to fibre. Although much of what the EU's 5G Public-Private Partnership (2013) and 5G Action Plan (2016) propose is a bit behind schedule, the new European supportive actions (funds) such as the temporary *NextGenerationEU* and the *Multi-annual Financial Framework 2021-2027 (MFF)* will speed up the promise to deliver. To date, Europe's most active traditional Mobile Network Operators (MNOs) in providing connectivity for 5G services have been Vodafone, Deutsche Telecom, Orange, Telefónica, Telia and TIM. European funding may boost various sectors earmarked in the respective national Recovery and Resilience Plans, in specific areas such as tourism, transport infrastructure, and economic activities.

In any case, 5G deployment is a **multi-stakeholder assignment** in which public-private partnerships play a key role in the setting-up of infrastructure for roll-out and provision of connectivity. As public policy and regulatory decisions can have a significant impact

on the development of 5G technology, there is a necessity of an active, constructive and complementary relations between public and private stakeholders for the deployment of 5G.

There are several **trials or pilots** in European cities and metropolitan areas, including territories governed by Metropolis members such as Barcelona, Madrid, Berlin and Turin. These are mostly public-private partnerships involving municipal governments and private companies. The examples from the **Madrid City Council**, for instance, highlight that 5G is not only a matter of cybersecurity. As shown in the 25 pilot projects conducted by Madrid, this technology will impact all fields: from public administration to translation services.



In **Madrid**, 5G technology is helping to significantly reduce the time of response of the service of medical emergencies and civil protection. *Source: Ayuntamiento de Madrid*

As 5G infrastructure is located directly on the ground of metropolitan areas, the local and regional governments that manage these territories must have a say in the matter, as they will have to handle both the benefits and risks of the technology.

5G-related risks centre around demand, given that the 5G offer is not perceivable by the market prior to full roll-out. Until then, a proper assessment of the product-market fit is not possible. There is a chance, therefore, that the financial commitment to 5G will not be tantamount to its payoff.

Business models for 5G often involve numerous stakeholders, resulting in high complexity and management commitments, and making it difficult to establish the transferability of one successful case to other contexts. The research and development phase of 5G will require companies, including small and mid-size enterprises (SMEs), to partner with, and make a significant commitment to, connectivity providers, while only yielding results once infrastructure is rolled-out (which is frequently outside the purview of SMEs). The difficulty will be in showing results that are significantly superior to those of comparable cases in which existing technology was altered to, for example, allow higher download speeds, without the additional financial commitments of 5G infrastructure.

Many cases will depend on how quickly providers, different governments and the private sector develop complementary technologies, which is something they may not always be willing to do, while driven by competitiveness. Furthermore, 5G is not immune from regulatory risks. Public policy decisions (including to cut back on financing) can have a significant impact. At least initially, 5G will principally be directed at enabling public or

semi-public sectors such as aerospace and healthcare, which are tightly regulated. An economic downturn or pressure due to environmental risks (of infrastructure manufacturing and energy supply) can impede 5G roll-out. In terms of health risk, studies have not shown a significant impact of 5G, with few exceptions, but mitigating measures are being proposed all the same.



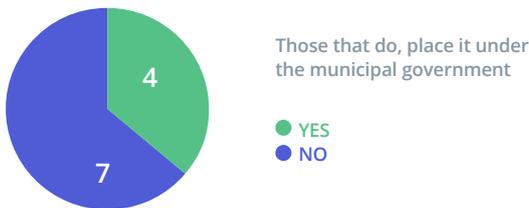
The metropolitan ring roads are another setting where the **Metropolitan Area of Barcelona (AMB)** is seeking the possibility to implement pilot 5G projects, in order to enhance traffic and pollution monitoring. *Photo: AMB*

Insights from the 5G Metropolitan Portraits

In early June, Metropolis sent to all its 141 members a survey named "5G Metropolitan Portrait". This survey contained questions seeking to analyse certain organisational and strategic issues regarding 5G as well as a better definition of its meaning and related facts and figures. Eleven members replied and actively participated in this survey. These were Barcelona (metropolitan area and municipality), Busan, Dakar, Guangzhou, Kaohsiung, Madrid, Ramallah, Rio de Janeiro and São Paulo. Although limited in terms of membership representation, the responses provided a good overview of how 5G currently stands, both in quantitative and qualitative terms.

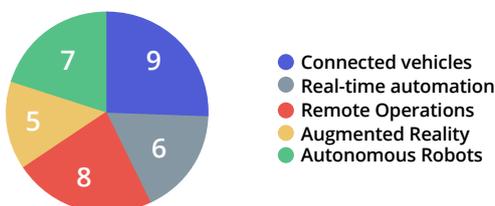
Probably due to the novelty of the 5G topic for metropolitan actors, less than half reported to have a dedicated department or unit for the development and deployment of 5G. Consequently, the same is true for the availability of an own political strategy for the roll-out of the technology in the metropolises.

Do you have a dedicated department/unit for the development and deployment of 5G?

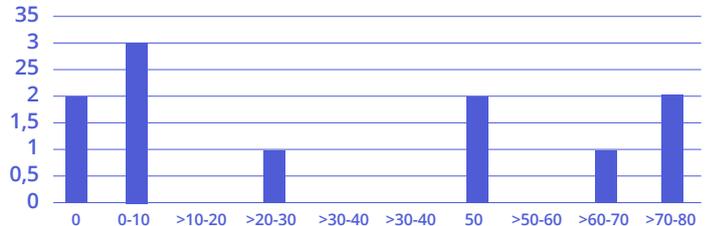


This fact supports the impressions received from the inputs that the majority of metropolitan territories are in **pilot stages**, with only a few implemented cases. A similar vague notion is perceived when members attempt to define the meaning (or mandate) of 5G in the metropolitan context which refer to undergoing testing phases, targeting vulnerable areas and/or populations lacking communication infrastructure, and help developing a competitive digital industry.

Regarding the question "In what use-case areas and service sectors do you consider 5G technologies are/will be further developed in your metropolitan space?", **connected vehicles** (selected by nine members), followed by **remote operations** (selected by eight members) were regarded as the most popular.

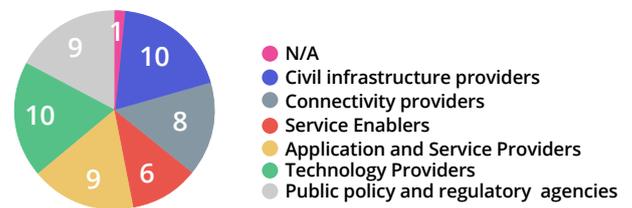


Another finding that is either ambiguous or displays a high range of variability is the percentage of population with 5G standard network access. This varies across metropolises and depends on the geographical zone, thus being related degree to maturity of 5G application services.



Percentage of the population in each metropolis with access to 5G standard

On the other hand, a clear message has been given by the respondents in terms of their approaches to be applied towards 5G deployment mentioning a wide array of stakeholders involved (i.e. local and national governments, private sector in different forms).



This leads to governance structure models in which vertical (national level) coordination and specific metropolitan scale government structures are mostly perceived as those that would fit best to fully deploy 5G at metropolitan scales (4 and 5 mentions respectively).



Key findings and takeaways

A call for cost/benefits analysis and cost-neutrality for end-user

While many issues debated during the Metropolis City Managers Community activities in 2021, including different views and approaches supported by practical cases from the members, are mostly related to the future deployment of 5G technology at the metropolitan scales, they generated the following findings and takeaways.

Higher costs at the beginning will be out-weighted by higher quality (of services) and greater benefits in the long-term, thereby ultimately reducing costs. However, cost-neutrality of 5G deployment cannot be assured for the end-user who will likely bear some costs and pay for its usage, although it is intended that these costs be low. Here are the perspectives from some participants:

With 5G, as with any other instrument, the public sector must be prepared to identify what public goods are being delivered in the territory and then take a pro-active role in terms of financing, piloting, etc. Our approach is based on the following question: how can we integrate 5G infrastructure in the urban spaces we already have?

Ramon Torra, General Manager of the **Metropolitan Area of Barcelona**

5G consumes two or three times more energy than 4G, so costs will be higher. The cost is higher but can also generate higher income, especially for operators. Consumer benefit from experiencing a better network, such that they may be willing to pay more for higher quality, as well as for AR, VR apps etc. 5G is also for businesses, so that when considering cost neutrality, it is not only a question of network construction cost, but also of application adjustment. With 5G, businesses can do more than with traditional communication, like utilizing remote factories or healthcare, which 4G cannot do. As applications of 5G diversify and proliferate, revenue from 5G increases and operators are compensated which confirms ultimately that benefits are greater even if costs are higher.

Pan Guixin, Deputy General Manager, China Unicom Guangzhou, Network Capability Innovation Center

Costs at the end have to be paid for and are likely to be covered through taxes and payment rates. Costs are taken up by operators, and trickle down from there. It is also true, however, that investment should increase efficiency and service deliver, thereby reducing costs. The City of Madrid does not believe the cost will ultimately increase for end-users. Therefore, public administration can produce 5G services as well, financed by way of taxes and private-public partnerships.

Pilar Gonzalez-Blanco, General Deputy Director of Communications, **Madrid** City Council

Initial investment must be made by both the state and private sector. They must determine whether there is a real benefit, because investment must have a return and pose a low cost for citizens in the case of Medellin. An analysis needs to take place on how to get benefits and get communities to voluntarily take them up to help 5G get to everyone.

Jaime Antonio Rugeles, ICT Solutions Developer at the Corporate Digital Management Team of Ruta N Medellín



Ruta N, **Medellin**'s innovation and business centre, has been hosting a pilot that teaches the applications of 5G technology in mobility enhancement, nanotechnology and medicine, among others. Photo: courtesy of Ruta N.

Roll-out of new technology can impact the end user's costs, through tariffs. Therefore, European laws point to collaboration or facilitation of roll-out. The Barcelona City Council aims to make the roll-out as light as possible, not only in terms of cost but of administration and length of time taken to implement.

Marc Perez-Batlle, Innovation Manager, Barcelona City Council

Different levels of government's roles in 5G deployment

While there is a need for national government (or higher level of government, which is the case of the European Union, for example) in terms of producing reliable legislation and initial investment, it is at the city level where we find the best scenario for piloting and implementing 5G technology. In this context, the role of local governments lies in creating a favourable environment, enabling horizontal and vertical coordination with other levels of government. In addition, and due to population density in urban areas, the role of local and regional government and administration are often to ensure equal access of 5G for people living not only in central areas, but also in peripheral and rural areas. In the latter, the government will have to step in, as there will be less private sector incentive.

Some of the economic disincentive affecting areas with low population density can be reversed by allowing people to work from home, which is in turn made easier through 5G, as stressed by the **Madrid** City Council. Moreover, governments should encourage companies to experiment with new technologies, through multiannual action plans. End-users can then benefit from new 5G applications, as highlighted by the experiences from **Guangzhou**.

The Metropolitan Area of **Barcelona** highlighted that 5G is an instrument like any other. As a consequence, the public sector must be prepared to identify what public goods are being delivered in the territory and then take a pro-active role in terms of financ-

ing, piloting, etc. We have the examples of healthcare drones as well as fire management and detection, which are also being developed. In general, 5G represents an opportunity for Barcelona, and for the entirety of Spain, to break the monopoly of existing providers. At present, companies stillw handle both operations and infrastructure, but we may now constitute a neutral infrastructure operator, differentiating operations from infrastructure. For instance, when Telefonica was public, it reached places that did not represent an economic benefit. Now, with 5G, we may come back to this paradigm.



The **Metropolitan Area of Barcelona** (AMB) aims to integrate 5G Wi-Fi spots in already existing infrastructure along 42 km of the metropolitan coastline, to provide fast and free internet connection to beach users. The pilot 5G spots have been added to poles called CIMs (acronym in Catalan for “integral modular columns”), which already provide services such as measurement of UV radiation, LED lighting, and loudspeakers for safety public announcements. *Photo: Frederic Comi/AMB*

Need for public and public-private alliances for the 5G development and roll-out

It was unanimously agreed that the private sector should be involved before, during and post- 5G deployment, i.e., involvement is to be requested from the start to the end, but in different ways.

Public investment comes first in **Guangzhou**: constructing the network, setting up telecommunication operators, and companies then engaging in a trial-and-error process, assuming the costs. There are various ways in which the government can encourage companies to take on 5G technology, and compensate them for undertaking trials.

For **Medellín**, the Colombian national government organized a public call and sponsored pilot testing, out of which viable projects are being implemented. The private sector has been involved since the beginning of the process, for development purposes, and also during the process, to provide expert technical assurances, as well as after, to generate a more user-friendly interface.

Promises ahead

Applications for 5G are numerous, but a clear distinction is to be made. If the aim is to deliver public goods and services, such as may be the case in producing drones for healthcare purposes, as mentioned earlier, then the public administration is to carry it out, but if the end is to benefit an industry in which the private sector is involved, such as tourism, advertisers can be brought in to fund a project.

All Metropolis members are looking into similar areas. In this context, mobility is very prominent, including tests for automated vehicles and early and remote detection of accidents, showing first (pilot) results. Guangzhou has 300 driverless vehicles with heavy use of the 5G network high-bandwidth and low-latency. In addition, healthcare and public security are sectors that government are strongly promoting and encouraging to use 5G. In the case of

Medellín, pilots were carried out close to high end hospitals. Madrid is looking into security services and emergency response issues and they hope to have developed a dedicated communication channel for the police within five years.



Guangzhou was the first city in the world to offer publicly accessible driverless taxi services, known as Robotaxi, which are enabled by 5G connectivity. In a little more than one year of operations, over 60,000 passengers have been safely delivered to their destinations with 140,000 Robotaxi rides. Robotaxi is gradually becoming a part of everyday life for people in Guangzhou. *Photo: WeRide.ai*

In 2021, the Metropolis City Managers Community showed that metropolitan governments seek social cohesion in the territory without inequalities in the quality of the services they offer, to also be demonstrated in the case of 5G deployment, applying a uniform and equal approach throughout the territory, adapted to its density characteristics.

The digital divide is both an educational issue and an issue of access to technology and services. Along with advanced 5G infrastructure, access to devices that allow people to connect to these new networks must be assured for the most vulnerable parts of society. The bottom line is that “technology must be at the service of human dignity”, as one of the panellists of the public event held on 17 November pointed out.

Further readings

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Metropolis members that engaged in the City Managers Community in 2021:

1. [Ajuntament de Barcelona](#)
2. [Alcaldía de Medellín](#)
3. [Àrea Metropolitana de Barcelona \(AMB\)](#)
4. [Ayuntamiento de Madrid](#)
5. [Busan Metropolitan City](#)
6. [Gauteng Provincial Government](#)
7. [Kaohsiung City Government](#)
8. [People's Government of Guangzhou Municipality](#)
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