



European cities best practice knowledge about 5G initiatives

- For inspiration to Copenhagen region cities

Henrik Aagaard Johanson

Founder

AKiLAY ApS

+45 2712 4221 / Henrik.johanson@akilay.dk

www.akilay.com

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Introduction

This document is a short summary of best practise knowledge and learnings about 5G initiatives in five European cities, who is leaders in this field.

The five cities are:

Barcelona,

Dublin,

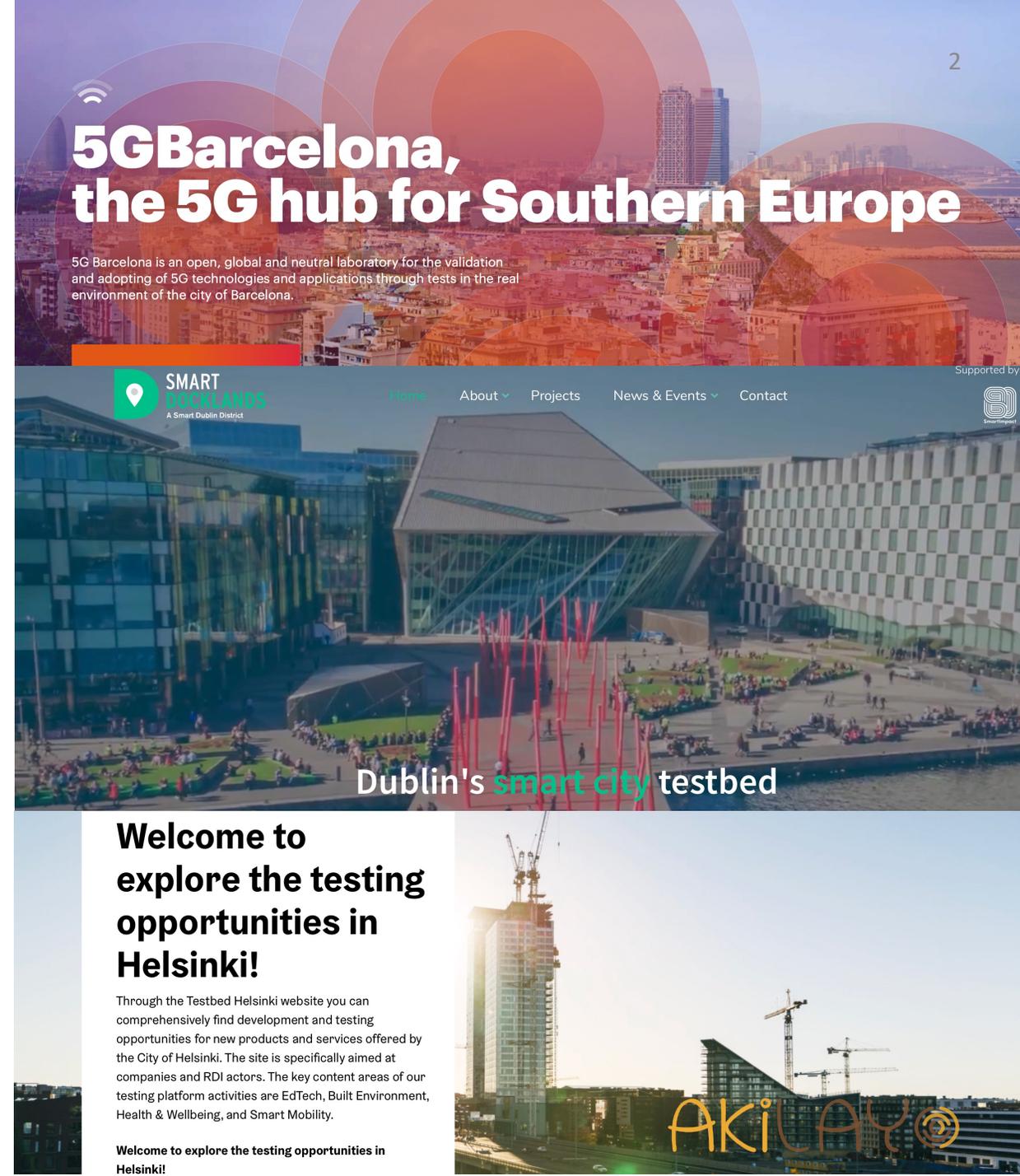
Helsinki (incl. Espoo),

Rotterdam, and

Sunderland.

The best practice knowledge is collected for inspiration to cities in the Copenhagen region.

Picture 1. Shows European cities public testbed webpages for 5G initiatives.



Key learning from 5G best practice initiatives in European frontrunner cities

There are six key learnings from the study of activities in European 5G initiatives:

- (1) Cities need to get a strategy in place, that is unique for the specific needs and opportunities for the city. The strategy should include connectivity needs, that will support these city needs and opportunities.
- (2) The city should attract the right technology savvy people – meaning people with the required digital skills to be able to build a digital connected city, that is a complex task.
- (3) 5G use cases in cities is driven bottom-up. But anchoring the development in city management is essential for scaling and implementing use cases in city operations and services.
- (4) Cities should spend time on collaborating across sectors and include key local partners and institutions in the (5G) initiatives. Use cases must clearly show the value for the intended users or citizens.
- (5) Cities should engage in collaborative networks and communities across Europe to share knowledge, financing cost of use cases and to lower the risks of failures of digital use cases.

Cities could improve cooperation and communication and use resources in a better way by sharing knowledge in an open and structured way (fig. 1).



Figure 1. Only few cities have an open and structured way to work with information.

A open and structured way of sharing knowledge improve cooperation and communication

(6) Cities should also spend time on documenting relevant knowledge and learnings from use cases in an open knowledge infrastructure (fig. 2). This is required if other cities and organisations should be able to reuse learnings and scale use cases and reusable parts into other sectorial areas.

However, documentation is only done to some extent in the city initiatives in this study. This limits knowledge sharing, open innovation, and automatization across business sectors and partners. If learnings are shared city resources can be used in a more efficient and innovative way, that provide increased value to city partners, citizens and eventually the city itself. On the contrary cities waste resources re-inventing the wheel over and over again in several use cases already tried in other cities or departments.

In European communities there is a focus on building frameworks and standards to increase the knowledge sharing and communication about digital solutions. Locally, the cities need to translate what these standards and frameworks means to daily practice in city operations to move beyond the traditional organization in business siloes. This is essential to digital transformation. But many cities are unaware of this work and the necessity to digitally mature. The results is that potential and valuable savings, climate and sustainability improvement are not made.

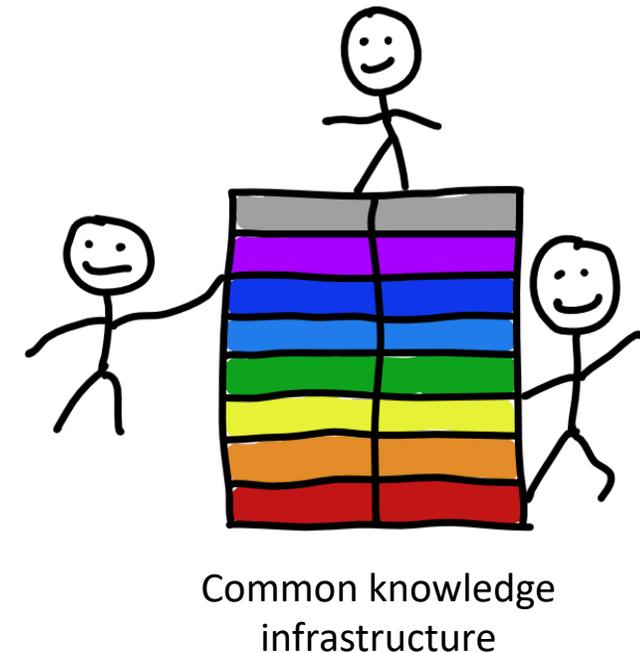


Figure 2. Several cities lack a common knowledge infrastructure and re-invents the wheel over and over again.

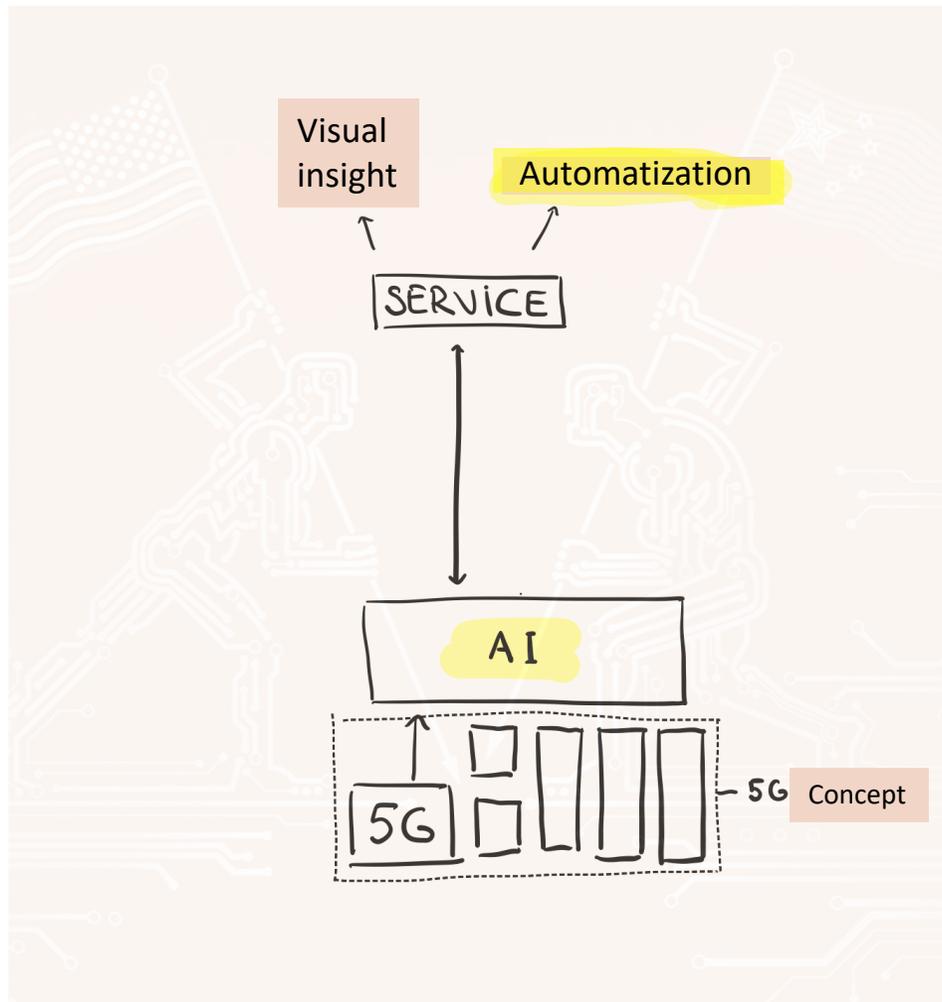


Figure 3. 5G is a concept consisting of several elements where software e.g. AI solutions can be built on top and contribute to automated operations.

Competition about the rollout of 5G – a foundation for automatization of city operations

There is a competition about the roll out of 5G mobile infrastructure internationally, especially in the US and China.

This is because 5G mobile infrastructure is an important infrastructure for the use of innovative technologies like AI (Artificial Intelligence) and drones etc. 5G is, unlike traditional 4G and standard hardware components, a much more complex mobile infrastructure. 5G consists of several physical (hardware) components, technologies, software layers built on top of this etc. Thus, 5G is more like a concept that consists of several different parts. These must be adapted to the needs of the specific use cases (fig. 3).

Therefore, cities need to take an interest in 5G to be able to adapt 5G technology solution to the specific needs of the city. This could e.g., be different parts that must be built into city furniture to support specific city operations or citizens' services etc.

In short 5G will be one of the important digital foundations for the automation of city operations and services throughout the city space for, e.g., waste control or gardening of public flowerbeds that are handled by drones, delivery of medicine for elderly people etc.

Denmark is a 5G leader in the EU, but could focus more on advanced usage of 5G

Denmark is, together with Netherlands, furthest ahead with upgrading the existing 4G antennas and base stations to 5G technology. Already 80% of the country is covered by 5G in Netherlands and Denmark (fig. 4).

But cities in Denmark could focus much more on establishing demonstrations projects to showcase the more advanced parts of 5G mobile technology. This includes 5G technology that can be built into city furniture.

Where and how this 5G rollout is done is in the interest of the city. But it may also be in the interest of other organisations that use the city to interact through digital solutions. These organisations might wish to share 5G functionalities and connections.

Therefore, key local partners should be included in a collaboration and dialogue about use cases and the supporting digital infrastructure e.g., 5G (mobile) telecommunications infrastructure.

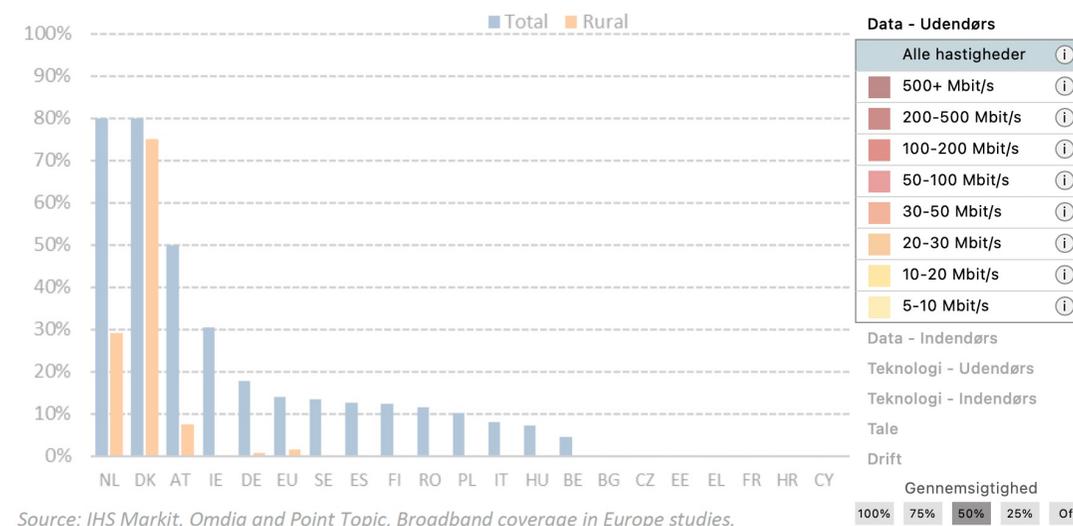
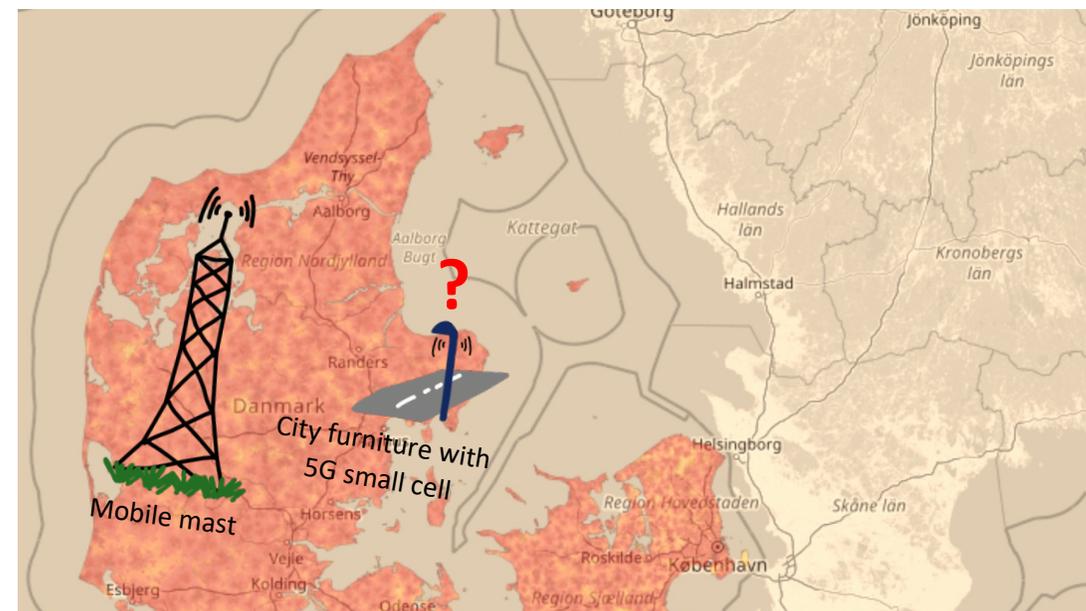


Figure 4. Shows the 5G mobile coverage (% of populated areas), mid-2020.

Characteristics of the best practice 5G initiatives in leading European cities

In the European cities furthest ahead on 5G initiatives four specific characteristics are identified (fig. 5):

- (1) There is a strong support from either a national institution or a larger international partner company, e.g., Nokia in Finland. The strong backing provides knowledge and financial support, that is necessary for investments and operation of the 5G initiative and organisation. The 5G initiative could be a part of a larger e.g., smart city initiative, as in Sunderland.
- (2) The initiative has a broad anchoring in the (top) management. This includes management in various business areas and different key organisations across several business areas in the local community or region. Additionally, the initiative has a strategic underpinning. This could be either a common strategy or a coordinated dialogue between different actors' strategic interests.
- (3) The specific use cases are organised across different kind of sectorial areas in the city. They are also psychically close to the users in the city operations or citizens, that is supposed to use the end service. Thus, the use case directly and visually shows the value of using 5G technology.
- (4) Finally, the use cases involve local partners, who has a direct interest in the use case. Thus, they also have a desire to finance the use case. The use cases also include a telecommunications operator, that have an interest in developing the specific 5G infrastructure service into their product portfolio.

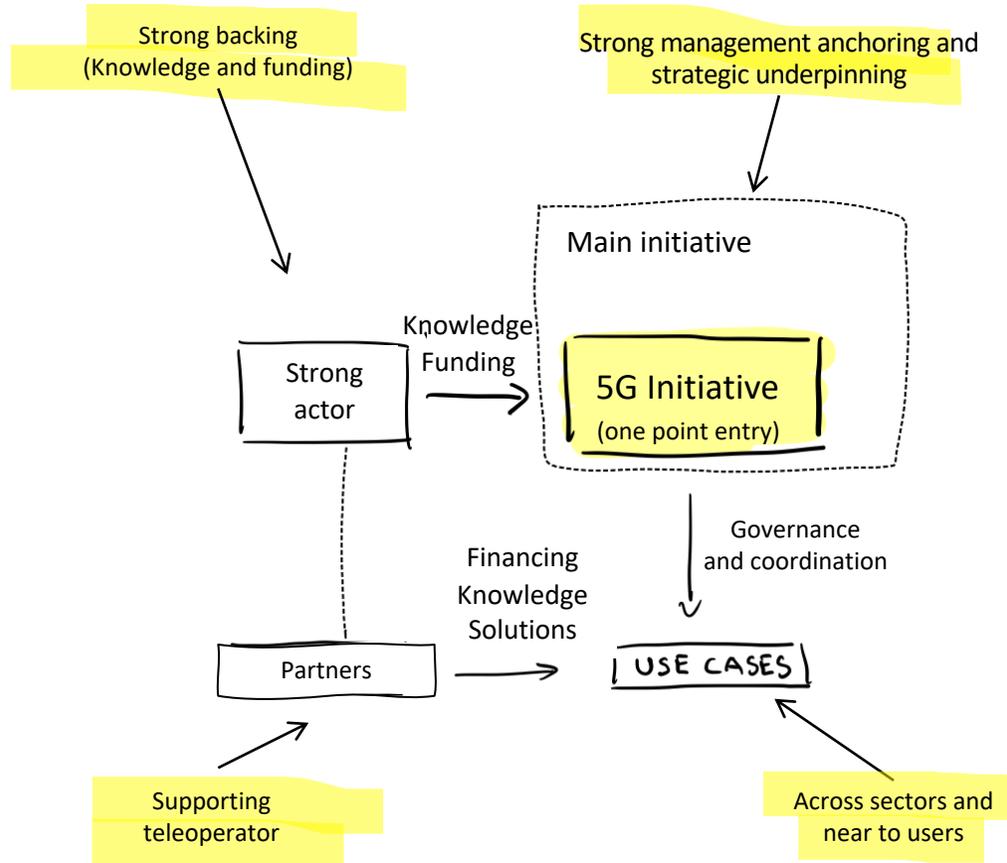


Figure 5. Model of primary characteristics in the European cities 5G initiatives.

Elimination of barriers to 5G rollout



Picture 2. Sunderland city, UK.

A city may be in a situation (due to local or regional market condition) where teleoperators have no interest in the rollout of more advanced parts of 5G technology. This was the case in Sunderland, UK.

Sunderland's forward looking city management and director gathered about 30 managers from key public administration institutions from, education, elderly care, business development and culture/sports. Nokia-Bell Labs (a research branch of Nokia) was invited to an expert insight workshop together with the group of managers. As an outcome a smart city strategy for the overall city was formulated. In the process the managers became aware of connectivity, as crucial to solve the major challenges for the difference city business areas. This was not 'technology for technology's sake', but a necessity for solving all kinds of challenges in the city operations, within education, elderly care, at the football club etc. Thus, connectivity became a central focus in the initiative to meet the smart city strategy.

Following, the city had a dialogue with more that 40 teleoperators before signing a 20-year contract with a global teleoperator. The operator became responsible for establishing 5G connectivity in the city. This was as part of several other wired and wireless connectivity technologies in Sunderlands ambition of an 'all-encompassing smart city infrastructure' supporting innovation – and to become the most connected city in Europe. The contracting teleoperator have an obligation to give access to other companies and interest etc. who needs access to the 5G infrastructure for different kind of purposes. Moreover, it is easier for Sunderland to decide and agree upon a design of 5G technologies that are built into city furniture e.g., light poles, bus stops etc.

Improvement of marked conditions by a collaborative organisation

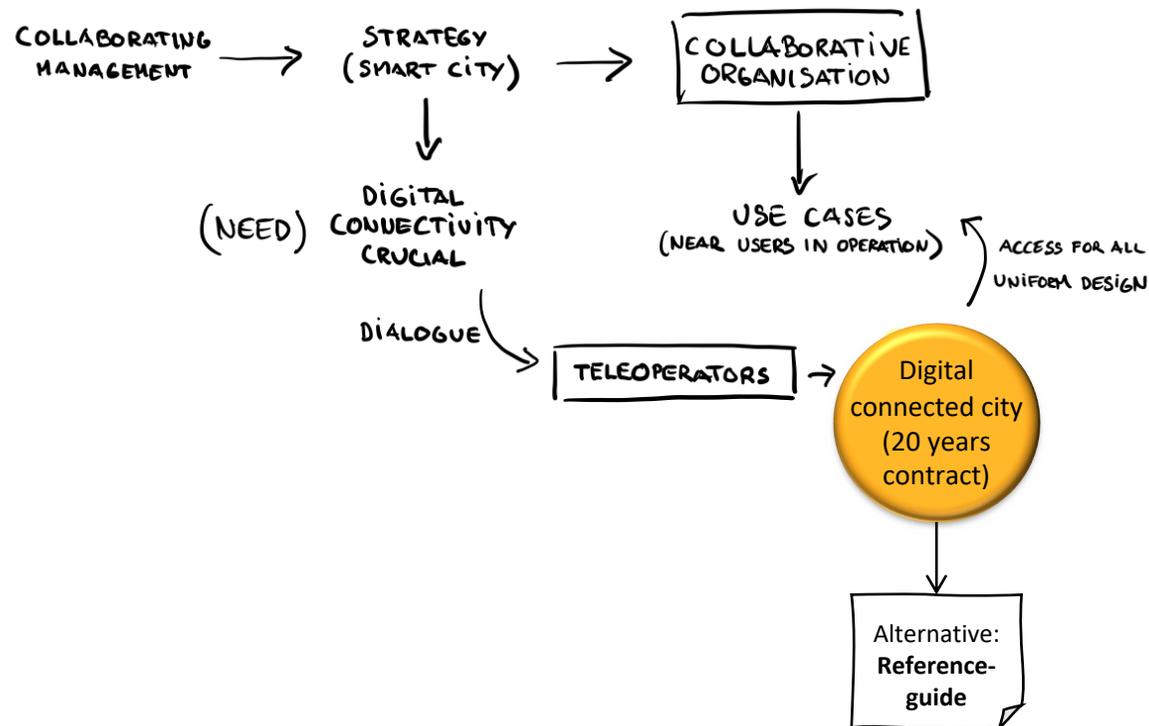


Figure 6. The development process in Sunderland city to establish a digital connected city.

Sunderland city has also established a collaborative organisation (fig. 6). This includes managers from both the public administration, private companies and teleoperator. It is organised in a structure with steering groups, development programs, projects and working groups. Business cases for use cases are approved by top management in the relevant steering group. Steering groups also gives strategic direction for the different use cases being developed, that is also closely connected to the city operations.

The Sunderland case represents a collaborations approach that goes beyond the traditional silo thinking in most European cities. It resembles a standardisation collaboration, and it increases the city's innovative capability when developing, testing, and implementing new technologies. It is also a focus to be inclusive for the overall local community.

An alternative to the Sunderland-model could be the one followed in Dublin. Here the rollout of 5G is left to the telecommunications operators' incentive to invests locally in Dublin. But Dublin has tried to increase these incentives. In collaboration in working groups Dublin has formulated a report summarising different city needs. To answer these city needs, Dublin have also in collaboration made a reference guide for how to integrate 5G technology into the city furniture etc. This reduces the administrative barriers and cost of rollout for the telecommunication operators and makes it easier for the private actors to develop 5G use cases and technology services.

European 5G strategy, action plans and initiatives support local initiatives

In the European Union 5G was early identified as a critical new network technology that will enable innovation and support digital transformation. In 2013 a public-private partnership on 5G (5G-PPP) was launched to accelerate 5G technology research and funding of more than 700 million Euro in the Horizon 2020 programme. In 2016 action plans was adopted together with a coordination of national 5G action plans to have 5G services in all EU Member States by end 2020. A (Digital Decade) strategy have been launched to have uninterrupted 5G coverage in urban areas and along main transport paths by 2025 and to cover all populated areas by 2030. Progress can be monitored at 'European 5G Observatory'.

In the Connecting Europe Facility (CEF, and e.g., 5G for Smart Communities) projects are funded to support the early deployment of 5G-based systems. Thus, there is a focus in Europe to increase the rollout of 5G. However, locally in most European cities the awareness of the need to actively engage in and prioritise resources for 5G use cases that increases the rollout of 5G infrastructure is lacking. City scares resources can be much better used, when sharing knowledge and collaborating in a relevant European context, even though this might seem resource-intensive at first glance.



Picture 3. European Union 5G initiatives.

5G collaboration in European networks and communities increase learnings and reduce risks

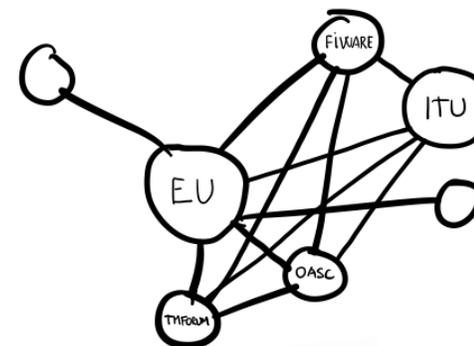
There are independent European arenas, where cities can find inspiration and collaborate in the complex digitization landscape.

More than 100 cities worldwide collaborate in the common network, Open & Agile Smart Cities (OASC). These cities collaborate on Smart City projects and the development of common so-called digital minimum standards (MIMS). The collaboration is linked to the EU efforts, including 'Living in EU', an EU digital transformation program of European cities.

Collaborating in these European networks and partnerships can bring value to cities e.g., best practise knowledge about 5G use cases, opportunities to share development cost, and directly development of new technology standards, sharing of learnings and lowering of risks etc.



Networks and communities



- Knowledge
- Common financing
- Standardisation collaboration



Figure 7. European 5G networks and communities.

Background and method of this 5G best practice study

The knowledge in this document is based on an initial screening of international, mostly European cities.

The purpose of the screening was to identify 5G initiatives, that go beyond the ongoing upgrade of exiting 4G mobile networks to 5G. The aim was especially to look for initiatives, where cities are trying to increase the rollout or prepare for the rollout of more advanced parts of 5G technologies. These could be e.g., small cells in city furniture, network slicing technologies etc. It was essential, that the initiatives could provide relevant insight and learnings for Copenhagen region cities.

The initial screening was based on Internet research of 5G activities in international cities and study of online available reports from different European organisations (see references). After identifying relevant 5G initiatives, five cities were selected for further study. In this, AKiLAY made short follow-up interviews (semi structured interview) of about half an hour, with mostly two persons participating from each city. The interviewed was from the top management of the initiative: 5G, smart city or technical and economic departments of the city – but in general primary source and knowledgeable of the city's 5G work.

The purpose of the interviews was to know more about the actual collaborations in the initiative and ad more actual and detailed insights into the different 5G initiatives and related use cases.

Several of the interviewed also followingly provided additional material. The research was made in a period of three months from early November 2021 to early February 2022.

The best practice knowledge is collected especially for the cities involved in the common 5G project called: “Ready, Set 5G”. This project is led by the non-profit organisation, Gate 21, for the Capital Region of Denmark (Copenhagen Region). Gate 21 have asked AKiLAY to perform the task of collecting and reporting best practice knowledge. The results are presented in a so-called ‘5G manifest’ (in Danish) and at a finalising conference for the project in Copenhagen for an audience from both cities, private companies, and research institutions.

This document is a summary of AKiLAY's work intended as a finalising knowledge paper.

The knowledge presented in this paper can be used as inspiration. Further research would need to have stronger validity. Thus, there may exist European 5G initiatives, that would be better comparable practice examples to inspire the Copenhagen Region cities.

Author and contact

For further information about this study please contact the author:

Henrik Aagaard Johanson, Founder of AKiLAY

henrik.johanson@akilay.dk / +45 27124221

AKiLAY ApS

Jansvej 41

DK-2300 Copenhagen

Denmark

www.akilay.com



AKiLAY help organisations and partnerships with strategic digital business development and knowledge

AKiLAY specialises in strategic digital business development and building knowledge infrastructure to increase digital readiness.

AKiLAY can help by collecting and introducing new knowledge, develop strategies, models and tools for practical use in smart city, IoT and data projects e.g., project process models for IoT use cases, value propositions for collaborative partners and develop shared knowledge infrastructure.

AKiLAY's focus is primarily a business strategic perspective, but the aim to increase coherence to more technical and IT departments, that lack today to support (sustainable) business objectives.

AKiLAY's core business is to help organisation and partners build knowledge infrastructure, that increases digital transformation through small steps in smart city, IoT and data projects.

To read more about AKiLAY, please visit our website, www.akilay.com

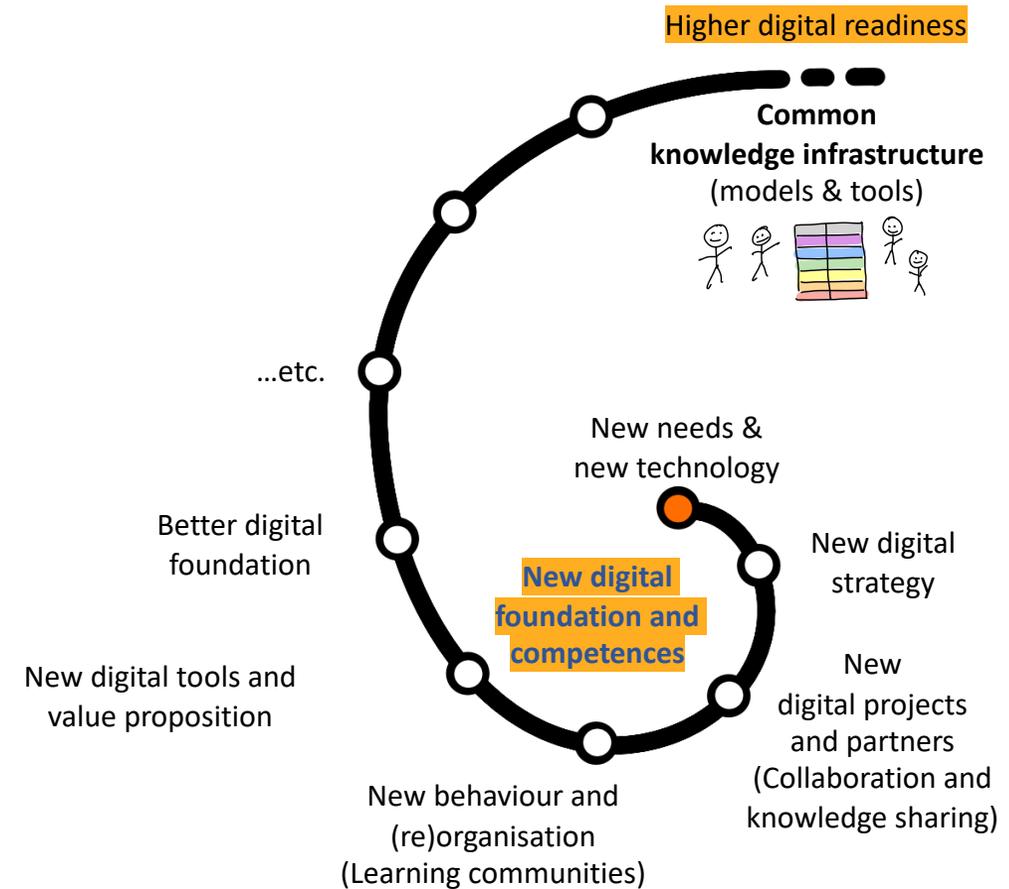


Figure 8. AKiLAY's development cycle and steps towards higher digital readiness.

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