European Commission

DIGITAL CITIES CHALLENGE

Assessment report for the city of L'Aquila

DIGITAL'AQ

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Digital Cities Challenge

Assessment report for the city of L'Aquila (DIGITAL'AQ)

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1. Introduction to the Digital Cities Challenge

According to the recent data, 72% of the EU's population lives in cities, towns and suburbs, making them the engines of the continent's economy. Cities generate 85% of Europe's GDP, they also face multiple, interconnected challenges, including energy and climate change, employment, migration, social inequality, and water, air and soil pollution.

However, through advanced digital technologies, Europe has the opportunity to re-invent the way we manage our cities' development and respond to the big societal challenges, such as efficient health management, cleaner environment, green mobility, and offering great-value jobs. Due to their high density, cities are put in a very good position to create innovative ecosystems made up of a wide array of different stakeholders from government, industry, finance, academia, communitarian organisations, social partners, etc. Cities have the capacity to make policies become reality.

In this context arises the **Digital Cities Challenge**, an initiative of the European Commission with the main purpose to support the cities in their path to digital transformation. DCC offers policy advice and support to 15 cities in Europe, namely **Alcoy, Algeciras** and **Granada** in Spain, **Arad** and **Iasi** in Romania, **L'Aquila** in Italy, **Kavala, Patras** and **Thessaloniki** in Greece, **Sofia** in Bulgaria, **Ventspils** in Latvia, **Grand-Orly Seine Bièvre** in France, **Pori** in Finland, **Rijeka** in Croatia, and **Guimarães** in Portugal. The support to be offered will speed up the digital transformation and the industrial modernisation of cities in order for them to take full advantage of the 4th industrial revolution.

This initiative draws inspiration on the recommendations set out in the "Blueprint for cities as launch pads for digital transformation". In addition, it will reinforce the networking among model

cities, facilitate their participation in on-going European initiatives in similar policy fields, strengthen stakeholder collaboration, cross-regional partnerships and stimulate investments.

The selected Digital Cities receive support in the form of field advisory services to be provided by a group of high level experts and peer reviewers, and offer the possibility for city representatives to participate in a series of capacity building and networking seminars. These activities take place in four Academy seminars during which cities share practices, take advantage of peer to peer learning and work together and in thematic groups on the steps of their transformation trajectory.

This document has been developed in the framework of the field advisory services being delivered in the city of L'Aquila. It represents the main output of the first step of the digital transformation strategy: setting the digital vision and ambition for digital transformation. The assessment report has been developed by the Digital City team on the basis of:

- The results of the Self-Assessment Tool and collection of Key Performance Indicators at the city level. A total of 25 valid replies were collected through the SAT (30th April 2018).
- A literature review of key documents provided by the local leadership team, including reports, policy documents and project plans (Appendix II for full list of documents consulted).
- An assessment visit which took place from (26th - 28th March 2018).
- A vision an ambition workshop which took place on (9th May 2018).
- Strategy workshops took place on the 11th of July 2018 and on the 19th of September 2018.

This document represents the key input to the work to be performed during the forthcoming phases of the digital transformation trajectory (i.e. definition of the city strategy and roadmap).

2. Key sectors of the local economy and DCC focus

Historically, L'Aquila economy was based on public service and trade sectors. The city of L'Aquila was established as an economic coordination centre between small towns and that role was fulfilled for long time. Only, after the second World War the economy of the city starts to take other routes.

Telecommunications and Technology Sectors. It is important to highlight the connection between the city and the Italian telecommunications sector through the Reiss Romoli, a post-graduated specialisation school in telecommunications supported by Telecom Italia. During the 60s,70s, and 80s, Reiss Romoli trained the large majority of the management of the Italian telecommunications space. Due to its high standard, the school become a point of reference for advanced telecommunications studies not just in Italy, but in Europe. Despite the school does not exist anymore, it has left a clear mark in the city inspiring various initiatives in telecoms infrastructures currently in deployment, but also driving the establishment of digital companies. Reiss Romoli, formed by some former employees of the school Reiss Romoli, is one of those companies. Specifically, Reiss Romoli provides technology training and consultancy to large enterprises worldwide. That inspiration is also visible in the Tecnoparco d'Abruzzo, where the arrival of the Chinese telecoms infrastructure company, ZTE, is boosting optimism around the possibilities offered by the 5G trial. In fact, ZTE has opened a research facility at the Tecnoparco focussed on 5G. As the development of 5G is becoming unexpectedly rapid and relevant, there could be a ZTE-effect incentivising other companies moving to the Tecnoparco. However, conditions need to be created in order to create a ZTE-effect. Certainly, this will be an important element of discussion in the definition of the digital transformation strategy. In that sense, the Department of Engineering, Mathematics and Computer Science at the University of L'Aquila is working continuously to get the momentum around 5G. Two research projects such as INCIPT and EMERGE, which explore 5G applications, see the presence of important international companies. L'Aquila will become the test-beds of cutting-edge projects and attracting the interests of other companies. However, those activities need to be endorsed by the city and the local business systems, which, sometimes, claim to feel distant from the activities of the University.

The Pharmaceutical Sector. The presence of large enterprises is not limited to the telecommunications sector. In fact, immediately outside L'Aquila, there is an important informal hub of pharmaceutical companies such as Dompe' Farmaceutici SPA. However, those companies appear to be exogenous entities, not very integrated in the city. The city stakeholders struggle to engage with those companies. Industry 4.0 applications for pharmaceutical industry could enable city stakeholders and pharmaceutical companies to joins forces together and build partnerships in the framework of specific projects.

The Construction Sector. The construction sector is probably the most active now, primarily, due to the reconstruction phase. The construction sector also drives growth in adjacent sectors such as building and road technical components and services. The construction sector is also exploring innovative ideas in the areas of smart buildings, supported by 5G trial linked projects. Those could also become a valid expertise for the construction sector on which building new business models for expanding outside L'Aquila and creating a sustainable future could be realised once the reconstruction phase is completed. Buildings for city resilience could be another important area to explore for the construction sector.

Tourism and Culture. Considering its artistic (classical and opera music in particular), architectural, and cultural heritage, art and craftsmanship community are also relevant for the economy of the city. All that can have a major impact in the development of an existing, but not mature enough, tourism industry. For example, L'Aquila is surrounded by mountains, ideal for winter tourism. Tourism 4.0 and Culture 4.0 strategy can be an important objective for the city of L'Aquila.

Agri-food Sector. There is also an important link between the tourism industry and the agri-food sector. L'Aquila is located in a rural environment with an important agriculture sector and several food companies such as the well-known "Torrone Nunzia".

Social Innovation. Finally, there is then the area of social innovation that can benefit from the use of digital technologies. Social enterprises are emerging strongly in the post-earthquake L'Aquila. They require the right conditions for improving their services and their impact on the city.

To sum up, the business system at L'Aquila is rich, diverse, linked to its economic history and the characteristics of the area. However, there are a number of challenges which need to be addressed. For example, the lack of rapid transportation systems towards Rome and towards Pescara is felt as a tremendous weak point by companies operating in any sector. L'Aquila is very poorly connected with inter-modal systems of transport and that affects the ability of companies of expanding and connecting with other markets. From the cross-sector

perspective, there is then the need for training employees and managers to be able to respond to the challenges of the market. Perhaps, that training is available, but, companies are not always aware of those opportunities. Similarly, it can be said for the availability of public and private financial instruments as well as forms of technological and business innovation support. This lack of knowledge is mainly due to a poor formal communication mode between city stakeholders. There are not formal networks that can channel the knowledge on how digital technologies can be successfully used by enterprises. Further, on the communication side, there is not branding and marketing activities of the city, on which companies could build reputation.

Looking at sector level, the **construction industry** lacks a strategic reflection on its future. Once the reconstruction is completed, the building market size will reduce dramatically affecting the existence of several construction companies. Beyond that, the construction sector is also very linked to the dynamics of the public administration which sometimes does not appear to be quick in its decision.

L'Aquila has a potential to be the hub of a **tourism** in the area. There is a spectacular nature landscape for opportunities for winter tourism. The city centre has a tremendous architectural heritage. The arts have been present in the city for long time with some examples of excellence such as "Solisti Aquilani". However, tourism is not developed as it should be and the main reason is the lack of an holistic strategy in this area.

3. Digital maturity level of the city: outcomes of the Self-Assessment Tool and Key Performance Indicators

3.1. Outcomes of the Self Assessment Tool

The Self Assessment Tool was completed by 25 organisations. Figure 1 shows the number of replies by stakeholder type.

Figure 1 Number of Replies by Stakeholder Type

TYPE OF ORGANISATION	NUMBER OF REPLIES
Companies and Industry Associations	13
Local Authorities	4
Education Organisations	3
Utility Companies	5
Financial Institutions	0

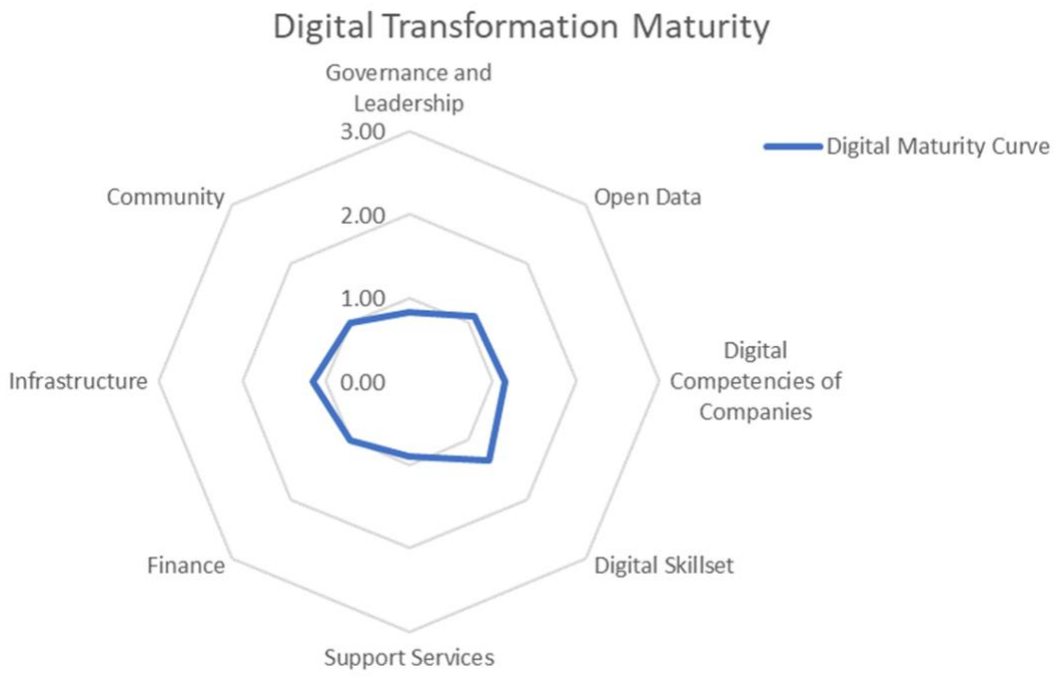
Source: SAT

The City Team has invited financial institutions to take part in the survey, but, no one has shown the interest to participate. It is important to notice that the only financial institutions present at L'Aquila are regional and national bank branches without executive capability.

The SAT results have been triangulated with the City Assessment Visit, which took place on 27th and 28th of March 2018 in L'Aquila. The City Team, including the Lead Expert, has met the University of L'Aquila, the Municipality of L'Aquila, Gran Sasso Acque (water utility), Reiss Romoli (specialised technology training company), and a number of companies and industry associations involved in digital and non-digital activities.

The result of the research shows that a city is in the early stage of its digital transformation journey as presented in Figure 2. The digital maturity of the city is assessed through 8 dimensions: **infrastructure** (availability and quality of digital and non-digital infrastructures), **open data** (availability and use of open data model), **digital skillset** (availability and quality of workforce with knowledge on digital technologies), **digital competencies of companies** (ability and sophistication of using digital technologies by local companies), **support services** (availability and quality of services for enterprises), **finance** (availability of public and private financial instruments), **community** (presence of accelerators, incubators, networks and events bringing together stakeholders) and **governance and leadership** (presence of a governance structure for digital technology policy). Each dimension is scored in a scale from 0 (very poor) to 3 (very high). L'Aquila digital maturity curve, showed in Figure 2, highlights that the overall maturity is in the region of 1 with digital skillset, digital infrastructure, and digital competencies of companies having higher scores than other dimensions. That result reflects also the perception expressed by city stakeholders during the city visit.

Figure 2 Digital Transformation Maturity at the City of L'Aquila – Digital Maturity Curve



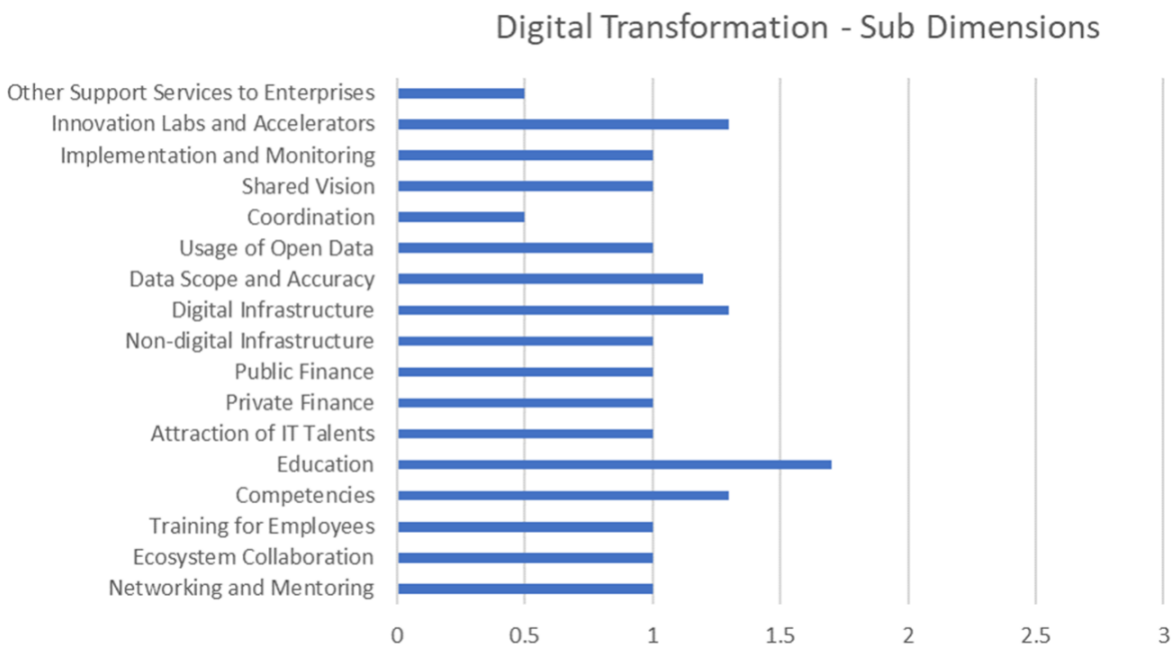
Source: Lead Expert Elaboration of SAT Results

The presence of the University of L'Aquila and the Gran Sasso Science Institute, post-graduate specialised schools in urban science, physics, and computer science, provides a strong source of new digital competencies. The digital upgrade of existing workforce seems to be more problematic. Not enough training activities is designed in the city for upgrading existing skills

in new digital technologies or in business and innovation management topics. There is also a lack of specialisation post- secondary school diploma.

Regarding digital competencies of companies, there are cases of mature adoption of digital technologies in some companies operating in the city. The case of Ludovici Raffaele & Figli in the case of manufacturing and cases of digital technology companies such as SPEE will be briefly illustrated in this document. However, that level of sophistication is not diffused in the city. Those considerations can be observed in Figure 3 always extracted by the SAT report. The dimension defined previously are composed of the sub-dimensions illustrated in Figure 3.

Figure 3 Digital Transformation Maturity at the City of L'Aquila – Digital Transformation Sub-Dimensions



Source: Lead Expert Elaboration of SAT Results

The sub-dimension with the highest score is "*Education*". That reflects the positive considerations discussed on digital skillset previously. The sub-dimension "Education" is then followed by the sub-dimension "*Digital Infrastructure*" and "*Competencies*" of enterprises reflecting the high score for the dimensions infrastructure and digital competencies of the companies.

The sub-dimension *"Innovation Labs and Accelerators"* has been scored in the range between 1 and 2. However, it has to be said that Tecnoparco Abruzzo is the only organisation present in the city that offers co-working spaces, but, it does not offer any incubating or accelerating services. However, Tecnoparco Abruzzo has the potential to offer such services.

The sub-dimension "Data Scope and Accuracy" also scores higher than 1 reflecting the positive experience coming from the open data model "Open Data Ricostruzione". However, the sub-dimension "*Usage of Open Data*" scores 1 reflecting that the use of the open data model is not happening. The experience of "Open Data Ricostruzione" and of an open weather data model present in city should be further exploited.

The other sub-dimensions are all scored 1 or less than 1 reflecting the need of major actions in those areas. The SAT and the assessment visit highlighted the lack of governance and leadership regarding digital technology policy. The "Cabina di Regia", recently inspired by the Mayor, is a good step, but, more is required. Regarding the *Community dimension*, the current scores of the two sub-dimensions reflect the fact that the concept of innovation community is very poorly present in the city. Networking events are rare in the city reducing the opportunities of exchange between stakeholders involved in innovation activities and adoption of digital technologies. This will be explored further in this document. Finally, regarding the *Finance dimension*, the availability of public and private financial instruments is not adequate. There are some public financial instruments, such as 4% share of funds for the reconstruction for digital technologies and innovation, but, there is no adequate visibility about those funds. Therefore, there is a clear need of better communication between public authorities and companies. Comparatively, looking at private financial instruments, the communication between private financial organisations and companies is almost absent. Most of the interviewees during the City Assessment Visit see banks as an unfriendly and unhelpful partner for investing in adoption and use of digital technologies.

3.2. Key Performance Indicators

The assessment of the digital maturity is completed with the use of Key Performance Indicators (KPIs). The KPIs are used to measure the eight dimensions of the digital maturity discussed previously and their sub-dimensions. However, the availability of the data for the KPIs has represented a serious challenge for the City Team. In fact, data is often not available at local level. Some other times, accessing local data is not an immediate task as it should be. The data sets are scattered in different organisations, therefore there is not a centralised data-based view of the city. The analysis of the KPIs per dimension is presented below.

Indicators on public **finance** potentially are available at the regional level, but, the data at the municipality level is missing. Obtaining indicators on private funding is problematic because of a fragmented and uncollaborative banking system. The industry associations have helped confirming that there are no venture capitalists and business angels operating in the city. There is also no exact figure on the numbers of loans granted in the last 12 months and according to

the Chamber of Commerce and Confartigianato that is a very low number. All this reflects a very difficult financial system in the city.

KPIs on **support services** confirm the picture discussed previously. There are no KPIs measuring the availability and quality of support services. However, some qualitative assessment can be done. There is only one potential accelerator, Tecnoparco Abruzzo. Currently, 10 companies are located at the technology park, including the telecommunications infrastructure company ZTE. There is a general absence of support services for companies directly linked to digital transformation topics and a lack of events on Industry 4.0.

Regarding **governance,** there is no advanced form of governance structure, a strategy, and a monitoring system in place. The recently formed "Cabina di Regia", inspired by the Mayor, is the only example of governance structure, created for coordinating activities of various digital technology projects happening in the city.

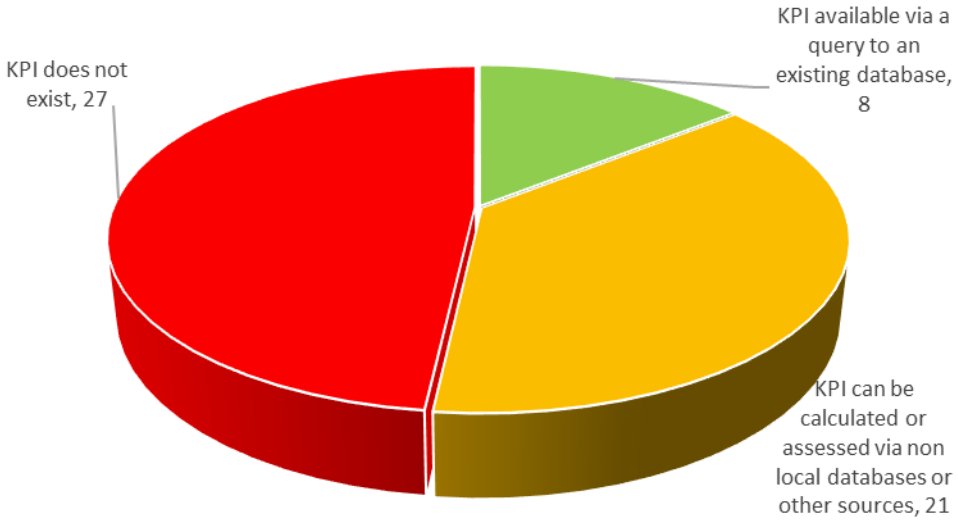
The Chamber of Commerce provides a KPI regarding the dimension **community**. That indicator is the number of start-ups operating in the city(82 in total). Other KPIs for the dimension community are not available. For example, there is no track of number of networking events on digital technology topics and no indicators on ICT cluster. In relation to the latter, Tecnoparco Abruzzo could be considered as an ICT cluster.

Instead some KPIs are available for the dimension **digital skillset**. In the last five years University of L'Aquila had 6.69% of students in digital subjects, equivalent to 1,352 students out of 20,196. Altogether 28 courses out of 58 include digital subjects. The foreign student population at University of L'Aquila is 2.21% of the total number of students. That percentage increases at GSSI, which is a post-graduate schools specialised in key subjects such as physics, urban sciences and advanced computer science attracting academics and students from all over the world. KPIs such as "# of employees in digital companies" and "# of vacancies for digital jobs" are not immediately available.

Looking at the **open data** dimension, it is possible to say that 1 open data set exist (Open Data Ricostruzione), but KPI describing the traffic on that data set is not available. More problematic is the situation with the **digital competencies of companies and infrastructure** dimensions, for which several KPIs are not available.

Appendix III shows the availability and the accuracy of each KPI. Those has been grouped in three categories: KPI available via a query to an existing database, KPI can be calculated or estimated via non local databases, and KPI does not exist. The summary of the categories is shown in Figure 4.

Figure 4. Summary of Availability and Accuracy of KPIs for L'Aquila



Source: City Team Analysis

Figure 4 shows that almost half of the KPIs proposed are not available. 14% of the KPIs are available via a direct query to an existing local database. The remaining requires research and estimation. This situation illustrated needs to improve dramatically if the City wants to have an evidence-based policy making approach to digital transformation. The set of KPIs needed for enabling a measurement framework should be almost immediate and rich. Today, the situation is very far away from this objective.

4. The local digital ecosystem: leadership and governance

L'Aquila is living a tremendous period of transformation following the earthquake happened in 2009. That transformation is not just about re-building the city, but, also giving to L'Aquila new dimensions for creating a prosperous identity for the future. Advanced telecommunications technologies have been seen as a driver for developing that. L'Aquila wants to become a living laboratory for new technologies. In fact, there are several initiatives happening at L'Aquila in terms of digital and non-digital infrastructures such as 5G Trial, Smart Ring (fibre optics deployment), and Smart Tunnel (underground city service management system). Those initiatives together will bring L'Aquila at the fore front of telecommunications infrastructure for cities creating the conditions for promoting innovation among business systems, enabling new forms of entrepreneurship and attracting companies to locate in L'Aquila. However, to achieve that, the technological infrastructure is not the only condition. Above all, a strategy that defines, guides, and monitors the process of digital transformation is necessary.

Currently, there is no a governance structure that can ensure that. However, in April 2018, , the Mayor of L'Aquila has promoted the establishment of a coordination group (Cabina di Regia). This group, composed by advisors of the Municipality, University and local association of engineers, has the objective of ensuring a holistic view of all the digital technology initiatives in place in the city, coordinating them, monitoring them and assessing their business opportunities. The "Cabina di Regia" appears to be more an explorative group with advising objectives, rather than having an operational mandate. In addition, the group should be opened to representatives of other city stakeholders for making the work more inclusive and effective.

The Digital Cities Challenge project could help the process of transforming the "Cabina di Regia" into a formal organisation in charge of the governance of digital transformation policy at L'Aquila. In fact, the Digital Cities Challenge provides a framework for evidence-based and monitored oriented approach to digital transformation city policy and an extensive network in which exploring governance best practices.

5. The use of digital solutions by local companies

The adoption of digital solution is not uniform among companies. There are some software companies providing products and services in web technologies and also the Internet of Things applications such as remote monitoring (*SPEE)* and wearable devices. However, that level of sophistication cannot be observed in non-digital companies. Companies mainly use basic Internet tools. There are few cases of companies exploring the use of innovative digital technologies. However, those companies mainly operate in a silo approach. Among those companies, there are some exceptional cases. For example, the case of *Ludovici Raffaele & Figli* is important to highlight for its excellency. The company manufactures components for the construction sector. Their components are used in buildings, but also in road construction and other transport infrastructures. Their products are based on innovative manufacturing approaches – the company holds two patents – including also sensor technology. The company sees technological development as a key competitive advantage. All this is inspired by a member of the company, who has a personal interest in digital technology, who continuously pursues in-house innovation activities. The company has not been a beneficiary of any digital technology programme available. The two reasons of interest in this case are following. Firstly, *Ludovici Raffaele & Figli* is running Industry 4.0 projects demonstrating that industrial Internet applications are possible in L'Aquila too. Secondly, the case is an example of a silo activity without any connection with the city. *Ludovici Raffaele & Figli* could become a champion of innovation and a best practice for others, but, there are not instruments that can enable that.

Putting aside the excellence in the city, SMEs in L'Aquila struggles in pursuing innovation via the use of digital technologies. Generally, there is a poor knowledge about the benefits can be achieved through concept such as Internet of Things, mobile applications and data management and analytics. The business community seems to agree on the importance of having broadband connectivity as a basic enabler for the use of digital technologies and develop of new business ideas, but, there is less clarity on how to achieve that. To sum up, there is a strong cultural barrier to overcome. Looking instead at technological issues, the performance of broadband connectivity is not always adequate, primarily depending on the location. Broadband quality is excellent in the city centres. It requires improvements in the

periphery. Generally, local companies believe that the telecommunications initiatives deployed in the city could improve solve those issues and, that, in turn, could enable new business opportunities. But, investing in broadband infrastructures should also come hand in hand with investing in explaining and demonstrating what a company can do with broadband connection. That lack of understanding is also due to the lack of digital skills in understanding the potential of digital technologies and how to exploit. Therefore, upgrading existing workforce at any level becomes crucial. But, it appears that it is not easy to do. There are not enough skill formation initiatives for existing workforce. And if there are, sometimes, their existence is not known to the entire business system.

This lack of knowledge on city initiatives also applies to the financial instruments for the adoption of digital technologies. In fact, there are some public financial instruments, but they are not very clearly and widely publicised. Regarding private financial instruments, the banking system is seen as a complicated partner to support development of digital technologies and that sentiment exacerbates at the start-up stage. Finally, it should be highlighted that the communication among stakeholders is mainly based on informal ties. That causes poor knowledge on support services and financial services for companies.

Figure 5 summaries the main strengths and barriers in the adoption of digital technologies.

Figure 5 Strengths and Barriers in Adopting Digital Technologies

Use of Digital Technologies by Local Companies	
Strength	**Barrier**
Presence of case of cutting edge use of digital technologies	Lack of digital culture among some companies
Presence of innovative digital technologies	Connectivity technology performance not always adequate
Several projects on digital technologies in development	Lack of knowledge on how to exploit digital technologies
	Difficulties in reaching funds for the use of digital technologies
	Support services for digital technologies not available or not known
	There are not enough training tools for upgrading existing workforce

Source: City Team

The situation showed in the Figure 5 is applicable across sector. Facing those barriers will enable companies to embrace *Ludovici Raffaele & Figli*'s attitude to technology, reaching the same results and becoming more competitive.

6. Community engaged in digital transformation

The concept of digital community, or simply business community, in the sense of formal or informal structure able to share ideas, enable networking, promote best practices is really at embryonic phase in L'Aquila. Industry associations run some events, but, they are one-off activities mainly designed around offering training in a specific topic. The Urban Centre was recently created to enable the community to discuss about urban development. In 2017, Fab Lab Aquila was launched. The Fab Lab run mainly courses on coding and other technologies for the youth. The lack of digital community reflects the silo activity discussed in the previous section. The existing evidence points that there is the lack of sharing platforms bringing companies together and enabling existing champions of innovation to become a best practice to follow.

In order to develop those initiatives, the initial support could come from Tecnoparco Abruzzo, which following the ZTE-effect could work towards becoming the core of the digital community at L'Aquila hosting periodic events on how 5G and telecommunications could affect business development. The Department of Engineering, Computer Science and Mathematics could be another excellent candidate. As described previously, the Department is very active and central to all the digital technology initiatives happening in the city, therefore enabling digital community means opening those to the entire city, bridging to the business sectors, perhaps, creating the conditions for formal technology transfer activities. Gran Sasso Science Institute (GSSI) can also promote community building around the Open Data Ricostruzione initiative. Finally, the initiative can come from young entrepreneurs, strongly supported by the city stakeholders (i.e. Municipality, University and others). In L'Aquila, there are cases of young entrepreneurs in digital and non-digital start-ups. An important initiative could be to bring together those experiences for creating a community that enables further community building in the city. Fab Lab L'Aquila could be an important player in this area.

7. The state of local digital and physical infrastructure

The common view is that physical infrastructures should be absolutely improved. The connections towards Rome and Pescara, towards intermodal transport systems and airports are not adequate for the development of the city. Comparatively, digital infrastructures represent the strongest element of the city of L'Aquila. It has also produced some results such as attracting a company ZTE to locate an R&D centre in the city and the finance of several projects in cutting-edge applications such as autonomous vehicles using 5G connectivity. There are several projects in areas such as smart city, connectivity, smart buildings, cybersecurity and others. Below, the subsequent parts of this section provide an overview of the most important ones.

In compliance with the Italian Digital Agenda, and with the aim of improving the access to ICT and supporting innovation in the context of the digitization of the PA (Public Administration), the University of L'Aquila is implementing the project "**Metropolitan optic network for the PA and experimental optic network for the city of L'Aquila**". It will pursue the wiring and the building of any other infrastructure necessary for the development of a metropolitan network (MAN) linking the city administrations, as well as for the development of an experimental optical network and a wireless extension available to the National and International scientific community (with university coordination). The project has been funded by CIPE with €6.5 million. Part of the project will be developed in partnership with the Company Gran Sasso Acque Spa, which is actually leading the flagship construction project "**Smart Tunnel**", a 20 km underground tunnel for the piping and delivering of water, power and communications into the old city.

"L'Aquila Smart City" project was born from an agreement between the Municipality of L'Aquila and ENEL (in the context of the post-earthquake reconstruction activities) in order to restore, strengthen and make 'the intelligent' electricity; to raise citizens' awareness about their own electricity consumption and to encourage their reduction; to promote alternative and sustainable mobility, facilitating the diffusion of electric vehicles. The initiative is running around the following thematic areas:

- "Grid automation", includes infrastructure interventions designed to make the current power grid more efficient and secure, and to implement its functionality for automated management. Above all, in the context of a smart and interconnected network, a broadband communication system (a fibre optic network) will connect all ENEL cabins distributed across the country from the periphery to the city centre.
- “Smart info”, which wants to raise and empower citizens awareness on domestic electricity consumption. It was delivered to all inhabitants free of charge a device able to 'communicate' with the new smart grid and providing users with simplified data about their consumption over the whole day directly to PC, smartphone or tablet. Collected information is then analysed by Enel, which can provide individual users with practical tips to reduce energy consumption. To date, about 40,000 devices (about 70,000 inhabitants) have been distributed.
- “Smart urban service”, which involves the installation of a publicly-used infrastructure network for charging electric vehicles. At present, 15 electric power stations have been installed, but all over 39 are in the area: 37 double-socket (electrical outlets are compatible with all types of attacks on the market) and 2 with three recharge points ("fast recharge" capable of recharging a battery in 20-30 minutes, against 6-8 hours of 'standard' columns. The proposed system is designed for charging private electric vehicles as well as for those that will be acquired by the municipality to activate a car sharing service, useful especially in the city centre. The whole project is funded by Italian Government with €16.2 million.
- Smart Community: an ENEA pilot project, financed by the MIUR and implemented in agreement with the Municipality with which a Memorandum of Understanding was signed for the sustainable reconstruction of the city. A ’physical square’ (near the Renzo Piano’ Auditorium) will be equipped with three large screens, allowing to show and share in real time all the initiatives, events, activities entered by citizens and associations in the 'Piazza100' portal, that represents the 'virtual' square. The hub is interconnected with the web portal and with the APPARTION APP100 smartphone app: the use of these three tools together represents the first experiment of Smart Urban Network in Italy, one of the possible ways to build smart communities.

Smart Ring is an urban development pilot based on a road link with intelligent public lighting installations, sustainable mobility, energy management and environmental monitoring, which aimed at the integration of mobility urban services, environmental monitoring and smart lighting along a 4-5 km circular path, the “Smart Ring”, around the historical centre of L’Aquila.

The **5G Trial** could represent another important driver for digital transformation**.** L'Aquila has been recently involved in the National Initiative "5G Cities", a pilot project which will last for 4 years (2017-2020) with the aim to test innovative services and technologies at service of the citizen, new business models among network operators, industry, SMEs, Academia, Research centres and Public Administrations. The main areas of experimentation are:

- Virtual and Augmented reality applied to Cultural Heritage: Valorisation, customised guided visits, virtual tours. One of the most important applications, given the seismicity of the territory, will be the establishment of a system for detecting and tracking damages and building movements through a network of sensors and drones. Anyone will be able to control the "state of health" of the buildings in real time and thus plan timely and timely interventions for greater citizen security and lower costs of implementation and maintenance.
- Agriculture: Innovative solutions are also available in the agri-food sector - in particular in precision agriculture and traceability of the supply chain - realized through the use of blockchain technologies, certification systems and the use of drones. It will be easier and more reliant to enhance the made in Italy and guarantee the quality and authenticity of products and production.
- E-Health: Thanks to the 5G it will be possible to have an integrated telemedicine system for remote medical consultants, with smart glasses, and remote monitoring of patients and vulnerable subjects by medical devices. It will also be possible to deliver drugs with drones. It can lead to more effective and timely interventions, reduced healthcare costs, more affordable care, and greater patient satisfaction, which can be taken care of at home.
- Smart Security for Smart City: The experimentation on L'Aquila encompasses law enforcement solutions for police and private surveillance through the use of smart glasses provided to street agents and drones equipped with high resolution cameras from top to bottom, in direct connection with the operations centre. The aim is to ensure greater security for citizens through coordinated and collaborative management of agents and timely and timely interventions. Enhanced viability: Finally, the 5G will offer new opportunities and advanced solutions in the field of advanced traffic, vehicles connected to the network that interact with other vehicles and infrastructure, and the management of fleets of vehicles (e.g. emergency, emergency, transport special hazardous substances) in emergency situations and day-to-day operations. Again, the

expected results are effective, efficient and secure fleet management; the safety of vehicles, drivers and people; the reduction of road traffic and pollution.

To sum up, digital infrastructures represent a strength for the city. Certainly, the work on the digital side should come with an effort on the improvement of the physical infrastructures. Figure 6 summaries the situation of L'Aquila in terms of infrastructures.

Figure 6 Strengths and Barriers of City Infrastructures

Physical and Digital Infrastructures	
Strength	**Barrier**
Smart Ring (Fiber Optics)	Physical connections (road and rail) towards Rome and Pescara to be improved
5G Trial	Poor high-speed connectivity outside the city centre
Current 4G coverage	
Urban Mobility Plan	
Projects spinning off from 5G Trial and Smart Ring	
Smart Tunnel	

Source: City Team

8. Digital solutions enabling the modernisation of business environment

The embracement of a digital paradigm for the public administration is more an ambition than a reality. The Municipality of L'Aquila at operational and political level is aware of the importance of introducing digital administration practices for citizens and enterprises, but, there is not a clear strategy in place for that. It should be said that since the earthquake in 2009, the Municipality of L'Aquila has concentred its attention on the reconstruction process.

In fact, the only public open data initiative was designed around the topic of the reconstruction. The Open Data Ricostruzione (http://opendataricostruzione.gssi.it/) initiative was established to enable transparency in the reconstruction process. It can be considered as a sign of attention on the digital paradigm by the local public authorities. However, that it is only a drop of what could be a more comprehensive initiative to spread digital modus operandi in all the practices of the Municipality and other public policy organisations. That implies a dramatic cultural shift in the management and operations of public organisations, in additional to political will and time.

It is also important to point out to a necessity of having a structure in charge of the implementation of the strategy led for instance by the "Cabina di Regia". As described previously in this document, the Coordination Group aims to make sense of the various digital projects happening in the city and identifying ways of managing their development, implementations and monitoring the results. The "Cabina di Regia" could also become pivotal for driving the adoption of digital paradigm in the relationship between the Municipality and the representatives of economic operators.

9. Data-driven innovation

There are several databases opened to the public use, primarily offered by industry associations. Those databases revolve primarily around data on company demographics and activities. They have been used for market research, but on very limited occasions. Data from sensor-based applications are not available. The only example of open data model in the city is the Open Data Ricostruzione (http://opendataricostruzione.gssi.it/), managed by Gran Sasso Science Institute (GSSI) and developed by a collaboration among GSSI, University of L'Aquila, Municipality of L'Aquila, ActionAid and National Office for the Reconstruction. The database provides information on the stage of reconstruction of private and public buildings. The Open Data Ricostruzione is primarily a transparency tool for citizens and companies. There is also a weather data platform developed by Meteo Aquilano, a local association of experts and amateurs on weather data, that provides access to real-time weather data.

Despite the fact that those open sources represent good examples of open data models, local companies use them very rarely. The use is primarily around querying the data set to get some information, however, there are no cases showing companies developing products or services on the basis of public data available. That is due to the lack of knowledge about what can be done using those data and the lack of skills able to develop ideas on that data. Generally, the idea of innovation via open data models is not part of current business practices. It should be promoted among companies and requires the following three main activities:

1) Creating new data sets, particularly, the ones related to smart applications in the city. For example, there is a smart lighting deployment in the city. The data gathered from that application can be made available in an open data model.

2) The current database infrastructure of the city is scattered among different organisations. Bringing together those databases into an open integrated model for citizens and enterprises via a portal. However, that requires a substantial shift in data management and governance in the city. The most important challenge is to develop a shared data governance structure.

3) Developing events for training city stakeholders on open data models and their benefits.

10. Skills and entrepreneurial culture

The education system at L'Aquila is able to provide the labour market with high-skilled people, at graduate level and post-graduate level. In fact, the University of L'Aquila is capable of forming future professionals in various disciplines with strong capability in digital technologies offering graduate and post-graduate courses in engineering, mathematics, physics and computer science. There are several courses in various disciplines, which include digital tools and technologies. Additionally, GSSI (Gran Sasso Science Institute) is specialised in PhD studies in disciplines such as physics, computer science, mathematics, and urban studies.

Despite this strong academic institution, the city of L'Aquila suffers a substantial brain drain as many other Southern and Centre Italian cities. This represents a big challenge for cities like L'Aquila and an important issue to consider in the definition of a digital transformation strategy for the city.

The other important issue for the debate on digital transformation strategy is the level of digital skills among the existing workforce. There are digital companies working on cutting-edge technologies upgrading skills through in-house activities and engagement with the university, even though it is claimed that that is not always an easy task. Upgrading digital skills in on digital companies is a major problem. There are exceptional cases in which that happens in-house. However, in most of the cases external training activities are needed. Companies recognise the existence of forms of training, run by industry associations primarily, but more is needed. There are not many training initiatives, and their visibility could be improved.

The organisations running trainings also highlights difficulties in organising such activities more frequently and for large audience. Coordinating those activities could be useful for providing a more holistic approach to training visible to the entire business system at L'Aquila. It is also important to note that the training is not necessarily limited to digital technologies, but, also includes business model innovation, and management practices. Another issue is related to the role played by the university in the training process of existing workforce. Companies would like to see more engagements with the university in this field. The business representatives also believe that secondary schools, particularly the technical ones, should involve in this debate. They could provide, collaboratively with university, post-secondary school diploma training.

Finally, digital entrepreneurship is not well developed in city of L'Aquila. There are very few examples of university spin-offs. There are not incubators or accelerator programmes that enable entrepreneurship. Tecnoparco D'Abruzzo could play an important role for entrepreneurship at L'Aquila providing incubating and accelerating services in collaboration with the University, GSSI and the Municipality

11. Digital transformation SWOT analysis

	Strengths	Weaknesses
Infrastructure	> Availability of wired and wireless high speed networks > Cutting-edge connectivity trials (5G, LPWAN) > Urban Mobility Plan	> Some activities in early stage > Network coverage limited > Lack of dev on software/data analytics infrastructure > Problems with non-digital infrast.
Access to data	> Open Weather data project > Open data on post-earthquake reconstruction buildings (3 databases including regional one)	> Data silos not integrated > Low culture of data openness > Existing open data model management poor
Digital skillset	> Strong ICT-oriented university > ICT-oriented research centers (public and private > Post-graduate ICT specialized education institutes	> Lack of collaborative strategy among (uni-public sector- private sector) > Lack of demand (companies do not ask for those skills) > Pre-university digital education not appropriate
Companies' digital competencies	> High digital competencies among digital companies > Web/e-commerce competencies well adopted among business sectors > Presence of some champions	> Lack of mentoring/training activities > Lack of collaboration among stakeholders able to diffuse new tech > Lack of knowledge on new digital tech (IoT, AI)
Community	> Polo ICT Abruzzo > Dominio Space – Digital Class at Uni > Thematic Research Nodes	> There are not incubators and accelerators > Lack of networking in general > Community activities are not structured > Industry associations not active in networking facilitation
Finance	> EU funds managed by local authority (mobility) > 4% Reconstruction Funds dedicated to innovation	> Lack of private investments in any form and size > Perception on difficulty engaging with banks > Lack of visibility on opportunities
Support services	> Some activities from university and GSSI (Gran Sasso Science Institute)	> They are not many and the ones present are not known
Governance & leadership	> Collaboration between municipality, university, and research centres on projects > Recent creation of a Coordination Group for managing 61 digital projects	> Early stage of the collaboration. > Lack of aligned and shared vision

	Opportunities	Threats
Infrastructure	> Enabling companies using infrastructure for business purposes (Living Lab for enterprises) > Promoting entrepreneurship > Attracting external companies (ZTE-effect)	> Levels of uncertainty (delivery time, under usage) > Difficulties in understanding the business value of the infrastructures
Access to data	> Data integration project leading to open data models (supported by evolving infrastructure) > Promoting new services > Transparency	> Privacy > Regulatory environment > Cybersecurity (Uni-companies project on this topic)
Digital skillset	> Driving new forms of employment > Increasing quality of digital skilled people > Promoting digital culture	> Digital skilled brain drain > Do not exploit current skillset > Lack of coordination and training silos activities
Companies' digital competencies	> Leveraging the infrastructure as source of innovation for raising the quality of digital competencies among business systems > Creating "Digital professionals"	> Lack of awareness of potential of digital technologies > Migration of company champions
Community	> Creating awareness on the potential of digital technologies > Knowledge creation > Best practices sharing	> Remaining silos > Too much focus on the after earthquake reconstruction phase > Too little, too provincial!
Finance	> Attracting external investors > Increasing stakeholders' capacity of attracting funds > Using the Lab as an investment enabler	> Inertia (remaining in the same status) > Random allocation of funds - not really per merit > SME isolation from the financial opportunities
Support services	> Creating support services dedicated to company growth, particulary SMEs and start-ups	> Inertia
Governance & leadership	> Rationalising the route towards a common digital strategy avoiding overlaps. > Making the coordination official (perhaps an agency)	> Strongly dependency on political will, consequently, the collaboration among stakeholders could end or change directions

Appendix I: Table of abbreviations and definitions

Digital Cities Challenge (DCC)

The Digital Cities Challenge initiative, was launched by the European Commission in November 2017 and scheduled to run until August 2018. It helps cities (The Digital Cities, referred as DC) develop and implement digital policies that can transform day to day life for residents, businesses, workers, and entrepreneurs.

Digital City Teams (DCT)

Each participating Digital City has a Digital City Team which will be in charge of managing and coordinating the involvement of the city in the Challenge. Digital City teams will include a) the core team which consists of one Lead Expert, one Local Expert, one Support Consultant as well as Thematic Experts; and the b) the Digital City leadership team which is made up of representatives of the city (i.e. local elected officials, local public servants, and the designated project management team).

Digital Transformation Trajectory (DTT)

The Digital Transformation Trajectory refers to the evolutionary path a city follows while taking part in the initiative, from the preliminary assessment of the digital potential of the City, to the definition of the City's digital transformation strategy and roadmap.

Field Advisory Services (FAS)

Field Advisory Services are services provided by the Digital Cities Challenge to Cities throughout the duration of the initiative. The Field Advisory Services include the organisation of one assessment visit and a number of local workshops, which will gather local stakeholders involved in defining the digital transformation strategy of the City.

Key Performance Indicators (KPIs)

The objective of the KPIs is to collect data that can diagnose the current status in terms of digital maturity and measure the progress made by cities during and at the end of the Digital Cities Challenge initiative. The KPIs will facilitate the activities of the policy makers and stakeholders of cities when identifying and addressing the bottlenecks and obstacles of the

processes of digital transformation and industrial modernisation. They will also enable the right identification of the key success factors of the different initiatives and actions undertaken.

Self-Assessment Tool (SAT)

The objective of the SAT is to identify the starting points for discussion on how to (further) develop, reshape and improve the digital transformation strategies of European cities. It is an online-tool developed by the project with a set of questions and corresponding response options to be filled in collectively by a set of stakeholders such as industry representation, utility companies, education and research and financial institutions. The SAT covers eight key dimensions: Infrastructure, Open data, Digital skillset, Digital competencies of companies, Community, Finance, Support services, Governance and leadership.

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Appendix III: Avalaibility and Accuracy of KPIs

The list below shows the set of KPIs per sub-dimension and their availability.

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
Infrastructure	Digital infrastructure	% of households with broadband internet at home [%]		1	
		% of enterprises with broadband internet at home [%]		1	
		% of households with internet at home [%]		1	
		Average speed of internet [Mbps]		1	
		Average cost of broadband internet [EUR/Mbps]		1	
		% of people using mobile internet to go online [%]		1	
		% of city covered by 4G [%]		1	
		Average cost of mobile internet [EUR/Mbps]		1	
		Availability of (intelligent) sensors in the city (e.g. Low Power Wide Area Networks for the			1

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
		connectivity of devices)			
		Number of unique devices connected to wireless internet freely available at public spaces in last 12 months [#]			1
	Non-digital infrastructure	Availability of integrated mobility platform to travel across transport modes [Y/N]			1
		Availability of real-time transport monitoring system [Y/N]			1
		# of public transportation tickets purchased online [#]			1
		Availability of one-stop shop for water, gas, electricity for address changes or new addresses? [Y/N]		1	
		Availability of coax or fibre network at main business parks [Y/N]		1	
		% of permits (e.g., housing construction, house extension) applied for online in last 12 months [%]		1	
		% of Individuals who used the internet for interaction with public authorities (average for the last three years)			1

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
Open data	Data scope and accuracy	Availability of open datasets [Y/N]		1	
		# of downloads of open datasets in last 12 months [#]			1
		% of datasets offering real time information [%]			1
	Usage of open data	Number of cases of digital companies using open data to develop a new service or to support their business operation [#]			1
		Number of cases of non-digital companies using open data to develop a new service or to support their business operation [#]			1
Digital skillset and education	Digital education	% of people who bought or ordered goods or services over the internet in past 12 months [%]			1
		% of students in digital subjects over the last 5 years [%]	1		
		% of ICT graduates employed in the city over the last 5 years		1	
		% of non ICT/digital diplomas at university colleges, universities (e.g., medicine, economics, biology, agriculture) including digital courses	1		

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
	Attraction of IT talent	# of employees in digital companies [#]		1	1
		# of vacancies for digital jobs [#]			1
		% of foreign students in digital subjects [%]	1		
		% of vacancies for digital jobs not filled in 6 months [%]			1
Digital competencies of companies	Competencies	% of companies with internet website [%]		1	
		% of companies offering online payment option		1	
		% of manufacturing companies offering digital services (e.g., company offering remote maintenance)			1
		# of mobile applications available in the city on smartphone (such as food delivery, peer-to-peer car sharing etc.)			1
		# of users of mobile applications available in the city on smartphone (such as food delivery, peer-to-peer car sharing etc)			1
	Training for employees	Share of companies offering training to their employees that are aimed at enhancing their digital skills			1

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
Community	**Ecosystem collaboration**	Number of ICT clusters and number of ICT companies joined as cluster member in any cluster organised/formed in the city		1	
		# of digital start-ups	1		
	Networking and mentoring	Number of events on digital topics and/or for digital companies in the last five years		1	1
Finance	**Public**	Grants / tax incentives provided at city level to support digital start-ups in last 12 months [EUR]			1
		# of digital start-ups which received grants / tax incentives at city level in last 12 months [#]			1
		Grants / tax incentives provided at city level to support non-digital companies for digital projects in last 12 months [EUR]			1
		# of non-digital companies which received grants / tax incentives for digital projects at city level in last 12 months [#]			1
	Private	Number of digital start-ups receiving a loan in last 12 months [#]			1

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
		Number of digital start-ups received venture capital in last 12 months			1
		Availability of business angels for digital start-ups [Y/N]		1	
Support services	**Innovation lab & accelerators**	# of innovations labs / accelerators [#]		1	
		# of start-ups / companies attached to innovation labs / accelerators [#]		1	
	Awareness raising	Number of participants in awareness raising events organised in the area of digital transformation/Industry 4.0 etc. [#]			1
	Other support services	# of support services (other than financial) available for supporting digital transformation in the economy			1
Governance and leadership	**Shared vision**	Availability of digital strategy [Y/N]	1		
	Coordination	Availability of clear executive responsible for digital development plan [Y/N]	1		
		# of man hours of executive responsible on weekly basis dedicated to coordination of digital	1		

Dimension	Sub-Dimension	KPIs	KPI available via a query to an existing database	KPI can be calculated or assessed via non local databases or other sources	KPI does not exist
		development plan [hours]			
	Implementation and monitoring	Existence of a monitoring framework for the implementation of the city digital strategy [Y/N]	1		
			8	21	27

Source: City Team

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