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# Guimarães: Intelligent City Transformation Overview

ICC Final Deliverable

European Commission | The Intelligent Cities Challenge is funded by COSME, the EU programme for Competitiveness of Enterprises and SMEs

# Executive summary [1/4]

- Being the birthplace of Portugal, Guimarães is a community with deep roots and a strong sense of identity, pride and belonging. In the image of the first king of Portugal, who was born here, Guimarães is inhabited by resilient people committed to the great causes of the city, such as the European Capital of Culture, European City of Sport, and now as one of the European 100 climate-neutral cities by 2030.
- In the city-needs analysis that was carried out, Guimarães stood out for the protection of its environment and sustainable development (Guimarães 2030 Sustainable Development Strategy), resilient industry (as seen during the pandemic), increasing digitalisation of businesses and city services, public security, and suitable access to health services.
- The main challenges highlighted to be faced in the near future include mobility and traffic congestion, monitoring of local pollution, energy consumption (especially in public buildings) and mismatch between existing skills and business needs. It was decided that all these challenges would be addressed under the ICC Guimarães strategy through specific digitally enabled measures.

# Executive summary [2/4]

- A number of major aspirations were defined together with the citizens to be achieved by 2030: Guimarães should have high standards of quality of life based on good technological infrastructure, sustainable economic growth, employment opportunities in the knowledge economy, and preservation of the environment. Based on these ambitions, the following long-term vision was established for the city:
  - "Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities".
- Five solutions were prioritised to achieve that vision and to address the identified ambitions and needs : 1) enhancement of the city's digital infrastructure and services; 2) sustainable mobility; 3) smart and sustainable energy; 4) monitoring and promoting environmental quality; and 5) capacity building.

# Executive summary [3/4]

- The implementation of the ICC Guimarães' action plan contributed to the expansion and improvement of the city's digital infrastructure (initiative #1), increasing the territory covered by the internet and by LowPowerWAN network, and fostering new digital services and applications.
- Better urban traffic management and more sustainable mobility was achieved through the implementation of new real-time available information solutions on underground and surface parking (initiative #2) and traffic monitoring (initiative #3).
- Reduction of energy consumption of public buildings (initiative #4) was accomplished with new investments in smart grids and public lighting infrastructures, while further efforts were made to monitor and reduce local pollution (initiative #5), namely regarding greenhouse gas emissions and concentration of fine particles.
- First steps were taken towards the creation of a Digital Academy (initiative #6) that will significantly support the digital transformation of local businesses, and more than 1,500 9$^{th}$ grade students were involved in an extensive career guidance programme (initiative #7) fostering better career choices and the development of critical personal and professional skills.

# Executive summary [4/4]

- In the coming years, Guimarães will continue to invest in people and organisations' access to high quality digital infrastructure and online services, ensuring that skilled people will improve their living standards by increasingly using digital technologies. Existing and new businesses will use digitalisation to improve productivity and grow, and a higher proportion of residents (particularly young people) will have jobs in knowledge-based and green businesses.
- As one of the European 100 climate-neutral cities by 2030, Guimarães will firmly continue its strategy to ensure that citizens' lifestyles and business activities will become even more sustainable and that the protection of the city's natural assets and ecosystems will be higher, also thanks to digital solutions.

# Mayor Foreword

Guimarães has a strong momentum for innovation and a digital and smart strategy. With a well-defined digital vision and strategy in-place, city innovation strategy aims to plan, organize and implement municipal policies in urban and public space, social and community intervention, education, environment, culture and sport, providing services to citizens.

To bring citizens closer, Guimarães has created a set of initiatives, pointed towards transparency, simplicity and inclusive access to the services provided by the municipality. Making use of new functionalities and betting on pioneering services, this ecosystem values the proximity relationship with citizens, promotes channels of dialogue and communication between city inhabitants and municipality allowing them to have access to the municipal services remotely.

Guimarães innovation ecosystem key vectors relies on knowledge as the driver for development. Therefore, the municipality aims to become a resilient, climate-neutral city contributing thus to improve the quality of life, urban environment and attractiveness (talent, resources, ideas, innovation, jobs and entrepreneurship), foster openness to innovation and creativeness and improve the quality of public services, security and safety as key success factors. This can only be possible with an integrated approach supported by a solid strategy namely with a quintuple helix model and a strong commitment to achieve the agenda 2030 and the respective SDGs.

The participation in the ICC initiative contributes to city's vision to be a resilient city that evaluates what the city does well and what it can do better through the use of data analysis and relies on smart transformation to boost economic growth and improve quality of life and make Guimarães known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities. To achieve the vision, the city designed and started the implementation of projects aiming to: 1) enhancement of the city's digital infrastructure and services; 2) sustainable mobility; 3) smart and sustainable energy; 4) monitoring and promoting environmental quality; and 5) capacity building.

The city benefited through the ICC's knowledge transfer and capacity building mechanisms empower the city to financing, open data, innovation, sustainability and climate neutrality topics. As a result, the city was selected to participate in 100 Climate-Neutral and Smart Cities Mission.

# The city of Guimarães pursued an EU-supported transformation over four main stages, and this document details that journey by these sections

## Overview to the city's journey and structure of this document

*Reported as one section*

| | 1 Preparation & assessment | 2 Ambition & roadmap | 3 Implementation | 4 Review & way forward |
|---|---|---|---|---|
| | 5 months:<br>September 2020 – January 2021 | 3 months:<br>February 2021 – April 2021 | 15 months<br>May 2021 – July 2022 | 2 months<br>August 2022 – September 2022 |
| Summary | Find out where Guimarães is, where it should go and who in the ecosystem is going to mobilise make things happen. To better understand the city needs, several initiatives were carried out in conjunction with a wide range of stakeholders, including the application of a large-scale questionnaire ("city scan"), individual interviews and organisation of two events largely attended by local organisations and individuals. Vision and ambition statements were established and 5 key priority areas were defined. | Develop a concrete plan to achieve measured improvements, collaborating with the community; push action with immediate benefits. A roadmap was prepared with detailed information on the actions to be implemented, including key activities, goals, contributors, budget, funding and timing. A governance structure was set up, while actively engaging the local community (a specific event was held for the roadmap) and strengthening the cooperation with other ICC cities. | Get "big moves" done and see results; take action in partnership with others. ICC Guimarães priorities and initiatives were implemented and monitored during this phase in accordance with the roadmap/action plan. | Measure success and commit to keep connections and improvements going. An extensive evaluation of key performance indicators - both quantitative and qualitative - was carried out, considering both direct outputs from the ICC initiative and overall impact on city performance. Key lessons were learned and commitments and main targets were defined for the coming years. |

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Section

1

# Guimarães: Preparation and assessment

ICC transformation

September 2020 to January 2021

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# Introduction

Guimarães' participation in the Intelligent Cities Challenge (ICC) was aligned with key strategic priorities established in the last years to make the city more sustainable and intelligent towards a more digital and low-carbon economy:

- Vision "Guimarães more than green" (2013) aiming at the sustainable development of the whole municipality territory based on a new governance model whose key pillars are leadership, education, sharing, involvement and cooperation.
- Digital Cities Challenge (DCC) (2018-2019), in which a strategic vision and action plan for digital transformation was developed and implemented.
- Guimarães 2030 Strategy and its Action Plan 2020-2021 based on nine pillars: governance; climate change; nature, biodiversity and sustainable tourism; waste; air quality; sustainable mobility; energy performance; monitoring systems; and water management.

# City needs: State of the city overview

Significance of insight to what we want to do on the ICC

- Of critical importance to ICC journey and we should be working to change
- Of importance to ICC journey, and we should act to change this along the journey as opportunity presents
- Contextually relevant, but not major point of attention in ICC and unlikely to be impacted on the journey

## The state of Guimarães today

- Strong sense of identity, pride and belonging of the local community.
- Increasingly digitalised city services and significant use of digital technologies in industry and services (less).
- Guimarães 2030 Sustainable Development strategy widely known and supported by the population.
- Despite the pandemic crisis resilience shown by local businesses, particularly industry (e.g., textile).
- Relevant city's role in supporting existing and new companies (e.g., business incubators, Guimarães Marca, Crisis and Economic Transition Office).
- Satisfactory level of cooperation between private and public sector actors (e.g., fields such as economic development, environment, training, social support).
- Heterogeneous territory: geography, economy, society and culture.
- Still considerable digital illiteracy in the population and insufficient digital skills in small and micro enterprises in traditional sectors (e.g., trade small businesses).
- Collaboration between companies and Research and Technological Development (RTD) centres still relatively low.
- Difficulties for employers to recruit human resources with the necessary skills, including both technical and soft skills.
- Need of more professional education, on-the-job training and reskilling actions.
- "Brain-drain", particularly of highly qualified young people.

## Key insights from city performance analysis

### Higher performance observed

1. Increasing digitalisation of companies and city services
2. Guimarães 2030 Sustainable Development strategy
3. Resilient industry
4. Public security and access to health services
5. Wastewater treatment

### Lower performance observed

1. Mobility/traffic congestion
2. Mismatch between existing skills and business needs
3. Energy consumption
4. Local pollution monitoring
5. Low collaboration between companies and knowledge centres

# City ecosystem

Summary of findings from the 1:1 interviews, local enablers analysis, stakeholders' workshop and working norms with the ecosystem:

**Shared aspirations and vision.** With an impressive historical legacy, Guimarães is a city with a young population oriented towards the future that aspires consensually to be a city of choice to live, work and visit thanks to its high standards of quality of life based on good technological infrastructure, sustainable economic growth, employment opportunities in the economy knowledge and preservation of the environment.

**What we bring and how we work together.** Strong sense of identity, pride and belonging. Being the birthplace of Portugal, it is a community with deep roots. In the image of the first king of Portugal who was born here, the city is inhabited by resilient people very committed to the great causes of the city, as were the cases of the European Capital of Culture and European City of Sport.

Good level of collaboration between actors from the private and public sectors, with interesting examples in areas such as economic development, environment, training and social support. But there is still scope for improving such interactions.

**Urban resources for transformation.** The city has a relatively qualified population and in recent years an effort has been made by various public and private entities to provide skilling and reskilling actions for employed and unemployed people. Nevertheless, employers experience some difficulties to recruit staff with the necessary skills, especially at the technical level. There still some digital illiteracy in the population and the city suffers from some “brain-drain” among highly qualified young people.

Increasing relationship between the city, Higher Education Institutions and companies with many good examples that can be shown, but there is still scope to strengthen these links.

The city and the various economic and social actors have been able to attract relevant financing for their activities, especially public funding available at national level with the contribution of EU structural funds.

# ICC strategy: vision and ambition statements

**Vision:**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Digital infrastructure.** People and organisations will have access to high quality digital infrastructure and online services.

**Skilled and connected people.** Skilled people will improve their living standards by increasingly using digital technologies in their professional, social, educational, leisure and cultural activities.

**Sustainable economic growth.** Local economy will be thriving as existing and new businesses will use digital and environmentally friendly technologies to improve productivity and grow.

**Employment opportunities.** A higher proportion of residents will have jobs in knowledge-based and green businesses.

**Environmental sustainability.** Citizens' lifestyles and business activities will increasingly become more sustainable, and the protection of the city's natural assets and ecosystems will be higher, through the use of digital technologies.

# City strategy: Justification [1/3]

- After consultation with local stakeholders, major ambitions for the city by 2030 were identified around the following themes:
  - Environmental sustainability.
  - Sustainable economic growth.
  - Knowledge-based and green employment.
  - Skilled people.
  - Suitable digital infrastructure.
- The results of the city scan questionnaire revealed that citizens and local organisations consider these to be the five main challenges for the city:
  - Mobility/traffic congestion.
  - Mismatch between existing skills and business needs.
  - Energy consumption.
  - Local pollution.
  - Low science-industry cooperation.

# City strategy: Justification [2/3]

- In the 1:1 interviews, as well as in the "needs assessment" and "ecosystem" events, the following topics were particularly identified by the stakeholders for improvement:
  - Better digital services and infrastructure to address the territory heterogeneity (e.g., geography, economy, society).
  - Potential for the sustainability area to generate employment and economic growth still far from being achieved.
  - Difficulties for employers to recruit human resources with the necessary skills, including both technical and soft skills.
  - “Brain-drain”, particularly of highly qualified young people.
  - More professional education, on-the-job training and reskilling actions are needed.
  - Still considerable digital illiteracy in the population (particularly in the older population).
  - Digital transformation has not been a priority for many small and micro businesses (e.g., trade small businesses).

# City strategy: Justification [3/3]

- In addition, environment and digital have been at the heart of city policies in recent years, namely:
  - Guimarães 2030 Strategy aiming at the city sustainable development (Guimarães has in the meantime been selected in 2022 as one of the 100 Climate-Neutral and Smart Cities by 2030).
  - Digital Cities Challenge (DCC), in which a strategic vision and action plan for digital transformation were developed and implemented.
- Taking into account the context outlined above, the ICC Guimarães strategy encompasses the following five strategic priorities, whose common ground is the ICC initiative coordinated by the governance bodies established for its implementation:
  - Extending digital infrastructure.
  - Sustainable mobility.
  - Smart energy.
  - Environmental quality.
  - Capacity building.

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Section

2

# Guimarães: Ambition and roadmap

ICC Transformation

February 2021 to May 2021

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# Priority solutions and initiatives

| Priority solutions | Initiatives |
|---|---|
| Digital Infrastructure | #1 - Extending digital infrastructure and services |
| Sustainable Mobility | #2 - Parking solutions<br>#3 - Traffic monitoring |
| Sustainable and Smart Energy | #4 - Sustainable and Smart Grids & EcoDigizens |
| Monitoring Local Pollution | #5 - Monitoring and Promoting Environmental Quality |
| Capacity Building | #6 - Digital Academy<br>#7 - Career Guidance Programme |

# High level implementation roadmap ("10000m plan") [1/2]

Activity | Milestone

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|---|---|---|---|---|---|---|
| 1 Initiative #1 – Extending digital infrastructure | Expand/improve land and wireless networks | Minho Access Point (MAP) and Open Data Platform | | | | Network technology infrastructure established |
| 2 Initiative #2 – Parking solutions | Planning & kick-off | | Setting up of parking lots & monitoring specifications | Proof of concept | Installation phase | |
| 3 Initiative #3 – Traffic monitoring | Planning & kick-off | | Setting up of localisation points & monitoring specific. | Proof of concept | Installation phase | |
| 4 Initiative #4 – Sustainable and smart energy grids | Sustainable energy (needs, state of the art, plan development and implementation) | | | | | Monitoring specifications set |
| 5 Initiative #5 – Monitoring environmental quality | Planning & kick-off | | Research of solutions and benchmark | Setting up of localisation points & monitoring specific | Proof of concept | Installation phase |
| 6 Initiative #6 – Digital academy | | | | Planning & kick-off | | Building and equipment acquisition |
| 7 Initiative #7 – Career guidance programme | | Planning & kick-off | Plan & budget | Career guidance support materials | Beginning of activities with students | Assessment of professional and personal skills |

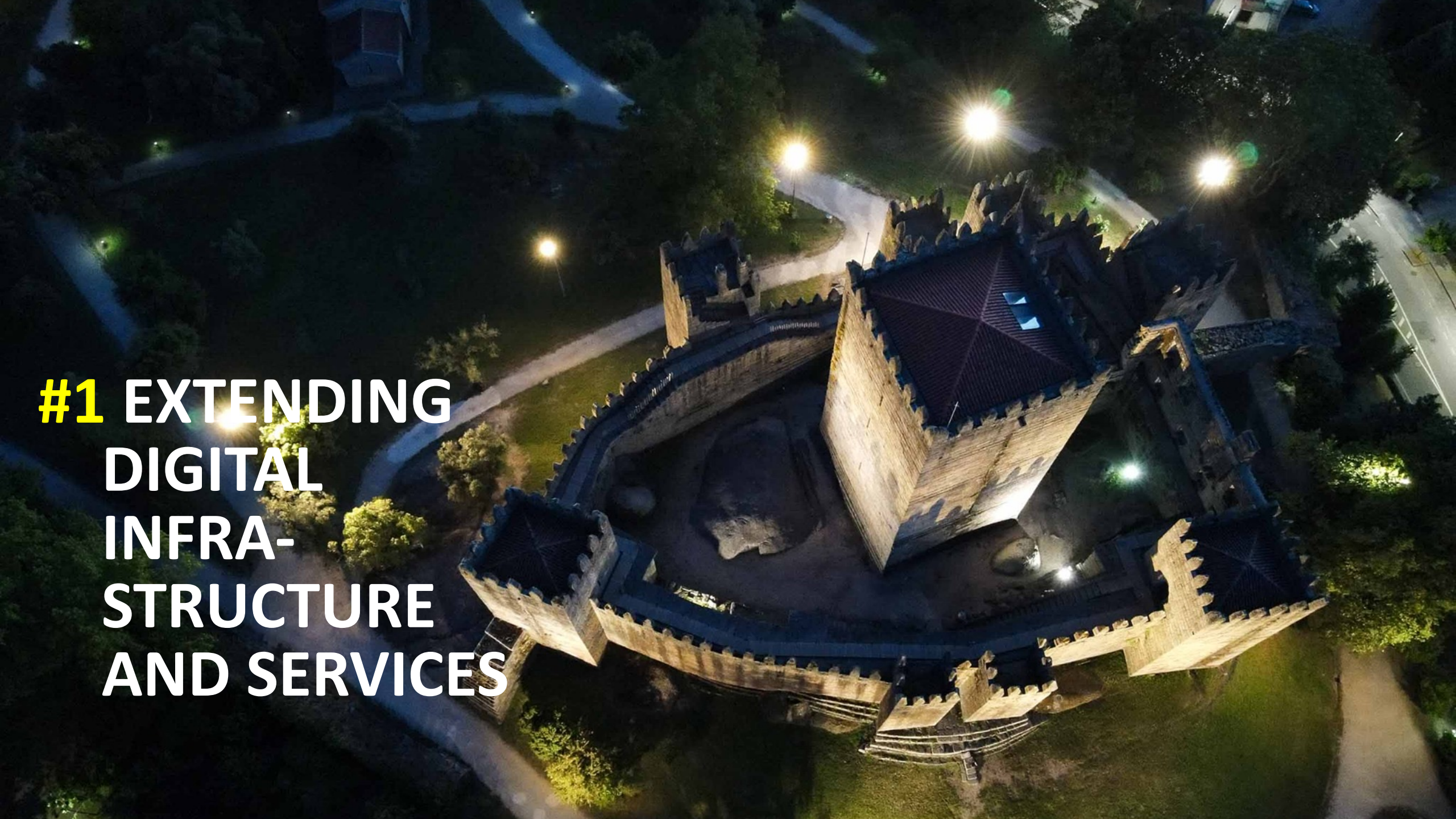
# High level implementation roadmap ("10000m plan") [2/2]

Activity | Milestone

| | Month 7 | Month 8 | Month 9 | Month 10 | Month 11 | Month 12 |
|---|---|---|---|---|---|---|
| 1 Initiative #1 – Extending digital infrastructure | Knowledge management & empowering platform | Specifications & interoperability issues set | | | | Installation phase completed<br>MAP & open data platform developed |
| 2 Initiative #2 – Parking solutions | | First data gathering completed | | | | Dissemination |
| 3 Initiative #3 – Traffic monitoring | | First data gathering completed | Data gathering & processing | | | Dissemination |
| 4 Initiative #4 – Sustainable and smart energy grids | Guimarães smart sustainable communities | | | | | Pilot projects/citizen groups completed<br>Good practices manual |
| 5 Initiative #5 – Monitoring environmental quality | | First data gathering completed | | Data gathering & processing | | Dissemination & replication delivered |
| 6 Initiative #6 – Digital academy | Activity plan<br>Visual identity and website | | 1) Infotech<br>2) Digital Business<br>3) Citizenship<br>4) Digital Kids | | | First service to individual client<br>First service to organisational client |
| 7 Initiative #7 – Career guidance programme | Development of professional and soft skills | Personal academic and professional plans – final portfolio | | | | Delivery of all 1st year activities |

# Rationale to roadmap

- The roadmap represents the commitment of Guimarães to continue its transformation process into an intelligent city and community, aiming at the well-being of its inhabitants, businesses and visitors through the offer of digitally enabled services.
- "More than an intelligent city", Guimarães intends to be a city focused on its citizens, a meeting space between the memory of the past and the ambition of the future!
- Addresses several challenges faced by the city – e.g., urban mobility, energy efficiency, environmental quality, digital skills – using the possibilities offered by digital solutions and technological advancements, in close alignment with other city's strategies already under implementation (e.g., sustainable development, tourism, energy).
- Puts into action five major strategic axes: 1) enhancement of the city's digital infrastructure and services; 2) sustainable mobility; 3) smart and sustainable energy; 4) monitoring and promoting environmental quality; and 5) capacity building.
- Establishes an integrated governance structure to ensure that the different needs identified are addressed in a collaborative way by involving the stakeholders who have the necessary skills and resources for the co-creation and co-production of the required actions.



# #1 EXTENDING DIGITAL INFRA-STRUCTURE AND SERVICES

# Initiative #1 - Extending digital infrastructure and services

## Strategy

**Description**

The initiative aimed at developing a connected city by providing a wide range of land and wireless networks and supporting new digital services.
It comprised three main activities:
- Expanded and enhanced land and wireless networks.
- Minho Access Point (MAP) and Open Data Platform.
- Knowledge Management and Empowering platform.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

People and organisations will have access to high-quality digital infrastructure and online services.

**Expected impact and timing**

High-quality digital infrastructure that fosters investment in new digital services and applications for the benefit of inhabitants, businesses, entrepreneurs and visitors. The initiative is making an impact from the first half of 2022.

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## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães / Intelligent and Information Systems Division

**Contributors:** Private companies and the Telecommunications Institute.

**Risks and mitigation**

1) Technical challenges; 2) Costs related to implementation and maintenance; 3) Market solutions availability and maturity; 4) Average broadband access speed inadequate for bandwidth demanding applications (e.g., IoT); 5) Planned investments delaying the penetration of 5G; 6) Network saturation due to use of IoT devices; 7) Security of the ICT and IoT deployed infrastructure. As **mitigation measures**, the team in charge of this solution endeavoured to find the best technical and market solutions for its implementation.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Activity #1**: €1,644,390
**Activity #2:** €1,276,000
**Activity #3**: €350,000

Funding sources: 1) Portugal's Recovery and Resilience Plan (RRP); 2) EU Cohesion Policy cycle 2014-2020 (Portugal 2020 and Norte 2020) and EU Cohesion Policy cycle 2021-2027 (Portugal 2030 and Norte 2030); 3) Municipality of Guimarães funding.

**Solution maturity outputs**

1) % of city's territory covered by the internet: 95% (2022).
2) % of city covered by LowPowerWAN network: 60% (2022)
3) New services, applications and businesses based on open datasets: +60% (2022)

**City performance outcomes and impacts**

1) Percentage of labour force employed in the ICT sector: target not set.
2) STEM higher education degrees per 100,000 population: + 40% (2022)
3) Digital inclusion for low-skilled and low-literate people: 60% of citizens (2022)

# #2 PARKING SOLUTIONS

# Initiative #2 - Parking Solutions

## Strategy

**Description**

The initiative was to produce strategic information about available parking lots, limited-time and conditioned parking areas, user-driver profiles with ecological footprint calculation, and integration and interconnection with the agents of the territory, in order to provide data analytics and models to support mobility decision-making.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

**Skilled and connected people.** Skilled people will improve their living standards by increasingly using digital technologies in their professional, social, educational, leisure and cultural activities.
**Sustainable economic growth.** Local economy will be thriving as existing and new businesses will use digital and environmentally friendly technologies to improve productivity and grow.
**Environmental sustainability.** Citizens' lifestyles and business activities will increasingly become more sustainable, and the protection of the city's natural assets and ecosystems will be higher, through the use of digital technologies.

**Expected impact and timing**

Availability of strategic information about available parking lots in the city. The initiative is expected to make an impact from the second half of 2022.

## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães: Mobility and Transport Division; and Intelligent and Information Systems Division

**Contributors:** Intermunicipal Community of Ave (CIM Ave); Association of Municipalities Quadrilátero; car parking owners.

**Risks and mitigation**

1) Early-stage Open Data Platform and Open Data/APIs; 2) Lack of open and real-time high value datasets; 3) Data security; 4) Technical challenges; 5) Costs related to electricity project and implementation, digital services, platform development and maintenance, implementation and monitoring; 6) Market solutions availability and maturity. **To mitigate the risks**, it was endeavoured to find the best technical and market solutions, as well as the best internal and external funding alternatives.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget:** €227,550.00

Funding sources: 1) Portugal's Recovery and Resilience Plan (RRP), particularly regarding infrastructure investment; 2) EU Cohesion Policy cycle 2014-2020 (Portugal 2020) and EU Cohesion Policy cycle 2021-2027 (Portugal 2030); 3) Municipality of Guimarães funding.

**Solution maturity outputs**

1) % of underground public parking spaces with real-time availability information: 45% (2022).

2) Surface parking spaces with real-time availability information: from 0 to 800 parking spaces (2022).

**City performance outcomes and impacts**

1) % citizens using means of transport other than personal vehicle: from 36% to 48% (2022).

2.) Number of bicycles available for shared services per 100,000 inhabitants: from 10 to 36 (2022).

3) % of underground and surface parking spaces with real-time availability information: from 15% to 50% (2022).

4) [Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5 830 000 Ton/CO2 (2011) to 4,960,000 (2023).

# #3 TRAFFIC MONITORING

# Initiative #3 - Traffic Monitoring

## Strategy

**Description**

The "traffic monitoring" initiative was to allow the monitoring of the city's traffic, integrating and interacting with the different agents of the territory (civil protection and emergency services, mobility and traffic) in order to develop analytical models to assist decision making.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

**Skilled and connected people.** Skilled people will improve their living standards by increasingly using digital technologies in their professional, social, educational, leisure and cultural activities.
**Sustainable economic growth.** Local economy will be thriving as existing and new businesses will use digital and environmentally friendly technologies to improve productivity and grow.
**Environmental sustainability.** Citizens' lifestyles and business activities will increasingly become more sustainable, and the protection of the city's natural assets and ecosystems will be higher, through the use of digital technologies.

**Expected impact and timing**

Availability of strategic information on a better monitoring and management of city's traffic. The initiative is expected to make an impact from the second half of 2022.

## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães: Mobility and Transport Division; and Intelligent and Information Systems Division

**Contributors:** Intermunicipal Community of Ave (CIM Ave); Association of Municipalities Quadrilátero; Police.

**Risks and mitigation**

1) Early-stage Open Data Platform and Open Data/APIs; 2) Lack of open and real-time high value datasets; 3) Data security; 4) Technical challenges; 5) Costs related to electricity project and implementation, digital services, platform development and maintenance, implementation and monitoring; 6) Market solutions availability and maturity. As **mitigation measures**, the team in charge of the solution endeavoured to find the best technical and market solutions for its implementation.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget:** €289,603.50

Funding sources:
1) Portugal's Recovery and Resilience Plan (RRP), particularly regarding infrastructure investment;
2) EU Cohesion Policy cycle 2014-2020 (Portugal 2020) and EU Cohesion Policy cycle 2021-2027 (Portugal 2030);
3) Municipality of Guimarães funding.

**Solution maturity outputs**

1) Main traffic lanes with real-time information: 7 traffic lanes (2022).
2) Traffic flow sensors: 10 sensors (2022).

**City performance outcomes and impacts**

1) Number of public transport trips per capita: from 24 to 26 (2022).
2) % citizens using means of transport other than personal vehicle: from 36% to 48% (2022).
3) Number of users using the shared transport economy: from 587 to 746 (2022).
4) [Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5,830,000 Ton/CO2 (2011) to 4,960,000 (2023).

# #4 SUSTAINABLE AND SMART ENERGY GRIDS & ECODIZIGENS

# Initiative #4 - Sustainable and Smart Energy Grids & EcoDizigens

## Strategy

**Description**

The initiative was based on a smart sustainable grid to monitor the consumption and efficiency of public buildings and promote strategic changes in the electric energy value chain, empowering the use of state-of-the-art emerging renewable and sustainable energy technologies.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

**Digital infrastructure.** People and organisations will have access to high quality digital infrastructure and online services.

**Sustainable economic growth.** Local economy will be thriving as existing and new businesses will use digital and environmentally friendly technologies to improve productivity and grow.

**Environmental sustainability.** Citizens' lifestyles and business activities will increasingly become more sustainable, and the protection of the city's natural assets and ecosystems will be higher, through the use of digital technologies.

**Expected impact and timing**

Improved energy efficiency in buildings and deployment of renewable energy sources, particularly in public buildings. The initiative is expected to make an impact from the second half of 2022.

## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães: Energy Efficiency Office, and Intelligent and Information Systems Division

**Contributors:** Private energy companies

**Risks and mitigation**

1) Lack of precision in installed sensors; 2) Technical investment and funding challenges; 3) Costs related to digital services, platform development and maintenance; 4) Early-stage Open Data Platform and Open Data/APIs; 5) Data security; 6) Market solutions availability and maturity. The project team responsible for the initiative sought to **mitigate such risks** through the search for the best technical and market solutions, as well as finding the most appropriate funding sources (internal and external).

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget**: €350,000

Funding sources:
1) Portugal's Recovery and Resilience Plan (RRP).
2) EU Cohesion Policy cycle 2014-2020 (Portugal 2020) and EU Cohesion Policy cycle 2021-2027 (Portugal 2030).
3) Horizon Europe; and 4) Municipality of Guimarães.

**Solution maturity outputs**

1) Percentage of public buildings and infrastructures in the city with smart electricity meters: 20 infrastructures (2022).
2) Public lighting: 1 000 infrastructures (2022).

**City performance outcomes and impacts**

1) Reduction of energy consumption of public buildings (GJ/m2): 30% (2022).
2) Reduction of greenhouse gas emissions (measured in tons per capita): 20% (2022).

# #5 MONITORING AND PROMOTING ENVIRONMENTAL QUALITY

# Initiative #5 - Monitoring and Promoting Environmental Quality

## Strategy

**Description**

The initiative was to support more real-time data on the city environment, able to provide alerts and/or incentives towards necessary correction actions. The project ensured real-time monitoring of air quality, noise, temperature, humidity and pressure (among others), and fostered citizenship participation in the improvement of environment quality.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

**Sustainable economic growth.** Local economy will be thriving as existing and new businesses will use digital and environmentally friendly technologies to improve productivity and grow.
**Employment opportunities.** A higher proportion of residents will have jobs in knowledge-based and green businesses.
**Environmental sustainability.** Citizens' lifestyles and business activities will increasingly become more sustainable, and the protection of the city's natural assets and ecosystems will be higher, through the use of digital technologies.

**Expected impact and timing**

Significant impact in real-time monitoring and management of the city environment. The initiative is expected to make an impact from the second half of 2022.

## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães: Environment Division, Sports Division, Intelligent and Information Systems Division, and the Landscape Laboratory.

**Contributors:** Ministry of Environment; Municipality of Guimarães; Vimágua (municipal water company); other institutions cooperating informally (e.g. Eco-Schools, Eco-Parishes); Landscape Laboratory; Guimarães' 2030 Mission Structure on Sustainable Development; and citizens at large.

**Risks and mitigation**

1) Lack of open and real-time high value datasets; 2) Lack of precision in the installed sensors; 3) Costs related to technological equipment; 4) Technical challenges; 5) Market solutions availability and maturity. The initiative team looked for the best technical and market solutions, as well as the best internal and external funding options.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget:** €248,896.65

Funding sources:
1) Portugal's Recovery and Resilience Plan (RRP).
2) EU Cohesion Policy cycle 2014-2020 (Portugal 2020) and EU Cohesion Policy cycle 2021-2027 (Portugal 2030).
3) Municipality of Guimarães funding.

**Solution maturity outputs**

1) Number of sensors with real-time information: 10 monitoring points (2022).
2) Information in the city sites and mobile app to citizens (environment awareness) (2022).

**City performance outcomes and impacts**

1) Concentration of fine particles PM2.5: from 3ug/m3 to 2.6ug /m3 (2025).
2) Concentration of fine particles PM10: from 7ug/m3 to 6.2ug/m3 (2025).
3) Gas emissions: from 2.6 tons of CO2/inhabitant to 2.2 tons of CO2/inhabitant (2025).
5) Number of people on bike paths and kilometres travelled: target not set.
6) Perceived number of people in sports and leisure parks: target not set.
7) [Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5,830,000 Ton/CO2 (2011) to 4,960,000 (2023).

# #6 DIGITAL ACADEMY

# Initiative #6 – Digital Academy

## Strategy

**Description**

This initiative was to create a brand new organisation (i.e. Digital Academy) to empower local businesses in digital and green technologies (including training their human resources and supporting management and production processes), support the upskilling and reskilling of the employed workforce and unemployed people, and enhance the digital literacy of the population at large.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

Available **digital infrastructure** for people and organisations who will have access to high quality digital services.
**Skilled and connected people** who will increasingly use digital technologies.
**Employment opportunities** to be seized by people able to work in knowledge-based jobs.
**Sustainable economic growth**, which will allow local economy to grow and be more productive through digital and environmentally friendly technologies.

**Expected impact and timing**

Empowerment of businesses in digital and green technologies, supporting lifelong learning, and fostering the development of a highly technological city where an increasingly number of people will be working in digital- and knowledge-based jobs. Expected to make an impact from the second half of 2023.

## Stakeholders involved

**Solution lead:** Municipality of Guimarães

**Solution working team:** Municipality of Guimarães, University of Minho and DTX Digital Transformation Colab.

**Contributors:** Polytechnic Institute of Cávado and Ave (IPCA) and DTX Digital Transformation Colab. The Academy includes in its management bodies a wide range of stakeholders such as businesses (inc. multinationals), state agencies, higher education institutions, and civic associations.

**Risks and mitigation**

1) Insufficient funding to finance the infrastructure; 2) Inability to attract and retain highly qualified and experienced staff; 3) Convincing the industry to reap the benefits of the new entity; 4) Inability to develop credible products and services within the relevant research and technical fields to match the expectations of potential customers. The team in charge of the initiative endeavoured to ensure all the necessary resources for its full implementation, so as to **mitigate** the above-mentioned risks.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget**: €1,000,000.00 (i.e.. premises, equipment and infrastructure, and software).

Funding sources: **1)** Portugal's Recovery and Resilience Plan (RRP); **2)** Academy's own revenue in in the medium and long term; **3)** EU Cohesion Policy cycle 2021-2027, both ERDF and ESF bearing in mind investment in equipment, and vocational training and lifelong learning actions; **4)** Municipality of Guimarães funding.

**Solution maturity outputs**

1) Number of organisation/business customers in the first year of activity: 25

2) Number of individual customers in the first year of activity: 500

**City performance outcomes and impacts**

1) Percentage of labour force employed in the ICT sector: target not set.

2) STEM higher education degrees per 100,000 population: + 40% (2022).

3) Number of highly qualified jobs to be created in companies and RTDI entities: 1 500 (2022).

# #7 CAREER GUIDANCE PROGRAMME

# Initiative #7 – Career Guidance Programme

## Strategy

**Description**

The career guidance is a comprehensive school counselling annual programme that helps students make the best career choices. It assists 9th grade students with career guidance, including the provision of career guidance support materials, suggestion of school-wide career activities, information about the educational system and academic choices, assessment of professional and personal skills, development of soft skills, and establishment of individual academic and professional plans.

**Link to vision**

Proud of its unique historical heritage and identity, Guimarães will be known as a sustainable city of choice for people to live, work, play and visit, as a result of its technology, business, educational and cultural opportunities.

**Link to ambition statement**

**Skilled and connected people** who will increasingly use digital technologies.

**Employment opportunities** to be seized by people able to work in knowledge-based jobs.

**Expected impact and timing**

Empowerment of students in the vocational areas where they are stronger with a view to the development of a highly technological city where an increasing number of people will be working in digital- and knowledge-based jobs. The initiative is expected to make an impact from the first half of 2022.

## Stakeholders involved

**Solution lead:** Intermunicipal Community of Ave (CIM Ave).

**Solution working team:** Intermunicipal Community of Ave and Municipality of Guimarães.

**Contributors:** Intermunicipal Community of Ave (association of municipalities of the sub-region where Guimarães is located) and public schools of Guimarães that provide the 9th grade of schooling.

**Risks and mitigation**

1) Insufficient funding; 2) Inability to engage all required students, namely due to poor dissemination or insufficient schools' engagement; 3) Low involvement of the University of Minho (through the School of Psychology) in the programme scientific and technical orientation; 4) Mismatch between the expectations of the participating students and the activities provided. Thanks to the funding obtained from CIM Ave and a project management carried out with a very close relationship with all stakeholders, it was possible to significantly minimise all risks.

## Inputs, outputs, outcomes and impacts

**Source of funding and estimated cost**

**Budget:** €3,000

Sources of funding: 1) Intermunicipal Community of Ave (CIM Ave) own funding; 2) EU Cohesion Policy cycle 2014-2020, namely Portugal 2020 and Norte 2020 funding.

**Solution maturity outputs**

1) % of students enrolled in the 9th grade in Guimarães' public schools participating in the programme: 90% (2022).

**City performance outcomes and impacts**

1) Percentage of labour force employed in the ICT sector: target not set.

2) STEM higher education degrees per 100,000 population: +40% (2022).

3) Number of highly qualified jobs to be created in companies and RTDI entities: 1,500 (2022).

# Key Performance indicators - overview [1/4]

| Solution/Initiative | Activities – Inputs and actions | Solution Maturity – outputs | City performance – outcomes and impacts |
|---|---|---|---|
| Extending digital infrastructure and services | Expand and improve land and wireless networks.<br>Minho Access Point (MAP) and Open Data Platform.<br>Knowledge Management and Empowering platform. | City's territory covered by the internet: 95% (2022)<br>City's territory covered by LowPowerWAN network: 60% (2022) | Labour force employed in the ICT sector: target not set<br>STEM higher education degrees per 100,000 population: +40% (2022)<br>Digital inclusion of low-skilled and low-literate people: 60% of citizens (2022) |
| Parking solutions | Setting up of parking lots for monitoring and monitoring specifications.<br>Installation phase.<br>Data gathering and processing. | Underground public parking spaces with real-time availability information: 45% (2022)<br>Surface parking spaces with real-time availability information: 800 (2022) | Citizens using means of transport other than personal vehicle: from 36% to 48% (2022)<br>Bicycles available for shared services per 100,000 inhabitants: from 10 to 36 (2022)<br>[Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5,830,000 Ton/CO2 (2011) to 4,960,000 (2023) |

# Key Performance indicators - overview [2/4]

| Solution/Initiative | Activities – Inputs and actions | Solution Maturity – outputs | City performance – outcomes and impacts |
|---|---|---|---|
| Traffic monitoring | Setting up of localisation points for monitoring and monitoring specifications.<br>Installation phase.<br>Data gathering and processing. | Main traffic lanes with real-time information: 7 (2022).<br>Traffic flow sensors: 10 (2022). | Citizens using means of transport other than personal vehicle: from 36% to 48% (2022).<br>Bicycles available for shared services per 100,000 inhabitants: from 10 to 36 (2022).<br>[Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5,830,000 Ton/CO2 (2011) to 4,960,000 (2023) |
| Sustainable and Smart Grids & EcoDigizens | Sustainable energy plan development, including needs analysis and state of the art assessment.<br>Establishment of Guimarães' smart sustainable communities. | Public buildings and infrastructures in the city with smart electricity meters: 20 (2022)<br>Public lighting infrastructures: 1.000 (2022) | Reduction of energy consumption of public buildings (GJ/m2): 30% (2022).<br>Reduction of greenhouse gas emissions (measured in tons per capita): 20% (2022). |

# Key Performance indicators - overview [3/4]

| Solution/Initiative | Activities – Inputs and actions | Solution Maturity - outputs | City performance – outcomes and impacts |
|---|---|---|---|
| Monitoring and Promoting Environmental Quality | Research of solutions and benchmark.<br>Setting up of localisation points for monitoring and monitoring specifications<br>Installation phase.<br>Data gathering and processing. | Number of sensors with real-time information: 10 monitoring points (2022)<br>Information in the city sites and mobile app to citizens (environment awareness) (2022) | Concentration of fine particles PM2.5: from 3ug/m3 to 2.6ug /m3 (2025)<br>Concentration of fine particles PM10: from 7ug/m3 to 6.2ug/m3 (2025)<br>Gas emissions: from 2.6 tons of CO2/inhabitant to 2.2 tons of CO2/inhabitant (2025)<br>Number of people on bike paths and kilometres travelled: target not set<br>Perceived number of people in sports and leisure parks: target not set<br>[Contribution to regional KPI – Northern Portugal] Estimated greenhouse gas emission: from 5,830,000 Ton/CO2 (2011) to 4,960,000 (2023) |
| Digital Academy | Building, infrastructure and equipment.<br>Infotech service.<br>Digital business service.<br>Citizenship service.<br>Digital kids service. | Organisation/business customers in the first year of activity: 25<br>Individual customers in the first year of activity: 500 | Labour force employed in the ICT sector: target not set<br>STEM higher education degrees per 100,000 population: +40% (2022)<br>Highly qualified jobs to be created in companies and RTDI entities: 1,500 (2022) |

# Key Performance indicators - overview [4/4]

| Solution/Initiative | Activities – Inputs and actions | Solution Maturity - outputs | City performance – outcomes and impacts |
|---|---|---|---|
| Career Guidance Programme | Career guidance support materials.<br>Assessment of professional and personal skills - individual portfolio.<br>Development of professional and soft skills - training sessions.<br>Personal academic and professional plans - final portfolio. | Students enrolled in the 9th grade in Guimarães' public schools participating in the programme: 90% | Labour force employed in the ICT sector: target not set<br>STEM higher education degrees per 100,000 population: +40% (2022)<br>Highly qualified jobs to be created in companies and RTDI entities: +1,500 (2022) |

# Key Performance indicators - Cross cutting indicators

| Cross cutting indicators |
| --- |
| Percentage of labour force employed in the ICT sector |
| Number of STEM higher education degrees per 100,000 population |
| Number of highly qualified jobs to be created in companies and RTDI entities |

# Rationale to KPI approach

The ICC Guimarães KPIs were chosen bearing in mind the following key aspects:

- **Relevance.** The chosen performance indicators relate to key aspects of the process of transforming Guimarães into an intelligent community through digitally enabled actions. Such selection took into consideration:
  - Identified needs (interviews, city scan questionnaire, local workshops).
  - Ambitions and vision.
  - City strategic priorities and on-going strategies (e.g., sustainable development, Digital Cities Challenge (DCC), sustainable tourism).
- **Availability.** Although not being the main criterion, KPIs were established considering data accessibility. The measurement of performance indicators should be as much as possible within the reach of the city and not overly dependent on external sources.
- **Trackability.** Whenever possible indicators were selected to allow the observation of developments over relatively short periods of time (i.e., a year or less).

# Governance structure for roadmap implementation

**Steering Committee**
- Guimarães Municipality (2 representatives)
- University of Minho
- Landscape Laboratory
- Sustainable Development Strategy 2030
- Business Association AEG
- Guimaraes Red Cross

Reviews overall progress, takes key decisions and sponsors overall roadmap

**PMO**
- ICC Guimarães Administrative and Financial Team

Provides administrative support for overall project implementation

**Core team**
- ICC city team (3 representatives)
- Guimarães Municipality (Intelligent and Information Systems, Mobility & Transport, Environment, Economic Development, and Education Divisions; Energy Efficiency Office)
- Landscape Laboratory

Coordinates overall roadmap implementation across initiatives

Drives implementation of single initiatives

| Initiative #1 | Initiative #2 | Initiative #3 | Initiative #4 | Initiative #5 | Initiative #6 | Initiative #7 |
|---|---|---|---|---|---|---|
| Lead: Intelligent & Information Systems Division | Lead: Mobility & Transport Division | Lead: Mobility & Transport Division | Lead: Energy Efficiency Office | Lead: Landscape Laboratory | Lead: University of Minho | Lead: Education Division |

The European Commission's
INTELLIGENT CITIES
CHALLENGE

Section

3+4

# Guimarães: Impact

ICC Transformation

February 2021 to May 2021

European Commission | The Intelligent Cities Challenge is funded by COSME, the EU programme for Competitiveness of Enterprises and SMEs

# Impact executive summary [1/3]

- ICC Guimarães has effectively fulfilled its objectives, representing a valuable transformation process of Guimarães as an intelligent city and community through the implementation of digitally enabled solutions.
- The city's digital infrastructure expanded significantly during the ICC period. The territory covered by the Internet has surpassed 95%, while the coverage of the LowPowerWAB network has risen from 1 to 60%. The actions carried out have enabled businesses and citizens to have access to higher quality digital infrastructure and online services to be used in professional, social and leisure activities.
- The measures implemented for sustainable mobility, which mainly consisted of enhanced real-time information on traffic and public parking spaces, have improved the traffic management in the city. All output and impact indicators monitored were achieved and in general exceeded. Underground public parking spaces with real-time availability information rose from 12 to 50%: surface parking spaces with real-time availability information increased from 0 to 900; the percentage of citizens using means of transport other than personal vehicle increased from 36 to 48%; and the number of bicycles available for shared services per 100,000 inhabitants grew from 36 to 120.

# Impact executive summary [2/3]

- The implementation of sensors for real-time monitoring of local pollution had relevant impact on the management of Guimarães' environment, contributing to foster greater environmental sustainability, more environmentally friendly citizens' lifestyles and business activities, and better protection of Guimarães' natural assets and ecosystems. The relevance of the results achieved is reflected in the reduction of both greenhouse gas emissions and concentration of fine particles (PM2.5 and PM10).
- Regarding capacity building, ICC Guimarães included two key initiatives to support the upskilling and reskilling of local workforce, as well as to empower companies in digital and green technologies, enhance digital literacy in the population and assist the entry of young people into the labour market. Although one of those initiatives - Digital Academy - has not yet been completed, the outcomes monitored over this period highlight very positive evolution in indicators such as labour force employed in the ICT sector (from 1.2 to 2.3%), STEM higher education students (from 8 to 9.2%), highly qualified jobs created (from 240 to 1500), digital inclusion of low-skilled people (from 36 to 48%), and 9$^{th}$ grade students participating in the career guidance programme (from 17 to 90%).

# Impact executive summary [3/3]

- Over the next few years, Guimarães will continue to invest in powerful digital and smart technologies to increase the efficiency of infrastructure and related services, making the city even more environmentally and people friendly.
- Continuing the work carried out under ICC and other initiatives, the Municipality of Guimarães will focus on effective decision-making based on data, less traffic and improved urban transportation, green energy, cleaner air and improved environment. Citizens will continue to be the protagonists of this transformation process: it will be for them that digital skills development initiatives will continue to be offered; it will be thanks to their active participation that intelligent solutions will continue to be implemented through co-creation actions.
- Extensive collaboration with stakeholders and other cities is to be continued after the successful practices carried out during ICC.
- Furthermore, as one of EU 100 climate-neutral cities, Guimarães will assume itself in the coming years as a hub open to urban experimentation and innovation towards green and digital transformation.

# There are four types of measurable concepts that come together to drive success in the ICC

...makes it easier to undertake certain...

...which work to drive up...

...leading to improved...

Change measured over time during ICC

| Idea | Local enablers –city characteristics | Activities – actions and inputs | Technology maturity – outputs | City performance – outcomes and impacts |
|---|---|---|---|---|
| Description | Each city has unique strengths and weaknesses that help action happen. These can be stakeholder networks, local capabilities, cultural factors or many more that drive success in ICC projects. | A cities main intervention on the ICC is to take actions. These can be direct (e.g., procuring technology), or indirect, (e.g., forming a working group on a topic). The right actions can lead to the right inputs going in to the ICC (e.g., funding, time) | Cities can drive technological solutions to try and improve city performance. How well these solutions are currently used can be described as their 'maturity', - considering whether they are available for stakeholder use, what stakeholders think of them, and so on | Success of an intelligent city is ultimately measured by its ability to address city needs. These can be considered an improved quality of citizen life and a better environment for stakeholders |
| Example | A history of strong collaboration between city and a local university... | ...allows the creation of a new e-health pilot project using social housing in the city... | ...leads to the launch a new tele-health solution utilising 4G data connections... | ...resulting in pre-emptive diagnosis and lower wait times at medical facilities |

# Assessment of city performance - progress against KPIs [1/3]

| City performance | | Where we started | Midway through the challenge | Final results |
|---|---|---|---|---|
| 1 | Labour force employed in the ICT sector | 1,2% | 1,8% | 2,3% |
| 2 | STEM higher education degrees per 100,000 population | 8,07% | 8,46% | 9,18% |
| 3 | Highly qualified jobs created in companies and RTDI entities | 240 | 500 | 1500 |
| 4 | Digital inclusion of low-skilled and low-literate people | 18% | 44% | 60% |
| 5 | Citizens using means of transport other than personal vehicle | 36% | 40% | 48% |

# Assessment of city performance - progress against KPIs [2/3]

| City performance | | Where we started | Midway through the challenge | Final results |
|---|---|---|---|---|
| 6 | Bicycles available for shared services per 100,000 inhabitants | 36 | 80 | 120 |
| 7 | Reduction of energy consumption of public buildings | 99.104,4 GJ/m2 | 69.737 GJ/m2 | 49.552 GJ/m2 |
| 8 | Reduction of greenhouse gas emissions | 7,5% | 23% | 15% |
| 9 | Concentration of fine particles PM2.5 | 3,0 ug/m3 | 2,8 ug/m3 | 2,3 ug/m3 |
| 10 | Concentration of fine particles PM10 | 7.0 ug/m3 | 6.8 ug/m3 | 5.9 ug/m3 |

# Assessment of city performance - progress against KPIs [3/3]

| City performance | | Where we started | Midway through the challenge | Final results |
|---|---|---|---|---|
| 11 | Gas emissions | 2,60 tCO2/inh | 2,0 tCO2/inh | 1,8 tCO2/inh |
| 12 | Number of people on bike paths and kilometres travelled (year) | 104.678 / 15,8 km | 152.403 / 22 km | 174.787 / 51 km |
| 13 | Number of people in sports and leisure parks | Not determined | Not determined | Not determined |
| | | | | |
| | | | | |

# Assessment of city performance – discussion [1/2]

- **Digital infrastructure and services.** ICC Guimarães has been instrumental to develop a more connected city by providing a wide range of land and wireless networks and supporting new digital services, hence enabling businesses, organisations and people to have access to high-quality digital infrastructure and online services and contributing to more digitally skilled and better-connected people, who are increasingly using digital technologies in their professional, social, educational and leisure activities.
- **Sustainable mobility.** The measures taken under ICC Guimarães allowed to improve the traffic management, increasing efficiency in travel times, raising traffic safety levels, and reducing parking issues. Observable impact on the city includes a clear increase in the number of people using means of transport other than their personal vehicle, number of bicycles available for shared services per 100,000 inhabitants, and number of people on bike paths and kilometres travelled.
- **Sustainable and smart energy.** The use of a smart grid to monitor energy consumption and efficiency of public buildings, had considerable impact both in terms of improving energy efficiency and growth in the deployment of renewable energy sources. During the ICC implementation period, energy consumption in public buildings (GJ/m2) has halved.

# Assessment of city performance – discussion [2/2]

- **Monitoring local pollution.** Important outcomes were achieved from the wide range of actions taken to monitor the quality of the city's environment, including greater environmental sustainability, more environmentally friendly citizens' lifestyles and business activities, and better protection of Guimarães' natural assets and ecosystems. The relevant impact of the achieved results is reflected in indicators such as the reduction of greenhouse gas emissions and concentration of fine particles (both PM2.5 and PM10).
- **Capacity building.** ICC Guimarães intended to support the upskilling and reskilling of local workforce, enhancing digital literacy in the population at large, assisting the entry of young people into the labour market and empowering companies in digital and green technologies. Although the key initiative "Digital Academy" has not yet been completed, there was significant evolution in this field during the ICC period – also with the contribution of other actions carried out by the city – namely significant increases in the labour force employed in the ICT sector, number of students enrolled in STEM higher education degrees, and number of people involved in digital inclusion activities. The number of qualified jobs created in companies and RTDI entities also increased considerably during this period.

# Assessment of solution maturity - progress against KPIs [1/2]

| | Where we started | Midway through the challenge | Final results |
|---|---|---|---|
| **Initiative 1 – Extending digital infrastructure and services** | | | |
| 1 City's territory covered by the Internet | 85% | 87% | 95% |
| 2 City's territory covered by LowPowerWAN network | 1% | 30% | 60% |
| | | | |
| **Initiative 2 – Parking solutions** | | | |
| 1 Underground public parking spaces with real-time availability information | 12% | 37% | 50% |
| 2 Surface parking spaces with real-time availability information | 0 | 100 | 900 |
| | | | |
| **Initiative 3 – Traffic monitoring** | | | |
| 1 Main traffic lanes with real-time information | 0 | 3 | 7 |
| 2 Traffic flow sensors | 0 | 5 | 10 |

# Assessment of solution maturity - progress against KPIs [2/2]

| | Where we started | Midway through the challenge | Final results |
|---|---|---|---|
| **Initiative 4 – Sustainable and Smart Grids & EcoDigizens** | | | |
| 1 Public buildings and infrastructures with smart electricity meters | 7 | 14 | 20 |
| 2 Public lighting infrastructures | 120 | 650 | 1200 |
| | | | |
| **Initiative 5 – Monitoring and Promoting Environmental Quality** | | | |
| 1 Number of sensors with real-time information | 4 | 12 | 20 |
| 2 Information in the city sites and mobile app to citizens | No | No | Yes |
| | | | |
| **Initiative 6 – Digital Academy** | | | |
| 1 Organisation/business clients in the first year | Not determined | Not determined | Not determined |
| 2 Individual clients in the first year | Not determined | Not determined | Not determined |
| | | | |
| **Initiative 7 – Career Guidance Programme** | | | |
| 1 Students enrolled in the 9th grade in Guimarães' public schools participating in the programme | 17% | 60% | 90% |

# Assessment of solution maturity – discussion [1/2]

- **Digital infrastructure and services.** A significant development of the city's digital infrastructure was achieved under ICC Guimarães. The territory covered by the Internet now reaches 95%, whilst the territory covered by the LowPowerWAB network has risen from 1% to 60%.
- **Sustainable mobility.** The technological solutions implemented to improve city's traffic and parking took place as expected. Real-time information on traffic and public parking spaces is now available benefiting both drivers and the city's services.
- **Sustainable and smart energy.** A sustainable smart grid was put in place to monitor energy consumption in public buildings, overcoming limitations of conventional electrical grids by using smart net counters. The new platform supports now the Municipality of Guimarães in the implementation of actions towards the reduction of energy consumption and costs. The number of public buildings and infrastructures with smart electricity meters more than doubled under ICC, and public lighting infrastructures increased tenfold.

# Assessment of solution maturity – discussion [2/2]

- **Monitoring local pollution.** The application of sensors for real-time monitoring of the city's environment had relevant impact on the management of Guimarães' environment, enabling the provision of key information for the implementation of necessary corrections. The results of this monitoring will now be shared with the citizens through city's websites and mobile apps.
- **Capacity building.** When the "Digital Academy" initiative is completed, the contribution of ICC Guimarães to strengthen local capacity building will have been highly valuable, namely regarding the empowerment of businesses in digital and green technologies, support to lifelong learning and development of a highly technological city, where an increasing number of people will be working in digital- and knowledge-based jobs. The effective implementation of the "career guidance programme" is now helping 9th grade students make the best career choices and guide them into the professional areas where they can be most successful. 90% of all students from Guimarães enrolled in that grade are attending the programme.

# 5 key lessons

| Lesson | Reflections |
|---|---|
| 1 | Identify problems for improvement, prioritise and align within the municipal executive's strategy |
| 2 | Retain that deployment can be complex, permitting and inspection takes time, investment can be costly and appearance matters. Plan ahead |
| 3 | It is all about data: automatic data collection is important; facilitate a smooth path from data to decision; prefer open APIs; decomplex data workflows and include area's experts |
| 4 | Involve citizens in the process and work with local stakeholders in a quintuple helix model |
| 5 | Keep in mind the environmental challenges |
| | |

# Reflections on city collaborations

- **Networking with other cities** gave Guimarães the opportunity to foster collaboration among network members and **share knowledge**, **best practices** and **experiences**.

- Through **peer-to-peer interactions**, Guimarães had the chance to identify new **methodologies**, new **ideas** and new **pilot projects**, discussing with all stakeholders different approaches, processes and technologies.

# Commitments

| Commitments to on-going resources | Commitments to on-going collaboration | Commitments to on-going KPIs |
|---|---|---|
| ▪ **Digital infrastructure.** Broadband and Wi-Fi connectivity, sensors network, software, user interfaces, communication networks, AI, open data, etc.<br>▪ **Sustainable mobility.** Smart traffic control and management systems.<br>▪ **Energy efficiency.** Smart grid sensors and platforms, renewable energy, smart street lighting.<br>▪ **Environmental monitoring.** Smart environment sensors and platforms.<br>▪ **Digital upskilling and reskilling.** Digital Academy, career guidance programmes, other initiatives for businesses, labour force, students and population at large. | ▪ **Local ecosystem.** The engagement of the main stakeholders will be fostered based on the governance structure established in ICC Guimarães and possibly extended to other actors.<br>▪ **Cooperation with other cities.** National and international cooperation with other cities will be maintained and strengthened. | **KPIs used in ICC will continue to be monitored and assessed in the following areas:**<br>▪ Digital infrastructure and online services.<br>▪ Sustainable mobility and urban transportation.<br>▪ Energy efficiency.<br>▪ Environmental monitoring.<br>▪ Digital skills. |

# 3 Year plan - ambitions

| | |
|---|---|
| Building on the ICC, what would will the city aim to achieve in 3 years time? | ▪ Increasingly access of local organisations and people to high quality infrastructure and online services and applications.<br>▪ Increase the number of companies, organisations and individuals engaged in digital skills development actions, empowering local businesses in digital and green technologies (including training their human resources and supporting management and production processes), supporting the upskilling and reskilling of the employed workforce and unemployed people, and enhancing the digital literacy of the population in general.<br>▪ Foster economic growth through digital and environmentally friendly technologies used by existing and new companies, enabling the creation of more and more knowledge-based and green jobs.<br>▪ Continue and reinforce environmental sustainability monitoring actions with the support of digital solutions. |
| What steps will you take over the next 3 years to achieve these goals? | ▪ Ensure financial resources, human resources (from across city departments), expertise (in-house and external) and access to the most advanced technologies.<br>▪ Integrate the results achieved by ICC into other future initiatives (e.g. "100 climate-neutral cities by 2030").<br>▪ Update the ICC roadmap and action plan. |

# 3 Year plan – targets [1/2]

| KPI | Category | What commitments will the city make to this end? |
|---|---|---|
| 1 Labour force employed in the ICT sector | City Performance | Develop workforce digital capability through strategic partnerships. Support computing skills and the digital talent pipeline from early years onwards. Digital Academy. |
| 2 STEM higher education students | City Performance | Continue strategic partnerships with local Higher Education Institutions to promote advanced education and research in digital knowledge and technologies. |
| 3 Highly qualified jobs created | City Performance | Attract more knowledge-based companies and keep launching high-tech, high-growth start-ups, as well as generating more higher education graduates, especially in STEM. |
| 4 Digital inclusion of low-skilled and low-literate people | City Performance | Promote awareness of digital benefits and progress digital literacy and education. Facilitate digital literacy programmes through strategic partnerships. |
| 5 Citizens using means of transport other than personal vehicle | City Performance | Increased public transport use; public transport attractive prices; shifting increasingly to bus fleet with zero emissions; achieving a cycling and walking progressive transformation; reduced congestion and air pollution, better traffic management. |
| 6 Bicycles available for shared services per 100,000 inhabitants | City Performance | Launch new bicycle awareness raising initiatives, foster Guimarães' bike-sharing schemes, expand bicycle infrastructure, provide suitable bicycle parking facilities, enhance streets safety for cyclists. |
| 7 Reduction of energy consumption of public buildings | City Performance | A sustainable energy plan will be further developed to ensure even better energy efficiency in public buildings, giving priority to smart grids, renewable energy sources and increasingly number of green buildings that have sustainable design, construction and operation and can generate their own energy. |
| 8 Reduction of greenhouse gas emissions | City Performance | Along with many other climate-friendly measures already put into action, a real-time monitoring of the city environment will continue to be promoted to facilitate the implementation of corrective measures. |

# 3 Year plan – targets [2/2]

| KPI | Category | What commitments will the city make to this end? |
|---|---|---|
| 9 Concentration of fine particles | City Performance | A real-time monitoring of the city environment will continue to be fostered to facilitate the implementation of corrective measures. |
| 10 City's territory covered by the Internet / LowPowerWAN network | City Performance | Additional investments to connect Guimarães at all levels, leveraging advancements in increased broadband connectivity and identifying further investment opportunities to extend digital connections. |
| 11 Underground/surface public parking spaces with real-time availability information | Solution maturity | Increased use of smart transport infrastructure, better parking management. |
| 12 Main traffic lanes with real-time information | Solution maturity | Increased use of smart transport infrastructure, better traffic management. |
| 13 Public buildings and infrastructures with smart electricity meters | Solution maturity | Expansion of the number of public buildings and infrastructures with smart electricity meters. |
| 14 Public lighting infrastructures | Solution maturity | Expansion of the public lighting infrastructure covered by energy efficiency measures. |
| 15 Number of environment sensors with real-time information | Solution maturity | Further development of the real-time environmental monitoring system, including the deployment of a wide variety of hardware, software and methodologies. |
| 16 Digital Academy (organisations and individuals) | Solution maturity | Digital Academy. |

The European Commission's
INTELLIGENT CITIES
CHALLENGE

Appendix

# Guimarães: Additional information

ICC Transformation

February 2021 to May 2021

European Commission | The Intelligent Cities Challenge is funded by COSME, the EU programme for Competitiveness of Enterprises and SMEs

# City Needs: State of the city – detailed analysis [1/10]

## Higher performance areas - Increasing digitalisation of companies and city services

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Increasingly digitalisation in the city, both regarding city services and use of digital technologies in industry and services (although to a lesser extent). | Evidence collected in the quantitative analysis of City Scan results; and qualitative analysis of the interviews carried out with the city's stakeholders. | The city is providing increasingly digitalised services with associated added value functionalities (e.g. payments, notifications, follow-ups, etc.), with public recognition of some flagship initiatives, such as wi-fi coverage in the Historic Centre, "Proximcity" electronic kiosk, "My Home City"/"Cityfy" app etc. At the same time, internal digitalisation of municipal services is also taking place (e.g. website of the municipality with increasing offer of functionalities, and increase in paperless processes).<br>There is therefore a good basis for continuing the city's digital transformation that can benefit the development of other areas, such as sustainable development.<br>Local companies are also taking advantage of such development, as they are also using digital technologies in a significant way, in particular industry and some services. Many businesses see the pandemic crisis as an opportunity to strengthen their presence in digital.<br>All this means that it is necessary to continue to invest in the digital infrastructure. | A suitable digital infrastructure should therefore be a priority solution within the ICC strategy, an idea that is widely supported by the stakeholders.<br>As part of the ICC strategy, an expansion of the infrastructure of fixed and wireless networks should take place, with both public and private investment, so that any citizen should be able to access high-quality public and community services but also access a wide network of services provided by private initiative. The following actions should be implemented:<br>– promote the expansion of high-speed broadband;<br>– reinforce wireless networks (i.e. Wifi, 4G+ and 5G technology, LiFi, NBIOT and LoraOne etc);<br>– better interconnection and consolidation of sensor networks of main commodities;<br>– encourage the use and sharing of open data;<br>– promote online services that support the development of value-added digital services, including the encouragement of the practice that each organisation has a digital twin. |

# City Needs: State of the city – detailed analysis [2/10]

## Higher performance areas - Guimarães 2030 Sustainable Development strategy

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Significant progress made by the city in the environmental area with the implementation of the Guimarães 2030 Sustainable Development strategy. | Evidence collected in the quantitative analysis of City Scan results; and qualitative analysis of the interviews carried out with the city's stakeholders. | Strong perception that there is a defined strategy (i.e. Guimarães 2030 sustainable development) that, in general, is known by the population which has been informed and engaged.<br><br>Stakeholder recognition that there is a strong commitment to environmental education in schools, the existence of more green spaces and the use of more natural energy resources.<br><br>Good collaboration in this field between different entities (universities, R&D centres, city services, and companies). | Although the Guimarães ICC Strategy is about digital transformation focused on sustainability, aiming at an intelligent and sustainable growth and moving towards a more digital and low-carbon economy, topics related to environmental sustainability will be considered within ICC to the extent that they intersect with solutions for an intelligent city based on digital technologies.<br><br>Thus, the ICC strategy will not overlap with the Guimarães 2030 Sustainable Development strategy, which has its own action plan and a dedicated mission team, but will instead have a complementary role to that strategy. |

# City Needs: State of the city – detailed analysis [3/10]

## Higher performance areas - Resilient industry

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Considerable resilience shown by some local economic sectors to the pandemic crisis, namely industry.<br><br>Pandemic crisis was an opportunity for many companies to digitalise their businesses. | Evidence collected in the quantitative analysis of City Scan results; and qualitative analysis of the interviews carried out with the city's stakeholders. | Such resilience shows that as soon as the pandemic crisis is overcome, local economy will be ready to flourish again. Many businesses will be technologically better prepared, with excellent potential for global empowerment of the business community within the scope of the ICC strategy. | One of the priority solutions of the ICC strategy will be companies' capacity building (skills and technology) in the digital and green areas, so the resilience and trajectory of increasing digitalisation shown by the local economy is very significant for the future ICC action plan. |

# City Needs: State of the city – detailed analysis [4/10]

## Higher performance areas - Public security and access to health services

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Guimarães enjoys high public security, as well as rather good access to health services. | Evidence collected in the quantitative analysis of City Scan results; and qualitative analysis of the interviews carried out with the city's stakeholders. | Respondents to the City Scan questionnaire and stakeholders interviewed considered that Guimarães enjoys high public security, deeming that, in general, citizens and organisations have been well protected against threats to their well-being, including the role of security forces, firefighters and emergency medical services.<br><br>Likewise, the same respondents and interviewees also very positively assessed access to health services available in the city, including public and private health services. | The areas of public security and health services reveal a high level of performance and maturity and will not be directly addressed under the ICC strategy. |

# City Needs: State of the city – detailed analysis [5/10]

## Higher performance areas - Wastewater treatment

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Very high level of performance of wastewater treatment | Evidence collected in the quantitative analysis of City Scan results. | Wastewater treatment was the subtopic best rated by respondents to the City Scan questionnaire, thus showing the high satisfaction of local stakeholders regarding the actions that have been carried out in the city to remove contaminants from wastewater and convert it into effluents that can be returned to the water cycle or reused for other purposes. | Wastewater treatment show a very high level of performance and maturity and will not be directly addressed under the ICC strategy. |

# City Needs: State of the city – detailed analysis [6/10]

## Lower performance areas - Mobility/traffic congestion

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Traffic congestion was the subtopic of the City Scan questionnaire that received the worst review from stakeholders. In the context of ICC locally organised events and interviews, it was realised that the city can do better in order to prevent traffic in its territory to be characterised by lower speeds, longer trip times and vehicular queueing situations.<br><br>On the other hand, the issue of car parking was also considered a problem to be solved, also taking into account that the demand for parking spaces is likely to contribute to traffic congestion. | Evidence collected in the quantitative analysis of City Scan results; qualitative analysis of the interviews carried out with the city's stakeholders; traffic information data monitored by the city. | The city should carry out better traffic monitoring through a “smart traffic” solution.<br><br>The city should begin to have more information about available parking places, limited-time and conditioned parking areas, user-driver profiles with ecological footprint calculation, integration and interconnection with the agents of the territory, promotion of communication between pedestrians and drivers, and provision of analytical data on the territory and models of decision-making assistance. | Traffic monitoring should be developed through a “smart traffic” solution, which would allow city's traffic monitoring, integration and interaction with the different agents of the territory (civil protection and emergency services, mobility and traffic), and the development of analytical models to support decision making.<br><br>Parking solutions are to be developed, scanning of underground and surface parking bags, with indication of available spaces, limited-time and conditioned parking areas and user-driver profile with ecological footprint calculation.<br><br>The implementation of communicative routes that allow the transformation of traditional walkways in intelligent crossings would also be sought, promoting communication between pedestrians and vehicle drivers, and providing at the same time analytical data on the territory. |

# City Needs: State of the city – detailed analysis [7/10]

## Lower performance areas - Mismatch between existing skills and business needs

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| – Difficulties for employers to recruit human resources with the necessary skills, including digital skills.<br>– Still considerable digital illiteracy in the population at large.<br>– Need of new upskilling and reskilling strategies and actions. | Evidence collected in the quantitative analysis of City Scan results; qualitative analysis of the interviews carried out with the city's stakeholders; and opinion gathered from the local agency of the IEFP - Employment and Professional Training National Institute. | Although there are ongoing training actions organised by private and public entities to respond to the needs of companies and to increase employability, it seems necessary to reinforce actions to support the upskilling and reskilling of the employed workforce; support the upskilling and reskilling of unemployed people; enhance digital literacy in the population at large; and support the entry of young people into the labor market. It is also necessary to empower companies in digital and green technologies, including training their human resources and supporting the implementation of new management and production processes. | The city would gain in establishing a new organisation that would be in charge of developing digital skills in different groups of the local society and support the digital transformation of the business community., including the upskilling and reskilling of the local workforce, addressing particularly the needs of the main economic sectors, and the development of digital skills in the population at large, promoting digital literacy and social inclusion.<br><br>In addition, it will be necessary to reinforce career guidance actions in the younger population in order to direct the latter towards the professions for which they have greater vocation, as well as to develop soft skills. |

# City Needs: State of the city – detailed analysis [8/10]

## Lower performance areas - Energy consumption

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| The stakeholder consultation highlighted the need to improve annual energy consumption in the city and the energy performance of buildings.<br><br>It is therefore necessary to improve energy efficiency through the implementation of new infrastructure and technology to provide modern and sustainable energy services. | Evidence collected in the quantitative analysis of City Scan results; and city energy consumption data. | Actions are needed in order to improve energy monitoring and efficiency, energy efficiency buildings and deployment of renewable energy sources, particularly with regard to public buildings.<br><br>Such actions should empower the use of state-of-the-art emerging renewable and sustainable energy technologies, leveraging automation tools and other cutting-edge technologies to give a sound response to energy consumption problems, including the use of intelligent monitoring, control and communication technologies. | The city is to implement measures in the sustainable energy field, regarding in particular municipal buildings and public equipment, through the use of sensors (e.g. smart counters) to monitor the energy consumption of each municipal building and equipment, to determine the ecological footprint of each, and create a register with a consumption profile for each of these devices. In the near future, it should be possible to actively activate or deactivate any equipment in public buildings. At the same time the analysis, measurement, and consolidation of energy consumption in public buildings and streetlamps should be feasible. Implementation of the Guimarães smart sustainable grid project: the intelligent energy grid is to monitor the consumption and efficiency of public buildings and promote strategic changes in the electric energy value chain.<br><br>Furthermore, municipality energy consumption information should be available through a public dashboard. |

# City Needs: State of the city – detailed analysis [9/10]

## Lower performance areas - Monitoring local pollution

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Despite the strategy followed several years ago to make Guimarães a greener and more sustainable city, there is a common concern among the main stakeholders that has to do with the possible pollution caused by the local industry that keeps being the city's main economic sector.<br><br>Despite all mitigation measures (including those put in place by the industries themselves), such activities may cause local troubles, such as air pollution, water contamination and noise. | Evidence collected in the quantitative analysis of City Scan results; and qualitative analysis of the interviews carried out with the city's stakeholders. | Actions should be put into practice, for instance through fixed and mobile real-time monitoring of air quality, noise, temperature, humidity, pressure and implementation of protection/correction measures, as well as encouragement to participatory citizenship in environmental improvement through behavioural changes to lifestyle.<br><br>With the implementation of such activities, Guimarães should start having real-time data on the city environment, providing alerts and or incentives to necessary corrections through the provision of information, as well as incentive to proactive citizen participation. | The following measures are to be implemented:<br><br>Environmental stations. Fixed and mobile monitoring in real time of air quality and noise (as well as temperature, humidity and pressure).<br><br>Monitoring the environmental quality of a number of schools. Observing the environmental quality of school parks and implementation of protection measures.<br><br>Healthy lifestyle monitoring. Lifestyle monitoring and participatory citizenship using beacon devices, sensors and GPS or passive QRCode technology. |

# City Needs: State of the city – detailed analysis [10/10]

## Lower performance areas - Low collaboration between companies and knowledge centres

| Key insight | Data points | Interpretation | So what? |
|---|---|---|---|
| Low collaboration between companies and knowledge centres, also regarding digital and green RTD and innovation. | Evidence collected from the qualitative analysis of the interviews carried out with the city's stakeholders. | Better coordination between RTD centres and companies is needed so that the latter benefit more from the skills of RTD centres.<br><br>Guimarães enjoys an excellent density of RTD centres with very relevant skills in the digital and environmental areas. It is necessary to better communicate these skills to companies, just as it is important to make companies aware of the need to invest more in R&D and innovation. | The Crisis and Economic Transition Office, created in 2020 by the city of Guimarães, has the mission of developing an action plan aimed at mitigating the negative effects caused by the pandemic crisis in the business community. One of the key partners of this initiative is the University of Minho, meaning that a number of projects will be developed between the University's R&D centres and local companies, including projects in the digital and environmental areas.<br><br>While being a critical issue for the local ecosystem, this topic will not be directly addressed by the ICC strategy, as it will be mostly handled in the framework of the city's Crisis and Economic Transition Office. |

# City Needs: bottom-up perspectives [1/2]

- What stakeholders considered is going well in the city:
  - Strong sense of identity, pride and belonging.
  - Young, modern, future-oriented city.
  - Increasingly digitalised city services.
  - Significant use of digital technologies in industry and services.
  - Pandemic as an opportunity for businesses to strengthen the use of digital technologies.
  - Guimarães 2030 Sustainable Development strategy known in general by the population.
  - Strong commitment to environmental education in schools.
  - Increasing use of natural energy resources.
  - (Despite the pandemic crisis) resilience shown by the industry (e.g., textile).
  - (Before the pandemic) remarkable growth in tourism, restaurants, and cultural businesses.
  - City's role in supporting existing and new companies (e.g., business incubators, Guimarães Marca, Crisis and Economic Transition Office).
  - City's effort to get closer to citizens, including, for instance, the “Balcão Único” (one-stop service), “Espaços do Cidadão” (citizen's spaces throughout the municipality), and online services.
  - Satisfactory level of cooperation between private and public sector actors (e.g., economic development, environment, training, social support).
  - Training for employed and unemployed people.
  - Increasing relationship between the city, Higher Education Institutions and companies.

# City Needs: bottom-up perspectives [2/2]

- What stakeholders considered the main challenges to be addressed:
  - Heterogeneous territory: geography, economy, society and culture.
  - Still considerable digital illiteracy in the population.
  - Insufficient digital skills in small and micro enterprises in traditional sectors (for example, trade small businesses and restaurants).
  - Digitalisation has not been a priority for many small and micro businesses.
  - Widespread difficulties in almost all economic sectors with the pandemic.
  - Potential for the sustainability area to generate employment and economic growth still far from being achieved.
  - Collaboration between companies and Research and Technological Development (RTD) centres still relatively low.
  - Difficulties for employers to recruit human resources with the necessary skills, including both technical and soft skills.
  - More professional education, on-the-job training and reskilling actions are needed.
  - “Brain-drain”, particularly of highly qualified young people.