

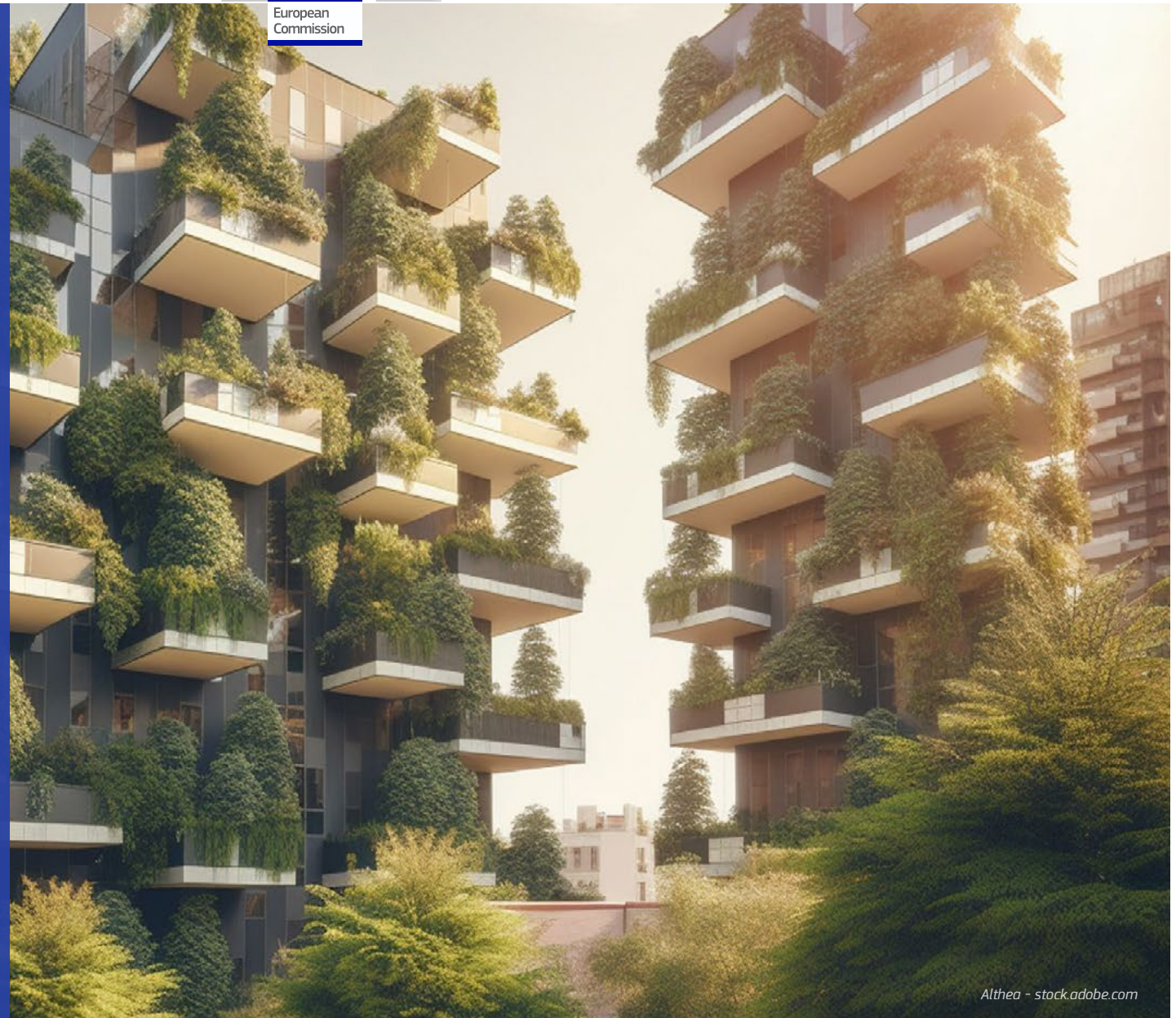


INTELLIGENT CITIES CHALLENGE

EU CITIES CHAMPIONING THE GREEN AND DIGITAL TRANSITION

The European Commission's
100 Intelligent Cities
Challenge

An initiative by **EISMEA** and **DG GROW**



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Foreword

Cities are vital engines driving Europe's economy and society, contributing approximately 80% of EU GDP. They serve as hubs of economic activity, innovation, and community engagement. Cities play a crucial role in implementing 70% of EU policies, delivering solutions and services that directly impact local businesses and citizens.

Today, global megatrends are reshaping economies and societies, demanding swift policy responses at all levels. Urban areas are at the forefront. From the COVID-19 pandemic, the fight against climate change and migration influx to Russia's unwarranted invasion of Ukraine, energy and food price surges, and supply chain shortages, cities are at the front line tackling shared challenges. Addressing these pressing challenges necessitates reimagining how cities are designed, constructed, and managed.

The EU Industrial Strategy recognises the imperative to accelerate the green and digital transitions of European industries, bolstering their resilience along with that of small enterprises and society as a whole. The European Commission, in collaboration with public authorities, businesses, social partners, and stakeholders, is developing transition pathways and action plans for this twin transition. The recent European Green Industrial Plan proposed targeted legislation namely the Net-Zero Industry Act and the Critical Raw Materials Act, with the aim to scale up clean technology manufacturing in Europe, enhance the resilience of critical raw material supply chains, and foster circularity and sustainability.

We are committed to promoting industry decarbonisation, improving energy efficiency in industrial processes, and developing and deploying strategic net-zero technologies. This includes harnessing solar and wind energy, using batteries and storage, leveraging heat pumps and geothermal energy, adopting electrolyzers and fuel cells, implementing biogas/biomethane solutions, employing carbon capture and storage technologies, and integrating grid technologies. Industries which have

high energy requirements, require special attention. Additionally, investing in circular economy facilities, closed-loop systems, and reskilling the local workforce to meet the demands of the green industrial transition are crucial.

To efficiently implement these measures, we emphasise the importance of public-private partnerships at all levels. This is why we are supporting the Intelligent Cities Challenge initiative which accompanies smaller European cities to set up the Local Green Deals. These agreements between city authorities, local businesses, and industries support the sustainability goals of cities and ensure mobilisation and commitment from all stakeholders. And I am happy to see that we have rolled out 42 Local Green Deals between 2021 and 2023.

This summary report presents valuable lessons from the Intelligent Cities Challenge initiative and provides recommendations for other cities embarking on their own transformation journey toward the twin transition. Looking ahead, we are committed to scaling up successful practices with the new phase of Intelligent Cities Challenge 2.0. Our aim is to connect more city ecosystems, empowering them to achieve social and environmental sustainability goals alongside economic competitiveness.

I hope you find this report insightful as we collectively strive for a sustainable and prosperous future.

Foreword by



Kerstin JORNA

Director General

*Directorate General for Internal Market,
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Abstract

This report of the first phase of the *Intelligent Cities Challenge (ICC)* presents the main takeaways, achievements, methodological approaches, learnings, challenges, and opportunities. The programme's four phases – which lasted 25 months (from September 2020 to September 2022) - brought together a large city community – combining 136 core and mentor cities from within the EU and globally – to achieve intelligent, socially responsible and sustainable growth through advanced technologies.

During the programme, cities have embarked on an action-oriented and collaborative approach implemented through five thematic tracks, facilitated by advice, strategies, regular networking and training opportunities, community gatherings, and access to online toolboxes and mentoring. The programme has contributed to designing impactful visions, targeted strategies and implementing concrete solutions towards a green and digital transition at the city level. It has helped to deliver on the European Green Deal by shaping 'Local Green Deals'.

Some major learnings of the programme for the realisation of Europe's 'twin transition' objectives concern the need to place citizens at the centre and to emphasise the building of strong partnerships with local ecosystem players such as businesses, social economy actors and civic organisations at the local level. At the core of the programme's impactful city strategies and solutions are approaches grounded in technological transformation, data and data analytics, upskilling/reskilling initiatives, and robust monitoring frameworks.



Executive summary

The *Intelligent Cities Challenge (ICC)* is a European Commission initiative, in the context of the *EU industrial strategy*, supporting European cities towards the green and digital ('twin') transition of their local economies through Local Green Deals. ICC helps European cities harness the power of cutting-edge technologies while improving their economic competitiveness, social resilience and citizens' quality of life.

This is the final report of the inaugural phase of ICC, introducing the methods and approaches and capturing the main takeaways and achievements of the participating cities, including the thematic networks and cross-thematic interests, as well as learnings for other cities to replicate. This report also includes an analysis of each of the five thematic tracks. It presents the achievements of participating cities, the lessons they learned, and the challenges and opportunities they faced.

Looking forward to the second phase of ICC (2023-2025), the report also includes an overview of potential future synergies and collaborations with other relevant EU initiatives, such as *Horizon Europe's Mission on Climate Neutral and Smart Cities*. The report's final chapter includes recommendations for the second phase of ICC.

Some of the **major learnings** for the realisation of twin transition objectives are the need to place citizens at the centre and to emphasise the building of strong partnerships with local businesses and social economy players while ensuring strong cross-departmental involvement. Further to this, some of the main drivers in addressing the needs of citizens and businesses are linked to the promotion of upskilling/reskilling initiatives, technological transformation, the uptake of data and data analytics, and robust monitoring frameworks.

Building on the legacy of its predecessor, the Digital Cities Challenge (DCC), the ICC expanded the network from 41 to 136 EU-based participants representing core cities, mentor cities and international cities. **Core cities** from the EU consisted of

different groups, including those participating in the DCC, new applicant cities from within the EU, and consortia of cities. **Mentor cities** covered cities with a proven track in ICC's thematic areas, offering inspiration and best practices for participating core cities. Two types of **international cities** were involved: core cities and mentor cities. The core cities were predominantly those with medium maturity in utilising advanced technologies for climate-neutral, sustainable and socially responsible growth. These core cities received guidance from a broad expert network and learnings concerning their twin transition ambitions from 16 mentor cities, five of which were international mentors.

The ICC provided support through **four main phases**, collectively preparing the cities' transformation and supporting them by reviewing and refining existing strategies grounded in actual stakeholder needs and developing a step-by-step roadmap to guide their transformation. Each of the four phases had a distinct purpose that built on the previous ones: 1) Preparation and assessment, 2) Ambition and roadmap, 3) Implementation, and 4) Review and way forward. At the programme's core, the third phase emphasised efforts to implement strategies and solutions in the context of the five thematic tracks.

Each participating city was made up of a local city team – combining representatives from public and private stakeholders – working with experts offered by the ICC programme. These advisors included a dedicated **lead expert** overseeing the day-to-day follow-up, coordination, and support. The lead expert was supported by **thematic experts** offering specialist advice to supported cities on sectoral and technological aspects of implementing twin transition solutions. These were complemented by **transversal experts** who helped cities navigate common barriers and utilise enablers in areas revolving around access to finance, open data and innovative public procurement.

ICC events were held locally in the ecosystem, at country level and with the full ICC community. Each city was asked to organise five workshops locally adapted to the objectives of each phase. While these workshops focused on the local ecosystems,

cities also participated in multi-city events bringing together the full city community or a subgroup. The events covered cross-city labs, mayors' summits, thematic workshops, meetings of cities from the same country, and a final conference. These were complemented by various workshops and events on topics such as the Local Green Deals, reskilling and upskilling, the COVID-19 pandemic and the Russian war of aggression against Ukraine.

The **performance assessment and tracking of progress** was done by looking at four components: local enablers; activities; technology maturity; and city performance. All components come together to drive success in the ICC. City-level indicators were chosen based on their relevance, availability and trackability. Furthermore, **three guides** have been developed to support ICC stakeholders during the process. These are also available to non-ICC cities wanting to transform their city. The methodological documentation of the ICC is composed of the following:

- **ICC conceptual guide:** A high-level guide including the city journeys, working norms and the main types of activities and tools.
- **ICC city flipbook:** A more detailed guide that follows the journey of a core city, describing each phase in turn and what to expect and prepare for success.
- **Lead expert addendum:** A compilation of illustrative event agendas and deliverable templates used mainly to guide the experts providing advisory services to the cities.

At the core of ICC's work were five thematic tracks or networks focusing on supporting cities in implementing solutions. The tracks covered the following: green economy and Local Green Deals; supply chains, logistics and the economics of mobility; upskilling and reskilling; citizen participation and digitisation of public administration; and green and digital transition in tourism.

The first track, **green economy and Local Green Deals**, emphasised green economy initiatives and promoted the European Green Deal on the ground locally. Transitioning

to 'net zero' requires large-scale technology deployment to create opportunities and build entirely new businesses. The track also sought to leverage decarbonisation strategies to meet climate targets while promoting new business models to spur economic growth at local levels. Emphasis was equally given to the need to decarbonise across all sectors within local communities. Given the high volume of emissions, this network track focused on developing strategies, projects and solutions that embrace the green transition and circular economy. Supported projects, among others, covered solutions for renewable energy sourcing, green manufacturing, and sustainable waste management. Cities were asked to develop **Local Green Deals (LGDs)**, serving as local tailor-made action plans to accelerate and scale up a city's green transition. Building on partnerships with public and private stakeholders, LGDs were encouraged to focus on the green transition and, in addition to decarbonisation, embrace issues such as circular economy actions, raw materials shortages, sustainable products and services, or sustainable food systems.

The **supply chains, logistics and the economy of mobility** thematic network covered an area severely affected during the first phase of the Intelligent Cities Challenge. Recent geopolitical developments and the enduring effects of COVID-19 have impacted supply chains across all industries, and the Russian war of aggression against Ukraine challenged the European Union's energy security. Achieving Europe's net-zero ambitions and making it energy independent relies on decarbonisation technologies to shift supply towards more sustainable options. Supply chains and support infrastructure must support this transition. However, when it comes to implementing logistics and mobility initiatives, challenges often hinge on data and integration. More specifically, these include the collection of quality data and the digital and physical integration of new and old public transport infrastructure.

Among European cities, various initiatives were initiated to address the need for **up- and reskilling**. Cities had already commenced up- and reskilling initiatives to bridge the high-demand jobs gap before COVID-19 struck. Still, this trend accelerated

during and after the pandemic due to rising unemployment and budget constraints. It also led to a growing belief that collaboration and partnerships are important to provide effective solutions, in which sense the Pact for Skills arrived promptly. Despite these initiatives, large-scale implementation of up- and reskilling initiatives has yet to be achieved. Two main barriers to poor uptake have been identified: the need to build a regional ecosystem and the need for financing.

Citizen participation and the digitisation of public administration was one of the most popular thematic tracks, particularly as European citizens interacted through digital means thanks to government-imposed isolation measures during the pandemic; even countries with low or slow digital uptake are catching up. However, the use of digital tools varies by sector and country. Digital tools open two-way communication between citizens and governments; they enable better outcomes and foster stronger relationships between government bodies and citizens. So, getting the digital experience right is critical. Data access has been a challenge when creating digital tools, but cities are beginning to understand the positive impact on what centralised, integrated and open-source platforms can have. Although cities are progressing with design and data access, challenges in these areas remain.

The **green and digital transition in tourism** was arguably one of the most challenging thematic networks because it was affected by various externalities throughout the ICC journey. ICC allowed cities to identify solutions focused on sustainability and digitisation, which helped accelerate the post-pandemic recovery. Disruptive technologies such as the Internet of Things (IoT), big data, and augmented and virtual reality were key in many destinations. The data economy – both public use of data through open data platforms and through dashboards and observatories to improve decision-making processes – are important trends being developed and whose consolidation in coming years will significantly influence many destinations' transformation. The main challenges were, in some cases, related to the lack of funding, or the difficulties in managing the funds available, the lack of key stakeholder engagement, the lack of local experts supporting the day-to-day implementation, and the lack of political awareness.

ICC **had three transversal networks: access to finance, innovative public procurement, and open data.** The **access to finance** network brought awareness of funding streams at European, regional and national levels and helped cities draw on new and innovative approaches to revenue-collection and financing. The capacity of cities to develop their financial sustainability and resilience depends on their ability to access diverse revenue sources to pay for urban infrastructure and invest in better services (i.e. delivery, implementation, operation, and maintenance).

Authorities across Europe showed they have the power to promote the uptake of new solutions and technologies through **innovative and social public procurement** by acting as an early adopter. It also requires public buyers to use their procurement processes as a strategic tool to enable more businesses to offer innovative solutions. Implementing socially responsible public and green procurement can also help cities adopt more inclusive and sustainable practices leveraging their purchasing power as local authorities.

Open data plays a pivotal role in advancing the development of smart cities across Europe. By making city data freely accessible to the public, local governments promote transparency, innovation, and citizen engagement. This transparency enables businesses, researchers, and developers to harness this data, creating tailored solutions to address urban challenges. Furthermore, open data initiatives drive informed decision-making, leading to more inclusive, sustainable, and efficient urban development, capitalising on the collective intelligence and insights of the community.

The **Tech4Good Marketplace**, developed in the context of ICC, has become a growing repository of innovative, labelled and efficient clean tech solutions and business models for real-time air quality monitoring, waste and water management, or clean mobility. The marketplace offers cities and local stakeholders access to successfully deployed solutions and best practices.

The thematic tracks showed several notable achievements among the participating cities, as shown in the table below.

Table 1: Thematic track synthesised achievements

THEMATIC TRACK	ACHIEVEMENTS
<p><i>Green economy and Local Green Deals</i></p>	<p>Among the main achievements by cities working under this thematic track was the facilitation of collaboration among local stakeholders through the LGD. Many cities cited cooperation and collaboration within their own municipality, such as between public and private stakeholders or between public departments, or with other cities for the first time.</p> <p>As part of this thematic track, 42 ICC cities have launched an LGD, and 23 ICC cities are part of the 100 Climate-Neutral and Smart Cities Mission.</p> <p>Among the mentor ICC cities with an LGD, the Amsterdam Metropolitan Area (The Netherlands) signed an LGD with the local construction industry, committing to construct at least 20% of new buildings using wood as its primary material by 2025. Another LGD was signed with organisations in the textile supply chain, committing producers of new textiles to use at least 30% recycled material as of 2025. Another example can be found in the mentor city of Mannheim (Germany). The city created a cross-department LGD team reporting directly to the Mayor and signed 19 deal contracts with local industries and businesses, committing to implement the 'Ideals for Mannheim' LGD.</p> <p>Regarding core cities, six cities have also completed the implementation of LGDs. For example, in the city of Mechelen (Belgium), they signed a Green Deal with another 76 signatories and the Flemish Government. In the case of Mechelen, the focus is on increasing the number of car sharers, car-poolers and bicycle sharers by 2020.</p> <p>In addition, 25 core cities are now in the process of implementation; this is the case of Leuven (Belgium). Through their 'Leuven 2030' initiative, the city has committed to working with stakeholders to act across 13 programme areas, including energy, mobility and urban resilience, as well as cross-cutting areas such as governance, finance, social justice, and data and monitoring. The city of Thessaloniki also follows a similar approach aligning its LGD with its longer-term 'Thessaloniki 2030' strategy. Finally, another six have envisioned to develop one shortly.</p>
<p><i>Supply chains, logistics and the economics of mobility</i></p>	<p>A large subset of cities working in this track stated that they were able to develop a mobility programme with strong impact potential locally. These cities considered that they were able to put in place the foundations of a futuristic transport offering greater interoperability and sustainability.</p> <p>As part of this thematic track, 23 cities developed 46 solutions. The solutions are meaningful as they tackle the drivers of cities' competitiveness, economic growth and job creation. These solutions included but were not limited to smart and green mobility and, the development of a multimodal mobility platform.</p> <p>For example, the city of Timisoara is developing and promoting electric mobility and collective mobility in the city. Another example is the city of Alcobendas, where to reduce the traffic in the city centre, they have implemented a car plate control system and are also replacing cars by greener alternatives such as electric buses.</p>
<p><i>Upskilling and reskilling</i></p>	<p>The achievements of this track were to a great extent coupled with the development of digital and entrepreneurial skills at city level. Similarly, it also relates to the building of an ecosystem of key city stakeholders, bringing together actors on the demand and support side for upskilling and reskilling.</p> <p>As part of this thematic track, 16 cities developed 26 solutions. 9 ICC cities signed the Pact for Skills and other 26 ICC cities have launched other skills initiatives from the promotion of upskilling and reskilling programmes to the creation of online or offline centres for upskilling.</p> <p>For example, Torrent has developed digital skills training and dissemination programmes that aim to bridge the digital skills gap among young people at risk of social exclusion and young mothers without family support.</p>

THEMATIC TRACK	ACHIEVEMENTS
<i>Citizen participation and digitisation of public administration</i>	<p>A key achievement in this track concerned the deployment of ICT-driven solutions to facilitate interaction and collaboration in the local ecosystem and with citizens. The initiative also saw a strong emphasis on open data platforms and participatory governance, such as e-administration portals and accessible dashboards and maps.</p> <p>As part of this thematic track, 49 cities developed 115 solutions, developing infrastructures and services to create growth opportunities for local businesses and start-ups. The importance of this particular transformation became even more apparent by the 22 digital initiatives that were created by ICC cities in <i>response to the pandemic</i>. Cities were able to develop digital-based solutions for improving local services; open data platforms; digital infrastructures; digital-based solutions for security, for improving accessibility and inclusion and for administrations.</p> <p>For example, Poznan is developing a public participation platform which will enable discussions, debates, civic budget consultations, ecological and transport consultations amongst many other things. One example is the Sweden Emilia Romagna Network, which is actively working on a practical application of open data in the fields of e-governance and tourism. Their efforts aim to utilise data more effectively as a foundation for decision-making processes, thereby enhancing efficiency, fostering innovation and benefiting the local ecosystem.</p>
<i>Green and digital transition in tourism</i>	<p>Cities in this track relied heavily on technological solutions to digitise and facilitate a green transition in tourism strategies and activities. Among others, cities focused on developing tourism strategies and digitalising tourism experiences and smart tourism platforms.</p> <p>As part of this thematic track, 17 cities developed 29 initiatives. The solutions were designed to create growth opportunities through smart and sustainable practices to support the green and digital transition in tourism. For example, the development of digital tourism infrastructures and the development of alternative tourism models. In addition, four cities are also part of the EU initiative <i>Smart Tourism Destinations</i>.</p> <p>For example, the city of Logroño has positioned itself as a reference in enotourism thanks to the city's strong wine industry and culture. The ENOPOLIS tourism plan has among its actions the sustainable restoration of hiking and cycling paths along the vineyards surrounding the city, as well as the digitalisation of all tourism and cultural heritage data and the creation of a Smart Wine Tourism Office.</p> <p>Other cities such as Kavala and Vratsa have invested in innovative tourist materials (e.g. virtual tours and interactive boards) to digitalise their touristic experience</p>

Nonetheless, cities have also faced challenges throughout the programme, as described in the table below.

Table 2: Thematic track synthesised challenges

THEMATIC TRACK	CHALLENGES
<i>Green economy and Local Green Deals</i>	Most challenges in this thematic track concerned the engagement of the ecosystem. Some solutions faced resistance from citizens, or a lack of involvement and support by local SMEs, networks and relevant stakeholders as well as having issues with finding appropriate service providers.
<i>Citizen participation and digitisation of public administration</i>	A primary challenge concerned finding the right skills for the design and implementation of solutions. Being able to attain or utilise data from internal and private sources was another issue for solutions related to open data platforms.
<i>Upskilling and reskilling</i>	The key challenges that the cities faced while implementing solutions were a need for more funding, political support or support from the administration during implementation, the inability to attract and retain highly qualified and experienced staff, and low participation rates in the training and upskilling programmes.
<i>Supply chain, logistics and the economics of mobility</i>	A common challenge was the collaboration between local stakeholders and between different government departments. Another challenge encountered by cities was the need for more data and information, notably related to local mobility issues such as parking spaces and traffic forecasts.
<i>Green and digital transition in tourism</i>	Many cities encounter difficulties to involve and coordinate stakeholders or end-users, including tourists. Cities that have implemented an application or a data platform in the context of their solutions have also indicated the management and exploitation of such digital infrastructures as a challenge.

The lessons learned throughout the thematic tracks were wide-ranging, even when analysed within the thematic tracks. Here is a synthesis of the **main lessons learned** across all tracks:

Due to the cross-city nature of some topics, early collaboration with neighbouring municipalities is necessary. Successful design and implementation of solutions, such as those with circularity objectives enabled by digital technologies, require close cooperation across municipality departments. Strengthening the ties and trust among the services before the implementation facilitates the work forward and allows the city to focus on the solution.

Intense stakeholder collaboration is a key feature. Many ICC projects needed intense collaboration between stakeholders, data from private companies and financial resources, but getting them to work in unison was difficult. In the cases where collaborative processes worked, they helped establish a common vision, strong political commitment and buy-in from local communities.

To support the implementation of large-scale projects, it can help to divide them into smaller subprojects and build a new, more coherent holistic architecture. Also, considering the extent of engagement required, it is often beneficial to set up working groups with the stakeholders to facilitate exchanges and operate in an agile way during the implementation of the solution.

Due to the large amounts of data needed, many cities realised they needed help obtaining datasets and having the skills to utilise them fully. Engaging with city stakeholders to understand the availability of expertise for developing and updating open datasets is crucial. Most importantly, however, as cities increasingly handle big data, creating a data governance framework for public and private entities within their cities becomes necessary.

Finally, considering the difficulty in appropriate budgeting for both design and implementation of such solutions, collaborating with local stakeholders and understanding what makes existing models in other cities successful are key inputs during the preparatory phase of designing a roadmap for cities' twin transition strategy.

Cities with a distinct or well-defined vision achieved better results. Considering city stakeholder aspirations and requirements, the visions were defined in this case. A needs assessment conducted during the first phase of the ICC looked at city performance and advanced technology maturity holistically, helping cities design an integrated vision and strategy. The common denominator across all ICC city visions was citizen-centricity and sustainability. The emphasis varies according to the main topics: resource management, carbon reduction, economic growth, businesses and innovation.

This report also offers **recommendations** for the next phase of ICC, oriented towards how cities can benefit more from the ICC initiative. While the first phase of ICC achieved some major successes, several recommendations are offered towards creating more effective city strategies based on evolving needs, helping cities plan a transformation and long-term change towards the twin transition, and advising cities on building capabilities and mobilising city stakeholders.

At the core of the recommendations for the next phase are ambitions to

1. help cities move at different speeds given a variety of capabilities and maturities,
2. pursue a more targeted approach to deliver on the twin transition and Local Green Deals,

3. narrow the focus to emphasise sectors of strategic importance and where cities have a high degree of local influence,
4. embed a stronger focus on matching cities based on common challenges,
5. offer enhanced mentoring activities oriented not only toward knowledge-sharing but also providing specific guidance on strategy and solution design,
6. offer advice for impactful engagement of local ecosystem stakeholders, and
7. facilitate cross-city departmental collaboration to ensure joined-up approaches to drive change.

Finally, the report provides potential cross-initiative partnerships, drawing on shared activities and focus areas of mutual interest.



The first ICC phase shaped a community of 136 cities from 21 Member States focusing on **Local Green Deals (LGDs)**: integrated, multi-disciplinary, multi-stakeholders action plans and investment plans to achieve the green and digital transition of the local economy.

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ICC yielded the following outcomes:



Ramping up strategic action:

80 cities developed action plans and investment plans to boost the twin transition; a blueprint for Local Green Deals resulted in 42 cities launching a Local Green Deal (LGDs).



Promoting use cases:

the **Tech4Good** marketplace offers examples of innovative and efficient clean tech solutions, be it for real-time air quality monitoring, waste and water management, or clean mobility; the **Cities Guide for Reskilling** the local workforce, showcasing city-led skills initiatives to prepare the workforce for the jobs of the future and a **Guide for implementing the Renovation Wave** in cities, which demonstrates city initiatives such as renewable energy source cooperatives.



Leveraging funding:

EUR 1.9 billion for 336 actions, of which EUR 377 million was already secured through private-public funding.



Business involvement:

500 SMEs, 200 large businesses, and 164 civil society organisations were directly engaged, leading to 187 public-private partnerships for solutions development.

Introduction

The *Intelligent Cities Challenge (ICC)* is a European Commission initiative bringing together 136 cities (including consortium cities) to achieve intelligent, socially responsible and sustainable growth through advanced technologies. In overcoming the difficulties of the COVID-19 pandemic, ICC cities are eager to become engines of economic recovery by creating new business opportunities, advancing sustainable developments and citizen participation, and enhancing their cities both digitally and socially.

The 30-month programme builds on the previous success of the *Digital Cities Challenge*, which focused on a smaller scale and helped 41 EU cities (including 15 challenge cities, 20 fellow cities and six mentor cities) to develop a strategic vision and roadmap for their digital transformation.

Taking an action-oriented and collaborative approach, the ICC has thus guided participating cities towards becoming the drivers of their transformational growth. It strongly focuses on the so-called twin – green and digital – transition, vitally important for cities. It has achieved this through advisory services and strategic guidance in five thematic tracks and

transversal services. Opportunities for collaboration and the ability to quickly integrate innovative solutions and technologies into cities were also important during the ICC. Interaction between participating cities was supported by creating opportunities to learn from one another and to tackle city challenges creatively. Cities were encouraged to form ‘intelligent ecosystems’ and develop crucial long-term relationships with other ICC cities.

In addition to receiving expert advice that is unique to the challenges faced by each city, the ICC has provided much more. Other offerings included networking opportunities and community gatherings for participating cities during the ICC City Labs and access to training, online toolboxes and guidance from the ICC mentor cities. To ensure positive outcomes, the ICC programme helped cities to build a tailor-made needs assessment, define their vision and establish a roadmap of priorities for implementation.

Thematic tracks of the ICC

These roadmaps were designed around common city challenges and consulted on by leading thematic experts. They were categorised into overarching tracks according to each city’s aspirations and desired outcomes.

Figure 1: ICC thematic tracks

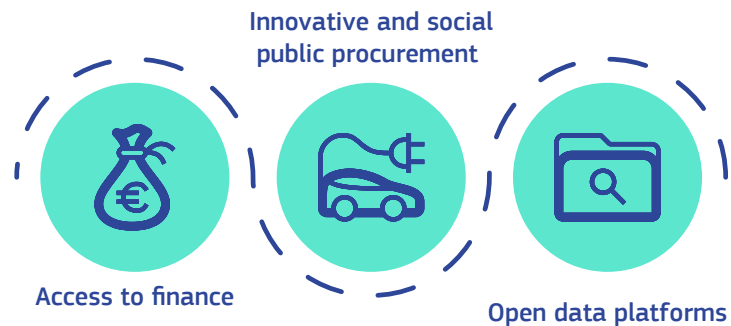


Empowering cities with transversal advisory services

To effectively engage with the thematic tracks and overcome associated challenges, cities were also given access to ICC's transversal services. These offered flexible support to cities through cross-theme coaching so cities could effectively plan for their digital and green transformation by refining and creating new effective strategies. Working with experts, cities have utilised these services to tackle common barriers and leverage local enablers.

The initiative also developed the [Tech4Good Marketplace](#), which collects successfully deployed solutions which might be relevant to other cities, and showcases the successful best practices of cities and communities. The Marketplace has 93 solutions implemented in 62 cities across 26 countries.

Figure 2: ICC transversal advisory services

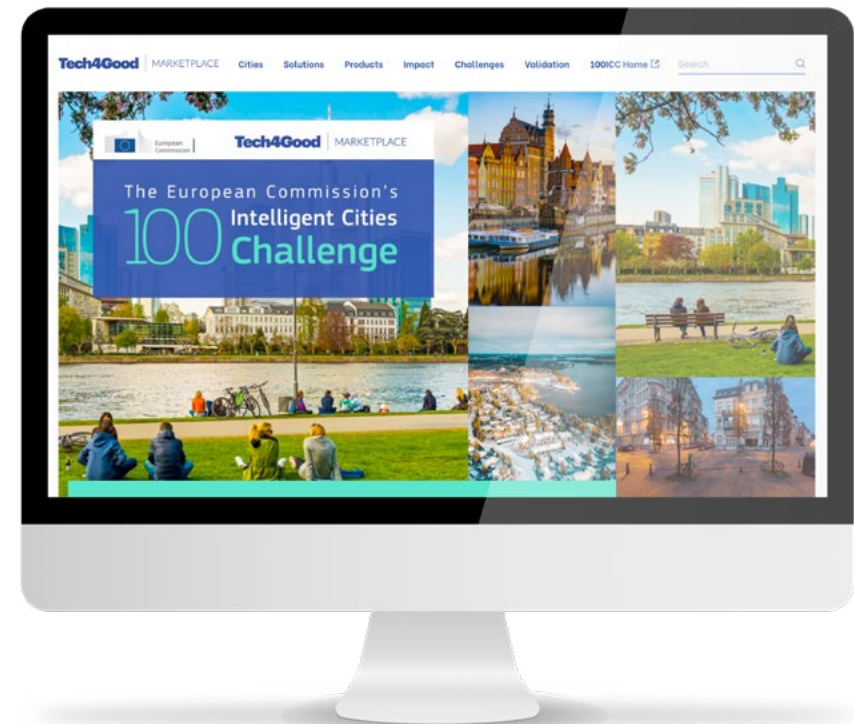


Context and structure of this report

This report has been prepared as a closing deliverable of the first phase of ICC, which ran from 2019 to 2022, presenting the main takeaways and achievements of the participating cities. It also offers the methodology implemented, including

the thematic networks and the cross-thematic interests, and explains how other cities can replicate this methodology for their benefit. The achievements of the cities, as well as the lessons learned and challenges and opportunities faced, are analysed per thematic track. With the second phase of ICC (2023-2025) in mind, the report also includes an overview of lessons learned and recommendations for the next phase.

Figure 3: Tech4Good Marketplace



Key takeaways of ICC

The following section outlines some major learnings from the first phase of the Intelligent Cities Challenge. This serves as a key takeaway for cities to embark on their twin transition by placing citizens at the centre, building strong partnerships with local businesses, and ensuring cross-departmental involvement. Some key drivers for addressing the needs of citizens and businesses are upskilling/reskilling initiatives, technological transformation, uptake of data and data analytics, and robust monitoring frameworks.



Table 3: Synthetised takeaways of ICC

TAKEAWAYS	
<i>Citizens at the centre and citizen participation</i>	A prerequisite for visionary leadership and for dealing with emerging challenges and trends is to ensure that citizens and the local population at large are given a central role in city strategy design and solution development. This means accounting for citizens' needs and trends and involving the population in strategy setting, implementation processes and evaluations.
<i>Partnerships with local businesses</i>	A key role for public authorities is to cultivate and activate the local ecosystems: SMEs and businesses, chambers of commerce, clusters, technology platforms towards common targets. This allows for sharing responsibility with industry, changing consumers' behaviour towards sustainable products and services, leveraging economies of scale and making solutions affordable for all. Cities are recommended to mobilise local stakeholders to identify common challenges, scope solutions, ensure commitment and explore funding streams.
<i>Upskilling and reskilling needs</i>	Mastering the digital and green transitions calls for disruptive education and training schemes and requires critical investment in reskilling and upskilling of the working age population. This need has been reinforced not only by technological advancements, but also the COVID-19 pandemic and supply and energy crisis. Partnerships among local governments, industry, knowledge institutes and social economy actors are crucial to make the required skills available rapidly at scale.
<i>Cross-departmental involvement and synergies</i>	Ensuring cross-departmental collaboration among public authorities' departments boosts productivity, reduces work in silos and competing agendas and delivers better public services. This requires not only mutual awareness of other departments' roles and goals but also regular broad-scale collaboration on visions, strategies and their implementation. Cross-departmental collaboration helps to tackle increasingly transversal urban challenges and it creates opportunities for businesses communities.
<i>Technological transformation</i>	The uptake of advanced technologies and clean tech is crucial for growth, competitiveness and sustainability at local level. Delivering transformative change requires not only a culture of continuous innovation and experimentation but also massive investments for the roll out of proven solutions and clean tech at scale.
<i>Data availability and analytics</i>	Data availability, analytics and services are a major topic in smart policymaking and governance using technology to achieve the twin transition. An approach for cities to govern and keep control of their data is pivotal for improving public services and making sound overall decisions. While plenty of data is available, and the use of urban big data from stakeholders is a key factor for transformation, cities need to closely consider data privacy, commercialisation of data and data governance. They similarly need to put a framework in place that incentivises local stakeholders to share data and to invest in data (i.e. for a platform development or skills for data collection and analysis). This requires an emphasis on defining clear data priorities and offer a value proposition that helps to involve local stakeholders in the delivery and use of the data collected.
<i>City-level monitoring through indicators and KPIs</i>	Monitoring serves as a key aspect when pursuing ambitious transformations, such as the implementation of initiatives that support the twin transition. Monitoring is equally essential to track progress of an initiative and evaluate its impacts. Setting up a monitoring framework and key performance indicators (KPIs) to keep track of local initiatives and measure outputs and impacts require practical models and benchmarks. Learnings from the ICC network show that cities need specific examples of computations for quantitative (often environmental), impact indicators, details on the development of qualitative indicators, and the link between them.
<i>Cities are vibrant market creators</i>	Cities act as vibrant market creators; they increasingly base their decisions on data analytics and are purchasing cutting-edge technology solutions and services. Also given contemporary urban growth trends, cities and city leaders can facilitate innovation and partnerships with businesses and SMEs leading to market growth. Drawing on citizen and societal needs, cities can help push forward transformative results, encouraging the business community to complete high-impact projects in support of the twin transition.

The ICC community

Cities are at the core of the ICC community. The ICC cities can be grouped into two main types: core and mentor cities.

The ICC targeted **core cities** with medium maturity in adopting advanced technologies for climate-neutral, sustainable and socially responsible growth. **136 core cities** were admitted to the initiative and received tailored advice and coaching on their twin transition challenges supported by **16 mentor cities**, among which **five were international mentors**. Along the way, all these cities have built a global community by being part of the ICC network.

As part of the core cities, the programme welcomed **eight consortium cities**¹. In total, these consortia represent 43 cities. Applying to ICC as a consortium city allowed smaller cities with lower populations to participate in the initiative. Consortium cities were either geographically close, strongly collaborating before the initiative (e.g. Gavà and Castelldefels) or distant cities with close links (e.g. Sweden and Emilia Romagna Network).

¹ The consortium cities are Coastal Towns Association (Italy), Palaio Faliro (Greece), Gava-Castelldefels Consortium (Spain), Ljubljana (Slovenia), Association of Municipalities and Towns of Slovenia (Slovenia) and Sweden Emilia Romagna Network (Sweden and Italy), Tripoli (Greece) and Pays de Saint-Omer (France).

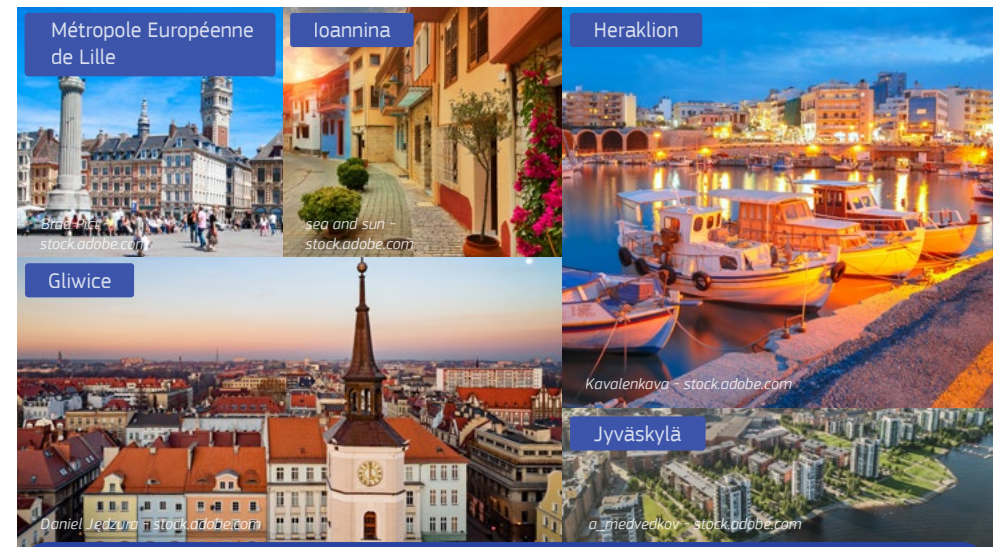


Figure 4: ICC network cloud

Following an Expression of Interest published in 2020 after the start of the COVID-19 pandemic, 143 applications from 17 countries were received. Finally, 136 core cities were admitted to the ICC initiative, supported by **16 mentor cities**, among which **five international mentors**.

Core cities were made up of four different groups: European cities that took part in the Digital Cities Challenge and, hence, were already familiar with the methodology; new applicant cities from within the EU; consortia of towns; and international core cities. European core cities were the main beneficiaries of the programme.

Core cities were those with more than 50,000 inhabitants, identified as being centres of economic activity, employment and innovation. They significantly promoted smart, sustainable and inclusive growth while tackling economic, environmental and social challenges. The core cities were to harness support from the experience of the ICC network of EU and international mentor cities and leading experts to identify appropriate local solutions and overcome key local challenges in a transformative process. From this, they were to engage their city strategies and become regional role models whose enhanced city performance would improve citizens' quality of life and create new opportunities.



"Cork City Council's participation in the Intelligent Cities Challenge has helped us to develop activities that have advanced our smart city ambitions. Through the ICC, we have developed projects that seek to understand our citizens' needs better while also introducing them to new tools and solutions. Projects such as the placemaking toolkit and citizen-centric open data workshops have helped in showing how innovative solutions can be accessible to everyone. We will continue to work to harness the benefits of digital advancement safely and securely for our citizens."

Cork ICC City Team

Mentor cities comprised European mentor cities participating in the Digital Cities Challenge, new mentor cities from within the EU and international mentor cities. Mentor cities are mature cities with a proven track record in at least one of the ICC's thematic areas. Mentor cities were to showcase and grow their successes, receive targeted advice and collaborate with other ambitious cities on thematic challenges and joint initiatives. They were also expected to support the core cities in reaching their objectives by sharing their knowledge and helping to scale intelligent city solutions.

"Amsterdam Smart City (ASC) is committed to accelerating the green and digital transitions through multi-stakeholder collaboration and innovation. A central tenet of the ASC approach is bringing together governments, companies, knowledge institutions and civil society to work on key challenges that no stakeholder can tackle. In this spirit, ASC joined the Intelligent Cities Challenge to share the experience of the Amsterdam Region, learn from other best practices, and form coalitions on topics which require cross-city collaboration. We believe that peer networks like the ICC are crucial to the transition to sustainable and inclusive European cities and are proud to have contributed to this journey over the past two-and-a-half years."

Amsterdam Metropolitan Region ICC City Team



International cities consisted of ten cities from outside the EU. Five are included as mentor cities and the other six as core cities. They added an international dimension that stretched beyond the EU. These partnerships with cities outside the EU were added with the idea of common action in accomplishing global climate and environmental targets using advanced technologies.

"The City of Toronto is grateful to be included as an international city in the ICC. Participating in the ICC initiative has been a positive experience, where Toronto benefited from first-hand exposure to creative ways European cities are tackling city challenges. As a mentor city, Toronto was pleased to have an opportunity to share our Council-approved, principle-based approach to digital infrastructure governance, where decisions and applications are effective for the right problems, operated in ethical ways."

Toronto ICC City Team



The ICC transformation vision

2.1 ICC methodology


The ICC trajectory

The ICC supported four main phases: 1) Preparation and assessment; 2) Ambition and roadmap; 3) Implementation; and 4) Review and way forward. Each phase had a distinct purpose that was built on the previous one. All phases worked together to deliver the desired transformation. The cities that joined ICC and had previously participated in the Digital Cities Challenge engaged in an additional ‘Activate and Accelerate’ phase before the start of the programme, which provided time to recap their journey during the previous phase and restart activity.

The initiative prepared cities for transformation and supported them through that journey by reviewing and refining existing strategies based on real stakeholder needs, forming a step-by-step roadmap of priorities. To deliver on the strategy, the ICC dedicated 12 months of the programme to implementing projects offering targeted support in the context of its five thematic tracks (see the trajectory below).

Figure 5: ICC trajectory

ICC journey at a glance

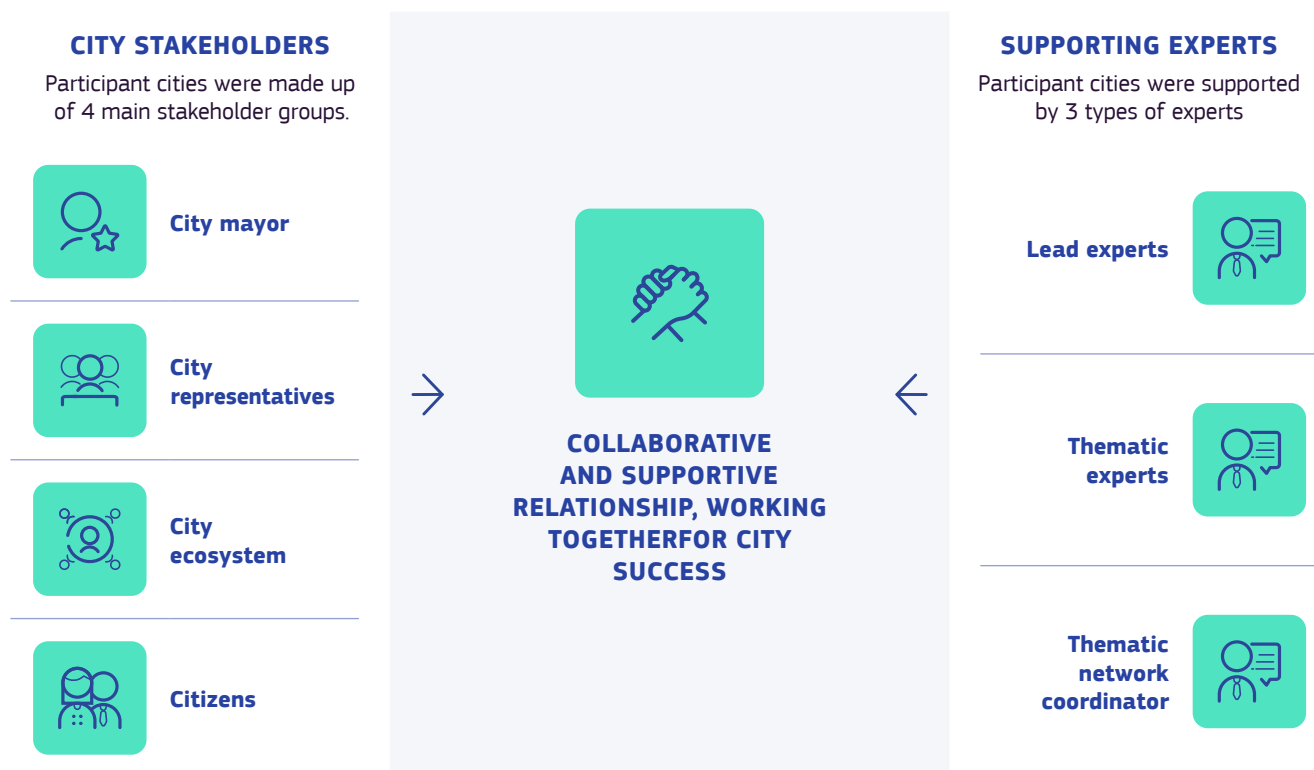
PHASE OF THE PROGRAMME	WHAT CITIES WILL ACHIEVE
<i>Start of programme for existing cities</i>	
 Activate & accelerate	Activate city's stakeholder ecosystem, reflect on the previous phase and define goals for the next phase
<i>Start of programme for new ICC cities</i>	
 Preparation & assessment	Find out where a city is, where it should go and who should be involved to get there
 Ambition & roadmap	Develop a concrete plan to achieve improvements, collaborating with the community; push action with immediate benefits
 Implementation	Get “big moves” done and see results
 Review & way forward	Measure success, and commit to keep connections and improvements going
<i>End of programme</i>	

Source: Intelligent Cities Challenge Methodology

The ICC teams

The cities worked with supporting experts, including a dedicated to their city **lead expert** and **thematic experts** specialising in twin transition topics/solutions the city prioritises. **Thematic network coordinators** assumed a coordinating role and steered the portfolio of lead experts working with cities and solutions under a given thematic track. Experts in **transversal** topics helped cities navigate common barriers and enablers, namely: **Access to finance** (e.g. available funding opportunities for cities), **Open data** (e.g. how to implement an open data strategy), **Innovative public procurement** (e.g. how to maximise the positive impact of cities' purchasing activities).

Figure 6: ICC teams



Source: Intelligent Cities Challenge Methodology





The ICC activities and events

Each city organised five planning workshops locally, which were adapted to the objectives of each phase – i.e. stakeholder mobilisation, needs assessment and solutions' maturity assessment workshops (phase I), roadmap and monitoring workshop (phase II), and a programme review workshop (phase IV). During implementation (phase III), cities regularly exchanged with their lead, thematic and transversal experts. While these workshops focused on active engagement with local ecosystems, participants also participated in multi-city events. These included five cross-city labs, two Mayors summits, thematic workshops (on reskilling, renovation, Bauhaus, Local Green Deals and COVID-19 webinars), and geographic meetings between cities from the same country with multi-layered objectives to share knowledge, raise political awareness and commitment, and build collaborations.

Figure 7: ICC activities and events per phase



3×

Source: Intelligent Cities Challenge Methodology

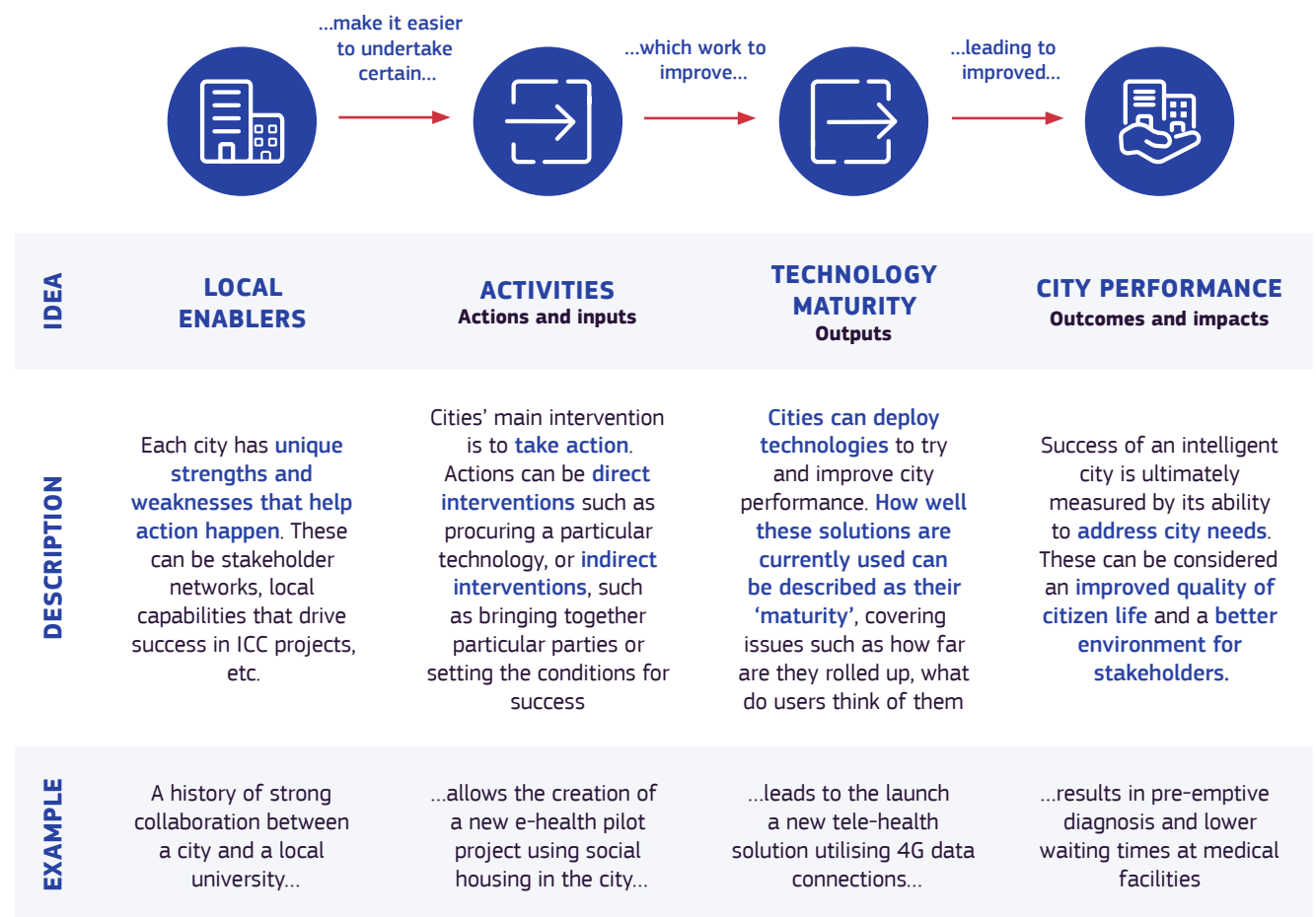


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The ICC monitoring framework

Performance and tracking progress in the ICC was assessed via four measurable concepts: local enablers, activities, outputs and city performance. All four components come together to drive success. Indeed, creating and measuring a system of indicators helps cities to assess progress over time, providing answers to key questions every city is faced with. In the ICC, cities developed KPIs to monitor their local initiatives and measure their progress regarding activities, short-term outputs and longer-term outcomes and impacts. Indicators were chosen based on relevance, availability and trackability. The ICC approach for tracking progress and impact at the local level through KPIs is described in a dedicated report, alongside insightful KPI and monitoring framework examples from cities – available [here](#).

Figure 8: ICC monitoring framework



Source: Intelligent Cities Challenge Methodology

ICC methodology documentation and materials for replicability by cities outside the ICC network

Three guides were developed to direct ICC stakeholders and help steer potentially interested non-ICC cities. The methodological documentation of the ICC is composed of the following:

- The *ICC conceptual guide*: A high-level guide including the city journeys, working norms and the main types of activities and tools.
- The *ICC city flipbook*: A more detailed guide that follows the journey of a core city, describing each phase in turn and what to expect and how to prepare for success.
- The *lead expert addendum*: A compilation of illustrative event agendas and templates used mainly to guide the experts providing advisory services to the cities.

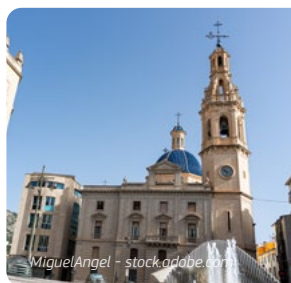
These support documents are *publicly available* and can be used by cities that would like to follow the ICC trajectory independently.



2.2 The vision of ICC cities

Cities defined their vision considering city stakeholder aspirations and needs. The needs assessment conducted during the first phase of the ICC considered city performance and advanced technology maturity holistically, helping cities to design an integrated vision and strategy. The common denominator across all ICC city visions is citizen-centricity and sustainability. The main topics include resource management, carbon reduction, economic growth, businesses and innovation.

A green and liveable city that attracts residents, visitors and businesses



Alcoy (Spain)

To be a region with a resilient economy that supports companies and entrepreneurs to be able to be integrated into the global economy.



Chalkida (Greece)

To create the conditions for attracting innovative companies and start-ups, support the implementation of new business ideas, form a smart and sustainable 12-month tourism model, and create an outward-looking business ecosystem and employment opportunities that will attract the settlement of young people, offering a quality life.



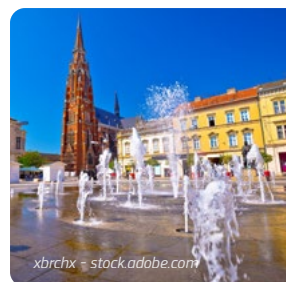
Corfu (Greece)

To build a smart and green city, consistent with our commitment to comply with the United Nations' SDG indicators, where citizens will be proud to live in and visitors happy to come back to all year around.



Guimaraes (Portugal)

To be known as a sustainable city of choice for people to live, work, play and visit, because of its technology, business, educational and cultural opportunities.



Osijek (Croatia)

To be a modern international smart city with 200,000 citizens and 25,000 students, out of which one quarter is foreign. The city is constantly growing because of a healthy lifestyle provided to the citizens in the form of beautiful city promenades, recreational zones, bike trails and a lively city centre, as well as a modern and internationally known university and, most importantly, numerous employment opportunities.



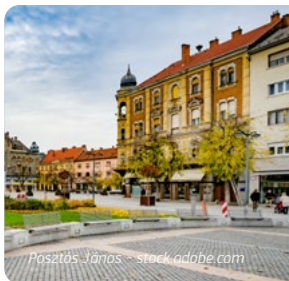
Pescara (Italy)

In 2030, to be the most important city of the Italian Middle Adriatic coast between Ravenna and Bari. This large city of 200,000 inhabitants and a metropolitan area of 350,000 inhabitants will be of high environmental quality, innovative, equipped with infrastructure and services of European level, with a balance between tourism and four-seasons entertainment (sea, mountains, arts, food). Research and development will be addressed in the field of services, trade, fairs and congresses, agri-food industry.



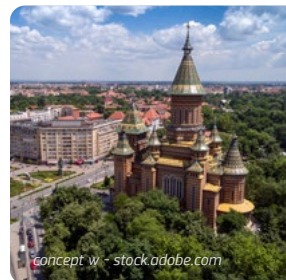
Split (Croatia)

To be a green city with a diversified economy that locally develops and implements sustainable solutions for the benefit of its citizens.



Szombathely (Hungary)

To provide quality environment for its residents and businesses as a regional organiser. Competitiveness and modern city life are achieved through partnership and open communication, regarded as core values.



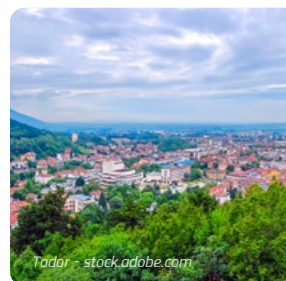
Timisoara (Romania)

To provide balanced sustainable mobility in Timișoara. A Living Lab for innovative mobility solutions.



Valongo (Portugal)

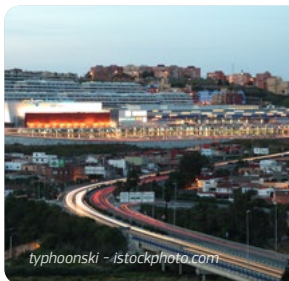
To be internationally recognised for creating outstanding nature, leisure, cultural and gastronomic experiences, while promoting its unique identity and history, the quality of life of its citizens and the sustainability of natural resources.



Vratsa (Bulgaria)

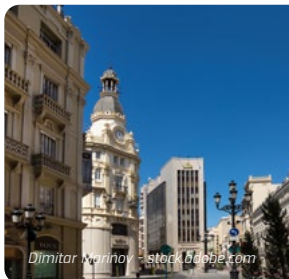
Sustainable tourism and green and circular economy.

A green and resilient city that excels in resource management and carbon reduction



Algeciras (Spain)

To become a reference on sustainability, being recognised for the responsible and efficient management of our resources, and for the respect and care of our environment.



Castello de la Plana (Spain)

CASTELLÓ 2050: A green city for all people to live.



Gava (Spain)

To promote the articulation of municipal policies to boost the circular economy and improve the resilience of our cities based on the analysis of data and predictive models generated with digital tools and solutions.



Haskovo (Bulgaria)

In 2030, Haskovo is an inspiring, environmentally responsible and sustainable city with entrepreneurial and active citizens. A city that offers opportunities for youth development and a dignified life for adults and elderly people.



Iasi (Romania)

Towards an innovative city with a green sustainable economy.



Jyväskylä (Finland)

A carbon neutral Jyväskylä in 2030 because of top research and cooperation between actors internationally known innovations in the bio and circular economy and successful business based on them have been built. In addition, responsibility crosses all companies and organisations, regardless of their field of activity.



Molina de Segura (Spain)

In 2030, Molina de Segura is a smart, open, transparent city, an economic and healthy hub. Where the circular economy is applied in its various industrial areas, and smart mobility reaches the entire city.



Ulm (Germany)

The Ulm Way. A green and resilient city that excels in resource management and carbon reduction.



Pori (Finland)

In 2030, Pori is an intelligent, sustainably growing and creatively renewing city. A recognised forerunner in industrial circular economy. Pori offers an attractive place to live, work and operate, also for the talented individuals and advanced businesses.



Terrassa (Spain)

To design a resilient city. A city model that allows us to rebuild our economy while ensuring sustainable and smart growth.

A smart city that reaches environmental impact with digital technologies



Alicante (Spain)

To become a European reference on digitisation and green economy, an intelligent territory relying on unique local assets.



Białystok (Poland)

Green and digital future city.



Catanzaro (Italy)

Defining a smarter city model, placing the issue of environmental sustainability at the centre of local policies, in the awareness that digitisation, transport, local mobility and urban resilience are key to achieve this goal.



Gdansk (Poland)

Quality of data flow and expansion of e-services in the city (to authorities, business and residents), lowering CO₂ emissions and investing in green energy.



Gijón (Algeciras)

In 2030, Gijón is a renewed city, with a growing economy based on knowledge, sustainability and energy efficiency, and with a comprehensive offer of public services based in digitisation, the use of data and the intensive application of ICT, thus becoming an attractive and inclusive place to live, work and make businesses.



Le Havre (France)

Le Havre Smart port city: accelerate the digital and environmental transition of the territory with innovative actions.



Leuven (Belgium)

'Ground-breaking Leuven': Leuven becomes one of the most caring, green and sustainable, prosperous cities – through dialogue, cooperation and participation, and by being innovative and willing to experiment.



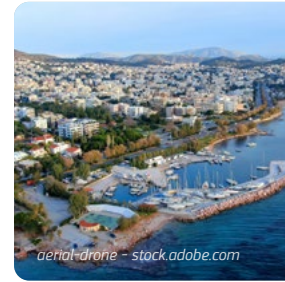
Mechelen (Belgium)

The City of Mechelen wants to be a smart city where technology and data are used to make life more pleasant for the inhabitants. More specifically, Mechelen wants to develop a digital twin in the field of energy and/or water for the Ragheno site.



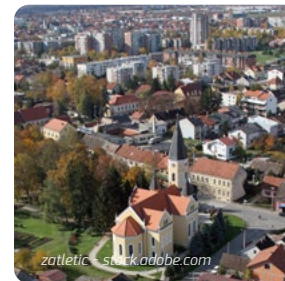
Tripolis (Greece)

A smarter, greener and more resilient and sustainable future for citizens. Embrace cutting-edge technologies in the areas of citizen participation and government services, green and digital transition in tourism, and green economy and Local Green Deals, and integrate into European and international networks with track record.



Vari Voula Vouliagmeni (Greece)

To become the first truly smart, green and sustainable city in Greece within the next four years, through the implementation of applications that will support citizen-centric services, based on international standards, primarily in the fields of energy efficiency, optimal waste management, smart and green mobility, digital services, and smart tourism



Velika Gorica (Croatia)

To secure the happiness of the citizens, foster a thriving business climate and protect the environment as a legacy for future generations.

An attractive destination that proposes innovative and digital experiences



Bistrita (Romania)

Rejuvenated, vibrant and distinctive historic centre in Bistrița, enjoyed by locals and tourists.



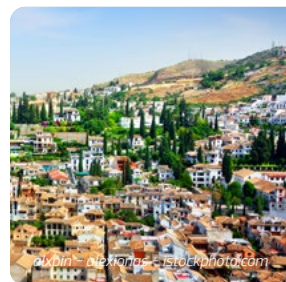
Brno (Czech Republic)

In 2050, Brno is a synonym for an attractive and at the same time sustainable city in international comparisons.



Cartagena (Spain)

Three-thousand-year-old city that continues to create history. Leading the green, digital and sustainable revolution.



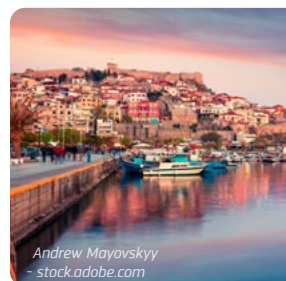
Granada (Spain)

To become an international reference in tourism (including arts and creativity) as a focal point of the local economy, and consequently to become the main regional hub or pole for the development of innovative solutions focused on tourists or citizens.



Heraklion (Greece)

Transform and diversify the city's tourist identity: toward a digitally empowered sustainable tourist destination.



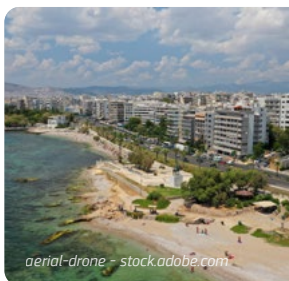
Kavala (Greece)

Kavala – The intelligent, entrepreneurial, blue city.



Logrono (Spain)

Leverage digital tools to provide high-quality services to citizens in an efficient manner, create an attractive touristic offer and generate economic and sustainable growth.



Palaio Faliro (Greece)

In 2030, Palaio Faliro is a place where tourists and short-term residents can visit and have a fully personalised and digitised experience, where all their needs are accommodated by quick and smart digital technologies.



Temporary Coastal Towns Association (Italy)

In 2030, Coastal Towns are recognised at national and international level as a single and sustainable tourism destination. The brand eCosta identifies the territory as an area leveraging digitisation to develop and customise product offerings, improve connectivity, generate and exploit data and facilitate public services management.



Trikala (Greece)

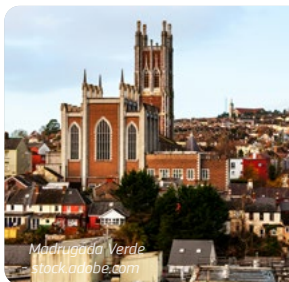
The development of an innovative ecosystem that attracts citizens, visitors and businesses, accompanied by a digitally transformed and interconnected local environment and by a strong stakeholder partnership and encourages new idea growth, towards an intelligent and resilient city.



Venice (Italy)

Develop Venice as a smart ecosystem and destination for tourists and citizen where all the players (public, private and academic institutions) share digital services, data and practices to improve the service offer, security and overall quality of living

An inclusive and innovative economy that grows sustainably



Cork (Ireland)

To make Cork the Connected City – innovative, inclusive and inspiring: an internationally recognised city for innovation; where through collaboration Cork citizens and businesses can benefit from innovative approaches to enhance quality of life, participate in their city and communities' development, and enable economic growth.



Derry/Londonderry (United Kingdom)

A City of opportunities for all: to stimulate and develop the digital skills of our young people – reflective of our values of community, inclusiveness and creativity – focused on sustainable growth of the city-region and on target economic sectors.



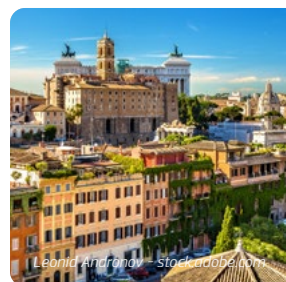
L'Aquila (Italy)

The city is trying to innovate itself, but innovation needs to be more inclusive, integrated, structured, co-designed and sustainable over time.



Metropole Rouen Normandie (France)

Capital of the 'world after': becoming a more inclusive, sustainable, resilient and attractive metropolis that is a model of ecological and social transition in a changing world.



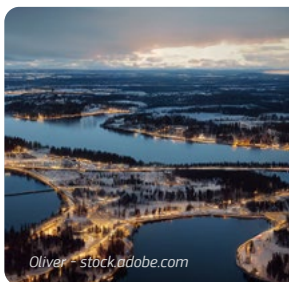
Metropolitan City of Rome (Italy)

Sustainable mobility is a key strategic resource for creating an inclusive and balanced metropolitan area which guarantees fulfilment for the individual and social participation, local development and competitiveness.



Pamplona (Spain)

To be a city that develops sustainably, inclusive in all local dimensions, culturally attractive, a bridge of knowledge and competitive in urban transformation processes through participatory, transparent and efficient governance.



Skellefteå (Sweden)

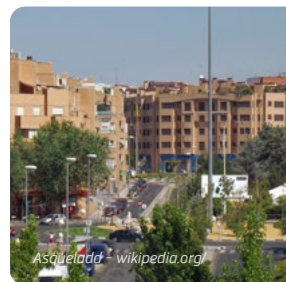
Skellefteå – a forward-looking, appealing and expanding municipality, which offers equal opportunities for those who live and work here, with the aim to have 80,000 inhabitants by 2030.



Torrent (Spain)

A smart city, citizen-centric, powered by up- and reskilling. An inclusive and innovative economy that grows sustainably.

An open and digital city connected to all its citizens



Alcobendas (Spain)

Create a digitally advanced ecosystem, connected, agile, sustainable and with a citizen-centric strategy.



Arad (Romania)

AR@Digital: Open. Connected. Educated: Arad reinvented using data and technology.



Association of Municipalities and Towns of Slovenia (Slovenia)

The digital open-source platform will be a common foundation for the exchange and storage of data and the modular integration of municipal services. With the joint digitisation of municipal services, we will be greener, mobile, accessible and friendly.



Gelsenkirchen (Germany)

Connected Gelsenkirchen develops an intelligent and sustainable city with social and participatory urban development to improve quality of life for all inhabitants with digitisation. In addition, the attractiveness as a science and business location is to be increased. We balance community, social, ecological and economic goals to benefit the common good. In 2030, Connected Gelsenkirchen is a collectively designed and liveable city for all and an innovative business location. Sustainable, resilient, with short distances is what we aim for.



Gliwice (Poland)

Gliwice 'effectively cooperating with its citizens' city, which communicates with all local actors using clear and consistent tools and procedures, and is prepared to start sharing possessed data in an open, digital way.



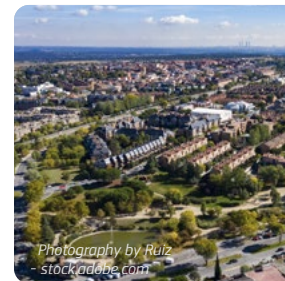
Idrija (Slovenia)

Being a small municipality, Idrija has an advantage to be flexible and responsive to innovations and development. Although it is not equipped with enough resources and budget for making a huge research breakthrough, it is very capable and determined to implement new solutions in day-to-day activities. The path to the future is clear: to stay or become a modern, developed, green, social and friendly municipality.



Ioannina (Greece)

Improving the service of the citizens incorporating ICT, strengthening the collaborations of the municipality with the local ecosystem, enhancing citizens' participation.



Las Rozas (Spain)

Las Rozas city: intelligent, sustainable, safe and close to the citizens.



Mantova (Italy)

Develop solutions linked to the vision of a smart city able to attract new citizens and entrepreneurs.



Metropole Européenne de Lille (France)

#Resolutely Digital! Moving forward strategically in an ethical way, keeping in mind social inclusion and solidarity transition.



Poznań (Poland)

Citizen participation and digitisation of public administration.



Reggio Emilia (Italy)

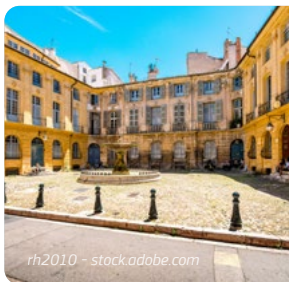
To facilitate access to digital tools needed for studying and accessing services; to promote cohesion at neighbourhood level; to provide tailored assistance, when needed, to elderly citizens living in care residence or nursing homes; to identify citizen needs and tailor public services; to promote cohesion at neighbourhood level; to support the city's shift towards a more cohesive society in a more sustainable urban environment.



Sweden Emilia Romagna Network (Italy)

To introduce a new approach to local policymaking based on more active citizen participation in the life of the local community and on a more effective use of data as the basis for more effective decision-making processes and innovation dynamics at local level.

High quality of life for the citizens fostered by digital technologies



Aix-en-Provence (France)

Aix-en-Provence Smart City Policy. For a healthier, cleaner, safer and more sustainable city. A city more connected with its citizen, more attractive and dynamic.



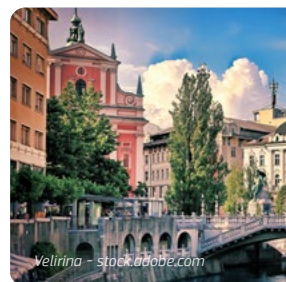
Bratislava (Slovakia)

The goal is to create a resilient city that uses technology to improve the lives of its inhabitants, ensure a healthy and sustainable environment as well as promote the city's economic opportunities and attractiveness to students and educated people. A key and most important ingredients are the city's decision to work with key stakeholders and meet the goals of a sustainable and resilient city through technology and innovation.



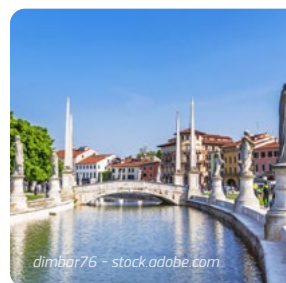
Karlskrona (Sweden)

Karlskrona 2.0, a leading-edge experience efficiently delivered.



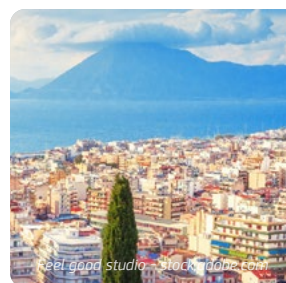
Ljubljana (Slovenia)

Digitally connected in the heart of Europe.



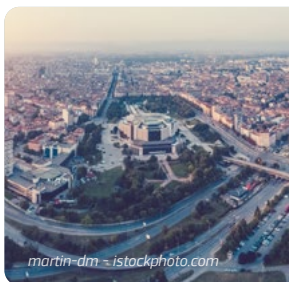
Padua (Italy)

Padua 2030: a flourishing urban ecosystem rooted through digital humanism.



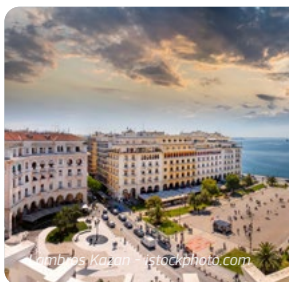
Patras (Greece)

The vision of Patras is to become a smart digital city with the aim to improve the living conditions of its citizens, professionals and visitors through the active involvement of its human resources, through innovative initiatives by academic and research institutes and by the business sector, taking advantage of the opportunities offered by the development of a next-generation network.



Sofia (Bulgaria)

The citizens and businesses play an active role in defining the future of Sofia and contribute to solving the urban challenges in creative and innovative ways. Citizen participation is streamlined, efficient and easily assessed using digital technologies.



Thessaloniki (Greece)

Thessaloniki turns into a resilient city which relies on digital transformation, its human capital and institutions to boost economic growth and improve quality of life.



Ventspils (Latvia)

To unleash the potential of Ventspils digital economy through its talent strategy.



2.3 Thematic networks

During the project, the ICC cities have followed one or several thematic tracks as part of their transformation process. These tracks were designed to represent the main challenges and drivers at the city level. The cities developed solutions under each one. Below is an overview of how each thematic track is understood within ICC. Afterwards, this section will also present the relevance of the ICC thematic networks with the EU policy landscape.

Table 4: Thematic networks and their scope

THEMATIC NETWORKS	DESCRIPTION AND TOPICS
<i>Green economy and Local Green Deals</i>	This track focuses on decarbonising infrastructure, greening industry and SMEs, and substituting it for more environmentally sound alternatives and new business models. By prioritising the management of a circular economy through the promotion of renewable energy sourcing, green manufacturing and sustainable waste management, cities transform themselves into more climate resilient spaces. This track builds on various supporting EU initiatives, including: the European Green Deal and Renovation Wave, aiming to cut emissions and boost building energy efficiency, Climate Law, turning climate ambitions into legal obligations, and the New Industrial Strategy which pushes for the twin green and digital transitions.
<i>Supply chains, logistics and the economics of mobility</i>	This track focuses on improving cross city and in-city supply chain resilience by increasing resource independence and the ability to self-supply. It targets a reduction in travel congestion and drives economic growth through improved mobility, particularly post-COVID. This track is further supported by the concept of the '15-minute city', in which daily urban necessities are within a quarter of an hour's reach on foot or by bike. From the policy perspective it builds on the new Sustainable and Smart Mobility Strategy.
<i>Upskilling and reskilling</i>	At the core of this track is a focus on innovative education and training for upskilling and reskilling the workforce of ICC cities. While seeking to reduce the skills gap, mobilise and strengthen skills-ecosystems, it concentrates on pursuing a green, digital and social transition of the workforce. This helps to equip cities in meeting new and emerging needs and challenges. From a policy perspective, it builds on the new European Skills Agenda and Pact for Skills, focusing on new engagement models that assist in better supplying the skills for a green and digital recovery at city-level.
<i>Citizen participation and digitisation of public administration</i>	This track helps cities enhance citizen and business participation, while understanding city stakeholder sentiments. It ensures that local communities are fully part of the digitisation run by local government and public services. It is supported by the European Climate Pact, the Digital Services Act, Digital Markets Act and the Living-in.EU movement. These back-bone EU policies aim to promote local climate action and secure digital transformations of public services.
<i>Green and digital transition in tourism</i>	This thematic track is oriented towards pursuing smart and sustainable practices as well as diversification in the tourism sector. It delivers a local roadmap for green and digital transitions, promotes improved data-sharing and management, and promotes new technology investments. These actions are driven by the aim to facilitate new growth opportunities and an economic recovery in tourism. At the policy-level, the track is guided by the objectives of sustainable recovery of the European tourism ecosystem discussed during the European Tourism Convention, and the work towards a new European Agenda for Tourism 2050.

The following sections provide a more detailed overview of each thematic track's latest trends and policy developments.

2.3.1 Green economy and Local Green Deals

Actioning green economy initiatives and maximising LGDs means leveraging decarbonisation strategies to meet climate targets while promoting new business models to spur economic growth at local levels.

To achieve these objectives, all countries must decarbonise in parallel across all sectors but mainly agriculture, power, transportation, buildings and industry. The speed of decarbonisation depends on the availability of mature technology and the ability to scale supply chains (European Commission, 2021a). Achieving net-zero emissions² will require sustained effort across sectors; some could meet the target faster than others. The recently adopted *Net-Zero Industry Act* will help to achieve this objective. The legislation aims to scale up clean technology manufacturing in the EU, aiming to provide at least 40% of the EU's annual deployment needs for strategic net-zero technologies by 2030. These strategic net-zero technologies include solar, wind, batteries and storage, heat pumps and geothermal energy, electrolyzers and fuel cells, biogas/biomethane, carbon capture and storage, and grid technologies.

To accomplish Europe's goal of achieving net-zero emissions and attaining energy independence, the key lies in adopting decarbonisation technologies to transition the energy supply. This transition would lead to a substantial decrease, estimated at around 90%, in oil, gas and coal consumption. Simultaneously, the power demand would significantly increase, potentially doubling compared to current levels. Renewable energy sources would be crucial to meet this rising demand sustainably, generating more than 90% of the electricity needed (McKinsey & Company, 2020b).

² Net zero emissions refers to the state where the net release of greenhouse gas (GHG) emissions into the atmosphere is zero. It is achieved when the amount of GHG emissions produced is balanced by the amount of GHG emissions removed or offset. In other words, any remaining emissions are compensated for by activities that draw or reduce an equivalent amount of emissions from the atmosphere.

Geographical factors will determine how easy it is for each country to reduce emissions and which decarbonisation measures would be the most cost-optimal. For example, EU countries in the north would benefit from 30-60 percent more hours of onshore wind than those in the south. On the other hand, Southern countries would benefit from 1,000 more hours of sunlight each year.

Transitioning to net zero requires large-scale technology deployment and will create massive opportunities to build entirely new businesses (European Commission, 2021b). Technologies that are mature and already available commercially, including onshore wind and solar photovoltaic, account for about 25 percent of the abatement potential in Europe. An additional 45 percent could come from technologies that can be commercialised soon.

Challenges to implementing decarbonisation actions include:

- **Funding** – High costs are associated with technical equipment and maintenance. Achieving EU net-zero goals would require investing €28 trillion in clean technologies over the next three decades. Approximately half of the business cases put forward by individual actors will not be positive investments due to differences in cost of capital, shorter payback period expectations or benefits not directly accruing to the stakeholder investing (McKinsey & Company, 2020a) (ICC, 2022a).
- **Economic markets** – The cost of food would rise as the agriculture sector takes steps to decarbonise. Similarly, energy efficiency interventions require up-front investment even if they result in long-term savings. But given the huge fluctuations in gas and energy prices caused by the Russian war of aggression against Ukraine coupled with rising inflation costs experienced across Europe upfront investment is less likely to be made (McKinsey & Company, 2020a) (ICC, 2022a).
- **Collaboration and participation** – Integrating local stakeholders and businesses into initiatives has been a major implementation challenge across European

cities (Committee of the Regions, 2022). The complexity of asset ownership and governance structures complicates coordination among stakeholders and quick decision-making (ICC, 2022a).

Decarbonising cities is achievable and presents opportunities with the right municipal policy and private-sector collaboration. Many of the solutions required to decarbonise cities – such as e-mobility, renewable energy, district heating and building efficiency retrofits – exist but are currently fragmented. City municipalities should bring the relevant actors together to shape policy and enable streamlined investments, thus driving innovative business cases to continue their transition. To be competitive and differentiated in the future green economy, a city should also consider how they best use its core capabilities. Whether utilising world-class academic institutions, leveraging tech-savvy populations, or leading innovation to decarbonise historic industries such as ports or rail infrastructure. Thinking strategically now about the role a city wants to play in this future economy can help to ensure they are competitive and able to capture the opportunities this transition presents.



Andrey Popov – stock.adobe.com

Local Green Deals

A Local Green Deal is a tailor-made action plan to accelerate and scale up a city's green transition. It builds on existing strategies – e.g., sustainable energy and climate action plans, circular economy plans, resilience, and economic development plans – and connects them to legislation and market and financial incentives to locally advance the EU Green Deal.

A point to be highlighted is that the Climate City Contracts (CCC) approach as part of the [100 Climate Neutral and Smart Cities Mission](#) and the Local Green Deals are very similar. Both are working towards the same objective, and the European Commission is providing (via the Intelligent Cities Challenge and the Net Zero Cities project, respectively) a well-defined methodology and support programme. While Climate City Contracts can be considered a form of Local Green Deal, the key difference is that CCCs are based on a mission with a timeline until 2030, and they focus on CO₂ emissions reduction. LGDs have a broader focus on the green transition and embrace, in addition to decarbonisation, issues such as circular economy actions, raw materials shortages, sustainable products and services, and sustainable food systems. In that regard, CCCs and LGDs complement each other and provide a useful means to integrate sustainability actions.

Within the ICC, a Local Green Deal survey was carried out in which 42 cities reported having deployed LGDs to advance their sustainable development. The survey also shed light on cities' challenges with implementing LGDs. Whereas many cities saw their activities as relevant or comparable to LGDs, only a few could qualify them as LGDs regarding actions or agreements between the local government and stakeholders.

The timing is right to strengthen the existing work on LGDs and build a strong case among the cities participating in the ICC, to include suitable new city candidates for the upcoming phase of the ICC, and to liaise with cities outside the ICC network that are currently working on LGDs.

2.3.2 Supply chains, logistics and the economics of mobility

Recent geopolitical developments and the enduring impacts of COVID-19 have impacted supply chains across all industries and challenged the European Union's energy security.

The global pandemic disrupted the supply of both critical and non-critical components, resulting in lengthy production halts while major supplier countries went into lockdown. For example, more than two years into the pandemic, the gap between chip supply and demand has widened across all semiconductor-enabled products. This semiconductor shortage will likely persist in selected technology nodes for three to five years. More recently, the Russian war of aggression against Ukraine has disrupted the oil and gas supply and has driven many European countries to make decisions that will have a long-term impact on where and how they source their energy (McKinsey & Company, 2022a). Organisations continue to have to innovate and re-think their operations to ensure they are resilient to any further challenges, and this is especially true as European countries transition to more sustainable energy supply chains (McKinsey & Company, 2022a), (McKinsey & Company, 2022b).

The reliance on strained fossil fuel supply chains can be reduced if cities leverage the rising 'prosumer' (producer-consumers) trend in renewable energy (European Environment Agency, 2002). While urban spaces can be a barrier to distributed energy generation, cities can enable 'prosumption' by granting easy access to available space (e.g. rooftops or unused municipal ground). City density can also benefit, enabling integration between energy and mobility sectors such as renewable energy generation and charging infrastructure for e-mobility sharing schemes.

Continued expansion of cities has led to a construction boom; however, the global pandemic has created supply chain shortages. Cities can convene or connect the public and private sectors to foster circular economy principles to use resources more efficiently and reuse waste, such as water or building materials, to create

recycled materials, thus reducing reliance on virgin materials bottlenecked in constrained supply chains.

Food supply chains are at risk from geopolitical tensions and climate change. The Russian war of aggression against Ukraine has provided a stark example of this. Ukrainian grain supply is predicted to see up to a 45% reduction this year, creating price increases and food shortages that could devastate highly vulnerable nations. Cities can safeguard food supplies by promoting urban farming methods such as vertical and rooftop planting or using abandoned infrastructure such as tunnels and bunkers. Increased agriculture within the city has additional climate benefits as it absorbs carbon dioxide.



Logistics in and around cities can be responsible for a considerable volume of emissions associated with supply chains. There is an increased focus on sustainable supply chains, and consumers favour suppliers and service providers who can demonstrate reduced emissions in their operations.

This market transition must be developed throughout supply chains and related support infrastructure. Demand for green technologies creates opportunities across the value chain; companies can benefit from the various components and raw materials needed to build and maintain assets that drive net-zero goals.

Historically, supply chains have been spread out over the whole globe to minimise costs. However, this can negatively impact distribution channels. With supply shortages, difficulties in transportation within cities, e.g. road infrastructure, banning vehicles with internal combustion engines (ICE) in major cities as part of the focus on sustainability, 'nearshoring' of production and regionalisation of supply flows becomes more important. COVID and supply chain disruptions have shifted the focus from international production networks towards alternatives closer to home to boost operational resilience. In 2031, nearshoring is expected to reduce global trade growth compared to the previous decade but not disrupt it totally (McKinsey & Company, 2021a). Governments have already started to limit the usage of private vehicles, and commercial vehicles are expected to follow – leading to increased use of carbon-neutral vehicles such as cargo bikes and e-trucks.



However, capturing these opportunities will mean already-stretched supply chains must be able to avoid bottlenecks that can affect all key energy transition technologies and every step of the supply chain. Here, affordability remains a key challenge for Europe. As recent increases in electricity costs demonstrate, price volatility means materials or components are exposed to market forces that result in huge price fluctuations that can be difficult to predict.

A second potential challenge facing European countries is their geographical sourcing dependency. Europe faces raw materials and labour shortages and has become dependent on non-EU countries' manufacturing and capacity. Long lead times are another potential risk for renewable solutions, such as onshore wind developers facing long delays and red tape – up to ten years – when securing the necessary rights/permits to begin work. Other potential risks include volume shortages, where supply chains cannot deliver the required quantities at sufficient scale due to lead times required to scale up or fundamental limits and quality issues. A massive spike in demand for certain materials/components can lead to potential quality issues as manufacturers attempt to speed up production (McKinsey & Company, 2021b).

The most common mobility projects include improvements in public transport infrastructure (e.g., metro expansion, new dedicated bus lanes, road infrastructure works to improve connectivity – tunnels, bridges, overpasses) and digitisation, including ticketing systems and parking automation. Leading cities across Europe implement a significantly higher number of these types of improvement projects than emerging and contenting cities (ICC, 2022b).

When it comes to implementing logistics and mobility initiatives, challenges often hinge on data and integration. More specifically, these include the collection of quality data and the digital and physical integration of new and old public transport infrastructure.

The global pandemic has highlighted the intrinsic link between well-functioning supply chains and cities' economic and societal health. This has prompted cities to

reconsider their plans to safeguard against future disruption. Cities must carefully consider these steps and find innovative ways to design resilient, smart supply chains that achieve decarbonisation ambitions. Certain policies, such as reducing vehicles in city centres, support emission reduction goals but may make deliveries more challenging. Meanwhile, plans to create more localised supply chains through onshoring in industrial ‘outer-city hubs’ could increase resilience, but could also create more pollution. Ultimately, these moves should not be seen as trade-off decisions. Still, cities should instead leverage technology, such as city ‘digital twins’, which can enable smart planning of city roads and transport links and create a participatory system between businesses and the local government to provide live feedback and adjust schedules, increasing efficiency and reducing congestion. Cities should also leverage policy to create business cases for last-mile delivery services using electric bikes or improve the use of ambient and cold storage lockers distributed throughout cities. Cities mustn’t think about simply adjusting existing supply chains to increase efficiency and resiliency, but instead rethink what their supply chains could look like, making the best use of technology available, which achieves both resiliency and climate ambitions.

2.3.3 Upskilling and reskilling

To solve the persistent challenges, cities must create new successes by leveraging opportunities and harnessing the power of technology and social innovation. To make this happen, cities need the right people with the right skills in the right roles to drive transformation and innovation. Yet many cities and regional governments increasingly face skills gaps – a mismatch between the supply and demand of needed skills – in both the public and private sectors.

Emerging digital, green- and clean tech skills constitute one of the most pressing needs. New technologies such as robotics, artificial intelligence (AI) and the Internet of Things (IoT) will play an important role in meeting future challenges. Yet progress is about more than just digital developments and capabilities. Skills such as people

management, collaboration and knowledge-sharing are important to deliver results through such initiatives as energy citizenships or cooperative electric waste-reduction programmes.



An analysis recently identified the benefits of transforming citizens from energy consumers to active, co-managing citizens for achieving carbon-neutrality objectives. In three different pilots in Amsterdam, a lighthouse city³, bottom-up approaches were used on the district level to create and share knowledge and to give citizens greater flexibility and control over their energy use/supply. This intensified participatory processes and innovation led to integrated, collective solutions for the urban energy transition developed by new partnerships between incumbents and newcomers. Another example comes from the City of Leuven, whose Sharepair programme aims to reduce waste from electric and electronic equipment (EEE) by empowering

³ A Lighthouse city refers to urban areas that serve as innovative testbeds for sustainable and smart city solutions. These cities are typically part of larger initiatives and research programmes to promote energy efficiency, environmental sustainability and advanced technologies in urban development.

citizens through providing resources such as 3D printing, repair tools and educational materials and via scaled-up repair opportunities such as Do-it-yourself (DIY) business models and repair cafes. Throughout the process, participants learned that converting interest to volunteer commitment is challenging, requiring them to find creative ways to add value for stakeholders.



Among European cities, various initiatives have been initiated to address the need for up- and reskilling. Cities worked to bridge the gap in high-demand jobs before COVID, but these efforts were accelerated during and after the pandemic due to rising unemployment and budget cuts (World Economic Forum, 2020). Cities played a pivotal role in the recovery, which led to a growing belief that collaboration and partnerships are important in providing effective solutions – and here, *the Pact for Skills* made a timely arrival.

Amsterdam's House of Skills is a good example, where up- and reskilling programmes target labour shortages in relevant sectors. Examples of up- and reskilling initiatives can be found outside Europe, too, such as *Singapore's Skills Future* programme, which promotes a better matching of quality education and training with constantly evolving needs, helping to foster employer recognition and career development based on skills.

Despite the need and examples provided by these initiatives, large-scale up- and reskilling initiatives still need to be made available. Two main challenges could explain the lack of uptake: the need to build a regional ecosystem and greater financing.

A well-functioning reskilling ecosystem that gains commitment and drives collaboration is a prerequisite for a successful reskilling initiative. Also, cities' political, economic, cultural, societal and environmental contexts must be considered when establishing a reskilling strategy. Cities must analyse and understand the broader context in which a reskilling initiative occurs. The European Week on Regions and Cities session on Building Regional Skills Ecosystems discussed the various success factors, lessons learned, challenges and achievements in this domain. One of the noted challenges is a growing gap between regions in terms of quality jobs and skills (EARLLAL, 2019), which can be tackled if local leaders can build solid programmes for lifelong learning thanks to their understanding of the local labour market combined with social innovation and new job-creation through boosting entrepreneurship and SME development. European case studies supported this point, adding that trust-building, collaboration, industry-led initiatives and political support are key success factors.

Funding is a major consideration because it constrains the scope and duration of any reskilling initiative. Different funding models can apply depending on the ecosystem context, the stakeholders involved, and their ambitions. There are multiple potential sources of funding – both public and private – for reskilling initiatives. The ICC *pragmatic guide to reskilling* offers a range of funding sources for up- and reskilling initiatives.

2.3.4 Citizen participation and digitisation of public administration

European citizens continue to interact digitally more than before the pandemic; even countries that are slower to adopt digital technologies are catching up. Europe has registered a net gain of 100 million users since 2019 (McKinsey & Company, 2022c). Digital adoption during the pandemic correlates strongly with a country's per capita GDP. Five of the six countries with the highest adoption rates (Denmark, Finland, Sweden, Switzerland and the United Kingdom) had per capita GDP above €45,000. However, the use of digital tools varies by sector and country. Services which traditionally required high levels of in-person interactions before the pandemic, such as education and health care, have lower digital take-up than sectors such as banking and insurance. Industries with a large share of remotely assisted users (such as insurance, utilities and education) can optimise their use of digital tools by encouraging more use of mobile channels.

Indeed, digital tools stimulate two-way communication between citizens and governments and foster stronger relationships between administrations, government bodies and citizens. Customers of public services are nine times more likely to trust a government agency if they are satisfied with its service (McKinsey & Company, 2019). Yet, despite high adoption rates, research has shown that user satisfaction needs to catch up to design and experience. The McKinsey study on digital sentiments found that poor user experience was dissatisfied users' number one pain point. Therefore, co-creation tools and service design methodologies supported by data strategies are central to meeting citizen needs.

Several participating ICC cities concentrated on designing and implementing city portals, applications for citizen participation and improving city decision-making processes. The work under this thematic network sought to digitalise public administrations, build up citizen participation capabilities, and create the conditions for growth for local businesses and start-ups. Within the Intelligent Cities Challenge, 115 solutions were developed in this area.



One of these examples can be found in Portugal. Porto has implemented the portal '[Explore.Porto](#)' put citizens and visitors at the forefront when designing the platform's services. It has been positively received and added huge value for tourists (ICC, 2022c). Data access has been another challenge when creating digital tools, but cities are beginning to understand the positive impact on what centralised, integrated and open-source platforms can have. Offering easy access to data to third parties and users has multiple benefits. It allows for more meaningful analysis to be conducted quickly, delivering more timely and impactful customer interactions. Open-source datasets also give rise to new services and businesses by allowing third parties to feed data to other products (ICC, 2022d).

Hamburg has created an Urban Data Platform which allows users and third parties to integrate and interconnect urban data quickly and efficiently. This has led to the creation of new apps such as 'My Tree' by allowing an external party to use data provided by the Ministry for Environment and Energy to map all free fruit trees and

share this information with the public. [Explore.Porto](#) also leverages open-source data from other government departments to update the public on tourism and mobility information (ICC, 2022c).

Although cities are progressing with design and data access, challenges in these areas remain. The data that government bodies rely upon are typically incomplete or locked away in silos. Thus, public bodies often lack a full, timely picture of the user's overall experience. Data strategies must be considered in advance, clarifying what data needs to be collected and how it will be stored and shared. Achieving greater interoperability sometimes means inefficient manual inputs or adjustments that negatively impact overall customer experience (ICC, 2022d).

Public institutions often need more capabilities to assess and address gaps in customer experiences. Those with deep analytics skills, as well as human-centred design skills, are often in need of more supply. Digital upskilling must be prioritised to ensure public bodies have the right technical teams to build the most effective, customer-centric solutions.



External factors also threaten to hamper digital growth. Consumers are concerned about economic uncertainty. Many harbour fears stemming from dangerously high inflation, financial market volatility and the possibility of extended bear markets. These fears can easily translate into lower consumer confidence (McKinsey & Company, 2022c).

While challenges exist, increased citizen participation through digital interaction with their local governments and city authorities will become an expectation rather than a 'nice to have'. A critical enabler to success is the trust between citizens and the city. Trust can be built in several ways, such as cities recognising that increased use of technology runs the risk of increasing the digital inequality gap (United Nations Public Administration Network, 2022) and taking measures to mitigate that by making such transitions transparent to citizens. One example is implementing a 'digital twin' pilot project to test potential city changes before full implementation to ensure the best outcome for citizens and that the infrastructure is developed carefully to ensure it is resilient, scalable and secure. A city with increased digitisation and citizen participation also sends a positive signal to the market in attracting talent, investment and innovative technology start-ups, creating future growth opportunities and a more efficient, smart city.

2.3.5 Green and digital transition in tourism

The COVID-19 pandemic has severely impacted the tourism industry, and it is now transforming to align with the new social, digital and environmental objectives of the European Green Deal and to reduce its contribution to climate change. The pandemic caused losses of between 60 to 80% in the tourism sector, and it was identified as the last industry to recover. However, recent data from 2022 and forecasts for 2023 suggest that the recovery has almost reached pre-pandemic levels (United Nations World Tourism Organization, 2023).

During the pandemic and the following year (2020-2021), many trends emerged to change how people travel, focusing on reducing mass tourism and promoting

more sustainable behaviours. While sustainable tourism is a growing trend and new initiatives related to the circular economy are being implemented in the tourism industry, the expectations from 2020 still need to be met.

Digitalisation and sustainability have become the pillars of the tourism recovery. The pandemic has accelerated the digitalisation of the tourism industry, leading to a significant impact throughout the tourism value chain, especially for small and medium-sized enterprises. New technologies, such as the metaverse and AI, are driving a revolution in the travel industry, shaping how people experience travel. Data is now crucial for smart destinations and the private sector, not only to improve decision-making processes and reduce resource consumption but also to offer increasingly personalised experiences to tourists. The tourism data space presents a new opportunity for the industry to evolve and become more competitive, building on the data-driven strategies already implemented in the sector.

The ICC allowed cities to identify solutions focused on sustainability and digitisation that have accelerated the recovery after the pandemic. Disruptive technologies such as IoT, big data, and augmented and virtual reality have been key in many destinations. Developments in the data economy – including public use of open data through platforms/dashboards and observatories to improve decision-making – will significantly impact the transformation of many destinations. For example, the mentor city of Nice Côte-d'Azur has implemented several projects to use the available data on tourism, culture, heritage and transport to make decisions and implement services. In addition, it also collaborates with cross-border Italian regions on common Smart Destination challenges and actions.

Tourism has close 'transversal' links to many other service and non-service sectors. Digital solutions identified in these 'verticals' clearly also apply to the green and digital transition in tourism. The city of Ljubljana, recognised as the 'European Capital of Smart Tourism in Digitalisation 2020', has implemented several actions targeting the green transition in the tourism sector in the city. Some examples are

the development of various apps for finding drinking water fountains in the city or scheduling trips itinerary across the city using public transport.

It is important to have a tourism strategy with a long-term vision that can be implemented step-by-step with clear solutions engaging the main stakeholders. From the outset, the ICC has played an important role in engaging and involving key destination stakeholders. Some destinations, such as Kavala or Palaio Faliro, have developed solutions jointly with the stakeholders, engaging them in all phases of the tourism strategy.

The main challenges were, in some cases, related to the need for more funding or the difficulties of managing the funds made available thanks to the [NextGenerationEU](#). In other cases, the lack of stakeholder engagement has complicated the proper implementation of solutions. Equally, the lack of local experts supporting the day-to-day implementation and political awareness threatens tourism's twin transition. Identifying solutions to pressing challenges and learning how to implement them has been a key element throughout cities' transformation journey under the ICC. Exchanging experiences between destinations within the ICC has helped cities learn and avoid repeating mistakes.



2.4 Cross-thematic interests

2.4.1 Access to finance

City infrastructure and operational projects are crucial in shaping transformative impacts, such as boosting resilience, addressing climate change, improving inclusivity and enabling digital urban infrastructure. Cities need to re-evaluate traditional mechanisms and draw on new and innovative approaches to revenue and financing.

The capacity of cities to develop their financial sustainability and resilience depends on their ability to access various revenue sources to pay for urban infrastructure, including implementation, operation and maintenance. The best practices confirm that the surest path to achieving this is to combine own-source revenues at the local and national level with private-sector investments and, to a lesser extent, crowdfunding, philanthropy and volunteerism as well as international finance.

The regulatory ecosystem needs to enable cities' access to finance and provide the ability to practice sound financial management. That is, leveraging the collective potential of a skilled workforce and knowledge hubs in financial planning.

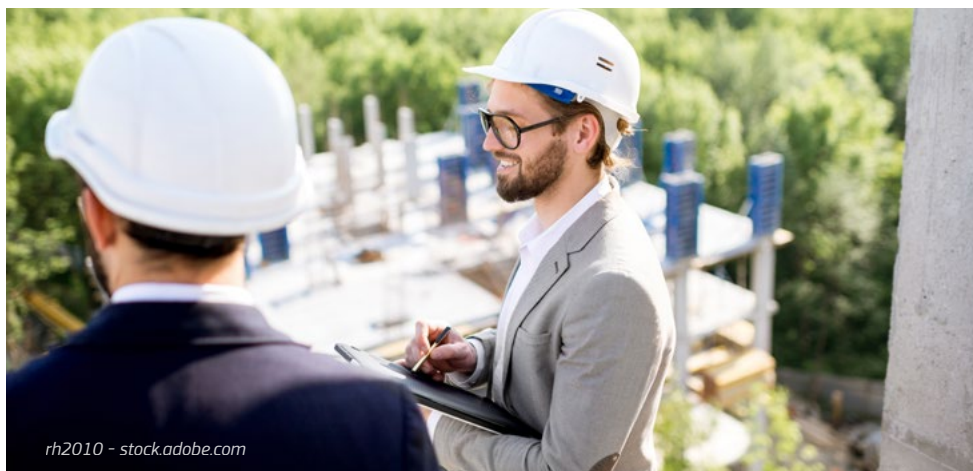
Cities should focus on projects stimulating the economy and anticipate future shocks or mitigate their impact. The ability to harness cities' influence and produce transformative change depends on financial and investment decisions at the municipal level. This requires rethinking traditional approaches to infrastructure finance and bringing more innovation into funding and financing.

The key challenges faced by cities include:

- Difficulties in providing a clear vision and strategy, as well as a roadmap for the city's future
- Lack of proper project preparation, urban infrastructure planning and management capacity
- Failure to develop bankable, investment-ready urban green and digital infrastructure pipelines
- Weak implementation capacity (lack of a clear plan and strategy to achieve it, skills, resources gap, etc.), resulting in implementation delays
- Regulatory obstacles and lack of clarity on city-level revenues and budget capacity fiscal space
- Failure to provide consistent procurement standards
- Ineffective national public-private cooperation policies and incentives (monitoring from the part of the public sector remains sub-optimal while there is no clear standard of cooperation)
- Improper engagement with the private sector during the project preparation and design phase
- Low municipal creditworthiness
- Politicised national and subnational decision-making



COVID-19 has compounded the financial pressures at all levels of government and increased the funding gap between cities' limited financial resources and their many needs. With citizens and investors focused on environmental, social and governance (ESG) outcomes, cities must recognise holistic issues. In addition, it is crucial to prioritise other factors like public goods, health, the preservation of commons (such as cultural and natural resources that are accessible to all), resilience, and addressing climate change. These aspects play a vital role in attaining sustainable growth. Cities cannot go back to business as usual. They need to take the opportunity to 'build back better' based on four priority areas, underpinned by a real participatory process and new forms of consensus-building: 1) Public services and infrastructure; 2) Urban planning and management; 3) Urban economy and finance, and 4) Urban environment.



At the same time, other more prosaic drivers such as regulatory frameworks, planning and permits are also part of the enabling environment for investment. Cities considering and using these drivers are better positioned to exploit funding opportunities and attract more private investment. Cities are at the forefront of combating and recovering from the COVID-19 pandemic. 'Building back better' would

require a careful but balanced development of the ESG dimensions, thus promoting a people-centric recovery that focuses on well-being, improves inclusiveness, and reduces inequalities.

2.4.2 Innovative and social public procurement

Public authorities across Europe have the power to promote the uptake of innovative solutions and technologies through public procurement. The European public sector spends over €2 trillion yearly, or 14% of the EU GDP, through public procurement. With half of procurement decisions done at the local level, cities can play a pivotal role in the transition towards a greener economy.

Innovative public procurement is how public buyers act as early adopters of innovative solutions to signal desired market shifts. It also uses public procurement as a strategic and flexible tool enabling more businesses to offer innovative solutions.

By adopting more innovative procurement practices, cities can accelerate the market introduction of innovative technologies and circular solutions to deliver a sustainable, digital and resilient transition. Through pre-procurement, market engagement and improved communication, public buyers can identify solutions to complex challenges and better understand how businesses can fulfil cities' needs.

Innovative public procurement and green public procurement can play a crucial role in achieving the goals of Local Green Deals. By integrating LGD objectives into procurement policies, local authorities can ensure that sustainability considerations are a fundamental part of their purchasing decisions. Market engagement and innovation procurement practices can also facilitate the development of long-term partnerships between public, private and social actors, leading to innovative and sustainable solutions. The terms of public contracts can be designed to govern effective partnerships, with clear expectations and incentives for suppliers to meet environmental and social sustainability criteria. The handbook [Buying Green](#) provides an excellent overview of the complete process for green public procurement.

Using lifecycle costing and other tools, cities can provide better public services, financial efficiency and environmentally friendly choices. Innovative public procurement can also support market access for businesses, including SMEs, social enterprises and start-ups. For example, the City of Haarlem⁴'s [Kennemer Inkoop Platform](#) provides an overview of entrepreneurs and innovative solutions available in the region. This platform is designed to help private and public entrepreneurs, public authorities, and other social organisations make procurement decisions that have a positive impact.

Socially responsible public procurement is another tool that can help cities achieve their social, environmental and transition goals. By leveraging the public sector's purchasing power, cities can encourage suppliers to adopt socially responsible practices and support sustainable development. By promoting social inclusion and fair labour practices, socially responsible public procurement can boost employment opportunities (long-term unemployed, disadvantaged people, e.g. with disabilities), social inclusion, accessibility and design for all, ethical trade (including human rights and decent work) and seek to achieve wider compliance with social standards. The [European Commission](#) website, [Procura+](#) and the [sustainable procurement](#) platform provide extensive case studies, good practices and guides on effectively and efficiently implementing SRPP.

Businesses, including SMEs, social enterprises and start-ups, can also **benefit** from engaging in innovative public procurement, giving them access to valuable public-sector clients. Furthermore, it also allows them to apply research, commercialise and scale up ideas. Several start-ups such as [Sajkla](#), [Inrego](#) and [HOLMRIS B8 Circular](#) have been able to test and scale their new business models with the backing of public procurement. It also helps to improve their competitiveness in national and international markets.

While the public and private sectors can benefit from collaborating to develop innovative solutions, several **challenges** prevent innovative public procurement from reaching its full potential. Integrated and holistic approaches are different. Thus, many local administrations purchase sub-optimal and specific services and solutions, often provided by big companies following a one-size-fits-all approach that may not fit the customer's particular needs, leading to vendor lock-in or limited control of citizens' data and digital rights. With initial higher capital cost, fragmented markets, and businesses using a one-size-fits-all approach, the process is being abandoned due to a lack of competition and limited time, resources and skills in procurement.



4 Haarlem is one of the cities part of the Amsterdam Metropolitan Area, a mentor city in ICC phase one.

Experience has shown that the success of using procurement to achieve intelligent cities depends on the level of political support and the staff's willingness. It also depends on a city or business's skillset and the resources they have at their disposal to engage the market early, choose the right procurement procedure, develop new business models and manage risk. It can also be more burdensome to consider alternatives to purchasing and owning products.



An important step is for a city to identify needs or problems that require solutions. Thinking about what outcome is required, rather than a specific technical solution to achieve that outcome, can result in better 'smart city' outcomes. An important lesson from successful city examples such as [Porto](#), [Ghent](#) or [Malmö](#) is that it is crucial to understand the market better. Intelligent cities often require sourcing new solutions, data, technologies, market actors, specialist materials and/or services.

Procurement can also be a key mechanism to address some of the difficult issues many of the ICC cities have faced: outlining how data can be managed transparently and appropriately and achieving social value (e.g. reskilling).

For the ICC cities to use procurement in a meaningful way, new knowledge or skills are required:

- Understand how to get started.
- How to use the key procurement stages for innovation.
- Understand business model design.
- Market engagement and how to support SMEs and social enterprises.

2.4.3 Open data

The utilisation of open data has become increasingly attractive to ICC cities, offering the potential to drive economic growth, tackle societal challenges, facilitate evidence-based policymaking, enhance transparency and encourage citizen participation. By enabling the reuse of public sector data for various purposes, including commercial applications, cities can foster innovation and create new opportunities for businesses and entrepreneurs.

Initiatives, such as [Open & Agile Smart Cities \(OASC\)](#) and [Living-in.EU](#), contribute to the overall work on open data within the ICC framework. OASC advocates for a practical framework based on open technical specifications, enabling cities and communities to replicate and scale innovative solutions. By developing Minimal Interoperability Mechanisms (MIMs), OASC provides the necessary technical foundation for procuring and implementing urban data platforms and comprehensive solutions. Similarly, Living-in.EU emphasises open data practices and adopts a citizen-centric and city-led approach to urban development. It promotes the ethical and responsible use of data, leveraging technology as an enabler, and focuses on interoperable digital platforms based on open standards and shared data models. These initiatives align with ICC's mission to drive the green and digital transformation of cities, enhance economic competitiveness, strengthen social resilience and improve the quality of life for citizens. Likewise, several ICC cities are part of both initiatives.

Nonetheless, there are several challenges that cities need to overcome to maximise the benefits of open data. One significant challenge is the risk of vendor lock-in, where cities become overly reliant on specific vendors or external parties for their data needs. This dependence can limit flexibility, hinder innovation and create long-term dependencies. To mitigate this challenge, cities should focus on reducing reliance on specific vendors by adopting open data standards and interoperability frameworks. Embracing open standards enables data to be easily shared and exchanged between different systems, platforms and organisations, promoting competition and innovation.

Another critical challenge is breaking down data silos. Often, data is fragmented and scattered across different departments and organisations within a city. This fragmentation inhibits effective data sharing and collaboration, making gaining a comprehensive and holistic understanding of urban challenges difficult. Cities must prioritise efforts to promote data sharing, collaboration and integration across the ecosystem. By doing so, they can leverage their collective knowledge and expertise to develop innovative solutions and address complex urban problems more effectively.

Developing comprehensive open data policies is a crucial aspect of successful implementation. Open data policies provide a clear framework for data governance, privacy, security and legal considerations. Based on best practices, cities should establish robust policies aligning with their broader digital strategies and goals. Involving various stakeholders, including government officials, citizens and industry experts, ensures inclusivity and responsiveness. Clear regulations and guidelines are essential to ensure that data is collected, managed and shared responsibly and ethically.

Open data initiatives also present significant opportunities for cities. Collaboration with partners and suppliers can lead to the development of innovative solutions that address urban challenges effectively. By sharing data and insights, cities can leverage the collective intelligence of stakeholders to drive positive change. Moreover, high-quality open data enables entrepreneurs and developers to create value-added applications and services. This fosters economic growth, attracts investment and enhances cities' overall liveability and functionality.



One example of a successful open data project is the initiative implemented in Aarhus. Aarhus has embraced open data and launched an open data portal, making many datasets available to the public. Through this project, [Aarhus](#) aims to empower its citizens with valuable information and encourage their active engagement in decision-making processes. The city actively engages with its community through various channels, such as online platforms, events and workshops, to promote the benefits of open data and encourage data-driven innovation.

Another example is [Hamburg's Urban Data Platform](#). This initiative aims to improve the city's quality of life and economic appeal through digitalisation. The platform enables efficient integration and interconnection of urban data with standardised interfaces for seamless data exchange. Users can access and evaluate the data in real-time, facilitating quick decision-making and preventing duplication of work. The platform promotes data sharing and integration, creating synergies and adding value for municipalities, companies and residents. Examples include applications for street trees and a citizen-led initiative mapping accessible fruit trees in the city.

Open data presents significant opportunities for ICC cities to drive innovation, efficiency and citizen participation. By addressing challenges related to vendor lock-in, data silos and policy development, cities can unlock the full potential of open data. The examples of Aarhus and Hamburg demonstrate the positive impact of open data initiatives on urban development.

2.4.4 Tech4Good Marketplace

New opportunities emerge from advanced technologies and capabilities as they reduce cost and increase quality, proactiveness and citizen-centricity. Technology-powered solutions and business models offer a chance to advance environmental and social causes. Still, at the same time, these transformations imply that the public sector faces a set of multi-level and cross-sectorial challenges in need of digital innovation strategies.

Different analyses (DIGISER, 2022) show that a growing list of major European cities, such as Aarhus, Poznan, Rotterdam, Helsinki, Thessaloniki and Ljubljana, are already deploying advanced systems, including IoT infrastructure and big data analytics as part of their smart city strategies. However, hundreds of small and medium-sized cities and towns in Europe still need to be faster to adopt a structured approach to advanced, technology-powered solutions.

Research within the *Open & Agile Smart Cities network* has shown that small and medium-sized cities/towns and their local ecosystems can especially benefit from collaboration with peers and from inspirational stories and practical implementations aimed at boosting access to ethical, environmentally sustainable and digitally enabled solutions which are human-centred, affordable and able to solve concrete challenges within cities and communities, and within the wider ‘social and proximity economy’⁵. Sharing and participating in networks is also mentioned in the DIGISER report as one of the challenges and main trends concerning adopting innovative solutions and ideas across organisations.

Based on these conclusions, the ICC initiated the *Tech4Good Marketplace*. This growing repository of innovative, labelled and efficient clean tech solutions and business models for real-time air quality monitoring, waste and water management or clean mobility, offers cities and local stakeholders access to successfully deployed solutions and best practices.

⁵ For more information on proximity economy, see: https://single-market-economy.ec.europa.eu/sectors/proximity-and-social-economy/proximity-economy_en

The ICC established an iterative process allowing cities and experts to play a key role in the platform’s development. Addressing specific needs, they contributed to creating a set of concepts and criteria needed to integrate the use cases available in the platform. **This structure was developed around five pillars which now underpin the Tech4Good Marketplace:**

- Technology – the readiness and reliability of the technology involved
- Social impact – the potential for the solution to bring positive societal consequences
- Sustainable development – alignment of the solution with the UN Sustainable Development Goals
- Proximity economy – the possibility for the solution to enhance the proximity economy (i.e. local/short value chains for production and consumption and human-centric city and social economy business models)
- Transferability – the possibility for the solution to be implemented in another city or community





Halfpoint - stock.adobe.com

The Tech4Good Marketplace elected and invited a panel of experts in technology, sustainability, social impact and the proximity economy who reviewed solutions on the platform against the criteria. Their role was to independently evaluate solutions using the established standards so that only the best ones appear on the platform.

The marketplace lists over 100 solutions and products deployed in cities and communities across Europe and seeks to create a vibrant community and 'makerspace' where cities and communities can:

- Showcase their digital, green and ethical solutions that solve concrete challenges within cities and communities and the social and proximity economy ecosystem, and their best practices to foster collaboration and unlock funding opportunities
- Find potential solutions to local challenges
- Validate solutions by examining existing deployments in other cities and understanding the underlying products
- Support their local vendors and solution providers, especially SMEs, by introducing them to new markets

The Tech4Good Marketplace thus offers:

- One location to showcase Tech4Good solutions
- An outlet to explore cities, their solutions and the underlying products that make solutions function
- The ability to search by relevant term or explore challenges like 'smart mobility' or 'air quality'
- Options to explore solutions which satisfy the United Nations Sustainable Development Goals (SDGs)
- Quality cases and examples of validated, deployed solutions and the cities where they have been replicated

Since September 2022, the marketplace has also been open to submissions (city profiles and/or solutions) from cities and solution providers outside the 100 Intelligent Cities initiative.

Achievements of the Intelligent Cities Challenge

During the 25 months of implementation, the ICC cities have been implementing the ICC methodology and achieving a green and digital transition of their local economies while focusing on developing concrete solutions under the thematic tracks.

The achievements of the Intelligent Cities Challenge are described at the level of the initiative, at the level of each thematic track and at each ICC city.

3.1 Overall achievements of the Intelligent Cities Challenge

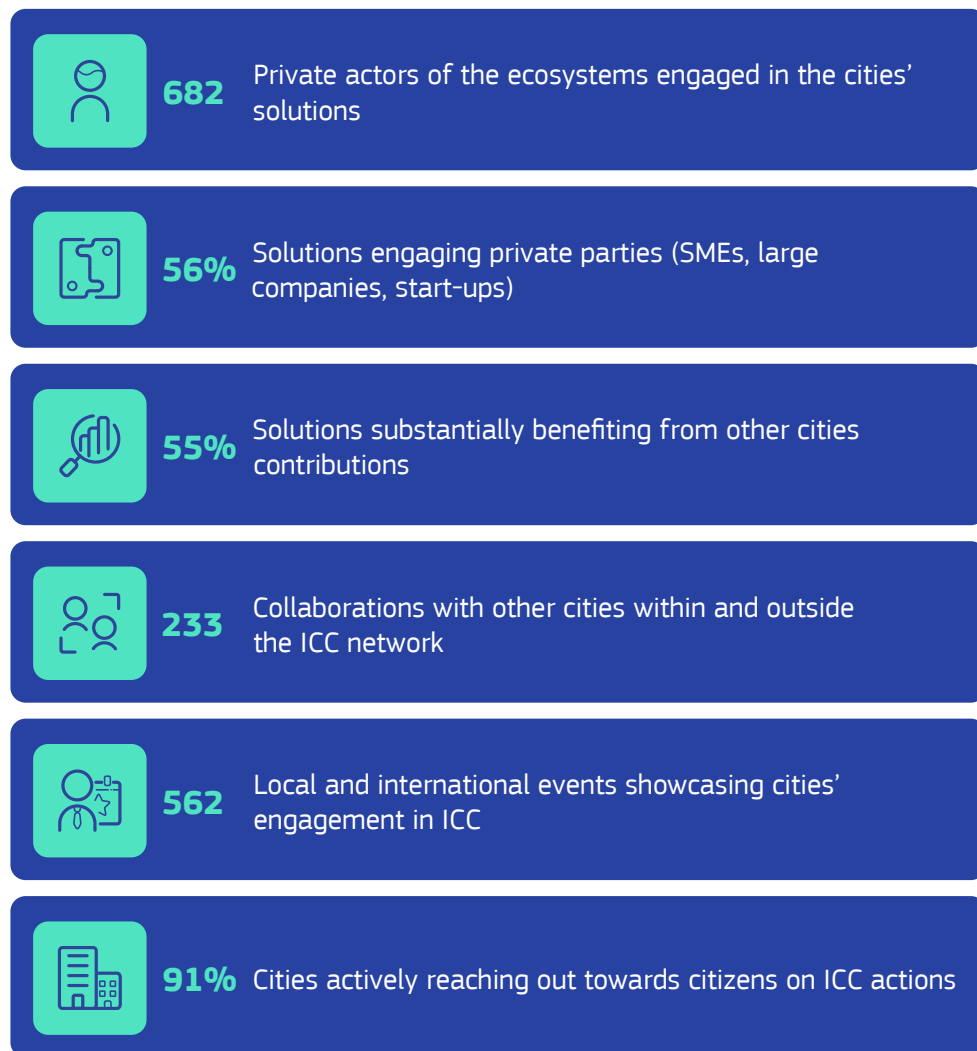
Between September 2020 and November 2022, €1.9 billion was earmarked for ICC cities' actions, and €247 million in public funding from EU, national and regional sources was leveraged which helped facilitate:

Figure 9: ICC achievements



Furthermore, the ICC cities successfully set up a meaningful EU-level ecosystem that delivered concrete collaborations:

Figure 10: EU-level ecosystem delivering concrete collaborations



3.2 Achievements per thematic track

This section provides an overview of the achievements per thematic track, giving additional details on the volume of funding mobilised⁶ by the cities and the level of engagement with public and private actors across the diverse solutions under the thematic tracks.

3.2.1 Green economy and Local Green Deals

In the green economy and Local Green Deals thematic track, **75 solutions were designed by 40 different cities**. The solutions implemented by cities under this track were quite diverse. However, several solutions focused on the use of data to improve decision-making with environmental implications at the city level (12 solutions), energy management (11 solutions), waste management, renewable energy and circular economy measures (seven solutions each), reduction of emissions (six solutions), development of energy communities, green mobility and water management (four solutions each). In addition, several solutions (13 in total) focused on supporting SMEs and entrepreneurs, raising awareness on environmental topics and using nature-based solutions in the city.



Figure 11: Share of secured funding for solutions under the green economy and Local Green Deals thematic track

⁶ Secured funding refers to the share of the total budget secured across all solutions under a thematic track.



SOLUTIONS TARGETING WASTE MANAGEMENT IN VRATSA (BULGARIA) AND WATER MANAGEMENT IN CASTELLO DE LA PLANA (SPAIN)

The effective treatment of waste and its use as a resource in the future plays a major role in achieving environmental sustainability and moving towards circular economy principles. The city of Vratsa in Bulgaria is developing a regional waste management system, including new software and installing video surveillance cameras and sensors in the waste bins. The objective is to promote a circular and shared economy and industrial symbiosis.

Cities face unique water management issues requiring specialised attention and policy solutions. Informed decisions on financing, controlling, regulating and managing urban water by cities to better meet economic, social and environmental goals represent a few challenges. The Spanish town of Castello de la Plana is developing a holistic solution that supports the ecosystem's recovery, encourages sustainable consumption and fosters the habit of conserving and reusing water. Their goal is to establish Green Industrial Areas and a Zero-Waste Water Cycle.

The funding secured (35%) is slightly below target, which indicates that some of the solutions with the largest budget still need to be able to secure (full) funding. For example, the most ambitious initiative, in terms of financial needs, under this thematic track is the realisation of a new sustainable energy bus line in Pescara with an estimated cost of €115 million and a secured amount of €49 million.

LOCAL 'DIGITAL TWINS' IN PRACTICE

Local digital twins provide cost efficiencies, operational efficiencies, better crisis management, more openness and better-informed decision-making, more participatory governance, and better urban planning. The city of Mechelen in Belgium wants to be a smart city where technology and data are used to make life more pleasant for the inhabitants. Mechelen intends to develop a digital twin in energy supply and demand for €1 million. The digital twin will allow for better and more accurate decision-making by all stakeholders, helping the city become more energy efficient and achieve its climate goals.

ENERGY COMMUNITIES IN SPAIN

One of the difficulties all cities face is the supply of reliable and affordable climate-friendly energy, particularly from intermittent sources such as wind or solar. Alcoy in Spain developed a solution centred on local energy communities in industrial areas, which was implemented using a smart, sustainable grid solution to monitor industrial consumption and efficiency. Furthermore, energy consumption data are accessible via a public dashboard. The goal is to become a resilient economy, transforming the industry through green manufacturing and clean production. Several other Spanish cities, such as Alicante, Castello de la Plana and Pamplona, are also working on developing and implementing energy communities.

Although the total leveraged private investment of ICC cities' solutions is still quite low, the initiatives under the green economy and Local Green Deals thematic track have been among the most active in engaging the private sector. For 59% of the solutions, the cities attracted various non-government actors to the project, particularly the design or implementation phases. Moreover, 73% of the solutions under this thematic track result from collaborations between cities – defined here as co-designing, co-implementing, or accounting for significant inputs from another city into one of the different stages of the solution. The number of initiatives implemented jointly with other non-ICC cities is particularly high for this track (13), highlighting the common interest from ICC and non-ICC cities in a green economy and LGDs, and their motivation to be part of advanced environmental initiatives. One notable example, Leuven, is implementing all three initiatives it participates in with fellow Belgian municipalities not participating in ICC directly (e.g. Roeselare). The solutions focus on supporting local companies transitioning to a circular economy, creating resource hubs, and using data analysis to support climate adaptive policies.



Figure 12: Share of solutions that implied engagement with private parties and collaborations with other cities for the green economy and Local Green Deals thematic track

SUPPORTING BUSINESS TO BE MORE CIRCULAR IN JYVÄSKYLÄ (FINLAND)

The city of Jyväskylä is moving towards a circular economy and responsible business models. City officials are undertaking initiatives over the coming years to increase participation in Ympyräks – a network comprising the Regional Council of Central Finland, Chamber of Commerce, local associations for entrepreneurs and the University of Applied Sciences – and to improve the understanding and capabilities of those businesses regarding environmental responsibility and the circular economy.

The Ympyräks network targets SMEs and thus relates to sustainability and corporate responsibility across all companies and organisations, regardless of their sector. Internationally recognised inventions in the bioeconomy and the circular economy, as well as prosperous businesses based on them, have been developed in Jyväskylä thanks to excellent research and collaboration among diverse players.

Many of these innovations fall under the CIRCWASTE (Heikkisa, 2020), a seven-year LIFE IP project coordinated by the Finnish Environment Institute, which promotes efficient use of material flows, waste prevention and new waste and resource management concepts. All actions contribute to implementing Finland's National Waste Management Plan and directing the country towards a circular economy.

While it was not one of the key areas at the start of the project, Local Green Deals soon became a pillar in the path towards sustainability taken by ICC cities. The development of an LGD was described in detail in the Blueprint for Action (ICC, 2023). As of April 2023, LGDs are in progress in 42 ICC cities. In addition, 23 ICC cities have been selected as part of the 100 Climate Neutral and Smart Cities Mission. This shows how the work started in ICC is helping further strengthen its sustainability commitment.

GREEN ECONOMY OBJECTIVES IN PORI (FINLAND)

Pori in Finland is an example of a city navigating a unique solution for the green economy and Local Green Deals, turning the city into an attractive place to live, work and operate as a hub for talented individuals and advanced businesses. The city is actively mobilising green investments by offering attractive locations and infrastructure for industrial investors and ensuring the availability of a competent workforce. In its strategy definition process, the ICC has made an important contribution by engaging many companies, financiers, educational institutions and public stakeholders. The ICC methodology and its step-by-step process have provided the city with a shared view of its green economy objectives, with a concrete and confirmed set of actions, actors and deliverables all integrated into the City Strategy. Based on the ICC vision, Pori will be an intelligent, sustainably growing and creatively renewing city in 2030.

"More than ever, local authorities seek innovative 'smart city' solutions for increasingly complex challenges. But custom technology and data-driven solutions are expensive, and government resources are scarce. The ICC project enabled the City of Mechelen [to progress] towards a renewed collaboration and business model for 'Climate Smart Cities' in which private and public stakeholders create value together around a smart and open data infrastructure."

Mechelen ICC City Team

3.2.2 Supply chains, logistics and the economics of mobility

A total of 23 ICC cities worked under the supply chains, logistics and the economics of mobility thematic track and designed 46 solutions. Most of the solutions (11) implemented under this track were focused on sustainable mobility. In contrast, other types of mobility – including bikes, trams, buses, and scooters – were present in six solutions, and two solutions represented digital mobility. Several cities were working on digital infrastructure for monitoring purposes (nine solutions) and using data for better decision-making (seven solutions). Infrastructure development was present in six solutions, and two solutions are developing an app to help users of local public services.

E-CONNECTED SUSTAINABLE MOBILITY IN MARIBOR (SLOVENIA)

The challenge of urban mobility is a pain point shared by nearly everyone who lives, works or travels to a densely populated European city today. By focusing public and private resources on key areas of change, such as technological and behavioural avenues leading to more sustainable urban mobility – from street trials to linked and shared on-demand mobility – cities' proposed solutions in this area hope to speed up the process.

Using open data platforms, the Municipality of Maribor, part of the Slovenian Towns Association consortia, sets the bar for e-connected sustainable mobility. As a pilot within the Interreg Alpine Space co-financed project, MELINDA, the sustainable platform was established as an efficient and user-friendly digital system for collecting data on sustainable mobility in the city. A key objective is a transparent interface for decision-makers, local administration, citizens, researchers and entrepreneurs to examine and download data on sustainable transportation. Additionally, the aim was to monitor individual travel patterns through yearly surveys to encourage them to adopt more ecologically friendly transportation within the city (on foot, by bike or by bus).

Nearly a quarter (22%) of these solutions have secured funding. To overcome this rather low rate of adequate funding (compared to the ICC average of 37%), the cities under this thematic track have actively applied for EU funding. They count for the largest share of solutions for which an application for an EU funding scheme was filled (61%), and the most popular EU funding programme among these cities appears to be the NextGenerationEU fund.



Figure 13: Share of secured funding for solutions under the supply chains, logistics and the economics of mobility thematic track



Figure 14: Share of solutions that implied engagement with private parties and collaborations with other cities for the supply chains, logistics and the economics of mobility thematic track

The solutions delivered under the supply chains, logistics and the economics of mobility thematic track reported high private-sector engagement. In 59% of the initiatives, the cities involved private parties at different stages of development. For example, Skelleftea involved large companies in discussions about the co-development of their mobility projects (autonomous bus shuttles, infra-system culverts, multi-function parking complex, mobility data platform).

For a similar share of initiatives (more than 60%), the cities benefited from inputs from other cities towards design and implementation.



"The main successes achieved by the City of Pescara are the growth of sustainable mobility on an urban scale, especially by bicycle, on foot, with electric scooters, both for daily mobility for study and work (Pesos, Biciplan, Pedibus programmes) [and] for the erratic mobility (that is not regularly programmable, for leisure, occasionally for service and needs), [as well as for] young people and city users (tourists, university students, occasional users of metropolitan services)."

Pescara ICC City Team

3.2.3 Upskilling and reskilling

There are 26 initiatives developed under the upskilling and reskilling thematic track by 16 different cities. Most of the solutions identified by the cities focused on developing and supporting digital skills (14 solutions). Cities were also working on the creation of training programmes (four solutions), and ones generally focused on reskilling and upskilling (two solutions) and sustainable skills (one solution). There are also five solutions belonging to other topics.

The upskilling and reskilling thematic track has the highest completion rate, with 8% of the solutions fully completed by the cities. While cities are on track to implement the designed solutions fully, the solutions have a longer implementation timeframe than the length of the ICC project.

GREEN AND DIGITAL UPSKILLING IN VENTSPILS (LATVIA)

Cities are undertaking a large-scale effort to upskill and reskill their workforce for green, digital and social transformation based on assessing each city's real-world needs and current changes in socio-economic and environmental trends. Ventspils is a Latvian city focused on closing the skills gap and empowering its citizens while pursuing a green, digital and social workforce transformation.

This enables the city to meet new needs and challenges. From a policy standpoint, it builds on Europe's *new Skills Agenda and Skills Agreement*, focusing on new participatory models to help better deliver skills for green and digital recovery at the city level. Ventspils is committed to establishing state-of-the-art digital infrastructure for educational institutions – by providing each educational institution with a 10G network connection, Wi-Fi in every classroom, and remote and distance learning solutions. The major objective is to provide fast internet so that educational processes may be organised effectively and allow for the use of modern technological solutions.

Among the 26 initiatives, the share of the solutions budget secured reached 62%, indicating that the largest projects have been funded and that the solutions still seeking funding represent a smaller share of the total budget. For example, the construction of the Science and Innovation Centre of Ventspils (VIZIUM) is the initiative with the largest funding under this thematic track (€29 million), and its budget has been fully secured, relying on different financing sources: the European Union, Latvian financing and the municipality budget. ICC cities working on upskilling and reskilling solutions do not rely heavily on European funding to finance their projects; only 23% of the solutions do.

Secured funding

62%

Secured funding (%)

Figure 15: Share of secured funding for solutions under the upskilling and reskilling thematic track





Figure 16: Share of solutions that implied engagement with private parties and collaborations with other cities for the upskilling and reskilling thematic track

A considerable share of initiatives (58%) benefited from private-sector engagement and other cities' inputs (65%). An interesting case of collaboration between ICC cities is the home assistance system for older people developed jointly by Torrent and Alcoy and co-financed by both municipalities (alongside EU funding).

In addition to the ICC projects, 35 cities participate in the Pact for Skills initiatives or other regional, national or European skills-related initiatives. Among the cities involved in the upskilling and reskilling thematic track, the engagement rate is stronger towards different types of up- and reskilling initiatives than towards the *Pact for Skills*: **nine of them signed the Pact for Skills, while 81% of them are involved in skills initiatives at the international, national or regional level.** For example, VIZIUM is a member of the Nordic Science Centre Association and the European Network of Science Centres and Museums (ECSITE). At the same time, for several municipalities, this involvement relates to their inputs in local strategies aligned with the European Skills Agenda.



"All eras have certain fashions. Using terms like 'Intelligent' and 'smart' is trendy. It doesn't take much to declare that one or another city is intelligent and smart. However, whether such a statement is justified is of decisive importance. To ensure that Ventspils can truly designate itself as an intelligent and smart city, we have decided to prioritise innovative education and training through remote, alternative or distance learning programmes and re-skilling based on instructional design – provision of skills for the digital world and industry. We are confident that the knowledge, skills and experience obtained via the Intelligent Cities Challenge initiative will provide substantial input to a targeted and organised approach to truly develop Ventspils as an intelligent and prosperous city for future generations."

Ventspils ICC City Team

3.2.4 Citizen participation and digitisation of public administration

In the citizen participation and digitisation of the public administration thematic track, 49 cities designed 115 solutions. This track reported the highest number of solutions and the types of solutions implemented. Solutions focused on using ICT to facilitate interaction with citizens was the most common solution implemented by cities (16 examples), followed by open data platform and digitisation of municipality processes (12 solutions each).

Other popular solutions among cities cover digital literacy improvements and participatory public policy (10 solutions each), the creation of a centralised e-administration portal or data-driven public policy (eight solutions), the creation of a centralised data platform and online public services for citizens (seven solutions each). The less common solutions revolved around cybersecurity and accessibility and dashboards and maps (three solutions each).

OPEN GOVERNMENT IN ULM (GERMANY)

In addition to highlighting the significance of digital transformation in boosting economic competitiveness, the solutions presented also recognised the advantages of technology in fostering citizen participation. When considering civic involvement and the digitisation of public administration, the German city of Ulm is a reference. While Ulm's geographic location has historically made it an industrial hub, the city pursued a digital agenda to encourage innovation while improving its sustainability and making it more attractive for investment.

The city agenda is marked by a strategy of digitisation from the ground up, which primarily benefits the citizens. The proposed solution, called 'open government', promotes open, inclusive, and trustworthy governance. The solution seeks to increase public accountability, transparency and participation. The ambition is to enhance citizen and business participation and better understand city stakeholders' needs.

The share of the total solutions' budget secured reaches 69%, the highest among all the thematic tracks. As this thematic track focuses mostly on public services and citizens, the private-sector engagement was lower, even though private parties were still consulted in developing 51% of the initiatives – mostly SMEs.

The citizen participation and digitisation of the public administration thematic track was of interest to a wide range of cities, as reflected in the collaboration rate between cities: 75% of the initiatives under the track benefited from inputs by another city, either sharing insights or collaborating on design or implementation.



Figure 17: Share of secured funding for solutions under the citizen participation and digitisation of public administration

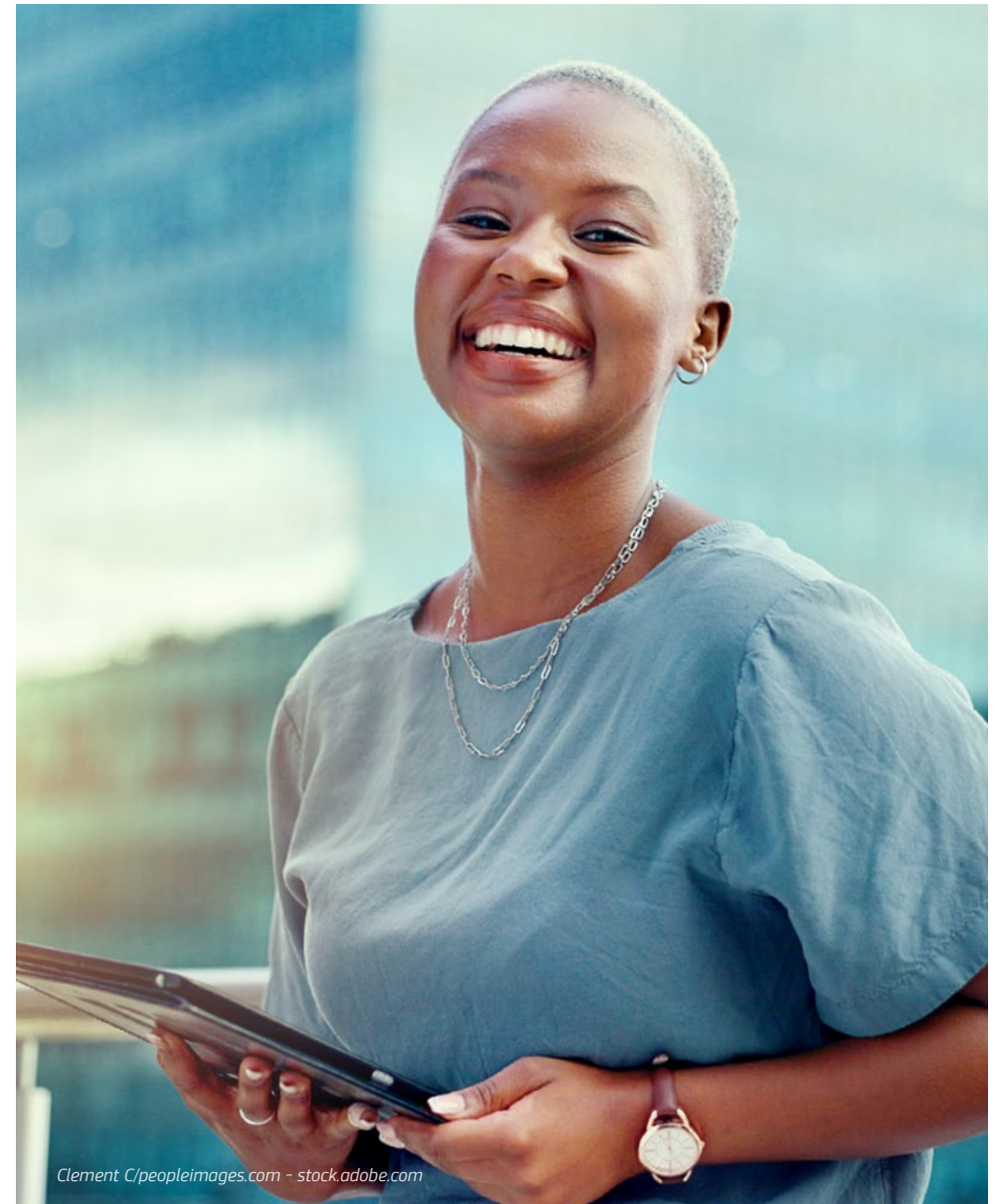


Figure 18: Share of solutions that implied engagement with private parties and collaborations with other cities for the citizen participation and digitisation of public administration thematic track

In addition to the ICC projects, 22 crisis digital initiatives were implemented by the ICC cities in response to the COVID-19 pandemic. For most of them, these solutions aimed at stopping the virus's spread and connecting citizens (including fragile populations) despite the lockdowns.

"The ICC has been an important brand in promoting digital development, focusing on developing digital solutions with and for citizens to live happier, more productive and sustainable lives. As Ljubljana was part of an 11-city consortium of all urban municipalities in Slovenia, the project also became an important platform for cross-city collaboration and regular communication. Successful practice showed the need for a regular exchange of information. This also led to forming a new Digitisation and Smart Cities Committee within the Association of Slovenian Urban Municipalities, which will further promote active cooperation between Slovenia's largest cities in developing digital solutions across city boundaries."

Ljubljana ICC City Team



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3.2.5 Green and digital transition in tourism

A total of 17 ICC cities have been working on the green and digital transition in the tourism thematic track, and they have designed 29 initiatives to implement under the ICC programme. Most of the solutions developed under this track (seven solutions) focused on destination branding, tourism strategy and the creation of alliances.

Several other solutions are using digital means, such as the creation and digitisation of touristic routes (four solutions), the development of smart tourism platforms in the municipality (four solutions), the creation of digital tools to inform and promote the cultural assets (three solutions) and implementation of digital infrastructure for tourists (two solutions). Finally, there are three solutions focused on the reduction of emissions for the tourism sector.

DIGITAL SOLUTIONS TO SUPPORT TOURISTS IN KAVALA (GREECE)

Online travel platforms are partners in driving the green and digital transition, offering hoteliers and consumers solutions to address challenges and capitalise on opportunities. This, in turn, contributes to European tourism's global success. Building on a digital tourism experience is frequently accompanied by pursuing sustainable tourism development and the twin transition.

This is the case with the Greek city of Kavala, which provides a solution consisting of goods and services that strive to improve the visitor experience through various efforts, including an advanced e-guide tour system that offers 'experiential' tours in space and time. The guide provides a list of the main points of interest in the municipality for tourists, giving them an overview and indicating how to reach them, thanks to geolocalisation. The solution aims to improve Kavala's tourism product, make the city more inviting to tourists, and combat seasonality and pandemic-related issues.

Figure 19: Share of secured funding for solutions under the Green and Digital transformation in tourism thematic track

Among these initiatives, funding was secured for 30% of the total costs. As of writing in the early part of 2023, they still need to be completed. Regarding the sources of funding, the ICC cities working on the green and digital transition in tourism rely on European financing schemes: 55% of the initiatives are linked to an application for EU funding, the most common being NextGenerationEU and European Regional and Development Funds (ERDF).





Figure 20: Share of total solutions that implied engagement with private parties and collaborations with other cities

More than half of the initiatives involved private parties at some stage of their development (52%), which is slightly lower than the ICC average and somewhat unexpected given the complex nature of the tourism industry and the importance of the private sector.

This is well highlighted by the example of Tripolis, which involved SMEs and large companies in the design stage of their 'connected tourist route' project – their early input was important, especially because they will ultimately benefit from the initiative through increased visitor flows.

Some 66% of the initiatives launched under the green and digital transition in tourism are collaborations between cities – either co-design/co-implementation or sharing relevant inputs.



"Through the ICC, we identified important priorities for developing the city of Vratsa in areas such as the green economy and sustainable tourism, as well as to plan further steps for achieving the developed thematic objectives. We received expert support, established contacts and exchanged experience and good practices with other cities during the City Labs and peer-review sessions. The most significant achievement within the project was the development of an idea for a digital integrated waste management system in the municipality of Vratsa. Later, we had the opportunity to be part of such a project and implement the idea. For the next years, our intention for the city is to be greener, smarter, with high levels of digital maturity in all sectors."

Vratsa ICC City Team

3.3 Achievement of ICC core cities

ICC cities' achievements emphasise the initiative's role in accelerating the implementation of solutions and initiatives, establishing a network while facilitating collaborations between cities, stimulating thematic learning and supporting internal processes for monitoring the progress of strategies via its methodology.

Table 5: ICC core city achievements

CORE CITY	MAIN ACHIEVEMENTS
Alcobendas (Spain)	<ul style="list-style-type: none"> • Strategy implementation: thanks to the ICC methodology and monitoring plan, the city of Alcobendas was able to address the past challenges in strategy implementation. • Improved sustainable mobility: the ICC helped to launch the procurement procedure of the first phase of the sustainable mobility initiative. Currently exploring possibilities of EU funds for the second phase. • Reskilling and upskilling: successful fulfilment of more than ten training programmes and employment drives to boost the local workforce skills empowerment. • Start-up Alcobendas: successful fulfilment of three Open Innovation calls and three roadshows involving 20 corporates and promoting Alcobendas' local ecosystem.
Alcoy (Spain)	<ul style="list-style-type: none"> • Impactful solutions: thanks to the ICC and the established cooperation with other ICC cities, Alcoy was able to implement solutions and actions linked to increase the city's green impact in industrial areas. • An improved local network: creation of a more consolidated network of stakeholders willing to improve the city of Alcoy. • Innovation: the recruitment of an 'innovation agent' and an Innovation Agency was put in place. • The industrial ecosystem: formation of several working groups and parallel activities in the energy and mobility domain to formalise the first local energy community in Alcoy. • Sustainable mobility: subsidies for companies offering bicycle and scooter parking.
Arad (Romania)	<ul style="list-style-type: none"> • An improved local network: creation of a local collaboration framework. • The twin transition: under the ICC, the city of Arad has achieved goals related to its Digital Transformation Strategy, coupled with other strategic documents developed by the city (Integrated Urban Development Strategy, Sustainable Urban Mobility Plan, Green Strategy, Sustainable Energy Action Plan). • Benefits to the local community: enhancement of citizen participation, connectivity and community. • Resilience: climate resilience, disaster management and the support in improving safety and security through the implementation of the Digital Transformation strategy.

CORE CITY	MAIN ACHIEVEMENTS
Białystok (<i>Poland</i>)	<ul style="list-style-type: none"> • The twin transition: the city of Białystok implemented photovoltaic installations on certain buildings and it is planning the development of e-service solutions (such as a video-visit system and a citizen portal). • Benefits to the local community: integration and implementation of a unified financial and accounting system at the Municipal Office, adopting digital solutions (use of open data and new digitalised operations).
Bratislava (<i>Slovakia</i>)	<ul style="list-style-type: none"> • Expert support: the access to relevant experts that helped Bratislava to implement the city's projects, in relation to the creation of the Innovation District and the Bratislava Living Lab.
Castelló de la Plana (<i>Spain</i>)	<ul style="list-style-type: none"> • An improved local network: adoption of a transversal work approach that helped the city to surmount the mono-sectorial mentality of the departments. • Image of the city in Europe: the international prestige achieved by participating in ICC and its international network. • The green transition: improvement of the energy efficiency of the city, with the support of the City Council and the reduced use of energy (through a more sustainable public lightning and the self-consumption in public buildings). • Sustainable mobility: adoption of electric vehicles for the municipal fleet, increase number of cycle lanes in the city centres as well as in the suburbs. • Resilience: implementation of multiple sustainable drainage systems and nature-based solutions in the city aimed at boosting rainwater re-use and flood prevention.
Catanzaro (<i>Italy</i>)	<ul style="list-style-type: none"> • Knowledge-sharing: exchange of best practices and cooperation among ICC cities as well as sharing the city's achievements, projects, progress and experience. • The twin transition: achievement of innovative digital infrastructures and sustainable mobility services affecting the quality of life and urban context, following the EU objectives on the twin transition. These include the development of 5G experimental applications, more sustainable freight logistics, introduction of a smart and digital parking system and creation of a new green cyclable road.
Coastal Town Association (<i>Italy</i>)	<ul style="list-style-type: none"> • Impactful solutions and the green transition: application of the successful LIFE project, focused on supporting environmental governance, and implementation, through specific projects, the priorities and objectives of the EU Green Deal. • Improved network: starting of insightful collaborations with a wide range of internal and external stakeholders (local universities, SMEs, large companies and other cities).
Communauté d'Agglomération Paris – Saclay (<i>France</i>)	<ul style="list-style-type: none"> • Impactful solutions: establishment of a consortium of relevant stakeholders in the urban area and the launch of project calls. • The digital transition: implementation of the first global and digital actions towards a common strategy, including the adoption of connected and automated mobility services, a 5G platform and new digital infrastructures for monitoring (a more connected territory for local logistics, parking lots, and a new operational and economic model).
Corfu (<i>Greece</i>)	<ul style="list-style-type: none"> • The twin transition: achievement of the initial steps of the green and digital transition of Corfu municipality with the successful implementation of impactful city solutions and actions linked to the development of smart mobility, introducing the Sustainable Urban Mobility Plan (SUMP) and the Electric Vehicles Charging Plan.

CORE CITY	MAIN ACHIEVEMENTS
Cork (Ireland)	<ul style="list-style-type: none"> • Project implementation: support helped the city to keep a focus on smart cities during COVID-19 thanks to the structure of the reporting requirements which was important to making sure projects were implemented. • The digital transition: embedding cyber security actions in the city council's agenda with events, training campaigns and technical implementations. • Benefits to the local community: development and awareness of open data at the senior management level as well as with Cork's citizens through engagement workshops, collaboration with a local university to explore how wearable technologies could be used to predict and identify loneliness in older adults and the development of a placemaking toolkit.
Derry/Londonderry (United Kingdom)	<ul style="list-style-type: none"> • An improved network: establishment of beneficial cooperation with other cities. One such collaboration included the start of digital construction courses in the city and identifying ICC cities (such as Amsterdam, Ventspils and Pori) with relevant experience/know-how for inspiration, ideas exchange, and enduring collaboration with Derry/Londonderry. • Upskilling and reskilling: implementation of several skills initiatives identified as part of the city's dialogues with the private sector, focus on digital/technology/entrepreneurial skills and building an ecosystem of key city stakeholders around that focus. • Local ecosystem engagement: establishing better cooperation between and across different stakeholders operating in the digital skills space. • Digital transition: good results of ICC projects are assured via a set of prioritised skills initiatives to be absorbed into the city-region's digital transformation plan.
Gavà - Castelldefels Consortium (Spain)	<ul style="list-style-type: none"> • Local ecosystem engagement: a profitable cooperation was established with the partners of the Gavà-Castelldefels consortium. The partnership is a network of local researchers, entrepreneurs and public entities with a high level of experience that allowed the consortium to develop an ambitious and well-structured action plan. • Knowledge-sharing and upskilling: the ICC programme allowed the consortium to form a highly trained working team who observed other cities' experiences during ICC City Labs. • Resilience: installation of a public management system of natural spaces and urban areas at greater risk during COVID-19. The management system consisted of the installation of sensors and 360° cameras.
Gdańsk (Poland)	<ul style="list-style-type: none"> • Local ecosystem engagement: improvement of the city's inter-departmental cooperation through the implementation of an open data system that improved the different departments reachability.
Gelsenkirchen (Germany)	<ul style="list-style-type: none"> • An improved network: knowledge exchange and communication of the obstacles faced with the other ICC cities. ICC provided a platform for this and helped with any problems that might arise.

CORE CITY	MAIN ACHIEVEMENTS
Gijón (<i>Spain</i>)	<ul style="list-style-type: none"> • Knowledge-sharing: acquisition of good practices for constructing a local innovation ecosystem, as well as access to solutions adopted by other cities. • Improved network: increased network of people and organisations with the common objective to develop a Smart City and the opportunity to have shared experiences and obstacles faced during its implementation. • The twin transition: the city of Gijón has been committed to rolling out its Green and Digital Strategy, based on promoting energy efficiency and deploying an IoT network that allows the creation of multiple smart services based. In parallel, the city council has made important advances in the field of digitisation and electronic administration, to reach greater efficiency and sustainability in our activities. • Local ecosystem engagement: greater involvement and commitment of the population in common future goals, which implies the development of a new governance model based on open government and encouraging citizens to adopt a new energy model based on autonomous production of renewables and the establishment of energy communities.
Gliwice (<i>Poland</i>)	<ul style="list-style-type: none"> • Solutions implementation: support in developing and implementing the city's solutions, including the introduction of a new open data platform, able to collect relevant data to plan the next strategies. • Local ecosystem engagement: a strengthened cooperation in the city ecosystem. The digital transition of the city engaged different sectors among the city stakeholders, including civil society and local business, as well as stakeholders involved in environmental and urban planning initiatives.
Granada (<i>Spain</i>)	<ul style="list-style-type: none"> • Improved network: new collaborations established with other cities and across the city's own departments.
Guimarães (<i>Portugal</i>)	<ul style="list-style-type: none"> • Strategy implementation: a clearer definition of the targets to elaborate funding applications. • Solutions implementation: acceleration in the implementation of the proposed solutions in the ICC. • Improved network and knowledge-sharing: interaction within current and establishment of new networks between municipal departments and other cities.
Haskovo (<i>Bulgaria</i>)	<ul style="list-style-type: none"> • Local ecosystem engagement: activation of local stakeholders for the implementation of the solutions planned, including local business organisations and the local university. • Knowledge-sharing: communication and knowledge-sharing with other ICC cities to exchange achievements and common obstacles faced.
Heraklion (<i>Greece</i>)	<ul style="list-style-type: none"> • Strategy implementation: the ICC methodology and its incorporation supported the city strategic planning. • Local ecosystem engagement: involvement of stakeholders and citizens in the implementation of the city's strategic vision, especially in the touristic and entrepreneurial sectors.
Idrija (<i>Slovenia</i>)	<ul style="list-style-type: none"> • An improved network: knowledge exchange and evaluations of real case studies with other ICC cities. • Digital transition: implementing a digital solution from other cities into our plans and visions.

CORE CITY	MAIN ACHIEVEMENTS
Ioannina (Greece)	<ul style="list-style-type: none"> • Solutions implementation: adoption of marketplace solutions for the city. • Digital transition: creation of a digital academy to enhance citizens' digital capabilities. • Green transition: improvement of the natural environment, green economy and economic growth.
Karlskrona (Sweden)	<ul style="list-style-type: none"> • Strategy implementation: creation of the municipality-wide development strategy with supporting capabilities.
Kavala (Greece)	<ul style="list-style-type: none"> • Local ecosystem engagement: cooperation established with local stakeholders, other cities and across own departments.
L'Aquila (Italy)	<ul style="list-style-type: none"> • Strategy implementation: ICC support helped to provide a clear overview on projects implemented by city administrators and stakeholders, proposing a new structure for the Smart City Director's cabinet, introducing a new transversal group dedicated to EU policies and smart city developments, and using research and the education system as boosters for economic development.
Las Rozas de Madrid (Spain)	<ul style="list-style-type: none"> • Improved network: insightful cooperation established with other cities.
Le Havre (France)	<ul style="list-style-type: none"> • An improved network: organisation of meeting with other ICC cities with common features and objectives to exchange on best practices and experiences. • Local ecosystem engagement: thanks to the creation of a shared community of practice and challenges, the cross-sectoral cooperation improved.
Leuven (Belgium)	<ul style="list-style-type: none"> • Strategy implementation: delivered a business and location model for the city's resource hub, allowing the re-use of specific residual flows and the creation of additional jobs as result of this project. • Local ecosystem's engagement: increased local business engagement towards a more circular approach.
Ljubljana – SiMOS ⁷ consortium (Slovenia)	<ul style="list-style-type: none"> • An improved network: valuable cooperation established with other cities.
Mantova (Italy)	<ul style="list-style-type: none"> • Solution and strategy implementation: adoption of clear and defined solutions through the ICC methodology. • Urban territory improvement: the city's engagement in initiatives and projects to design innovative solutions for urban regeneration, environmental protection and recovery, community engagement and social inclusion.
Métropole Rouen Normandie (France)	<ul style="list-style-type: none"> • The twin transition: the design of a Smart and Sustainable Territory strategy and the opening of the Open data portal.

⁷ SiMOS consortium refers to the 11 Slovenian Urban Municipalities and it is led by Ljubljana.

CORE CITY	MAIN ACHIEVEMENTS
Città metropolitana di Roma Capitale (<i>Italy</i>)	<ul style="list-style-type: none"> • Local ecosystem engagement: an enhanced participation of local stakeholders in sustainable mobility policies. • An improved network: valuable cooperation established with other cities at national level. • Strategy implementation: ICC helped the city to have a clear overview on projects implemented by city administrators and stakeholders, especially through a more integrated planning of the city's sustainable mobility hubs and network.
Molina de Segura (<i>Spain</i>)	<ul style="list-style-type: none"> • Funding opportunities: obtained an important part of financing through the NextGenerationEU mobility funds. • Benefits for local community: arrangement of new techniques for working with citizens through workshops and the development of a new mobility programme. • Improved network: better knowledge of the achievements and obstacles observed in similar European cities. • Sustainability: implementation of a circular economy web solution.
Pamplona (<i>Spain</i>)	<ul style="list-style-type: none"> • Strategy implementation: stronger engagement with the local ecosystem and development of smart city projects. • Twin transition: on the way to have a mobility and air quality digital twin of the city in the midterm, with funds guaranteed.
Patras (<i>Greece</i>)	<ul style="list-style-type: none"> • Strategy implementation: creation of Smart City Strategic Plan for Patras. • Funding opportunity: funds for project implementation obtained from National Recovery and Resilience Funds. • An improved network: beneficial collaborations with other Greek cities.
Pescara (<i>Italy</i>)	<ul style="list-style-type: none"> • An improved network: opportunity to meet and exchange experiences with European and Italian cities.
Pori (<i>Finland</i>)	<ul style="list-style-type: none"> • Projects implementation: development of concrete investments and alignment between the ICC vision and strategy and the City of Pori Strategy 2030.
Poznań (<i>Poland</i>)	<ul style="list-style-type: none"> • Strategy implementation: under ICC guidance, the city of Poznan has been able to bring together a wide range of stakeholders to develop new tools that have further developed digital competencies, fostering new partnerships, promoting engagement from the private and public sectors.
Reggio Emilia (<i>Italy</i>)	<ul style="list-style-type: none"> • Improved network and knowledge-sharing: cooperation across ICC cities and opportunities to share with and learn from other cities' experiences.
Skellefteå (<i>Sweden</i>)	<ul style="list-style-type: none"> • Strategy and projects implementation: advancement in several areas of urban improvement. The ICC helped the city to join the Viable Cities and the Climate Neutral Cities mission at national level.
Sofia (<i>Bulgaria</i>)	<ul style="list-style-type: none"> • Digital transition: prior to the ICC, there was very little awareness and interest in smart city related topics. Sofia has recently implemented several pilot projects to build a smart city infrastructure that would facilitate future developments.

CORE CITY	MAIN ACHIEVEMENTS
Split (<i>Croatia</i>)	<ul style="list-style-type: none"> • The twin transition: thanks to the ICC, Split was able to deliver innovative solutions for the city and its citizens. With support from the lead expert, the Split is becoming a smart city. The existing urban infrastructure, environment, recreational zones, waste and water management, and degree of ICT integration provide a good starting point for further progress in terms of developing and implementing smart solutions. • Local ecosystem involvement: the City of Split, as a local public administration, has recognised the need to establish a smart city infrastructure and thus launched numerous projects which resulted in raised awareness of issues such as sustainable urban transport, digitisation of public services, energy efficiency and housing, and urban management.
Sweden Emilia - Romagna Network (SERN) (<i>Italy</i>)	<ul style="list-style-type: none"> • Strategy implementation: new organisational changes thanks to the introduction of the digital transformation strategies designed under the ICC, giving space to an approach linking the city to the themes addressed through the initiative. • Smart tourism: thanks to a successful application for funding, SERN was able to work more and extensively on digital transformation in and with the local ecosystems in the touristic field.
Szombathely (<i>Hungary</i>)	<ul style="list-style-type: none"> • Local ecosystem engagement: valuable cooperation established with a wide range of local stakeholders. • Project implementation: creation of a ten-year development programme. • An improved network: application, together with city's partners, to several EU projects and awards.
Terrasa (<i>Spain</i>)	<ul style="list-style-type: none"> • Urban territory improvement: to achieve the city's vision – creating a model to rebuild the economy while ensuring sustainable and smart growth – actions in several areas have been taken. These include climate adaptation, urban resilience, promoting the health and well-being of citizens, collaborative and participatory new economic models, and improving citizen participation.
Thessaloniki (<i>Greece</i>)	<ul style="list-style-type: none"> • Strategy implementation: development of projects that were based on the strategy developed from the participation in the ICC. • An improved network: cooperation and knowledge exchange with the other Greek cities that participated in the programme.
Trikala (<i>Greece</i>)	<ul style="list-style-type: none"> • Local ecosystem engagement: involvement of city stakeholders in the definition and prioritisation of local needs.
Tripoli (<i>Greece</i>)	<ul style="list-style-type: none"> • Funding opportunities: successful application for funding in the current national framework. • Smart tourism: innovative solutions and actions implemented for the sustainable development of tourism in combination with the rural countryside. • Local ecosystem engagement: new cooperation established across own departments and involvement of stakeholders through mobilisation of the local ecosystem, mainly towards universities. • Solution implementation: implementation of actions with positive results for the city, also rewarded with national awards. • Digital transition: achievement of targets set in rural areas using new technologies that make the most of rural assets.

CORE CITY	MAIN ACHIEVEMENTS
Ulm (Germany)	<ul style="list-style-type: none"> • Visibility: the ICC added value in terms of giving Ulm visibility as a smart city and city of the future in line with ongoing and funded activities. • Knowledge exchange: by providing the city with opportunities to reflect on what is going well and where there are points for improvement as well as exchanging and learning. • Collaboration: formation of an informal group with other ICC cities, such as Arad, Gliwice, Bistrita and Las Rozas with the aim of exploring intersections and common needs that could be answered in a collaborative approach. The group aims to facilitate peer learning and match needs in terms of a citizen-centred smart city development with financing opportunities.
Valongo (Portugal)	<ul style="list-style-type: none"> • Improved network: thanks to networking with other ICC cities, the city was able to acquire relevant knowledge on European urban development, especially in relation to the implementation of smart city solutions. These include greater sustainability awareness (through environmental monitoring) and digitisation (through an open data platform).
Vari Voula Vouliagmeni (Greece)	<ul style="list-style-type: none"> • Knowledge-sharing: valuable communication and exchanges allowed the city to observe and evaluate actions that other cities have implemented.
Velika Gorica (Croatia)	<ul style="list-style-type: none"> • Knowledge-sharing: valuable exchanges with other ICC cities. • Project implementation: adopting an impactful solution – the open data portal – for the city rather than a smaller dashboard.
Venezia (Italy)	<ul style="list-style-type: none"> • An improved network: creation of a network of European cities, interested in the same topics. • Cross-sectoral collaboration: establishment of a cooperation across own departments.
Ventspils (Latvia)	<ul style="list-style-type: none"> • Knowledge-sharing: valuable communication and knowledge-sharing with other ICC cities to exchange achievements and obstacles faced during the ICC. • Benefits to the local communities: improvement of digital literacy for all groups of citizens, especially targeting wider youth participation and for students in STEM (levelling out gaps in STEM pupil/student representation in terms of class, gender and ethnicity), and searching for innovative ways to overcome barriers to this.
Vratsa (Bulgaria)	<ul style="list-style-type: none"> • The twin transition: development and implementation of a mobile app and website providing information about the waste management system in the region. • An improved network: the City Council of Vratsa was able to implement projects with the support of business organisations, aiming for the next phases to involve citizens and other stakeholders.

Challenges and opportunities for the cities

The ICC journey had several challenges for the cities but also provided many development opportunities. The section below offers an overview of the challenges the cities face, followed by the opportunities that cities enjoy.

4.1 Challenges

The 30 months of the Intelligent Cities Challenge have been characterised as a time of tumultuous changes and instability. The initiative started in early 2020, and soon after its launch the COVID-19 pandemic fully impacted the work of the cities for months to come. In addition to the challenges and disruptions that the COVID-19 pandemic created, ICC cities also experienced a lack of funding, delays in implementation and the lack of capacity to ensure the quality delivered by service providers, all of which challenged the extent and speed of their transition. While each city faced challenges, some general trends can be identified among all the cities. Likewise, even if the challenges are presented individually here, the cities often face a conjunction of different challenges.

Engagement of the local ecosystem

Difficulties in engaging with the local ecosystem were the most common challenge across all the thematic tracks and cities. Several of the cities mentioned the lack of engagement, and it referred to little engagement with different types of local ecosystem actors such as citizens, businesses or other institutions.

There needed to be more citizen engagement and adequate involvement and support from local SMEs, large companies, networks and relevant stakeholders such as industry associations and incubators during the cities' prioritisation and design of solutions. While COVID-19 restrictions hampered active engagement, challenges persist in those cities without established ties with the local ecosystem, since taking the initial steps towards nurturing a culture of collaboration takes time.

For example, to overcome these challenges, Castello de la Plana, Corfu, Molina de Segura, Venice and Vratsa increased the awareness raising and communication campaigns with their citizens to present the benefits of the change and improve the local ecosystem's involvement. Alcoy also faced delays with private actors' participation in the solution's implementation, which was mitigated by scheduling meetings to organise the work and closely monitor it. The Metropolitan City of Rome saw the implementation of solutions at risk due to the need for more involvement and support from local SMEs, networks and relevant stakeholders. For example, for future developments, the Métropole Européenne de Lille plans to implement a working group to help mitigate the lack of stakeholder engagement.

In the thematic track of **green and digital transition** in tourism, many cities encountered difficulties involving and coordinating key stakeholders in the tourism ecosystem and among end users, including tourists. Cities have implemented different actions to overcome this challenge. The definition of a communication plan is the mitigation measure used by the city of Venice in this regard, while Kavala improved the publicity about the workshops for stakeholders. For example, in Vratsa, there has yet to be uptake by tourists of its virtual museum tours, and the city is working

on creating more engaging content to overcome it. Palaio Faliro is building a strong local network to overcome the lack of participation in the solutions deployed.



Collaboration between stakeholders

Within the thematic track **supply chain, logistics and the economics of mobility**, a key challenge was the collaboration between local stakeholders and different departments within the municipalities. In some cases, difficulties were faced regarding the involvement of specific mobility stakeholders, such as logistics companies and electric charging-point actors. This was the case for the cities of L'Aquila and Terrassa, which established a common vision, a strong political commitment and a push from local communities to improve the collaboration.

Haskovo offers another example of the challenges faced. The municipal digital strategy aims to form a development programme of competencies for sustainable development and ensure the alignment between educational activities and the

needs of businesses. However, the city needs more involvement and collaboration from local business representatives.

Access to finance and the procurement process

Access to finance for twin transition solutions represented a key barrier for cities throughout the DCC and persisted in the ICC, especially during COVID-19. Since the EU's Recovery and Resilience Facility (RRF) entered into force in 2021, city finance opportunities have increased, but the challenge has shifted towards securing funding. Difficulties establishing co-financing schemes and business models ensuring continuity are persistent risk factors for cities.

Lack of resources remains a challenge for several cities due to the high infrastructure maintenance costs and the need for regional investment. Deploying public tenders is also seen as very time-consuming and causes delays.

To identify different funding opportunities, the city of Patras indicated that establishing a Steering Committee at the city level has helped to ensure the involvement of the entire ecosystem, identify the relevant skills, and investigate different funding opportunities.

Lack of data

The need for appropriate data was a recurrent challenge for several cities in different thematic tracks, with other specific challenges applying to each case.

Cities implementing an app or a data platform in the context of their tourism-focused solutions indicated the management and exploitation of such digital infrastructures as a challenge. For the city of Kavala, the inclusiveness of the solution is also a challenge, as the city wanted to avoid excluding customers/businesses without access to IT from its Digital Tourism Management plan. Tripoli, Palaio Faliro and the Coastal Towns Association in Italy also mention the project's coherence with existing initiatives (for example, at the regional level).

Another common challenge encountered by cities implementing mobility solutions was the need for more data/information, notably related to local mobility intelligence, such as parking spaces and traffic forecasts. Involving more or different stakeholders (private companies) in the project and the data collection helped cities such as L'Aquila and Molina de Segura overcome this challenge.

Being able to attain or utilise data from internal and private sources also hampered the implementation of solutions related to open data platforms. Arad was facing the first challenge and planned on mitigating this -by gathering groups of stakeholders willing to bring in their share at developing and updating some open datasets. On the other hand, Gijon started improving data governance within the city.

Technical issues

Cities could face two types of challenges linked to the technology used. In some instances, the cities had trouble identifying appropriate service providers, compromising the timely implementation of more technical solutions.

In some other instances, the difficulties were linked to the existing technology in use. Technical challenges were often mentioned in the implementation of solutions, including, for example, accuracy problems with sensors, network saturation from IoT devices, and inadequate broadband speed for demanding applications. This is the case for Vratsa since the city was facing technical issues with the software and systems they have in place, posing a challenge for the timeline implementation of the solutions.

Regulatory framework

The fragmented regulatory landscape or lack of a regulatory framework also hindered the progress of cities pursuing energy solutions. In the case of Bialystok and Chalkida, as well as Castellon de la Plana, the cities need help with the existing legislation or the lack of legislation that covers the topic of energy communities.

However, the cities have limited options to overcome this challenge since local authorities cannot define the legislation.



Lack of skills and appropriate knowledge

Cities faced difficulties in designing and implementing solutions due to the need for more relevant skills to develop their solutions. This challenge was especially present in small to medium-sized administrations needing more expertise in-house or with established connections with the local ecosystem, such as research institutes and universities. This was particularly an issue in developing solutions within the citizen participation and digitisation of the public administration thematic track.

For example, the city of Arad indicated that the lack of time and barriers, such as a limited number of IT specialists in the municipality, hindered the development of digital training courses.

Political cycles

Political cycles significantly impact attempts to carry out transformative projects, as electoral deadlines and demands do not necessarily align with project needs. Similarly, bringing together stakeholders or citizens from different backgrounds requires significant time and resources to create a common lexicon and align needs and expectations. The time and effort needed to build such social capital were only sometimes compatible with project deadlines.

COVID-19 and Ukraine crisis

In addition, cities have faced additional challenges because of the great exogenous shocks of recent times, such as COVID-19 and the Ukraine crisis. COVID-19 caused delays in almost all projects, the reallocation of resources, amendments to original project plans, and a high staff turnover.

During the Ukraine crisis, many cities faced supply chain issues; price rises – particularly for energy – and an influx of refugees. Today, city administrations are confronted with high inflation at the end of COVID-19 and the start of the Ukraine crisis, putting pressure on budgets.



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LOCAL GREEN DEALS – CONCRETE CHALLENGES

The setting up of Local Green Deals also has a concrete set of challenges:

Starting with **governance and politics**, it takes more work to change city departmental structures and mobilise staff from all relevant departments into an integrated cross-departmental group. Sustainable development is often still seen as an issue in a single department rather than a cross-cutting approach (for more details, see the updated [ICC's LGD blueprint for action](#)). This step usually needs support at the mayoral level. It requires a strong commitment from cities and their political leadership to encourage innovation in the administration and bring all stakeholders, businesses, academia and civil society on board.

Stakeholder engagement is most common in citizen consultations for planning and infrastructure projects. But LGDs require more: commitment to behavioural change and bringing household-level consumption patterns to a collectively accountable level – an ambitious and thus challenging process. On the other hand, businesses and industries increasingly embrace corporate social responsibility (CSR) in their practices. Shared responsibility for a city's footprint is a reasonable entry point to engage these parties further; business communities are diverse, and not everyone is easily convinced. Commitments to implementing LGDs must be part of sustainable business model development, a medium- to long-term process.

Financing is a key concern for local governments, which tend to be constrained by their budgets in many EU countries without or with other crises currently stressing energy, food and housing prices. The fiscal budgets handed down to cities often do not allow for more strategic initiatives and thus depend on external (sometimes conditional) funding. Practically speaking, a lack of resources also means a lack of staff capacity, which was identified as the most urgent barrier to start developing LGDs.

4.2 Opportunities

Building up and joining existing strategies to advance the twin transition creates **opportunities for small to medium-sized cities to become regional role models**. Deploying solutions under the different thematic tracks enhanced city performance, improving quality of life and creating new opportunities for citizens and the local economy.

By participating in an international network, cities can exhibit their innovations and accomplishments and improve their visibility. This leads to increased engagement and access to opportunities offered by the community of cities striving to advance actions that benefit their citizens and industrial ecosystems.

The exogenous shocks that cities faced, with COVID-19 and the Ukraine crisis, also presented an opportunity to fast-track transitions motivated by the urgency to implement solutions rapidly. Through COVID-19, cities were forced to speed up their digital transformations. Those providing upskilling and reskilling solutions must try different delivery methods, such as online training. New modalities of interaction with the public administration emerged, with significant ramifications in the long term.

The experimentation not only involved testing novel methods of service delivery but also exploring innovative approaches to data sharing, utilising open platforms, and leveraging artificial intelligence tools to provide information to citizens. Cities were also pressed to advocate for green transition solutions, especially energy efficiency-related ones.

Opportunities enabling implementation during the initiative included identifying **innovative funding methods and different funding streams**. Cities used common funding streams for their solutions, including from their municipalities, regional or national governments, and other EU funding schemes such as European Regional Development Fund, Interreg, Recovery and Resilience Fund, and NextGenerationEU. A few cities took the opportunity for an innovative approach to generating funding by creating complex networks between private entities, public bodies, NGOs, academia and R&I organisations.

CITIES CAPITALISING ON THE TWIN TRANSITION FOR ENERGY EFFICIENCY

The cities of Gijón, in Spain, and Guimarães, in Portugal, have capitalised on the opportunities of the twin transition and implemented smart, sustainable solutions. Gijón combined sustainability and an intense IoT application to deploy sensors, meters and actuators on all municipal buildings to track their gas, electricity and water consumption and monitor air quality. The employment of this solution is set to cost approximately €3 million. However, national and regional funding is expected to cover the full cost. Guimarães has set up an intelligent platform to modernise their conventional electrical grids using smart net counters. These sensors will allow the municipality to monitor, analyse, control and communicate within the energy supply chain to help the Guimarães Municipality implement preventive actions to improve efficiency, reduce consumption and costs, and maximise the transparency and reliability of the system. This system costs approximately €350,000 with funding from national and regional budgets.

Other cities explored public-private partnerships for reasons other than funding. These include creating open data sources, understanding the skills needed for their area, and general awareness and collaboration in developing and implementing their solutions.

Collaboration opportunities were provided throughout the initiative for public and private entities in a local or international context, facilitated by local workshops, cross-city labs, geographically bound networks and thematic networks. A knock-on effect from this was that, in the process, many cities created new support networks and collaboration networks within their ecosystem and with other cities ranging from formalised relations, such as a local steering committee, to informal connections between cities sharing experiences in applying solutions.

5 Concluding remarks

The final section of the report offers, on the one hand, an overview of the main lessons learned by the cities during the initiative and the implementation of solutions. On the other hand, it also offers a list of recommendations for the next phase of ICC, oriented towards how cities can benefit more from the ICC initiative in the future.

5.1 Lessons learned from the cities transformative journey

The concrete lessons learned by the cities are unique to their characteristics and transformative journey during the Intelligent Cities Challenge. However, some lessons learned apply more broadly to cities drawing on the ICC experience with the uptake of solutions and strategies. In the following, we have outlined some of the main lessons learned.

Stakeholder engagement

The appropriate engagement of stakeholders has been a major driver shared by cities in the diverse thematic tracks. A vast majority of cities identified the need

to engage with stakeholders in the local ecosystem to implement the solutions and strategies defined successfully. Some concrete examples from the different thematic tracks:

- Transforming the economics of mobility needs intense stakeholder collaboration. Many ICC projects required high levels of cooperation between stakeholders, data from private companies and financial resources, but getting them to work in unison was difficult. In the cases where collaborative processes worked, they helped establish a common vision, a strong political commitment and a push from local communities.
- The need to focus on effective engagement with the stakeholders of the local ecosystem, who are key to successful implementation. Many cities learned how to build interest in the training they offered their targeted audience, for example, by creating effective communication programmes and awareness-raising or steering committees.
- Engaging with city stakeholders to understand the availability of data and expertise for developing and updating open datasets is crucial. As cities increasingly handle big data, creating a data governance framework for public and private entities within their cities becomes necessary, as it was the case in Gijón.
- Direct engagement of various actors with the cities' solutions is necessary, especially considering the tourism sector's complex ecosystem. This is also an opportunity to diversify the resources and, in some cases, to raise significant funding from private parties. For instance, Logrono financed about a third of its Enopolis Plan for promoting wine tourism through private-sector investment and public-private partnerships.

"The ICC is not a project; it is not an initiative. It is a catalyst and a framework for our city, Szombathely. It has led to a collaborative partnership with our 1,000 inhabitants, working jointly with competent local stakeholders for 1.5 years, and a series of workshops for citizens and company leaders. These workshops were the very first strategy in the history of our city. Collective thinking enabled a broadly identified strategy with an action plan. Over €2 million was mobilised for the implementation of the ICC project. These workshops with 150 participants [and] complex rehabilitation programme [were] the catalyst for a new smart, teaching and learning factory, health reference site status, and so on."

Szombathely ICC City Team

Acceptance of solutions

The acceptance of the solutions by the citizens is a key element to ensure its successful implementation and to increase citizen acceptance levels.

In the green economy and Local Green Deals thematic track, several cities such as Castello de la Plana, Corfu, Molina de Segura, Venice and Vratsa have implemented awareness-raising and communication campaigns to explain the benefits of the solution to their citizens.

In the case of cities part of the upskilling and reskilling thematic track, the cities learned how to build interest in the training they offered to their targeted audience by creating effective communication programmes and awareness-raising or steering committees.

Collaboration with other municipalities

In some of the thematic tracks, there was a need to collaborate with other surrounding municipalities due to the nature of the solutions to be implemented. This was the case in the green economy and local green deal track, where early collaboration with neighbouring municipalities is necessary to develop a smart waste management system. Successful design and implementation of such solutions with circularity objectives enabled by digital technologies require close collaboration across municipality departments. Strengthening the ties and trust among the services before the implementation facilitates the work forward and allows the city to focus on the solution.



Blue Planet Studio – stock.adobe.com

Funding of solutions

The funding process of the solutions, which is evolving and considering new challenges and funding opportunities, has also brought some lessons for the cities. While optimally, cities should secure funding before developing and implementing solutions; this is only sometimes possible. When cities are ready with their Local Green Deal and/or twin transition strategies, they must actively and continuously seek funding to speed up the transition. The lack of secured funding may delay the implementation of the solution, so cities need to build momentum and identify sources of support continually.

On the other hand, large budgets are only sometimes necessary to achieve local impact. In the case of the tourism thematic track cities, most of the solutions' estimated costs are below €100,000, and their implementation is currently on track. For example, Cartagena benefited from significant European funding and allocated around €100,000 to develop the city's smart tourism app, which is already functional with additional features being tested. Thanks to the limited

"The support from ICC helped us organise workshops and sprints to identify steps to establish mobility hubs in our city, considering the special needs based on our arctic location and sparse population in places. Based on this work, we have initiated several activities with external funding to bring the work forward after the end of the ICC phase."

Skelleftea ICC City Team

cost of their tourism solutions, the consortium of Italian Coastal Towns could use the municipalities' budget to finance them without delay. And results are already visible – the consortium has developed a detailed tourism marketing plan signed by several cities, and the eCosta Digital Platform is in the implementation stage.

Engagement of the private sector

The engagement of the private sector is a crucial component for the success of the implementation of solutions, and not only when the end users are from business segments. Explaining the benefits to private organisations of the solutions to get them on board is essential, especially for data collection. For instance, mobility data held by private-sector players was particularly key to many of the projects in the supply chains, logistics and the economics of mobility thematic track. Therefore, the cities had to set up successful partnerships to get private companies involved in delivering successful projects.

Project management

Likewise, strong coordination during the design and implementation of solutions is fundamental as the stakeholders come with other (sometimes conflicting) interests and different levels of commitment. The strategies cities use to face this issue should be implemented as early as possible in the project to be efficient: clear definition of roles and responsibilities, regular monitoring meetings, and efforts to build a strong network.

Effective project management of typically large-scale projects requires decomposition into smaller subprojects and building a new coherent and holistic architecture. Considering the needed significant engagement, it is beneficial to set up working groups with all stakeholders to facilitate exchanges and operate in an agile way during the implementation of the solution.

Lack of skills

The lack of skills, including the need to reskill and upskill the local workforce, has also been the source of lessons learned for several cities. This was, among others, driven by the impact of COVID-19 and then the supply crisis. The lessons learnt primarily applied to a lack of skills in public administration and the need for skills in the local ecosystem. The missing skills varied depending on the specific solution that needed to be implemented. In certain cases, there was a need for technical expertise, such as knowledge about the technology and its impact. However, in other instances, there needed to be more project management and implementation skills.



Lack of experience and expertise within public administrations puts projects at risk due to poor budgeting for the design and implementation of solutions where experience is missing. Collaborations with local stakeholders and understanding existing successful models in other cities are key inputs during the preparatory phase of designing a roadmap for cities' twin transition strategy.



Engaging in public-private partnerships is necessary to understand the skill demands of the area. Cities have realised that they cannot decide on their own what kind of skills are relevant in their city ecosystem and that they should engage with the private sector to identify what skills are in demand. This led to many public-private collaborations in cities.

COVID-19 and other external shocks

Resilience and flexibility are vital for cities to effectively handle and respond to exogenous shocks, such as the unprecedented COVID-19 pandemic. This global crisis posed numerous challenges that required cities to swiftly adapt their operations and services to ensure the well-being of their communities. One specific area that demanded immediate attention was the provision of online training, particularly for individuals who faced digital limitations or lacked digital skills. Cities met an urgent demand to devise effective strategies and inventive methods for delivering training that was accessible and impactful as the shift to online platforms occurred swiftly.

5.2 Recommendations and the next phase of the ICC

The first phase of ICC achieved several major successes, most notably: more than 90% of cities finished the programme and delivered on the deliverables despite the global pandemic, and 70% of participating cities were, to a (very) large extent, satisfied with their advisory services. The question needs to be asked about how the ICC initiative can help to better:

- Create effective city strategies and form prioritised roadmaps based on evolving needs.
- Help cities plan a transformation and long-term change towards the twin transition.

- Support cities to build capabilities and deliver projects resulting in measurable improvements on city performance KPIs.
- Mobilise a city network of innovation and collaboration.

On this background, a list of recommendations is provided in the following table, steered towards facilitating impact and allowing cities to benefit from the ICC programme increasingly:

Table 6: ICC core city achievements

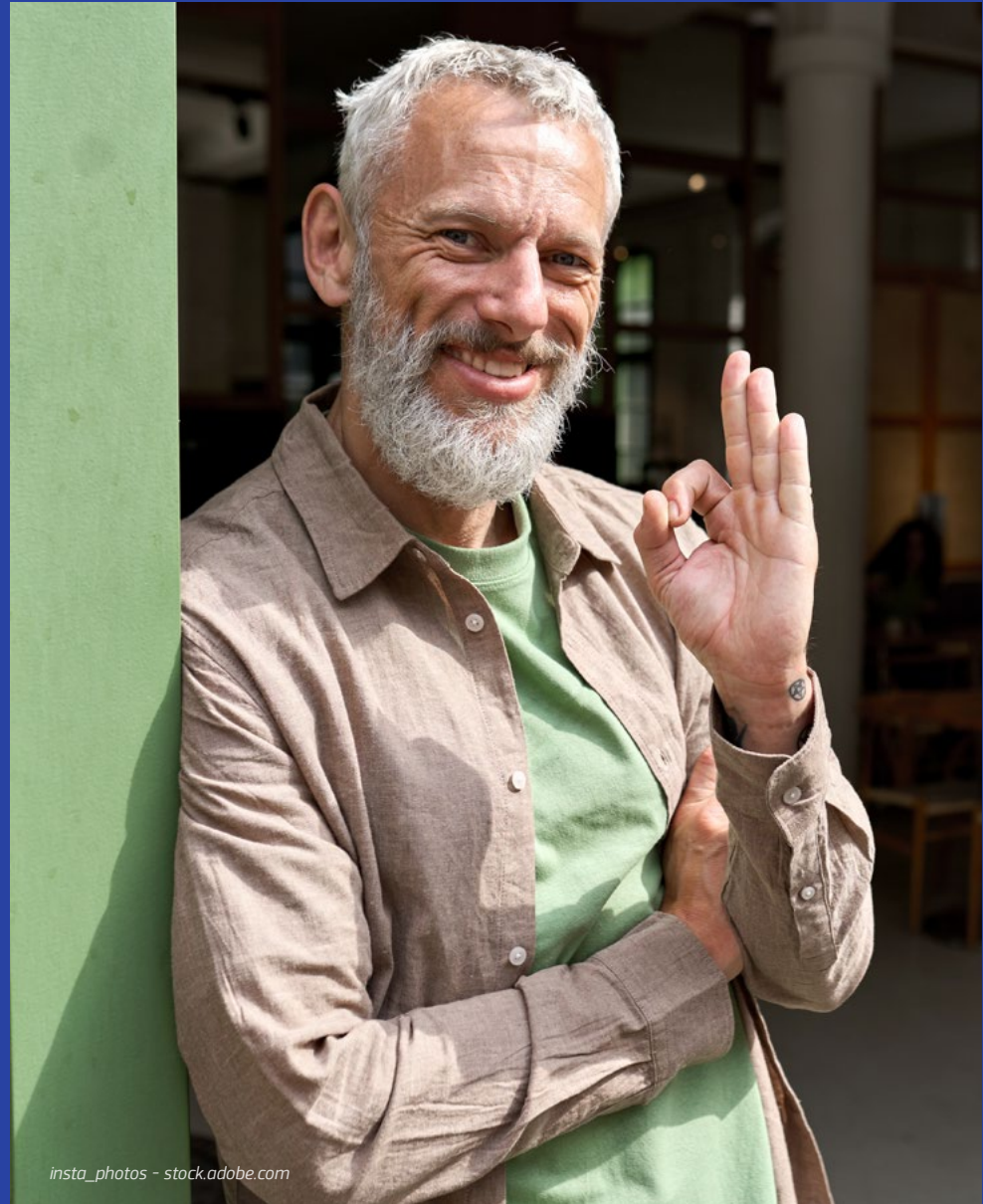
TOPICS	RECOMMENDATIONS
<i>Demands and needs of cities</i>	<ul style="list-style-type: none"> • Cities move at different speeds – their capabilities and maturity vary. The ICC programme should explicitly address the variance by allowing cities to enter and participate in the programme at different speeds and with different ambitions. A programme catering to a wider variability in city resources, capabilities and sizes, and allowing for tailored support can help to absorb different maturities and accelerate progress and impact among participating cities. • Increased emphasis should be given in the programme to gather city feedback along the ICC journey and phases as well as to account for the fact that city-specific needs evolve over time (as experienced with the COVID-19 outbreak, supply chain disruptions and energy crisis). A more flexible approach is recommended to help tailor the programme towards emerging city needs. This asks for tracks with different speeds and requirements, and for regular check points to take stock of progress, barriers and enablers.
<i>Twin transition and digital and green objectives</i>	<ul style="list-style-type: none"> • European cities have a crucial role to play in accelerating the twin transition. Moving from a broader thematic approach in the first phase of the ICC programme, the recommendation is for the second phase to increasingly emphasise the twin transition, delivering on the promises made by the European Green Deal. This will help cities move towards a more digital, service-oriented and low-carbon economy, generating local impact through a knowledge-based society that enables the circular economy based on evidence-based reskilling and sustainable investment. • A city needs a data-driven strategy for the green and digital transition. A coherent data strategy in the digital and green domain helps cities build innovation, ensure accountability and transparency, set measurable objectives, and sustain best practices aimed at delivering on the twin transition objectives.
<i>Local Green Deals</i>	<ul style="list-style-type: none"> • To achieve the European Green Deal objectives, cities will be encouraged to pursue an increasingly integrated and cross-disciplinary approach to governance. Key building blocks evolve around the need for local authorities to define and implement an action-oriented approach and multi-stakeholder partnerships, geared towards collaboration between local public and business stakeholders and long-term change. Support activities should be geared towards helping cities pursue collaboration, co-production, co-design and co-innovation, to support the transition.

TOPICS	RECOMMENDATIONS
<i>Narrower sector focus</i>	<ul style="list-style-type: none"> To generate impact, a narrower thematic focus should be pursued. The ICC programme should encourage participating cities to transition in sectors of strategic importance and where cities have a high degree of local influence, namely the areas of construction and the built environment, energy and renewables, and mobility and transport. The overall ambition should be to help cities develop and implement strategies – grounded in clean tech and advanced technologies – making them greener, more liveable and more ‘intelligent’.
<i>Phases and tangible steps</i>	<ul style="list-style-type: none"> A clear transition from strategy to planning and to implementation is called for, to help cities lead their own transition. For this, the cities need to have a well thought out strategy in advance, so they can pursue tangible, achievable and measurable steps.
<i>Cross-city collaboration</i>	<ul style="list-style-type: none"> A prerequisite for cross-city collaboration is to facilitate stronger ties, deeper cooperation and co-development of solutions within and across borders. Matchmaking activities need to be driven by common challenges and approaches; a sounder framework for matching cities based on commonalities is considered to generate more opportunities for mutual learning experiences and joint work as well as for pooling city resources. Cities should share experiences, ideas and challenges, and pursue strategic partnerships to drive change. A sharing journey can help to leverage skills, generate ideas from different perspectives, shift mindsets and promote collaboration in different areas to deliver solutions of mutual interest.
<i>Mentoring schemes</i>	<ul style="list-style-type: none"> Participating cities benefit from knowledge-sharing from high-performing cities (i.e. mentor cities) who can leverage best practices, experiences and implementation successes. Knowledge-sharing is beneficial but not enough on its own. There is a need for more specific guidance on specific challenges and solutions to make advice more concrete and targeted. Similarly, high-performing cities that are comparable in size, sector focus or geography can facilitate mutual understanding and learning.
<i>Local ecosystem and collaboration</i>	<ul style="list-style-type: none"> Cities’ ecosystems can be at the forefront of the twin transition, the path towards circular economy, clean tech and resource efficiency. Cities need to emphasise skills, facilitate new forms of city stakeholder collaboration and act as catalysts for innovative ideas to advance businesses. Greater ecosystem-wide collaboration should be a continued feature of the ICC methodology, fully engaging local stakeholders – citizens, local business community, social economy stakeholders – in every step of strategy and solution design. Cities are asked to bring different stakeholder together, for instance through workshops, seminars and peer review activities, to work on common strategic objectives. To achieve more system-wide and systematic collaboration, cities are recommended to emphasise more partnerships across business segments to secure local commitments and buy-in.
<i>Cross-departmental involvement</i>	<ul style="list-style-type: none"> Delivering on the twin transition objectives calls for city departments to avoid working in silos on separate objectives. Instead, cross-departmental involvement of public departments of local authorities – working with local stakeholders – is key to fostering, supporting and promoting opportunities for innovation and change. Interactions across departments and at all staff levels will help to ensure joined-up approaches especially during the needs assessment stage, but also for strategy setting, implementation, and ultimately the evaluation stage.

Specific recommendations for the implementation of Local Green Deals by cities:

The development and implementation of a Local Green Deal in cities in collaboration with their local businesses and citizens to advance the green transition will be a key characteristic of the upcoming face of the ICC. The following are concrete recommendations to ensure the successful implementation of a LGD by cities:

- The first step is to develop of a common narrative and political consent as to how LGDs help to fill the ‘action gap’ to shift from existing strategies and goals and align more closely with other key sustainable city initiatives across Europe.
- It is also important to establish LGDs as a transversal instrument, which connects different sectoral goals and action plans. LGDs are a new governance instrument that benefit most from a co-creation process that builds on the collective know-how of cities’ staff members across departments and expertise.
- Fostering collaboration and knowledge sharing with other cities will allow cities to gain valuable insights about the drivers and obstacles they might face during the implementation of a LGD.
- Cities also need to advocate for targeted support, policy alignment and financial resources at the national and European Union level, in coordination with other cities working on LGDs, to amplify the overall impact.
- Finally, it is recommended that cities explore potential support from existing national and EU initiatives or propose LGD ‘action agreements’ to combine funding applications, events and activities, maximising their joint effectiveness.



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APPENDIX 1

ICC city reports

Appendix 1 – ICC city reports

The table below provides an overview of the final deliverables prepared by the ICC cities during the project.

Table 7: ICC City Reports

CITY	COUNTRY	LINK
Aix-en-Provence	France	Aix-en-Provence Final Deliverable
Alcobendas	Spain	Alcobendas Final Deliverable
Alcoy	Spain	Alcoy Final Deliverable
Algeciras	Spain	Algeciras Final Deliverable
Alicante	Spain	Alicante Final Deliverable
Arad	Romania	Arad Final Deliverable
Association of Municipalities and Towns of Slovenia	Slovenia	Association of Municipalities and Towns of Slovenia Final Deliverable
Bialystok	Poland	Bialystok Final Deliverable
Bistrita	Romania	Bistrita Final Deliverable
Bratislava	Slovakia	Bratislava Final Deliverable
Brno	Czech Republic	Brno Final Deliverable
Cartagena	Spain	Cartagena Final Deliverable
Castello de la Plana	Spain	Castello de la Plana Final Deliverable
Catanzaro	Italy	Catanzaro Final Deliverable
Chalkida	Greece	Chalkida Final Deliverable
Corfu	Greece	Corfu Final Deliverable
Cork	Ireland	Cork Final Deliverable
Derry/Londonderry	UK	Derry/Londonderry Final Deliverable
Gava-Castelldefels	Spain	Gava-Castelldefels Final Deliverable

CITY	COUNTRY	LINK
Gdansk	Poland	Gdansk Final Deliverable
Gelsenkirchen	Germany	Gelsenkirchen Final Deliverable
Gijon	Spain	Gijon Final Deliverable
Gliwice	Poland	Gliwice Final Deliverable
Granada	Spain	Granada Final Deliverable
Guimaraes	Portugal	Guimaraes Final Deliverable
Haskovo	Bulgaria	Haskovo Final Deliverable
Heraklion	Greece	Heraklion Final Deliverable
Iasi	Romania	Iasi Final Deliverable
Idrija	Slovenia	Idrija Final Deliverable
Ioannina	Greece	Ioannina Final Deliverable
Issy-les-Moulineaux	France	Issy-les-Moulineaux Final Deliverable
Jyvaskyla	Finland	Jyvaskyla Final Deliverable
Karlskrona	Sweden	Karlskrona Final Deliverable
Kavala	Greece	Kavala Final Deliverable
L'Aquila	Italy	L'Aquila Final Deliverable
Las Rozas	Spain	Las Rozas Final Deliverable
Le Havre	France	Le Havre Final Deliverable
Leuven	Belgium	Leuven Final Deliverable
Lille Metropole	France	Lille Metropole Final Deliverable
Ljubljana	Slovenia	Ljubljana Final Deliverable
Logrono	Spain	Logrono Final Deliverable

CITY	COUNTRY	LINK
Mantova	Italy	Mantova Final Deliverable
Mechelen	Belgium	Mechelen Final Deliverable
Metropole Rouen Normandie	France	Metropole Rouen Normandie Final Deliverable
Metropolitan City of Rome Capital	Italy	Metropole City of Rome Capital Final Deliverable
Molina de Segura	Spain	Molina de Segura Final Deliverable
Osijek	Croatia	Osijek Final Deliverable
Padova	Italy	Padova Final Deliverable
Palaio Faliro	Greece	Palaio Faliro Final Deliverable
Pamplona	Spain	Pamplona Final Deliverable
Patras	Greece	Patras Final Deliverable
Pescara	Italy	Pescara Final Deliverable
Pori	Finland	Pori Final Deliverable
Poznan	Poland	Poznan Final Deliverable
Skelleftea	Sweden	Skelleftea Final Deliverable
Sofia	Bulgaria	Sofia Final Deliverable
Split	Croatia	Split Final Deliverable
Sweden Emilia Romagna Network	Italy	Sweden Emilia Romagna Network Final Deliverable
Szombathely	Hungary	Szombathely Final Deliverable
Temporary Coastal Towns Association	Italy	Temporary Coastal Towns Association Final Deliverable
Terrassa	Spain	Terrassa Final Deliverable
Thessaloniki	Greece	Thessaloniki Final Deliverable
Timisoara	Romania	Timisoara Final Deliverable

CITY	COUNTRY	LINK
Torrent	Spain	Torrent Final Deliverable
Trikala	Greece	Trikala Final Deliverable
Tripolis	Greece	Tripolis Final Deliverable
Ulm	Germany	Ulm Final Deliverable
Valongo	Portugal	Valongo Final Deliverable
Vari Voula Vouliagmeni	Greece	Vari Voula Vouliagmeni Final Deliverable
Velika Gorica	Croatia	Velika Gorica Final Deliverable
Venice	Italy	Venice Final Deliverable
Ventspils	Latvia	Ventspils Final Deliverable
Vratsa	Bulgaria	Vratsa Final Deliverable

APPENDIX 2

Relevant ICC documents

Appendix 2 – Relevant ICC documents

The ICC methodology is presented through the following key documents:

- *ICC Conceptual Guide*
- *ICC City Flipbook*
- *ICC Lead Expert Addendum*

In addition, in the context of the ICC, the following reports have been developed:

- **Local Green Deals:** *Local Green Deals – A Blueprint for Action.*
- **Renovation Wave:** *Renovation Wave in Practice.*
- **Upskilling and reskilling:** *A Cities Guide to Reskilling the Local Workforce.*

APPENDIX 3

Synergies with other EU initiatives

Synergies with other EU initiatives

The table below offers a view of potential cross-initiative collaborations, drawing on shared activities and focus areas of mutual interest.

Table 8: Overview of potential cross-collaborations and synergies

INITIATIVE	DESCRIPTION	SYNERGIES WITH OTHER EU INITIATIVES
<i>Mission on Smart and Climate Neutral Cities</i>	<p>The Smart and Climate Neutral Cities Mission is part of the Horizon Europe missions to deliver concrete results on ambitious goals by 2030. The mission is intended to support cities in the twin transition, one of the main EU priorities, transforming them into a more digital and greener urban environment.</p> <p>Delivering 100 climate-neutral and smart cities by 2030 and ensuring that these cities act as experimentation and innovation hubs, to enable all European cities to follow suit by 2050, are the two main objectives of the 'Cities Mission'.</p> <p>It uses a cross-sectoral approach involving a wide range of local, regional and national stakeholders and authorities.</p>	<ul style="list-style-type: none"> • The ICC's Local Green Deals and the mission on Smart and Climate Neutral Cities directly address cities' climate neutrality ambitions. While the Cities Mission is more geared towards action plans, the ICC has a stronger focus on the partnership, business and industrial components through its Local Green Deal approach. • Both the initiatives promote the use of activities aimed at implementing strategies, delivering planning and investment documents, as well as the application of innovative and systematic governance approaches.
<i>Smart Cities Marketplace</i>	<p>The Smart Cities Marketplace (SCM) is a European Commission project to improve citizens' quality of life, increase the competitiveness of European cities and industry, and reach European energy and climate targets.</p> <p>The project involves many market-stakeholders, including cities, industries, SMEs, investors and researchers.</p> <p>The current impact of the Smart Cities Marketplace foresees the delivery of 127 bankable project proposals, 17 investor network members and €616.3 million in matched funds from investors.</p>	<ul style="list-style-type: none"> • The SCM provides guidance and assistance to city-led consortia with smart city investment project proposals to increase their operational, financial and governance maturity. Through an Investors Network, the SCM facilitates access to funding and financing. Possible synergies could be adopted through ICC city support in terms of project implementation. • The SCM community and expanded SCM Investor Network have the potential to adopt a knowledge-sharing approach with the purpose of implementing, replicating and upscaling proven smart, climate neutral urban solutions for the ICC. • The organisation of joint back-to-back matchmaking events, namely meetings with facilitated sessions between cities and investors represents a valuable networking opportunity for the two initiatives.
<i>Living-in.EU</i>	<p>Living-in.EU is an initiative aimed at boosting local communities and cities' digital transition, improving them at the economic and social level.</p> <p>Participation of citizens, business representatives, SMEs and start-ups are crucial to helping communities reduce their environmental footprint and guarantee prosperity.</p> <p>Digital solutions envisaged include smart urban mobility, energy efficiency, sustainable housing, digital public services and civic-led governance.</p>	<ul style="list-style-type: none"> • The Living-in.EU movement benefits from the ICC in taking inspiration from its vision and its sustainable and smart projects for cities. • Greater mutual recognition of the solutions developed by ICC cities and communities will boost interoperability with mechanisms proposed under the Living-in.EU initiative. • The ICC city ecosystems and innovation processes (financial, legal and technical dimensions) shared among the EU community serve as examples of good practices for the Living

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<i>Circular Cities and regions initiative</i>	<p>As part of the Circular Economy Action Plan, the Circular Cities and Regions Initiative (CCRI) is a project funded by the EU.</p> <p>The CCRI's aim is to implement the circular economy across European cities and regions, as part of the 2050 climate neutrality target identified by the European Green Deal.</p> <p>Sharing best practices, dissemination of relevant knowledge and the use of technical and financial support are the ways the CCRI is helping stakeholders across cities and regions to foster the circular economy transition in Europe.</p>	<ul style="list-style-type: none"> • CCRI pilot cities involve some of the ICC cities such as Guimaraes (Portugal), Pori and Tampere (Finland). • The development of ICC activities linked with the Local Green Deals will create further opportunities for both CCRI and ICC project collaboration.
<i>Pact for Skills</i>	<p>As a shared engagement model, the Pact for Skills fosters the development of job-related skills across Europe.</p> <p>Companies, workers, national, regional or local authorities, social partners, cross-industry and sectoral organisations, education and training providers, chambers of commerce as well as employment services play an active role in the Pact for Skills initiative.</p> <p>Upskilling and reskilling projects focus on guaranteeing the Pact for Skills is in line with the Resilient Recovery Plan/Facility, deliver on the ambitions of the twin green and digital transitions, and help to achieve the EU Industrial and SME Strategies.</p>	<ul style="list-style-type: none"> • Both initiatives emphasise the engagement model for skills development, i.e. through the involvement of businesses, citizens, local authorities and sectoral organisations. • Both the Pact for Skills and ICC steer the reskilling and upskilling activities according to twin transition objectives, to help cities and stakeholder deliver on their respective green and digital transition ambitions.
<i>Smart Tourism Destinations</i>	<p>Smart Tourism Destinations is an initiative adopted by the European Commission for EU cities.</p> <p>The main objective is to facilitate access to and use of technological innovation to improve tourism products and services. Digital solutions, especially applied to data-driven approaches, help to create a smarter, more sustainable tourism sector, while respecting cities' cultural heritage.</p> <p>Policymakers, private-sector practitioners and academic researchers are the main actors involved in the Smart Tourism Destinations through concrete collaborations able to solve current challenges of the EU Tourism sector.</p>	<ul style="list-style-type: none"> • This initiative and the ICC both use digital tools to promote smarter cities and destinations. Sustainability is as a key topic seen through the lens of a green and digital transition in tourism. • Both initiatives consider the involvement of local stakeholders as an important factor in generating successful strategies. • The experience of ICC cities on the use of data provided a valuable example for Smart Tourism Destinations to improve their transformation journey. • Mutual learning between the two initiatives means more exchanges of good practices and knowledge-sharing among the cities.

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<i>New European Bauhaus</i>	<p>New European Bauhaus (NEB) is a co-creative space for architects, artists, students, engineers and designers to work together in decision-making. It is an interdisciplinary initiative that connects the European Green Deal to citizens' living spaces and experiences. The three adjectives from which the New European Bauhaus actions should be inspired are: enriching (needs beyond functionality), sustainable (respectful of the environment) and inclusive (encouraging dialogues across cultures and generations).</p>	<ul style="list-style-type: none"> • The New European Bauhaus will ensure access to training and technical assistance, online toolboxes and guidance to the cities involved through a bottom-up (top-facilitated) movement. Best practices, project creation and Tech4Good Marketplace are some of the ICC elements from which the NEB can draw inspiration. • The networking dimension of the ICC will have a crucial role in defining the nature of the NEB. At local level, the emphasis on industrial ecosystems is key to creating partnerships that can support the delivery of NEB-aligned projects through the participation of relevant stakeholders (individuals, neighbourhoods and local communities) and intergenerational and interdisciplinary outreach. • The twin transition, specialised in the construction industry and covering circular, sustainable design and the use of renewable materials, is a crucial part of the New European Bauhaus, in line with the ICC vision. • Following the launch of the 2023 as European Year of Skills, the ICC and the New European Bauhaus will both focus on upskilling and reskilling projects.
<i>Big Buyers Community of Practice</i>	<p>The 'Big Buyers' is a European Commission initiative promoting collaboration between large public buyers in implementing strategic public procurement for sustainable solutions. Adopting digital solutions in the healthcare sector, circular construction, usage of electric heavy-duty vehicles and the creation of zero-emission construction sites are the main objectives that the Big Buyers have in Europe.</p>	<ul style="list-style-type: none"> • In particular, the Big Buyers for Climate and Environment initiative and the ICC look at the twin green and digital transition as fundamental tracks to follow in the implementation of their projects. • Engagement of innovators and social enterprises through public procurement is one of the common objectives for both the ICC and Big Buyers initiative.

The European Commission's
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