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AMBITIOUS AND INCLUSIVE TRANSITIONS IN CITIES: bridging green and digital agendas

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Digitalisation and climate change are two closely interlinked transitions that will define how cities evolve over the coming decades. Climate neutral cities of the future will be made possible by new digital transport and energy infrastructure, and the transition to a circular economy driven by greater data availability.

Since cities are the level of government that is closest to the people, with direct understanding of their needs, they are well-placed to engage citizens and other relevant stakeholders in these interlinked challenges.

As climate leaders, hubs of the digital economy and home to over 50% of the world's population, cities can also act as microcosms of the wider ecosystem of society and drive innovations that would help to reduce greenhouse gas emissions and improve resilience to extreme climate events.

National and regional government should be responsible for ensuring that a comprehensive set of support functions is in place to enable city authorities to carry out the vital task of delivering the twin digital and climate transitions.

National governments will also need to mandate other delivery bodies such as digital and energy regulators and network operators to work with city authorities to ensure consistency between city plans and national infrastructure on the way to climate neutrality.

Cities will play a key role in shaping the future of the planet. By 2050, an additional 2.5 billion people, accounting for 68% of the total global population (UN, 2018), are expected to be living in urban areas. The world in the mid-twenty-first century will be very different from now. Change is inevitable. The extent to which this change improves lives will depend to a large extent on the efforts of city authorities.

The COVID-19 pandemic has been a shock for cities. It has triggered dramatic changes in behaviour which have transformed city life. As workers begin to return to their offices and recovery is underway, investment is needed to ensure that cities become vibrant and prosperous again.

However, this should not be about a return to former glories. The future will hold many new risks to be addressed and opportunities to be taken. Climate change and the adoption of new digital technologies are central amongst these. Preparing for the future by harnessing positive drivers for change while ensuring resilience to new challenges are tasks that must be taken on by city authorities.

Transitioning to climate neutrality and a digitally optimised urban ecosystem are strongly intertwined initiatives that cannot be treated separately. This paper sets out some of the issues that must be tackled in bridging the green and digital divide and the solutions that city authorities are already putting in place.

Connecting the climate and digital transitions

Digitalisation and climate change are two closely interlinked transitions that will define how cities evolve over the coming decades.

The amount of data now being captured has increased exponentially and the tools that turn this raw information into useful products and services is ever more sophisticated. These trends are already transforming lives and will continue to do so as digital technologies develop and are applied more widely. From **providing better daily commutes** to enabling local authorities to deploying scarce resources more effectively, the opportunities for improving the way cities function through the application of digital technologies are endless.

Although the ‘twin transitions’ are often at the centre of policy initiatives, a detailed roadmap of how they will be aligned and implemented is missing.

Climate change is both a threat and an opportunity. As temperatures rise, extreme weather events will become more common, endangering lives and **placing pressure on city infrastructure**. National and local governments across the world have set ambitious targets to reduce greenhouse gas emissions. At the city level, adopting such targets represents an opportunity to improve citizens’ lives and achieve local objectives such as reducing air pollution and supporting the local economy. The development of a range of technologies and solutions capable of providing the services that citizens require without using fossil fuels is essential if cities are to achieve their emissions reduction targets. Rapid deployment of these technologies, many of which will directly affect city infrastructure and require major behavioural changes by citizens, will be crucial.

The digital and climate transitions cannot proceed independently. Digital technologies have a major role to play in making it **easier, cheaper, and more enjoyable for citizens to adopt zero emissions products and services**. At the same time, rising demand for energy-intensive digital devices, the associated expansion of data centres and cloud computing services, and requirements for critical raw materials will have significant climate impacts. A changing climate could **both accelerate and disrupt digital trends**.

Although these ‘twin transitions’ are often at the centre of policy initiatives, a detailed roadmap of how

they will be aligned and implemented is missing. For example, **the EU has frequently emphasised data and artificial intelligence (AI) as critical enablers for attaining the goals of the European Green Deal**, without detailing how to scale them up in a way that would accelerate decarbonisation.

Cities will need to be at the forefront of driving and harmonising the digital and climate transitions. Since cities are the level of government that is closest to the people, with direct understanding of their needs, they are well-placed to engage citizens and other relevant stakeholders in these interlinked challenges. As climate leaders, hubs of the digital economy, and home to over 50% of the world’s population, they can also act as microcosms of the wider ecosystem of society and drive innovations that would help to reduce greenhouse gas emissions and improve resilience to extreme climate events.

This will be a major challenge for city authorities. It will require strong leadership combined with a culture of learning and innovation, a constant focus on understanding the needs of citizens, and governance and processes capable of driving delivery of positive change.

City leadership

Cities across the world have already shown high ambition to deploy digital technologies and achieve climate neutrality, and their goals often exceed the timescales set by national governments to eliminate emissions. More than 10,500 cities around the world, accounting for 974 million people, have adopted emissions reductions targets, and around 800 cities have committed to achieving net zero emissions (REN21, 2021). Numerous cities are also adopting digital strategies and looking for ways to link the two agendas. **Singapore**, for example, is using a variety of digital technologies (including, for example, the Internet of Things and apps) to optimise energy use, encourage adoption of greener energy sources, and **improve the efficiency of its public transport system**.

It is important to maintain this strong leadership position. This will require sustained attainment of goals in the face of challenging obstacles. These obstacles will vary from city to city, given that there are different starting conditions, access to energy resources, social challenges, and exposure to a changing climate, amongst other issues. However, there are two factors that will unite all cities.

– First, they will have severe financial constraints, especially in the wake of the COVID-19 pandemic.

- Second, certain aspects of the green and digital transitions will appear to be technically and socially very challenging, many of them without any apparent solution.

These realities (see Box below on funding building upgrades as an example of the challenges involved) could drive cities to limit their ambition to short-term goals involving discrete initiatives that are relatively easy to achieve.

However, focusing purely on low hanging fruits would be a mistake. Climate neutral cities of the future will be made possible by means of new digital, transport, and energy infrastructure and the transition to a circular economy that is driven by greater data availability (Hedberg and Šipka, 2020). The entire ecosystem will be highly interdependent and based on a clear philosophy of capturing and using data. All projects to upgrade infrastructure—digital, transport, waste, energy, and buildings—must be consistent with this long-term vision.

The work of city authorities must therefore be based on a template of how the city ecosystem will function in the future. This should be derived from the current best view of the technical opportunities and the aspirations of citizens and workers. Precisely how climate neutrality is expected to be achieved and how constantly evolving digital technologies will be harnessed to achieve this goal should be clearly explained. This would require an ambitious perspective on how the collection and processing of data can be used to optimise all aspects of city life. Above all, it should clearly articulate why this would create a better future to which all citizens can aspire.

Developing such a template is a step that remains to be taken in many cities worldwide. Although more than 1,850 municipal governments in 29 countries had declared a climate emergency by the end of 2020, only a few have issued associated climate action plans (REN21, 2021). Nevertheless, climate emergency declarations usually include a commitment to produce climate action plans and the number of these has been increasing rapidly and is likely to increase further.

Presenting an ambitious and inspiring vision is necessary but not sufficient. This must be underpinned by solid delivery processes and a learning culture that is quick to adapt to lessons learnt locally and elsewhere, and to take advantage of emerging technical opportunities. Interoperability of all digital devices must be taken as a given, with the presumption that appropriately anonymised data will be available to public and private entities aiming to develop products and services for citizens.

Various city initiatives can be seen as steps in this direction. For example, the city of **Leuven** has produced a roadmap to achieve climate neutrality by 2050 with intermediate roadmaps for 2025 and 2035 that include provisions for collecting and monitoring data on the progress made in order to adjust the roadmaps.

Box – Delivering deep building retrofit at scale

Delivering climate neutrality means that millions of existing buildings in cities need to be upgraded to ensure high standards of energy efficiency, and the use of zero carbon energy sources. This is a huge task and one in which digital technologies can play a valuable role. Cities including **London** and **Paris** are, for example, using “digital twins” to analyse their building stock and target retrofit strategies.

One of the key challenges for unlocking this potential is cities’ **lack of access to financing for smart retrofits**. Only part of the funding required could possibly come from public sources and it will be necessary to achieve a significant proportion of private finance. However, the costs are fragmented into numerous small-scale projects that are too expensive for individuals but too small to attract major investors, while the readiness of financial systems to invest, whatever the project scale, varies considerably from country to country. Nonetheless, potential returns are available through ongoing energy and maintenance cost savings and increases in property value. New approaches, including digital tools, are required to capture these returns in a way that attracts the levels of investment required and ensures the full engagement and support of property owners.

Putting citizens at the heart of the twin transitions

Effective and sustainable transition plans should be focused on improving the lives of individuals. It is tempting to think of the challenges ahead in terms of technological and systems change linked with efforts devoted to encouraging citizens to change their behaviour in line with a pre-conceived view of the future. This would be a mistake (see Box below). The behaviour of citizens will inevitably change over the coming decades in line with their evolving needs and desires. The challenge is to explore how climate and digital solutions can align to make their lives better.

City authorities should focus on exploring how digital solutions can help with two key issues:

1. Finding ways in which digital technologies can support citizens to engage with the range of new zero emissions products and services (as discussed in relation to energy in the box above).

Some cities have already begun to use such digital solutions to meet the needs of citizens and other stakeholders. For example, the city of **Amsterdam** is gathering data on the amount of raw and other materials that the city consumes and produces as waste to show where improvements can be made to foster the transition to a circular urban economy. **Hamburg** has developed an urban platform that connects existing

and future digital systems and services. This platform provides real-time feedback and simulations for various sectors, including sustainable mobility, with the aim of reducing emissions from the mobility sector by enabling the development of solutions such as autonomous driving and smart last mile logistics.

Box: Citizens at the heart of energy system digitalisation

The focus of recent policy initiatives by central governments¹ has been to ensure that digitalisation enables a more flexible energy system that would reduce costs of decarbonisation and to do so in a way that maintains security and respects privacy. These policies are, therefore, seeking ways in which digital technologies can help energy consumers to provide services needed by the energy system.

Whilst this is helpful, effective transition plans must have a broader agenda focused on identifying how digital technologies can make citizens' lives better along the way to climate neutrality. This should be the focus for city authorities, which is the level of government closest to citizens. They must go beyond simply developing local energy markets that offer incentives to install and use digital devices to control the use of appliances or for charging electric vehicles, which is what might be understood as high-level policies. In addition, they must find ways in which digital technologies can help citizens to engage with the range of new zero emissions products and services.

It can be extremely complicated for people to navigate all the options they are presented with by different providers (efficiency, zero carbon heating and cooling, micro-generation, electric vehicle charging, home energy storage, etc.), let alone understand the combined benefits and manage project delivery. Digital platforms (for example, smartphone apps) can provide a seamless omni-channel experience, giving access to a wide range of products and services, providing rapid response, and defining a pathway to delivery. This minimises individual transaction costs, including time and resources, of big projects such as home retrofitting. Feedback from the engagement process can be rapidly diagnosed, leading to fast learning and improvement. Such platforms can make it easy for people to choose zero emissions products and services in all aspects of their lives (transport, shopping, heating, waste etc.).

At present, the development of digital platforms is being left to the market and is the basis for the competitive success of service providers. This represents challenges for city authorities that are seeking to coordinate the transformation across sectors, to offer the associated infrastructure, and to ensure that it is fair and inclusive. The best platforms will be able to choose their customers regardless of location, generally based on what they can afford. Ultimately, platforms might achieve market dominance and use this position to further increase profits. City authorities will need to work with platform developers to come up with solutions that suit the city context and involve algorithms that promote fairness and inclusion.

2. Involving citizens in the policy and decision-making process through inclusive governance.

Digital solutions allow city governments to reach more people and enable greater transparency. For example, they have been used to engage citizens and other stakeholders in the formulation of city-wide climate initiatives in Jakarta (REN21, 2021), including multiple public consultations on energy, green buildings,

transport, clean water, and disaster management commitments. Digital solutions that aim to involve citizens in the policy and decision-making process have gained importance during the COVID-19 pandemic, as many in-person meetings could not take place.

Despite existing initiatives, there are several issues facing city authorities in delivering these objectives. They will not have the capabilities or resources to develop their own digital solutions and will have to rely on relationships with third party providers. It will be necessary to strike a balance between establishing a close working relationship with a selected provider without becoming locked into using poorly performing products. Importantly, they will need to maintain incentives for innovation and improvement to ensure that citizens have access to cutting-edge services. They will also need to create a range of devices that enable all citizens to benefit and become involved, especially those that are socially disadvantaged. Inclusion requires that actions should be taken to address access, affordability, skills, and awareness issues. This is likely to involve ensuring access to high-speed Internet, public awareness campaigns, training, and establishing intermediaries to act on behalf of groups of individuals.

Delivering the climate and digital transitions

Much of the burden of delivering the climate and digital transition will fall on the shoulders of city authorities as they produce and implement their plans. This will be a major challenge and individual cities should not bear the entire burden. City authorities have limited resources and will not possess the breadth of expertise required. They must be prepared to ask for help where needed and to offer it where they have expertise.

City authorities are already building sophisticated delivery capability. Effective delivery processes must distil the required work into a series of feasible projects. These projects should be consistent with the overall transition plan, not only in terms of delivering the required infrastructure, but also ensuring a sustainable financing package that does not negatively affect the ability to fund other investments that will be needed. The delivery capability must also ensure effective project oversight and management in such a way that delivery is on time, that estimates are respected, and that the end product is of high quality.

The key insight that city authorities can bring to the delivery process is deep understanding of the local context. Capturing this knowledge in the form of data will allow AI and machine learning techniques to recognise hidden patterns and support the identification and programming of individual projects. This might help to identify the most effective way that buildings

1. EU Action plan on the digitalisation of the energy sector, Ref. Ares (2021)4720847 - 22/07/2021; UK Transitioning to a net zero energy system, Smart Systems and Flexibility Plan 2021, July 2021

can be grouped for refurbishment, the preferred areas for solar technologies and heat networks, the potential for introducing sustainable waste management, and traffic management schemes to improve air quality. For example, the city of **Stockholm** is using machine learning systems to identify, from an extensive housing stock database, buildings that should be prioritised for renovation, as well as to provide accurate cost estimates for energy efficiency improvements.

It should be emphasised that city authorities should not be expected to solve every problem from scratch. National and regional government should be responsible for ensuring that a comprehensive set of support functions is in place to enable city authorities to fulfil the vital task of delivering the twin digital and climate transitions. This may require them to establish new institutions in areas where there are significant gaps. National governments will also need to mandate other delivery bodies such as digital and energy regulators and network operators to work with city authorities to ensure consistency between city plans and national infrastructure on the way to climate neutrality. A further important point is that national and regional governments should set out what financial resources are available to cities so that they can deliver their plans.

One helpful development in this regard is the EU 100 Climate Neutral Cities by 2030 initiative (Gronkiewicz-Waltz *et al.*, 2020). A plan for implementation is currently being drafted and is expected to address the issues set out above, including setting up a knowledge centre to encourage, monitor, and evaluate the scale-up and replication of climate neutral solutions and technologies, and also a “one-stop shop” to facilitate city access to existing funds when seeking finance.

Four key delivery support functions are needed to unlock the potential of cities to drive and harmonise the digital and climate transitions (see Figure 1):

1. *Funding support*: It is necessary to provide expertise to ensure that cities can maximise the financial resources available. This will include approving and allocating direct national public funding and ensuring that this is used efficiently, as well as supporting cities in accessing funding from relevant multilateral development banks (MDBs) and supra-national bodies such as the EU. This function could advise cities on opportunities for leveraging public funding so that they can access the significant amounts of private finance that will be needed, and it could also facilitate dialogue with lending institutions.

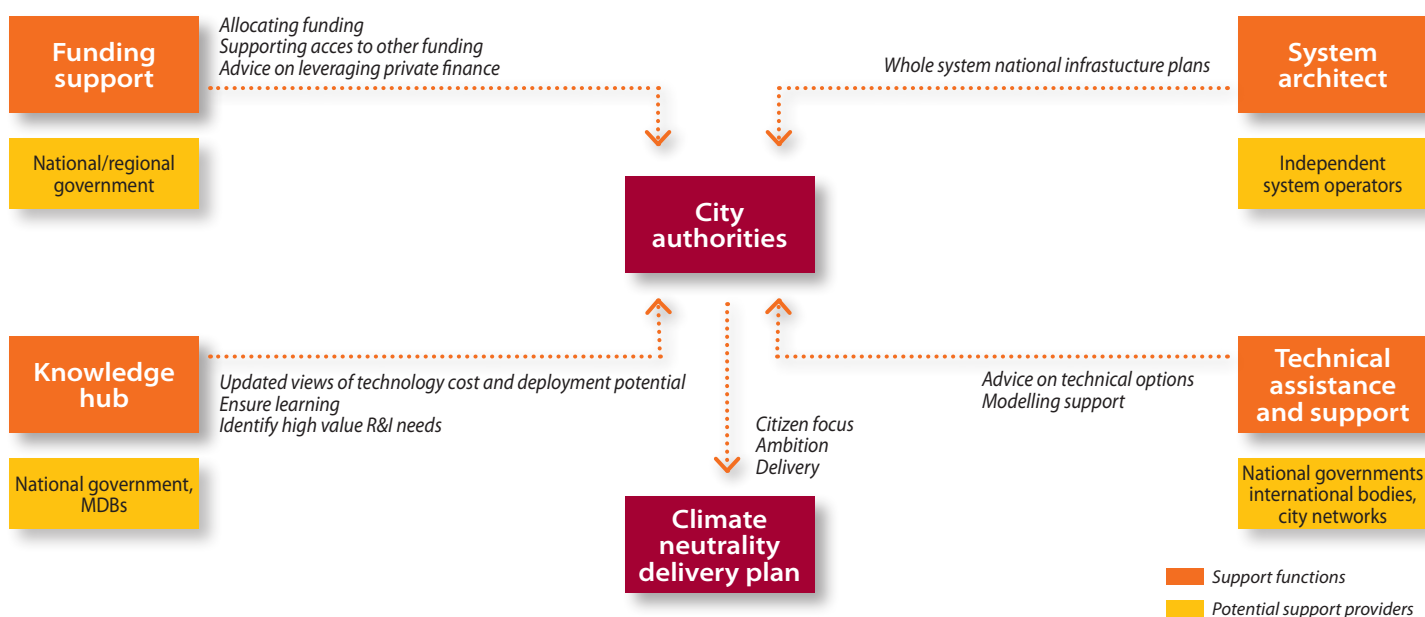
2. *Knowledge hub*: Technology, especially digital technology, is rapidly evolving, and individual cities cannot be expected to keep abreast of all developments. A centralised knowledge hub can provide up-to-date views regarding future technical opportunities, including their cost and deployment potentials. It would liaise with deployment activities to ensure that new knowledge is processed, to provide a coherent base of assumptions for transition planning (national and local), and to identify high-value research and innovation needs including requirements for demonstration projects (Skillings, 2020). While many countries would wish to retain this ability to support national technical expertise it may be necessary for multi-national organisations, such as MDBs or the **EU’s Joint Research Centre**, to provide this service in order to ensure that cutting-edge technical knowledge is available to all cities.
3. *System architect*: City-level infrastructure must fit seamlessly into broader national and international networks. A system architect is required to produce whole system national infrastructure plans. It must work with city authorities to identify “zones” which determine local priorities, particularly relating to

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decarbonisation of buildings, and it should also coordinate with network operators in order to understand network development requirements. Infrastructure is increasingly interconnected, and this interconnection is enabled by digital technologies. A system architect must be able to ensure coherent plans across all sectors.

4. *Technical assistance and support*: There will be many activities that all cities will need to undertake. There are huge benefits to be obtained from providing a common support service that cities can use to access expert resources. This will help cities to develop local plans, give advice on technical options, and provide system modelling support. For example, whilst cities must compile their own data, a technical support function could provide the AI capability to scrutinise the data and recommend actions. As with the knowledge hub, it is likely that national governments would wish to host this function to build national capability, but international bodies or city networks could also provide this support.

Figure 1: Support functions for cities



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