**BRITISH COUNCIL**

# Smart Places:
How universities are shaping a new wave of smart cities

# Contents

# Map of case study cities

**Nottingham, UK**
population: 781,000

**Warsaw, Poland**
population: 1,776,000
capital city

**Darmstadt, Germany**
population: 170,153

**Dublin, Ireland**
population: 1,215,000
capital city

**Bucharest, Romania**
population: 1,812,000
capital city

**Lille, France**
population: 1,058,000

**Milan, Italy**
population: 3,136,000

**Zaragoza, Spain**
population: 727,000

Note: population figures for metropolitan areas and estimates for 2019, taken from United Nations World Urbanization Prospects (https://population.un.org/wup/) except for Darmstadt – population figure for city and an estimate for 2019 taken from http://population.city/germany/darmstadt/.

# Foreword

Europe is changing, and so is the UK's position within Europe. With the shape of our political borders changing, there is also increasing awareness that the state is not the only actor on the political or economic stage. Multinational organisations, civil society and regions play an increasingly important role in diplomacy – as do our cities. Cities connect with other cities, linking actors across national borders and political parties. In the era of globalisation, world cities like London, Berlin and Paris have large-scale economies with clear political power and an ever-increasing socio-cultural impact.

The British Council, as the UK's cultural organisation, is taking a proactive approach: we are working with city leaders and local policymakers with whom we share numerous cultural and educational priorities. Cities are also home to numerous universities, our traditional partners for research and international co-operation. It is fascinating to follow urban developments closely and the role higher education institutions play in contributing to and shaping city transformation.

The arrival of the internet of things (IoT, a network of objects that talk to each other) has allowed many cities to become smart – some quicker than others. Over the last five years, European cities have often focused on technology for the improvement of city infrastructure. Houses, buildings, people, cars and streets are connected, fitted with smart sensors that continuously collect information and this can lead to greater prosperity and new opportunities.

However, the smart city of 2019 looks different from the smart city of five years ago. There is increasing awareness that our smart cities need a human rather than a technological face. Today's city planners put the needs of their residents first – all residents, not only the happy few in wealthy city centres. More disadvantaged communities need to be involved in urban planning: smart solutions only work for all if they promote equality and inclusion from the outset. The smart city of the future uses technology, new ideas and innovation to improve the lives of all citizens, as well as visitors. And it is exactly in further shaping this ambition for human smart cities that universities can play an important role – by means of their structures, research, student involvement and international networks.

This report focuses on the role that universities play in working with city planners and city policymakers in shaping a new wave of smart cities in Bucharest, Darmstadt, Dublin, Lille, Milan, Nottingham, Warsaw and Zaragoza. With our presence in over 24 European countries and many more across the world, we are looking forward to bringing together university and city staff to build the next generation of truly human smart cities.

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# Executive summary

This report is about how universities can help solve the challenges faced by cities and towns. In doing so, it puts people first and technology second. It is written for university leaders, city leaders and officials looking to form stronger partnerships with their universities.

Examples are given of universities working with their city halls in eight cities across Europe: Bucharest (Romania), Darmstadt (Germany), Dublin (Ireland), Lille (France), Milan (Italy), Nottingham (UK), Warsaw (Poland) and Zaragoza (Spain). Each city has different needs and opportunities, and each has a different history of partnership working between the university and city hall. Together they illustrate three fundamental lessons.

First, **universities should focus on their competitive edge** (page 12). Given limited resources and the complexity of urban challenges, universities need to concentrate their efforts on those activities and in those places where they can add most value. This includes combining insights from across academic disciplines, sharing and contextualising lessons from other cities, monitoring and evaluating progress, communicating the benefits and drawbacks of smart city activities and making use of the university estate.

Second, **universities and city halls need to build deep links** (page 16). Successful partnership working between universities and cities emerges from effective processes for identifying and tackling challenges. These include encouraging the activities of boundary spanners – individuals able to effectively work across sectors and institutions – and supporting secondments and jointly funded positions. The act of responding to competitions (for funding or other rewards) can be particularly effective in building and maintaining

relations between different organisations. Mapping university research on urban problems and developing links with the city can spur new activity. Formal and informal structures, such as physical hubs for collaboration or forums for universities to present their research, help build deeper links.

Third, **universities and cities should put inclusiveness first** (page19). Universities have a responsibility, by leading projects, conducting research and working with partners, to ensure their work on smart cities is inclusive – meaning a focus on all people in society and the challenges they face. Staff should build effective community engagement into projects, and be mindful to avoid accidentally excluding intended beneficiaries. Effective communication is critical.

If universities are not aware of the limitations of new technologies, of the potential pitfalls of smart city policies and of the need to be constantly focused on inclusivity, they can end up reinforcing the exclusion and marginalisation present in cities.

The report concludes with eight **recommendations** (page 24).

# Introduction

A simple message runs through this report: universities are needed to help tackle the serious challenges faced by towns and cities across Europe. Climate change and changing job markets are complex problems needing a wide-ranging response. Poor quality housing and pollution have plagued cities for centuries and progress will require new partnerships.

City leaders should include universities in the fight against these challenges, and in the push to build better societies. Cities need to upgrade universities from advisory roles to actively shaping and implementing projects. But the real onus lies with universities themselves. Universities need to align themselves with the priorities of the city, to be proactive in building partnerships, and to make sometimes difficult internal changes to better meet local needs.

Thousands of partnerships, projects and pilots are being implemented across Europe, from multicity programmes to neighbourhood initiatives, some in places at the top of smart city league tables and renowned for their research and innovation, and others in regions grappling with economic uncertainty. Yet leaders and planners across the continent share common challenges. Budgets are tight, populations are expanding and new threats and challenges are appearing. City leaders are required to think beyond their city centre to the broader metropolitan area, balancing regional and national relationships while forging new international links. They shoulder increasing responsibilities for their city to tick the latest urban policy boxes – to be resilient, sustainable and smart.

Universities are also under financial strain, and often juggle teaching and research with the mantle of being civic institutions. While many university leaders understand that this civic role of helping to co-ordinate social and economic activity, being a good neighbour and positively shaping the place they are in strengthens their teaching and research, challenges remain. Universities are being called to seek tighter integration with their environment, to form stronger bonds with local communities and to produce more effective projects with longer-term impact while developing national and international networks, all within a complex political arena. Even in places with a track record of local partners effectively working together, new thinking and new ideas are required.

This report takes you on a tour of eight European cities. It explores how universities and city halls are working together to tackle the challenges faced in each city. Each city has a unique configuration of institutions and a different history of collaboration between the city hall and local universities. In some cities, both sides are building on decades of close working; in others, universities are balancing a history of state control while exploring new opportunities to work with city officials. All eight cities, however, illustrate a broader trend – the emergence of a new wave of smart cities, placing universities at the heart of a more inclusive, people-focused movement to build better places and societies.
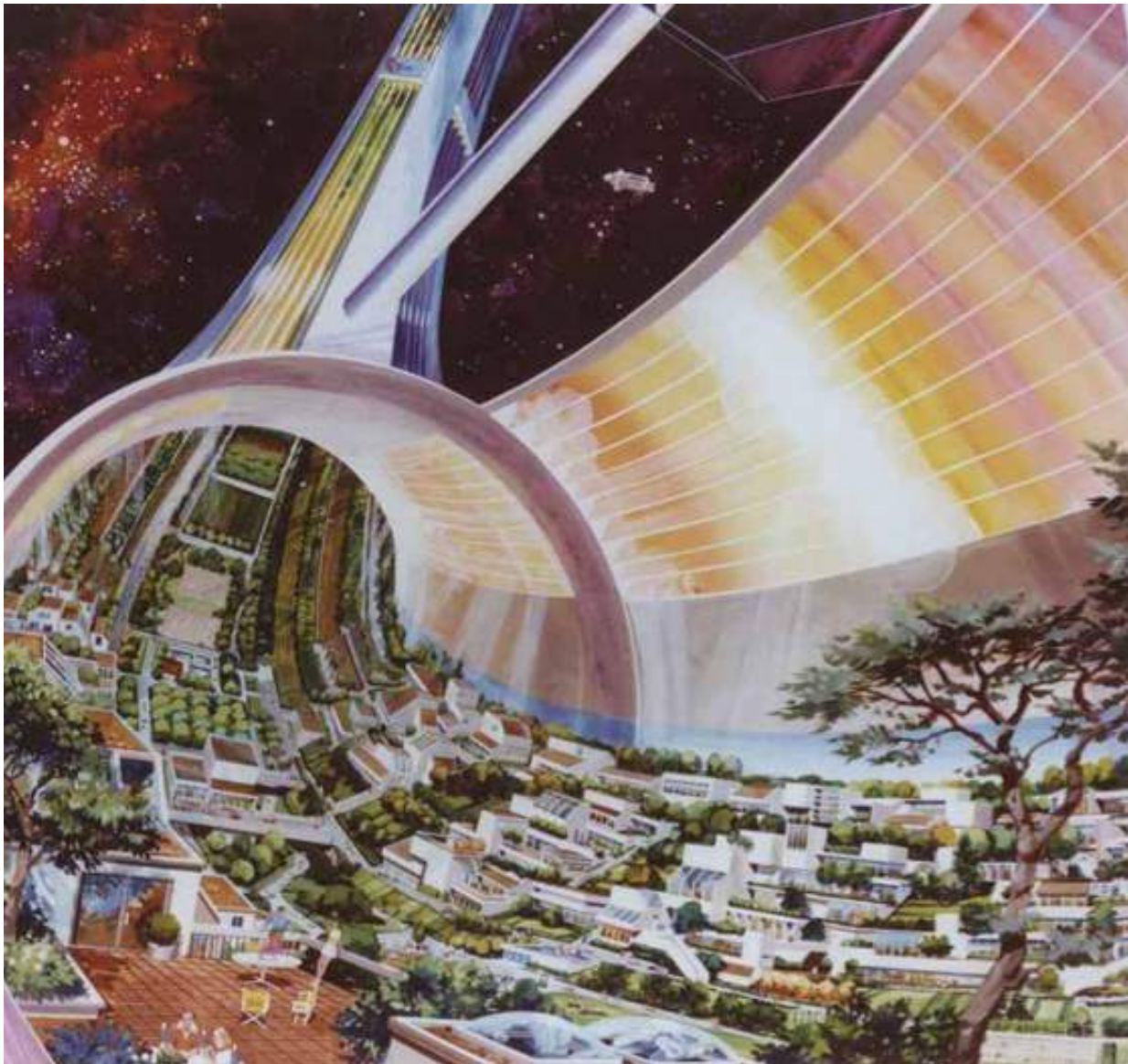


Artist's impression of Stanford Torus, 1975. (image credits: p.28)

# Smart cities redefined

In 1975, NASA drew up plans for a colony in outer space. Called Stanford Torus, the colony would resemble a small city housing up to 140,000 residents, drawing on the latest technology and designed to be completely self-sufficient.[1] Stanford Torus is worth considering for two reasons. The first is a reminder that we have been thinking about smart cities, and how the latest technology can meet our needs, for a long time (the expansion of Barcelona 150 years ago was designed around the telegraph and railroad).[2] The second is the close resemblance between the artist impressions of Stanford Torus in 1975 and promotional visions of the future city when the hype concerning smart cities hit in 2013.[3]

Discussion around smart cities in 2013 was focused on issues of technology, control, efficiency gains and large infrastructure upgrades, and was driven in part by multinational companies. In his excellent book *Smart Cities*, published during this period, Anthony Townsend described a vacuum between the top-down, technology-heavy solutions for cities promoted by big companies and the bottom-up but limited-scale grassroots work of community activists.[4]

The smart city of 2019 looks quite different from that of 2013. The utopian visions have mostly gone (as we will see, they tended to alienate citizens). Movements towards smart governance and smart citizenship have developed, embodied in initiatives such as open data platforms. This second wave of smart cities favours incremental improvements to existing infrastructure rather than entirely new systems. The spotlight is on the needs of residents rather than on glamorous new buildings. Technology may play an important part in solving problems, but it does not look like science fiction. Culture and politics have joined the party. The path to the future city may now be a little messier and a bit nosier, but it is also more realistic and more achievable. Accordingly, this report uses a new definition of smart cities: *using new ideas and innovations (which might include technology) to improve cities for the people who live, work and visit there.*

Townsend predicted that mayors would step into the vacuum between industry and activists and design the smart city of the future. He was right – but mayors and their teams have company. Organisations such as universities can bolster the work of city hall by drawing on the vast amount of research and innovation they provide, and also working in closer partnership with city hall. This requires universities to concentrate on where they can really add the most value, and for both university and city leaders to pay attention to developing strong processes and structures for collaboration. Universities also work closely with large and small businesses who continue to be an essential part of this partnership. And their work with communities can help ensure a constant focus on inclusivity and participation. This report shows how eight European cities are doing just that.

# How universities can help build successful smart cities

We are seeing a new wave of smart cities across Europe. Putting citizens first, they involve close working between universities, communities, businesses and city hall. The following three parts of this report set out the universities' role in this effort, drawing on examples from European cities with unique needs and opportunities, and at different stages of the same journey. However, if universities are not aware of the limitations of new technologies, of the potential pitfalls of smart city policies and of the need to be constantly focusing on people from all parts of society, they can end up reinforcing the exclusion and marginalisation present in cities. The first task for university leaders is to focus on the value their institution can add.

# Part one: Universities should focus on their competitive edge

*Given limited resources and the complexity of urban challenges, universities need to concentrate their efforts on those activities and in those places where they can add most value.*

The eight cities and the many universities featured in this report have several things in common.

First, staff in city halls are resolutely focused on the needs of their citizens. When they consider smart city policies, it is with local residents in mind and part of a broader vision for the city. If they adopt or adapt smart city technologies, it is a means to an end rather than a goal in itself. Enticing promises to overhaul ageing infrastructure using a digital revolution, or to produce vast efficiency gains with technology, are unlikely to seduce city leaders. If city halls were ever in thrall to large IT companies (as some cities across the world were accused of when the hype around smart cities

peaked five years ago), those days have passed. Now, even managers of smart city teams in city halls recognise that technology alone is rarely the solution to urban challenges, which are often complex problems that cities have been grappling with for decades.

City officials are increasingly working with citizen-led movements and are attuned to the implications of any policy changes for communities. The problems of the future that officials seek to tackle are those which will affect their citizens. This means, for example, providing affordable and energy-efficient housing is always near the top of every city hall's list of priorities. Projects such as retrofitting old housing stock on the periphery of the city are not immediately visible to tourists and business visitors, and lack the glamour and ribbon-cutting spectacle of a shiny new transport hub. Instead, they favour incremental changes and gradual improvements to existing infrastructure in a quiet shift in focus that is emblematic of the second wave of smart cities.

Second, the work of local universities in all eight cities includes research and innovation in these priority problems. For example, the two universities in Nottingham are prioritising work on housing. Calculations suggest bad housing costs the UK's National Health Service £1.4 billion a year, and improving the quality of homes can cut visits to local doctors almost by half.[5] Project SCENe at the University of Nottingham is a new housing development in the city's Trent Basin, demonstrating a new way of providing locally generated heat and electricity to 120 new homes.[6] Work by nearby Nottingham Trent University and the Institution of Engineering and Technology has explored deep retrofitting – upgrading a home in one process to become energy-neutral for heating and cooling. There is a close relationship between our built environment and our physical and mental health, and – with cities bearing more responsibility for the health of their citizens – investing in housing is a wise social and economic move.[7]

Third, both city halls and universities are working within tight constraints. Both need to try to plan for the long term with limited resources, fragmented funding streams and financial uncertainty. Staff are often stretched. Successful collaboration is often sparked by an individual with entrepreneurial flair, or a team working extra hours beyond their core remit. Often institutions have to be creative to marshal resources. The Politecnico di Milano set up PolimiRun, a 10km run that ends in the university quarter of Città Studi, to raise funds to help regenerate part of the city.[8]

Most universities are increasingly aware of their duty to *work for* the city rather than simply be a *part of* the city.[9] Universities are keen to work with cities, and city halls want to build strong links with local universities. What is not always clear is how city hall can best work collaboratively with local universities to tackle complex urban challenges, and, for the university, exactly how they can best contribute given limited resources.

Universities can offer a competitive edge to cities planning for the future, but university leaders need to make the case for what their institution can add, and how they can be most valuable. There are four areas where universities can best focus their attention.

## Bring a wider perspective
(but beware of best practice)

Universities can share lessons from what has worked elsewhere, drawing on their international activities that often span several cities. The multicountry *Smart cities and Communities* projects funded by the European Union (see part two) have this peer learning built in. However, cultural, political and regulatory contexts can differ wildly from one city to another. What works in Lille may not work in Bucharest, and even within countries any conclusions need to be highly contextualised; Warsaw, for example, is not representative of many Polish cities. What is often most useful is similar-sized capital cities and similar-sized non-capital cities sharing experiences with one another.[10] Once partners understand what the city needs and have scrutinised good practice, this needs to be tested to see whether it would work and be discarded if not.

Mayors and other elected officials are held to account by citizens for promises made and implemented, and the liveability and prosperity of the city. Where universities sometimes fall short, but where they have the potential to excel, is acting as a critical friend to the city. Universities should be challenging officials to rethink what a smart city should be, and analysing policies and programmes to ensure they benefit marginalised groups in society (see part three).[11] There are often opportunities to do so: university leaders sit on mayoral advisory panels in several case study cities and have helped to write urban development or smart city strategies.[12]

## Combine disciplines

The smart campus project at the University of Lille brought together computer scientists, engineers and social scientists to create a large-scale demonstration of a smart city (see below). The new ENABLE project at Trinity College Dublin brings together researchers from seven Irish universities and industry to discuss the challenges that currently limit the benefits of the internet of things for communities.[13] These researchers include social scientists and experts in behavioural change alongside specialists in artificial intelligence and information technologies. Researchers at Nottingham Trent University are bridging computer science and behavioural psychology by exploring digital technologies and loneliness – a particular concern with many countries home to an ageing population.[14] Why combine disciplines in these ways? Doing so can help ensure smart city innovations benefit the greatest number of people, are designed to be user friendly and are widely adopted. But caution should also be applied. Interdisciplinary work can be messy and difficult, it can take longer and may not always work. Securing funding for interdisciplinary research can make it hard to get started. When bringing disciplines together does work, it can yield (sometimes unexpected) breakthroughs.

The breadth of expertise within universities can also shape smart city developments. The victory of Darmstadt in the German Digital City competition (see part two) was partly due to the inclusion of an ethics advisory committee and a strong focus on cyber security, informed by the local Fraunhofer Institute for Secure Information Technology. In several case study cities, universities have helped shape policies on cyber security and ethics. The longevity of smart city projects and their adoption by residents depends on balancing the benefits of new technologies while managing privacy and security concerns. A regional alliance in Lille that includes the university and city has launched humAIn – an interdisciplinary institute aimed at understanding and explaining the decisions and predictions being made by artificial intelligence from healthcare to transport.[15]

Universities can connect related schools of thought. A range of concepts – smart cities, sustainable cities, creative cities, liveable cities, resilient cities – are sometimes dismissed as buzzwords, but looking to see how they can reinforce each other can be helpful. Resilience, for example, refers to how a place responds to shocks and disturbances. Milan's Chief Resilience Officer, a post supported by the Rockefeller Foundation, leads the EU-funded Sharing Cities project (where universities and cities apply new technology to solve smart city challenges) on behalf of the city of Milan.[16] In Germany, Technische Universität (TU) Darmstadt is helping the city's IT infrastructure to become more

resilient. This includes coupling real-time information with historical data, so we can learn from past crises. As systems become more interconnected and smart infrastructure is integrated into wider networks, the threat of a cyberattack against public services – as seen in attacks worldwide from ATMs in Chile to trains in Denmark – means systems need to return to normal as quickly as possible.[17] Linking smart and resilient thinking is important. If smart infrastructure fails after an environmental disaster or cyberattack, the effects can be highly damaging and spread even faster than with traditional infrastructure.

## Use the university campus

The campus of the University of Lille is a small town: 25,000 users, hundreds of buildings and 100 kilometres of urban networks from roads to sewage to electricity. The SunRise project led by the university developed a smart city demonstration model, and produced a large body of knowledge on what works, the benefits and the costs.[18] There are advantages to testing and embedding smart technologies on a campus before launching more widely: immediate access to expertise and researchers, reinforcing partnerships with local government and with the private sector, and capturing learning in new education programmes that can be provided to students as they are being implemented on campus.

Developing a smart campus is perhaps easier than developing a smart city, with most of the campus falling under the ownership of one institution. Both of Nottingham's universities have substantial smart campus projects underway; universities from Bucharest to Zaragoza and Dublin to Warsaw are implementing their own versions of smart campuses, and setting the standard for developments across their cities.[19] As the co-ordinator of SunRise commented, the smart campus can 'promote the concept of smart city to the city'.

Events on campus can provide space for debate. In Bucharest, an annual smart cities conference at the National University of Political Studies and Public Administration (SNSPA) aims to raise awareness and build capacity, and POLIFEST at Universitatea Politehnica Bucuresti demonstrates collaboration between academia and society.[20] The University of Lille and the European Metropolis of Lille (a network of cities around Lille) runs Mix'cité, a day of engagement activities for students and local residents starting on campus and involving 40 activities from workshops with the elderly and raising awareness about disability and accessibility, to renovating local community spaces.[21]

University activity should not, of course, be confined to campus locations. Promoting city–university working by means of other visible projects can help to build

awareness amid groups of people who rarely visit a university campus. Dublin City University is helping to develop Croke Park Stadium, the third largest sports stadium in Europe, as a testbed for internet of things (IoT) technologies.[22] Innovations include using machine learning to adjust heat lamps to promote the best grass growth (and save energy), and analysing crowd movements to ensure health and safety.

## Monitor progress and tell the story

Universities support the development of the Milano Scoreboard, an online standard of the attractiveness and competitiveness of a city against similar global cities.[23] Over 220 indicators are grouped into several categories (including smart city) and are open for all citizens to access. The next challenge will be to further localise this information to districts and neighbourhoods. In doing so, statistics can take on a new meaning for people living in those areas. Cities, including Dublin and Milan, have used research projects involving universities to introduce innovations such as smart lamp posts (see box two) from demonstration sites and testbeds to sites across the city and the wider metropolitan area. This allows more detailed local information to be recorded on measures such as rainfall and temperature, which can show the impact of climate change at a very local level.

Telling the story of what this evidence means is critical, and universities have an important role to play both in terms of contextualising information for local communities, and explaining clearly the benefits and drawbacks of smart city activities (more on this in part three). Universities are well-versed in public engagement. In the UK, engagement is a requirement in many funding programmes, it is a core metric in the Research Excellence Framework that assesses the quality of university research, and the UK is home to a national centre for improving engagement.[24] As such, public engagement has been researched and analysed and improved, and universities can bring both their knowledge and practical experience to city partners and work with them to engage citizens in a worthwhile way.

Storytelling can set a vision for the future of the city. It can mobilise people and is often an important form of urban planning.[25] Academics have long called for an alternate smart city story told by and for communities to match the corporate storytelling of large multinational companies.[26] Universities can continue to do more here: analysing and communicating the problems cities are facing, and working with all parts of the city to chart the city's future course.

## Understanding the roots of city challenges and innovating to solve them

The four areas outlined in this section both complement and build upon the problem-first approach that city halls are taking. Technology can play an important and often decisive role in tackling problems, but as most of these problems – from unemployment and homelessness to ageing populations and pollution – predate our digital world, technology sits at the end of the path to finding solutions, not the start. Universities can help conceptualise these problems, find deep-rooted causes, provide clarity on complex matters and position global trends within local contexts.

## Box one – Unsung heroes of smart cities: Students

Students at the University of Bucharest and the nearby National University of Political Studies and Public Administration (SNSPA) have placements in public institutions as part of their degrees, including within city hall.

The Creative Thesis for Warsaw awards recognise the best PhD and master's theses, and form a starting point for further co-operation between university researchers and city officials.

In Zaragoza, students present research ideas on housing and regeneration to the local residents. A recent innovation to widen accessibility while reducing costs in tower blocks is being adopted by the municipal housing authority.

Master's and PhD students across different faculties worked on the smart city demonstration project at the University of Lille, and similarly are shaping work on resilience and IT at TU Darmstadt together with the city.

From encouraging students to develop new ideas for the city that can be quickly implemented, to embedding students in city hall to foster new relationships and understanding, students are a resource for both short- and long-term city development. Placing students at the heart of plans to tackle challenges the city faces not only builds their skills, but may well be the speediest path to effective solutions.
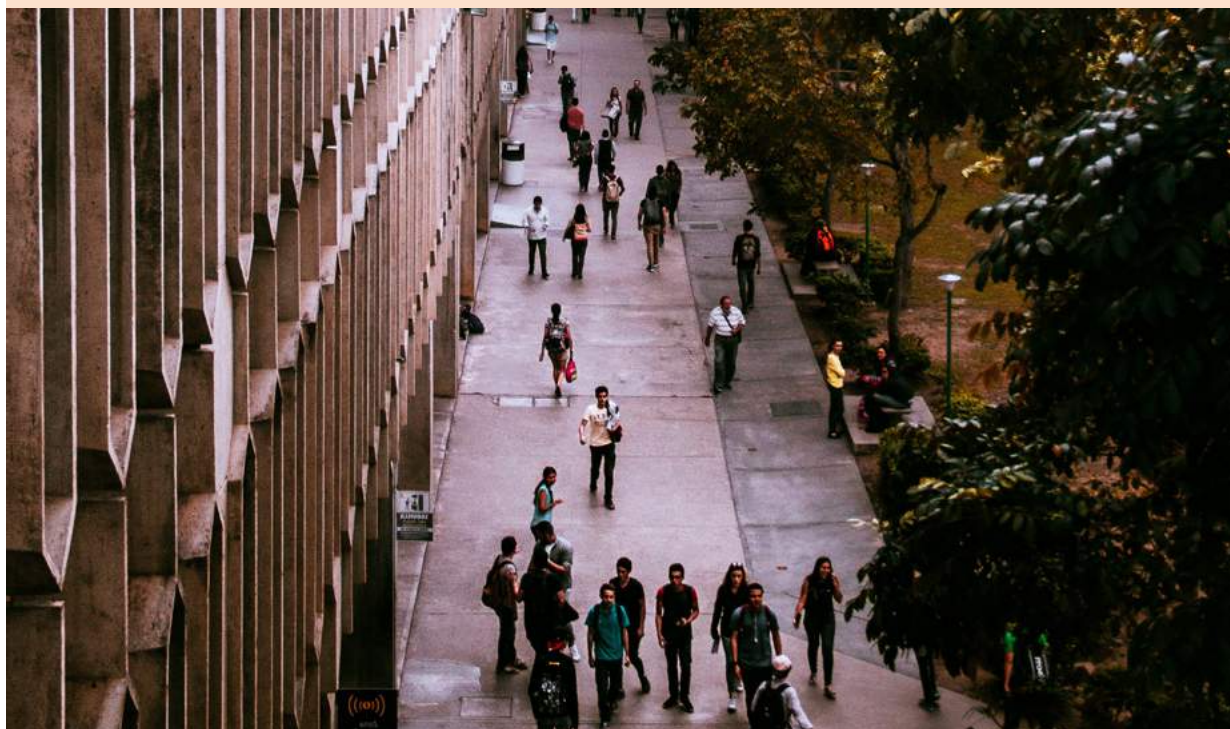
# Part two: Build deep links

*Successful partnership working between universities and cities emerges from effective processes for identifying and tackling challenges.*

The industrial district of Cogullada sits north of the river in central Zaragoza. A recent newspaper article described the 'spiral of degradation' in the area, with abandoned factories, few public spaces and a risk of the area becoming cut off from the rest of the city.[27] The School of Engineering and Architecture at the University of Zaragoza is working with Zaragoza city hall on a regeneration plan to strengthen the connection between the district and the city. Realising the rare opportunity to rethink the use of a large parcel of land to benefit the city as a whole, the plan proposes several new uses for the area, including as a logistics centre for last mile transportation of goods into the city.

Logistics is yet another example of decidedly unglamorous activity that can bring real benefit to cities, while tackling pollution and traffic congestion. A last mile centre is a hub for trucks to deposit containers just outside the city centre, and for the contents of these containers to then be distributed to their final destination by – usually – smaller electric vehicles. At this point, it is helpful to take a step back. Building a last mile logistics centre is a major investment for a city, requiring not only a facility that can handle the goods and vehicles, but complex modelling of the effect on existing traffic flows and implications for supply chains. It reflects a big bet on the future: this is how the city will operate for decades to come. Big bets have trade-offs – what else could be built on this site? What else could the money be spent on? Who benefits, and who loses out?

Understanding the process for taking decisions and speculating on the future of cities is clearly important. As in Zaragoza, universities play an important role in calculating the benefits, shaping policies and understanding risks around major decisions (indeed, there is a burgeoning academic literature on last mile logistics, for example).[28] But this role also reflects a wider lesson about cities tackling the challenges of the future, and of successful partnership working between universities and cities – a recognition that *process* is as important as *content.* A prioritised list of the top problems facing a city with the unanimous backing of citizens is of little use without a clear process by which to bring people together to solve them. In successful cities there is a focus on the process of tackling challenges, and here three things are particularly helpful.

## Cultivate boundary spanners

When visiting the eight cities in this report, the same names often pop up. In Dublin, the co-ordinator of the smart cities programme. In Lille, the university professor who developed a large-scale demonstration project. In Nottingham, a manager in the city council responsible for working with universities. In their book exploring how former industrial cities are reinventing themselves as innovation hotspots, Antoine van Agtmael and Fred Bakker call such individuals connectors: people who have 'vision, relationships, clout, diplomatic skills, convincing power and energy' and who, crucially, bring people together.[29]

It is hard to avoid the conclusion that a history of collaboration, and a culture that encourages this, helps greatly when building strong links between universities and city halls. But cities without this history, or places that are beginning to grapple with complex problems requiring true partnership working, should take notice of these boundary spanners. Histories of collaboration can begin with a single conversation and a small project, and over time boundary spanners can help change cultures. By opening the door to future collaboration by bringing people together and demonstrating tangible results, they leave a legacy that outlasts their post.

Boundary spanners are often particularly adept at carving out new projects with little funding (combining small amounts of money from industry with contributions in-kind from universities and community organisations), bringing diverse groups together with a single vision and speaking the language of different organisations all while winning what is often the biggest battle – internal approval within their own institutions. They also understand the balance between securing some early and visible quick wins while planning for longer-term impact.

Perhaps the easiest way to cultivate boundary spanners is by staff secondments or jointly funded posts (most commonly with universities funding a position within city hall, although in several cities officials from city hall are guest lecturers at local universities). A recent flurry of such appointments in the UK may provide inspiration, as might programmes such as *Leading Places*, designed to bring local partners together over specific challenges and break down cultural and language barriers between institutions.[30]

## Exploit the galvanising effect

Several cities in this study have been part of multimillion euro *Smart cities and Communities* projects funded by the EU under Horizon 2020, testing new technologies in districts in multiple 'lighthouse' cities and working with follower cities to replicate the benefits. Nottingham City Council and Nottingham Trent University have been part of REMOURBAN, developing energy, mobility and ICT innovations with partners across Europe.[31] Milan and Warsaw are members of Sharing Cities, aimed at developing affordable solutions to common smart city challenges mostly around energy and transport. In all cities, universities are integral partners. These large-scale, ambitious programmes have great value in bringing people together from diverse cities to share ideas and develop solutions that can be applied more widely.[32] But they also illustrate another phenomenon: the galvanising effect.

Funding opportunities such as those offered by the EU often require a network of partners to come together to submit a programme of work lasting five or more years. Such bids can take many months to put together, building on existing personal relationships but also forging new ones to ensure a balanced range of organisations and companies. The result is a loose coalition of people initially brought together to represent their employers, and formalised into a team if funding is secured. However, effective cities will use this coalition to drive forward new work even if the bid for funding is unsuccessful. As a senior university manager said, 'big funding can support smart city development, but smarter thinking utilising existing assets with more modest funding can also deliver benefits to citizens'.

Dublin's ambitious Smart Docklands testbed is marketed as 'the world's most connected business and living district'.[33] The project was born from extensive collaboration between Dublin City Council and the CONNECT Centre at Trinity College Dublin in an unsuccessful EU *Smart cities and Communities* bid that nonetheless sparked work between partners that resulted in a succession of other successful initiatives and programmes that continue today.

Other forms of competition can also trigger the galvanising effect. The German Digital City competition, run by the digital industry association Bitkom and the German Association of Towns and Municipalities (DStGB), called for bids from medium-sized cities who could demonstrate support from partners including universities and good transport links.[34] The competition was won by Darmstadt, and the act of calling for proposals rallied the city and universities together with citizens, museums and businesses to submit a clear vision for the future.[35] Yet, the competition may have wider ramifications. Nearby Heidelberg has vowed to 'forge ahead' with projects started as part of its bid for the Digital City award, with universities highlighted as principal partners.[36] And Darmstadt itself is now



working closely with other German cities to share what has worked – highlighting the benefit of national competitions in sharing processes and content with similarly structured cities with similarly structured institutions. Other schemes such as providing small pots of money for groups of organisations to pilot projects, for example, are also likely to have a galvanising effect.

## Introduce structures

Cultivating boundary spanners and bringing groups together to respond to competitions can only take a city so far. Once a culture of collaboration has been introduced and universities, public organisations and businesses become familiar with working across sectors, formal or informal structures can help. These structures should be driven by visible high-level leaders or champions, and will (and should) vary from city to city.

Universities are often vast and complex organisations with thousands of staff and researchers. Those at the centre or in leadership teams can be unaware of much of the work in their institution and within the dozens of faculties and departments. As a result, it is unsurprising that many city officials are also unaware of much of the exciting research and innovation taking place a bus ride away from their office.

Milano City School brings together the Municipality of Milan and six Milan-based universities to discuss urban regeneration and issues facing the city. The city manages the project, and each university has an academic contact point and an operational co-ordinator. Universities take turns to exhibit research and activities tackling city challenges, giving city officials access to new insights and forming new links between universities. Research on Milan's urban development and on the city's neighbourhoods is being mapped, and a directory of experts is being compiled.

Other cities, including Zaragoza, are undertaking similar mapping exercises.[37] Universities should proactively map their own work. Not only does capturing individual and institutional links between the university and urban projects (including those with other universities and city hall itself) benefit the city by sharing what is going on, it helps universities too. When it comes to research and innovation for the city, it is often the case that researchers do not need to do more, but instead more people need to be made aware of what is being worked on, so they can shape it, use it and build on it.

Other cities have created new organisations. With equal funding from the city council and the CONNECT Centre at Trinity College Dublin (via Science Foundation Ireland), the team behind Dublin's Smart Docklands Programme play an independent broker role between the city council, entrepreneurs, universities and citizens. This model is often credited with the success of the programme, which explores the application of smart technology, regulation, business models and forms of collaboration.

In most of the cities, there are regular meetings between city and university staff. In Warsaw, there are framework agreements with the major universities and a mayor's advisory board that includes academics. The Academic Warsaw project is designed to bring universities and the city of Warsaw together to co-create solutions to problems. Practical first steps following the initial agreement with the University of Warsaw included sharing calendars so each could anticipate busy periods (such as exam season), and setting up joint conferences and student internships.

Physical hubs for collaboration can combine university and city expertise and soften the edges between the two institutions. Zaragoza City Hall and the University of Zaragoza have staff working alongside each other in the Etopia Center for Arts and Technology, an open laboratory in the centre of the city.[38] The building was established by the city, with the university contributing staff time and equipment. Etopia is also home to Cesar Laboratories, another collaboration between Zaragoza City Hall and the University of Zaragoza, with 11 laboratories for scientific research open to the public.[39] Elsewhere, Zodiak, the Warsaw Pavilion of Architecture, opened in late 2018 and is a physical hub for debating city planning and sustainable development.[40] And 38 Carrington Street is Nottingham's Urban Room, set up as an independent partnership between Nottingham City Council, the two universities in Nottingham and other partners as an exhibition and events space to engage the public and improve the built environment.[41]

## The ingredients of success

The proposal for a centre for last mile transportation of goods in Cogullada is an example of drawing on an academic field – logistics – that is only tangentially related to smart cities. Most urban-focused research is not commissioned or framed under the banner of smart cities, and the most effective innovations may well be those translated from apparently unrelated fields. Universities can encourage city planners to look outside the smart city realm when planning for a smart city. To do this, it is necessary to build deep links between universities and the city that go beyond senior leadership teams and single disciplines. The three initiatives outlined here – creating boundary spanners, utilising the galvanising effect and building appropriate structures for collaboration – are all ingredients for success in building these deep links.

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## Box two – Unsung heroes of smart cities: Lamp posts

The EU has between 60 and 90 million of them. Three-quarters of them are more than 25 years old, and only a single digit percentage use energy-efficient bulbs. Upgrading the humble lamp post is a core part of the Sharing Cities project involving university researchers and city officials in six European cities, including Milan and Warsaw and co-ordinated by London. Lamp posts embody many of the basic principles of the new wave of smart cities.

First, they can present a quick win to demonstrate the benefit of smart city technologies. They already line every street and can be fitted with sensors to track climate change at a very local level, provide electric vehicle charging, digital signage and push-to-talk systems for information services or to report an emergency.

Second, they represent an incremental upgrade to existing infrastructure. Street lighting consumes between 20 and 50 per cent of the energy budget of a city. Upgrading to LED lights can save 50 to 70 per cent of energy costs (two billion euros across the EU) and can halve maintenance costs.

Third, they also highlight some of the complexities of smart city initiatives. Planners need to ensure interoperability – that is, that systems can talk to each other and are free from technological lock-in. Smart lamp posts need to be future-proof, and leave capacity for new developments that we cannot anticipate. There are also the upfront costs, and the need for effective procurement and value-for-money processes.

Despite this, the lamp post offers an excellent starting point for collaboration, for learning more about a city from the information that can be collected and for quickly scaling up what works across a wide area. As one interviewee remarked, lamp posts 'are like gold in cities'.[42]

# Part three:
## Put inclusiveness first

*Work on smart cities needs to be inclusive – requiring a focus on all people in society and the challenges they face.*

Technological University (TU) Dublin is the second largest university in Ireland, born in January 2019 with a campus in a large regeneration zone near the city centre. The development of this campus gave planners a chance to design almost from scratch a university site that works with the city. Sited in Grangegorman, a historically deprived district walled off from the city, the university formed the Grangegorman Development Agency with Dublin City Council. Together with the surrounding community, the Agency opened up the walls to the rest of the city, built playing fields for the community and is home to a school and primary healthcare centre. The city's light rail service, the Luas, extends to the campus, and the community are encouraged to eat with the students in the canteen (and they do). But it is the work behind the scenes that makes the difference. New buildings re-used material from the abandoned site. Green energy generation and local storage allows excess energy to be released into the grid and for supply to better meet demand. And signage throughout the campus is the same as the rest of the city, deliberately blurring the edges between the university and the city.

The development of TU Dublin is a reminder that, although most people do not live in the centre of cities, cold spots of poor connectivity and marginalised communities can still be found in the heart of the city. Elsewhere, universities are working closely with city

halls to develop second campuses as part of urban regeneration processes – from the New Technologies Campus of the Warsaw University of Technology in the village of Zamienię just outside Warsaw, to the Bovisa campus of the Politecnico di Milano in an industrial area in the outskirts of the city. Central to the success of such developments is working with communities and local partners to build open campuses, rather than islands of exclusivity in a sea of suburbia.

The first wave of smart cities became known for schemes such as free Wi-Fi and bike sharing projects. Visible to visitors and attracting press coverage, such initiatives disproportionately benefit relatively affluent people who are far more likely to use them than the poor or those in minority neighbourhoods.[43] The second wave of smart cities puts communities at the centre of city planning processes, and works with universities to do so.

However, smart city projects with a clear focus on broadening access can still run into problems. A Columbia University analysis of New York's 311 helpline (for reporting anything 'from dead birds and potholes to juvenile loitering and noise control') found poor neighbourhoods with minority populations complained less often.[44] Although these neighbourhoods might have received better services, it is perhaps more likely that they either did not know how to complain or felt less able or willing to do so. Such schemes, emblematic of the second wave of smart cities – low-key and focused on everyday problems facing residents – can unintentionally reinforce inequalities, with resources then dispatched to those areas that do complain more. Such problems are not confined to the US. A study covering the UK, Scandinavia and the US showed that

middle-class people are in an advantaged position, compared with less affluent social groups, when it comes to accessing public services.[45] Similarly, open data platforms and digital civic engagement tools, although nominally open to all, are rarely used by all.

City officials interviewed in the eight cities in this report were aware of spatial inequalities in their cities and were conscious of the need for smart city work to reflect the needs of areas beyond the city centre. In some cities, such as Bucharest (which is divided into six sectors), university staff are working with mayors in individual sectors to formulate smart city strategies tailored to the area. Yet risks remain – the decision to build new infrastructure in a suburb, for example, may not be done *with* or even *for* the people living there (think a new data centre, or a green power generator, or a metro line connecting the city centre to the airport).[46] Indeed, the idea of 'splintering urbanism' explores how such investments can worsen social inequality and divide communities by being designed with the affluent in mind.[47] Similarly, isolated high-tech buildings or disconnected high-tech streets tend to foster social inequality.[48] Universities have a responsibility, by leading projects, conducting research and working with partners, to ensure their work on smart cities is inclusive. Asking the following two questions can help.

## How can we ensure effective community engagement?

A central tenet of the second wave of smart cities is that communities need to be engaged from the start of smart city processes and have a sense of ownership of any new initiatives. For city planners and university researchers this is accepted wisdom, but it can be difficult to do correctly. Academics working on technology and development such as Tim Unwin have long argued the importance of working *with* communities, rather than *for* them.[49] We have already seen (in part two) how bringing a together mix of academic disciplines, such as social scientists focused on user design or behavioural psychology, can help.

At the start of the Smart Docklands programme in Dublin, staff brought together the community and simply asked, 'what problems are you facing?'.[50] As the programme proceeded, they took the decision to only promote current and completed projects, rather than advertising future work or aspirational activities, to keep the community engaged and the work tangible. Elsewhere, citizen engagement is a core part of the Sharing Cities programme featuring city halls and universities in Milan and Warsaw, and the REMOURBAN project with Nottingham Trent University and Nottingham City Council (including a goal to develop participatory mechanisms that other cities can learn from).[51]

Universities working with their partners in city hall can take a twofold approach to communicating with communities and building trust. First, effective storytelling (see part one). This requires clearly explaining the benefits and drawbacks of activity or interventions they have developed, and setting these within a narrative about the future of the area. Second, to provide training in data literacy, as nearly half of Europeans lack basic digital skills.[52] MEET, an international centre for digital culture recently founded in Milan, has founded the Citizen Data Lab, focused on citizen awareness about big data and how to become smart citizens.[53] The philosophy behind the initiative is to frame inclusion and the digital divide as a cultural matter rather than a technological one. Amid increasing scepticism about the motives of large technology companies and their use of personal information, and fears over privacy and transparency, there is a risk that those who could benefit most from technological innovation will miss out. Taking a culture-first approach can help maximise the benefits for all parties.

## How can we avoid inadvertent exclusion?

Researchers at the Open University and the University of Oxford have compiled a toolkit for ensuring that smart city initiatives effectively engage the people they are intended to reach.[54] Often these people are inadvertently excluded by the designers of these initiatives not thinking enough about the social aspects of smart cities. Pitfalls range from an over-reliance on big data to not sufficiently engaging with local networks and community leaders. Developing niche mobile apps, or promoting a utopia-like vision of the future city which has no relation to present reality, can also be problematic. In addition, focusing too closely on the poorest neighbourhoods can also result in the exclusion of those that are not very poor or rich. As the researchers point out, not only does this limit the number of people who can benefit, it limits the potential to drive future innovation and improve urban governance.

Ultimately, people and the challenges they face are the most important issues facing cities. It is the role of universities, together with local partners, to help understand and solve these challenges.

## Box three – Unsung heroes of smart cities: Urban farming

Urban farming offers the potential to cut pollution, help deal with climate change and shift cities towards being producers – and not just consumers – of food. University researchers are exploring vertical farms that run up the side of buildings, as well as farms deep beneath cities.

There are an estimated 25,000 square kilometres of abandoned mines and tunnels in the UK. A team at the University of Nottingham has developed a cost-effective method of growing food in these tunnels, yielding up to ten times as much produce as farms above ground. The researchers are working with investors to develop a full-scale demonstration unit of a Deep Farm in Mansfield, north of the city.[55]

In Milan, officials are thinking smart across the lifecycle of goods and services, from the creation of products to their disposal. Milan City Hall, the Politecnico di Milano and other partners launched a hub in the Isola di Milano district for stocking and distributing food, aimed at cutting food waste and child food poverty. The university conducted a feasibility study and will monitor the hub and the impact of the project, building a logistics model that can be scaled up and replicated in other parts of the city.[56]

# Conclusions and recommendations

Of all the demands being made of universities, two are especially noteworthy. The first is pressure for universities to develop (or rediscover) their civic mission, and to do more for the place they call home. Such demands have been building for several years, and universities that have not prioritised the civic agenda are beginning to respond. The second is a call for universities to meet the tide of policy initiatives focused on urbanisation – from UN, EU and OECD agendas to the strategies of individual towns and cities – with an increase in urban research and education. This science of cities needs to bring together different disciplines, promote equality and justice, and provide effective advice to policymakers.[57]

These two demands are significant because they challenge different ends of the traditional university mission: research and the so-called third mission of economic and social engagement. The eight cities in this report demonstrate that work between universities and city halls draws on both of these missions, which overlap and reinforce each other. The urgent calls for universities to do more for their place, the challenges that urban areas face, the strengths that universities have and the work that they are doing, mark now as the time for universities to act and build stronger links with their city partners.

Like a satellite image of lights at night, smart city activities with universities at the heart are developing across Europe. This report focused on eight cities, but other examples are widespread. The University of Helsinki worked with city hall to connect civic activists with the shaping of innovation policies. Ghent University and the city are looking at how technology and social innovation can support people who need care. And the University of Salford in the UK has set up THINKlab, which lets city leaders experiment with different information sources and visualisations to increase their understanding and generate new ideas.[58]

There is, however, the potential to do more. Activity is often a patchwork of disconnected projects – across cities and institutions – and needs better co-ordination. Stronger relations between universities and city halls are often hampered by cultural and organisational barriers. A model relationship is one where university and city staff co-create solutions to urban challenges with city residents, but also where there is space for challenge, debate and making worthwhile changes to things that are not working.

This report has argued that universities are needed to help tackle the serious challenges facing towns and cities across Europe. Whether work is developed under the banner of smart cities or not, the university role remains the same: to use new ideas and innovations (which might include technology) to improve cities for the people who live, work and visit there. It is now up to university and city leaders to make this a reality.

# Recommendations

## Short-term

**1. Central university teams, or heads of faculties,** should map the work they are doing on issues relevant to their city, identifying research projects, business engagement and any links between university and city staff.

**2. University leaders** should strengthen personal links with their counterparts in city hall, and incentivise staff working on particular issues to do the same. Any potential boundary spanners – individuals who are well-placed to develop new projects that involve partners from across the city – should be supported and encouraged (see part two). The **British Council**, with a presence in hundreds of cities across the world, could also convene a session for university and city staff to build links and discuss city challenges and responses, while sharing examples of what has worked elsewhere.

## Medium-term

**3. University and city leaders** should create structures that build on personal links between the university and city hall. These should not be overly bureaucratic. Part two gives some examples of different models. An effective structure will bring in multiple universities, can demonstrate the relevant research and innovation work of universities, and give space for debate, evaluation and analysis. Jointly funded posts, secondments or exchanges between universities and city hall (in both directions) can be effective, particularly if they have a clearly defined mandate across both institutions.

**4.** Community participation and a focus on people from all parts of society should drive smart city work. **University and city staff** should build effective community engagement into projects, and be mindful to avoid accidentally excluding intended beneficiaries (see part three). Effective communication is critical, as is building data literacy (see parts one and three).

**5. University staff** should involve students in efforts to tackle challenges facing the city (see box one).

**6.** International learning and networking across European cities has benefited both universities and city halls, and several large projects facilitating this have been funded by the European Union. The **British Council** could support smaller, softer peer-learning projects between (and within) multiple cities focused on specific city challenges. Programmes such as *Leading Places* in the UK could provide a model (see part two).

## Long-term

**7. City and university leaders** should consider physical centres of collaboration that bring staff from both institutions together, such as joint laboratories or research centres. These can encourage the mixing of disciplines, perspectives and ideas to solve deep-rooted and complex problems (see part one).

**8.** Successful smart city programmes balance quick, visible wins while taking a long-term perspective, recognising that effective change can be a slow and sometimes messy process. **University and city leaders** should try to adopt a long-term perspective, building flexible projects that can outlast electoral cycles and vice chancellor/presidential appointments. Developing high-level agreements and joint strategies may help, as can developing work jointly with partners across the city (including residents and industry).

# About this report

# Methods

Interviews and focus group discussions with 49 university staff and city officials in Bucharest (Romania), Darmstadt (Germany), Dublin (Ireland), Lille (France), Milan (Italy), Nottingham (UK), Warsaw (Poland) and Zaragoza (Spain) took place between November 2018 and March 2019.

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# Acknowledgements

# Photo credits

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# References

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[6] https://www.projectscene.uk

[7] https://www.theguardian.com/artanddesign/2018/oct/03/living-with-buildings-review-health-architecture-design

[8] https://run.sport.polimi.it/en/politecnico-di-milano-running/polimirun-2019/

[9] This has been well documented by academics; see, for example, John Goddard at Newcastle University and JP Addie at Georgia State University. The recent Civic University Commission in the UK (https://upp-foundation.org/civic-university-commission/) is a manifestation of this developing awareness which has resulted in increasing expectations placed on universities.

[10] The EUniverCities Network, consisting of tandems of university and city partners from medium-sized cities across Europe, is a good example of this: http://eunivercitiesnetwork.com

[11] An example of where universities can challenge expected norms is the increasing weight placed on smart city rankings, and the effect this has on local decision-making. Universities themselves should be well aware of the pitfalls of international rankings, and more attention is being given to the consequences of these. See https://www.economist.com/books-and-arts/2019/02/23/life-and-society-are-increasingly-governed-by-numbers for an overview, and this article for a smart city discussion: Söderström, O., Paasche, T. and Klauser, F., (2014). Smart cities as corporate storytelling. City. 18(3), 307–320.

[12] For example, the two Nottingham Universities and Nottingham City Council have jointly created a smart City Strategy (PDF: https://www.nottinghaminsight.org.uk/d/192847), and Bucharest City Hall is working with Ion Mincu University for Architecture and Urbanism on the General Urban Plan for 2025.

[13] https://www.enable-research.ie

[14] https://www.ntu.ac.uk/staff-profiles/science-technology/eiman-kanjo

[15] https://twitter.com/alliance_humain

[16] http://www.sharingcities.eu/

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[30]https://www.local.gov.uk/topics/devolution/leading-places

[31]The five-year REMOURBAN project is supporting the retrofitting of 400 social and private homes in Nottingham to improve insulation and reduce energy bills. It is also supporting the development of the Nottingham district heating network, which will be extended to a network of 94 homes in order to replace their current heating with a lower cost, low carbon alternative. This new Low Temperature District Heating system will be the first of its kind at this scale in the UK. http://www.remourban.eu

[32]These include non-technical innovations. Nottingham City Homes, part of the REMOURBAN project, has introduced an outcome-focused approach to procurement where energy performance must be guaranteed for at least 30 years. With one overall contractor there is no uncertainty over responsibility and liability – a critical shortcoming of some housing projects exposed in the Grenfell fire tragedy. https://www.smartcitiesworld.net/special-reports/special-reports/smart-energy-starts-at-home-in-nottingham

[33]http://smartdocklands.ie

[34]The focus on medium-sized cities (defined as those of around 150,000 people) is important in the German context as a significant proportion of German cities are around this size.

[35]https://www.digitalstadt-darmstadt.de (in German). See here a summary in English: https://www.smart-magazine.com/digital-city-darmstadt/

[36]https://www.heidelberg.de/,Len/910948.html and https://www.heidelberg.de/,Len/901130.html

[37]Often these begin with high-level agreements. In the case of Zaragoza, the university has a series of cátetras instucionales (long-term agreements) with the city council (four), with companies (67), and two on specific smart city initiatives, which makes the mapping exercise more straightforward.

Mapping exercises between cities and universities are increasing in importance outside Europe, too. This report (by the author) explores how Toronto began mapping such activity from 2017: https://home.kpmg/content/dam/kpmg/uk/pdf/2017/11/universities-harnessing-their-superpowers.pdf

[38]http://www.zaragoza.es/ciudad/etopia/

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[49]Through his work, Tim Unwin convincingly argues that the latest technologies are often designed and implemented by the rich and the benefits associated with them accrue disproportionately to the rich. https://unwin.wordpress.com

[50]It can be helpful to allocate a significant amount of time for such workshops.

[51]For Nottingham, see this university paper: https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/4-mobility-transport-and-smart-and-sustainable-cities/community-engagement-as-a-tool-to-help-deliver-smart-city-innovation-a-case-study-of-nottingham-united-kingdom/

The Sharing Cities project has the goal to 'Prove the active participation of at least half of the 15,000 locals affected by the building renovations'. http://www.sharingcities.eu/sharingcities/home_sharingcities

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