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Smart cities: understanding the challenges and opportunities

How do you make a city smart? That is the underlying question that unites the responses to the SmartCitiesWorld/Philips Lighting survey, which draws on input from 150 thought leaders from across the world

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Introduction

The smart city concept will have different meanings in different cultures and can sound elusive until you break it down into practical terms.

A good place to start is with the stupid realities many city dwellers accept as part of their daily lives. In some major cities, residents will spend four years of their lives trying to find a parking place. Elsewhere, they may find themselves stuck in an 182km-long traffic jam. Or they may have trouble sleeping because strong neon lights brighten up their street as if it were a soccer stadium.

Using technology – in particular the Internet of Things (IoT) and artificial intelligence – to alleviate such situations would be good for citizens and cities. It is, for example, not uncommon in modern metropolises, for public lighting to account for half of the city's energy budget. In the short term, smart LED lights could use 50 per cent less power than traditional lights. (This is the very least that needs to happen if the world's cities are going to cope with their growing populations.) In the near future, as 'dumb' poles become smart, they could form the digital backbone of a city, giving citizens – and officials – real-time, accurate information on anything from rush hour delays to air quality.

Most urban governments embrace the compelling environmental, financial and social case for the development of smart cities. What some are struggling with, as this SmartCitiesWorld/Philips Lighting survey underlines, is exactly how to implement such a programme.

If smart cities are to become the 'new normal', local authorities and key decision makers need to navigate such difficult areas as technology, communications, data and security, knowing that costs can be difficult to predict and that the project will grow in complexity. Nor can they afford to underestimate the internal challenges, such as the need to engage other stakeholders, drive collaboration and break down silos. Political leaders, their careers determined by short-term electoral cycles, also need quick wins to maintain faith in a project.

The purpose of this survey was to identify and explore what factors are driving – or blocking – the development of smart cities, as enabled by the application of the Internet of Things and discuss ways to ease implementation.

The ultimate purpose of the 'smart city' concept goes beyond such modest, if beneficial, initiatives as free Wi-Fi on public transportation, traffic calming and making doctor's appointments online. Cities already consume more than 70 per cent of the world's energy supply. By 2050, 6.5bn of us will live in urban areas – 2.5bn more than today. We need to use the Internet of Things to create efficient, sustainable cities if we are to live in an efficient, sustainable world.

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The key findings:

Three best smart cities in the world

1 Singapore

2 London

3 Barcelona

Three most critical requirements for a smart city

64.7% Open data/sharing of data

54.9% Citizen engagement

52.9% Enhanced services for citizens
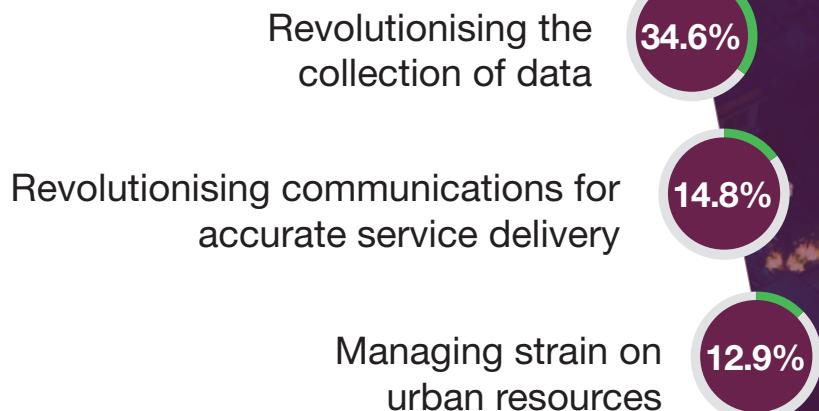
Key components of a smart city

68% Inter-operability of systems

57% City wide connectivity

51% Security
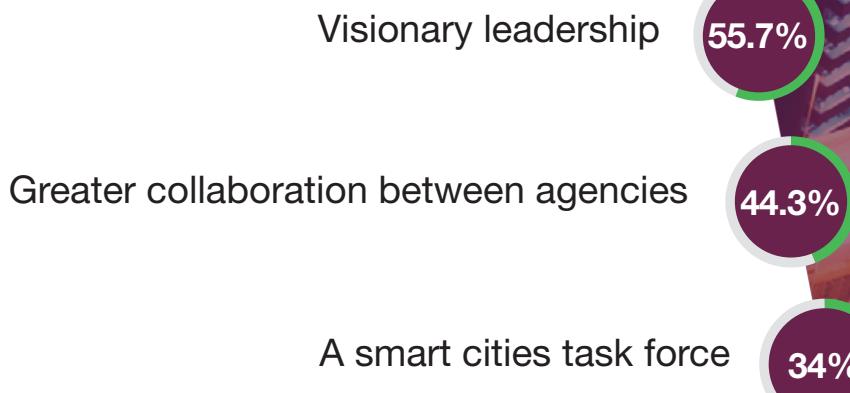
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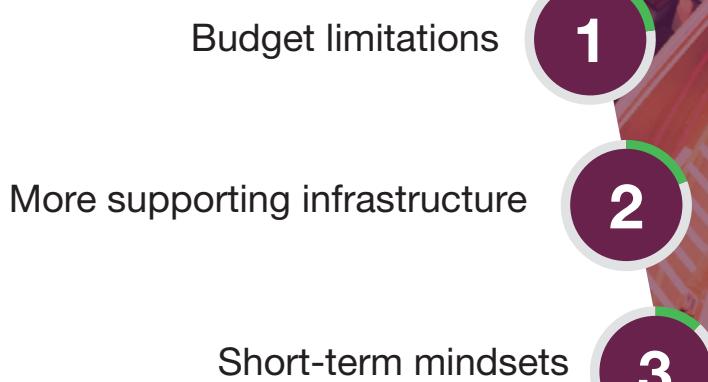
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Key role for the Internet of Things in smart cities

Revolutionising the collection of data — **34.6%**

Revolutionising communications for accurate service delivery — **14.8%**

Managing strain on urban resources — **12.9%**

Things that would most ease implementation

Visionary leadership — **55.7%**

Greater collaboration between agencies — **44.3%**

A smart cities task force — **34%**

Factors that inhibit implementation

Budget limitations — **1**

More supporting infrastructure — **2**

Short-term mindsets — **3**

SmartCitiesWorld/Philips Lighting survey methodology

SmartCitiesWorld, in conjunction with Philips Lighting, launched a worldwide survey that looked to understand and identify key attitudes and perceptions around the implementation of the smart city infrastructure.

The survey sought to uncover perceptions and understanding of smart cities and the Internet of Things from the viewpoint of different stakeholders. It also looked to identify the drivers and blockers to smart city implementation and how the latter could be eased to enable successful, dynamic cities of the future.

The results of the survey were then used to commission this white paper on smart cities, gathering views from the SmartCitiesWorld reader database on the challenges and opportunities that those working to implement a long-term vision face.

Target Audience
The audience targeted for the survey came from six main vertical categories of infrastructure providers (Connectivity, Data, Buildings, Transportation, Governance and Energy) but also the R&D sectors and educational establishments.

Which company/organisation were targeted:
• Governmental departments/regional authorities
• Policy-makers
• Investment community representatives
• OEMs
• Equipment manufacturers
• Facilities Management/Asset Management
• Service providers
• Network operators
• Systems integrators

Which job functions were targeted?
• CIOs, CTOs, CDOs (new functions addressing: innovation, information, technology, data)
• Mayors, City Department Heads/Managers
• Consultants
• Specifiers, architects and consultants

Background to the survey questions
Eighteen questions were asked in the survey – which was split into various sections. These were:
1. Beliefs around smart cities
2. Challenges around implementation
3. Services & Cost Savings
4. Final Thoughts

Over 150 thought leaders provided answers to the survey which ran between August and September 2017.

Companies/organisations who we know completed the survey included: Dallas Regional Chamber (USA), Vodafone, Brisbane City Council (Australia), Ericsson, IBM, Chubb, York City Council (UK), Libelium, Dominion Holdings, BE Advisory, BBC, Nokia, Cisco, Transport for Greater Manchester (UK), Department for Environment (UK), Moscow City (Russia), Bristol City Council (UK), New York City Authority (USA), Ford, Barcelona City (Spain), Transport for London, Highways Agency (UK), EDF Energy, T-Mobile, Birmingham City Council, SNCF, Accenture, Kent County Council, Institute of Engineering Technologist, Harvard University, Royal Institute of Chartered Surveyors (UK), Ealing Council (UK), Charlotte City Authority (USA), City of Atlanta (USA), City of Ottowa (Canada), Washington DC Government (USA), Berlin City Council (Germany) and City of Prague (Czech).

Countries responding to the survey include: United States of America, United Kingdom, Russia, Portugal, India, Israel, Finland, Spain, Germany, Canada, Italy, Australia, France, Slovenia, Japan, China, Belgium, Czech Republic and Romania.

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Findings

The smartest city on the planet is...

Visitors to Singapore often say they feel as if they are living in the future – a sentiment shared by many respondents to the 2017 SmartCitiesWorld/Philips Lighting survey, who nominated the technocentric Asian city as the smartest city in the world.

Thought leaders in the creation of smart cities were impressed by the city's "simple goals", communications infrastructure and executive commitment. In the words of one respondent: "It showcases good examples of forward-thinking infrastructure, smart transportation, smart buildings, smart underground pedestrian malls to reduce the number of people crossing the road and smart environment." The buy-in from the very top is exemplified by the Smart Nation plan which has effectively made Singapore a test-bed for the use of the Internet of Things to improve city life.

That said, Singapore does have certain advantages that other smart cities may struggle to replicate: the city–nation state – directly and indirectly – owns or controls many aspects of daily life, including public transportation and housing. As a democracy that has been dominated by a single party since independence in 1965, the state can also move quickly and decisively to innovate. The level of data monitoring envisaged in the next iteration of Smart Nation – which could include sensors to monitor when people are littering from high-rise buildings, record toilet visits in elderly care homes and detect smokers in prohibited areas – would be politically unacceptable in many other cities, where people have less trust in government.

London, which came second to Singapore, impressed respondents with its openness, focus on communities and the creation of what one manager described as a "honeypot of technologies and partnerships." The UK capital was also praised for its green spaces – at the last count there were more than 3,000 of them, covering around 47 per cent of the city. London is not on a par with Singapore as a testing ground for IoT technologies but it is experimenting with an intriguing variety of concepts.

Buy-in from the very top – especially from the mayor and the city's innovative chief technology officer Francesca Bria – is one reason why Barcelona was voted the world's third smartest city. That commitment, one executive suggested, is reflected in the city's willingness to accept – and keenness to promote – change. Other initiatives – meters that monitor and optimise energy consumption, parking apps – impressed respondents but, underlying the praise, was a sense that these developments were being integrated into a coherent vision of the city's future.

The array of cities nominated – 42 in all – suggests significant cultural differences in the way the 'smart city' is interpreted. A handful of executives also suggested that reality had not yet lived up to the rhetoric, with one noting: "Smart remains a relatively low bar."

> **The level of data monitoring envisaged in the next iteration of Singapore's Smart Nation would be politically unacceptable in many other cities, where people have less trust in government**

1st

Singapore: the buy-in from the very top is exemplified by the Smart Nation plan which has effectively made this nation state a test-bed for the use of the Internet of Things to improve city life

London impressed respondents with its openness, focus on communities and the creation of a honeypot of technologies and partnerships

2nd

3rd

Barcelona: a willingness to accept and keenness to promote change

Smart cities

The business of definition

What does constitute a smart city? On this question, there was a reasonable degree of global consensus. More than two out of three respondents identified inter-operability of systems as a key component, 59.0 per cent chose sustainability, specifically when it came to water and energy use, 57.0 per cent city-wide connectivity, 46.0 per cent efficient transportation and 43.0 per cent public-private partnerships.

Yet alongside a 'can do' ethos that relishes the opportunity to technologically transform city life, there were also significant concerns. More than in one in two executives identified security as an essential part of any 'smart city', with 21 per cent saying the same about privacy.

This concern has inspired Barcelona and Amsterdam to launch DECODE (DEcentralised Citizens Owned Data Ecosystem), a project designed, in the words of Barcelona CTO Bria, "to develop practical tools to protect people's data and digital sovereignty." If citizens are to engage with – and trust – smart city programmes, Bria believes that the "thorny questions around the ownership, control and management of personal data, preemptively decided on everyone's behalf by the big tech firms, must be addressed."

What do you think are the key components of a smart city?

68% Inner-operability of systems

59% Sustainability – energy and water efficiency

57% City-wide connectivity

51% Security

46% Effective transportation

43% Development of private/public partnerships

Though sensitivity on such issues varies between countries – surveys show, for example, that personalised posters are regarded as cool by Chinese consumers but creepy by their Japanese counterparts – the private sector has supplied ample evidence of the damage data breaches can inflict on organisations. Yet many smart city leaders will agree with Bria that data produced by people in a city belongs to them and should benefit them – not just tech-powered businesses such as Uber and Airbnb.

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One third of executives stressed the importance of smart construction. This is an intriguing challenge because even industry bodies such as the UK's Institute of Civil Engineers recognise that innovation is not something many construction companies excel at. This is not a lone view – the sector is often described as the "least innovative industry in America." Concerns over health, safety and regulation have encouraged the industry to avoid risk. The net result is that, some analysts say, it invests virtually nothing in R&D. This is changing. Smart buildings cannot be constructed in the way skyscrapers were 50 years ago. Major groups such as Arup and Bechtel are incorporating smart city technology into their offerings but there is still work to be done.

One in two respondents could envisage instant financial returns on smart lighting

The focus on sustainability – and efficient use of resources – has prompted hundreds of local authorities across the world to invest in smart LED street lighting. The lights last longer, use much less energy and make streets safer. Yet smart lighting can do such more, providing the foundation for an eco-system of data that can help people make better decisions – whether they are managers delivering public services or ordinary citizens wondering how best to get home after work.

One in two respondents could envisage instant financial returns on smart lighting and saw this technology as a potential source of revenue when other smart services were integrated into the infrastructure. Revenue-generating opportunities include – but are not limited to – digital signage for advertisers, electric vehicle charging and supporting cellular networks.

The strong belief in the value of public-private partnerships is intriguing, given the opprobrium many of these initiatives have attracted in the media. Yet it does suggest that many local authorities understand they can learn from best practice in the private sector and use businesses to help fulfill their vision.

More than 1 in 2 executives identified security as an essential part of smart city, with 21 per cent saying the same about privacy

From definition to delivery

The development of the smart city

There are, according to the thought leaders who engaged with the SmartCities-World/Philips Lighting 2017 survey, five essential requirements for organisations looking to create smart cities. They are:

Open data/ sharing data

Citizen engagement

Enhanced citizen services

Digitised government services

Integrated public transportation

Other popular suggestions were connected lighting infrastructure (17.6 per cent) and connected health programmes (15.7 per cent).

Almost two out of three managers identified open data/sharing data as the most important factor. Yet the public sector has become, often through bitter experience, so risk averse when managing data that sharing goes against the grain.

The complexities involved in classifying data – and how it should be shared – are too extensive to explore fully here but, as Brenna Berman, chief information officer for Chicago, has observed: "Every city has to tackle privacy more directly now, because we manage, share, and collect data in a more publicly visible way than ever before. As residents become more savvy about data usage and IoT solutions become more expansive, cities need to get serious about telling residents how data is being used and how it is being protected. The best way to do that is through resident engagement."

Local authorities need to address such concerns if they are to make the most of their data – as Helsinki has done. Authorities in the Finnish capital began financing statistics bureaus more than a century ago – you can see the results online at City Of Helsinki Urban Facts – and is now sharing data with three neighboring cities in a body called Helsinki Region Infoshare to give the authorities a more rounded picture of life in the metropolitan area.

The landmark projects to emerge from this collaboration include R, a software package designed to make it easier for researchers, journalists and citizens to access city data and BlindSquare, a smartphone app that draws on data from transportation systems, public services and social networking app Foursquare, to help blind people navigate Helsinki.

The key for tech developers in Finland is that the data they are working with is free to use and in standard formats. If it wasn't, they would be looking elsewhere for business.

Data cannot be shared – and smart cities cannot fulfill their potential – if systems cannot work with other systems. With technologies and standards constantly, and rapidly, evolving, many cities recognise the need to avoid getting locked into a single vendor's integrated solutions which lead, inevitably, to siloes of information and services and make it much harder to share data with citizens, developers and other cities.

Open data cannot work with closed minds. To engage with citizens is to empower them and that loss of control, in organisations that have historically made top-down assumptions about what users need, remains a cultural challenge. Innovative local authorities already recognise that creating a smart city goes beyond automating existing processes and launching new apps. As Peter Drucker, the most influential management thinker of the 20th century, said:

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Spotting and filling in potholes has become a popular initiative in Boston

"Culture eats strategy for breakfast". The road to smart cities starts with a new mindset, not new technology.
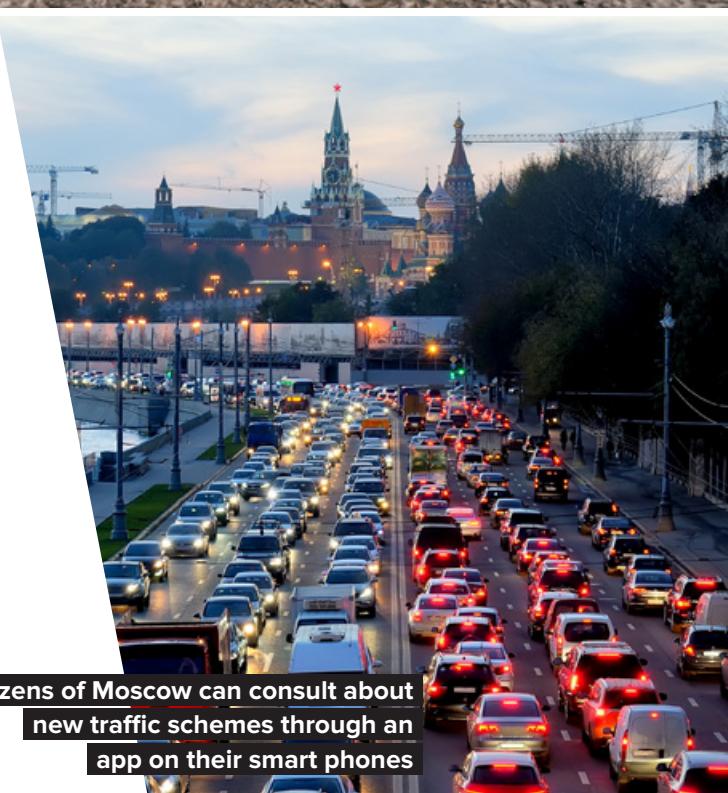
Changing mindsets internally is a prerequisite for changing them externally. As Tiago Peixoto, governance specialist at the World Bank, observed: "There are going to be cycles about leveraging collective intelligence. With cable TV in the 1970s, everyone thought we can have what they call tele-democracy. Then in the 1990s and 2000s, you have e-democracy and e-participation, particularly in Europe. Despite the generous funding and favourable institutional conditions, many of these projects are not there any more. Yet now, in the open government arena, we have a second wave."

Peixoto is not arguing that citizen engagement is unattainable or irrelevant. As he says, "government without citizen engagement is like a restaurant without a menu", but he says that if information is to deliver better, digitised public services it needs to be tied into management processes. Most important of all, Peixoto says, citizens will only engage with governments if they believe it will make a difference. In an era when public trust in the state – and politicians – is at historic lows, this is more critical than ever.

Making a difference can mean any tangible improvement in people's lives – from spotting and filling in potholes (a popular initiative in Boston) to consulting about new traffic schemes (as Moscow does through an app) to integrating public transportation (Atlanta links its transit app MARTA to the Uber app Go). The improvement of public transportation – which necessarily involves the integration and digitalisation of the service – is, in many cities, the most powerful proof that the authorities are listening, acting and determined to make citizens' lives better and easier.

Citizens of Moscow can consult about new traffic schemes through an app on their smart phones

By using BlindSquare, a smartphone app that draws on data from transportation systems, public services and social networking app Foursquare, to help blind people navigate Helsinki

Atlanta links its transit app MARTA to the Uber app Go

What part does the Internet of Things play in the smart city?

The IoT is not a magic wand that can suspend the laws of time, space and budgets, but it is an exciting new technology that, used wisely, can expedite the creation of smart cities. The key for executives is to look beyond the hype and identify where the IoT is best put to use. Different cities will have different 'bests', as the SmartCitiesWorld/Philips Lighting 2017 survey shows.

Just over one in three managers said that the IoT's most important role was to revolutionise the collection of data for planning and decision-making. That belief was shared by another 15.8 per cent of managers who said it would be vital to prosperity and innovation on the grounds that what can be measured can be changed. Some executives seem to regard the IoT as a kind of lifeline, with 12.9 per cent believing it can help ease the strain on urban resources. Costs were also on the agenda for some but often as part of a broader agenda to streamline processes and encourage joined up thinking.

Data can help achieve these goals but only if governments separate the signal from the noise. Managers also need to be realistic about the power of information to sway decisions. On many issues, an organisation's values – as interpreted by managers – will have as much bearing on a decision as the information at hand. You also need to have information on the right things – having the date to improve traffic flow may be helpful, but in many cities it would be more useful to upgrade public transportation.

The IoT is already making a difference to urban lives in cities across the globe, but there is so much more that could be done. Sadly, the message isn't always heard in government's upper echelons where IoT and, by extension, the smart city concept, can be seen as a gimmick, quick fix or image enhancer.

The US government's smart city programme, through which 70 cities are awarded $1m in new investment, is well intentioned, but it probably costs each city more than that to repave one mile of a four-lane road. In many developed economies, billions of dollars that could be invested in using IoT to improve cities is being used to maintain an infrastructure that is no longer fit for purpose.

One role for the IoT that managers did not identify is to digitally empower citizens. As Adam Dennett, lecturer in smart cities at the University of London, said recently: "A smart city will be irrelevant to most of its inhabitants, unless they can learn how to use new technology. Until more people can pull live data from an API or set up a sensor network to monitor air pollution, smart cities risk being seen as little more than a marketing tool for big business."
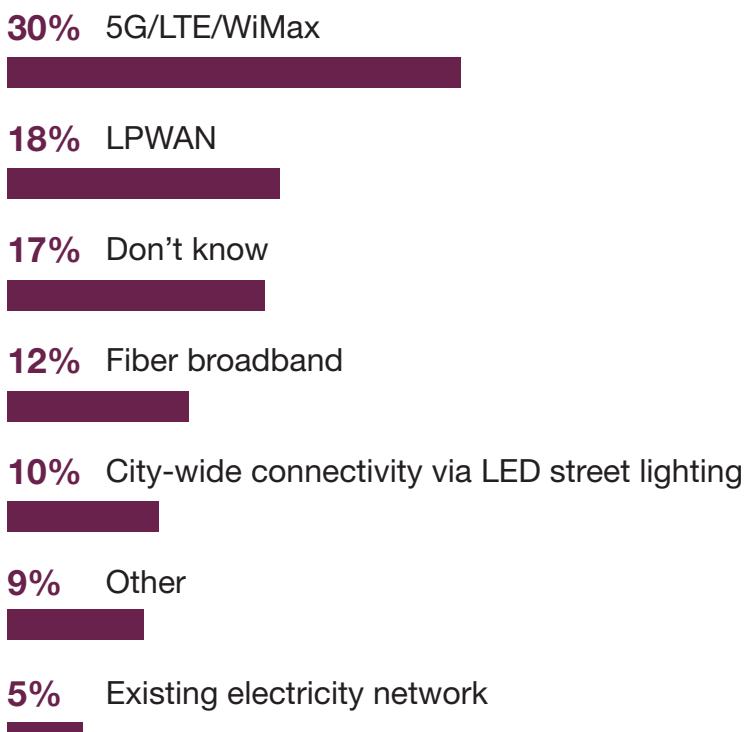
Only connect: the question of networks

Not all networks are created equal. Every organisation investing in this technology will calibrate such variables as range, bandwidth, power usage, intermittent connectivity, interoperability and security in their own way. How they prioritise those factors will ultimately decide which network – or more likely networks – they need to deliver the connectivity that is the foundation of any smart city.

The SmartCitiesWorld/Philips Lighting survey provided no clear consensus about the way ahead, probably reflecting the plethora of choices managers face. Just under three out of ten respondents believed that 5G/LTE/WiMax network would be the most effective, 17.8 per cent chose LPWAN while 16.8 per cent were honest enough to admit they didn't know. Other suggestions were the low power, low cost IoT network LoRaWan and the Wi-SUN Field Area Network.

The vast ecosystem of connectivity solutions may get more standardised but it won't necessarily get any easier to understand. There are some obvious trends – such as the shift towards wireless – but more solutions keep emerging, especially from Bluetooth. The overriding imperative for managers is probably not to bet the farm on one solution. As one manager put it, the means is less important than the end – ubiquitous connectivity – and that will probably be achieved by combining all, many or a few of the networks that are currently available – and many others that we haven't conceived of yet.

Which IoT network do you think might deliver the most efficient form of connectivity?

30% 5G/LTE/WiMax

18% LPWAN

17% Don't know

12% Fiber broadband

10% City-wide connectivity via LED street lighting

9% Other

5% Existing electricity network

Ubiquitous connectivity will probably be achieved by combining all, many or a few of the networks that are currently available – and many others that we haven't conceived of yet

How to make implementing smart cities easier

The factor that would make the biggest difference to the success of smart city programmes, in the eyes of survey respondents, is not technology or funding but visionary leadership. That is what 55.7 per cent of executives are crying out for.

In the public sector, it is often safer to do today what you did yesterday. Many governments have effectively admitted as much by incubating innovation hubs to challenge the status quo. Yet to lead change is to take risks and the media's ruthless scrutiny of the public sector – which, in many countries, starts with the assumption that taxpayers' money is being wasted – hardly encourages civil servants or politicians to think outside the box.

Despite such pressures, the considerable progress in such diverse cities as Barcelona, Seoul, Copenhagen, San Francisco, London, Helsinki, Singapore, Mannheim and the French commune of Saint-Suplice-la-Foret is testament to what can be achieved by enlightened leaders inspired by a long-term vision.

That vision needs to be inclusive, encouraging collaboration between agencies and across departments, a need identified by 44.3 per cent of respondents. Top down command and control management will not genuinely unite stakeholders in pursuit of a common goal – nor will it encourage the sharing of knowledge that 26.8 per cent of executives believe will smooth implementation. Almost one in five of those surveyed believed there was merit in learning from – and with – other smart cities.

Slightly more than one in three executives consider that creating a smart city task force would expedite change. Task forces are popular but their roles vary. In Baltimore, a task force of the great and good effectively laid out paths for the city's digital future, a vision now being studied by University of Maryland researchers. In India, where task forces proliferate, such bodies have been created in Ajmer, Allahabad and Visakhapatnam. The latter, a financial hub and port on the Bay of Bengal, hosted an agricultural hackathon, under the aegis of Bill and Melinda Gates, in November.

The fashion for task forces can provide the perfect alibi for those who are determined to resist, delay or frustrate change. The mere existence of such an organisation can encourage complacency about how much progress is being made. That said, task forces can act as a useful, high-profile statement of intent, drive engagement with the community and keep change on track.

Yet if cities are to become truly smart, the new mindset has to be embedded in the organisation. If a local authority's smart city programme becomes the exclusive preserve of a group of managers, supported by IoT-savvy technocrats, it will take longer to fulfill expectations.

Fulfilling – or better still, exceeding – expectations is critical in securing funds. A bigger budget would, 26.8 per cent of managers say, make it easier to deliver a smart city. Yet the public purse is not as full as it was and – from Tokyo to Tallinn – the battle for its contents is fiercer than ever.

In arguing their cause, leaders of smart city initiatives might do well to ground their vision in the difference they can, reasonably quickly, make to citizens' everyday lives and to the organisation's costs. The proposition that smart technology could reduce crime rates by 20 per cent should intrigue most mayors. Those who control the purse strings in the public sector will be receptive to any innovation that is will reduce costs or boost revenues. Barcelona wins on both counts here – saving $58m on water and generating an extra $50m a year through smart parking.

Yet ultimately, the case for funding Barcelona's smart city projects rests on something every politician can understand – jobs. The council estimates that the application of IoT systems has created 47,000 jobs. If smart cities are to become the 'new normal', managers need to remember that success isn't defined by technology, but by outcomes.

Why creating smart cities is harder than it needs to be

"Not within the scope of business as usual". That is one manager's succinct summary of the problems hindering their organisation's smart city projects. The remark is a salutary reminder that many local authorities – even those that understand why they should invest in smart cities – are hard-wired to deal with urgent crises at the expense of important strategic issues.

The manager's remark was echoed by 1 in 10 of respondents who said, unequivocally, that they did not have the capacity to implement a smart city programme. (The same proportion said they lacked in-house expertise or experience.) Those frustrations were shared by 12.4 per cent of managers who lamented "short-term mindsets", 6.2 per cent who identified "lack of political will" as an obstacle and 5.1 per cent who felt they lacked stakeholder support. Collectively this type of response came in at over 30 per cent.

The two most common inhibitors – budget limitations (highlighted by 22.7 per cent of respondents) and the need for more supporting infrastructure (a concern for 18.6 per cent) – show that securing investment in smart city projects is no easy task. The key to unlocking funds may be to establish proof of concept with small pilot projects that deliver the right outcomes and strengthen the case for further investment.

Most common blockers to smart city development

12.4%	**6.2%**	**5.1%**
of managers blame lack of smart cities on short-term mindsets	identify a "lack of political will" as an obstacle	lack stakeholder support

San Jose's investment in telco-integrated street lighting is a case in point. Ericsson and Philips Lighting collaborated to create a lightpole site that delivers mobile broadband connectivity through smart LED street lighting. The system improves mobile connectivity and saves the Californian city money – the remotely managed LED lights can save up to 70 per cent on energy costs. In nearby Los Angeles, installing 215,000 smart LED street lights cost the city $57m but delivers annual savings of $9m – so the city knows it will get its money back within seven years. Where possible, a good way to manage "short-term mindsets" is to deliver short-term gains.

When starting small, it is critical to think big. If each smart city initiative is part of a coherent, long-term strategy, you can anticipate the future – by, for example, making sure that the smart traffic network you are installing can be expanded to handle smart water meter data at a later date. Having a strategic vision reduces the risk that innovative hubs will become isolated, stuck in siloed departments.

What the survey findings do suggest is that there is a need for a stronger evidence base to support smart city projects. Tom Saunders, a senior researcher at British innovation foundation Nesta, has said: "This could be something as simple as blogging about the experience, but cities could also form networks to share the lessons from their IoT pilots."

Many local authorities – even those that understand why they should invest in smart cities – are hard-wired to deal with urgent crises at the expense of important strategic issues

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Being smart about getting feedback

What does success look like? That question has haunted change management since the Industrial Revolution. It is particularly critical for managers involved in the implementation of smart cities. The famous observation by American management thinker Rosabeth Moss Kanter that "Everything looks like failure in the middle" seems particularly relevant to managers trying to lead transformational change on complex projects within the public sector.

The SmartCitiesWorld/Philips Lighting survey clearly shows that most executives seek feedback from the public. They do this in a variety of ways – user trials (18.6 per cent), public consultations (15.5 per cent), focus groups (11.3 per cent) and digital surveys (10.3 per cent) being the most popular. This collective feedback in one way or another account for 56 per cent of responses.

The most striking finding is that 18.6 per cent admit that their feedback processes are not good enough. There can be specific reasons for this – in 2015, a public consultation by Agra, a northern Indian city with a population of more than 1.5m, generated just 10,000 responses, undermined by lack of internet access and confusion about how to submit feedback. (It later launched a more compact app to engage citizens.)

The pressure to execute can encourage those who regard user feedback as a box-ticking exercise. Yet many leaders realise that if they don't listen to the public before and during a project, they are inviting some unwelcome user feedback at the ballot box. One city that has taken this issue seriously is Santa Monica that has created an index of well-being to measure its progress and appointed Julie Rusk as chief well-being officer.

In 2015, a public consultation by Agra, a northern Indian city with a population of more than 1.5m, generated just 10,000 responses, undermined by lack of internet access and confusion of how to submit feedback

Types of public feedback responses

18.6% User trials

15.5% Public consultations

11.3% Focus groups

10.3% Digital surveys

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Being smart about stakeholder advice?

To embark on a smart city project is to travel along a road not taken. As familiar as the concept is in general terms, its application in a particular metropolis will inevitably be shaped by a unique combination of social, geographical, environmental, technological and financial factors. In consequence, benchmarking success can be very difficult – measuring the success of Songdo, built as a smart city on reclaimed land in South Korea, against the performance of a sprawling metropolis such as Los Angeles is hardly comparing apples with apples. That doesn't mean each city can't learn from the other but it does suggest that simply importing ideas from one to the other would be misguided and risky.

Against that backdrop, it is no surprise that managers implementing smart city projects turn to a variety of sources for advice – most notably businesses (25.8 per cent), city leaders (16.5 per cent), private utility companies (15.5 per cent), citizens (13.4 per cent) and planners (12.4 per cent). This does highlight the role that businesses – especially large groups who can draw on their global experience and expertise – play in ensuring that smart city transformation projects actually deliver.

There is considerable scope, though, for more collaboration between urban innovators, along the lines of the partnership between Amsterdam and Barcelona. Although ideological fissures still influence decision-making on many issues, there is a burgeoning global marketplace in public sector initiatives that work, whatever the political agenda that has driven these ideas.

Which stakeholder do you turn to for advice and guidance with regards to smart city implementation?

26% Businesses

16% City leaders

15% Private companies e.g. utilities

13% Citizens

12% Planners

10% Consortium's

4% Other

2% NGOs

Smart city application in a particular metropolis will inevitably be shaped by a unique combination of social, geographical, environmental, technological and financial factors

Case study

Changing Jakarta in seven months

When it comes to creating smart cities, momentum can be critical. In Indonesia's bustling capital Jakarta, the replacement of conventional street lighting – including many wasteful mercury-vapour lamps – with nearly 90,000 street luminaires with energy efficient lights, took just seven months. Each day, around 430 light points were connected to the system, making it the fastest street lighting retrofit and remote management project Philips Lighting has ever carried out.

The CityTouch installation enabled Jakarta to upgrade half of its street-lights, control and monitor the new system remotely and save money on its energy bills. Staff in the city's lighting office can match illumination levels to needs in a particular district. They have already found that they can save energy by reducing lighting levels by 50 per cent in the evenings after the city's rush hour is over. With access to status updates and automatic notifications of failure, staff can send repair crews out only when and where they are required.

Jakarta launched its smart city programme in December 2014 with Qlue, a crowdsourcing smartphone app through which people can report such incidents as crimes, fires or waste knowing that their information will be sent to the relevant public officials. (This app is also now being used in Malaysia.)

The sheer scale of this metropolis is a challenge for government – the city itself has a population of just over 10m but if you include the suburbs that rises to more than 30m, making it the largest urban area in the world after Tokyo. In area, Jakarta is three times the size of Kuala Lumpur. The city is thriving – it has the 34th fastest-growing economy among the world's 200 largest cities – but officials recognise that it needs to grow more efficiently, especially in its use of resources.

The transformation in Jakarta's street lighting is a landmark achievement and an inspiring precedent encouraging the city to invest in other smart city projects. One of the most ambitious is Jakarta Jaya, the creation of a "green Manhattan" on a reclaimed island which could be home to 1.9m people and help prevent floods in the Indonesian capital.

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Case study

How improving IoT infrastructure is transforming Buenos Aires

Every mayor would like to run a smart city. Yet much of the rhetoric around the development of smart cities is all about new systems of automation. For many cities, the more realistic – and pressing – focus is on upgrading their legacy systems and infrastructure withy smart technology.

This was the political and financial reality in Buenos Aires. The metropolitan area is home to 14.5m people – 38 per cent of the country's population – with around 3m living in the centre, where there are more people per square kilometer than in San Francisco. The city has not been immune to the economic turbulence that has marked Argentina's recent history – the last crisis struck in 2016 – but it has proved resilient and its economy is now growing.

The city's challenges, as administrators sought to cement economic recovery, were hardly unique: budgets were under pressure (after the elimination of electricity subsidies); public works were exacerbating traffic congestion and, not coincidentally, the citizens were becoming increasingly frustrated with the quality of their daily life.

Convinced of the need for change, administrators, led by mayor Mauricio Macri, set out to turn Buenos Aires into a smart city by using the IoT to improve infrastructure, upgrading legacy applications, developing new citizen-centric systems and using new analytics to create insights that could be turned into action. One major element of this transformation was a public-private partnership with Philips Lighting to deliver a smart, scalable lighting system to make Buenos Aires safer, more sustainable, energy efficient and reduce light pollution.
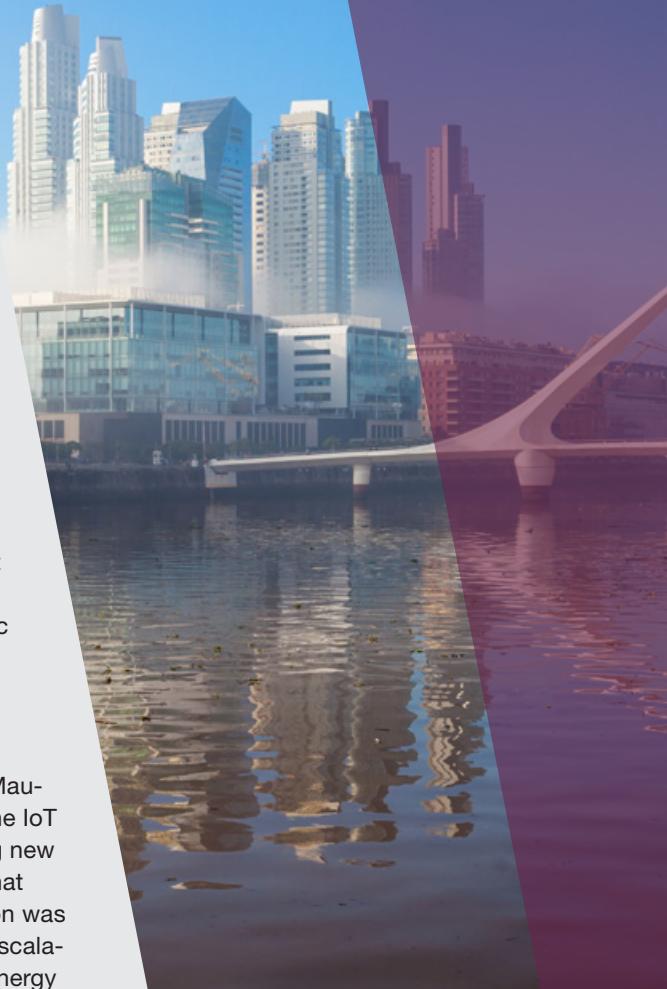
The solution involved the installation of 91,000 streetlights, including 51,000 energy-efficient LED luminaires, which has renewed 70 per cent of the city's lighting stock. CityTouch, a sophisticated light management system, controls this network. Working with SAP, Philips Lighting provides cities with a 360-degree view of data on the SAP HANA platform. The beauty of this approach is that governments do not have to replace the entire system at once – they can implement new applications while working with existing infrastructure. Given that limitations on budget were identified as the greatest barrier to smart city initiatives by almost one in four respondents to the SmartCitiesWorld/Philips Lighting survey, this should make such projects easier to launch – and establish proof of concept.

The SAP HANA platform collects data from different departments, such as street lighting, waste management and traffic, and shares it through a single dashboard. With CityTouch, each light point in the network can be remotely monitored, switched and dimmed, saving energy and make the streets safer.

The white light of LED lighting illuminates streets more effectively, improving facial recognition and colour perception by the human eye – and security cameras. Because LED light doesn't radiate as much as traditional lighting, which means there is less light pollution and less waste, trees had to be pruned in some streets to help the light get through. The new LED lights are also cheaper to maintain than traditional lights and last five times as long.

Gustavo Verna, CEO of Philips Lighting Argentina, says: "CityTouch provides our customers with unique, flexible, sustainable and integrated lighting management solutions which we could not even have envisioned only a few years ago."

This ambitious lighting project will avoid the emissions of 23,600 tonnes of CO_2, halve the amount of power needed to light the Argentinian capital and, as part of a smart system design, reduce accidents. Such projects turn 'dumb' street poles into valuable digital assets as governments realise that lighting, when linked to cloud-based platforms and 4G mobile networks, can deliver accurate, real-time information about how clean the city's air is, how congested its roads are and how safe its citizens are.

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Case study

Philips Lighting reaches milestone 1,000th connected LED street lighting installation in Cardiff

Philips Lighting has delivered its 1,000th project using its Philips Lighting CityTouch streetlight management system. The milestone project, involving installing more than 14,000 Philips Lighting connected LED streetlights in the City of Cardiff, supports safety and security in the Welsh capital and will help reduce the city's carbon footprint through massive energy savings and increased operational efficiencies.

The network of street lights, monitored and controlled remotely by Philips Lighting CityTouch, provides Cardiff with a scalable digital infrastructure that may be upgraded to provide additional smart city services.

The installation of more than 14,000 energy-efficient Philips Lighting Luma LED street lights has been carried out by contractor Centregreat. Each light point is connected wirelessly to Philips Lighting CityTouch, which is used to monitor, control and manage the entire lighting network. This enables lighting managers to dim or increase the brightness of streetlights to meet the needs of the city at any given moment. For example, brightness levels can be increased near busy crossings or to help emergency services.

Philips Lighting CityTouch also offers a powerful lighting asset management capability. Through a web browser, the lighting manager has multiple screens and a map-based view of the city's lighting assets and workflows. Here network performance can be monitored in near real time, pinpoint faults and dispatch crews to precise locations.

Switching to connected LED lighting is expected to reduce electricity used for lighting by 60 per cent with estimated savings for the Council of more than GBP 750,000 per year.

Cardiff has approximately 360,000 residents and 20 million visitors a year. To determine the impact of lighting on the lives of its citizens, Philips Lighting and Cardiff City Council, along with consultancy firm Jacobs Ltd, researched public views on the city's current street lighting to assess potential options. The research also involved consultation with people with visual and hearing impairment. Philips Lighting CityTouch gives the Council the ability to remotely adjust the level of light for partially sighted citizens who may want brighter lighting outside their home.

"We looked at a broad range of factors when selecting our new connected lighting system. Our top priorities were to ensure maximum benefit for our citizens and capitalize on potential cost and energy savings. Philips Lighting has given us an infrastructure that will grow with our needs and provide quality light to make our citizens feel safer. With continual monitoring, we can now respond instantly – such as increasing light levels at peak times outside schools and hospitals," said Chris Jones, Lead Electrical Officer at Cardiff City Council.

"Our connected street lighting will contribute to a safer environment for the citizens of Cardiff and will enable the city to achieve savings in energy and enjoy operational efficiencies. It provides a scalable and flexible digital infrastructure which gives the city options for the future, such as inputting data into smart city dashboards or adding sensors that could, for example, monitor noise or traffic," said Jacques Letzelter, Head of Public Lighting for Philips Lighting. "It's fitting that Cardiff represents the 1,000th project to use our Philips Lighting CityTouch street lighting management system: a city and a technology shaping the future."

For further detail on the Cardiff case study <u>CLICK HERE</u>

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Case study

LA, a smart city pioneer through open systems

Los Angeles has always dared to try new things. The city has pioneered the use of digital, connected lighting by converting 140,000 of its 215,000 street lights to LED, and intelligently monitoring and managing 110,000 of them with the Philips CityTouch connected lighting management system. Together, these innovations have reduced the city's energy usage for street lighting by over 63 per cent, saving at least US$9.5 million annually in operational and maintenance costs.

As impressive as these results are, they're only the beginning. Together with Philips Lighting, Los Angeles is shaping the future by exploring new smart city applications that build on the connected lighting infrastructure to realise additional value beyond illumination.

The ability to add new applications and data streams to the digital ecosystem demonstrates the power of open systems. Smart city infrastructures that employ an open systems approach use defined interfaces and de facto standards to integrate a wide range of smart devices, gathering and analysing data from them to support new initiatives.

Philips Lighting created a pilot programme that uses an open systems approach to leverage the city's connected street lighting infrastructure:

• Lighting power grid monitoring uses the connectivity offered by CityTouch to allow the public lighting department to continuously assess the quality of the lighting network's power supply.

• Environmental noise monitoring uses an acoustic noise sensor (microphone) that builds on the smart city ecosystem, including the CityTouch connector nodes already deployed throughout Los Angeles.

Now the Bureau of Street Lighting can actively monitor sound levels on the street to understand activity levels, check compliance with regulations, and support the well being of citizens.

Network complexity, increasing power demand, and lack of effective fault monitoring increase the risk of power grid issues. Light poles equipped with CityTouch connector nodes and additional equipment acquire key power quality parameters continuously and at an unprecedented scale, supporting the Bureau of Street Lighting to assess the quality of the power supply to its lighting network.

Exposing this data to other city departments and utilities will enable grid managers to be quickly informed of outages. In this way, faults can be restored faster, benefitting both residents and local businesses. In addition, tracking power quality over a luminaire's lifetime alerts street lighting managers about upcoming maintenance needs, making planning more efficient and lowering operational costs.
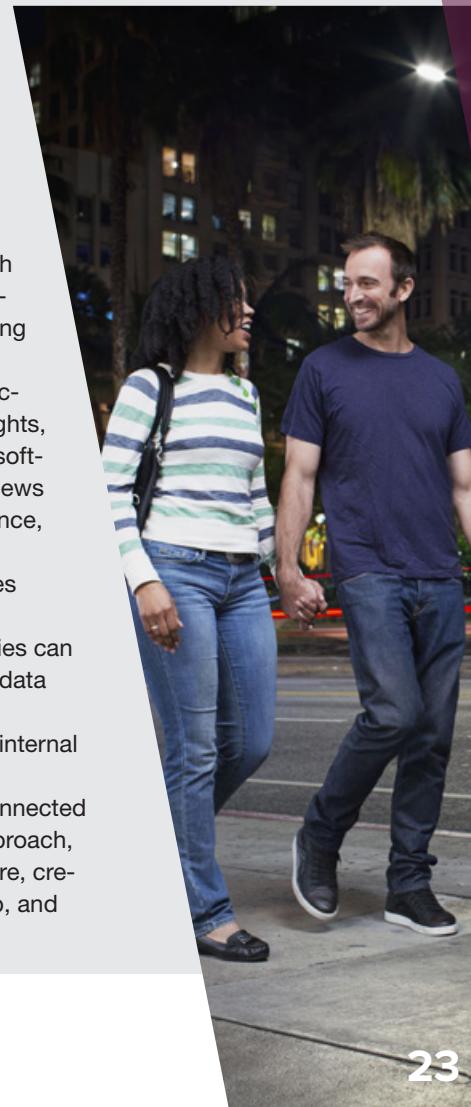
The city of Los Angeles is leveraging their connected street lighting infrastructure to actively monitor and manage noise levels on the streets. Using existing connected streetlights, the city has installed microphones to collect noise data at the street level. Visualisation software creates real-time and historical timelines using this data, along with map and list views of code violations and alerts. Such visualisations help the city to maintain code compliance, assess urban policy, and respond adequately to noise complaints.

Sharing noise data with the public raises awareness about noise pollution and provides quantitative evidence for the city's mitigation efforts.

The lighting power grid and noise monitoring pilots in LA are two examples of how cities can leverage open systems and the connected street lighting infrastructure to acquire more data about operations, both of the lighting grid and beyond. Since the data is available via the cloud, the city can visualise insights rapidly and facilitate additional dialogue with internal and external domain experts.

Philips Lighting is exploring many additional value spaces that leverage ubiquitous connected public lighting systems to yield new information and insights. With an open systems approach, cities like LA can add sensors and other smart devices to the public lighting infrastructure, creating a rich conduit for data that can support high-level decision-making, city leadership, and quality of life for the people who live there.

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Smarter cities powered by **connected** street lighting

New connected lighting systems like CityTouch can serve as a digital backbone for a city improving both the quality of life and light for citizens while delivering greater energy efficiency, reduced maintenance costs and improved management of lighting services.

It's just one of the many ways Philips Lighting is taking light beyond illumination.

innovation ✦ you

Learn more at philips.com/citytouch

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