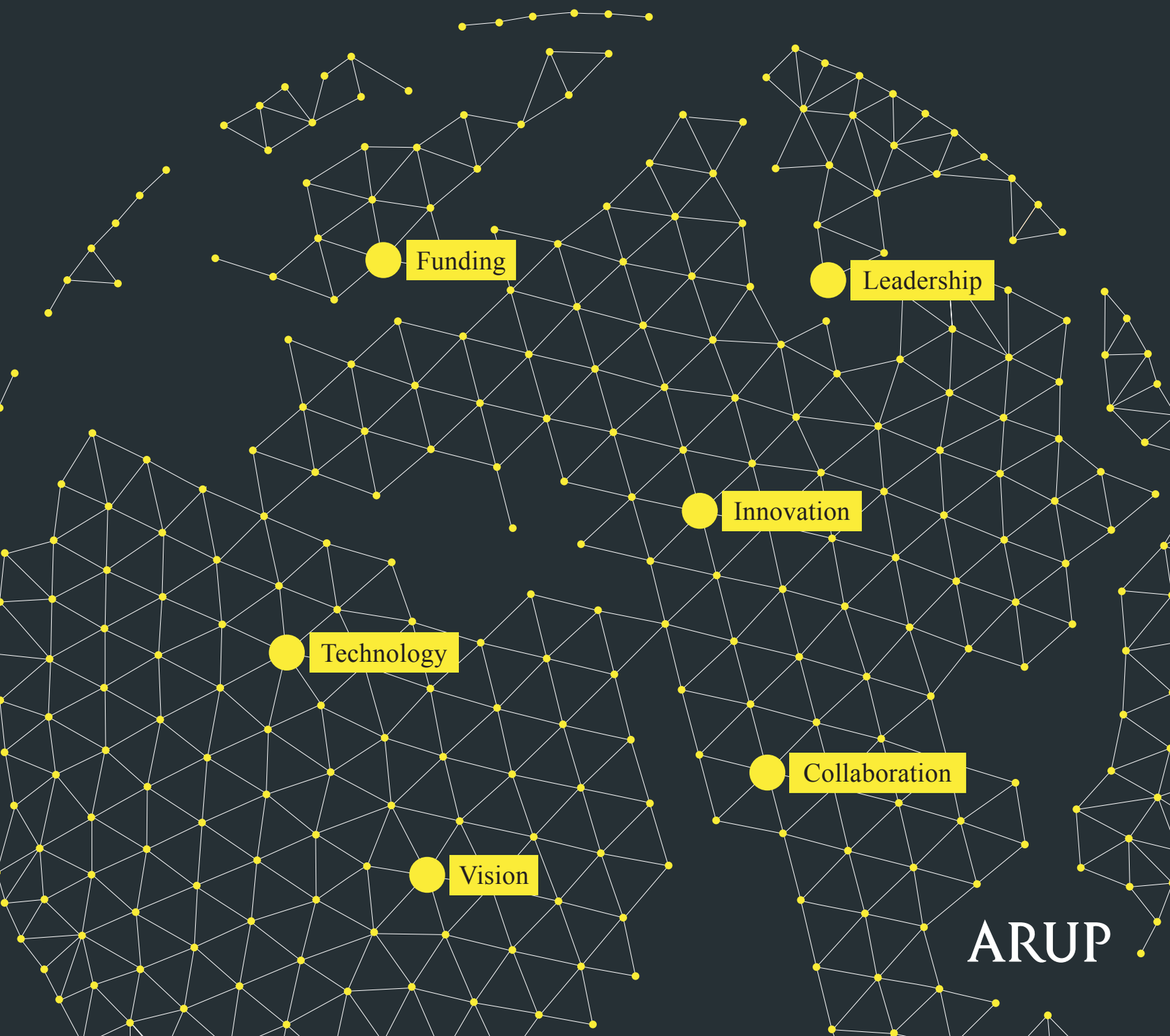
A2

NEW DIMENSIONS FROM ARUP | NO.13

Resilient Cities

Adapting to a changing world



ARUP

Resilient Cities

Resilience can mean many things to many people. It's widely accepted, however, that we all need to look closely at our businesses, the economy, our communities and at the environment around us to ensure that we can weather the impact of future events, both expected and unforeseen. This issue of A² takes a look at some of ways we can adapt and improve to make us more resilient in an ever changing world. We talk to Brian Kilkelly of the World Cities Network about the need for effective leadership and decision making. We look at methods to fund new technologies in a challenging commercial environment, speaking with Richard Miller from the Technology Strategy Board; and we consider how a collaborative approach can help us to manage our cities more effectively. Our contributors to this edition of A² share their views on just a few of the influences that impact on the resilience of our urban environments. I hope you enjoy reading it and find the content valuable. And if you have any feedback, we'd love to hear from you at a2@arup.com.

Alan Belfield,
Director, Arup

The future of buildings in 2050

Arup has launched 'It's Alive' - a new report that describes how buildings in our cities could look and function in 2050.

The study, undertaken by Arup's Foresight + Innovation team, foresees that structures will be fully integrated into the fabric of the city, responsive to changes in the external environment and designed for continuous adaptability according to real-time needs and demands of its users.

This forward thinking report is illustrated with a series of artist's impressions to demonstrate how the futuristic components - such as photovoltaic surfaces and algae producing bio-fuel pods - can theoretically enable buildings to produce food, energy and resources.

The report can be downloaded at http://bit.ly/XMo7Py

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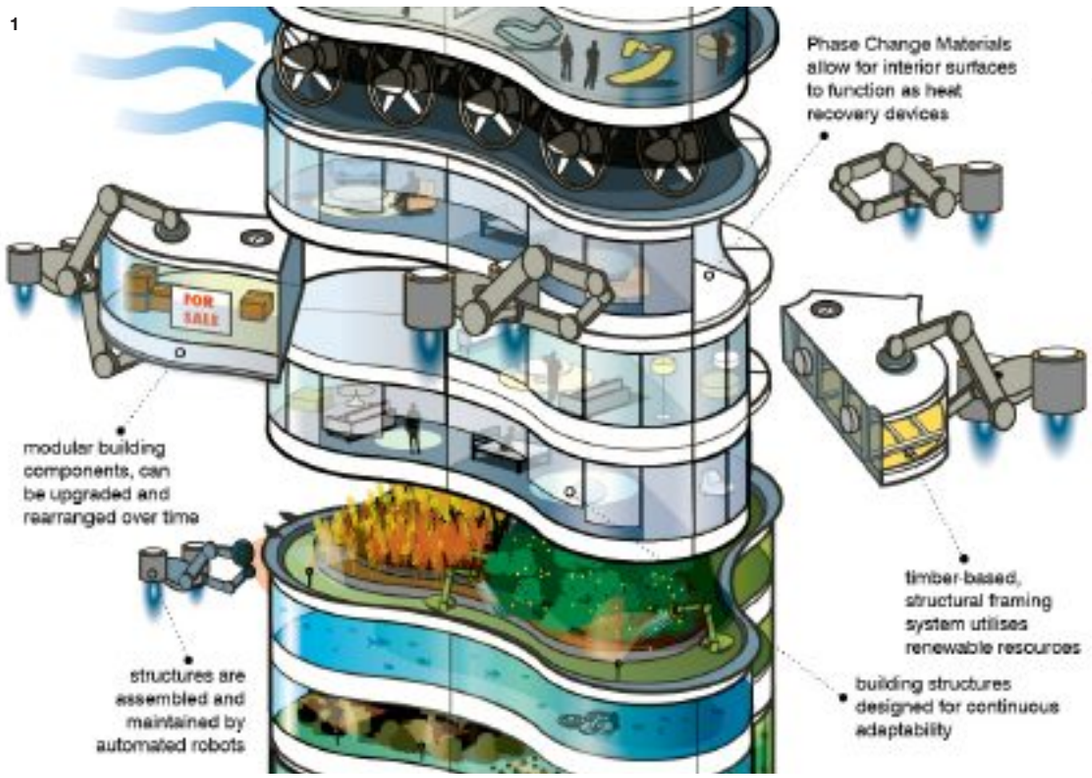

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Arup shows microalgae façade

Jan Wurm, European Research Leader at Arup, presented the microalgae façade system at the international trade show BouwBeurs in the Netherlands. Jan talked about the zero-energy house that will test the world's first bio-adaptive, a new façade system that uses live microalgae to provide shade and generate renewable energy at the same time.

The concept is designed so that algae in the bio-reactor façades grow faster in bright sunlight to provide more internal shading. The bio-reactors not only produce biomass that can subsequently be harvested, they also capture solar thermal heat – both energy sources can be used to power the building.

The façade is installed in the 'BIQ' house for the International Building Exhibition (IBA) in Hamburg, which opened on 22 March. Arup will lead a two year research project, funded by Zukunft Bau, monitoring the energetic and technical performance as well as the users' acceptance of this new technology.

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1 'It's Alive' futuristic components

2 Microalgae Facade

Best Environmental Consultancy Award

Arup won the Best Environmental Consultancy Award at the 2012 Sustainability Leaders Awards.

The independent market research agency, Accent, surveyed a cross-section of Sustainable Business magazine readers to determine the finalists.

The survey reviewed procurement habits, how businesses engage consultancies, the number of live projects and annual spend on consultancy services. The awards are accredited by the Royal Society for the encouragement of Arts, Manufactures and Commerce.

Shackleton epic journey completed

Shackleton expedition leader, Tim Jarvis of Arup, and mountaineer, Barry Gray of the Royal Marines, have completed the final part of the recreation of Shackleton's famous Antarctic rescue.

The two arrived exhausted and severely weather beaten at the site of the former whaling station at Stromness, the same location where Shackleton and his men raised the alarm that the crew of the Endurance needed rescue almost 100 years ago.

The harrowing three-day climb across South Georgia's mountainous interior followed in the wake of a gruelling 800 nautical mile ocean voyage from Elephant Island – the same journey Ernest Shackleton originally completed in 1916.

Tim commented: "It was epic, really epic, and we've arrived here against the odds. I want to pay tribute to the outstanding team of courageous men who did this journey with me – Barry Gray, Paul Larsen, Nick Bubb, Seb Coulthard and Ed Wardle. I could not have selected a finer or more capable team of people who braved the odds and achieved what at times felt like the impossible."

Advisor to Climate Futures Report

David Singleton, Arup's Global Planning Leader, has been selected as a panel member on the independent expert group advising on the development of the Australian Government's Climate Futures Report. The Report will assess how well Australia is placed to deal with the risks of climate change impacts. The Department of Climate Change and Energy Efficiency (DCC&EE) will also be consulting and seeking input from a broad range of stakeholders, including academia, industry and community sectors. The first instalment of the Climate Futures Report is expected to be released later this year.

Arup supports first Liquid Air energy report

Arup is part of a group producing a white paper to explore the energy and economic potential of liquid air, and whether it should - and can - become a new strategic sector in the global 'clean tech' ecosystem. The group includes leading industrial gases company, Messer Group, as well as academics, research institutions, industry and policy experts.

Liquid air is a new energy storage technology that many experts believe could solve some of our toughest energy challenges - including grid balancing and zero-emission transport. The technology enables energy to be 'banked', or stored, which is particularly helpful in dealing with excess off-peak energy and peaks and troughs in demand.

Arup and Messer are bringing their expertise to the project as well as sponsoring the report which is also supported by The Institution for Mechanical Engineers and the Centre for Low Carbon Futures.

Building Award for NIOO-KNAW

The NIOO-KNAW has been awarded the Dutch Building Award 2013 (buildings category), at the International Buildings trade fair earlier this month.

Arup was responsible for the structural engineering on the Netherlands Institute of Ecology, including carrying out a study on the efficiency and sustainability of construction materials. A concrete skeleton was used as part of the building services concept. The concrete was made as sustainable as possible by using concrete rubble as aggregate and incorporating granulated blast-furnace materials into the mix.

The jury called the architectural expression 'powerful' citing the choices made towards sustainability as innovative. NIOO-KNAW has also won the Golden Pyramid Award and the Timber Award.

Southbank Centre appoints Arup on refurbishment project

Southbank Centre, the UK's largest arts centre, has appointed Arup to project manage the extensive refurbishment of the Queen Elizabeth Hall, Purcell Room and Hayward Gallery complex and provide structural engineering services for the project.

The refurbishment and renewal project will bring the performance spaces and galleries in the complex up to the standard of the recently transformed Royal Festival Hall and will provide better access; substantial upgrading of the stages and galleries and back stage areas as well as addressing worn out services.

Arup has a long standing relationship with Southbank Centre having worked on the original designs in the 1960s. The firm is working closely with both Southbank Centre and the architects Feilden Clegg Bradley Studios, who were appointed to develop design proposals for this part of the 21-acre site.

Arup named one of the 'Most Innovative Companies'

Arup has been named by Fast Company as one of the 'World's Top 10 Most Innovative Companies in Architecture.'

This list is Fast Company's annual guide to the state of innovation in the economy, featuring the businesses whose innovations are having the greatest impacts across their industries and our culture as a whole.

Fast Company's staff recognised Arup for 'engineering a madcap vision of the sustainable future.'

3 Tim Jarvis, Mountaineer and Senior Associate, Arup

4 David Singleton, Global Planning Leader, Arup

5 London's Southbank Centre

6 Offshore wind turbine

BIS Global Market and UK Capability in Future Cities Study

Arup has won a commission from the UK Government Department for Business, Innovation and Skills (BIS) to assess the global market opportunity for future smart city projects, and review the UK's capability in the field.

Arup will inform the UK Government's Industry Strategy on the Information Economy which will cover government policy on the UK's Smart City/ Future City industry. Our team will also produce case studies on leading projects around the world that illustrate the reality and potential of the Smart/ Future City industry and the impact on cities and citizens. The report is due for publication in early summer.

Rio 2016 Olympics venues appointment

Arup has been appointed for the design of two venues for the Rio 2016 Olympic Games – the COT (Olympic training halls) and the Velodrome. The COT is the largest sports venue of the Games and for both the COT and the Velodrome, Arup has teamed up with local Brazilian design firms.

On the COT venue, Arup is working with RioMais, the private group that won the concession to develop the main Olympic site in Rio. Arup is providing the structural, mechanical, electrical and public health engineering as well as sustainability consulting services.

On the Velodrome, Arup is providing structural analysis of the roof and sustainability consulting and is working with the Rio Mayor's office EOM (Empresa Olímpica Municipal), which is responsible for the design and construction of a number of the Games venues.

Ofgem policy proposal

Coinciding with the latest energy bill reforms, Ofgem (Office of the Gas and Electricity Markets) has published its proposals for updating the offshore transmission license for future tenders - helping to shape the future of UK energy policy.

Arup's Transaction Advice team delivered two reports for Ofgem – 'OFTO Availability Incentive Report' and 'Technical Support for the Enduring Regime' – that have played a significant part in informing Ofgem's policy positions for future Offshore Transmission Owner (OFTO) tenders. These reports investigate the technical and commercial aspects of delivering and operating the transmission assets that will connect future offshore windfarms to the onshore grid.

For more information on the consultation, the 'OFTO Availability Incentive' report and the 'Technical Support for the Enduring Regime' report, visit the Ofgem website.

Big decisions

World Cities Network chief executive Brian Kilkelly on why fast and effective decision-making will help cities adapt to a changing world

"Cities have to deal with the impact of population growth, climate change, urbanisation, economic stress, changes in lifestyle and resource depletion," says Kilkelly. "To address these, they need to rise to the challenge of creating effective decision-making processes, whilst being realistic about what they can achieve."

Businesses are already feeling the impact, Kilkelly points out. They are at risk from severe events; damage to the US East Coast from storm Sandy is estimated at as much as $50bn, for example; and on a day-to-day level many are seeing costs for resources such as energy rise dramatically.

Yet business can boom in cities that create the right environment. "Vibrant, high quality places help businesses attract the top talent they need," says Kilkelly. "For example, I'm hearing that in the US, firms are choosing to move away from Silicon Valley into the heart of San Francisco because they want to be in a more vibrant community setting. They want more flexible, adaptable office space, with high environmental standards."

He argues that, if businesses and cities are to flourish together, resilience is vital. "Resilience affects whether cities can recover quickly from acute stresses such as storms or a sudden shift in the economy," he says. "It's also about whether cities can deal with chronic stresses – like dealing with pressure for housing by adapting and increasing the current housing supply."

For Kilkelly, delivering resilient cities is as much about the decision-making process as it is technical innovation. "There are great technological and design solutions out there for many of the challenges cities face. But I'd argue that we know what we need to do and we know we can do it – technically speaking. The real challenge is making the tough decisions to invest and make things happen. This takes leadership."

"Vibrant, high quality places help businesses attract the top talent they need."

"Just look at how long Crossrail has taken to come about in London," he continues. "We've known it was needed for some time but it's taken decades. Cities simply can't afford to wait decades before putting solutions in place. They must speed up the decision-making process – because the longer they leave it, the more it will cost and the harder it will be to deliver."

Kilkelly is adamant that city authorities must lead the way. "Mayors and city leaders are in the best position to take the lead," he says. "They need to work closely with the private sector – as the best ones already do. And they need states and governments to cede them enough power to effect change."

"Of course, you need strong leaders who can win the trust of businesses and the local community," he points out. "In the recent UK elections only one mayor was elected from a potential ten – Bristol elected a mayor but other cities chose not to have one. Does this point to a lack of confidence that we've got the right sort of people to lead our cities?"

Any lack of leadership could be problematic – because Kilkelly believes cities simply have no choice but to get on with addressing their challenges. "Things are moving so quickly that cities simply have to take decisions," he says. "Investors are looking for engagement and proactivity from the city leadership. So there's little option but to be out at the front. The leadership

style needed today is collaborative, it builds trusted relationships that can deliver through times of great change."

Some cities, Kilkelly points out, are already demonstrating fast and effective decision-making. "When New York's Department of Design and Construction wanted to bring all its police academy facilities under one roof it was projected to take six years," he explains. "They halved this timescale by using building information management (BIM) to enable all contractors and suppliers to work together."

"Creating resilient cities is in the interests of the business community."

"Another example is Helsinki. The city recently revised its building regulations to permit wood-structured buildings over two storeys high. This reflects advances in materials and enables more sustainable choices in construction. It's an example of how good decisions, even on small issues, can help create change and it shows the benefits of aiming for realistic, achievable actions."

So cities need to take swift decisions about the solutions they need, but in our age of austerity, who will fund them? "I think there are opportunities for public-private collaboration," says Kilkelly. "Creating resilient cities is in the interest of the business community so we need to find ways to build trust between the sectors and to widen our pool of partners. There is an interesting role for large infrastructure providers at the urban level."

"There are also opportunities for reducing risk," he continues. "The insurance industry picks up the tab for damage caused by natural disasters. Losses continue to rise year on year globally. Could some of these losses be mitigated if the insurance industry were to work with cities? I think there's an interesting conversation to be had about this."

"There's also a lot of talk about pension funds. They want investments that will give them secure long-term returns and many of the infrastructure projects that cities need to put in place fit this profile. Traditionally, pension funds have been involved in large infrastructure projects like bridges and roads. So I think it will be interesting to see whether they can also become involved in city-level infrastructure."

For Kilkelly, it comes back again to decision-making. "There are many options for making cities more resilient and for funding these investments," he says. "But the burning question is whether we have the processes and decision-making structures to choose the right ones quickly enough."

World Cities Network

An independent body, World Cities Network was created to improve the resilience of cities. The organisation facilitates sharing ideas between city leaders and professionals in the real estate, technology, and urban infrastructure industries.

Its objective is to create a network of people who recognise that by coming together to share insights, they can generate much greater impact for cities. To help do this, World Cities Network provides a learning network where ideas can be shared and actions planned in a confidential environment.

Over the next twelve months, World Cities Network will hold a series of workshops and round-table discussions with cities on issues such as energy network resilience and how insurance industries and city leaders could collaborate to mitigate potential losses.

More information is available at worldcitiesnetwork.org.

Turning innovations into investable propositions

Funding sustainable technology

Solving the problems that pressures such as climate change and urbanisation create for cities around the world will require sustainable technology on an unprecedented scale. With the right approach, this could create opportunities for technology businesses, investors and the cities themselves.

Richard Miller is head of the Technology Strategy Board, the UK's innovation agency. He believes the key is for cities to be managed in an integrated way. "We can't create cities with strong economies, excellent quality of life and reduced environmental impact simply by optimising individual components," he says. "There's lots of work happening on individual systems like energy, transport or healthcare. But the missing link is integration."

Miller believes that integrating city systems will create huge opportunities for sustainable technology: "We think that the global market will be in the order of £200bn per annum by 2030," he says. McKinsey has identified 400 midsize cities in emerging markets that are poised to undergo rapid expansion, generating nearly 40% of global growth in the next 15 years. So the big opportunity is in retrofitting and upgrading existing cities."

In response to this, the Technology Strategy Board has set up the Future Cities Demonstrator. After Glasgow won the competition for funding, it will receive up to £25m of public money to become a large-scale demonstrator of how integrating city systems can add value. "The project will enable businesses to test new solutions for connecting and integrating city systems in a real city environment," says Miller, who manages the Board's Future Cities programme.

The demonstrator project will show what's already possible but, says Miller, there's an equally large challenge in bringing the next generation of technologies to the market. "One of the biggest barriers in innovation is making the connection between the market need, expressed in market terms, and the technical capability," he explains. "This is a really important part of making innovation flow and we've identified a gap there."

"Cities in the UK are struggling with really complicated problems in areas like health, migration, fuel poverty and the economy. They've struggled to articulate what they want in terms of engineering solutions to these problems. They need to become better customers for the businesses developing the technology."

"At the same time, there are businesses out there with solutions," Miller continues. "And those businesses need to bring the solutions to the attention of city leaders and articulate what they might mean for that city. For example, there are companies doing fantastic work on ultra-low-energy sensors. These can be embedded throughout a city's systems and communicate through mesh networks to monitor what's happening in that city in very fine detail. But this needs to be explained in a way that shows cities how it could solve their problems."

This is what the Technology Strategy Board's Future Cities Catapult hopes to help with. When it's set up later this year, it will join business, city governments and academia in a unique collaboration, enabling business to develop products and services for the cities of the future. The catapult will test business solutions in large-scale demonstrator projects, including the one in Glasgow.

One organisation working to develop these business solutions is MASP, a joint venture between Arup and Mitsui. Aimed at getting low-carbon investments off the ground, MASP is initially focusing on low-carbon transport and distributed energy management.

Amanda Bailey, MASP's chief technology officer, highlights some of the barriers the joint venture faces: "One of the main barriers we've found is finding a technology at the right stage of development," she says. "We don't want something that will only come to market in ten years time. But equally we don't want something that's already commercially viable, because everybody would be doing it. So we look for something that will be commercially viable or have a recognisable

Wireless electric buses for Milton Keynes

An innovative approach to charging electric buses heralds a quieter, cleaner future for public transport in Milton Keynes in the UK.

In a trial planned and managed by MASP, diesel buses on the Number 7 route will be replaced by electric buses that will run seven days a week. The eight new buses will be able to recharge their batteries wirelessly through the day, which means that for the first time, electric buses will be capable of carrying the same load as a diesel bus.

The buses charge using power from a primary coil buried in the road, which is picked up by a secondary coil on the bus. Just 10 minutes parked over a coil will replenish two-thirds of the energy consumed by the journey.

The change will eliminate approximately 500 tonnes of tailpipe CO_2 emissions per year, remove 45 tonnes of other noxious tailpipe emissions and slash fuel costs.

Data collected from the Milton Keynes trial could demonstrate the economic viability of low-carbon public transport and, if successful, will help kick-start electric bus projects in other towns and cities worldwide.

The trial sees collaboration between:

- MASP
- Mitsui subsidiary eFleet Integrated Service Ltd
- Milton Keynes Council
- Bus operator Arriva
- Manufacturer Wrightbus Limited
- Technology supplier Conductix-Wampfler
- Chargemaster Plc
- SSE

market – no matter how small – in two to five years' time."

"Once you've found a promising technology, the next step is putting a commercial case together. That can be difficult and expensive, and it also needs a crystal ball. Most business cases for low-carbon technology rely on the assumption that energy prices will rise. But if shale gas comes on to the market and temporarily lowers prices, that could be enough to throw your business model out by five years – and that could lose you a potential investor."

"Government policy is also unpredictable," Bailey continues. "For example, diesel for bus operators is currently subsidised. There has been talk of removing this subsidy to encourage low-carbon alternatives. But there's been no definite statement from the government on when or how this might happen. That uncertainty might be enough to undermine your business case."

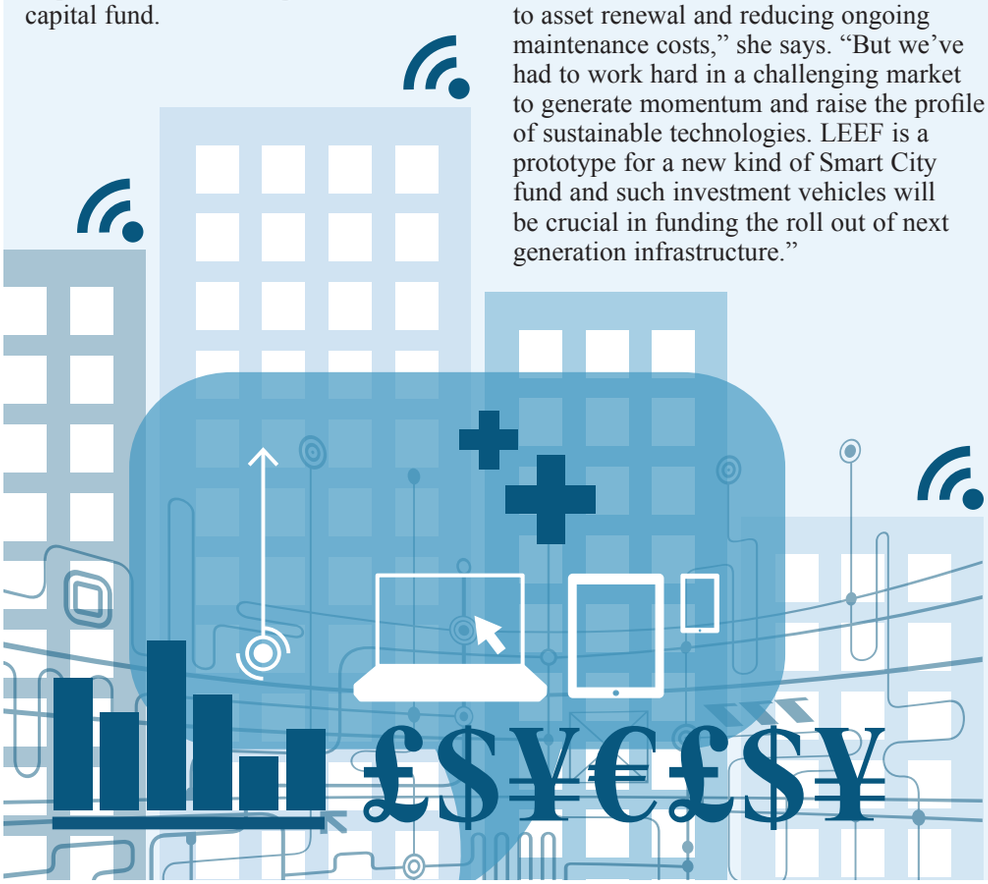
The London Energy Efficiency Fund, LEEF, is aiming to alleviate some of these uncertainties by providing low cost finance to enable energy efficiency and low-to-zero carbon energy generation in public sector owned and occupied buildings. Amber Infrastructure, in collaboration with RBS and Arup, is responsible for investing LEEF's £100m capital fund.

Thomas Briault is technical advisor to LEEF. He believes that one of the main challenges to energy efficiency investment is the high transactional cost of installing the technology. "The aggregation of projects has been key to helping LEEF make viable investments," says Briault. "We've done this by engaging with large property portfolio holders who can implement technologies across their estate."

Jenny Curtis, Director at Amber Infrastructure, is starting to see some success in this approach. "In our first year of operations we invested £20m in energy efficiency in the capital, supporting projects that can deliver annual energy savings in excess of 20% as well as contributing to asset renewal and reducing ongoing maintenance costs," she says. "But we've had to work hard in a challenging market to generate momentum and raise the profile of sustainable technologies. LEEF is a prototype for a new kind of Smart City fund and such investment vehicles will be crucial in funding the roll out of next generation infrastructure."

"The UK economy and UK cities are at a critical point where innovative thinking regarding the city as a system cannot only help cities deliver better transport solutions or support growing technology clusters, but also target the global smart city market."

Volker Buscher, Arup Director



Miller acknowledges the risks and barriers involved in developing sustainable technology in an integrated way: "We're trying to do something very difficult here. We're looking at a sector where everyone knows they need to change but nobody quite knows how to do it or where to start. So the risks are high, and that's why the Technology Strategy Board has got involved."

"It's a classic case for public investment," he continues. "It's going to be good for business, good for cities, and good for the UK economy. But it's just kind of stuck because it's too difficult." "We believe that modest public investment can kick-start the process. And it's clear that it has to happen. Carrying on with our existing infrastructure is not an option if we're to cope with the challenges that are coming."

If cities are to get the sustainable technology they need, says Miller, then it has to be an enticing investment proposition. "We need some clever thinking on how we connect the investment needs of an organisation like a pension fund with a city's need to upgrade its infrastructure," he says. "We've already got strong interest from some big organisations in the City of London as well as insurance and reinsurance markets who want to work with us on how such products might be developed."

For Miller, the opportunity to create an attractive investment makes the dream of future integrated cities achievable: "We're standing on a the brink of a period of profound change not dissimilar to the great transformations of the industrial revolution. This is one of the most exciting challenges we face. And the really nice thing about it is that these possibilities could actually happen – because they are economically beneficial."

Briault agrees. "It will take careful consideration and the right mix of fiscal incentives, government regulation and local authority policy to break down the barriers and enable much smaller investments – but it can, and will, be done." And despite the challenges MASP faces, Bailey is equally upbeat about the possibilities. "It's exciting because you know that these problems have to be solved – we can't run vehicles on diesel or petrol in the future; we have to get a lot smarter at managing the energy our homes use. It's just a matter of finding the answer. And when we do, it will change the world."

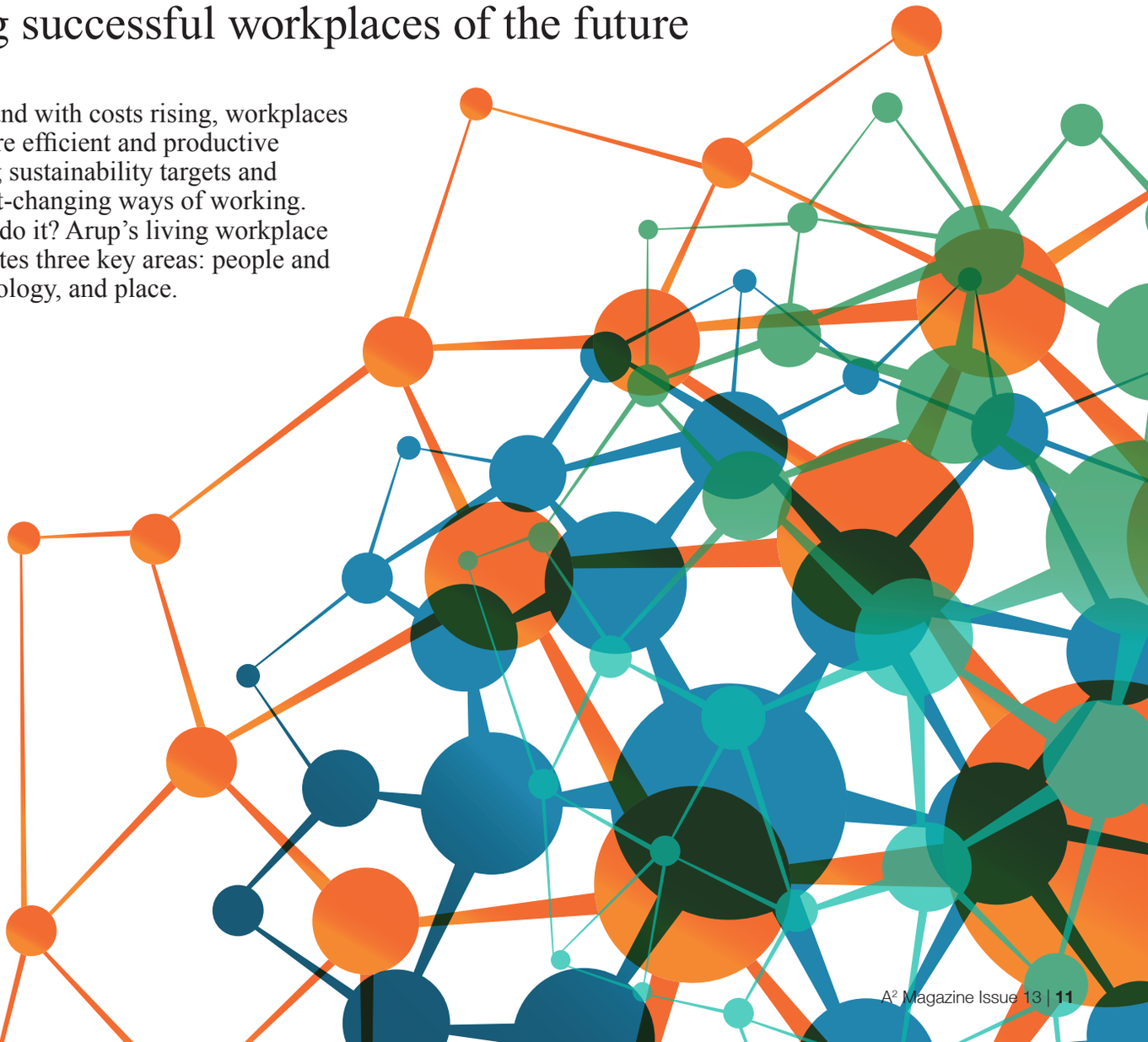
'There is an increasing tendency to put together teams and ad hoc groupings of people from both within an organisation and outside it to solve specific problems, or to address specific issues that require particular combinations of knowledge, skill or access to networks for their solution.'

Demos, 2010

Living workplaces

Defining successful workplaces of the future

In lean times and with costs rising, workplaces need to be more efficient and productive whilst meeting sustainability targets and supporting fast-changing ways of working. How can they do it? Arup's living workplace team investigates three key areas: people and process, technology, and place.



CASE STUDY:
European Investment Bank

Using the living workplace methodology, Arup devised a workplace strategy and guidelines to help the European Investment Bank (EIB) create a thoroughly modern working environment at its Luxembourg headquarters.

"The bank is evolving from a traditional public sector style of organisation to one that's adapted much more to the modern world, with open and collaborative ways of working," explains Nick Barclay, the EIB's head of internal communications. "This requires a change not only in the way we allocate space but also in the way people are managed and in the way technology is used."

The EIB sees upgrading its workplace as essential to attracting top talent – as head of facilities management Philipp Horn explains: "Our present building is around 40 years old with everyone working in office boxes. Newly recruited people don't consider this sort of environment as being up to modern standards."

In response, the EIB wanted to come up with a clear strategy and set of actions to ensure that the workplace was tailored to the jobs people do on a day-to-day basis. This is what Arup helped them achieve, with experts in design, technology, psychology and other disciplines combining to deliver the project.

The Arup team considered factors affecting the organisation, its people and its technology. They also looked at how medium and long-term trends such as an ageing population and increasing diversity should influence the design of the workplace.

Engaging staff with the process through workshops was a vital part of the project. "The consultation exercise was perceived positively by staff and we were surprised by some of the results," admits Horn. "There were factors that we hadn't considered that will have an enormous impact on efficiency and on staff satisfaction."

By bringing together people, place and technology Arup was able to help the EIB create a clear vision for its workplace.

People and process

"To succeed in the future, workplaces must attract top talent and foster creativity and collaboration," argues Arup consultant Josef Hargrave, who is part of the living workplace team.

"Future workplaces will be characterised by hyper-diversity," continues Hargrave. "People from different cultures and generations, with different beliefs and requirements, will share spaces and work together. So workplaces will need more flexible facilities: a meeting room that can act as a prayer room; a canteen that serves all dietary requirements; flexible working times that suit different lifestyles."

Hargrave's colleague Rebecca Goldberg agrees that, with a more diverse, mobile, and global workforce, future workplace environments must help businesses attract and retain the best staff. "In the global competition for talent, adding value to existing physical places, creating a strong corporate identity, and offering excellent facilities and benefits will become ever more important," she says.

And once you've attracted the top talent, a workplace needs to reflect how these people will all work together.

"The shift to a knowledge-driven economy is reshaping how companies innovate and how work is organised," explains Hargrave. "The need for more responsive, fluid networks of people to come together quickly to solve new business problems results in a need for innovation, better collaboration and knowledge management."

"For workplace design this means facilities and layouts that allow different types of interactions to take place," Hargrave continues. "Activity-based work, open-plan designs, library areas for privacy and focused work, cafes, restaurants and informal meeting spaces can all help employees work more effectively and creatively."

Technology

New ways of working will rely on flexible technology that enables people to connect and share information and ideas, explains Goldberg. "Tomorrow's workplace is not a defined space, but a combination of physical and virtual facilities that allow people to work together and collaborate in a variety of ways."

"In the future, organisations will be characterised by open systems and networks, where the limits of industries, markets, and businesses dissolve," she continues. "The need for flexibility is also driven by continuing changes in family patterns and the need for flexible and part-time working arrangements."

"The advent of powerful mobile devices and the rise of social networking is leading to unprecedented personal hyper-connectivity. Today, you can work from home in the morning, attend a virtual meeting at lunch, and collaborate on the company's ideas platform while travelling."

Goldberg also believes that, for mobile workers, location will no longer be a limiting factor. "The current requirements for the traditional physical workplace will change," she predicts. "This opens up opportunities for companies to re-arrange and optimise their spaces and work patterns, and for people to collaborate with each other in new ways."

"Apply this level of flexibility to all employees, and the workplace emerges as a fluent network of connections that constantly shift from physical to virtual and from local to remote. This is why ICT and Audio Visual technologies are some of the most important tools for achieving high levels of flexibility and collaboration – resulting in increased productivity."

"The key to realising the potential of ICT," says Goldberg, "is to address issues of security, remote connectivity, and personal choice to create a framework that supports mobile workers. It's more critical than ever to provide leadership and training on how best to use the plethora of ICT tools and devices available."

"What's needed is a holistic approach. The workplace strategy may look complex, but to our experts it's not – it's what they do. By combining their knowledge we can develop a single executable plan governed by a clear vision about what the future workplace should look like."

Volker Buscher, Director, Arup

Place

As the need for the traditional workplace declines, office space will have to work harder for the business. Increasing productivity and utilisation to create more efficient workplaces while improving sustainability will be a key challenge.

Hargrave points to a series of questions companies face: "Can businesses increase the productivity of their workplaces and improve utilisation to drive down costs?" he asks. "Can they do this while designing spaces and facilities that can cope with fluctuating occupancy rates and changing functions? Can they use office hubs and serviced offices for a more flexible approach? And how can they do this without large-scale investment in permanent infrastructure?"

To respond to these questions, Hargrave says it's vital to assess an organisation's unique requirements and deliver tailored design solutions. "Within an organisation it's common to have different job profiles, each with their own requirements," he explains. "For example, HR employees need spaces where they can have private conversations, in-house teams may make more use of individual offices for focussed work, and project teams can benefit from more open-plan and break-out meeting spaces."

"Some organisations are implementing activity-based work arrangements where few employees have dedicated desks. Instead, employees choose from a number of different settings and workstations, each with its own advantages: spaces ideal for conversations, project areas, spaces designed for high degrees of privacy, or even relaxation rooms that support wellness and creativity."

"By limiting the number of dedicated desks and maximising shared and diverse spaces, such set-ups can increase the utilisation of space without sacrificing the quality of the overall experience. But new workspace design needs to be complemented by careful implementation of new working practices to avoid de-motivating staff and affecting the business."

"Growing use of social collaboration tools could free up 7-8% of the working week for more productive activities – resulting in a 20-25% improvement in knowledge worker productivity."

'The social economy: unlocking value and productivity through social technologies', McKinsey, 2012

Implementation

So how can workplace projects balance all these factors to achieve a successful implementation? For Goldberg and Hargrave, a holistic approach is essential.

"As workplace projects grow in complexity and ambition, so more teams and organisational divisions need to be signed up to the programme," says Hargrave. "This applies internally, where disparate divisions work together. And it also requires a wider range of external specialists."

"Another significant challenge is bringing end users along with the changes," says Goldberg. "To realise their full potential, workplace projects need to undertake comprehensive stakeholder engagement and change management from the outset."

"Each business has its own context and no single approach can help all organisations to optimise their workplace. But an approach that embraces people and process, technology, and place forms a starting point for HR, IT, estates or business managers considering how their organisation will respond to workplace challenges in the future."

Lloyd's of London

Hidden assets

Through reuse and recycling, businesses can unlock value from the materials in buildings

Could a building's value one day take into account the potential for reusing and recycling the materials it contains? In a world where more than half our supply of copper has already been extracted and put to use in our cities, Arup materials consultant Mark Bowers believes that these hidden assets are at last beginning to get the attention they deserve.

"There's already a market for copper, steel and concrete recovered during the demolition process," says Bowers. "And we're seeing the role of demolition companies change – instead of being paid to take away waste, they're buying the privilege of taking materials away and reselling them."

"I believe the rising costs of materials will continue to be a real incentive for reuse and recycling. This is because their cost isn't just driven by the price of raw material but also by the cost of processing them. Recycling glass and steel requires less energy and costs less than manufacturing them in the first place."

Despite this, Bowers acknowledges that it's still generally assumed that materials will largely have to be thrown away when

Glass recycling plant

a building or piece of infrastructure reaches the end of its life. But he also believes that demonstrating the viability and cost-effectiveness of reuse and recycling will help to change this situation.

"Take glass as an example," says Bowers. "Glass from buildings is not widely recycled because it's not as straightforward as taking empty bottles to the bottle bank. But when Arup worked on refurbishing the Lloyd's of London building, we showed it can be done."

Arup worked with glass manufacturer Saint-Gobain to reuse the building's special translucent sparkle glass in a new façade. Any glass that couldn't be reused was recycled in the system set up by Saint-Gobain to recycle cullet (waste glass) from processing plants.

"We started recycling cullet to produce new float glass in 2003 because it reduces energy consumption, CO_2 emissions and material use," explains Darren Kearns, Saint-Gobain's architectural project manager. "Albeit in a unique set of circumstances, we were able to use this system for glass collected from the Lloyd's site."

With the whole project team backing the recycling effort, a process was set up to strip old glass of contaminants such as silicone seal and send it back for recycling as cullet. Because recycling was seen as a vital part of the Lloyd's project, the slightly higher cost was acceptable.

"What we have to find now is a way of taking glass from site, separating contaminants and recycling it at a cost that's equal to or less than the value of the cullet this produces," says Kearns. "If we can do this – and I think doing it on more projects will help to increase efficiency – then it will become an economically viable option."

What this experience shows, says Kearns, is the potential to recycle other materials. "Although the energy and processing costs of glass are significant, the raw material is cheap because it's essentially sand," he explains. "So the value of cullet glass is relatively low. But if we're on the verge of making glass recycling from site demolition economic, just imagine what you could do with higher-value materials."

Bowers is optimistic that this experience points the way forward. "We now have a model for taking material out of a building and returning it to a supplier for recycling," he says. "The recycled material can come back to site on the same lorries as the new material, keeping costs and transport emissions down. There's no reason why this approach couldn't be applied to a range of materials."

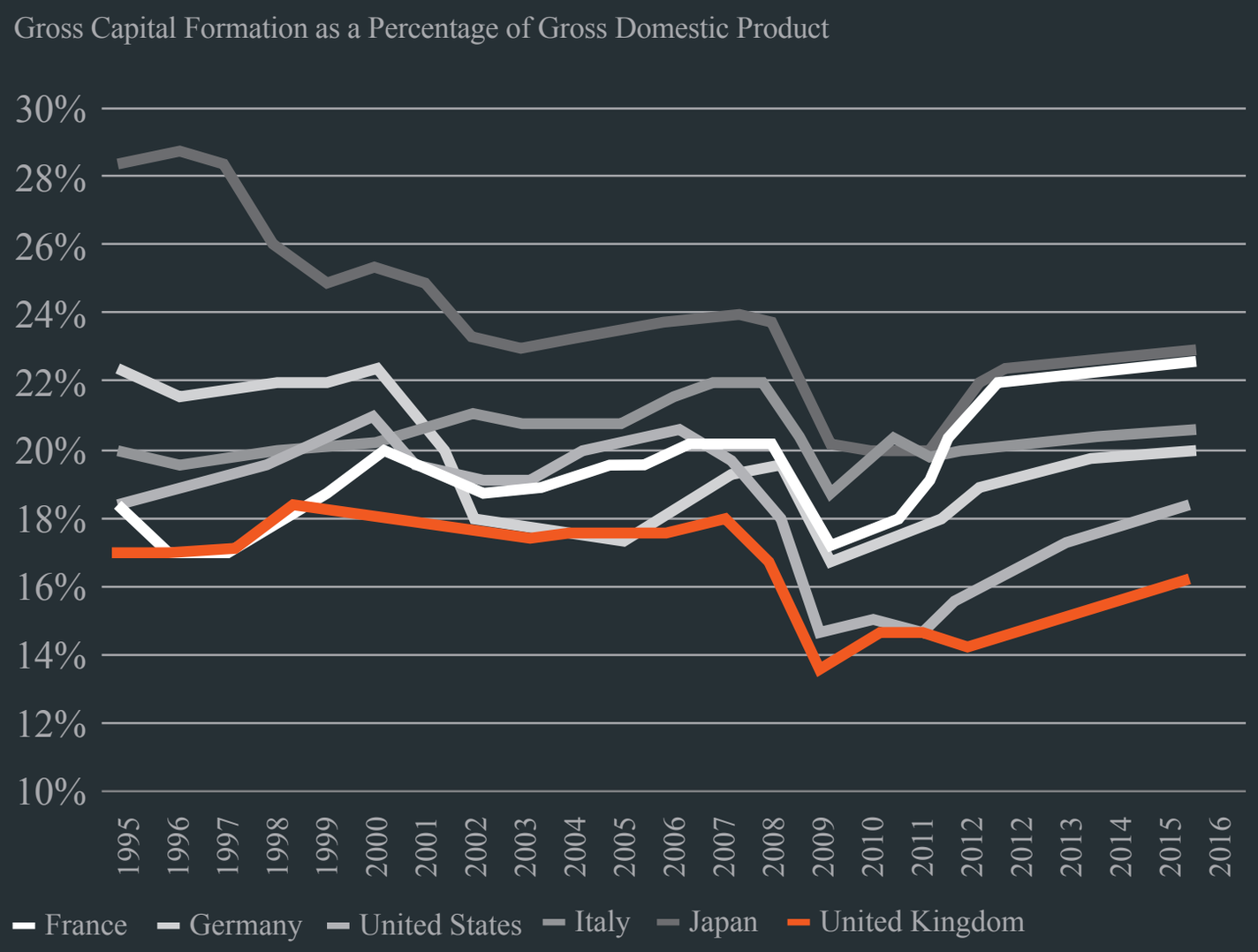
Could this encourage building designers to ensure materials can be reused or recycled easily? "I think ease of reuse and recycling is already starting to drive building design," says Bowers. "Environmental assessment methods like LEED and BREEAM are already putting more emphasis on what will happen to a building at the end of its life. And in the future, I think those looking for the greenest of green buildings will have to take reuse and recycling even further."

"I think those looking for the greenest of green buildings will have to take reuse and recycling even further."

Bowers argues that as materials become scarcer it will become increasingly important to reuse them in more inventive ways: "Piles are rarely re-used at the moment because you can't be certain what they contain. If we could keep accurate records from the construction phase through to the end of the structure's life then we would know which piles were suitable and they could be reused much more widely."

"You could take this further," he argues. "Some steel is already barcoded to make it easier to recycle. But why not electronically tag all the parts in a building so that when it comes to retrofitting or demolition you know exactly what's there and can get the most value from reusing and recycling the materials? This is something building owners increasingly want to implement and I think there's a real opportunity for a pioneering construction company to take an approach like this."

With recycling and reuse unlocking value from buildings, maybe it's time to take a closer look at our hidden assets.



Source: World Bank; International Monetary Fund (2012)

Wanted

a Secretary of State for Infrastructure

After some neglect, the UK is ramping up investment in its economic infrastructure. A Minister for Infrastructure should lead the charge, argue Alexander Jan and Ben Berman*.

The Government has acknowledged that Britain will not be able to compete without major investment in its economic infrastructure. Its National Infrastructure Plan notes that "many power stations are ageing, road congestion is a growing concern, train punctuality in the UK is worse than in other parts of Europe and in the longer term there will be an airport capacity challenge in the South East of England." Few readers could disagree with this. And without action it is going to get worse. Energy analysts darkly talk of power outages if the country's generating capacity is not renewed, official forecasts point to big increases in congestion on the road network. As the UK's population grows and economic confidence (and growth) finally return, airports risk once again returning to bursting point. Even Crossrail, the new east to west rail link being carved out under London will need supplementing with a second scheme and possibly more.

The Government's plan, released in 2010 and revised in 2011, stitches together a list of more than 500 projects from both the public and private sectors. Together they demand in excess of £260bn of investment (2010/11 prices). In all, the Government says an eye-watering £400bn of infrastructure investment is needed before 2020. Energy, telecommunications, transport, waste and water all feature. But in an age of austerity and with a long term desire to reduce the size of the state's take of national income, the Government hopes that pension funds, banks and other private investors will stump up more than two thirds of requirements. That would be a remarkable triumph of hope over experience.

The reality is that successive governments have shifted spending away from capital formation. At the same time, private investment in fixed assets has decreased. Taken together, UK investment in property, plant and equipment has lagged behind our competitors since the late 1990s (see chart). For the countries in question, infrastructure investment - one part of the total shown - averaged 3.5% of GDP over the last decade. The Organisation for Economic Co-operation and Development (OECD) notes that British infrastructure investment was as low as 2.5% of GDP in the same period. More worryingly, analysis by Arup (using data from the Institute for Fiscal Studies) shows that UK public investment has actually fallen in real terms from around £52bn in 2009/10 to an expected £24.6bn in 2012/13. Further declines are forecast to the end of this parliament. This fiscal reality sits uncomfortably with Treasury aspirations.

Few commentators or ministers question the need for increased infrastructure investment. Billions of pounds are looking for infrastructure opportunities, we are told. But somehow they are failing to fully connect. Britain is a preferred destination for international capital. It has tried and tested investment models (think water), a stable legal system, low political risk and lots of infrastructure expertise (think Arup). All this raises the question as to whether the UK's machinery of government is right. The National Infrastructure Plan itself can provide only so many clues about the Government's overarching investment strategy. Some would argue it reflects the UK's department centric approach to major project planning. Changing that requires more than a plan.

Government is moving in the direction of improving leadership around infrastructure. Infrastructure UK, a Treasury body, provides some long-term focus on the UK's infrastructure priorities. In July 2012, the Chancellor announced new funding programmes enhancing Whitehall's capacity to support private investment across the infrastructure sphere. Guarantees and co-lending and equity investment by the state, are intended to accelerate projects that developers are struggling to finance or where commercial lending appetite falls short. To orchestrate funding and development, the Chancellor has focused the work of the incoming Commercial Secretary to the Treasury on infrastructure development. The Treasury may now appear more joined up. But are the departments of state?

A Department for Infrastructure should be created. This super ministry would provide more than leadership for spending departments. It could consolidate infrastructure resources and talent spread thinly through the rest of Whitehall. It would give the prime minister a mechanism for knocking heads together and ensuring delivery. It could oversee the development of effective frameworks including reforms already in train, to bring in private sector investment to boost growth and competiveness across the countries and city regions of the UK. It could be the agent for delivering a big part of Lord Heseltine's £40bn 'challenge' fund idea. It could provide a strong delivery partner for the all powerful Treasury. With firm delivery objectives that would not be lost in other departments' business plans, its minister would be high profile. It would be a potent department of state that senior politicians and civil servants would fight over. There would be a real sense of urgency to get things done and join them up with local government.

The Treasury is not a spending department. In today's straitened times some would say, perhaps unfairly, it is a "how not to spend it" ministry.

This new department of state could be modelled on those found in other Commonwealth countries. Australia integrates infrastructure leadership with its transport ministry. The Department of Infrastructure and Transport adopts a national strategic function, advising regional governments. It coordinates construction timing and investment decisions under a cabinet-level minister. In Canada which has an enviable track record on securing private sector investment, there is a Minister of Transport, Infrastructure and Communities.

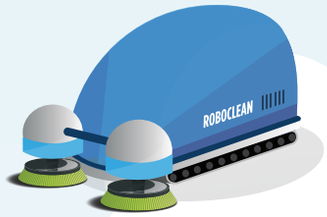
As Dieter Helm, a leading UK economist has pointed out, Britain is in knots over infrastructure. A Department for Infrastructure might just slice through them.

*Alexander Jan and Ben Berman are both consultants at Arup

SAFER, CLEANER NEIGHBOURHOODS
Automated police vehicles could 'patrol' streets with sophisticated camera systems, which would supply a feed of real-time information to a control room, freeing up officers to spend more time in local communities and solving crime.

Automated vehicles will also end all forms of traffic violations and therefore the need to police motor vehicle operations, generating savings with respect to law enforcement. Autonomous vehicles will automatically detect approaching emergency services, quickly moving out of their path.

Driverless street cleaning vehicles can be automated to keep streets clean and collect and recycle waste.



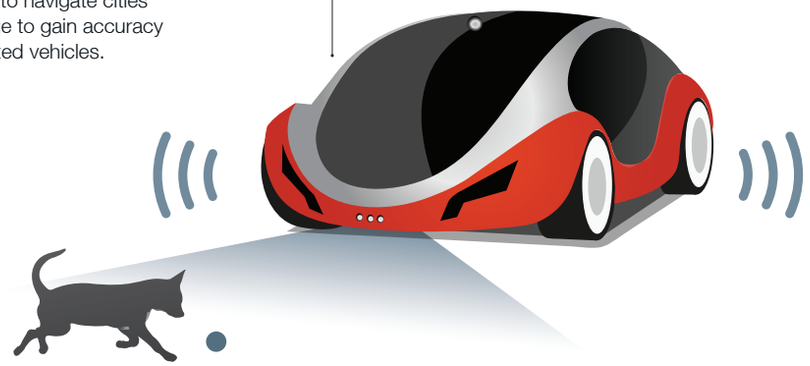
Bicycles will become more advanced, changing the way they are used in cities. Each bike will be linked to GPS systems for navigation, as well as integrated air pollution and traffic sensors, which will advise cyclists on the best route to take across the city.

In a city environment, sidewalk lighting will illuminate pavements for pedestrians, while automated vehicles will need less lighting on the road.

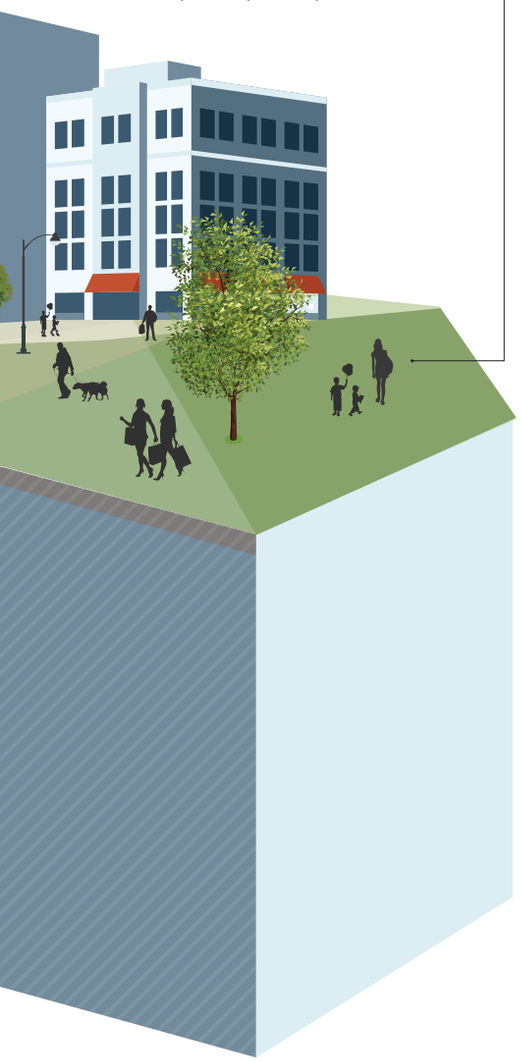
MORE SPACE FOR ALL
Cars which aren't being used will drive themselves to the nearest available parking area, freeing up space on our roads and in city centres.

SAFER, SMARTER VEHICLES
Each vehicle will rely on an intelligent system of sensors, cameras, radars and lidars – sensor technology using light - to map and react to the features around it, including road markings, road crossings, pedestrians and other vehicles. Vehicles will be able to stop suddenly in reaction to unpredictable objects such as people and animals.

These vehicles will use built-in GPS systems to navigate cities and respond to traffic flows. GPS will continue to gain accuracy and can help in the gross herding of automated vehicles.



REGENERATED COMMUNITIES
Quieter cars, capable of driving themselves in smaller spaces, will make urban centres more appealing, with additional space created for shops and public spaces.



Automatic for the people

Driverless cars and the future of mobility

Could the signing, in September 2012, of a bill to bring driverless cars to the roads of California mark the start of the next major change in mobility? Could it even redefine our relationship with the car?

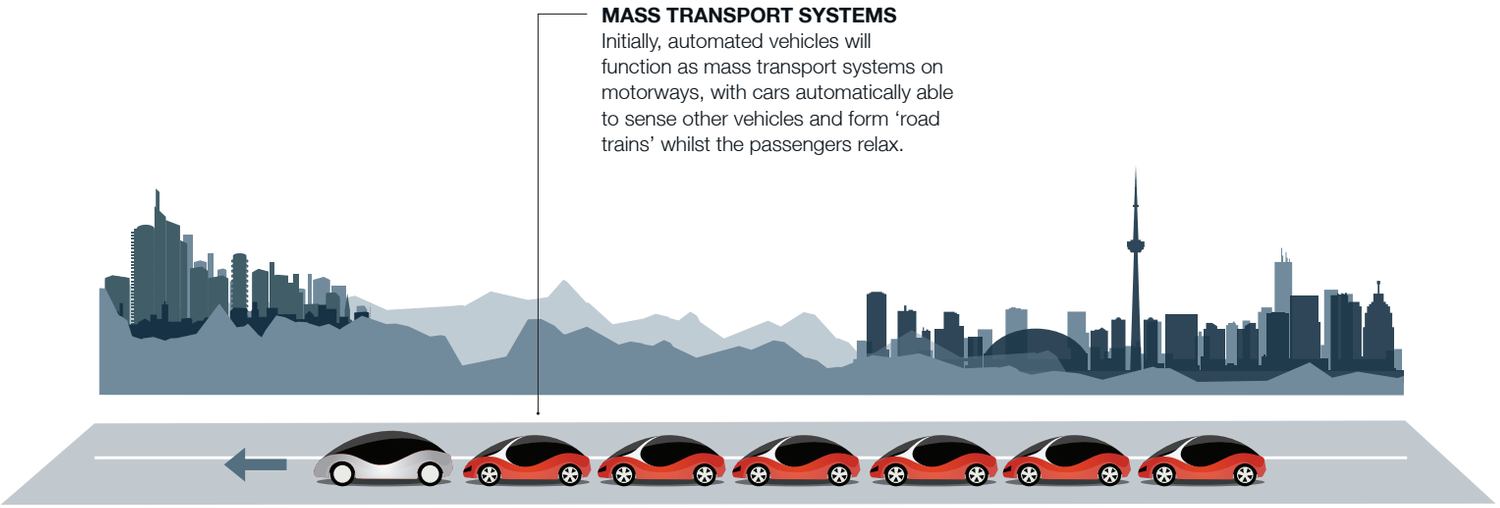
Josef Hargrave, a consultant with Arup Foresight and Innovation, thinks so: "Driverless vehicles will have wide-ranging implications for society," he predicts. "There's no doubt that as the potential of automated vehicles unfolds, we will experience a massive shake-up in how we live, work and travel."

New ownership models, new city designs

For a start, Hargrave expects driverless cars to drive an entirely new model of manufacturing and ownership. "I think we'll see manufacturers transforming into mobility service providers to build on the growing success of car sharing schemes such as ZipCar," he says. "And, in the longer term, private companies, governments or local authorities could work together to own and maintain a fleet of automated vehicles for consumers."

John Eddy, Arup's global civil engineering leader, believes that widespread adoption of automated vehicles could lead to a radical change in the way we design and use our cities. "This will give us the chance to evolve our cities away from an auto-centric construct where private cars clutter up our city space and return instead to cities designed around people."

"The automated vehicle will gift our dense urban areas with quieter and more



predictable traffic flows on smaller roads. Grid-lock will be eliminated because we will be able to automatically reroute traffic to prevent bottlenecks, and driver hesitancies will be a thing of the past. Smooth traffic flow and super accurate automated vehicles will free up space, giving city planners and urban designers the enviable choice of greening or developing those spaces for the benefit of the community."

"Traffic enforcement will be extinct," continues Eddy. "Traffic accidents will be all but eliminated by the development of failsafe vehicle control systems. Emergency responders will have unabated paths to provide medical, law enforcement or fire assistance because the traffic control centre will open lanes and usher vehicles out of the critical path of our response teams."

"And travel times will no longer be predictions. Unlike our current traffic management systems that focus on the road, as we've seen with ramp metering and congestion pricing, we will be able to manage the vehicles directly. Data fed into highly accurate algorithms will let the traveller know in advance of potential issues and the impact on getting to their final destination."

But the biggest change, Eddy believes, will be in our relationship with the car. "Driverless cars will put car sharing programs on steroids. Vehicle utilisation will skyrocket and the fleet size per capita will fall. Cars that are dropped in one location will immediately drive themselves to the next user. Consumers will pay as they go for the type of car they need – from the people-carrier for the family vacation to the sleeper that gets you to that early morning flight."

New approaches to technology

Richard Parry-Jones, Chair of the Automotive Council, believes that telecommunications will be key to unlocking the potential in the technologies that driverless cars will use. "We require long range, high bandwidth wireless internet – so 4G or 5G communications - to make this work," he says. "This will require the automotive industry, the transport sector and telecommunications companies to work together to share data and standardise technology. Although it is in its early stages, these conversations have started to happen."

Hargrave argues that making automated vehicles part of our everyday lives in this way will require a different focus from industry. "Private sector companies – particularly those in IT, have the skills and resources to move these developments forward very quickly," he says. "They could become leading players in the automotive sector but they must build up a level of trust with consumers who aren't used to seeing their brands associated with motor vehicles."

"Meanwhile, automotive manufacturers will see a major shift towards delivering 'motoring services' and developing the technology and infrastructure behind driving. They will also need to devise the most economical and sustainable method for producing driverless cars – whether this is an entirely new production line or retrofitting existing cars."

There are still many questions to be answered. But one thing is clear – automation will have a huge impact not only on vehicles themselves but on every aspect of our lives. "It is ironic," says Eddy, "that over 100 years of car history has been banked and we are only now realising the true promise of "auto" mobile.

How driverless cars will work

On highways or motorways between cities, cars will drive themselves in close-linked formations at high speed, thanks to vehicle-to-vehicle wireless connections that make them spatially aware.

With breaking and acceleration directed by the lead vehicle in the train, driverless cars will be able to react more quickly than human drivers. Their smoother driving will, in turn, make the journeys safer and more energy-efficient.

Within cities, they will map and react to features such as road markings, road crossings, pedestrians, and other vehicles.
To do this, they will use an intelligent system of sensors, cameras, radars and lidars (a sensor technology that uses light).

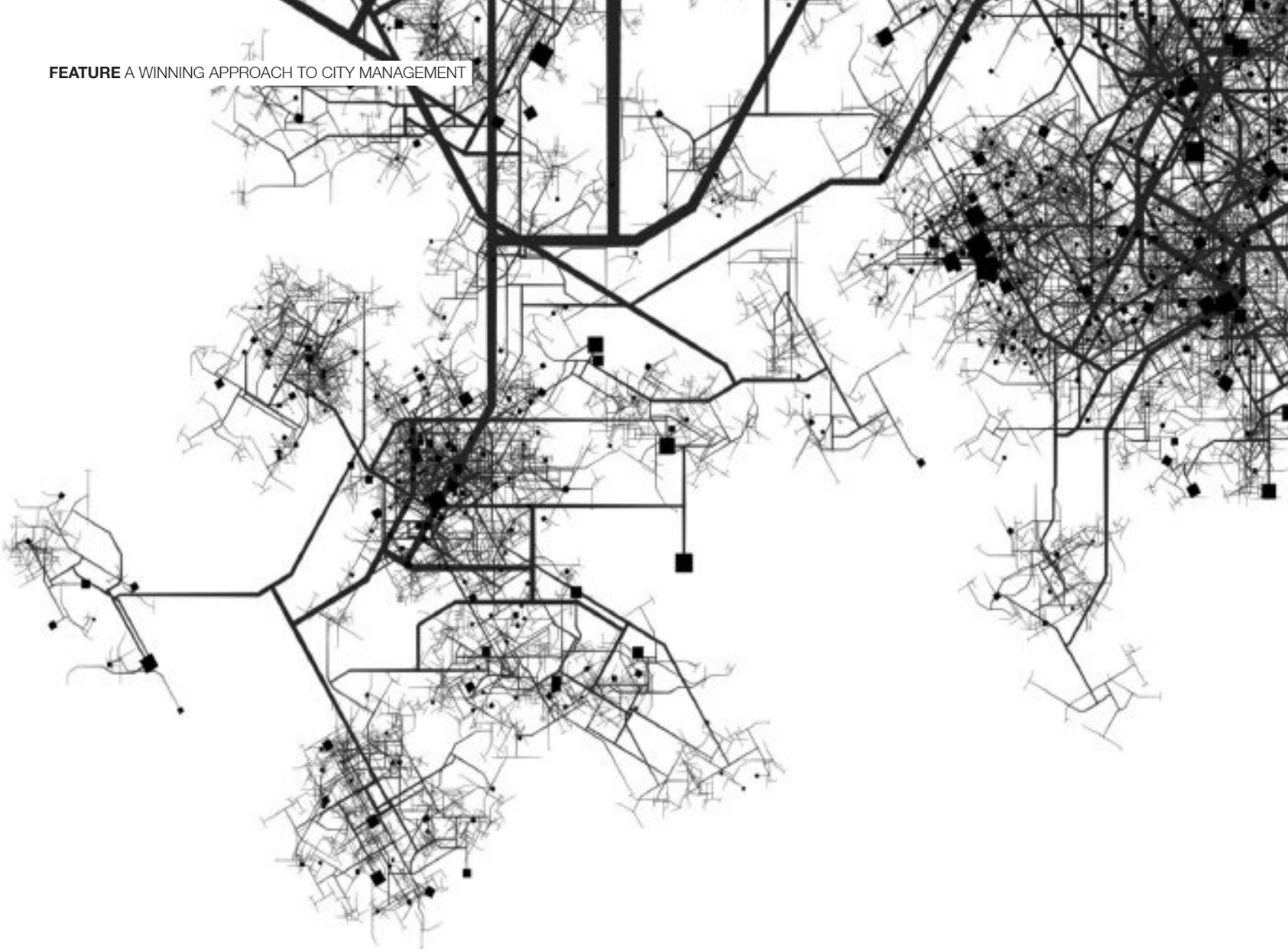
The driverless car concept is already in development by Volvo as part of the SARTE project. And Google has been testing a fleet of 12 autonomous computer-controlled vehicles at its Californian headquarters for several years.

Have your say by visiting thoughts.arup.com 'driverless cars to end parking problems' http://thoughts.arup.com/post/details/273/driverless-cars-to-end-parking-problems

A winning approach to city management

Efficiently run, well managed, contemporary cities will attract investment, residents and employers

By 2050 it's estimated that 70% of the global population will live and work in cities. Economic progress has seen a rise in mega cities and unprecedented growth in mid-size urban hubs. City management is becoming increasingly important to ensure that they can cope with the growing demand placed on them.



CASE STUDY:
Keeping London moving

During the Games, the Transport Co-ordination Centre (TCC) coordinated all the different partners involved in delivering transport. People representing organisations, ranging from the Highways Agency to the British Transport Police, physically located alongside each other and worked collaboratively. By taking this approach, the TCC delivered benefits ranging from faster journeys for travellers to better relationships between transport organisations.

"Nothing like this had been done before," explains Jorge Escobar, operations consultant at Arup. "So at the start, most organisations didn't know much about each other's operations or about the Olympics. By the time the TCC was up and running they had a clear picture of each other's operations."

Laura Bache, an occupational psychologist and part of the team that delivered the TCC, explains more: "Before we could identifying all the processes and technology we needed to put in place to make the TCC function, we had to engage the different stakeholders and get them to buy into the vision for the centre."

"We developed a structured approach involving one-to-one engagement with stakeholders, along with group design sessions where we got everyone together in one room to talk about the design of the TCC. This meant that not only were everyone's views addressed but also that everyone understood each other."

It was an approach that proved popular with stakeholders such as Network Rail's principal project planner Mark Harrison: "In the past I've found that stakeholder management can be a bit unclear and inconsistent," he says. "But Arup's approach ensured that everything was set out in a clear and logical way and all activities were always linked back to the overall objectives and to how we would achieve them."

As well as ensuring that the TCC could deliver timely travel information to the press and media, this level of coordination also made a real difference to people's experiences of travelling during the Games. "The overall result was a smoother, higher quality transport service where people had access to accurate real-time information," says Escobar.

"For example, if you went to watch an event during the Games, you'll have seen volunteers in pink vests giving out transport information. All those volunteers were in touch with control centres linked to the TCC, so everyone was connected to a single source of timely information."

"Ultimately the proof was in the experience," says Bache. "I know when I used the transport network to get from the Midlands to the Games it was a very smooth journey. And thousands of other people experienced the same."

Could other cities benefit from their own versions of the TCC? Escobar believes so: "The more effective coordination a city has – either during a major event or day-to-day, the smoother and more cost-effective its transport network will be," he says.

"Through a relatively modest investment in technology and data, coupled with the basic human skill of cooperation, London's aged transport system was able to accommodate over 62 million passenger journeys during the Games, without a major hitch."

"The 'Information Marketplace' allows city authorities to use digital assets both to run the city more effectively and to deliver a greater experience for citizens," says Volker Buscher, Director at Arup. "This is a new component of our urban economy and is resulting in the development of city information products and services."

"Efficient city management is increasingly a priority for Local Authorities, blue light services and transport operators looking to reduce their cost burdens," he continues. "Take the regeneration of East London leading up to the 2012 Olympics; this is a fantastic demonstration of how cities can take control of urban development, invest in future city infrastructure and deliver smart systems strategically and systematically. The successful management of London during the 2012 Games has shown the world what can be achieved."

Jerome Frost, Arup's Head of Planning and former Director of Design at the Olympic Delivery Authority, agrees. "Through a relatively modest investment in technology and data, coupled with the basic human skill of cooperation, London's aged transport system was able to accommodate over 62 million passenger journeys during the Games, without a major hitch," says Frost. "The Olympics taught agencies, authorities and public services that effective city management requires the sharing of data and information, collaborative working to solve problems and the collective management of situations."

Olympic Lanes and bus lanes were accompanied by live screens telling people when they were operating, road sweepers cleaned up as soon as races passed, rubbish collection days were reorganised to reduce congestion and police enacted diversions as soon as crowds built up. "But perhaps most importantly," says Frost, "people living in, working in and visiting the city could make hourly choices about their routes, transport modes and entertainment, based on the live updates received from organisers, radio bulletins and digital signage."

This approach to city management was made possible by a network of Operation Centres, which collated a never-ending stream of live data from barcodes, Bluetooth signals, ticket tracking, Oyster card monitoring, traffic cameras and CCTV. The data was shared with local authorities, police, transport and other services and fed into pre-prepared dynamic models to predict effects and produce new routes and diversions.

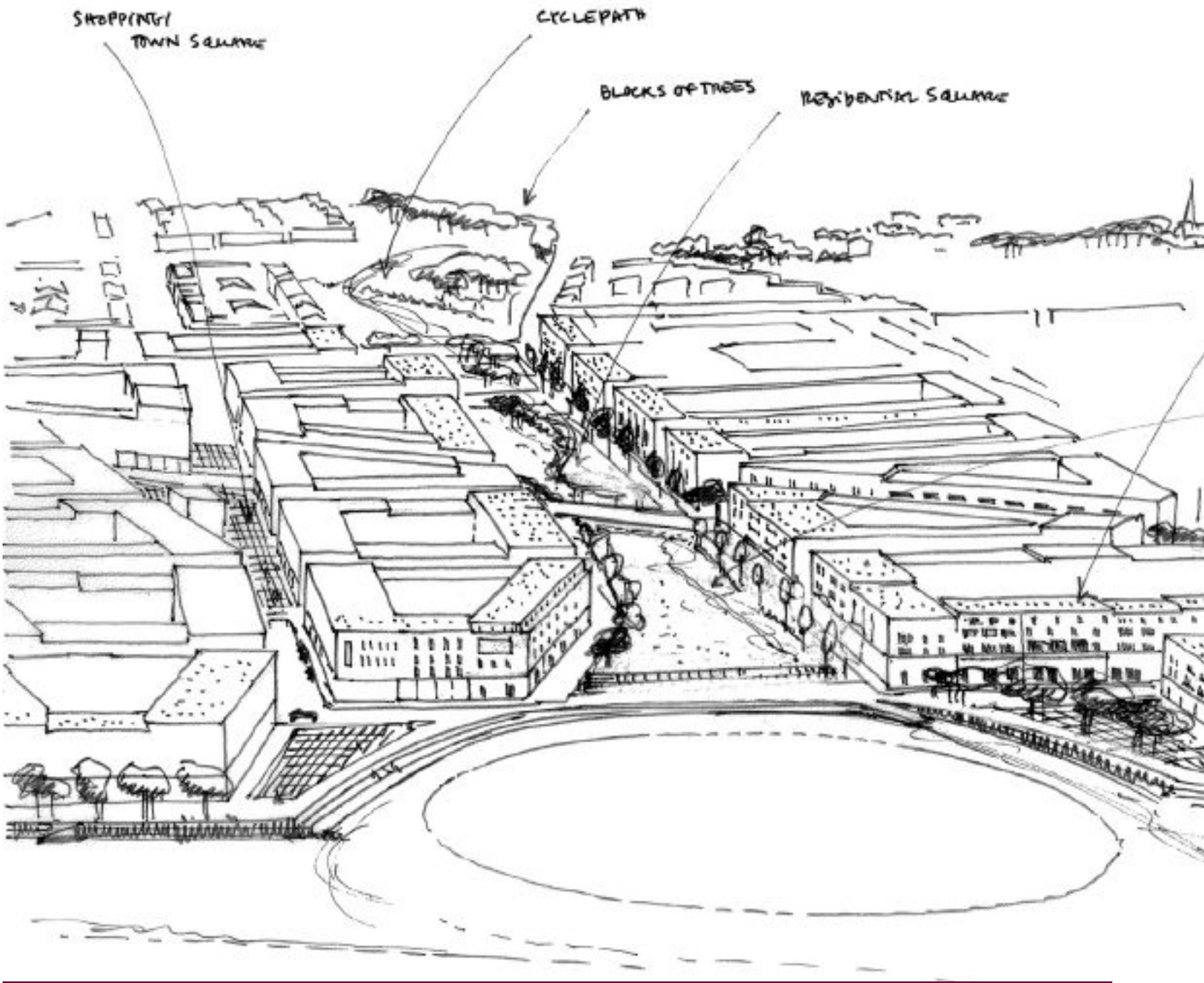
To some cities, this may sound very hi-tech and futuristic. For others, this technology is already in place, but Frost believes that the real revolution that took place was the collaborative human response. "Instead of keeping data to themselves, authorities shared it with others. Instead of making decisions in isolation, agencies made them together. Instead of keeping information from the public, it was made widely available. Joint, integrated and coordinated responses meant reaction times were quicker, duplication was avoided, management costs were shared and problems solved before they escalated."

This had a major impact on London's image. The London 2012 Games received international acclaim with a large number of references to the cleanliness and safety of the streets and the efficiency of the transport network.

A year before the Games were due to start, when London had just experienced the civil disturbances of 2011, the international press queried visitor safety and the reliability of the Underground, portraying London as a city of faded grandeur. Thanks to the success of the Games, London has been able to rebrand itself as a contemporary city that can deliver a truly sustainable public transport system.

Frost thinks that other global cities and towns can learn from the Games, using similar approaches adapted to suit local demand to save money and increase efficiency in day-to-day management. "At its core, London has a relatively simple, affordable network of IT, dynamic modelling, detectors and cameras which focuses on the movement of people and vehicles, overlaid on the ancient streets and infrastructure of the city," he says. "Much of this network is already in place in many towns and cities and models can be quickly built. All that needs adding is the integrated operation and joint responses of the various public services that manage the urban realm."

Efficiently run, well managed, contemporary cities will attract investment, residents and employers. For London, it was the gargantuan task of preparing for the Games that brought these systems and collaborative approaches together.



CASE STUDY:
Northstowe new town

Integrated planning is helping to create the UK's latest new town: Northstowe.

To the north-west of Cambridge on a former airfield, Northstowe will provide around 9,500 homes, as well as employment, retail, leisure and open space, including recreational facilities.

Arup has worked on the project since 2003, providing planning advice and promoting the scheme to regional bodies and local authorities. Before planning applications were submitted, the firm worked with stakeholders to debate issues and find solutions.

The design team used proxy communities to understand the needs of people who might live in the town once it's built. Having modelled the socio-economic profile of the new town, they gathered together people who reflected this mix and consulted them to find out about the needs of future residents. Plans then balanced these needs with the views of residents in the surrounding areas.

The plan for Northstowe also balanced the needs of a new town with an awareness of the history around – and underneath it. For example, the plans considered the archaeology of the site, which included prehistoric settlements, ancient hedgerows and the remains of the Second World War airfield.

Much of this history was incorporated into the new town. For example, the designs retained the layout of the old airfield runways, kept the old hedgerow system, and re-instated a footpath cut off during the Second World War. The result is a place that has a resonance with its history while meeting the needs of today's residents.

The design team hope that these connections with their town will help Northstowe residents avoid the 'new town blues' mental health issues identified in the nearby new town of Cambourne.

Phase one of the Northstowe project was granted planning permission in October 2012. It includes up to 1,500 homes as well as employment land, a primary school, allotments and open space. Phase two, which includes the town centre, is about to enter the implementation stage.

Prosperous places

How integrated planning can enable secure, thriving communities

With the UK government backing large-scale development as a way to meet the country's housing needs and help it build its way out of a recession, experts are calling for an integrated approach to planning these projects.

"Historically, the world has often taken a top-down approach to change," says Malcolm Smith, Arup's global leader for masterplanning and urban design. "But the world we live in now is more complex, more dynamic. So we need a way of working that allows you to address the changing dynamics of different priorities and consider them all together. And this is what an integrated planning approach does."

By working in this way, Smith and others aim to deliver good urban design. Research available from the Design Council suggests 'adds value by increasing the economic viability of development and by delivering social and environmental benefits'. "There's evidence that values will be much greater for a development designed using an integrated approach," says Abigaile Bromfield, an associate in Arup's planning, policy and economics team.

"All the evidence shows improved quality of life in developments produced by an integrated approach," continues Bromfield – who previously worked for ATLAS, an independent advisory service set up by the UK government to help local authorities dealing with complex large-scale housing-led projects. "These successful developments retain people, their families stay and help to create secure, prosperous communities."

Bromfield goes on to outline the four key elements in an integrated approach to planning large-scale development projects or in sub-regional planning: "You need a strong project vision or ambition for the scheme. You need successful collaboration. You need robust project management. And you need high quality spatial planning. These are the elements that make up an integrated approach, and you need to do all of them well."

"You need a strong project vision or ambition for the scheme. You need successful collaboration. You need robust project management. And you need high quality spatial planning. These are the elements that make up an integrated approach, and you need to do all of them well."

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CASE STUDY:
Tottenham investment framework and regeneration strategy

An integrated planning approach is helping to revitalise a previously troubled part of London through housing-led growth that will drive renewed confidence in the area.

Tottenham is experiencing dynamic change and challenges, including the regeneration associated with the new Tottenham Football Club stadium and the aftermath of the 2011 riots. After the riots, a task force was set up to address long-standing under-investment in the area. One of its recommendations was to commission a regeneration strategy for the whole of Tottenham along with a detailed investment framework for North Tottenham. Arup is working on both these projects.

The focus of the work is diversifying the residential mix in Tottenham, which is currently dominated by the social rented sector, to bring new investment into the area. Together with a large team of consultants – Jones Lang LaSalle, S333, Useful Simple, Playspace, Wolff Olins, Landolt Brown, Zero Zero and Space Syntax – Arup is working on strategies and studies that support this overall ambition. Their work includes:

- Consultation with local residents to understand how new development can improve issues such as safety and security and the poor quality of existing open spaces
- A retail strategy to transform existing shop units to meet the demands of modern retailers
- An asset management plan that looks at how cultural institutions such as the leisure centre and library could work together and make better use of their buildings
- Understanding how increasing rail capacity at Tottenham Hale and station improvements would help to regenerate the area
- Helping the London Borough of Haringey build the capacity and expertise to lead large-scale development

Overall, the project aims to create significant change in Tottenham, creating a sense of place and transforming it into both a vibrant community and a popular destination. The work is backed by robust financial modelling that demonstrates how up-front investment in place-making will pay back through increased residential values.

When this plan is implemented, Tottenham residents can expect to see more high quality housing, new businesses and more visitors coming to the area. There will be more opportunities for local people. And investment will improve public transport, community facilities and open spaces – as well as making this an attractive and safe area to live.


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"Successful growth is about delivering places people want to live in and work in" says Bromfield. "The UK is, sadly, renowned for a poor track record on large-scale growth and integrated planning is a key tool in turning this around."

Planning in the UK: the current situation

The UK's planning framework now includes a clear thrust towards encouraging growth.

- A presumption in favour of sustainable development
- An emphasis on deliverable and viable development with long-term supply of housing
- Changes in mechanisms to apply for permission make applications easier
- New Local Enterprise Partnerships created with sub-regional planning powers

However, there are still barriers to successful large-scale development

- Developers' confidence remains low and they want fast returns and delivery
- The housing market remains weak with affordability issues
- New developments are expected to be of very high quality
- Restricted lending continues to mean a lack of funding for development
- Many local authorities lack the skills and resources for managing planning on a large scale

But is it really possible to align all these elements in the current climate? "Planning in the UK is in a state of flux," Bromfield acknowledges. "We have new politics and new ideas but little clarity on how the national framework will pan out and complement the emphasis on local working. But I think the situation does create an opportunity for more collaboration."

"The introduction of 'localism' brings with it potential for interested parties with different mindsets and knowledge to become involved in the planning process in a different way from the past," she continues. The increase in collaborative forums also brings more opportunities for working in an integrated way."

"For example, the government is encouraging Local Enterprise Partnerships (LEPs) to take on an advisory strategic planning role. And other partnerships are being developed with a duty to co-operate. This is an opportunity to take a properly integrated approach to planning. Establishing the right partnerships early on in the planning process and monitoring arrangements makes for more robust outcomes."

"But to make the most of these opportunities, public and private sector organisations really do need to work together to share resources, knowledge and skills," Bromfield continues. "This is why, at Arup we respond to large planning projects with a multi-disciplinary team that includes not just planners, but urban designers, environmental specialists, economists, transport planners, infrastructure engineers, and others."

Smith agrees, arguing that planning shouldn't be about personality. "To take an integrated approach, people who work in planning need humility," he says. "It can't be about them; it has to be about everybody. Collaboration is vital to delivering a shared vision for a large scale development."

This vision is vital for shared decision-making, says Bromfield. "In my previous role I worked on a scheme where a 5,000-home development depended on a new link road. When funding problems arose, stakeholders worked together to find a new way of funding the road – because it was vital to their vision."

Ultimately, the real test of large-scale development is in how it functions when built. "Successful growth is about delivering places people want to live in and work in," says Bromfield. "The UK is, sadly, renowned for a poor track record on large-scale growth and integrated planning is a key tool in turning this around."

Visualisation of Pentre Gardens, Grangetown

Water Sensitive Urban Design

Why cities should get smarter about managing water

Fundamentally changing the way we manage water in our urban landscape could help reduce flooding and conserve precious water resources. With the resulting benefits for cities and businesses including reduced costs and increased resilience, pursuing water sensitive urban design (WSUD) today could bring large rewards in the future.

Combining a range of different measures, WSUD is an approach that looks to capture, store, use and slowly dissipate water. "WSUD is ultimately about rising to the real challenge of how we can use that water from the moment it falls on the ground until it's disposed of, and use it for the benefit of mankind," says David Evans, who leads Arup's water business in the West of the UK. "Climate change is making the need for this focus particularly urgent."

A global challenge

The impacts of climate change mean that, in many parts of the world, preventing rainwater from flowing straight into drains or sewers will help to preserve a precious resource. "In places where water resources are under pressure, you need to ask if you can put water to a good use two or three times after it falls on the ground before you dispose of it," says Evans.

"In Wales, only 3% of the rain that falls is used in the supply of drinking water", explains Martin Hennessey, the Director of Capital Delivery for Dŵr Cymru Welsh Water. "We get a lot of rain, so we can afford to let water run away as long as it doesn't harm anyone by causing flooding. But in many countries, the ability to capture, manage and process that water would bring enormous benefits if it could be designed into the fabric of cities and their infrastructure."

Indeed, Arup is already helping to do this for cities around the world. For a low-carbon community in Changxindian, Beijing, Arup devised a comprehensive water strategy. This incorporates rainwater harvesting, with rainwater collected from roofs across the district and stored in pools underground. Domestic wastewater is also treated by a regional treatment plant and partly recycled for non-potable use.

Applying WSUD principles to the Bay Meadows development in San Mateo, California, has helped to mitigate flood risk and fostered community regeneration. The detention pond that stores and cleans stormwater also provides 600,000 gallons of water for firefighting. And new floodable recreation fields are specially designed to safely accept and shed retained water from major storm events without compromising the playing surfaces.

Dealing with flooding following storms is also increasingly important in the UK. "Climate change is increasing the intensity and frequency of storms," explains Hennessey. "With the problem exacerbated by urban environments containing too much hard standing and not enough permeable surfaces, the result is combined sewer systems that can no longer cope with the stormwater flowing into them."

During heavy rainfall, water companies can be left with no option but to discharge wastewater swelled by run-off into watercourses. This not only risks pollution but could also land the companies with infraction proceedings from the EU. But currently they have no choice if they are not to exacerbate flooding which has caused multi-billion pound damage and severe disruption to the UK over the last few years.

Retrofitting WSUD

Traditional solutions to this problem involve increasing the size of sewers or providing extra storage capacity. But these sorts of schemes are expensive and although they address the immediate problems, they don't unlock wider benefits in the same way as WSUD does.

So why haven't more cities with combined sewers – where sewage is mixed with rainwater run-off – implemented alternative solutions? "I just think no-one had looked at the problem that closely until now," says Hennessey.

"Everyone thought it would just be too hard to separate the combined systems. But actually if you take the time to look at the hard standing, where the water's emerging and the topography of the area then I think those opportunities emerge. You need to start by understanding – and modelling – how water behaves in the catchment area."

This, Evans explains, is how Arup tackled a project with Welsh Water in Llanelli designed to help avoid spilling wastewater into the Loughor estuary and alleviate surface water flooding. "Multi-criteria

Managing Wales' natural resources

Peter Matthews, the chair of Natural Resources Wales, explains how Wales has taken an innovative approach to managing its natural resources – including water.

Following consultation, the Welsh Government decided that the best way forward was to create a new single body to ensure that the environment and natural resources of Wales are sustainably maintained, used and enhanced for the benefit of the people and economy of Wales.

The new body, Natural Resources Wales, started on 1 August 2012 and will begin operations on 1 April 2013. It replaces the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales and will take on the marine regulatory functions of the Government.

Its focus will be on the environment, but as part of a much bigger picture. In managing the environment, Natural Resources Wales will use knowledge, add to knowledge and take account of the needs of communities and economy.

Further legislative changes are planned in Wales for sustainable development and the environment in coming years. Natural Resources Wales will be an important part of a process under which the Welsh public service will have a duty to embed sustainable development.

We are witnessing the tangible outcome of a new way of thinking - integrated natural resources management with the ecosystems approach.

Before and after images of how a swale could be retrofitted into open green space in Llanelli, Wales

analysis produced a priorities list looking at the effects of different schemes," he says. "It included factors like ease of stakeholder engagement, ease of construction and carbon effects as well as cost."

The result is a 20-year delivery plan involving WSUD measures such as dispersing surface water into parkland to create a feature instead of putting it into sewers. As part of the plan, towns will have more green areas and roadsides will have trees and places where water can infiltrate instead of going into combined sewers.

Evans points out that introducing measures over a long period of time makes them more cost-effective and enables Welsh Water to reassess them as the climate changes. "After 20 years, we predict the investment around Llanelli will achieve the same outcomes as replacing sewers and building storage," he says. "But it will also enhance the environment and provide green-space amenities. And it will come at a fraction of the cost of traditional solutions."

"In Wales, only 3% of the rain that falls is used in the supply of drinking water."

Martin Hennessey, Director of Capital Delivery, Dŵr Cymru Welsh Water

"In Llanelli, it's in the municipality's interests as well as Welsh Water's interests to take water out of the system. They're releasing land for development, which generates income, which can be used to change the way drainage is handled in the towns. Win-win situations like that make a big difference."

Community and stakeholder engagement

It's clear that one challenge to successfully implementing WSUD is that it relies on engaging a lot of people – from organisations to individuals. Evans points to Arup's work on the Greener Grangetown project in Cardiff as an example of the detailed thought that needs to go into community engagement.

"We're trying to link part of Cardiff to the riverine environment and extend that into Grangetown," he explains. "Grangetown is a multi-ethnic area so as we're creating green spaces to capture and clean the water, we need to make them equally attractive to all residents. For example, a community orchard could be planted alongside the swale. If the local community is going to take ownership of something like this, we have to plant it with fruit that people from all ethnic backgrounds will want to eat and select trees that are native and assist with the cleansing process."

Implementing WSUD on a larger scale would also mean working with lots of institutional stakeholders, as Hennessey explains. "At Welsh Water, we have a lot of interfaces with Welsh Government, Environment Agency, Highways and Local Councils. A partnership approach to the development and implementation of WSUD is key to success."

Evans believes this is why governments must ultimately drive WSUD. "For this sort of approach to become commonplace in the years ahead, I'd like to see it fitting into a wider legislative context so that WSUD is a planning requirement in new developments," he says. "I think this needs to happen on the construction side too, going beyond aspirational ratings like LEED or BREEAM and becoming part of primary legislation. That way, more communities might start to reap its benefits."

A vision for water sensitive urban design in the UK

Arup has been working closely with the Construction Industry Research and Information Association (CIRIA) to produce a report which creates a vision for WSUD in the UK.

'Creating Water Sensitive Places', published in spring 2013, summarises the results of a scoping study which explores the potential to deliver WSUD in a UK context. The report demonstrates the benefits of WSUD in creating more adaptable places that enhance amenity and well-being, respond to the water challenges facing communities and support economic development.

As lead research contractor on the project, Arup has assisted CIRIA in proposing recommendations for its uptake in the UK, drawing upon research from international experience in WSUD and feedback from workshops with key agencies who could deliver and benefit from WSUD in the UK.

For more information, please contact Justin Abbott, Director in Arup's water business – Justin.Abbott@arup.com.

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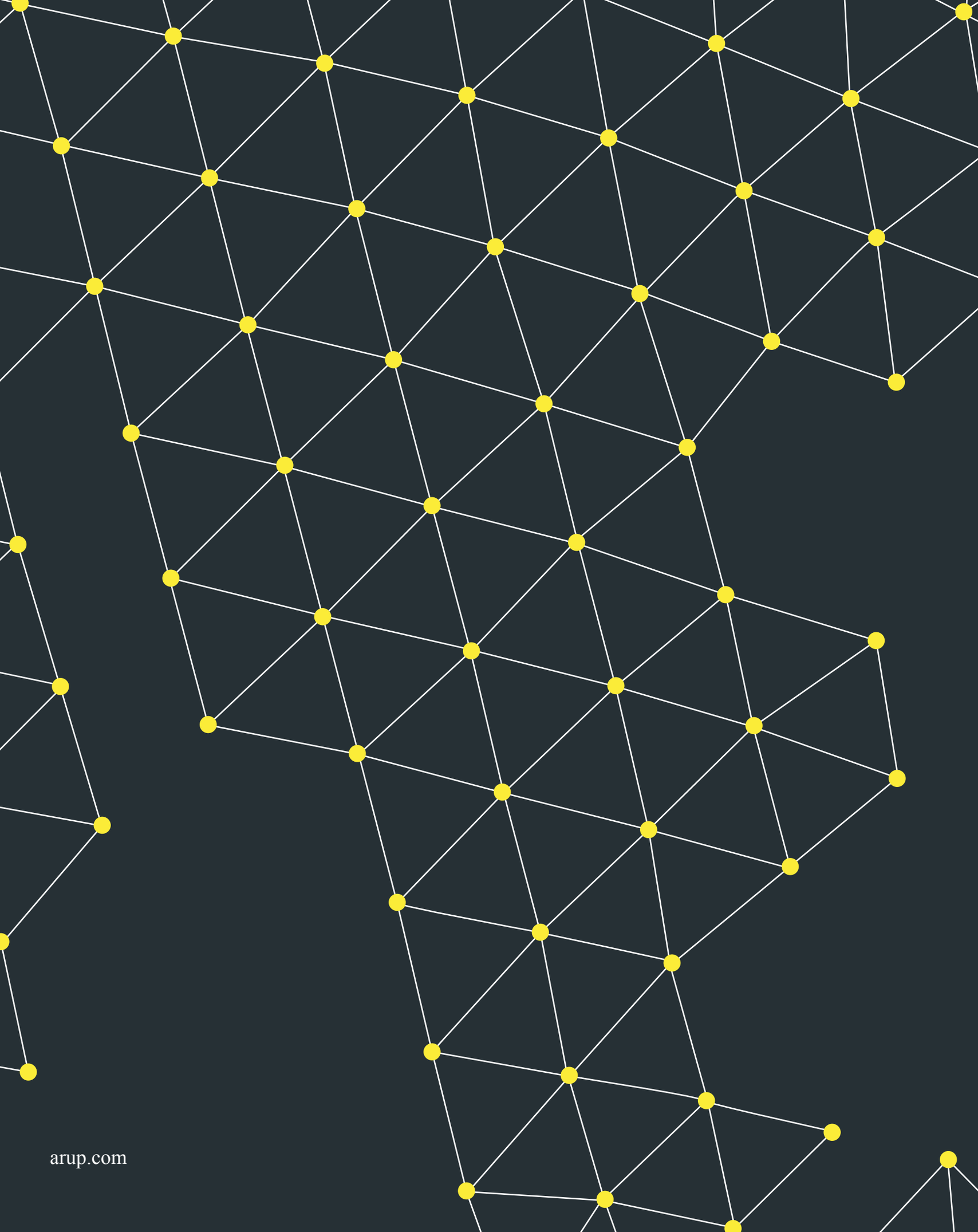

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