Cities of the future

HSF's Matthew White looks ahead to the ever-changing challenges and opportunities of urban growth

The We Company recently announced new 'future cities initiatives' which will combine technology, data and real estate to 'help address problems spurred by globalisation, urbanisation and climate change.' The project will involve a team of engineers, architects, data scientists and biologists.

No further details are available at this stage, but resist the temptation to dismiss this as just another tech company jumping on a popular bandwagon. WeWork has already disrupted the office real estate market to such an extent that it is now the largest corporate office occupier in central London. Meanwhile, Google's parent company, Alphabet, has set up Sidewalk Labs, an urban innovation organisation that 'is reimagining cities to improve quality of life.' This is not just indulgent desktop idealism: Sidewalk Labs is currently designing a district in Toronto's Eastern Waterfront 'to tackle the challenges of urban growth.'

Bricks and mortar real estate companies should be tracking these companies very closely as an existential threat to their business models. Real estate has suffered relatively little from disruptive entrants to the market and it remains one of the most conservative of sectors. This combination makes it look very much like a target. Building practices have hardly changed in decades and the value of land is still heavily derived from its innate scarcity, rather than any sort of dynamic pricing model.

So, let's say you are an innovative, blue sky, go-getting real estate lawyer (because you are, right?). What do you need to know to hold your own in a discussion with Silicon Valley's upstarts about the cities of the future?

Demographics

According to the United Nations, around 55% of the world's population live in cities. By 2050, that proportion will increase to two thirds. Megacities – with populations of more than 10 million residents – will also increase in number, from only 10 in 1990 to a predicted 43 by 2030.

These factors make global gateway cities the most attractive places for capital investment. This creates a reinforcement effect, with greater investment making cities more attractive places to live and driving further densification: a virtuous circle of urbanism.

The irrepressible urban march is not evenly distributed however. The population of Europe is actually shrinking. The rate of growth in Asia – the engine room of global economic growth for more than a generation – is declining. The biggest increase will be in Africa, with the population set to more than double between 2013 and 2050.

Moreover, people in Africa will be younger than in any other part of the world, with a median age of 25 by 2050 compared to 40 in Asia, 41 in North and South America and 46 in Europe.

Demographics drive change. Older people typically buy fewer consumer goods. They are generally less innovative. They tend to vote more conservatively. An older population will place greater stress on public services such as health and social care. Unless economies are propped up by high rates of immigration, we will need to work for longer to support ourselves. The labour force will move increasingly towards older workers, the group currently most threatened by automation. And while the biggest challenge in the UK housing market today is the lack of supply preventing young people getting on to the housing ladder, the cities of the future are likely to experience the highest demand for supported living and luxury retirement properties.

There are some positives as well though. High quality housing products aimed at the older generation could generate a 'win win' outcome: if older people choose to leave their family homes, this will put existing housing stock back into the market and free up smaller and cheaper properties for younger buyers. And PwC has concluded that if the USA raised its employment rate for 55-64 year olds to the same rate as in New Zealand, its GDP would increase by $815bn.

Energy

Large, densely populated cities use a lot of energy. How will the cities of the future generate this energy?

Everyone knows that fossil fuels are a finite and diminishing resource. You may therefore be surprised to learn that proven oil and gas reserves have actually increased by more than 50% since 1995. This counter-intuitive trend is due to the improving technological ability to locate and extract reserves (the hydraulic fracturing of shale gas being a prime example). Combined with unpredictable and uneven rates of consumption across the globe, it is difficult to forecast how long fossil fuels will last, but on current estimates there are still more than 50 years' reserves of natural gas and oil left in the ground and more than a century's worth of coal.

So will the oil, gas and mining sectors therefore remain good clients for decades to come? The risk for cities of the future is not that we will

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run out of fossil fuels, it is that we will need to find urgent alternatives due to climate change and security of supply issues.

To meet current global climate change targets, at least two thirds of known fossil fuel reserves will need to be left unexploited. The figure is higher for coal, which is the most polluting of fossil fuels, with as much as 82% of reserves needing to remain 'unburnt'. A significant proportion of oil and gas reserves are in the arctic, where drilling is environmentally and geopolitically controversial. Just three countries (Russia, Qatar and Iran) control more than half of the world's natural gas reserves. And many parts of the world are water-stressed, which constrains the expansion of methods of power generation that rely on water consumption (including nuclear).

Decarbonisation isn't only being driven by environmentalists and politicians. Energy companies recognise that the risk of their reserves being 'stranded' – ie, rendered valueless – means that they have a strong incentive to explore alternatives. Further growth of renewable energy sources can therefore be expected. Last year, BP predicted that renewable energy generation will quadruple by 2040, but this would still only amount to 14% of global energy demand.

Renewables remain expensive compared to fossil fuels, with many subsidies being phased out. Remember, however, that the greatest population growth over the next 30 years will be in Africa, which has relatively few gas and oil reserves (or access to reserves) compared to most of the rest of the world. But it does have very high solar energy potential. These demographic and geographical factors point to improving economies of scale for solar energy.

Solar energy is not limited to solar thermal and photovoltaics: it can also be used to produce hydrogen. In March, scientists in Belgium announced that they had invented a solar panel that uses sunlight to generate hydrogen from the moisture in the air. They claim it works so quickly, you can see hydrogen bubbles appearing within the panel as sunlight hits its surface. This is exciting because of the potential for hydrogen fuel cells to be used for heat and power generation without any combustion, pollution or carbon emissions. At the moment, the economics of hydrogen and fuel cells are prohibitive for large-scale production, but this will undoubtedly improve. London is one of the market leaders in the use of hydrogen technology, one example being the fuel cell system installed by the Crown Estate at its 7 Air Street sustainable office scheme.

The future for energy is certainly moving towards decentralised energy generation. Domestic solar and wind powered microgeneration is already commonplace, but relies on the baseload provided by the national grid at night and when the wind isn't blowing. Advances in battery technology mean that a shift to local energy independence – and even net positive generation – now looks more commercially feasible. As electric vehicle (EV) ownership increases, so does the possibility of using EV car batteries to store domestic energy. Larger battery storage facilities are already being built in the UK and the government consulted earlier this year on treating facilities with more than 50MW of installed capacity in the same way as generation stations for planning purposes.

Battery storage clearly has a major role to play alongside renewable energy in the cities of the future. Storage systems can be housed in units that are the same dimensions as shipping containers, facilitating quick and easy delivery even to remote locations using existing transport networks. While finding sites in city centres might appear more challenging, could the failure of big box store retailers in the UK and US provide a ready pipeline of suitable sites for new battery storage facilities right where they are most needed?

Planning and sustainability

Badly planned cities have many negative effects, including congestion, pollution and poor quality public open spaces. These factors can already be seen in many megacities across the world. Good planning and stewardship of real assets are therefore essential to the success of the cities of the future.

Technology can help, with smarter buildings using less energy, for example. But innovation involves risks. Private autonomous vehicles and mobility-as-a-service may be the future of transport, but this could cause a huge increase in congestion if people shift away from the use of mass transit systems for journeys into and around cities.

The cities of the future will require visionary planning, robust infrastructure and judicious regulation to maximise the potential benefits of technological advances while minimising the negative externalities. The problem is that we are not starting from scratch. Most of these cities already exist, but their sustainable growth is hamstrung by existing systems of planning, infrastructure and regulation. Transition planning will not be easy.

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In the short term at least, we can expect greater state intervention to encourage behavioural changes by citizens. Tackling air quality is the frontline of this battle. Londoners are already used to paying the congestion charge to drive into central London on weekdays. On 8 April, the 24/7 ultra-low emission zone also came into effect, requiring anyone driving into the central area to pay a daily charge unless their vehicle meets strict exhaust emission standards. Road and congestion pricing, exhaust emission standards and vehicle bans are likely to expand. London is, if anything, lagging behind other cities in this regard. Paris has already banned all cars built before 1997 from entering the city. By 2025, all diesel vehicles from before 2010 will be banned from the A86 Beltway, an area extending far outside the city centre and into the suburbs. Madrid plans to allow only zero-emission vehicles to drive in the city centre, including for residents, from 2020.

Vehicle emissions are only one element of the air quality problem in the UK. The government estimates that 38% of particulate matter is caused by open fires and wood burning stoves. The Clean Air Act 1956 introduced smoke control areas in towns and cities in the wake of London's great smog of 1952. Steps to ban the burning of wood in these areas now look likely under the Clean Air Strategy published by the government in January.

For new cities being planned now, building underground transport networks for servicing and deliveries, and using autonomous electric vehicles for these functions, would reduce emissions and free up valuable land for public green spaces and amenity uses. Sidewalk Labs propose the use of robots to transport freight and waste via underground tunnels, for example. This is not so far-fetched – Bazalgette designed London's sewerage system in the nineteenth century on the same basic principles after all – but the degree of infrastructure interventions required will present a huge challenge. There is an urgent need for new investment models to unlock the necessary finance, which will involve an unprecedented degree of partnership between the private and public sectors.

Data

The most distinguishing features of cities of the future will be their collection, use and storage of data. Sensors will be embedded throughout cities to gather data on every aspect of life. This data will be used to calibrate the delivery of services more efficiently: rubbish collections, street lighting and traffic management can all be improved with better data systems. Barcelona's Sentilo city operating system already puts many of these ideas into practice.

It is the connection of sensors and the pooling of data – often referred to as the Internet of Things (IoT) – that offer the greatest potential to improve city life. Data from wearable tech can be used to diagnose health problems and forecast the medical resources required to address them. Low-cost IoT sensors fitted to existing infrastructure can monitor capacity usage and detect maintenance issues before they cause a failure. Real time crime mapping can identify patterns of criminal activity, allocate police resources and even predict crimes.

Some regard this interconnectivity as an invasion of privacy, but it is already happening and the roll-out of 5G networks will only accelerate this trend. We have grown used to the convenience of big data, without paying much attention to the value of the data that we create and share in our daily lives. This is likely to change in future as people reassess the social contract between service providers and users. Data will increasingly be seen as a valuable asset in its own right and this will lead to greater regulation of data privacy, access and security.

For lawyers, we can expect increased data sharing and the growth of IoT devices to drive demand for self-executing or 'smart' legal contracts. Smart contracts use embedded computer code to interact with external data sources to determine when events occur that trigger the automated performance of legal obligations. A simple smart contract might contain a clause that requires a retailer to pay a supplier when goods are delivered. When the delivery is scanned at the retailer's goods depot, the contract can be drafted so that this automatically instructs a payment to the supplier's bank account. The use of smart contracts is necessarily constrained by existing laws – for example regarding the transfer of land – but the adoption of distributed ledger technology (such as blockchain) will improve the security of transactions and is certain to lead to increased contract automation.

Conclusions

Amara's law, named after the American futurist Roy Amara, states that we tend to overestimate the effect of a technology in the short run and underestimate its effect in the long run. Many of the innovations described above fall into the first part of Amara's law: autonomous vehicles, hydrogen fuel cells, underground robot tunnel networks, big data, the IoT and smart legal contracts are in various early stages of a hype cycle. But the underlying demographic, political and environmental factors affecting cities suggest that many of these technologies will influence future development. Cities share similar issues and challenges wherever they are in the world and global connectivity is accelerating this verisimilitude. Our cities of the future may well have more in common with each other than they do with the rest of their home countries. ■