

**Sue Nelson**

Hello I'm Sue Nelson and welcome to another episode of 'Create the Future', a new podcast series brought to you by the Queen Elizabeth Prize for Engineering. Today I'm joined by two engineers who encompass the integration of technology and infrastructure needed to produce smart cities, they are Larissa Suzuki a senior manager for machine learning platforms at Oracle and an assistant professor at UCL... and Andrew Comer director of the 'Cities' business unit at BuroHappold Engineering. I'm going to begin by the definition of a smart city because, basically, I've read so many and I want to make sure that I've got it right. Here's how I view it, a city that uses technology to make things work more efficiently and sustainably - from transportation and sanitation to power supplies - and along the way, improves the quality of life for those who live there. By technology we mean primarily the internet and data. Larissa would you agree with that?

**Larissa Suzuki**

I do believe that we need to make use of the data and the technology but I believe that we can only achieve a smart city if we make those two things work for the benefit of the people we are building them for. So a smart city can only be smart if any solution that we put out there mirrors the society we are building them for to address really real cases for people.

**Sue Nelson**

Andrew I know you work all over the world at the moment, you're doing a lot of work in Saudi Arabia. Does a smart city mean the same in Europe as it does in say the Middle East or Africa or America, is that definition the same?

**Andrew Comer**

I think broadly speaking you're probably right. There are lots of nuances that are involved and I think it depends really on what the aims and aspirations of the of the various players are. By and large I would concur with the introduction you gave. The only thing I would add is that I think there are some fundamental principles that need to be addressed before you could start to think about overlaying technology onto a city platform. They've got to be planned designed and constructed correctly before you can even think about the way in which technology can help with the sustainable approach.

**Sue Nelson**

Well here's what Lord Browne, the chair of the Queen Elizabeth Prize for Engineering had to say when it came to thinking about the definition of smart cities.

**Lord Browne [Audio Clip]**

"Engineers understand the system impact of changes, so more people in more places, how to make it more habitable, more enjoyable, how to get traffic around and the right way and how to do it intelligently. It's everything that we don't see happening in most big cities at the moment where people dig up the roads willy-nilly and cause gridlock everywhere because no one has an idea of how to plan the whole system".

**Sue Nelson**

Which is exactly what you said Andrew - It's a planning and integration.

**Andrew Comer**

Indeed.

**Sue Nelson**

What is the first smart city, have we got one, do we know there was a time when we thought 'ah, this is it'?

**Larissa Suzuki**

This idea started with the concept of digital cities in the 60s in the United States when community networks started to emerge giving people access to information about the city online, so you could see about events, about cost, rubbish collection, all that information. One of the things that then started to give rise to smart cities was because in between digital cities in the 60s and the evolution of pervasive computing, we started embedding sensors everywhere collecting data from everywhere and the idea of 'smart' is to get insight from the data so we can learn how to do better. But the problem that we have as of today is infusing technology into older vintage cities like London is really a difficult and very complicated. Also bringing all stakeholders together to actually agree on a way forward because if energy suppliers water providers and transport providers don't have the same understanding on how the city is growing, people are going to do X here, Y over there, and Z over here so we will never have a consensus of how much housing we have to provide to ensure that every single person living in a particular city will have access to food, jobs and healthcare and clean water and energy. So we need to bring everybody together and integrate not only the technology but also the stakeholders. They have to all join up together.

**Sue Nelson**

Well Andrew you a very good experience of something similar with the Olympic Games because you're using London, which as Larissa says has an existing old infrastructure, but you were actually on a site that wasn't necessarily fit for purpose when you led BuroHappold Engineering team for building the Olympic Park in 2012. It was considered a massive success, the greenest Olympic Games at the time - would you call what you did, building a sort of smart neighbourhood at the time? Explain what you actually did for people who are not necessarily aware of all the things that you had to build for that site.

**Andrew Comer**

Looking back now it seems some distance ago.

**Sue Nelson**

It's only seven years.

**Andrew Comer**

Seven years since the event but probably 15 years since London started planning for the games. I think that one of the big success stories was not necessarily the focus that was given to the Olympic Games themselves, although that in turn turned out to be, as you say, a great success and seen as a benchmark I think not just for sustainability but accessibility. That in itself was an achievement but I think the real focus and the real effort was on trying to establish a framework and an infrastructure that would serve the development of an urban community in that part of London for the next 25 to 30 years. So using the windfall if you like, of the access to investment that came as a result of winning the games to actually help build a future for what was, at the time, probably one of the worst parts of a city in Europe. There were very low levels of employment, very high crime rates, the ground was polluted. It really was not a pleasant place. One only has to go back now as you say we're seven years post-games, to have a look at the transformation that's taken place the rate of development. I would say it's probably exceeded everyone's expectations, but it shows I think the focus that was given to planning and good quality design and a focus on not just a temporal blip on the 25-year horizon but seeing the games simply as that. As a stepping stone towards so much better urban development. In terms of technology I'm not sure that there was a huge emphasis placed on that for the for the site itself, there are some good examples of smart grids for water resource management, for energy resource management. But by and large because of the speed at which things had to had to happen and the fact that it that the games had to be

delivered on time, it was one of those projects that you couldn't delay. A lot of focus was given to processes and products that were known to be successful and could be delivered with confidence.

**Sue Nelson**

And what about the green aspect? It was called the 'greenest Olympic Games'. What was it about your planning and infrastructure that made a collection of stadia green and allowed it to have a legacy that people are sort of using today?

**Andrew Comer**

I think there was a genuine attempt at the outset to rationalize what was meant by a 'sustainable Games'. It was broken down into the end into 12 key areas. It focused around issues such as water usage and energy, as I've said, plus the ability for every member of society to be able to access the games properly. It also looked at the reuse of resources and materials. Each of those twelve key areas were effectively given aims and objectives and they were set out as key strategies and then effectively those strategies were taken on by the various leaders of the different components of the Games. Each of them had an objective in terms of how much water they were going to be able to conserve through their building design or through reuse during its operations and as a cumulative approach, they worked very well I would suggest.

**Sue Nelson**

What would you say was your greatest legacy with that project from your point of view?

**Andrew Comer**

From a personal perspective I think it was the double win that that the games were hugely successful and by and large went off without a hitch and secondly it has created a development platform that's been built upon and is now proving such a popular and valuable asset for the Londoners and for the population of the UK as a whole.

**Sue Nelson**

Larissa you've worked with the mayor of London as well, what was the project that you were working on and that you had to bring the sort of technology side to?

**Larissa Suzuki**

When I joined the City Hall I was requested to firstly write a complete data strategy for the London Government, which is one of the things that I did on my PhD thesis that also became a book now, which is how we can use data to empower systems and also to be reactive to for instance know that something's going to go wrong in a particular system before it happens and do something about it. Or how we can test how our policies are going to impact the KPIs we want to have for our cities. So if we want to improve mobility, how a government policy might affect that.

**Sue Nelson**

And by KPI you mean?

**Larissa Suzuki**

Oh god.

**Andrew Comer**

Key performance indicator.

**Larissa Suzuki**

Yes.

**Sue Nelson**

Every profession has its acronyms.

**Larissa Suzuki**

After creating that data strategy I got to work on a particular project that was to address the problems that we have in infrastructure provision in the city here in London. So for instance if Transport for London has to go and do something on a particular street they go dig it up, do their work and goodbye. The next day, Thames Water comes and digs up the street again.

**Sue Nelson**

Exactly what Lord Browne said!

**Larissa Suzuki**

Yes. What it creates, it really causes issues for businesses. It wastes time, it wastes money and also a lot of resources. It also increases air pollution because you have a lot of congestion and it is not good for mobility. Also, for the safety of the workers because in London we have vintage technologies underground that we aren't sure about. I think in the UK it is estimated that we have a hundred accidents from like electricity cables alone every single year and that is a major problem. My responsibility was to bring in and convince partners - because a lot of people are very afraid of giving data about what their next projects are because not everybody is accountable to follow the Mayor's policies - so we had to convince UK power networks to really follow the Mayor's plan and other companies as well. The idea was to convince them to join our network of partners providing us with data to create a geographical information system that you can actually visualize how the city is growing in the next 15 years and then where projects should go. So for instance where we want to put houses because we know a lot of people are moving to the city, but we have a drainage capacity in the location, what do we do about this? So Thames Water, the UK power network and Transport for London, they can plan together to address how the city is growing and also address any issues we have in terms of transport accessibility, water supply, drainage capacity. So I created this solution for London called 'Infrastructure Mapping Application'. You can find a lot of insights about how London is growing, where technology is helping us to visualize where we have connectivity issues - we now have 5G coming up to allow us to get data from the internet of things much faster, but how do we provide that connectivity to every individual in the city and also one of the things that we put into that technology was the skills that we would need to realize those projects. It is quite interesting because it shows the amount of engineers that we're going to have to have. We have to address that skill shortage as well, how many engineers are we going to need and also technologists. Engineering is about human survival and then we can correct all the issues that we have in terms of natural resources, we cannot replace them, they're going to be gone. Also, cities of the "first world", like London, they have to start thinking about issues that we see in "third world" countries as well. It's predicted that in the next 10 years London is going start having issues with water provision so we cannot afford to think only about "first world" problems like putting drones flying, we have to really think about what it is that is coming up that is going to affect not only the city but the entire population.

**Sue Nelson**

What you're saying to me sounds, both of you, I know it's got this this overall term 'smart cities', which sounds like you're doing something clever and intelligent. But it sounds like common sense to me?

**Andrew Comer**

I would say, I mean this is comes down to the role of the engineer in society I would suggest. We have serious challenges globally with urbanization and resource depletion creating climate change and social unrest, it is one of the inevitable consequences if we're not careful. Engineers have historically taken the advances that have been made in science and technology and applied them where they've been beneficial for the improvement of society for mankind. The challenges that we have now is that the problem is huge and time is of the essence and there's an enormous challenge for us all to work out how on earth we can resolve the problems that we've really built up over the last 50 years and probably beyond that.

**Sue Nelson**

What do you mean by social unrest?

**Andrew Comer**

Well inevitably we are getting to the point where a lot of people, even in developed countries, are now not necessarily seeing themselves as equal citizens. There disparities between opportunities in the workplace, there are challenges in terms of the ability to enjoy the quality of life perhaps they see others enjoying.

**Sue Nelson**

So it's the haves and have-nots, but not just in terms of money but maybe in terms of technology as well?

**Andrew Comer**

Well money will be a big root cause I suspect, or the lack of it, or the excess of it by others. But there are opportunities to start to create broader... I think as an industry we've seen environmental sustainability fairly well defined and being tackled certainly over the last two decades. Most professionals are aware of the challenges of environmental sustainability and working towards improving that. I think the Great Recession focused people's minds on economic sustainability and a lot of developers now and mayors and municipalities are giving great deal of thought to making sure that money's being spent wisely and that the outcomes are driving better economies so that success can lead to success. I think the one big area where we haven't had as much focus and there is a need for all of us start to think a bit more carefully about and that in terms of social sustainability. I know the Institution of Civil Engineers has been running a series of workshops over the past year or so to think about issues around women in cities and how they can feel safer and more secure. Also around disabled people and their ability to gain access to their places of work and where they live more equitably. So you know, even in London and the UK there are enormous challenges and we're a fairly sophisticated mature society I think, in other parts of the world those challenges are even greater.

**Sue Nelson**

I must admit, I remember being in Birmingham once and I only had to walk literally five minutes from one building to another and it was one of the most terrifying experiences of my life because it was through dark alleyways. As a woman in terms of feeling secure I just thought who and earth designed this?

**Larissa Suzuki**

I know pretty well what we're saying because I remember when I was run over by a car it was exactly because of this. I was so afraid to walk on the sidewalk that had so many trees and was so dark with no lampposts. I was so scared and then I started walking a little bit closer to the sidewalk and then a car turned around and ran over me. I was in the hospital for a while and this really links back to what we were saying - a smart city is not smart if it does not mirror the society we are building them for. I also I think we have to bring this conversation more down to earth for instance self-driving cars; a lot of people that talk about 'this is so techy, AI' and all this - we can be reading our newspaper in the car. It's all about the laziness and the convenience. However, that shifts the conversation on smart cities to a small proportion of the population who will have access to that. We

cannot make a smart city become a commodity that will serve just a few. Think, we have 285 million people who are visually impaired around the globe. We have 80 million people relying on wheelchairs. Self-driving cars can really bring them back their right to the city.

**Sue Nelson**

Because at the moment you think of technology and you think of you Jeff Bezos, Elon Musk and Dyson - you think of very wealthy people. So what you're saying is that these cities are actually going to be more beneficial to all aspects of society as well as being smarter in terms of how we use resource?

**LARISSA**

Indeed, and even in terms of connectivity we are talking about 5G and that is so fantastic for us to transmit a bigger amount of data much faster which can enable self-driving cars.

**Sue Nelson**

You're saying 5G - I live in a village and it's not far from London and we barely get 4G, most of the time it's 3G or we get no service at all. We are less than 30 miles outside one of the biggest capital cities in the world!

**Larissa Suzuki**

That is really my main point. If you think about that we are moving everything digitally in terms of government - a lot of government services are online. You have to upload documents. Even learning, a lot free things you get online. Think about those who live, for instance, in poor communities, they don't have that fast broadband they might not be able to take part in this. So I think going back to the thing about the right to the city, this is something that has been neglected into the conversation of smart cities and we have to bring everybody to the table.

**Andrew Comer**

I mean, I think it is one of the big current conundrums we face that the wealth and the access to investment money sits fairly squarely within the private sector and they have a main objective in life and that is to earn a return on their investment. The public sector is therefore with a different set of aims for the public good and so the reality is that the only way in which you can approach this whole problem is to make sure there's a very close compact if you like between the public and private sector. There needs to be some mechanism, some agreement in terms of what is a reasonable amount of return on that you can expect on investment, how do you even assess that when it can be, as in London's case, extremely complex. Who actually owns what and how do you actually recover your return on investment when there are so many players at the table. The public sector needs to be able to also feel that they're benefitting by allowing the private sector to engage in the affairs and the helping with the operation of the city but most importantly as Larissa said, the citizen needs to be right at the heart of that whole deal and they need to feel that they are benefitting. People are using their data, probably depersonalized, but nevertheless there needs to be some opportunity for them to feel that they are getting something in return.

**Sue Nelson**

Well let me move on to you know one of the biggest can private companies in the world then because as I'm sure you're both aware there are plans to build a smart city neighbourhood prototype in Toronto called the Quayside by a company called Sidewalk Labs which is a sister company of Google. Now the plans include streets that will heat up so that you don't need to put salt down to de-ice the streets, awnings for buildings that will lower and raise temperatures, but those plans have actually been delayed because the residents are unhappy partly because of having a private company have access to publicly owned land and also about future revenue and also because of data privacy. Larissa there is a genuine fear at the moment that tech companies

are not necessarily deemed the good guys that they perhaps were 15-20 years ago. Can these companies reassure people that their data is safe and what sort of data do we need to hand over as part of the smart city developments?

**Larissa Suzuki**

When it comes to data, things get very complicated especially because what do you do with that data and if that is for profit and not for the benefit of their own citizens that becomes a big question. There are some other cities around who did what Sidewalk Labs are planning to, so in South Korea a lot of towns were built smart from the ground up which is much easier when you have nothing and then just start building with superfast internet connectivity there. I think there's a lot of issues in this proposal in Toronto because I don't think there is a clear transparency and you don't have the trust for the citizens that their data are going to be used for the benefit of all of mankind and also how that data can then be used to extract insights that can help other people around the globe who might be needing a lot of help in terms of like managing their transport our having more sustainable houses and energy supply.

**Sue Nelson**

And what sort of data is it though?

**Larissa Suzuki**

I think they would collect information about pedestrian movement and also are they going to collect videos or images? If that is in front of somebody else's house, you can sense how many people are coming in and coming out, so if that data is provided outside you can pretty much tell whether people are home or not.

**Sue Nelson**

There are examples, aren't there, where some people are more at ease with handing over data than others and you mentioned about cameras and having your picture taken. Japan for instance is a good example.

**Larissa Suzuki**

Yes, so for instance a few years ago in Japan, they are super open with tech you see robots everywhere so Japan is like Disneyland for any techie it's fantastic. But they are still very privacy preserving people they don't like to be filmed or to be photographed - Google Street maps was not used in Japan until a few years ago and I think that if the residents in Toronto are unhappy about this it is because maybe the company didn't do a very good investigation at the beginning to understand what are the expectations of the society that are going to be living in to that 'smart neighbourhood'. In order to gain the trust of the citizen, transparency has to come first and also what it is that's going to happen with that information and who is going to own that, do I have the right to be forgotten, what if I move house. So there's a lot of things going around and it becomes a huge problem because we see a lot of scandals with private data and how people are monetizing this and targeting people and there's a lot of like risk of data leakage and fraud so it's a very complicated matter and I think people might also feel that they are in Big Brother, you know, 24-hour surveillance. I think that might not be a good way forward. A good example of a well-accepted citizen driven approach is the Oxford Flood Network. So in the canal as you have floods, each house owner has their very own sensor they're responsible for, they maintain it like it's theirs and then they're responsible for getting the data and sharing it with others. You really empower citizens, they feel they're a part of the data processing, they have full control over that information and what information goes into the system but a system is a black box that you have AI or things working behind it, you never know the output of that and that can become a little bit dangerous in the way that is used but also unsettling for people. I think a better approach would have been to give the power to the people because that again, is private.

**Sue Nelson**

That's revolutionary talk there.

**Andrew Comer**

I probably disagree to certain extent with Larissa. I think in a way this represents quite an interesting opportunity. I think there needs to be room for experimentation and trial and error. I think Google or Alphabet, I think they understand the challenges and the risks of kickback from their customers. I know they've had challenges in the past, I think they will probably have learned a lot from that and I honestly think this represents an interesting opportunity to see what is possible in a pilot program. The proof of course will be in the future when they can start to reveal what benefits if any have been accrued through their approach. One of the opportunities I think it provides is to start to think about a much more integrated and comprehensive approach to management of the various infrastructure systems, all of which by and large nowadays rely on data and data management, but as Larissa said right at the outset, at the moment, especially in cities like London a lot of those networks are managed either independently or certainly in a set of systems that are not necessarily speaking to one another. I think where you can find an opportunity to start to create what I think Sidewalk Labs would call a 'City Operating Platform', a layer of infrastructure that actually starts to connect all of those components that go to make up the city functions, to be able to access the data that's accrued from them in real time and then be able to manage them very much in the way we use the iPhone nowadays or a handheld device.

**Sue Nelson**

But when data is valuable it's quite difficult to get private companies to share something of value and give that up?

**Andrew Comer**

That's goes back to this challenge of the compact that's needed between the private and public sector. The public sector has a huge role to play, they can set rules and governance issues and make it a case that if a private sector wishes to play a particular role in a city then they have to comply with certain rules and regulations.

**Larissa Suzuki**

In my opinion we cannot embed and infuse technology into cities if the people living there are not comfortable with it. In fact, I do understand, so I'm also computer scientist, most of the technologies that we need to create smart cities, they are available. It's just a matter of bringing them up together. Why? The private sector can move faster is because of the culture - they bring the technology people to sit at the table, which is one of the things that I have been talking for many years - for governments to bring technologists to sit at the table at the time they're making decisions about what systems to build and what data to collect because most of the time we see only policymakers, but we don't bring the technologists to sit at the table at the same level to devise blockchain or GDPR concerns for example.

**Sue Nelson**

It's also bringing engineers in earlier.

**Larissa Suzuki**

Indeed, bringing engineers in earlier to sit at the table because I think that is something that is great. So Megan Smith when she was CTO for Barack Obama, she brought in engineers from Google and Amazon to sit there and to help the public sector government to move as fast and agile as the private sector. We have amazing intelligent people in the public sector. The only thing I think it's missing is bringing the techies, which a lot of

people they call like 'nerds' but they are not nerds they are the experts, bring them to sit at the table and together create something because it's very multidisciplinary smart cities. You cannot only have the policy side you have to also have people who are experts on all the technologies and things that you're putting together to deliver it.

#### **Sue Nelson**

Would it be easier to start from scratch? I know that it's more realistic that you will have to apply your engineering and the technology and the infrastructure onto existing cities, but what about the case in Malaysia where they're going to build spend a hundred billion US dollars on four islands from scratch to turn these into smart cities. Would that be for you Andrew, would that be your sort of dream commission, to start from scratch? You're smiling.

#### **Andrew Comer**

Well I think I've already had my dream commission which was working on the London Olympics so I'd be very selfish if I asked for another one. I think we were already working in that environment in countries like Saudi Arabia actually, where the whole focus is on trying to change the country's economy and wean itself off reliance on the carbon economy and refocus on technology. I think it is certainly easier if you've got a blank sheet of paper to work with but it again depends upon the aims and ambitions and I guess the eventual arbiter of whether or not these cities are going to be successful will be whether they're going to be populated and who is going to live there and what businesses are going to move there and is society going to accept them fully. So as Larissa said there are examples of cities built from scratch in in South Korea - Songdo I think is a good example of that. I've never been, but colleagues who have visited said it's a pretty soulless place, it's very well connected in terms of technology but they wouldn't want to live there. I think that's part of the difficulty. Cities have often survived generations and are popular because of either their location or their position on the trade route and by and large they change and respond to change in a way that allows them to continue to trade or to be prosperous. I think setting up new cities always has a big element of chance about it and it'll be interesting, in a way, experiment both from all the aspects; environmental, economic, but mainly I think social.

#### **Sue Nelson**

That's interesting as we come to the end of our discussion, Larissa do you feel that is something that we need to remember. You can't just have the most amazing gee-whiz wonderful buildings all interconnected with all the right technology if actually no one likes it?

#### **Larissa Suzuki**

Indeed, and again it also brings up the point that the one-size-fits-all approach will never work. You cannot get a city in Toronto built by company X and totally translate this to Japan. It's a different culture, different digital readiness of the citizens as well, different overlapping of technology. So if we don't mirror the society we are building it for and for the particular KPI's we're going to measure. We have to have real outcomes at the end that's going to bring benefit for mankind. Without that we are just going to have tech flying around us but really not bringing us much benefit in the end.

#### **Sue Nelson**

My thanks to Oracle's Larissa Suzuki and Andrew Comer from BuroHappold Engineering for joining me on the 'Create the Future' podcast and giving us an insight into the engineering and technological challenges of smart cities.