CLC LECTURE

Urban Innovations in the City II

24 April 2017

A continuation of the "Urban Innovations in the City" Series, the second instalment will feature the innovative master-planning approaches that JTC adopts in its role as Singapore's lead agency for the development of industrial infrastructure. JTC's Assistant Chief Executive Officer, Mr David Tan, will share on JTC's efforts in shaping Singapore's urban environment and ensuring that the emerging needs of Singapore's industries are well-supported.

Lecture Segment

Victoria Wu
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Mr Tan oversees land use planning, redevelopment, procurement and contract management, as well as master planning and development of JTC's [Jurong Town Corporation] next generation estate[s] such as One-North, and Jurong Innovation District. Mr Tan is also involved in the development of Jurong Island, as [one of the] world's top 10 world energy and chemical hub, and the Jurong Rock Caverns, Southeast Asia's first underground liquid hydro carbon storage facility.

Today's lecture will start off with a presentation by Mr David Tan, followed by and Q&A [question and answer] session with [the] audience moderated by Mr Tan Szue Hann, Head of Sustainability at Surbana

00:00:52 Jurong. We would now like to welcome Mr David Tan on stage to commence his presentation. Mr Tan, please.

David Tan
00:00:59 Maybe for some of those who may not know what JTC is, we are a government agency under the Ministry of Trade and Industry [MTI], which is an economic agency. So, our key role is really to support Singapore['s] economic growth so that we can create jobs—good quality jobs in a good conducive environment—for Singaporeans. Essentially that is what our job is: to make sure we have plan and space for the people to work in.

And if you look at our mission, our mission is really to develop industrial infrastructure—focusing a lot on industrial. Later on, I will share with little bit about how we are slightly moving away from industrial but still predominantly focusing on industrial and really to help catalyse the growth of new industries. So [we have been] looking at new industries such as advance manufacturing, as well as to transform existing industries. You probably would have heard about the Committee for Future Economy, who has these plans to develop various industry transformation maps for industries. And our job is really to be part of that to be able to create land and space to support various industries transformation maps.

Industrial Story: JTC Corporation

00:02:18 That's the so-called outline of my presentation later on. Let me share with you our industrial story first. How many of you know or have heard a lot about JTC industrial stories? Just a show of hands. Maybe not so much [for] the younger people because the younger people [weren't around in] 1968—we were born. Just to share with you, we were actually born in 1968. We were originally part of the Singapore Economic Development Board which was formed in 1961. As our name suggests, we were tasked to develop Jurong Town. Jurong Town, is anything from Jurong East to the West. For those who live in Singapore, Jurong Town is anything from Jurong East to the West, okay? Our job was actually to develop the Jurong Town. Of course, we were a stat

00:03:09 board and we were focusing in the early years—we really focused on not only on industrial development, but we also focused on providing a township. So we built flats, we built recreational facilities, gardens, so on so forth.

So I will share with you from 1970s onwards, alright? Immediately after Singapore's independence. And during that time, Singapore of course has a small domestic market. And, the environment then was that companies from developed countries were also looking to relocate some of their the manufacturing activities. So obviously, they were looking around the world [and] they come over to Singapore to set up their businesses, or at least their manufacturing facilities. And our strategy then, was really as an export-led industrialisation programme, so that we bring in the industries and the industry will manufacture—and then of course, most of products that is [*sic* are] actually produced will be exported to the region as well as to the world.

And really at the point, we were focusing on creating jobs to pursue what we call labour-intensive industries—essentially to provide jobs for the people, good quality jobs. And so, some of the industries could be garment factories, wood-working, like the furniture industries. So, [19]68 this is how Jurong used to look like. Swamp lands with lots of hills. So our job was really to transform, the whole swamp land of Jurong into a thriving industrial estate. And we managed to do it shortly in just about three years: transforming the landscape, and putting in industries, preparing the land, putting the infrastructure, and ensuring that the industries can come.

And our job then was really to prepare what we call space—industrial space, and that can be in two forms. One is, we prepare the land for companies who want to build their own factories; two, we built the standard or flatted factories. So, these are what we called land-based as well as high-rise and multi-storey factories. And these are essentially for

00:05:29 companies who want to have [a] quick start-up. So instead, they don't want to build their own, they don't mind renting a space from JTC.

So as I mentioned, it's not only industrial development that we looked at, but we also looked at developing Jurong as a township. We actually built the Chinese Garden, the Japanese Garden, as well as the Singapore Science Centre. So that was our job.

Move on another 10 years down the road, 1980s to 1990s, as you know the economy grew through the dependence on so-called abundant labour and affordable labour. And also, many countries are [*sic* were] also opening up during that period of time, especially around our region; and also in 1985, we had our first recession. So, since our independence until 1985, there wasn't really a recession. But recession really hit us in Singapore in 1985.

Our strategy then was a twin engine of growth: one that focus[ed] on manufacturing as well as services. So that was in the '80s and '90s. And for manufacturing, we focus a lot more [on it] now. Instead of the so-called lower value-added manufacturing activities, we focused a little bit more on the higher valued capital, as well as technology intensive industries. So, in terms of the type of industrial typology or industrial facilities that we built at that point in time, we started to look at business parks. And that's really the Singapore Science Park which is at Buona Vista, the International Business Park that's in Jurong and the Changi Business Park which is located in Changi. And these business park[s] of course cater to both the manufacturing as well as the services industries. So that was our strategy in the '80s and in the '90s.

And at that point in time, we also focused a lot of [*sic* on] capital intensive industries. What are some of the capital intensive industries? For example the Jurong Island, which is for the chemical industry. This is a picture of how Jurong Island looked like in 1998, which we started in 1995—as well as the semi-conductor industry. So today, we have about

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four wafer-feb parks, located throughout Singapore to support the semi-conductor industries. But the key, at that point in time, was really this concept about cluster development. What does cluster development mean? Essentially, it is a concept where we cluster industries together so that they can enjoy synergy and they can enjoy economies of scale. And hopefully because they are closely located, they actually have a lot more business collaboration and therefore, reduce[d] business costs.

So, an example of Jurong Island, a typical example is the industry—the product that is produced by one company is sold as a feedstock to another company. And that sort of moves on so the product of another company becomes the feedstock of another company. So, there is a synergy across the whole value chain. Secondly, companies on Jurong Island for example, could also outsource a lot of their services and utilities. They need not provide their own, they can actually outsource it. For example, warehouses, tank storage terminal[s], they can actually outsource to a third-party logistics provider. That was the strategy then, in the '80s and '90s.

Then come the 2000s: that's where [*sic* when] we focus[ed] a lot more on knowledge-based industries. During that time, the challenges were really in the area of globalisation and technology advancements. Things have changed, I mean, things have improved. In the good old days, I remember [that when] going to work, we don't [*sic* didn't] even have a computer. I don't know, how many of you started work without a computer? Probably many of you started work without computers, alright? Computers only came on board in the 1990s- mid. That's when we all can [*sic* could] afford to have one computer each. But so the strategy then was very different [and] focused a lot more on knowledge-based economies. And the strategy then was really to leverage on our connectivity with the world to create an ecosystem of large companies, small SMEs [small and medium enterprises] as well as start-up companies. But [we] focused a lot on innovation-based industries, so

00:09:22 industries such as the biomedical sciences, infocomm and technology as well as the media industries.

So in a sense, we tried to enhance Singapore's connectivity to the world. We actually developed ALPs–airport logistics parks. Very similar to like a trans-shipment port, the ALPS allow companies to fly in their products, and do value-added services within a free trade area, and then export it out—without even having to come through into Singapore. I mean physically they are in Singapore, but in terms of the trade, they are actually within a free trade zone. So that's how we enhance Singapore's connectivity with the world.

Secondly, at that point in time we also created One-North. That was when one-north was born–2001. We started to develop one-north as what I call a work¬–live–play–learn hub. It's actually a business park, but it's a hub that allows mixed use[s]: work, live, play and learn. So this is how one-north will look like when it is fully completed. But at that point in time, we have Fusionopolis, Biopolis as well as some of a F&B [food and beverage] facilityies within one-north. So, [we were] trying to make it like a self-contained hub.

Changing Trends: Key Challenges

00:10:57 So, moving forward, 2010 onwards, what are some of the challenges that we will face? Any guess? I guess you all have some answers behind you. But some of the challenges that's facing us, essentially, [there are] five key challenges. And I think these five key challenges not only face our industries, our industrial development, but I think these five challenges may also apply to other sectors of the economy.

First, land—land constraint. Singapore is 720 square kilometres. A lot of our land is reserved for many different uses, so we need to ensure that we have efficient use of the land space. Second is really economy. The manufacturing sector has changed, and later I will explain a little more

00:11:52 with more and more servicisation. Third, is really the labour. The labour profile has changed and also, the expectation of the work force has changed. And I will explain that later. Fourthly, is [the] environment where a lot of industry[ies] will focus on sustainability and liveability. And I understand that there are lots of architects and engineers among our midst today. And we can have a few chats about what are some of the sustainable features we can look at! And also, of course, the issue about carbon footprint, reduction of carbon emissions and so on. And finally, technology. With the advance[ments] in technology, really, things have changed a lot. And there are lots of disruptive technology, such as robotics, automation, industry 4.0 and so on.

So, land constraint. As you can see the purple part, this is actually from the URA [Urban Redevelopment Authority] concept plan. Its available in the URA website, you can have a look at it. The purple area[s] are all the industrial land. The so-called…[For] the lighter orange colour, these are the residential and the green the waters and so on so forth. I think there is a cap on land supply, so-called, right? Singapore is only so small. You can't get larger, and there is also a limit in the plot ratio, for example, for industries.

In the early years when we started to build our flatted factories and our standard factories, the plot ratio was actually quite low [at] about 0.5 on average. Today, we are going up to 2.5 to three plot ratio. You are familiar with plot ratio, right? I think all the architects are very familiar with plot ratios. So there is also a limit on how much you can grow for industrial buildings, because as you go higher and higher, you need to bring the goods up. So, there is always a limit on how high you can go. And the question is we really ask ourselves [*sic* that we should really ask ourselves is], how can we generate more value from the same amount of land? That's a big question we ask, we constantly ask ourselves. And I think as architects and engineers, we also need to ask ourselves the question: how do we design our building and infrastructure so that we maximise or optimise the building, the function and so on?

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Now, manufacturing will continue to remain a key pillar of Singapore's economy. It fluctuates around 20 to 25% of our GDP [gross domestic product]—and you can see 20% of GDP in 2015. So manufacturing is important and it will continue to remain important in Singapore. It will be a part of our Singapore's economy. Although we look at various types of industries from capital to energy to so-called knowledge and innovation, it doesn't mean that we are all going to focus just on [an] innovation-based industry. The capital ones are still important, the technology-based industries are equally important. A very important thing is really, a diversification of our own manufacturing. We can't have one of one type, but we want to have many different types to diversify our economy. So, manufacturing is important.

Unlike a lot of countries that have moved away from manufacturing, I think it's important that Singapore retains its manufacturing sector because that provides a lot of economic spin-off for the economy. Just take the chemical industry for example. The amount of plastics they produce will require services sector, and will need to be exported. So that in itself has a lot of economic spin-off.

Second, is that the kind of manufacturing activities will also change slightly. I think in the past we focus a lot in the centre: production. I don't know whether those at the back can see [that] you have these three wheels. First wheel is what we can pre-produce, second wheel is production, third wheel is post-production. I think in the past, we focused a lot more on production. But I think moving forward, we will focus also on the pre-production site, as well as the post-production site. The pre-production [sites] are essentially your R & D [research and development] and your prototyping—coming up with a right design, coming up with the right prototype and then to manufacture in Singapore. And then after that [comes] post-production, which is manufacturing services.

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Take an example: Dassault Systèmes is here—aerospace industries. Today, we have Rolls-Royce. I use the word Rolls-Royce, right? I know they are here. You also are in the Aerospace industry. But take Roll Royce for example. Do you think Rolls Royce sells engines or do you think Rolls-Royce provides engines as a solution? (Pause) As a solution! They probably sell you—I'm not sure whether they sell low or not—but they do sell you. But the partnership and the collaboration is really a long-term partnership to service the engines. So, it becomes manufacturing services. And that really the post production that is important.

So the type[s] of industry[ies] that we want is really pre-production, production and post-production. And of course then, the type of buildings and the type of infrastructure that we provide must also cater for that. Right, it's no longer just manufacturing, the production, but the pre- and the post-.

Then of course we need the growth of services. How do we cater to these changes? What kind of buildings [do] we need to build to need to be able to do that? And also, the question we ask ourselves is [about] moving from industrial space to economic space. Because today a company, when they come, set up businesses, they will have their R & D functions, they will have their HQ [headquarters] functions, they will have their manufacturing functions and also services functions—and even some of them [have] backend functions. And you can't have a company say my HQ is in Shenton way, my production is in Jurong, and my R & D is in one-north. That doesn't work, right? You don't want to have one company in three different locations. So how do we then create a space to make sure that we put these three together? I think that is the question that I would like to ask all the architects and the engineers. How do you do that?

So, our labour profile, right? [We] talked about the economy, talked about the land, we now talk about labour. If you look at this chart, this is a prediction that the number of PMET [professionals, managers,

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executives and technicians] and non PMET in 2011 is about 50-50. But I think moving forward—this is just a projection—but I think moving forward, I think the amount of PMET to non-PMET will be much higher.

As you know, more and more people are entering university or diploma. [The] question is with more and more graduates, how will that change the industry, the number of people going into the industry. In the past, we also bring [*sic* brought]people to job[s]. If you look at how Singapore is developed, in terms of manufacturing, most of the manufacturing activities are in the West. So we bring people to jobs. I think the question we ask [next] is how do you bring jobs to people? Right? How do you bring jobs to people? I probably posed a lot more questions than giving you answers. (Laughs)

Also changing…in the past we were quite happy with hawker centres and amenities centres in our industrial estates. But I think we are now, maybe because of our weather, we are looking forward to more food courts or air-con[ditioned] food courts. So, the expectation of the work force changes. Then the question is: how do we then develop our building and infrastructure to support that change in expectations? And of course, our work force is now more environmentally conscious, they need to stay connected, they are socially minded, they prefer work–life balance. I know there are a lot of young people at the back there. Whenever you ask them what would you like? I would like to have work–life balance. Flexible working hours for example. They want to have informal collaboration. Active mobility is very important, most of them prefer to take public transport, which is I think, good for Singapore so that can move towards a car-lite society. So, we need to cater. I think the message is: we need to cater to the changing workforce expectations. That is very important.

The way we work is also changing. Can we rent or lease space to individuals? Typical lease today is three years, correct? Three plus three. You always hear about three plus three plus three. And we always lease

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space to companies. What about leasing space to individuals? Right, how do we do that? Can we have short term leases [of] three months, two months? We talk about co-work spaces, right? We-work is very popular today. I believe their leases are actually very, very short, okay?

So that's the labour part. I think the other so-called challenge is really environment. [There are] many, many examples of environment [and] how we need to take care of the environment. And associated with the environment are a few key concepts: one of course is, how we put industries closer—maybe not next to, but closer to—to ensure that we have this synergy. How do we create our industrial space such that it is conducive? I use the word conducive—conducive for people to work in as well as to live in.

And in terms of design, back to basics. I don't know whether…[there are] not many attap houses left in Singapore today. For those, been around for some time, I think you will remember the attap houses. In fact, the attap houses are designed very nicely. Right? Just look at the attap house. They are raised, because of flooding, right, in the case of flooding. But because they are raised, they air flow is very good. You don't need air condition[ing]. They are made of wood, so it doesn't absorb heat. So you don't have a problem about urban island heat issues. Your ETTV [envelope thermal transfer value] value is very low. Okay? For those who know ETT value: Emission Thermal Transfer Value, alright? That's the amount of heat gained the structure will take. You have the over-hanging roof that provide[s] sun shading and yet, provide[s] lighting into our building or into the attap house.

So the question is, are we going back to basic in terms of the sustainable buildings that we are building? I think that is the question we would like to ask.

Safety is also very important. And within JTC, when we build our facilities, we want to ensure that safety is the [*sic* of] utmost importance.

00:23:43 And here I am just sharing one example. This is how the site looks like before and this is how the site looks like after. And we are practising these five–S's. Essentially in short, its area-cleaning for those who goes to the army—making sure that your site is clean. When the site is clean, you reduce the risk of accidents. So, yeah, people call [it] five–S's, I call it area-cleaning: making sure you clean up the area after you have finished your work, so that it doesn't create a hazard, and therefore it reduces accidents. So, safety is also equally important.

Technology is also changing the way we do things. How will robotics, automation and industry 4.0 affect the workplace? We are not saying robots will take over our work, no. But I think, what we are saying is there will be automation and so on, to help us do our job better. Right? Do our job more productively and efficiently. And secondly, this guy, he is probably working in some offices. But the question is, is he working at home? Or is he working in the office? Or is he an employee or a freelancer? Right, you have different disrupters like Uber, AirBnB. But you also have different a lot of freelancer[s] who will help and they don't need industrial space. So, these are some of the things that are changing.

Disruptive technology too, for example. And these are a few things JTC has done in the past. Let's take use of drones. In the past, okay this is not a very good example of industrial building, this is actually a normal house. But for us in the past when we want to inspect a building, we have to either build a scaffold or we have to take a boom lift, something like this, to go up to the roof to do inspection, to check for mosquito breeding and so on so forth. But within JTC now, we have a drone that flies all the way up. You can inspect a lot of roof spaces, and you can actually determine whether there's any water ponding or any cracks or anything right? That sort of helps us in our productivity.

In fact at one-north, we are the first to have a public trial of a driver-less taxi, okay? We are working with this company call the nuTonomy, right?

00:26:10 So we provide our industrial building and industrial estate or district as platforms, as a living lab for companies to test bed their facilities. So that's what we do. And here we are building a test track for AV [autonomous vehicles] research at Clean Tech Park.

Moving Forward: Strategies

00:26:34 So I've shared with you our stories, I've shared with you our challenges. Let me now what are some of the strategies that we have adopted moving forward.

First, we will provide innovative building solutions to transform industries. That will be the key. We will not just build generic buildings. We will build buildings that will help companies to be more competitive in today's economic environment. What do I mean? Some of it we have done, like clustering. We cluster industries together not only at the estate level but at the building level. We also, within our building, provide shared facilities, shared services. Let's take an example of…and these are some example of our facilities. So, take example of food hub. We all…Singaporeans love food.

Food hub. We hope to cluster a few food industries together. Now some of these industries will require for example a cold room to store their food after they have prepared them before they are being exported. So like fish balls or even roti prata—today you can buy roti prata in packages. Don't have to go to the hawker centre, but you can actually buy roti prata in packages. So instead of each individual food company have their own cold room, what we did was, we work with a…we built a centralised cold room. So that, that will then help companies reduce the capital expenditure and also their operations, OpEx [operational expenditure]. So CapEx [capital expenditure] and OpEx. Then food companies will be able to operate more efficiently within the building.

So that's an example about food. Another example could be say, [a] surface engineering hub. Surface engineering hub is for companies in

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the business for surface treatment, heat treatment and so on, so forth. Heat treatment, what do I mean by that? Everyone has a phone right, nowadays? And sometimes the phone, at the back of the phone, its very shiny. So, it has been treated to be shiny. In order to do that, you need to put a lot of chemicals onto the phone—not the phone, but the metal. And those metals, after going through the processes, you actually use a lot of chemicals. So the chemicals are in a sense, hazardous—some may be hazardous, some are acids, some are alkalis, and so on so forth. So, we actually built a centralised waste water treatment plant. A centralised one for the companies located within our buildings, and they can then discharge directly from their factories spaces which can [*sic* could] be on the second floor, third floor or fourth floor and discharge it like a sewer all the way down into the centralised water treatment plant.

So in a sense, we designed these buildings that are very different from generic buildings, generic factories. It will have very interesting features and I guess the architects will have to think very differently about how to design the building, so that the services don't clash, the movement of the goods and the people don't clash. How do you design your building that is what I call, very functional, right? Not only must it be, say, a green mark building but it also must be very functional. It must meet the needs of the industries that is located there.

We have many other innovative space[s] for various different industries. For the aviation or the aerospace industries, we have aerospace one and aerospace two [JTC Aviationa One, JTC Aviation Two]. For clean tech industries, we have CleanTech one, and CleanTech three, CleanTech Two, sorry. For service engineering I have mentioned.

And even for medical technology, we also have another one And these are some of the completed innovative space that we have done in the last say three to five years. Moving forward, we are currently still building some and an example would be a space at Tampines. Even for chemicals, we are building a chemical hub and that allows us to co-

00:31:14 locate some of the chemical companies together. And this particular building for example, is designed in such a way that as long as you produce or use certain kind of chemical—it is like a pre-approved, because if you use these chemicals within the chemical hub it will be considered safe. And we have sufficient firefighting, even foam fighting, to ensure that…and even blast-proof walls and windows, [such] that if really, really, something—just touch wood, something really, really does go wrong, the surrounding[s] will still be safe. That's how we designed them.

So from a design perspective, our buildings could very innovative and very different. You have to think through your design. Blast resistant for example, how do you have a[n] underground tank that stores water over and above SCDF [Singapore Civil Defence Force] requirement for firefighting. These are some of things that are in our buildings, okay?

nanoSpace for the semiconductor industries, as well as JTC space at Tuas. Let me give you an example of this, a little more example of JTC space at Tuas. This is the first kind, first of its kind integrated industrial development with the work–live–play concept. It will house many different facilities, for example, a heavy vehicle park, workers' dormitories, amenities, and different type of factories for light and heavy. It will have a ramp-ups, flatted as well as land-based factories—all located in one location. It is currently under construction. And if you drive along the AYE [Ayer-Rajah Expressway] on the way to the second link, it's on the left-hand side.

Now, in addition to some of these industries, we are also looking at providing spaces for new industries [such as] The LaunchPad @ One-North, for example. How many of you have been to LaunchPad? How many been to Timbre? More people go to Timbre, right? If you haven't been to Timbre, I will encourage you to go to Timbre. It is a hawker centre by day, and it's a pub by night, right? Lots of different food. I was told the beer…[it] has a lot of selection of beers. But please don't drink and drive, okay? So, LaunchPad is for the start-up industries. These

00:33:55 industries, they don't require a very big space, so some of them can be 10, 20 square metres. Of course, if they want bigger spaces, you have more start-ups, you can have 50, 100 square metres—not an issue. Because all of our buildings are designed flexibly, they can be expanded. So today I take 20, tomorrow I take 40, the next day I can take 60. Of course, it's multiple of something so in this case F=for LaunchPad, I think its multiple of 20s; and it can be short-term lease, long-term lease to help the start-up industries.

So, we have two LaunchPads. The one at one-north is completed. The one at Jurong Innovation District, which I will share a little bit about it later, will be completed in the middle of this year. And we locate our LaunchPads next to or close to universities, because it is very important that there is this, what I call industry-academia collaboration. Most of our launch start-ups are actually from people coming out from the universities, who have very good idea[s]. And we help to nurture that good idea, by providing the right space to them. Of course, we are not an incubator or an accelerator: there are incubators or accelerators as well as the venture capitalists [VCs] out there who supports them. But we make sure that we bring the eco-system together. So, the space at LaunchPad will have VCs, accelerators, incubators as well as start-up companies.

You probably have heard recently that we want to develop Punggol as a cyber-security. So that is another example that we create a new area, where we have support [for] a new industry, called the cyber security industry and that will be at Punggol.

And lastly advanced manufacturing. These are your industry 4.0 where you have a lot more automation, a lot more robotics, a lot more Internet of Things-type technology. And for that, we will go to Jurong Innovation District or even the CleanTech park that is located within the Jurong Innovation District. So in the sense, we look at the various industries and we provide the necessary land and space for the various industries. I

00:36:21 think in addition to those things that I have mentioned, we are also looking at other areas to keep pace with the emerging trends. We talked about buildings, [but] what about at the whole district level? We talked about providing space, [but] what about flexible space? And lastly, after we have built the infrastructure, how do we create a community? How do we build a community with this thing called placemaking initiatives? Let me share with you.

Master Development: Vibrancy & Sustainability

00:37:00 So as a master developer, we look at the whole district. So an example is the Jurong District and one-north, these are district level facilities. So, we try to integrate various users inside the estate, looking at work, live, play and learn. And within this area, we want to ensure it is sustainable, liveable, accessible or connected as well as smart solutions within the estate. We also want to use our estates as living labs for companies to test bed their innovative technologies or yet to commercialised technology. And lastly, we want to foster a vibrant community through placemaking activities. So, in our mixed-use district, these are the key design features that we need to have: it must be smart, it must be sustainable and liveable, well-connected, industries–academia integration or collaboration as well as vibrant.

Let me share with you two case studies. First is One-North, second is Jurong Innovation District. So, let's start with one-north. I think more of us are familiar with one-north. one-north: 200 hectares, eight precincts, 48 buildings, 400 companies, 800 start-ups and 46,000 workers working there today. It was developed progressively from 2001. That's the numbers that we have achieved today. We focused on four key areas: work, live, play and learn. In terms of work, we have various developments: the Biopolis for the biomedical sciences, the Fusionopolis for ICT [infocomm technologies], media science and engineering, Mediapolis for the media;, and LaunchPad for start-up, incubators and accelerators.

00:38:51

In terms of live, we have a few typolog[ies] there. We have condominiums, of course surrounded by the surrounding residential estates. We have apartments, left behind from the colonial times, as well as F&B facilities within One-North. In terms of play, Star Vista is there, Timbre+ of course. We have One-North park that, so-call runs across the whole One-North. And for those who want to bring your family, please come to one-north park. Timbre+ of course, as well as lots of F&B at some of the selected bungalows within One-North.

And lastly, learn. We have INSEAD [Institut Européen d'Administration des Affaires] there, ESSEC [École Supérieure des Sciences Economiques et Commerciales], both are business schools, as well as corporate universities from Unilever and BASF [Badische Anilin und Soda Fabrik]. So, we also look at talent development within One-North [and] all these are all integrated together. Not only are we now planning at the building level, but we are [also] planning at the estate level, at the district level. And the planning and the design of all these are all very different because you not only need to cater for the building, but [also] how the building and the buildings interact with each other. You have to look at connectivity, footpaths: how people move from public transportation nodes to the facilities? How do they move efficiently—taking into consideration user behaviour, taking into consideration of social behaviour. [This requires] very, very different type[s] of design [that] goes into the buildings.

And of course, placemaking. How do you build intellectual vibrancy, as well as social vibrancy? How do you build a community so that people can come together, not to socialise—I mean socialis[ing] is important. But hopefully when they socialise, they interact, and then they collaborate, especially [in] start-ups. I may be doing something, you may be doing something, but I have a problem trying to solve this problem but suddenly I meet you at Timbre+ and you tell me your solution then we collaborate. Hopefully you can become the next multi-million-dollar company. That's the key: to create the conducive environment for

00:41:20 people to collaborate. And you start off as social then you move towards intellectual vibrancy.

And also [to] enhance the place, we put in table soccer tables, or futsal tables, we put in table tennis tables, we even put in a piano to bring people together during lunch time. And, we built some of these things, I mean, they are not expensive things, but they are very simple things that can be put in to bring people together and also to enhance the place. And various locations within one-north are designated for such things for example, the Biopolis Epicentre, the Fusionopolis atrium and some of the outdoor plazas. So, the key things is when you design your buildings, you have to design them with placemaking in mind. There must be areas where there are places where you can come together. So it not just design[ing] a building with a drop-off point and then they can go straight to their lift lobby and all the way up to their offices or to business park space or R&D space. But you need to create a space that is exciting for people to come together to collaborate, exchange ideas and hopefully innovate. That's the type of design that we are looking at.

Let me share with you the second example, that is the Jurong Innovation District. This was announced by Minister Heng some two years ago. Work is still very much in progress today. Nothing is built yet, but a lot of the planning and design are now being put in. So, it is going to be the future of innovation for enterprise, learning and living. It is going to be like One-North but a little bit more than One-North. Because One-North does not allow you to manufacture. There is no manufacturing in One-North. But hopefully with Jurong Innovation District, we will be able to integrate, work, live, play, learn and create or make.

That's what I mean. How you can integrate the various uses together, and yet still maintain the necessary environment for people to be integrated together. So, you have the offices, you have R & D spaces, you have some residential, you have open community space, landscape and then you have industrial space. Of course, these will not be your

00:44:01 pollutive type industries. They will be slightly…your cleaner type of industries. How do you integrate all together? And how do we create what you call a smart district that focuses on various issues? Right, and these are just a few examples of what we mean by smart, for example. Alright, smart parking [is] nothing new, it's already in some existing buildings. Smart waste management, shared way finding, intelligent street lighting, mobile apps, smart metres—smart water metres, electricity metres.

But the key is really to develop the smartness so that you can get the good public feedback. And then, you can continue to continuously improve your building. So for example in this room, a space, auditorium in Jurong Innovation District will have sensors in this room. When all of us leave, the building will know we have all left and therefore, turns everything off [by] itself. But when we come in, the building will know that we are here and depending on the number of people in this room, the air condition will be [turned] up or. That is what I call a smart building that responds to the people using it.

Panel and Q&A Segment

Tan Szue Hann
00:45:29 David, I've noticed a few dualities that JTC has somehow managed to navigate over the years. First of all, constraints and opportunities: you have turned what is effectively a swamp or JTC has effectively turned swamp into industrial power house that's recognisable in the world.

The second duality is basically the concept of localisation, meaning bringing in global industries, global players, global industrial players into Singapore and having them co-exist and having them survive and thrive with each other and with one another—so localisation versus internationalisation. It is not really in your mandate, I would say, to internationalise if I am getting that correctly, but somehow you have managed to bring in global players into Singapore.

00:46:16

Third duality will be corporations versus SMEs. JTC exists as a corporation but yet, it is harbouring or it is encouraging the thriving of SMEs, of start-ups and so on. Forth would be manufacturing versus the service and tertiary industries. Fifth would be PMETS, P-M-E-Ts versus what is vocational skills, and we have to manage some sort of balance in between. And lastly industry versus academia.

I think you have also brought up that industry have also been very nebulous? I think AirBnB, does not own a single square foot of real estate and yet its whole business is premised on real estate. Uber, despite buying over some fleets, Uber technically, based on the model, they don't actually need to own any fleet of cars at all, right? So as JTC, as an industrial player, what is the new value of real estate from the guise of JTC as a developer, a landlord, and also a placemaker. Where is the new value of real estate?

David Tan
00:47:19

Well, I think the new value essentially is that the we will provide flexible spaces for everyone. It's not only just focused on MNCs [multinational corporations], nor SMEs nor even start-ups—but really providing spaces for everybody, so that we can all come together in a district so that we can be fully integrated. And when they are integrated, we also have what we call estate-level utilities and services. I didn't share a lot about district cooling systems, but essentially if you have a district, you can actually put in a district cooling system to help to lower some of the business costs—at least the chilled water cost, or the cooling cost of some of these companies.

So essentially, it's that we provide flexible space for different people, different industries, different needs and they can be integrated together so that they can reduce their business cost and become more competitive. So hopefully, and all these hopefully will help to grow our economy, would provide good jobs for our people and also provide a good conducive environment for our people.

Tan Szue Hann
00:48:27

Would you foresee any environment where industrialisation could happen in the absence of physical real estate?

David Tan
00:48:37

Well, in the past, we don't build everything. So, we do partner other private sectors developers to build. In fact, we don't own 100 per cent of all industrial space. So, the answer is we don't need to own 100 per cent, we can work with our partners to build. But I think the key thing is that when it comes to manufacturing and some of these, you will still need real estate. But doesn't mean that the real estate must belong to JTC. It can belong to anyone out there.

Mark Thomas
00:49:08

You've described your very complex developments, both one-north and the Jurong Innovation precinct. Thinking back to the one-north, what were the biggest challenges in putting together that proposition? And how do you think those challenges might have changed, as you are now fully meshed into the innovation precincts?

David Tan
00:49:24

It's very easy to develop a single building or maybe one or two buildings. But it's very challenging to develop a district of buildings. Because your consideration is totally different, right? You are not looking at one building, you are looking at the district level. And how buildings interact, how the infrastructure interacts with each other, how people move in and move out need to be taken into consideration. And as a master developer you need to take care of that. You are not just developing one building and just worrying about cars going to the driveway of that building. But you have to look at how you bring people—be it by public transport or be it by private transport—into the district. You need to look at car parking, you need to look at how buildings interact with one another. You need to look at district cooling. You need to look at utilities. And also, the form and shape of buildings. Right, you don't want to have a lot of building all having the same height located in one location, for example. So the urban design comes in very differently when you develop a district. And I think these are some of the challenges we have to go through over the years.

And not only that, it's also the type of industries you want to bring in. Where do you put the start-up companies? Where do you put your bio-medical sciences? Where do you put your residential? So, it's the whole

00:50:59	value chain of master planning to design, to construction, to facilities management. And that the whole value chain itself is a challenge. And of course with one-north, the many years of experience and the learning of one-north, we hope that we can do better in our next district.
Tan Szue Hann 00:51:23	one-north evolved quite a bit or has evolved quite a bit from the biomedical and biotechnology hub that it originally was slated out to be. How has the physical infrastructure adapted to that change or rather the different needs of the market today?
David Tan 00:51:41	When we first started one-north, I mean, we always had that plan I mean the whole one-north is actually a business park. So the master plan takes care of work, live, play and learn. The question is, how we plan all the work and the live fully integrated with each other. Then with the work, you need to decide what are the industries that need to go in. So we worked very closely with the economic development agencies like EDB, SPRING [Standards, Productivity and Innovation Board], A*STAR [Agenecy for Science and Technology Research] and even IMDA—in the past, it's MDA [Media Development Authority] and IDA [Infocomm Development Authority] and now IMDA. We worked very closely with them, to see how we can bring the industries [in]. We are essentially the infrastructure provider and we work closely with the economic agencies to bring in the industries. And I think Singapore needs to respond according to what is happening out there in the world. And when we developed one-north, biomedical was something that we thought…and it is, we still think right, is an industry that we want to promote in Singapore. And I think we have been successful from that aspect. And similarly, we think how the ICT and the media is another group of industries we want to build. In addition to that, there is also the science and the engineering. That's why one-north is designated to support these industries.

Peter Stones
00:53:01

Would you be able to explain a little bit behind…or the processes behind JTC deciding what the next big piece of industrial estate will be in Singapore, and the process behind identifying where that is going to go. So for example, you mentioned food hub, how is it that it arrived at the decision that food is going to be a next big focus in the sort of industrial life in Singapore? And then how was the location for the hub sort of finally pinned down?

David Tan
00:53:32

As you know, Singapore, we are focusing on various different sectors. I think there are…can't remember how many, but I know there are more than 20 industries, and we are now developing over 20 industry transformation maps. Now, the transformation map essentially is to look at the industries. So, we want to grow existing industries and we want to bring in new industries. Our job is to determine where to put them.

So let's take the example of the food hub. When we do master planning for the whole of Singapore—for industries, not Singapore but industries. We have to look at where are these potential locations that we can put the food industry and we want to distribute them quite nicely around Singapore. So, there is one in Senoko, I think there is one somewhere in the Jurong area. And we first of all identify where should all the food areas be. Once we have identified that, then we look at the supporting industries that need to provide for the food. Because you don't want to have food all clustered together—you want to have some distribution around Singapore, because your restaurants are all not together. So you need to have a proper supply chain to be able to support your different restaurants and so on so forth. So that's how we do it.

Once you determine the location of your food areas, then obviously the food hub will go into these areas because food in itself, it needs to be located in a clean environment. You don't want to put food and chemicals together—that's the last thing you want to do. So, there is always this buffer area that you want to keep away, the non–…the pollutive type industry away from the food. So, we do that for different industry sectors. Diversifying some of them, putting them in different

00:55:36	locations, thinking of where the warehouses are, look[ing] at where the port is—all these needs to be planned. So integrative planning, I didn't share a lot about that, but essentially integrative planning is very, very important. How we plan and how we integrate.
Lin Soon Heng 00:55:55	Mr David Tan, very interesting talk but there is one area I thought you should deal with. Could you please share with us your views as to the sea as a space solution, and what sort of challenges do you see using sea as a space solution? And how could you promote investments on floating assets in Singapore? Thank you.
David Tan 00:56:33	Well, I mean today's talk is on urban innovation in the city, so we didn't talk about other innovations elsewhere. But essentially, if you look at Singapore, we started off as an entreport, where ships come and go, we are a trading hub. There are lots of opportunities to go into the sea. But of course, the challenges of going into the sea is that it needs to be connected to the main island. And unless you can come up with the right technology, the right connectivity, then of course, we can always tap on to the sea. As of today, I think we just focus on land. I mean, this is… topic on urban innovation so, I mean that's land. And I think there are [*sic* is] potential in the sea, but the technology part needs to come in first before we can talk about going into the sea. Because in the sea, you are in a totally different environment, right? Whether is it fix or floating, it needs to be connected to your main land. How do you supply your utilities, how do you supply electricity, how do you supply water, how do you remove the waste and so on so forth? So, the potential is there and that's something that separately, JTC is also very keen to look at. I think there are a lot of studies going on, in looking at going to the sea.
Lin Soon Heng 00:58:04	Connectivity is important, but then if you look at the way we used to commute, between Singapore and Bukom, it's not such a huge problem, ferries take people across. If you look at Hong Kong, the Star Ferry

00:58:18	carries people across. So, ferries have been around for a long time. Today with hovercrafts and other new innovations, transporting people is not such a huge problem. As far as treatment and the M&E [mechanical and electrical] services are concerned, like you know, how do you treat waste, all these solutions are available. If you look at cruise ships, 10,000 people onboard. They deal with it. The waste treatment, the food problem, the desalination of water straight from the sea, they desal[inate]. So those problems are not really problems because the solutions are there, and really, we should look at this area seriously. We are very short on sea front land. I mean, if you look at the entire coast of Singapore, virtually every metre of our coast is occupied. So I think there is huge potential and we should look seriously in that direction. What I have problem with [is] I am one of the people who are championing seas solutions, floating solutions. One of the problems I have is talking to people who say, "Yeah good idea, great, but how do you go about it because there is no master plan for the sea in Singapore. You got a master plan on land, right? People know exactly that if you want to put a factory, you go to Jurong. But in the sea, if I want to put a factory where shall I put it? So, we need a master plan for our sea and I hope that can be developed soon. And we need some kind of direction because there are ideas popping up every day around the world on floating solutions. But in Singapore we don't have a road map to go, to address these problems. Thank you.
David Tan 01:00:25	Thank you for your comments. I don't know whether there are any URA chaps here to respond to that. If not, I can convey your request to URA.
Tan Szue Hann 01:00:35	I do an idea for our next CLC talk, it's basically the marine innovations. And I do understand JTC is also doing air rights development, so that also needs a master plan in three-D[imensions]. So that could be interesting as well. Yeah, but Mr Lim I think that comment is really well-taken, it is something that leaves quite a lot to the imagination, and it's something that certainly merits a lot more study.

Alexandre 01:00:59	I would just be interested in having your point of view about the sustainability part of the sustainability description. You mentioned the heat district and cooling systems, which is very interesting at the district level to optimise the efficiency and sustainability of the district. What are the other solutions you are thinking of to optimise the global footprint of those innovation parks?
David Tan 01:01:25	Well there are lots of…I mean DCS [district cooling system] is one, okay? They are also discussing… we are also looking at a pneumatic waste conveyancing system, that could be another. We are also looking at…an example could be way finding, car parking systems so that you know where to park, you don't go round and round the whole district finding where to park. In fact, some of our buildings for example, the basements are all integrated, connected. So that if you park in one building and you find there is not enough carpark [lots], you can actually go to the next building—so that is how we designed Biopolis. We have seven buildings in Biopolis, the seven buildings in Biopolis are actually all interconnected at the basement level. So in that sense, there are many, many district-level type facilities that we can think about. But at the end of the day, we hope that we can enhance the competitiveness of the companies, that is the key, right? To help companies to be able to do their jobs better, to be able to reduce their business cost.
Assel 01:02:27	Actually, referring to your presentation, two brief questions. First one, you just mentioned but didn't expand your thoughts on the servicisation, so my question is on the future of service industry in Singapore. And the second part of the question is actually about if Singapore sustains its current pace or current share of let's say 20% of manufacturing, what would be the future of this and how to balance with the high tech, with the new technologies, with the disruption that you mentioned and keeping the manufacturing at the current pace? Thank you.

David Tan
01:03:07

I think services supports the manufacturing, so that's equally important. Now, I didn't mention a lot, but logistics is one, that we will definitely need logistics: warehousing, logistics, urban logistics, to be able to support the manufacturing activity. But I think what's more important is that there are some manufacturers that are moving down into manufacturing services. And I shared with you an example about Rolls-Royce, where they sell engine as a solution where they sell engines as it is.

So I think between manufacturing and services, they are equally important. Take the chemical industry for example, the chemical industry is where it is today because we have a very strong trading services support. Singapore is one of the largest trading, the third largest trading hub, not only in terms of physical trading but derivative trading. So in terms…you need to have both physical and non-physical, so I think manufacturing and services will come together quite well.

The second question I think is on the manufacturing right? The percentage?

Assel
01:04:17

[Percentage?] and the high tech.

David Tan
01:04:19

Okay, how would that…how would new…well I think our target—target, huh, I talk about target—is really to maintain manufacturing at about 20 to 25% of our GDP. That's our target. Now obviously, it will move up and down. In 2015, it was 20%—I'm not sure what is the 2016 numbers. But essentially, you will have when you go into advanced manufacturing, you go into automation and robotics, technically speaking, that should drive up your productivity. So hopefully when it drives up your productivity, your manufacturing share will also hopefully huh? Hopefully, not saying that it will, hopefully will go up.

John
01:05:04

I am curious because you did say "live" in your urban innovation title. But it looks like in your JID, it's pretty much like one-north, hardly any residential components. So, I don't know whether it's not your purview or it's done in conjunction with URA, so how are you going to do it? One

01:05:28	question. Second thing is, you[‘re] still looking at 20%, right? Any particular industry that you are eyeing? And the third thing is, is JTC still looking at underground production phases? Thank you. Oh yeah, fourth question how is your JID connected to the new Tuas? The new port [at] Tuas.
David Tan 01:05:53	[Off mic] Not connected.
John 01:05:54	Not connected at all? But how are you going to…I mean eventually the two got to be connected to get the [unclear] right? For them to work together. Thank you.
David Tan 01:06:03	Firstly, when I say residential, it [*sic* there] is also a percentage of the space for residential. There will be some residential development within JID. But I think equally important is how JID is then interconnected and leveraged on the vast Jurong West that is surrounding JID. So that is equally important. So, it is not just looking at residential inside JIB, but residential with the surroundings. So that is for JID. And similarly for Tengah, you probably have heard, there is a Tengah new town coming up. Part of JID is within Tengah. So again, how does the Tengah part of JID integrate with the Tengah new town? I think that’s important. So that is on the residential part. For potential industries, I did highlight a few. Advanced manufacturing is one that we are looking at, cyber security is the other. Internet of Things is the other, okay? So, these are some of the new industries that potentially will come…well, that’s the trend now. And the various economic agencies are trying to see how we can bring some of these industries. But essentially, it’s how different make use of technology—I think that is also equally important. Like how existing industries transform themselves and make use of technology. So, in the past you may be doing this, but how can I do it better with automation and robotics? Up-skilling the people to be more efficient and productive. I think that is equally important.

01:07:58

Underground, we've recently completed the Jurong Rock Caverns. I think you know that we are looking at various underground developments, but they are all at the conceptual stage; some of them at the R&D stage. The key thing about going underground is, how do we go down in such a way that it is…the cost, we can bring down the cost of going underground. Because anything that goes underground is expensive! So how do we reduce the cost of developing underground projects? That will be the key. It's not that we don't want to do underground [projects], but the question is how do we do so in a cost-effective manner, so that people don't mind going underground? In fact if you look at Singapore, there are a lot of underground developments, right? Go to all the MRT stations, they are all underground. There are lots of underground roads everywhere. Even shopping malls, right? City [Link] Mall, they are all underground. And underground is not new. You go to other countries, they are everywhere. Japan has lot of underground facilities.

Tuas, well, it's nothing to do with Tuas, Jurong innovation District.

Marcus Lim
01:09:08

Today many of the industries that we have are going though changes, and many of the industries that we have want to promote need to experiment with a lot of things. So, it is now more difficult to pick winners, or to even predict the longevity of the industries. Now and in that respect, you mentioned a couple of times about creating flexible working spaces. Can you elaborate on how do we create such flexible working spaces such that they allow room for experimentation, but at the same time also reduce the risk such that the cost of failure—if somehow some of the experiments don't work out, can be managed both for the companies, as well as, for JTC.

David Tan
01:09:51

Well, our buildings are designed in such a way that not only are they functional, but they allow flexible use of the space. So, a lot of the buildings, if you just take the floor plate, if you want the whole floor you can have the whole floor; you want half the floor you can have half the floor; you want to have one small little…one quarter and then with the view to expand in say six months down the road, we will help you to

01:10:18 facilitate that. So in a sense, it's flexible space providing. That's the key, because we know that different industries, when they start, they may start at this level, [but] after a while [when] they expand, they can come up to this level. Economy turns, they may come down and so on so forth. So I think what JTC provides, is the ability for you to scale up and down — and that's the key in terms of flexible space provision. That will help, hopefully help companies to reduce their business risk.

Bernise Ang
01:10:52 So, my question actually speaks to…I'm interested in what Peter…or your gentleman from Arup was asking, and just wanted to get you to build up on your response a little bit. So you talked about how you decide to place a cluster or a certain industry after that has been decided like food, for example, so where should the food district be placed. What's the process of deciding how it's food in the first place? What if it's fashion or something else? Right, I mean in certain organisations like mine, we use foresight methods, like scenario planning, complexity mapping. There's a lot of other methods. What's the decision-making process as you understand it?

David Tan
01:11:30 Oh, it's a very complex decision-making [process]. But essentially, it's that if you look at the what EDB does and what SPRING does, they will determine what are the different industries that Singapore needs. And once they have decided [on] that industry, they will go in depth into that industry. Okay first of all, you have to decide what industry first, right? And that will depend on what is the trend, what are the needs of the world. No point…I don't know what industry that's sunset already, but essentially if this is an industry that you want, then you want to promote them in Singapore, or you want to grow them into Singapore. Next is, of course, to determine where to locate them. And then next of course, is to determine what kind of infrastructure or building that they need.

And here we work very closely with the trade associations, various associations because they represent the companies and we collaborate with them to understand their needs. And then once we understand their needs, we will then develop the building or the infrastructure to support them. So, it is a very iterative process and we need to work very

01:12:44	closely with the industries. Collaboration with the industry, to us, is key. We don't build anything without knowing what the industry wants, and we work very closely with them to determine what they need.
Tan Szue Hann 01:12:59	Maybe if I could probe just a bit further, JTC clearly is influenced by these decisions, and both an influencer of these decision at the same time. Wherein lies the push and pull, in terms of how you master plan as opposed to say the other planning authority URA, versus say HDB as well. And certainly, there will be loops where you could actually feedback to EDB and SPRING imaginably. So what sort of models, if you can share them of course, come about in determining food would be the next big thing for instance?
David Tan 01:13:30	Well, the only comments I say is everybody needs to eat, so…(laughs) food industry is obviously an industry that we need, right? And we move from there, yeah. And EDB will be out there to determine what's the trend and so on.
Tan Szue Hann 01:13:48	Alright, so three questions again. First is does JTC need architects? (Laughter in room) Second is—or something like that. Second question is underground or in the sea, how do you R&D before you set foot underground, set your tunnels underground? Third question will then be where is the line between JTC and URA?
David Tan 01:14:11	Well, URA is Urban Redevelopment Authority, if I get it right, they are essentially the planner for Singapore's…I mean the development of Singapore, so they plan the whole Singapore. Essentially, JTC we are an industrial development agency. We are a government agency looking after industrial development, so we will plan the industrial area that URA has designated as industrial area. So that's how we do [it]. So URA will be the Singapore master planner, we will be [the] industrial master planner and planner. So whatever [*sic* whenever] URA says [this] area must be for industry, then we will take the area and master plan that area.

01:15:03 That's how we work very closely with URA. Of course, URA does a lot more things, and we also do a lot more other things. But essentially, that's what it means when it comes to planning.

Creating space, we do have architects and we do recruit architects. So, any architects out there if you are keen to join JTC, you can send your CV [curriculum vitae] over to myself or Rachel who is sitting over there (laughs). We are happy to recruit architects, too. The way we do it is that we know our industry best, because we have been interacting with them for…well, 49 years and we know what they want over the years. Of course, there are new things they want as things come along.

So, we have a lot of in-house architect[s] that do a lot of what we call conceptual design. So most of the buildings like…that you see, the conceptual design are all done by us: the function of it, how things move, how much factory space you need, where should the lift—the cargo lifts—be, how should you bring the trucks in and out, where to put your cold room, where to put your waste treatment plants, and so on and so forth. So we come up with the conceptual design in consultation of course, and in collaboration with the industries and the associations. That's the first thing to do.

Then the detailed design, usually will be done by the external architects. Although we do some detailed design ourselves, the majority of the detailed design and the engineering will be done by external consultants. So, we work very closely with the various consultants, I think most…some of you are in this room today. Thank you very much for being our partner. So, we work very closely with you all. That's the second question.

The third question is on R&D. We do have a small R&D outfit, not very big. We call it the innovation programme office, and within our engineering arm and architectural and project management arm, we do have different people looking at innovation and R&D. But we leverage a

01:17:36 lot on our universities. Today, we have three research centres, one with NTU, one with NUS and the other one with SUTD [Singapore University for Technology and Design]. So, we work very closely with the universities who are like the contract R&D for us. Because we tapped on the wide expertise of the professors out there as well as the students out there.

So we do a lot of research with them, be it blue sky research, as well as applied research and even test bedding, and even prototyping. Recently, I think you all may have heard, we developed two robots: one is call the PictoBot, and the other one is call the QuicaBot [Quality Inspection and Assessment Robot]. One paints and the other one does CONQUAS [Construction Quality Assessment System] scores. Basically, determine whether the wall is straight, the floor is level and whether there is any cracks in the wall, because the naked eye can't see. So, we install[ed] infrared onto the robot and [*sic* which will] be able to scan for any cracks or any…because if the wall, there's hollowness, the colour changes. So, we can determine whether there's any crack. So, we work very closely with our universities. That's one.

The second is, we also have our innovation calls. We had the first one and the second one, we are probably going to launch another one this year—so look out for it in our website. But essentially, it's that we work very closely with companies who may have an idea and we partner them: they will do the research and we will test bed their research in our facilities. It could at the building level, or it could be at the district level. So, an example of one of the innovation, ECOSOFTT is one of our partners if I'm not wrong, right? They are looking in[to] wastewater treatment if I'm not wrong. Black water recycling? Right. So, they have their own technology, but they need a space to test and see whether it works or not. So we provide them [with] the space [to be] physically connected in our buildings.

01:19:58	If it works great, if it doesn't work, it's still one part of the building—not the whole part of building, of course. So we provide, you use our building as a platform, as a living lab for companies to be able to do that. So that's how we do our R&D.
Tan Szue Hann 01:20:14	Alright, so I guess we've come to pretty much the end of the afternoon. I've got one closing question for you, David, and that would be seeing that we've both been invited by the Centre for Liveable Cities, how then would JTC design Singapore to be more liveable? Would there be a liveability quotient? Would that be a certain consideration for liveability that you will take up?
David Tan 01:20:36	Well absolutely. If you look at my earlier presentation, we want to develop our district and our buildings as not only sustainable, but also liveable. Essentially, when we say sustainable and liveable, we want to create the right conducive environment for not only the industry to be able to operate, but also for the people who want to work there—so making sure that all our industrial estates are liveable. Not so much as to live there, but working there in an excellent conducive environment. Thank you. [Transcript ends at 01:21:08]

LECTURE INFORMATION

TITLE
Urban Innovations in the City II

SPEAKER
Mr David Tan
Assistant Chief Executive Officer (ACEO), JTC Corporation

MODERATOR
Mr Tan Szue Hann
Head, Sustainability, Surbana Jurong Pte Ltd

DATE
24 April 2017

LOCATION
URA Function Hall

DURATION
1 Hour 21 Minutes 8 Seconds

Note:

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[ ] are used for insertions, after the interview. The information is not necessarily contained in the original recording.