CENTRE for LiveableCities SINGAPORE

SUBJECT: **Sustaining Singapore's Farming Heritage**

SPEAKERS: **Dr Ngiam Tong Tau**

MODERATOR: **Dr Paul Teng**

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Elyssa Ludher (EL) 00:00:03	Your excellency, distinguished guests and fellow colleagues, welcome to today's CLC Lecture Series. My name is Elyssa and I'm from the Centre for Liveable Cities. The Centre was jointly established by the Ministry of National Development and the Ministry of Environment and Water Resources in 2008 to distil, create and share knowledge on liveable and sustainable cities. The CLC Lecture Series is one of the platforms through which urban thought leaders share best practices and exchange ideas and experiences. Today's lecture is part of the CLC Urban Pioneer Series where we hope to share Singapore's urban development expertise, experience over the last 40 to 50 years. In today's session, we are honoured to have with us Dr Ngiam Tong Tau, Chairman of Sky Urban Solutions and former Chief Executive Officer of Agri-Food and Veterinary Authority. Dr Ngiam Tong Tau, who has actively promoted the farming sector for the past 40 years, will share his observations on the rapid changes in the farming industry and the resilience and entrepreneurship of our farmers in meeting the challenges of farming in land scarce Singapore. He will also share his vision on the way forward for the farming sector. The presentation will be followed by a moderated panel discussion and the Q&A session with the audience, which will be moderated by Dr Paul Teng, who is an adjunct senior fellow of food security in the Centre of Non-Traditional Security Studies at the S. Rajaratnam School of International Studies in the Nanyang Technological University. With this, let us begin the session. Let me invite Dr Ngiam to stage. Dr Ngiam please.
Dr Ngiam Tong Tau (NTT) 00:02:19	Good afternoon, ladies and gentlemen. I would like to thank you for giving me this opportunity to share with you on sustaining Singapore's farming heritage. I would like to show you that despite having little land for farming, we do have a thriving farming community. However, in recent years, we have seen a decline in the amount of land for farming which, threatens the viability of our farming industry. I would like to show you how our pioneer farmers have managed to develop successful and economically viable farming ventures in the very challenging environment for farming in

	Singapore. We have seen the modernising of Singapore farms in the last 50 years. Our farms have come of age and should be sustained for the next 50 years. I would like to share you, share with you some ideas on how we can achieve this. Let me start by showing you this series of pictures of farming in Singapore in the 1900s. From the 19th century and up until the 1950s, our rural people practised subsistence farming. Often the farmers are mixed [indistinct], growing vegetables, sweet potatoes, tapioca, yam, chicken, ducks and pigs and some fish in the ponds. There were also coconut and rubber plantations. Small rubber and a small rambutan and durian plantations were also kept. Other fruits such as soursop, jambu, chiku, mangosteen, were also cultivated in small holdings. Surprising enough, there were also farms cultivating tobacco. This slides here shows you Singapore in the old days. I think many of us knew that that Orchard Road was once an orchard. And there were Chinese farmers since the 1900s and look at the farming family. I think those of us who are older can identify with such a scene. Vegetables farms, which were the easiest to farm, vegetables. The farmers did a lot of it. We even had chicken farms where the chicken were free ranging. Cattle farms. Egg farms. The bigger egg farms are housed and eggs are collected manually. Pigs of various breeds. Slow-growing Chinese breeds. And the picture on the right, maybe some the younger people will not be familiar with, that's how we transported pigs in the old days. They were put in cages and they put behind the bicycle and they bring them to the slaughter house. Feeding of ducks out in the open. Enclosed duck farm. And for fish, there were many kelongs in the sea but they've all been removed now [indistinct]. I can identify with this scenario as I grew up in the rural area of Upper Serangoon in the 1940s and 1950s, where many people grew some food in their backyards. My family shared a house with three other families. At the back of the house was a coconut plantation with some empty land. We cultivated sweet potatoes, tapioca and yam in this empty lands. I remember collecting our urine in pots to be used as fertilisers for these crops. There were also a few fruit trees such as guava, jambus, buah rambai and a couple of durian trees in our backyard. It was a

00:06:52	great joy climbing up these fruit trees to harvest the fruits. One advice I can give you is that the guava tree has very subtle branches, it don't break. But if you climb a jambu tree, the branches break easily. I have fallen off a jambu tree once. And of course, for durians, you wait for the durians to drop, you don't harvest them. My mother also kept a flock of some 30 to 40 hens for meat and eggs. We also kept two to three pigs a year, to be fattened and sold at Chinese New Year. We collected food waste from the neighbourhood and cooked them as swill for feeding the pigs. The other families did the same. There were other small holder pig, poultry and duck farms in the neighbourhood. Pig farms kept about 200 pigs each and duck and poultry fams… farms kept about one to two thousand birds. Small herds of cattle and goats are also kept. This idyllic existence in the rural areas ended in the 1960s when the government decided to resettle and clear the rural areas of squatters and farmers. The rural land was cleared to protect water catchment areas and to give way for development for public housing estates, industrial estates, roads and other public facilities. Over a decade, from 1975 to 1984, the farm holding area fell from 15,000 hectares to 5,800 hectares. The number of farms fell from 15,600 to 7,900 farms. It was quite a massive resettlement exercise but the squatters and farmers, and the farmers with farm licence were compensated. Most of the farmers were rehoused in our HDB estates. Special attention was given to pig farms in the, in the rural areas because the pig farms were known to contaminate the water source. This slide shows you one of the farms which was developed in the Punggol area and the Jalan Kayu area, they were shifted from the Lim Chu Kang area and they went over to farm in Punggol. This is Tan Chye Huat Farm, one of the biggest farms at that time in Singapore, pig farms. And the picture you see, the, with the, the man with the white check shirt is Mr Tan Hong Khoon. He is now the Chairman of the Prime Group which has the, runs the Prime Supermarkets. And because he could not farm pigs in Singapore, he went over to China to farm pigs. And he has successfully developed a pig farm in China. He also owns six golf courses in China and some organic vegetable farms. The, our farm at that time attracted quite a lot of attention,

00:10:39	internationally and this gentleman own the rights. He's a visitor from FAO. And we have visitors from ASEAN countries and we showed them the new way of farming pigs and extended our knowledge to our neighbouring countries. The pig farms which were removed from the ru… from the other catchment areas were all resettled in Punggol and Jalan Kayu. This is where our Punngol new estate is, our Sengkang new estate is. We very successfully developed large pig farms in these areas. This picture shows you the Punggol Phase III Commercial Farms which are, consists of 12 huge farms having 20,000 to 30,000 pigs and we did a lot of research on treatment on waste, animal waste. And the, the animal waste programme was head by Professor Paul [sic: Pagalidis] under the UNDP FAO project which was in Singapore in the 1970s and 1980s. New breeds of pigs were brought in, were introduced. However, in 1984, the government decided to phase out pig farming from Singapore. Basically, to acquire land for housing and also to prevent smells coming out of the pig farms which were disturbing the surrounding housing areas. And by 1989, all the pig farms were phased out. However, as usual, all the pig farms were compensated and they moved out of the land. This is to, just to show you that these are the farmlands of 1960. About 15,000 hectares. 1984, 6,000 hectares. And by 205 [sic], the farmlands were 1,500 hectares. The, in 1984, there was a review of the farming policy in Singapore because we knew then that if we did not provide land for farming in Singapore, there will be no more farms in Singapore within 10 years or so. So the EDB and the Primary Production Department at that time, developed, put up a scheme to develop Agrotechnology Parks. The Agrotechnology Parks were to produce a measure of our food supply, reducing our reliance on other countries and also, local farm produce, serve as a benchmark for safety and quality for imported produce. For example, our vegetables can be grown with minimal use of pesticides and therefore we could require imported vegetables to be free of pesticides or meeting the required MRL. Also, our egg farms can produce eggs free of Salmonella enteritidis, which is a disease, serious disease, which can in fact, especially young babies, causing them to die. Because of that, the eggs that we import

00:15:22	from Malaysia, must come from accredited, Salmonella enteritidis free farms. The Agrotechnology Parks were designed for modern farming systems, good farm management practices, producing high quality farm produce and the lease was for 20 years. You can see here that we had planned the Agrotechnology Parks so that various farming activities are compatible. We could not have, ya, we could not have a fish farm next to a vegetable farm because when the vegetable farms use pesticides, the pesticides may drift across, into the ponds and kill the fish. And we had a mix of farms, poultry farms, vegetables, fish farms, in the Agrotech Park. By 2008, there were 233 farms for ornamental fish, food fish, layer, bird, cattle, goat, crocodile, vegetables, fruits, orchids, ornamental plants, aquatic plants and pets within the Agrotechnology Parks. This slide just shows you that by 2008, there were 228 farms which occupied 703 hectares of land. The farms within the Agrotechnology Parks were successfully developed. There were vegetable farms using modern housing, using protected cultivation houses. Netted houses, to produce quality and safe vegetables. The egg sector intensified the use, they're automated and they could produce high quality and safe eggs. Ornamental fish sector. There were many ornamental fish farms and Singapore is known as the ornamental fish capital of the world. We are famous for our guppies, which you can see in some pictures there and also the arowana, the dragon fish. We, Singapore is very efficient in exporting ornamental fish because we are a logistics hub and the AVA had done research and extended the knowledge to the farmer to make sure that they can transport these fish to other countries with low mortality rate, right. Healthy fish. Because Singapore is a transport hub, logistics hub, much of the ornamental fish was brought in from overseas and are conditioned in our farms. And if you should visit Qian Hu Farm, which is the leading ornamental fish farm in Singapore, you could see the operations there. The dragon fish is interesting because we could export the dragon fish from our farms because we got our farms accredited by CITES. If your, to get accreditation from CITES, the government authority, that is the PPD or AVA will have to certify that the fish that are sold, are from the second

00:19:25	generation. If you put that [indistinct] in place and that actually allowed Singapore farms to export dragon fish. And we were the first in Southeast Asia to do that. Ornamental plant sector, again, Singapore is known as the cut orchid capital of the world. In fact cut orchids, the trade of cut orchids began from Singapore and our orchid farmers developed their farms to produce very high quality vegetabe… orchids and a huge variety of them. And one of the technologies that was applied was actually tissue culture, where the farmers could micro propagate the plants, the orchids, instead of having to germinate them, taking a long process of germinating them before they can be grown. Our orchids are distributed to many countries in the world. And few will know that in the Agrotechnology Parks, we have 6,500 fruit trees of some 20 varieties, planted along the sides of the roads. In fact it is a huge ethnobotanical park as well. There were replanted fruit trees which were fast disappearing from Singapore. There were the jambu, the ba… the jambu batu there. Milk fruit, berambai. And also the red fruit in the middle there, is what we call a miracle fruit. If you take that fruit, the food that you take in thereafter, will always taste sweet. So, for those people who has a sweet tooth, you can pluck the fruits and eat it and after that all your food will taste sweet. That's why they call it the miracle fruit. It is grown in one of the roads within the Agrotechnology Parks, right. And all these fruits can be harvested by the public as long as they don't destroy the trees. Now, behind all this is PPD and AVA [indistinct]. Where we provided veterinary services, horticultural services, fisheries and also aid for development. They're, I, I will leave this at that because if you want to describe the work of PPD and AVA, it will take another two hours. Right. Suffice to know that behind all this farm development was PPD and AVA. This picture shows the old district veterinary station. AVA provided a lot of extension services. Did a lot of research in our pig and poultry research and training institute, supported by the UNDP, FAO programme. And under that programme, the UNDP sends many experts to Singapore in various fields in agriculture. And we, I can say that we owe the modernising of our agriculture, of our farms to this group of people who came and taught us how to farm in a modern

00:23:27	way. AVA also has a central veterinary laboratory which does diagnosis for all the plant diseases, animal diseases and initiate programmes to control this disease. And of course AVA has the Agri-Bio Park in Lim Chu Kang where the, the most up to date laboratories in agriculture, animal health, veterinary public health, post-harvest technology is situated. Now let me turn to the fish farms, in the 1960s, there were many kelongs in our sea but we also decided to phase out the kelongs because the kelongs is a very wasteful way of harvesting fish. The kelongs take out fish young and old and is bad for the ecosystem. So we phased them out and replaced them with floating net cage farms which you see in the picture there. The AVA also developed the Marine Aquaculture Centre, which provides research and also experimented on various ways of farming the fish and extended these technologies to the farmers. We brought in and bred new species of fish for the farmers to farm. For example the pompano and cobia fish. And they were farmed in larger net cages called polarcirkels. MAC also produces quality fish fingerlings for distribution to the farms and introduce new types of fish. Especially pompano, the snapper, the golden travelly, for the farmers to farm. So we find that currently, there are many farming families, which have sustained farming in Singapore despite having to relocate up to four times in the last 40 years. Our farmers have successfully developed diverse farms over the last 30 years despite many challenges such as land tenure and competition from imports especially for our food farms. Our farms have modernised and have come of age. They are ready to further expand if given the opportunity. Let me share with you the journey of the development of six of the suc… successful farms so that we can appreciate what is needed to sustain them for the long term. I would like to start off with Seng Choon Farm. Mr Koh Swee Lai is here, the, our Seng Choon, founder of Seng Choon Farm and he comes from the Koh family. The Koh family had a transport business for animal feed and a mill to grind mace as well as a small pig farm in the Yio Chu Kang area in the 1970s. Seng Choon Farm was established in 1987 in the Sungei Tengah Agrotech Park as the first fully automated, high tech poultry farm in Southeast Asia. The ina… the initial 7

00:27:26	million investment to set up the farm with his own chicken rearing feed mill and egg packing facilities was partly financed by a loan and low interest rates under the EDB scheme. It is, this is something that we have to take note that for farmers to, to develop high tech farms, they may need to take loans. And EDB at that time is very enlightened and they had a scheme to give soft loans to the farmers. Seng Choon broke away from the traditional farming methods and used automation and improved the feed for the hens to get better quality eggs. They [indistinct] the trend to try to sell eggs through wholesalers and set up its own delivery team to ensure quality from [indistinct] to table. The farm invested heavily on advertisement and promotions to market its eggs. Now, the Seng Choon brand is a household name. In 1999, Seng Choon began to convert its two tiered cages in open houses to multi-tiered cage systems. That is about six to eight tiers high in environment control and closed houses with cool air, tunnel ventilation. However, as more housing developed near the Sungei Tengah Agrotech Park, complaints of odour from the farms and area increased. In 2002, three poultry farms chose to close down with ex gratia compensation. Seng Choon chose to stay and invested in odour reduction systems. After much consideration. Seng Choon relocated to its current 12-hectare site in Lim Chu Kang as it managed to get a 30 years lease for land and it will also be further away from housing developments. At the moment, the farm produces 150 million eggs per annum, it is undergoing expansion with the potential to increase its flock size to 1 million birds and a production of 250 million birds, 250 million eggs per annum within the next few years. Seng Choon has also developed a modern poultry waste treatment plant which produces bio gas which is converted to electricity. It also reduces the smell coming out of the farms. The electricity produced is enough to supply the farms needs and the excess electricity is also, is sold to the national grid. This development is subsidised by a grant from AVA. Seng Choon Farm shows us that with relevant incentives such as soft loans under the EDB scheme, extension of the farm lease to 30 years and subsidy of the development of the waste treatment plant has helped to develop and sustain the farm. The

00:30:48	vision, business acumen and tenacity of the chairman, Mr Koh Swee Lai, has driven the development of the farm despite at times seemingly insurmountable challenges. And I'm glad to say, there is also a succession plan. His son, Yeow Khoon is now CEO of the com… of the farm and his daughter Chen Peng is the farm manager. Let me show you some pictures of Seng Choon Farm. There're many visitors to Seng Choon Farm and we are very pleased that President Wee made a visit. President Wee, when he was our president, would bring the diplomatic call to visit the farms, the Singapore farms, every year. Right. And they visited Seng Choon Farm. Dr Richard Hu, who was supportive of the Agrotech Parks also visited Seng Choon Farm. And recently our senior ministers Maliki and Lee, and Mr Lee and CEO of AVA also visited the farm. So I would say that Seng Choon Farm is a model farm for Singapore. And we should try to find out what are the success factors that the government has provided to help Seng Choon develop and expand their farm. Seng Choon is now also bringing in new hen cages to give group housing for laying hens and, which is a trend in Europe at the moment. They've a lot of automation, auto loading and packaging machines. 22 lane egg grading and packing machine. Feed conveyor, there's no more feed… they don't have to use feed trucks. And this is the waste treatment plant which produces bio gas. Let me now turn to the vegetable farm. Kok Fah Farm, Kok Fah Vegetable Farm. Kok Fah Technology Farm is a well-established farm that does soil cultivation of leafy vegetables under protected netting shades. It consists of five farms ranging from 0.9 to 2.6 hectares with a total land area of 7.8 hectare. The farm opened in 1992 and produces about 1,400 tonnes of vegetables annually. It has a cold room, processing and packaging facilities and overhead mist sprinkler system. Kok Fah specialises in soil cultivation of green leafy vegetables and the production of seedlings for transplanting. He also has expertise in the construction of netted green houses. In fact he helped the team, the AVA team which went to Pekanbaru to help Indonesian farmers set up netted green vegetable, netted farms for the veg, for farmers

00:34:11	in Indonesia to produce quality and safe vegetables for the Singapore market. Kok Fah Vegetables are mainly sold under the Pasar brand in NTUC Fairprice supermarkets. The access to this market has helped him to expand his business in initial years. Kok Fah had also, to nurture the soil for vegetable cultivation, as our soil was very, has very little topsoil. It takes almost three years to nurture the soil for successful cultivation. Therefore we see here, a farmer successfully planting, cultivating and producing vegetables. All the time improving, doing R&D and learning new technologies. This is a rain shelter. Vegetable packing machine. Now, let me turn to a surprising farm in Singapore. The Long Kuan Hung Crocodile Farm. I do not know how many people know that we have a crocodile farm in Singapore. This farm was founded by Mr Lee Buck Kuan. I think Mr Lee is here, ya. His whole family is here. At 25 years old, Mr Lee Buck Kuan started out a backyard crocodile farm in 1964 in his mother's betel leave farm in what is now Seletar Hills. He started importing baby crocodiles from Indonesia for rearing. In mid 1980s the family sold the farm in Seletar Hills. Mr Lee then relocated his crocodiles to Jalan Kayu where he took over a fish farm. He also rented two locations in Lim Chu Kang to house his crocodile breeders. Crocodile breeders are very valuable because the crocodiles start to lay eggs only when they're 12 years old. So you gotta keep them for 12 years and they're very treasured by the farmer. Long Kuan Hung Crocodile Farm Pte Ltd was established in 1977 to produce crocodylus porosus. which is an endangered species, highly priced around the world for its beautiful skin and delicious meat. Mr Lee successfully tendered for two plots of land in the Lim Chu Kang Agrotech Park. Thousands of crocodiles ranging from baby crocodiles to breeders were transferred to the site in 1994. Currently the farm houses 14,000 crocodiles of various ages. And you may know that the crocodile skins is sent to a tannery which supplies, which is now owned by Louis Vuitton and you see all the beautiful crocodile bags around, some of them may have come from our Long Hung Kuan Crocodile Farm. The farm obtained accreditation from

00:37:28	CITES, this is an important fact, for the rearing of crocodylus porosus with the help of AVA. It was the first crocodile farm in Southeast Asia to obtain CITES accreditation. With this accreditation the farm could sell and trade the second generation crocodiles produced in the farm. This was crucial for sustaining the farm. The farm helps to increase and maintain the population of this endangered species. It has put Singapore on the map for the conservation of crocodiles. When the crocodiles were moved to the farm in 1994, it took the breeders many years to adjust and settle down in their new environment. The female crocodiles lay eggs only once a year. In the initial six to seven years, the number of eggs laid and the fertility of the egg was very low. Crocodiles start to breed only after 12 years of age. It was only in 2001 to 2002 that the female crocodiles acclimatised to the environment and produced more fertile eggs which hatch into healthy baby crocodiles. After hatching, the crocodiles takes another five to seven years before they can be harvested and marketed. The farm carried out many trials to design the environment and housing for the crocodiles. Mr Lee had to carry out much R&D on the rearing of crocodiles. He also successfully designed an incubator room to hatch the eggs of the crocodiles. The incubation period is three months. After 23 years, all the hard work and dedication towards the farm is just slowing, is just slowly bearing fruits. As the development of crocodile farms, of the crocodile farm takes a long time and is capital incentive, intensive, Mr Lee actually had to sell two of his coffeeshops and a condominium to finance development of the farm. He looks forward to a longer lease of the land to 30 years plus 30 years, for him to continue. So, we have to appreciate that to set up a crocodile farm, it takes a long while. And if the lease of the land is too short, then it is not worth for the farmer to put more investments into the farm. And, again I'm glad to say, Mr Lee has also done his succession planning. His son Robin, is now the manager of the farm. I show you some pictures of the farm. That's Mr Lee and Robin, a recent group photograph. Mrs Lee is at the back there and Mr Yap Boon Chang. The crocodile ponds, crocodile pens. And the incubation room. It takes three months to incubate before the crocodile can hatch and this is a

00:40:34	new hatchling and if you see a new hatchling, you think that they are harmless, but the moment they're born, they start to bite you. And the farm also has a AVA accredited crocodile slaughter house and where they take the skins, salt the skins and they sell the crocodile meat to the market place. Now, let me turn to Hay Dairies. [indistinct] Hay Dairies is the only goat farm in Singapore. The his… it has a very long history. In 1920, Mr Hay Yak Tang came to Singapore at the age of 16 to be a teacher. He later became a clerk for a hatchery and later started his own hatchery. Subsequently, he bought a 16 acre plantation in Punggol and started Yak Seng Hay Farm to rear ducks, chickens and pigs. By 1970, he decided to switch to pig farming. Breeder pigs were imported from the US and as the farm expanded, eight of his 11 sons, helped in the operations of the farm. In the next 10 years. Hay Farm kept 20,000 pigs and became one of the biggest farm in Singapore. In fact Hay farm was the first to have a double storey pig farm, two layers alright. They were the first to go vertical. When pig farming was phased out from 19, from 1984, Hay's Farm decided to go into goat farming. Goats were imported from the US with the help of AVA and after a few years, the project was deemed viable and Hay Dairies obtained a 20 years lease at Lim Chu Kang Agrotech Park in 1993 to farm meat and milking goats. The farm became fully operational in 1997. For the first five years, business was relatively slow and marketing efforts include educational tours to acquaint the public on the qualities of goat milk. Demand slowly increased and the pasteurising machine was increased to a higher capacity of 1,000 litre power to cater to 1,000 goats on the farm. The farm also started online order of the milk and the milk was delivered in six chiller delivery trucks to 70 to 80 percent of the residential areas in Singapore. The farm increased its goat population to 1,500 goats to meet increasing demands. However, the farm is apprehensive in expanding further due to the uncertainty of the farm lease. They are one of the farms which has been asked to close down by nineteen ninety… 2017 because the government has acquired the land, a large source of land in Agrotechnology Park. The farm hopes that it can remain at its present site and if this is not possible, to be allocated another site to carry on

00:44:05	its business. So, we see here a farm which has taken 20 years to develop and producing good goat's milk for the public. Goat's milk is good for asthmatic children. For children who are allergic to cow's milk and they are freshly produced in Singapore. And this is a farm which I feel that we should not lose. The farms attracted many school children in, for visits during the weekends. And you can see in one of the pictures the Mr Hay, John Hay, I don't know whether he's here, milking the goats. Ah, John. Alright. So, I've known John's family for a long, long time since the Punggol days, ya. And I'm really glad that you have managed to successfully develop this goat farm right. And I hope that you'll be allowed to continue. Now, I'd like to turn to a small farm, Ho Wan Fish Farm, belonging to Mr and Mrs Ho Soon. This fish farms one of the many that we have in Singapore growing ornamental fish. Of course Qian Hu fish, ornamental fish farm is more famous. But there is a few others who are doing very well in our Agrotechnology Park, producing ornamental fish to support the ornamental fish trade. They have ponds there and they also produce dragon fish. And the, the day I visited actually quite recently, the AVA was there to check the identity of the dragon fish, because every dragon fish has a microchip with its identity number and it is only the second generation dragon fish which can be sold internationally. Alright. And they just pack the fish into box and it is air flown to the destination, alright. Now, Jurong Frog Farm is another interesting farm that we have, supplying frog meat to Singapore. You will see that it's very popular, you go to Geylang, you eat the fish, the, the, the frog porridge and so on, very popular dish. Alright. And we farm them in Singapore, fresh. The owner of the farm is Mr Wan Bok Thiaw. Mr Wan Bok Thiaw started supplying frogs to the market in the 1970s. Foreseeing the potential of American bullfrogs as a business and alternative food source, he started Jurong Frog Farm in Old Jurong Road in 1981. The farm moved to a 1.2 hectare lease site in the Lim Chu Kang Agrotech Park in 1994. The farm breeds and grow the American bullfrog which produces delicious frog meat. The ovary ducts are processed into hashima. The farm is also a tourist destination much due to the effort of Mr Wan's daughter,

00:47:50	Chelsea, who took over the role as a second generation frog farmer. It has also obtained ISO 2000 certification. And again, this farm is affected by resettlement and hopes to be allowed to remain at its current site. If this is not possible, it hopes to be allocated a new site to continue its business. There're some pictures of children enjoying the frogs. They visit the, to see the frogs, and you can see this child is very fascinated by the frog. Now let me turn to Too Orchids. Ya, Mr Too is here. Here. I think, I think I saw him somewhere. He's at the back there. Ok, Mr Too. The Too family has been farming from the 1960s. The family had a mixed farm in the Boon Lay area. Pigs, chicken, fruits and vegetables were grown. When the land was acquired by the government for the Jurong Industrial Park, I suppose, the farm was moved to TOL Farm in Choa Chu Kang. The farm continued with chicken farming and also started farming orchids. When, when demand for orchids grew, the farm converted to orchid farming. This farm was also acquired through the government's resettlement programme and it is now relocated to Sungei Tengah Agrotech Park in 20 years. So in a span of 40 years, the farm had to move three to four times. Too Orchids is a leading orchid farmer in Singapore and it spots 30 varieties of cut orchids in Singapore. The company has expanded into another two farms, totalling 9.8 hectares with one farm specialising in orchid production and the other in ornamental plant production. The farm has a well-established marketing and distribution network that enables them to deliver fresh cut orchids overseas within 24 hours. It is the leading farm which help Singapore maintain its status as a major orchid exporter in the world. The quality of the orchids is ensured through stringent selection of new hybrids and micro propagation in the farms specialise tissue culture laboratory. Too Orchid is also ISO certified and is also certified by AVA under the Assurance Certification Scheme. The farm has also participated in international flower shows and trade exhibitions and has won many awards. These are some pictures, this is Mr Too and his son, Wilson and the whole Too family. Right. Mr Too and that I think his brother is running the ornamental plant farm. The orchids in bloom there. In summary, this six farms represent the various farming

00:51:22	sectors in Singapore. There are many other farms which has also successfully developed in the last 40 years, for example Qian Hu Ornamental Fish Farm, Chew Brothers Egg Farm, N&N Egg Farm, Oh Chin Huat Hydroponic Farm, Lian Wah Hang Quail Farm, to name but a few. They've all shared with me that land tenure is a major concern to them. Uncertainty in the land tenure has hampered their development and has prevented them from further expansion and improvement. Now, let me take you to recent innovations in farming. I'd like to share with you Sky Greens vertical vegetable farm. Right now, we would like to say that we are farming in the third dimension. Farming, creating farming space in the air. And Jack, Jack is here ya, Jack Ng is the founder of the farm, the, the designer of the system and he has developed Sky Greens farm in Lim Chu Kang. The farm is very efficient, it can produce up to 10 times more vegetables than a conventional farm with soil cultivation. The whole system is a A-frame rotating tower, powered by hydraulic, a hydraulic system and it is, the operation cost is very low and we have streamlined operations to make sure that we cut down on manpower costs. The key economics, 10 times more production. The farm only use 12 litres of water to produce 1kg of vegetable. In normal soil cultivation you use much more water. And the electricity cost is only five cents per kilogramme of vegetables. We use less manpower and the inputs is reduced and we only have 75%, reduced by 75%. This farm has won the Index Award, the latest design award in the world, given out by the Danish government and it recognises that Singapore farmers are able to innovate, able to design the system which actually can be sold overseas. For example, Sky Greens has expanded to Hainan in China and they have successfully developed this vertical farm using the Sky Green vertical farming system. Now, there's a lot of discussion on farming in the city and I'm glad to see there's a lot of activity in this area. The, the Sky Green system has also been designed for rooftop garden farming and it can green the urban environment. This is [indistinct] in the, in Scape. It's a rooftop, young rooftop farm, farm,

00:55:15	farmer, doing rooftop farming. Community farms sprouting in Singapore in many places in the city. Sky Greens has also proposed to, to have structures on the façade of the buildings to produce vegetables. It is, we have seen the greening of walls in Singapore but we could use these walls to produce vegetables and they can be what we call edible gardens. Sky Greens has also proposed the development of an agrotechnology hub. The hub will intergrade the whole vegetable business from growing to packing to distribution and for shared labour. And on a more ambitious level, Sky Greens has proposed the development of Agripolis. Agripolis is a combination of our vertical towers in greenhouses and vertical towers in indoor farming. And on 20 hectares of land, we foresee that we could produce 30,000 tonnes of leafy vegetables or over 30% of Singapore's national needs of leafy greens. Indoor farming is coming on, in [indistinct]. This is Panasonic indoor farm. You will see the Panasonic vegetables, the salads being sold in Isetan and so on right. This is highly energy intensive and you can only grow vegetables which are valuable, of high value. You cannot grow your Chye Sim, your Kai Lan and all that in such a place. You have to grow micro greens, high value lettuces and so on and this is what Panasonic does. We also have another farm by ENF Technologies, developed by our local Singaporean. They have a farm in Tagore Lane in an industrial factory in Tagore Lane. And they also use LED lighting and produces very high quality lettuces which are sold directly to the high class restaurants in Singapore. So let's take stock now, the number of farms in Singapore. This is 2014 numbers and I believe the 2016 numbers will show a further drop in the number of farms and the amount of land that we have. Now, I have tried to, to paint you the picture of the farming industry in Singapore and I hope that I've also pointed to you some of the factors that we need to look at to make sure that we put in place to sustain our farms for the next 50 years. 32 years ago, we revealed the strategy of our farming policy arising from the review, the proposal to allocate six parcels of land totalling 1,500 hectares, to be developed as Agrotechnology Parks to house modern hi-tech farms which can maximise the production of the land. The

00:59:24	farms in the Agrotechnology Parks provide us with a good measure of our vegetable and egg supply as well as milk from cows and goats, frog meat, crocodile meats. Farms in the sea also provided a measure of fish for our markets. The farm also generated orchid and ornamental fish production which enabled Singapore to be recognised as the ornamental fish capital of the world as well as the leading exporter of quality orchids. However, in recent years, land available for farming has depleted due to planning and land use policies. This is actually due to the policies of our government, land use and planning policies. There's now only about 600 hectares of land left for the farming sector. Last year, I was sad to hear that 62 of the in the Lim Chu Kang Agrotech Park have been informed that they would have to leave the land by 2017. Some of the very successful farms which I've mentioned are also affected. Most of the farmers I spoke to expressed the land tenure is their main concern. If the land tenure can be 30 years, they can invest more in the land and adopt new technologies to improve production. The uncertainty of land tenure has left many in a limbo. I've shared with you the development of Hay Dairies, Mr John Hay of Hay Dairies, is keen to expand production to meet market demand for his goat milk. The uncertainty in his land tenure has deterred him from investing more in the development of the farm. On the other hand, Seng Choon farm which has a 30-years lease has actively invested in expansion, increasing the hen population to 1 million birds and increasing production of eggs from 150 to 250 million per annum. It is time that there is a new review on our farming policy. There's a, there is an urgent need to safeguard land for farming. Looking at all the existing farming enterprises and new entrants to farming, we need, in my opinion, to safeguard at least 1,000 hectares of land for farming. In 1984, we safeguarded 1,500, 1,500 hectares of land for the Agrotechnology Parks, I think it is reasonable to safeguard 1,000 hectares of land for farming, looking at all the farms in Singapore and what do they need and new entrants into the farm, farming industry. I would like to suggest that a farmer's cooperative be formed to own and manage the safeguarded farmland. Management by a farmland by a cooperative will allow the farmers to decide

01:02:47	on the use of the land and offer to longer land leases. This will be a more effective and efficient way for the allocation of land for various farming activities. I like to make mention here also the Kranji Countryside Association. They are the association of 35 farms in the Kranji area and they have joined, united to make the Kranji area into a park for visitors. And they have attracted a lot of visitors. They organise farmers' market, they have a bus service that brings you from the MRT station to many farms in the area. And you will find many visitors visiting the Agrotechnology Park in Lim Chu Kang, the Kranji area to visit the farms and to learn more about farming in Singapore. Farms which are slated to be relocated but have a proven production record should be retained on site. I would urge our planners to look more closely at the allocation of land for other purposes. Can it not be that some of our farms can coexist in land used for other purposes? I'm sure if you look at it and you plan it well, you could accommodate some of these farms which are already established on the land for the last 20 to 30 years, then we should leave them in situ. If this is not possible, they should be allocated land under the direct land allocation scheme to continue with their farming. And also, I think we should give consideration to proposals of, to build an agrihub, an agripolis in the future and land should be identified and allocated for that. In developing the farms in the safeguarded areas as in our Agrotechnology Parks, all farms must also meet environmental requirements so as to integrate into the pairing urban and urban areas. And most of all, there must be constant R&D to be carried out by the farms as well as by AVA to improve the productivity of the farms. Ladies and gentlemen, I've shared with you the successful developments of our farms. Our farms have come of age and have the necessary experience to improve and expand production. I, I'm of the view, of the strong view that if land tenure can be extended to 30 years, our farms will take off, they will fly. And they will be more willing to invest in technology and ex… and expansion of, and expansion of their farms. Thank you very much for your attention.

EL 01:06:24	Thank you Dr Ngiam for not, not only the very, very insightful lecture but also helping us get acquainted with our farms in Singapore. Now we will go into our question and answer, Q&A time. First I'd like to invite Prof Paul Teng to please come on stage. Prof Teng will be our moderator today. We have mics, please put up your hand and a mic runner will come and pass you the mic for your questions. I'd like to hand over now to Prof Teng.
Dr Paul Teng (PT) 01:07:01	Well, thanks Elyssa. You know, I'm sure you'll all agree with me, that was a fascinating journey back in history. For that sort of good capture of what Singapore is doing today and capable of doing. I think there were so many learnings really from, from I think Dr Ngiam's presentation. You know to me, it is strong entrepreneurial spirit, the tenacity of some of the farmers here is just amazing. You know I, I travel all over Asia, I'm so sorry, in fact I'm just, I'm one of the few qualified agriculture scientist left in Singapore, ok? Cos I do a lot of work in agriculture. But what Dr Ngiam was also able to do was to give us a glimpse of the future, ok? Now, I've a lot of questions in fact but I think I'm gonna defer to the audience. I'm sure all of you will agree with me that it's been a fascinating talk and you must all have questions. So let's, somebody break the ice. Alright, I'll break the ice then ok, hopefully somebody will follow. You know Dr Ngiam it's interesting when you look at what's happened in developed countries, you know as countries industrialise, develop, inevitably, agriculture contributes less and less to gross domestic product. Number of farmers also decline, ok? And we find that countries like the Netherlands for example, where I used to live, you know they have purposeful policies to designate land use, ok? And farming is not just to produce food. Now, they're very strong arguments to keep farms as part of the landscape. There're aesthetic reasons, there're ethical reasons, recreational reasons. Now, certainly in Singapore I think we're starting to see the beginning of agritainment as we all know, you know, in the Kranji area. So what I really want to ask you is, you know how do we make the arguments, you know, to whoever is in charge of planning to look you know, there's a multiple purpose for farming, which we need to

	recognise in Singapore, apart from losing our heritage. Ya. There's a very strong arguments as to why we need to keep farms in Singapore. So, [indistinct].
NTT 01:09:05	Now, I agree with you that other than the production aspects, there's also a social aspects right. I think most of us have an affinity to the soil, to production of food. Production of agriculture products, flowers, trees, fruits. And our children are very interested in this and I, I did mention to you the KCA, the Kranji Countryside Association. An association of 35 farmers with diverse farming activities and they have managed over the last few years to create an interest in Kranji area. And in fact they were very gratified that our, our authorities have given them the brown sign to say that Kranji Park is actually a park, ya. And within the parks, you know, you, you, you have different types of farms for the children to visit. For visitors to visit and also there are international visitors to come and see us, alright. Recently we were planning for the Commonwealth Royal Agriculture Show Conference in November. And when they brought the British agriculture people to Singapore and we showed them our farms, and they were fascinated, right. And that is why they chose Singapore to be the venue for this conference in November. It should be an interesting conference where people will share about farming. So, I would say that farms are not just for producing goods. Farms are for visitors also. It serves a dual purpose. I, I, I bring my grandchildren to Western Australia just to visit farms. Right. Of course I visit our own farms here too but looking at different types of farming systems. And I can, I can tell you that my grandchildren really enjoy such trips and they look forward to it right. So, we should retain some of our farms which may not be in the mainstream, what we understand is mainstream farming. We have organic farms which produces not much vegetables but organic vegetables right. And there are people interested in this. They will go to organic farms to by organic vegetables. The frog farms, the goat farm, goat milk. I think, John has shared with me, he had to really spend many years developing this market in Singapore. But once the people

	get to drink the goat's milk, they're, they're, they're, they're, they're addicted to it so they come back for more right. Right. Ok, thank you.
PT 01:12:34	So, let's just have a quick poll of hands. How many of you have not been to the Kranji area? Not been to. All of you have been? I can't believe that. That's very good, amazing, ya. Alright let me ask the question in reverse, how many of you have been to a farmers' market, in Singapore. Not, less than half, well, still a way to go. Ok, that, that is a good indication that we still have still have a lot of work to do really, in the sense. Dr Ngiam actually was being very modest. He's chairing our local committee to organise the 27th Commonwealth Agricultural Conference in November this year and it's gonna be held in Singapore. And it's the first time ever this conference is being held in Asia. That's how significant it is. As I will urge those of you who are interested to learn more to sign up, ok. Now, he's been able to convince a few of us to help him in the organising committee. So, really credit Dr Ngiam [indistinct].
NTT 01:13:37	Prof Teng is on the committee.
PT 01:13:40	You convinced me, so. Ok, I think we see quite a few hands now. Let's start with the lady over there, please.
Audience 01:13:45	Thank you. Hello. Dr Ngiam thank you so much for your interesting story…
PT 01:13:48	Can you introduce yourself?
Audience 01:13:50	Ya. Dr Teng, my name is Olga Grant. I work with the Netherlands Embassy here in Singapore with the agricultural section. And thank you so much for bringing up the Netherlands. Thank you, for our good land use. Huge promotion. I'm from the agriculture section, I'm here with my colleague

	from the innovative section and together I think old school farming is no more of this world. It's all the hi-tech farming. I have a question and a suggestion for the Hay Farm, the goat farm. I understand that your land lease is you know, coming to an end maybe unfortunately. In the Netherlands, we have a cow farm built in Rotterdam, on the water. It's the first floating cow farm in the world. I don't know if goats get seasick but maybe if you people will talk to our people. Who knows, Singapore can have their first floating goat farm in the world. It is a suggestion that I would just like to mention. The other question I have is I watched the video of Channel News Asia about the Jurong Frog Farm and the other day, I don't know if you've seen it. Where the lady was saying you know, we have to move as well. With what is going on, ya, see I recognise you now. Great video by the way and well like you said, you cannot eat money and I agree. I don't know about the power of social media and maybe the government in Singapore has made their decision about the land lease. But in Australia, Australian are under tremendous stress because the milk they produce, they have to sell below their cost price. So the power of social media has been so that most people in Australia now have gone for Australian only brands. Where the Australian brands of milk have been sold out in supermarkets, leaving the cheaper milk there. So people are willing to, you know, buy. So I'm thinking, power of social media, will we still have an impact if we all write in to say we think that the land lease should be extended for 30 years. We think that Singapore should have their heritage. What is your opinion on that? Will we have an impact as the public or has a decision been made and cannot lah. That's my question.
NTT 01:16:17	Thank you very much for your suggestion to have a floating farm right. In fact Sky Greens has designed a floating farm for vegetables, ya. And John you may want to look at it, ya, as a floating farm, ya. I think the fact that CLC has given me the opportunity to talk about our farms here that is to inform the public of the plights our farms are facing and I'm very sure, that if from ground up there is a petition to, to the government authorities to give

	consideration to extending the leases up to 30 years. That will be much appreciated.
PT 01:17:09	Chelsea, do you want to say something for your…? Because…
Audience 01:17:16	Thank you. Actually I do have one question. Hi, I'm Chelsea from Jurong Frog Farm. Because speaking about farming, old school farming being a thing of the past, I just a have a question for Dr Ngiam about you know the children that come out to the frog farms for excursion, they want to see the frogs, they want to be in the sun, you know, but there's this whole idea about productivity, about putting frogs in high rise buildings, in factories. You know, so how much do you think there's an allowance for the government to allow farming to be retained onsite as it is so the children can really experience farms as they are and not in blocks, in buildings. Ya.
NTT 01:17:57	I think should be addressed to some of the government authorities here. No, I, I agree with you. In fact we should farm animals like frogs and all that in their natural environment for, for people to appreciate it. And I think for frog farms as well as the crocodile farms, for breeders, they have to be in a very natural environment to breed. Right. I know, I've done some little research of frog farming in the past and I know that you need for them to listen to the rain before they lay eggs. That's a natural behaviour. And if you put them in a building, will they do that? We don't know. The crocodile farm is the same. The crocodile breeders have to be very comfortable in their environment before they lay their eggs. This I think is the maternal instinct of crocodiles. They must know that where they lay their eggs the eggs will incubate and hatch you know? So they're very discerning and we, we, we should look at nature and see that and emulate nature right. So, if we're forced to do indoors then we have to pay attention to these factors as well.
PT	Thank you very much Dr Ngiam. I think this gentleman in front.

01:19:24	
Audience 01:19:31	My name is Robert, Robert Lee. I would like to ask Dr Ngiam to share his view. We have been talking about local farms and basically to produce food and the increase, do R&D. But the, there was an aspect of the local farms that you touched on about the transferring technology to overseas. Now we are in the area of agriculture, food production in the centre of ASEAN. Can you share with us your view about local farms developing, doing R&D, developing technology, being a pilot farm and then going overseas to actually produce food and bring back to Singapore? We have done that a little bit in the past. We've done it in Indonesia. We've done it a bit in Aceh and also a bit [indistinct] fish and prawn hatchery in Aceh and also in Laos. But how do you see this a argument of developing urban, modern farm, R&D technologies that we can actually apply and actually supplement our food loss from local production by having developing such farms overseas? Thank you.
NTT 01:20:49	Yes, I think there's a lot of scope for our farms to, to, do R&D to build pilot farms to apply to apply the new technology. A case in point actually is Sky Greens, which I'm very closely associated to. Sky Greens have come up with a new system, vertical farming system and we have proposed to build such a, larger farms like this in Singapore. But the government is still considering whether they will allow us, will allocate some land for us to expand our farms. So what we did was, we brought this technology overseas because there was a lot of international interest in this area. People from far, as far away as Saudi Arabia, China, even New York, somebody came to approach us to buy our systems. Right. Malaysia has interest in our systems and therefore, we can actually innovate new farming systems which can be sold overseas. For the Sky Greens case, when we, I have joined ventures to produce vegetables using our systems in other countries, the idea is to bring it back to Singapore. But some of it should be imported back to Singapore because we know that if you grow vegetables using our system, then the vegetables will be safe for consumption. Clean, quality and safe vegetables

01:22:36	right. So there're other aspects like fisheries right. If you can have intensive fisheries, land based fisheries which other countries have done but not many in this part of the world has done. Land based aquaculture. I fact this is one of my pet interest in the past. How do we develop intensive land based aqua culture? Because, the coastal seas are being contaminated. The last incidence of algal bloom in Singapore killed much of our fish. And in other countries, the tendency is to bring farming to the coastline on land where you can control the water quality. Even in, in, in Canada, in Vancouver where they have farms outside, they are closing down the farms, bringing it back on land. In the Mediterranean sea, in fact Mr Loy and I we went to visit some of the farms and they all are land based. Because the sea, once it is contaminated, will, will create disease problems for the farms. So, I think one of the areas, Robert is that we can actually do more research into developing land based fish farms. Actually land based fish farms is a combination of biology and engineering. It is actually basically treatment of the water. Recycle of the water. Cutting down cost in the pumping of the water and the cleaning of the water. And the biology is the breeding of and, and of the fish. Alight. So, I think there is potential in that area. Some of our factory farms, vegetable farms, they have innovated and they probably can also be extended into other countries who needs some urban city farming.
PT 01:24:58	In fact one of the reason I think Singapore was chosen to be the venue for the 27th Commonwealth Agriculture Conference is mainly because of the interest in urban farming. You know, in a sense Singapore has become like a microcosm for modern urban farming. And just to set the context, you know the, the, the UN's estimates are that for 20% of the world's food currently come from the urban [indistinct], urban area. And there's a lot of interest worldwide, to look at how we can actually grow more food in urban areas, not to replace the food from the countryside but to complement it, ok. And in the process also derive the aesthetic benefits and so on really, that kind of thing. But you actually raised another interesting question which I not sure whether anybody else in the audience would care to comment on,

	which is the role of Singapore to be the R&D hub. Ok, to actually generate value, create value for example research on seeds. You know, the, the big multinational companies don't grow corn or, or rice. They produce seeds. And that's where the big value capture is. It's all in the genetics. And Singapore prides itself as a major R&D hub. Lots of scientists here, ya. So the question we often have to ask ourselves in Singapore is, "Where do we play" ok? Which part of that, basically the chain do we play really? Unfortunately we haven't really started doing a lot of that in Singapore, ya. I want to move on to another hand. Ladies first. Andrew ok.
Audience 01:26:27	Actually Dr Paul, you gave me a rally great [indistinct] because my question, sorry my name's Anne, I'm from New Zealand Trade and Enterprise so, representing the other side of the world and the farming capital of the world. Actually you touched on the very question I was gonna sort of state that smart cities in the world is actually looking at the integration in rural sectors and trying to find solutions to that and by virtue of your location, Singapore is doing that anyway because they're trying to integrate the farms into an urban situation that is actually a living breathing R&D lab for what the rest of the world wants to know. Is that not a great push to ask the government to review the agricultural policy because we know policy is what sort of stonewalls everything? Or, how do we do that and, and present that as an, as an option?
PT 01:27:26	How have you done it in New Zealand?
Audience 01:27:28	Well, through the Dutch sort of situation, the people talk you know. But we've only like you got five million but it's still talks.
PT 01:27:48	By the way I used to live in New Zealand too, ok so. Andrew you have a question.

Audience 01:27:54	Hello, I'm Andrew Paul from Asia Bio Business here in Singapore. So, Dr Ngiam totally, great talk. Really, was it very interesting. I totally agree on your comments that we need to support the farming community here to do more R&D, tech… develop techno… technology. But I also could agree with Paul in that we have an intellectual capital base in Singapore that is really strong. We don't, we, not all of these folks that we're training in university here are gonna work in a biomedical science industries. They can work in the life science industries and the plant science industries. And they can really drive Singapore forward and partner with countries around the region. My question though is that, Dr Ngiam, in all this time you've been involved in agriculture in Singapore, even in my time in Singapore, we've seen Singapore grow so much in size, not just in population but actual geographical size, so much reclamation, is there, is there never any discussion in using some of that reclaimed land for agriculture? Or hi-tech agriculture?
NTT 01:29:06	I'm not aware of that but I can share with you that the policy for farming has always been that farms can be temporarily housed on land and they are expected to move when the land is required for other purposes. This is something that I hope the government will change. That is why I'm proposing that we should safeguard 1,000 hectares, which is less than 1% of Singapore's land for our farms. Can it not be done? I think the planners need to really look at it more carefully. Because I've shown you that it is worth our while to retain our farms because we do have a heritage in farming. Although Singapore you look at it as a city. It's business and banks, manufacturing electronic goods, but we have a sector in our population who comes from the farming background and they are providing good services to us. Giving us nice vegetables, eggs. Making us goat's milk, cow's milk. Making us crocodiles, I must not forget and, and frogs. Crocodile skins and so on. Making us the ornamental fish capital of the world. Leading exporter of orchids. Can you imagine a small country being recognised for these

	abilities? So, I, I do really urge our authorities to relook into our farming policy, safeguard some land for farming. It is worth it.
PT 01:31:09	That gentleman over there and then, ya.
Audience 01:31:11	Ok, I'm CS Lee from the Media Development Authority. I just want to ask maybe a silly question know. We have Sky Green. How about underground green? Grow vegetable underground. There are a lot of abandoned mines and coal mine, mineral mines all unused know. So, if you can find a way to understand the photosynthesis process then there's potential to grow vegetable underground is huge.
NTT 01:31:37	I think underground farming is practiced in London itself. You know? They have farms in their disused tunnels as you say, and they, they can farm it. It is no different from farming it in a factory in Singapore. The Panasonic, the ENF's type of farms right. But those are very energy intensive and you can only farm high value vegetables because it costs so much to produce the vegetables. Right.
Audience 01:32:16	Just a follow up, that means there's a potential convert energy to food. We can't eat, like the lady say, can't eat energy but you can eat food, eat vegetable. So there's a means for us to grow. And we can do it. Tunnelling, we expert now with all the MRT lines.
NTT 01:32:31	But if you can produce cheap energy fine. You can get the solar panels that will do the job for you, you know? Wind turbines and things like that alright. If you can have very cheap energy which I don't believe in the world there is a country with cheap energy now, ya.
Audience 01:32:50	So if we can do R&D and understood, understand the process of photosynthesis, maybe the plant just need one hour of sunlight, it doesn't need 24 hours. So, there's a way if we do more R&D, of growing a plant underground with just one hour of sunlight you know.

NTT 01:33:05	Yes, I think that is one aspect to look at. I think our scientist have also been looking at it. Do you need a lot of sunlight to grow the plant? If in some papers I read, you only need pulses of light you know. Intermittent light, you don't need continuous lighting, alright. So, this is the type of research as you mentioned, that we can encourage then maybe we can use spaces which is not conventionally used for farming, for farming.
PT 01:33:34	Sorry, I can resist but comment on this. Because I, I, I'm in agriculture and I used to work in the International Rice Research Institute. One of my pet peeves is that if you look at global agriculture research almost exclusively it's directed at selecting breeding plants to grow outside. There's been hardly any work done to select, to breed, plants that are space limited, light limited. Also water limited for that matter. Here's where you know Singapore's R&D capacity in fact can be tapped to do that. It will benefit not just Singapore but the whole world actually, itself. So, that's another area kind of knowledge you know value addition that Singapore can actually do. But I, I can talk a lot. But anyway yes, this gentleman over here please. Oh, sorry the lady first.
Audience 01:34:28	Hi, I'm Hui Ying so I represent a citizen science initiative called Foodscape Collective. Our interest is in home gardens and people who growing things by themselves. But my question today is more about ground up innovation, the whole idea of R&D. We've mentioned R&D a few times and it is true, Singapore is an R&D hub. Education and human resources are supposed to be our prime assets. But I have spoken to many people in the farming industry who say that sometimes when they come up by innovations by themselves, this is taken up by the government and it's not credited. So there's this lack of trust amongst or between different sectors. And I feel that that is a obstacle to the kinds of collaboration and partnerships that could evolve and that, you, me, you bring up of great examples of partnerships that have happened in the past. So, I'm wondering in the future as we want to support more kinds of innovation from citizens, from people in Singapore and perhaps even collaborations across region and Singapore

	and Southeast Asia. What kind of policies would be useful for protecting things like IP rights in a way that doesn't, in a way that doesn't you know force citizens who come up with innovations to have to pay extremely high patent fees in a way that actually supports an interest in trust, in sharing and not just about R&D for economic sake, ya. Thank you.
NTT 01:35:59	Ya, I think you, you bring up the issue of IP, I think that's very important. From the private sector, when we want to do research with the universities for example, the universities will insist that the university retain the IP. In fact this has been a deterrence from the private sector doing research with the universities. I think this is something that we have brought up to the NRAF and so on and I, I think it needs to be addressed. If the private sector does joint research with the universities or with the government institutes then the IP must be shared you know. It cannot be just retained by the government and the government will give you research grants. The research grants is 70% of your cost. But the farms still needs to come up with 30% and provide the facilities for the research and yet the farm has, does not share the IP. This is actually a policy matter which should be looked at right. I'm glad that you brought this up, thank you.
Audience 01:37:25	Thank you answering.
PT 01:37:28	I think the gentleman here.
Audience 01:37:30	Hi, Raymond Kwok from Kwok Group LLP. I'd like to bring the two gentleman together especially Dr Teng, Paul because you look after food security. I understand that Singapore is a very small country and we need to develop our ecosystem in an economic sustainable way. And I think that if we want to go forward to propose sustainable farming whether it is agri or aqua, we need to have a model whereby it has to be able to build a financial model so that it justify the alternative use of land. I think if we want to talk

	to the government to says can we have 1,000 hectares of land, we need to basically create an economic model and the only way I can see that if we cannot get the dollar to fit into it, we will need to bring in the food security angle whereby we need to have some sustainable food on Singapore where we produce. If at all we cannot get import food. So maybe the two gentleman can share whether how can we build this ecosystem in an economical sustainable way.
NTT 01:38:46	Actually just now I did mention that we should have a farmers cooperative right. And using the cooperative mechanisms, we probably could have a business plan to justify buying the land from the government at market rates right. And leasing it out to the farmers for various activities. That, that can be looked at actually, ya. But I agree with you in the past we've always been asking the government for land because we wanted food security and so on, which is something quite amorphous right. In the end actually it's the business, it's the farming business. Can the farm operate and be economically viable right. I agree with you that we should look at, into that aspect.
PT 01:39:47	I'll give an academic view ok? There's always the big picture view. Societal [indistinct], security and so on you know. Then there's also the individual business case basically. I think at the macro level there are other benefits to maintaining a farming sector, which you know the resource economist will tell you the externalities, you can't actually quantify those. K, having green space you know. In the resource economics, one of the most difficult things to quantify is ecological services. Greening for example. Better air, you know. Aesthetics, ethics, even learning values for our children. I think have, having a farming sector does all that. But at the micro level, the farm level, it's the business case. It's the you know, you have to have a strong business case. And that's where you could have enablers provided by the government. And this is not the stuff that Dr Ngiam talked about you know. For those who have survived farming in Singapore, there're some success enablers that they build, they tap into. The question is how much you want

	to push the frontier. Now how much is the government willing to also push the frontiers to maintain that? I mean, I, I research food security and Singapore will never be hundred percent food secure, I mean we all accept that. Which is why I think AVA's you know, policies and so on you know? 10% import you know. It's like 10% of, of the food here that's grown locally. You're focussing on a few products, I think that that's the right way to go. Ya, and today, if you talk to food economists, they will tell you, it doesn't make sense to be 100% sufficient, at all. It doesn't make economic sense. And I always tell this story. I was in Korea, about two month, this was 16 months ago, talking to one of their parliamentary committees because they were having to make the same decisions, how much rice should we grow, given that 18% of the rice is used to feed animals. We all say why opportunity costs? Water, labour and so on you know, to grow that rice. It doesn't make sense. Let's go and buy the rice from Vietnam to feed animals instead and use that land and money to invest in other things, ya. So, economic sense, very different altogether. So that's my academic answer to your question. Others? Ok, Amanda? Ya. This lady over here please. Ya.
Audience 01:41:54	Thanks very much. My name is Amanda. I'm the executive secretary of the Kranji Countryside Association. I'm also a research associate at NIE. My question is for the both of you actually. Glad that you debunked the myth that Singapore has no land for agriculture. We can surely increase the 0.7% to 1% of the land use for agriculture. We should also move away from thinking about land to thinking about space because we've got lots of I think, potential for, for developing space for agriculture, it doesn't just have to be land so to speak. Now my question is then about talent because you know, you, you can build, you can have. You can bring fence, land for agriculture. You can have lots of money coming into the industry. But what about talent pool? As it stands you know, there is no agriculture degree in any university in Singapore. There is no agriculture diploma even, in the polytechnics. Where are we going to find the people to run theses farms. Or we don't even have unskilled agricultural labour, they all come from Bangladesh or India

	or China. So where are you going to find the people to then run these farms. This is a very I think a pressing problem for, from the industry perspective. Thanks.
PT 01:43:06	There's one aquaculture diploma, Republic Poly.
Audience 01:43:10	Ah, yes, yes.
PT 01:43:10	Ok.
Audience 01:43:13	Where do we even start?
NTT 01:43:15	Yes, I think the question about manpower, skilled manpower. People experienced in agriculture, lifestyle farming and so on, Singapore there is a lack of it, ya. From our experience, I think Jack is here, from our experience in Sky Greens, you know it's very difficult for us to find horticulturists in Singapore right. To, to, to, to, to work on our farms. We had to bring in foreigners actually, to help us right. And this is something that we have in our polytechnics. Schools that teach agriculture, farming and so on. Temasek Polytechnic, Singapore Polytechnic, they also do a lot of aquaculture research and so on. But when the graduates, when they graduate and you ask them to work on a farm, they come for one month and off they go. You see. So this is something that I do not know how, how, how we can solve you know, ya. So this is something that again, we need to look into the curriculum within the polytechnics to actually train people who will work on a farm after they graduate. And also, actually manpower is a problem not only in the farming industry, it's for all industries in Singapore right. So, we have always been appealing for, for more quota for foreign workers in our farms, which the government has never agreed to. So it's one for one for a long, long time. So, this is something which I think in a way,

	AVA fills a bit of the gap you know because they, they have specialists within AVA who are able to help and advise the farmers on certain aspects of the farming, right. Especially in disease control and so on. So, but to employ someone to work on a farm, someone with specialised knowledge to work on a farm is not easy. However, I can see the day where our farms has expanded and has grown. Then the farm will be able to afford to bring in specialists to help us, scientists and specialists. It's again, a matter of how much your, you want to pay, right. We look for people to work on our farms and many people from overseas, they apply for the job but we have to pay a hefty salary which we ill afford, ya. So these are some of the practical aspects, ya.
PT 01:46:21	You know, I've been signalled by your host of this seminar that all good things must come to an end. And I think, shall we stop here then? One last question. Yes, please.
Audience 01:46:44	Hi, good afternoon, Dr Ngiam and Dr Teng. I'm Maray from MDW consultancy. Just want to share a comment because I'm in real estate. And some of the international property consulting firms have investment staff here who are advising clients from Singapore overseas to invest in farms particularly in Australia and New Zealand, of course in Europe. Right. So these kinds of farms can actually take on the form of vineyards, could be sheep farming, goat farming etc. So, then again, you know from my perspective, if this kind of real estate invest can take form and shape in Singapore then this is another aspect for real estate investors from other parts of the world or even in Singapore to also look into investing apart from the traditional or conventional office shophouse investment etc. So, just want to enlighten some of us that indeed, there is a, a real aspect to farming investment that could actually well, make Singapore property market investment a more exciting landscape. Thank you.
NTT	I, I, I, I think in the property market, you can invest in properties with 99 years lease with freehold and so on. But in the farming sector, the lease at

01:48:04	the current time is only 20 years. And investors are very reluctant to invest in such lands, ya. And our, our, our, when we go for loans from the bank, when the bank look at the, at the lease and they say it's 20-years lease, they turn us down flat. They tell us, this is non-bankable. Alright. So, so that is why we need to look in Singapore to extend the lease of land for farming. Best is if it can be made permanent. 99 years. My goodness, they'll be a [indistinct] form to invest in, in, in farmland right. So that is why I suggested that we, we, we, we develop a farmers cooperative in a way to own land, farm lands in Singapore. Ya, thank you. I hope your, your investors can be persuaded to invest in, in, in our farmlands with shorter leases.
PT 01:49:32	Ya, there's another, definitely last question from there.
Audience 01:49:37	Thank you very much, I'm Timothy Shawn from, from, representing Foodscape Gardens. We actually work with people who, who grow their own food as well, there. This is more of a concern of, from the point of the, of the consumer. You know, based on your, your, your, based on what you've foresee, Dr Ngiam, what do you think is, what are the measures that Singapore in the future at as a community will, will, will take, to keep on, to keep with the, to or, or rather to maintain the ethics of farming whilst progressing in high technology. Maybe Dr Paul Teng can, can, can comment on that as well?
PT 01:50:28	Did you say ethics?
Audience 01:50:29	Yeah, the ethics of food and its produce. You know add on, in terms of biocides, you know, pesticides, chemical farming and things like that, like what, what do you think, or rather, what, what do you foresee as Singapore will, what, what sort of measures that Singapore will take in the future to,

	to maintain this while, you know, progressing rapidly in, with higher technology farming.
NTT 01:50:58	Ya.
Audience 01:50:59	Ya. Thank you.
NTT 01:51:00	Ya, I think with intensive farming, there's always been concern, especially when you farm livestock, on animal welfare. So, I did mention to you that our, our farm, Seng Choon farm has followed the trend in Europe, whereby laying hens are caged in groups so they call it enrichment pens to take care of their welfare, alright. And when Seng Choo expanded the farm when they built new poultry houses, they adopted that system because we are aware that there is a movement in America and in Europe that is going to put laws for, on animal welfare. And if you don't conform with their standards of animal welfare, you cannot export any of these products to Europe and to America. I know that they have already imposed the law for pig farming whereby pregnant pigs cannot be put in gestation pens, they must be housed in a group to make them move around. Because in the tra… in, in, in the current way of farming pigs, they're kept in gestation pens for the period of the pregnancy of, for, gestation, which is three months and three weeks after mating. So many of them feel that this is cruel and actually the pigs should be kept in a group. And the European Community has made laws for this. And by 2017 I believe, all the pig farms have to convert their gestation pens into group pens right. So, we're aware that such movements is on. And I agree that especially for livestock then we should actually take care of the welfare of the animals while we produce them.
PT 01:53:20	I think that's a good note to end on before Elyssa comes up. I, I think we, we've really been very privileged this afternoon, to hear from Dr Ngiam, you know. You're, you're a national treasure. I think ya. And certainly,

	thank you all for participating. I'm sure you know, some of you want to stay behind and just network with each other and talk more really, ya. But I think we have to end this session I'm afraid, ya. So, thank you, ya.
EL 01:53:55	Thank you Dr Ngiam and Dr Teng, for your insights, as well as your, the sharing. We would now like to invite, the executive director of the Centre for Liveable Cities, Mr Khoo Teng Chye, to come on the stage and present the tokens of appreciation to the panellists and for photo taking please. Photo. We have now come to the end of the lecture for today. Thank you very much to the audience for sharing and asking questions. And we would like to thank you also if you could share your feedback of, on this lecture via email which we, would help us to improve our lecture series. Have a good evening and we hope to see you again.
	[Recording ends at 01:55:02]