Title: Perspectives of Greenhouse Stakeholders on Community-driven Greenhouse Development in the Netherlands

	Type of Organisation	Organisation	Interview Details
1	Research	Wageningen University	Email Response
2	Greenhouse Industry	Artechno Growsystems	Workshop Response
3	Circular Sustainability Industry	Closing the Loop	Email Response
4	Greenhouse Industry	BOAL	Email Response
5	Individual Technical Engineer	-	Email Response
6	Government	Municipality of The Hague	Interview
7	Research	AMS Institute	Interview
8	Research	Wageningen University and University of Bologna	Interview
9	Greenhouse Consultancy Company	Delphy	Interview
10	Community-based garden project	MijnStadtuin	Interview
11	Non-Profit Organisation for Water Solutions	Aqua for All	Email Response
12	Greenhouse Industry	GrowX Vertical Farming	Interview
13	Home-based Greenhouse Industry	Plantui	Email Response
14	Greenhouse Industry	Food Venture	Email Response
15	Community-based Greenhouse	Metabolic	Interview
16	Small Greenhouse and Garden Grower	Wij Bijma	Interview
17	Research	Wageningen University	Interview note-taking
18	Greenhouse Residence	City of Culemborg	Interview
19	Permaculture and garden Consultancy	Towards Nature	Interview
20	Greenhouse social cooperative	Das Kas Kantine	Interview note-taking
21	Greenhouse social cooperative	Das Kas Kantine	Interview note-taking
22	Seeding company	Bejo	Interview note-taking
23	Greenhouse Industry	Floriada Expo	Interview
24	Community-based Greenhouse and Garden	Volkstuinvereniging Klein Grondbezit	Interview note-taking
25	Community-based Garden	de Rijke Sterrentuin	Interview note-taking
26	Community-based Greenhouse and Garden	Tuincomplex Tuinvereniging Kringloop	Interview note-taking

Interview 1 (Researcher, GTB Horticultural Technology, Wageningen University)
I have seen several examples of greenhouse combined with new residential houses/areas. I must say from economies of scale and large production perspective, there are probably lots of challenges. I think (residential) building integrated- or community driven greenhouses are an interesting idea with regards to social impact factors, community goals, health benefits, education etc. Greenhouse is definitely an interesting feature to integrate into architectural/residential areas.

For commercial purposes I would say that this is definitely not the trend; greenhouse operations are scaling up not scaling down and decentralizing. Also an interesting question I sometimes ask myself is; "If the westland greenhouses are only 4-5 km away from the heart of large cities such as Den Haag and Rotterdam, aren't these greenhouse already a form of urban farming?"

If only the connection between the city and the greenhouses area would be made stronger by local supply, community projects etc., then what would be the difference between the niche you describe and the reality?

Interview 2 (CEO Artechno Growsystems, Indoor farming)
From a business perspective, I think it's not feasible. But how we can grow in a sustainable way, healthy crops with everything is controllable, how you want to have the taste, for shelf life to increase as well, for that part it's an interesting case. But from business wise, I don't believe in that.

Interview 3 (Sustainable IT at Closing the Loop)
Thanks for reaching out. I'm always open to sharing my knowledge around different topics, but I'm afraid I'm not an expert on greenhouses. Having said that, I do have an opinion on greenhouses but it's definitely not based on extensive knowledge. The way I view food production is that it gets most sustainable when you produce in countries where products can grow naturally, so without too much human interference. I think it's a misconception that local food production is always the most sustainable option.

Dutch greenhouses are very successful but they usually do require a lot of extra energy for lighting, heating. Even in summers we usually burn natural gas for the sole purpose of adding extra CO2 to the plants for growing them quicker.

I do not see how that's sustainable. Even if we could do all that with renewable energy, it makes more sense to me to produce in countries where heat and light is more readily available and then ship products with sustainable transport.

Interview 4 (CEO BOAL group)
Unfortunately it is really very busy for me right now. Not in the last place because I had to spend 10 days extra in the UAE in isolation as a result of a covid infection.

Interview 5 (Individual Technician, author of the book „Dé Hightech Kas“)

I am a technical engineer and now 2 years retired. I worked for 43 years at the University of Amsterdam. In the beginning as electronic engineer working on extreme high accuracy temperature-controlled thermostats, later on, as project leader for development of scientific instrumentation. The last 6 years, I worked on horticulture experiments with led light. Now I am retired and have a hobby which is growing vegetables is a greenhouse, urban farming. The Greenhouse is only 5 meters long, 2m width and 2 m high. My ultimate challenge is to work on this small greenhouse and to decrease the energy consumption as much as possible. There are in the height 4 levels of growing the plants:The upper 3 levels are hydroponics (vegetative, generative and seedlings), each has its own light level, colour and nutrients. By playing with colours, it is possible to control the growth of the plants. The bottom position is for the higher plants (60 cm) like cucumber, tomatoes. DWC (deep water culture). Technically it works fine and there are a lot of improvements still going on.

Unfortunately, end of last year, four different bugs visited the greenhouse and now it is an enormous challenge to get rid of these bugs. I removed all the plants apart from the strawberries, my favourites. The improvement of the greenhouse is an ongoing process and for me, it can take a few years or even more, which is fine. I am happy to share the information. Transfer of knowledge is not yet done, apart of my website and some books. It is not professional for the horticulture part. As said, my challenge and focus is still in the technical part (reducing energy). At the same time, I am helping the people in the township to make their homes neutral of energy but my greenhouse project is stopped for a while and I decided to work on the greenhouse on a low level with no interaction to other parties. The most important reasons are the sustainability issues in the Netherlands (Heat pumps, isolation, solar etc.), I am an expert on the heat transition of residential buildings which is an enormous lot of work. This is a hell of a job in the Netherlands and take the majority of my time. I made my own home completely energy neutral in the past (apart from the greenhouse).

Interview 6 (Senior Policy Officer at Municipality of The Hague)

Meilin Lyu

So to start off, as an expert tackling green policy city agenda, how do you think like community based or home based greenhouse is currently perceived and developed in the Netherlands?

Interviewee

Well, I see is very small scale, and it's very, very much in a niche of the entire building problem. Addition to build something like 1 million dwellings in the next 10 to 20 years. If I look at the majority of what's what we are planning, it's mostly local high rise or semi high rise, at least in The Hague and in the major cities. And it's more suburban settlements in the in the small municipalities. But still, I think the focus is mostly on getting houses built, and not so much greenhouse effects or that sort of thing, it's in the Netherlands, the prices of houses have risen considerably in the last 10 years. So the focus is on building, building, building and everythingelse comes next.

Meilin Lyu

But maybe, do you think like, was this housing developments greenhouse like Home Base greenhouse can be an opportunity because like, they are just a tiny device? Where is like, I think it's really suitable for like metropolitan buildings that way?

Interviewee
Yes, I think it's a possibility. I think it's probably certain niche, because in the Netherlands we are not used to a small house. So 40 square meters, we consider to be small. So if you have your kitchen, your living room, your dormitory and then our space is left for the greenhouse facilities. So I think it's, it's for people like me, it would be interesting because I like to make it to cook my own food to prepare my own food. but to people who are blue collar workers and come home tired after a hard day's work. I think they will not be interested in having to do other activities. I do think it's a prospect but I think to a certain group of people who are into food who are into health sort of things.

Meilin Lyu
But do you think it could be a potential business model that could be scaling up and scaling wide in that case, like, not only you see examples of smart devices, but also you achieve energy neutral households where you can just, you know, like utilize this carbon dioxide from your home, and then you grow like vegetables in that way is like a kind of system in the future?

Interviewee
I think is a system, it could work only, it would be quite a high tech system and the high tech systems are acquired. Because if the system has to be quite neatly, and if someone opens a window, or someone gets their own thing, then the system can get out of balance quite easily. So I think it could be a nice tentative to housing. But I think the development of the product still has to go some way. Because we are quite private as to all the things that we do in our households, so sharing a greenhouse facility, and then what will not be acceptable for older people, I think communication facilities will be welcomed by, let's say, a quarter of the people that three quarters are not too keen on sharing, car sharing, or other sharings. If we have to, okay, we do, we're not really focused on our own possessions.

Meilin Lyu
And learning from the Floriade dialogue, like I can see this trend of industrial actors, they're very focusing on the efficiency problem and economics of scale, in general. And they would be I mean, from another perspective, like this kind of home based startup companies, they want people to kind of engage in nature, and they are inspired maybe to achieve this community democracy or having positive social effects such as for therapeutic purposes or educational purposes. So like, do you think this too, can these two regime actors can actually be connected together, or they will just remain like parallel development?

Interviewee
For short term and short term in my generation, I think it's a parallel development for the next generation. But it may be complete, but also depending on the scarcity of materials. So I think it's a very interesting development as an alternative to the things that we are used to do now, but whether it will be success and we will enter a genuine transition. I don't have a crystal ball to see the future. So, I think the concept is promising, but it still I think, the time to work it, so to speak in the economical terms. There must be some time before the genuine market.

Meilin Lyu
What do you think like in The Hague, for example, has the green policy discussing the idea of, how do you promote community democracy in the greenhouse sector?

Interviewee
A difficult question I think we might have some influence, but I tend to be quite modest about because I see that some people from the community, but it's mostly with a form of community with our kind of people, like, if I would engage in a community, I will do that with, with, with what, European people. And we are, like inter-ethnic groups, or I think we tend to search for the people that we know that the habits that we know. So I think the to to start, the communal way of housing ends of providing is very promising, but it demands amount of change in the social and economic sphere. And I'm not sure we are already ready for that or not. I think for now, it's a niche market. And they certainly are a major cities use it as a way to save as a marketing tool, showing that our city cares for health cares for good living. As a expression of that ambition, we can't engage in commercial greenhouses or communal facilities within our housing program.

Meilin Lyu
I noticed that you have been talking a lot about like social kind of challenges, like people are more private in the Netherlands. But do you think in terms of the technicality aspects of this kind of home base or community based farming, there are some challenges in terms of, like, developments into communities?

Interviewee
I think the technical problems, it's more like we have to learn how to implement the techniques needed. But I don't think the technique on itself will be a problem. But let's say we want to capture carbon by gathering our exhaust into greenhouses for them to facilitate the growth of plants. It's, it's more like where we're going to use for growing doing integrated within one building system or do we did do we do that on a larger scale? Those things I think, need to be elaborated a bit more than techniques are available. So, if we make an intelligent building, it should be best a lot of techniques that is needed for modern building, I think technicality is the least of worries.

Meilin Lyu
I saw one of your interview about Green Capital and biodiversity in the city. if we apply greenhouse concepts in the in the city system, like do you think they are like a promising development to promote Green Capital?

Interviewee
I think actually, country must be working in prviate space, well, as it intensifies, you have less public space so if I do not have a square to work with, I do have a very nice greenhouse where we can grow our own food, fruits, that might be enough. So I think yes, it could be a very nice extra to have him but it will not be a greenhouse and and not being alternative to a playground.

So short I think, yes, it could be a very nice extra to the housing concept that in the old days, people used to have their small allotment gardens next to the house. And I think we have moved very far away from the town. So I think technically, perhaps even economically, you might be able to make a nice business case. But I think, we need to experiment in in convincing people. Like we have this building, in Milano, vertical forest. We are now going to build some high rise in the Netherlands. But it's trees and not food crops. You might think of a high rise building, like vertical forest. With a greenhouse concept, that technically unconvinced even economically, I think it's very feasible, that we're going to build it. But yet noone has yet had the courage to come up with such an idea. There is, there are smaller communities mostly in Urban Development's where they live,

like in the Community Garden already, or they all have parts in growing food together. So what we call the community farming, I think concepts are working, and they might be a nice vehicle for more greenhouse oriented development, which we still have a long way to go to get things done. Once again, I think it's promising it's changing our way of thinking about housing, and what you do is your house just when you sleep, and when you go for shelter when it's raining. It's also where you grow your food where you whatever you can do at home. I think it's, I'm struggling a bit because I see opportunities, but it's not dressed a bit. It's still well trying to figure out where I could where we fit this concept to the existing planning methodology.

Meilin Lyu
One side is kind of this community base greenhouse scaling up is one opportunity. But from the other perspective, it could be like the current industrial greenhouse leader can be more open for community participation. And at the same time they fulfill economies of scale in crop production. How do you suggest industry actors could be more socially responsible, or socially considerate.

Interviewee
Wow. You really have big questions. Thank you very much. When I was young, 20-30 years ago, there was a concept of rooming houses within a giant greenhouse. So where people would live in a glasshouse environment that never took off. And what you see in the Hague, there's not a lot of greenhouses in the municipality, next to the town. And what you see is that the farmers the food crops, they tend not to be where the cities, so they are away from the city. It's the distance is not not very big some 10-15 kilometers. But still the greenhouse developments they are next to each other, they don't have a lot of interaction. And a lot of workers in greenhouses, they are from Eastern Europe, because they are cheap, because not a lot of people from the Netherlands themselves working here, because the wages, but I think there's also some thresholds in the social. So, what the challenging aspect of your questions is that we are used to do a greenhouse business on an industrial scale, but also on industrial intention, and in fact they are away from the city. So, if you would want to combine with large-scale greenhouse production, I think it would require a total different approach, because for instances in greenhouses, they have a lot of logistics, and who wants to live in an environment where he has to combine your window twice a day. So he would have to, to solve a lot of issues where industrial production conflicts with modern housing. On the other hand, if you would be able to, let's say, to make a neighborhood with a lot of greenhouse facilities, then you could say I have my semi-public space uncovered. So I have a street where it never rains. So that could be an asset. So it's really something that the challenging thing is what kind of demands will be pivotal, which this housing demands dominate the production requirements or the other way around. It comes to housing environments. So I think if I wanted to make a greenhouse neighborhood, then the housing requirements would have to dominate over the production requirements, if I want to make it successful.

Meilin Lyu
But if, for example, like I were to envisage like a future greenhouse business model, would it do you think it will be practical if the private companies could provide necessary equipment, and the community would grow vegetables according to instructions, which the vegetable harvest can either be consumed directly by the community were purchased by the private companies, and they will retail it somewhere else?

Interviewee

I think it could be a solution for a limited scale. I think a lot of people would feel very restricted in having to go according to instructions and having to eat use of having to preserve raw materials. So, it would feel very much like you are restricted to a combination of people. We feel like we have no free choice. So I think the problem is probably between our ears, and not so much technically because technically it's feasible. And I think if you don't do well be a market for some people. That's not to live in such an environment. I would say, well, let's say a group of 50 people, something with a greenhouse that you will not get an envelope of 10,000 inhabitants working according to same concept.

Thank you for your challenging questions. I have something figured out. And I wish you the best of luck with you.

Interview 7 (PhD Program Developer, Metropolitan Food Systems Research & Valorisation, AMS Institute, Netherlands)

Meilin Lyu

How do you think like community based or home based greenhouse is perceived and developed in the Netherlands?

Interviewee

First, I'm not, let's say the experts in greenhouse technology, I'm program manager and I work on on different food items in urban environment of which greenhouses is one, so, if it really comes to technology, I check with my expert, but I do see developments in greenhouse technology in urban environments. That is for several reasons, because, first of all, all these greenhouse technology that is developed, because of the climate conditions in the Netherlands, in in quite some periods during the year, we have a climate which is not good for, for growing vegetables. Therefore, farmers sought for protection, just like the animal farmers they sought for, for stables, the greenhouse producer sought for protection to cover let's say the vegetable production for weather, and to better control all these conditions, they built the greenhouse technology. But even if you want to go further than even beyond greenhouse, you get vertical farming because even the light cannot be fully controlled. That because every day if there are clouds, then the radiation level will change for the day. And in the Netherlands, sometimes we have a lot of cloudy days, sometimes it's open, then it's raining, we have we have even no sun. So you see that to grow in a stable way and farmers making contracts with the people who buy from them that it's very handy if you have full control of everything and the most control is in vertical farming because then you can even fully control the light and the moisture and the nutrients and energy and need an economy oxide. So, you'll feel already that this whole usage of greenhouse vertical farming it is about how much do you want to control your produce and easily molded by the one who buys it. And if we then go to consumers, then of course, what we observe is that for example, in the Netherlands, we have a lot of cultures. So, I think we have more than 150 cultures in the city. And a lot of these groups want to produce food that comes from the origin, but then certain ingredients are not for sale during the whole year what we observe is that people would like to get involved to produce it themselves, but as I said in a country, where the climate is sometimes very okay but other parts of the year not, then how to support people to produce let's say up exotic vegetables, fruits themselves, then you need some kind of climate condition also for for the people themselves. And what we do is we want to stimulate them to grow their own produce, whether it is in the open field, because some some vegetables are very stable for open field, but then we guided with professional guidance and

but some like exotics, you need protection. And then we say well, if you want certain very special ingredients from China from Taiwan or from Vietnam or Mexico or from wherever they come from, from Africa, then they can also grow their own stuff in in climate conditions, which normally do not allow the production of these vegetables or fruits and of course, not everything will come into is suitable to produce. So therefore, we will help them to provide with the best seeds or the best genetics and help them with as professional as possible to produce it. So for us this whole greenhouse integration and transition is in first out based on professionalization. During my talk that I said professionalization is one. professionalization can be with let's say the commercial farmers to further robot eyes. And robotization means that you acquire more data. Because if your robot can exactly put a few drops at a certain plant with only the nutrients that it needs, we store that information. So we retrieve a lot of data from the production which is not possible in the open field. Plants, we know what the goal speed is, what the growing conditions are, what the expression is, or expression in the sense of quality parameters. And then we can learn from it and change it to optimize it. And that's the way that we want to professionalize both commercial farms. But also, let's say, the citizens who want to produce, let's say, a more in professional or informal way, I should say, in an informal way, produce for the whole family, or maybe some friends but that's it. So, that's how we see this transition, professionalization are different levels.

Meilin Lyu
So, you think that if the technicality aspects of vertical farming for example is matured, or is professionalized, then it can further be brought and diffused into communities?

Interviewee
Yes, I have confidence about that vertical family will become a serious competitor of the greenhouse. But only for those applications where it is most suitable every never believed that you call that cauliflowers will be grown in sugar beets will be grown in a vertical farm. But if we can make the micro so the micro greens, and you can eat them as a snack, then I think there is some competitive competitiveness possible. So very specific vegetables for specific markets, especially high end, and you'll see it already. You see that photo farming is already integrated in the high end restaurants.

Meilin Lyu
And like, what are some challenges in terms of like social or technical challenges when you develop this vertical farming?

Interviewee
Yeah. The challenge is also that we did now for example, this test with boatyard we did it with we have a big population of Suriname people. And so we had access to this group. But it's important that this group is already organized. And that's a, let's say, really enthusiastic about the foods of their origin, and that they want to grow it themselves. If there was a too big gap between, let's say, the, the second or a third generation, then I can imagine that the feeling with the country of origin becomes bigger, and maybe not so interested anymore. But this group of people really want to prepare menus that are typical from Suriname, but then they need certain ingredients. And these ingredients, I don't know the English words, but these are some kind of beans which are fairly low, like half a meter, this half a meter beans are not do not grow in the Netherlands, because the market is too small, then they have to import it from Suriname, but the quality is very poor, because of the low volume. If you transport it by container, it takes two three weeks for transport. So the quality is not good. There is no supervision about the use of pesticides. So sometimes there

are a lot of pesticides used that are harmful by European law. So people are a little bit afraid to import it. It is about seasonality. It is about price and sometimes certain parts of the season. It's too costly. So all these reasons they care that they cannot prepare the recipes they are used to from the past. And by growing themselves in these harsh conditions, then we believe that is possible and we see good results from only this this group But if we want to, let's say, copy this to other groups, then we see it's not too easy because there's also has to be a certain amount of people. If that just two people, they are too busy with our work, then nothing happens. And for growing, you need to be there at certain moments. So you need to have a continuous continuously. People who monitor the growth, it doesn't need to be every day, but there needs to be knowledge about it. How do you grow with what what is good? What are good conditions, this whole has to be sorted out. So you need a certain minimum group and enthused futuristic people, and who finally also wants to enjoy it. If you just say, well, it's a nice, it's a nice recipe from the past nice that my parents that I get a little bit feeling about my parents were used to. And that's it, then it's not enough to get involved in this whole production process.

Meilin Lyu
Maybe like one of the kind of urban greenhouse method is vertical farming. But maybe it has come to your knowledge that there are also many other Dutch local startups or individual technicians, they have been building these like home based smart devices, which allow you to plants your own Herbes, or like, there have been technicians who have been achieving this energy neutral household concept by I don't know, utilizing the co2 from their own home. And they they are kind of like DIY a little bit. So like, the same kind of inspirations is that people want to bring garden the nature into their homes. And do you think like, this kind of variety of approaches, they're feseable, or like they have this potential to be scaling up and scaling wide in the future.

Interviewee
I doubt about that, I think you have to separate that. Also, when I started my talk, two parts, there's one part that that is enthusiastic about the social aspect, show your friends that you have greenery in your house, get a little bit in touch with. It's green, you see it grow you like that. And then the other group is more for commercial farming, to really produce food. And one is more enjoying the social aspects and the other one was more about to sift through. And the other one is more about real food production professional high volume, and then get returns that work to put all this energy. So you can say one is more or not allowed to say that variable. One is more like the other one is more professional. But both, we want to because both are important. It's not that we say the other one is not important. The other one is important for, let's say the mental aspects of people get getting connected to the food system. So there has more behind it than just just a hobby. So I know that the hope is not a good words. But both are important. Because otherwise people see food more and more. So let's say a commodity, or buy it and throw it away. And we think that's not a good way.

Meilin Lyu
I mean, from the Floriade dialogue. I mean, they're also like privates industrial actors, they they have told me that there will be doubtful about such community based approach. Because if you consider the efficiency of the crop harvest the efficiency of energy consumption and economy of scales in general. But then like, but from another perspective, we know that this home base there, they're very like therapeutic in that way and they can achieve like community democracy, they can promote participation, and are very important. So how do you think this to regime they can bridge the gap in the future?

Interviewee
They don't need to, they don't need to bridge the gap. There are different trajectories. I showed her my whatever slides that we produce for the city, in the city and with the city. And these are three different trajectories which can perfectly exists parallel to each other. But it's unfair to to compare one with the other. For example, producing with the city is there where the city invest in access to good food for people with a small with a small wage, we call it people on the lower part of the social economic position. For people, the really poor people, they get a passport from the city of Amsterdam. And with the only way this passport, they can get access to good food that has been subsidized. This is what we mean with the city. Now you compare the commercial ones will produce for the city with let's say, urban agriculture in the city, you cannot compare that. And I think it's good when they exist in parallel. So people have good feeling and relation with how food is produced what is always to be done with it. But you cannot compare an urban garden with with a commercial farmer. This, this will never be profitable. But for the social contacts. The commercial farmer hardly contributes to the social welfare of citizens. Because it's just a crop cabbage in in a shop, you don't see the farmer, you have no clue what what what pesticides have been sprayed on this lettuce, or whatever produce, you have no idea where it's coming from. Sometimes it says but sometimes you don't see it. So there is no connection. So I think the contribution to social welfare of commercial farmers is also very low. Which is a route if you compare, if you compare, let's say the quality of lettuce rates and the cost with that of urban farm, then it's also not fair to compare. So you see, they both contribute to something access to good quality food by commercial farmers. But no social welfare. And the other one is the other way round takes a lot of time. But it provides you social welfare.

Meilin Lyu
But if in the community-base greenhouse, it provides like a social welfare it but it's remains as a niche innovation. Could it be scaling up? Like how do you think they have?

Interviewee
I think some communities will be able to scale it up to some extent. But I never believe it that I will scale up to a self sufficiency. Maybe it's only in certain ingredients. But think about it. If you What are many different menus, do your use in a year. That yourself for example, if do you have any idea how many different menus recipes, you use?

Meilin Lyu
Maybe 20 or 30?

Interviewee
I thought it would be more but then how many ingredients? Do your needs and then do you need them so you can provide them yourself? And you think already all these Herbs and ingredients may be special ingredients that you need and then how do I plan it that I don't need to to eat from September till October, everyday potatoes. And then in May and June I only eat strawberries. But you can also divide it through the years. So that's quite quite a thing. Of course, you can eat more from the season, that's a good thing. But only eat from the season with different I don't know how many people can do that. But I have no scientific research about how far you can go. It's more like what I observe in my neighborhood. So it's not scientific analysis.

Meilin Lyu

If for example, like the technicality aspect of greenhouse can be like deepened, in that case, could we like envisage like a future greenhouse business model where the big like private companies, they would provide the necessary equipment where the communities would grow vegetables according to the company instruction, and then the vegetables harvest can be purchased by the private companies in bulk and retail it somewhere else?

You mean that people grow for the big companies? Oh, I don't believe that. What Why would you do that?

I mean, it's kind of like a diffuse, you diffuse the production into communities.

Interviewee
Now to pick greenhouse farmers have hectares of space, they have one system fairly controllable about climates, about moisture about carbon dioxide levels, which differ during the growth of the vegetables. And then you ask the same by doing this in small compartments, at different locations where people are asked to, to retrieve the green fingers. For example, if there is a discovery at the vegetable, you need to know what to do. And if in your backyard the lettuce looks a little bit yellow. And I've never seen that before, what do I do? So your field already that if there is a surplus, or if there is some irregularities, all these people need to be upgraded what to do. And in principle, you can help them with some platform that informs you. But then again, this farmer wants to be absolutely sure that everything has been grown by the same conditions. And if there is one of these, let's say decentralized producers, who has trouble and is a little bit cheating, with with pesticides, or whatever, and that comes out, then the big sales company has a big problem, because they don't trust anything anymore. So I never believed that the big ones, the only thing you can say is are people put a small greenhouse because it's possible to to make a micro greenhouse and grow down stuff. That only for own-use. That could be possible. But I don't believe in in decentralized production for public for professional for the supermarket's I'd say.

Meilin Lyu
And maybe, like, how do we maybe criticize this kind of large industry actors? Where if we have all this roboticized or AI intelligence system, then it will drive out employments? And yeah, like in that case will be monopolistic? Like against the traditional farming and small-scaled farmers. In that sense, it would have a negative social impact in a way.

Interviewee
Do you have a car? If you would get access to a car that was built 100 years ago? Or a car that that you can buy now in a shop? Which one would you choose? If it was for free? Why would you in the first case, the old car is has been built by hundreds of people by hand. And nowadays, a car is built by robots, only a few people check to checks. Or you say I prefer because otherwise people get employed by the car manufacturer. I don't understand that. Why should you Why should you prevent progress? Because you have folded people? Of course, we have to, we have to think about how to, to take people to work or how to involve them that they have a meaningful life. But you should not do that by preventing innovation. Because then other people will do,

Meilin Lyu
but if it's an innovation that's everyone can participate.

Interviewee

Yeah, but then you go back to the participation part, producing in the city for the city of ethnicity. You cannot compare it if it is for social, that's fine. But don't mix it with commercial farmers. It's a well you shouldn't be that commercial because then our people don't have connection with the system anymore. We have to separate that. I was once in Africa, I think was somewhere in South Africa. And then people said, Yeah, we want to stimulate the small farmers. And then a businessman said, that time that you stimulated, will then inform the small farmers that they only can compete on the local area. But they should not ask that they also want to earn money to buy a car, to buy a television and a house, because then you have to compete with a commercial farmers. But if you separate it, and you produce for the local community, you don't have to compete with commercial firms, then it's okay. But then you're in a different category that you produce in the city or in the local community. With a city you can replace with the local community, if you can separate that, then it's easier to understand. But don't try to compete with a commercial farmer who has hundreds of hectares of land, who has robots, and then you as an individual farmer, have to compete at that price for your union is this is compatible with that? That's impossible.

Interviewee
I work together with one colleague, he has the same opinion as me. So, but I think we have a good let's say representative view of our organization. So, this is how we look at it. Of course, we also have foreigners who have a different opinion even at the university, we also work in marketing people with different views that this is how we observe the situation for food production in an urban environment. So I would like to see what are the final conclusions that you that you will draw from your study.

Interview 8 (Researcher at University of Bologna, Guest PhD, Wageningen University Greenhouse & Horticulture)
So as you probably know, the Netherlands are really small country. Although they did in the past 50 years they develop these technologies to increase the production agricultural production, because basically the Netherlands have two problems. The first one is to be a really small country. So you didn't have a lot of production. And the second one is that it's mostly underwater. Most of the land, it's used for building construction and cities, whatever, it's actually reclaimed, reclaimed land from water, or sometimes it is artificial land. And this sense, it's really hard to produce food all over the land. This was just when Legion, the Flevoland, where you'd have like more intensive ground based production. So basically, let's say, cutting edge consumer technology. And this is due to the history in the difficulties of producing foods in these reclaimed land. Today, especially in the Netherlands, they have the technology to try and bring some of the production into the cities. So that's, I think, what's your interest. So integrating these greenhouses buildings, this is a practice that only goes by the name of building integrated horticulture as many of you ever heard these name. So what you've seen, is actually more vertical farm that differs from the greenhouse integration because vertical farm, although they use hydroponic systems, they actually tried to produce food in High Tide structure, so that there is no connection with the outside climate. That makes that makes it easier to integrate them into building, at least theoretically. In this regard, if somebody has funds in the Netherlands, that's like row x, in Amsterdam. Building next amerterdam river to produce microgreens. So they basically stopped, okay, so it's a small plants, we have, like, I think, five level of docks. Each dock has its own production with light, and they produce for they've got this niche in the market that produce microgreens for luxury restaurants. So if you're interested in like the social part of the greenhouse production, we have to consider

that most of the practice that it's going right now is more connected to the economical pile. Because it's really vertical farms will be struggling economically, if you consider that you have inputs, like energy and labor. So lots of economic inputs that are necessary for a vertical farming to work. So with different perceptive.

The project "Flor-Green: The Living Tower“ I was involved I guess the municipality bumped from the center to the prison was abandoned. First thing, so decided to reconvert which were like seven towers and several buildings, that sort of complete, often things, decided to convert the old the old Bible Bible by decided to make a new district for 3300 people or something. They were really trying to focus on social inclusivity also trying to use recycled materials for for the renovation of the of the buildings there is actually a section a project that is going to be implemented by FabriCATION, Bajes Kwartier.

so I guess the experiencing devices for the first time is actually introducing into the planning of vertical farming, for the people that the vertical farm that is required is less connected to the production to the commercial price more connected to how the men, social inclusion in a multicultural environment. So, that was really interesting. Let's say whatever the project is, you know, the architecture project is the functions as you know, since you're doing this investigation, urban agriculture in general, in its various forms, can be a boost for social integration, because it can help connect people with nature with plants, and can bring people together. Of course, certain based agriculture, like community guidance are the first examples of community integration for agriculture, and you've seen them, since the First World War, and then during the wars, for example, community guidance where we people have to cope with the war. If you're doing it now, with the modern technologies, also, urban farming can be a way to lead people today. Of course, it's more difficult because you might have the problems that are connected with contamination, because the plants are grown, for instance, in aeroponic system, the whole environment should be sterilized. And therefore you can't really bring people to work there. They don't have the know-how and they're not really completely in a suit that you know, that they're not going to infect the plants. Although there's it's a sort of collateral activities, vertical farms that can be used to be social inclusion that's needed was to put like kitchen forms and labs for research, and also very important key factor of vertical farms is that since you need to have this know-how to operate the plants, you can actually preaching so people can learn. So you have the opportunity to create new jobs for the least-advantaged people or marginalized classes in a certain area. So you say, I'm going to teach you how to do that and work here. And this is the most, I think, important social aspect to vertical farm, so if you are not only for commercial purposes, you can have the time to teach groups of the population, how manage and work into the greenhouse for the main point. So, this is this is for the vertical farming, to integerate this with greenhouses, which I am not really much of an expert, that they have to only use always hydroponic production, but cultivate an environment that is connected with exterior climates, where you have transparent glazing, you can use natural ventilation inside a greenhouse. That's something that it's actually easier to implement. I have seen in the Netherlands now, there are many like greenhouses integrated in the buildings. So there's some for commercial purposes, perhaps you have heard about the Urban Farmers in Rotterdam? In 2016-2017, they were the biggest prospect greenhouse in Europe, it was 5,000 square meter on the top of buildiing by the Philipis, which iss a very well-known technological company that was born in Eindhoven in the Netherlands. Their greenhouse system was Aquaponics and hydroponic system. Aquaponic is when you use species you have a tank and activate aquaculture with water and lots of fishes. And then the excretion of the fish in the water will feed the plants and then the plants will be nutrient-solution made with excreation of the fish.

The liquid flows in the system, so, all the organic particles and the plants and when it goes back to the tank, that fish can be organic practical to the plant. So, Urban Farmers it was also a private initiative, from a private company. They actually struggled since the beginning and after three years they went bankrupt. So they failed completely the company closed and that was because it was difficult for them to sell the same products that were produced that greenhouses in the countryside. So if you have the same product, it cost much, much less than if you have a smaller scale. So because they made the choice to produce the same crops, tomatoes, cucumbers, peppers, whatever. So there was a big issue. I mean, it was really nice they had like a sort of a small marketplace where they used to sell their products also transform product.

A key point is the social interactions, where you have greenhouses or vertical farms is nice, you can sell in a small market in the same buildings where you have vertical farms or your greenhouse, you can actually sell the products if you also have a transformation lab that can transform for instance tomato into salsa and basil into pestos. So that there is the added value where you could sell many other things connected to the production. It was really nice to be used to organize like concerts once every week or once every two weeks they had the greenhouses aside, they also had like a ssmall stage where they could events. Of course you couldn't organiz visits of people interested in greenhouses or going to the greenhouses because they are sterilized. But you could see the greenhouses as a background with the plant and production was really nice.

So it's a place where people can enjoy the food can learn from how they produce it can enjoy the entertainment so later so if you think about these things that we've talked about here are considering doing in the Netherlands you have social inclusion I've been trying to provide opportunities for the creation of new jobs. The second is basically raising awareness on the way food is produced for instance having schools into the farm. So that children can learn about diets and how production works. And then the parts of the social aspects of these greenhouses is the nature, so you can use it also for where people can enjoy in the front. So these are the three main aspects if you consider the social sphere of greenhouse production. And the fourth one, is like commercial, so selling vegetables, for example The Greenhouse Restaurant in Utrecht basically it's really close to the train station. Before it was like a small building I don't remeber what's connected to the train station or whatever like tickets office or something. It was really awful and they decided to tear it down. The municipality concession to the owners of the greenhouse restaurant to build something. They decided to make this restaurant if you can dismantle it and build it in another part of the city, so it's really easy to take down and build it again, with the same materials on another site, so that basically you have zero waste for construction. What they did is they build a greenhouse with all sorts of vegetables and they run the restaurant downstairs. The greenhouse is really small, actually, but it's really interesting experiment, it's been one of the first one to connect in the Netherlands greenhouse to the people.

Meilin Lyu
Do you think like this kind of small pilot project could be scaling up like in the Netherlands? Do they have the potential to promote drastic change in the greenhouse sector? Or do you think the current industrial actor would be resistant against such change?

Interviewee
And this is of course, like the major question right. So, this is what we have now. So we have like spot interventions, of course, for people to start like this. The try and push for like more diffuse, more spread of integrated greenhouses in city. let's consider that cities have never be completely

independent from traditional agricultural countryside agriculture. So like this new farming systems that will get not provide the cities its food needs. So you always have to keep a connection with the countryside at least, unfortunately. I have seen some interesting development that you can have by using greenhouse production in cities and that is for instance, cities they actually produce a lot of waste, right. It can a form of heat, or the process that you consume a lot of energy, CO2, and wastewater, right. These four waste that actually be used for production for production. In this sense, it can implement to integrate building integrated agriculture integrated agricultural systems in the city, you could potentially use most of those resources in the Netherlands. At the moment, they have developed several structural, and several plants connecting to the circular economy development of the city of Amsterdam and other cities in the Netherlands. And the key points in the new policies is how to reduce wastes to the minimum. I can imagine that initiatives connected to a vast reduction take place in the next years in the Netherlands is one of these, one of which could be the development of building integrated agriculture and integrated greenhouses. I think that if the systems for integrating buildings into the greenhouses are going to be when developed and stated, you will see for the next five to 10 years, a huge development of vertical farms and integrated agriculture The Netherlands. That's because it's connected to these new policies that the government is making.

Meilin Lyu
Maybe in terms of architectural feasibility of this city-based or community-based greenhouse, what do you think are some constraints?

Interviewee
Yeah, a lot. So first of all, for instance, if you, if you put the roof on house, you have to make sure that first roof, structurally strong enough to support the whole greenhouse, because the structure of the greenhouse, it's really light, but then you have the plants and the water, tanks, and all the production system heavy machinery. So you have to be sure that is actually structurally solid enough to support all the weights coming from the greenhouse. So for instance, if you're not building something new, but if you want to put a greenhouse on top of an existing, like the European Parliament's, you have to have the questions of the structural integrity of the building. Also, if you make it vertical farm in an existing Europe had to be avoided, for instance, like structure from the 60s or the 70s. Or 80s, where you have a lot of columns in the naval space, and vertical farming is completely by chambers. Those chambers, basically full of columns, and sometimes construction use really like narrow common roles, you may not be able to fit the production within the structure of space. So the first issue is a structural concern. The second one is a spatial concern, when we're talking about innovation. Another concern is that new construction of greenhouse, of course, incurs like an extra cost, which is not irrelevant to be a very high construction costs. So for instance, in a period like now, where the steel the prices are sky high, in the buildings that you're constructing, it will account for five to 10% more expected spend on your building. So this is an economical constraint. But sometimes these greenhouses they're not for commercial use, but social and professional use, educational activities, or simply providing food to the people that are living in the building that are actually not generating income. So, sometimes the building constructors might not wanting to do that, because it will be an extra cost without any income. So this is another economical constraint. And then the fourth constraint is, especially now that energy is really high energy costs is really high. If you are not taking care of the production system, it would be powered up to have really, really, really high energetic costs, because in vertical farms, energy costs account for 20% of the total cost of the production 25% of the total cost of the production. So, if you only rely on fossil fuel based energies, even have huge

problems in generating revenues. This is another constraint which is environmental and economic as well.

When we talk about urban agriculture in the coming days, the production of the triangle, they have environmental aspects, social aspects, and economic aspects, all those three aspects, they actually had to be combined in a way. There are some constraints, as you said, during the fast development of these systems in the Netherlands, like the past two years, that vertical farms are more than doubled, compared to the previous 10 years. So, actually, it's really fast growing markets. If you're asked me if I'm afraid that it will be more commercial than social and environmental. Yes, of course. I would like more that integrated greenhouse is a way, where actually my PhD thesis was based on how to treat domestic wastewater from residential buildings. Today, the phonic system was not really generating income, but was generating environmental benefits, which can also relate to economic benefits, because you don't have to treat the wastewater on central scale education when you discharge the wastewater into the water reservoirs, so that I really opt for. Efficiency like really high-tech applications now, for the vertical farming systems and greenhouse integrated systems, I see more fine way that which we can use the systems versus as construction method. But application infrastructure is quite far away for now.

Meilin Lyu
One last question, urbanization is the global context. And do you think one greenhouse design project could be transferred into another place? Do you think there are some cultural sensitivities? Or how can it be extended to wider different communities, let's say from Netherlands to Italy, for example.

Interviewee
Maybe like the architectural design could be quite similar, but when we talk about these systems like architecture designing is maybe the less important thing because what you have to take into consideration is, firstly, like by diet habits of the people of the places that you're building your production system. For instance, people in the Netherlands, they don't really have such different diets, they're mostly based on tomatoes, mushrooms, mostly the same way. Of course, it's the first big difference from you know, like Western countries and developing countries. So, this is a systemic different of production that you want to invest in, in Western societies, you have this technological availability, and we better know how these systems can go be high tech, which you can't design in developing countries, there will be really not necessary and it will be more energy-consuming than really beneficial for the people. So the first big difference is high-tech versus low-tech. The second difference compared with Italy to the Netherlands, is that there is a different approach. Because if you consider Dutch greenhouses, we actually work completely different. That's because we are in the Mediterrenean region, you have much more energy produced by the sun. So, you can use much more solar energy to start photosynthesis of the plants, while in the evidence you need to use much more artificial lighting, which really is going to affect the cost of the production. For instance, on the other hand, Italian greenhouses, they spend a lot of money to cool down the greenhouses, which in the Netherlands, for instance, you can do by natural ventilation, so the systems are designed differently to accommodate the different climatic condition of the place where you're desigining your system. So the second differences will be the characteristics of the climates. Of course, if you want to design a greenhouse, in the UK, in the north of France, in Belgium, mostly the same because during the same geographic area. So you

have the same design base, and now I think that's mostly the basic difference, which are like they make all the difference.

Interview 9 (Greenhouse Vegetables, Pot Plants, Cut Flowers, Chrysanthemum; Region: The Netherlands, Europe, International; Expert: Economy & Strategy, Management, P&O, Mediator)
I work with the Department of the greenhouse at Delphy, there is also other departments, arable farming and so on. And what we do it that we visit growers in depends on the crop and the states of the crop of, for instance, tomatoes at the beginning at the start of tomatoes, and you planted the plant every week, visiting the grower, and giving advice on the climate, on the fertilizers, on the IPM, and so on. And the purpose of the labor and what they have to do with the plants, they have to cut the leaves, that kind of thing. And after a while, I think after three, four months, we did it once every two weeks and three months later, once in three weeks. Now for instance, energy is a hot topic because it costs a lot of money. So now we are also busy with the energy to save energy, how we can do the best for in this situation. And there's not only in Netherlands and I'm responsible for Europe, we are consulting worldwide, like 90 countries.

Meilin Lyu
You talk about the kind of reducing energy or the sustainability aspect. Do you also consider other sustainability like challenges in terms of greenhouse?

Interviewee
one of the things is IPM so the other way around, we are making the plants stronger and the diseases are not easy to get. That's one thing IPM sometimes some chemicals when I think I started 30 years ago, I think we used maybe 5% 10% It's fairly low. We also use biological control, and with fertilizers, it looks like a nutrient but it is not, that give to the plant. And it's getting healthier, and also stronger. And it's biological , so we dont have chemicals you give it to the planet as a kind of nutrient. Now it's also saving energy evidence of trials in bleiswijk that normally when I started we used 45 cubic square per year of gas, I think now the average is 22 cubic square meter. And there are also other crops which have a positive so we have more energy. So we can keep the energy to other crops. It's a hot topic. I also make business plans. And if you want to have some finance of the bank. then have to do something with accessibility. If you don't have a plan, you do not get money. Because to build a greenhouse, you have to have a plan and if that's okay. What you are doing with IPM and what you do with energy for instance. Also, you have to open windows and insects can go through windows. But now more and more people get the screen, kind of screen, this is also one of the things for IPM and for saving energy. I think 10 years ago, no one had to have screen in this greenhouse on vegtables, now they have two, sometimes three, because it saves a lot of energy.

Meilin Lyu
And you mentioned about the biological control in terms of controlling pesticide. And maybe what kind of like how is it operating?

Interviewee
We have a few suppliers, like Koppert, Three or four companies who are specialized in biological control. And what they do, they have that you can look up a website with for every crop, they have a natural competitor, enemy. Of course, sometimes, because some diseases like wildflower, corn,

the predator is coloned, the supplier produce a lot, so it's cheap. They also have solutions for some specific insects. And it's very expensive. And we're going to do it can get, for instance, I think five years ago, we have a big problem with thrips increasing. So growers were spraying some terms, they say, doesn't matter to us. They became resistant. So what they have now is the biological controlled And now everyone knows. And now they will not have a problem with thrips and they even do not spray anymore. So IPM is the solution for everything. And that's great. But now we have a discussion, because we have not much chemicals. But sometimes you can not use it with IPM today, for example larch, We have a lot of trouble. It doesn't work. It's too much. And that's because it's nice weather here in the Netherlands. You can spray the chemical was not good for the larch, but it's good for the predators once to get the balance again with larch and the predator, then it is okay. But the chemicals they say no, they are not allowed. We think again, biological control is about 90-95% is covered. But sometimes you need to make a correction on chemicals and we are talking to the government to say okay, now you can combine the chemical just say okay, I wanted to combine it because now I have a problem. Can I get the chemical? You have to ask for it, And then they say yeah, you're right. You can get it and combined and the problem is solved.

Meilin Lyu
How Delphy engages with different social actors, do you engage with universities intensively?

Interviewee
We are sitting next to bleiswijk and we have a lot of students and for horticulture students they do kind of internship at Delphi. I have two of my team members, they give two days a week lectures of university topics, so that we have connection with University and also we have the connection with the students and we help them because they are working in practice. So, the students now okay of course, you have school books, but you also have a practice, so my collegues work every day (three days a werk) in practice, and you have two days where they share their knowledge with the students and sometimes the students have an internship as possible, you always have some questions.

Meilin Lyu
In your experience has there been any like community-based greenhouse project, local residents approached for Delphi consultation?

Interviewee
Yes there are some projects, one project started just a few weeks ago, taking until the end of the year, and I think 4 different crops are involved in that project. That's what we do and of course, that's for free. So we don't charge any money or something like that. It's for us also important to community like that. We have time to help to show what is possible.

Meilin Lyu
and maybe like what kind of like consultation or how do you supervise the communities like the technical part or like you tell him about the knowledge how to do like a greenhouse.

Interviewee
The only thing we know is knowledge. The knowledge we have enabled to develop our own research stations, we have an in-depth knowledge we use for the community but for the growers for for everyone and universities, but also for companies, also investors but also communities for

everyone who wants knowledge. They can ask us several projects, also from the government, at Nuffic (Dutch organisation for internationalisation in education), but also in Africa, we have some projects from the government and they said well food is very important of course and we get more and more people in the world. Please help Africa that they have more kilograms per square meter to feed everyone. And then the kind of project we help the local farmers with also to make and cooperation from each other. They help each other that it gets a little bit higher cooperation that they show the project for cooperation.

Meilin Lyu
But like, how do you kind of passing knowledge like, do you, like teach some representative of the local residents, and then they would further on teach other residents or?

Interviewee
Teach the teacher, that is what we do, especially in countries like Africa, you're right about it. What we also do is that we teach. Of course, for instance, we have 10 or 15. Growers together, and then we visit one or two growers in the afternoon, teach in a subject. And then next time we do the same thing with other subjects. We explained it over there. So it's practical, theoretical, that's what we do. I think most of the time, one on one, I think 90% with a grower, we talk with a grower, or his manager. If the company is big, we have sometimes seven or eight people will consult, then we also go with these seven people to see the crop and then we discuss with them. With teaching we call it caching, and explaining things with what they think and what we think, and ok this is what we are going to do. So that's how it works.

Meilin Lyu
Right. And, community-based greenhouses, also, in the category of this residential greenhouse, like installations, do you think it might have created like a new niche innovation markets for for this greenhouse, and how they adapt the smart technologies

Interviewee
We have some colleagues from our company who have together with the technical consultants that we work together, because we are looking from the plant the subject and for the technical solutions, and so together we can make good composition. And of course, every time there are some suppliers, sometimes startups, and they come to us, and then we do a trial. Okay, this is like a sensor or something else, and then we help them to start up to make it bigger. So sometimes are working, then, of course, we tell our clients, they have to buy such equipment or something like that. Yeah, that's what we also do. Because our goal is that our clients every day, we help them every day to make sound equipment. And, of course, we consult or we advise that equipment. And also the other way around, we do a trial and we say, well, we don't see anything, then we say don't buy it.

Meilin Lyu
I have seen some examples of Dutch startups where they have like a smart device in your home, which you can grow the Herbes, for example, or like bring greenhouse glass glass box, like Yeah, like do you think like these kind of new innovations, they have this potential to scale up in the future? Or they have they can compete with industrial actors, for example.

Interviewee

That's funny because two years ago, I had also of course, to teach myself so I was in an innovation for six days and I have to, they have to teach me the one of the circuit boards you have to make innovation ID, and I worked out with three, four people, that people could grow their own salads at home, and so they can grow, salad, tomatoes, and so on. And we did a small marketing tests. So we went to Rotterdam,and we asked people what they think about. And the responses were very positive. And later on, there is a company in Norway where they developed something likes a cooling fridge and working with different temperatures. I thought that was 2000 euro. I think maybe it is a bit far away, but I think such innovations alike will come. Because now the vertical farming, if you make the calcultations, it's far too expensive. Especially in Asia, China, but also Saudi Arabia, we see their vertical farming is booming. A lot of investors they say, Well, this is not this may be the right way of growing the future. And they want to build near or inner cities and that's what happened is happening now. Five years ago, there were a few. Of course, that is now in the factory but the next step is that people say, I can also do that at home. I think it has a potential, not today, but in the future.

Meilin Lyu
And maybe, like in terms of the normative impact at Delphi, does your company also consider some ethical principles such as food justice, or food equity, when engaged with like local residents, or local communities

Interviewee
No, we are not thinking in that area.

Meilin Lyu
Right. And one last question. Like I'm sure, like you mentioned, it has been involved with many projects all over the world. And under this kind of global context of urbanization, do you think cultural sensitivities when designing one project in the place and how do you kind of modify this Dutch greenhouse model to another place in the world?

Interviewee
Yeah, I think that is the biggest mistake people think, that's my opinion, I also hang out with my members when I am going abroad I always say leave the holland alone. because you have to look at local opportunities. So if you have to look at opportunities in the county because it's in different climates. In Africa, it's make no sense to build a greenhouse, glass greenhouse. it doesn't work, it is too much expensive. Instead, they have plastic tunnels, working in the soil, in roses and so on. So it's, it's another way of grwoing, but you have to look. I was there several years. And there are a lot of labour. And they do not spray, why I asked, the man said well it is cheaper, and also better for the climate, and so on this sensibility, but it's also cheaper to have the people working and put away the weeds and so it is other ways of thinking.You can say just use chemicals, but if you realize no, chemicals are very expensive. So it's cheaper to say okay, we used labour for the same climate. it's okay. Because you cannot do anything. It's a plastic greenhouse. What you do over there is that, if it is too hot you have a hole on top to leave it open.So, you have to make solutions.

So what if the temperature is too high? And then you have to look okay, what do we do in Holland? But you can't compare it to the country. Of course, in America which hs almost the same greenhouses as in Holland. Yeah, well, then we can compare it. Most of the time is no, you have to see the reaction of the plant if it is too hot, you always have recognize what are the possibilities to solve this problem? I think 90% It's not the same solution as we do in Holland, so we can't make a

copy to Asia to Africa, I think america like in Kentucky for example, where they have snow but we do not have in Holland, the construction we also have to cope with that. So it's really different. Like, if you are going to Belgium and Germany, and Switzerland, you can almost compare it to Holland. But if you go farther, further away, in Spain or in Italy, or if you go to Norway, we also have clients, of course, you have to look at the local solutions, at local climate.

Interview 10 (Director of MijnStadstuin [My City Garden], Urban garden social enterprise)

Meilin Lyu

So, to start off, I have seen that the My City Garden has different ways of plantation. Like do-it-yourself, and you're also outsourcing the work. So could you describe a bit on the business model of my city garden?

Interviewee

Yeah, sure. So we rent out gardens, so first of all vegetable gardens we rent them out mostly to people from the city. And we do it sort of as a service, so we make it as easy as possible for them to grow food. We do this in a few different ways, we have irrigation system and we have a garden Butler and this is a person that can help with advice or who can help in the garden and this would also raise money for us because set it per hour or like a deal. It's sort of a membership. So if it's a special service that you can have that we work a few hours per month in your garden, there are different packages.

Meilin Lyu

Okay, and who is taking the job of this garden Butler?

Interviewee

Just my collegue.

Meilin Lyu

Okay. And how does like my city garden disseminates knowledge and provide supports if somebody wants to, like grow their own vegetables?

Interviewee

Separate different ways. So we, we sell ecological vegetable courses. Of course newsletters people can also email us or just come to us when we're here in the garden as for advice.

Meilin Lyu

How do you engage with like, all these people were like, with different social actors, like the local residents, maybe they come to your place or at a local governments, for example.

Interviewee

Our land is owned by the government by the municipality. So we have quite a good relationship with them. And this is a tender, the company started attending their municipalities during the tenure we want it, and inhabitants of Amsterdam come here for different reasons.

Meilin Lyu

What are the socio-economical backgrounds of inhabitants or reasons make them come to My city Garden?

Interviewee
For me, this is really interesting because I've come from a food background and I really have passion for the food system as a whole and have different roles in this. And for me, it was really good to change something within the food system, and I think that's one of the three pillars (food system). Also notice that people can have different reasons: for being a part of the community, being outside in nature, teaching their kids vegetables production or even having a workout. So it's quite a lot of different reasons why people come here. And I would say that it's quite a diverse if you say from socio-economic backgrounds, we literally have an old bus driver and someone was sitting on the bus next to someone really high position within a municipality manager next to each other. That works really well. I think we are definitely Expensive. So we have a lot of allotments and price for renting that is really really cheap, is heavily subsidized, indirectly by the government. But we're not, so we're more expensive per square meter, that we have services for these kind of things, these are mostly like not for profits, etc. And, for instance, you have to do a lot of labor into the community. This is optional, so you can have it if you want, but it is not necessary that you have on a regular basis, we do all the things that you normally have allotment. And that's why we can still compete with these kinds of gardens also smaller.

Meilin Lyu
And how do you involve people who are less privileged, including the wider communities, even those who are not so willing to participate?

Interviewee
That's a good question. So we have every month a meeting, so everybody's welcomed with the Minister and it's really low key. There are several neighborhoods, that we are a representation of the neighborhood we are in. But this also means I also think that the neighborhood is not as diverse as in the whole Amersterdam. I think we are quite a good representation of the whole Amsterdam but not our neighborhoods because our neighborhood has a lot of people from Turkey and Morroco. One thing we used to do is setting up a special garden for people that are not able to afford it, so there is a subsidy for this because I personally thought it was really important to have such thing. So that also people that cannot afford a garden can still order healthy vegetables. The subsidy stopped and so we had to stop with this as well. And I also notice that we did not market it enough, so there was not a lot of people going.

Meilin Lyu
but what do you think like by offering such a garden space mean for the for the local people, their culture?

Interviewee
I think it's really meaningful for the people that come here often so we say it's about twice a week and it is quite normal. I get a lot of stories from people that were really inspired by being here, etc. We also noticed that some people of course quit, because that's a big time effort.

Meilin Lyu
You also mentioned about the subsidies. So as a social enterprise that my city garden is regarded, in terms of funding and finances,is it sufficient? And how how do you kind of receive this type of support?

Interviewee
We work really hard to get an acquisition and finance. No, the money we get is not sufficient and incidental to work hard to get the money from the government, then it will be gone already. They are very small amounts, and we receive on average one to two times a year.

Meilin Lyu
So as the director, your leadership position might be important in the conditions of, like facilitating collaborative process. What kind of role do you play in this organization?

Interviewee
I try to connect people, as much as possible, always try to have like, an oversight of what is important, and what is the less important and I tried to monitor people to do they're doing. Three years of My City garden, we make sure that we do not cease to exist.

Meilin Lyu
Do you think at a regional level, that my city garden has impacted the local environmental policies, in some ways?

Interviewee
I have two hobbys, one is cooking and the other is politics. But I put a lot of time in politics because I think it's interesting and it is really work related. And of course, they're intertwined. Because I have this position due to work, that I can actually say something about it. But I think that's quite hard because the municipality is really big, and there are different levels outside of the municipality of Amsterdam, and a lot of government layers. We have a different district for water, different district for permits, we have a different district for national subsidies, we have a different layer for the province. So in all these different layers, we are trying to implement and like asking different questions like saying, This is how it is for us, maybe you can help us.

Meilin Lyu
Why did my city garden choose this kind of traditional farming practice? Instead of maybe including smart technologies, developing greenhouses?

Interviewee
Roughly, there are two types of people that want to change the food system. You have indeed, let's say the ecological people and tech optimistic people. And I'm definitely from the school of ecological for solutions, so I think we should do more simple, less technology. I'm not against technology, we have a few of those electric tractors already for maintanence, but they are quite expensive. And I think these are really nice innovations that we can definitely use. But I don't think technical solution can solve a lot of problems I think. Education is the solution to a lot of problems, it is also what we do here. Teaching people about being better consumers, that's more our direction. We say innovations have tend to have also the downside that we don't always see upfront. So that's where I don't really believe in these. So, for instance, fertilizer was of course a big innovation, but we now also see big downside of using a lot of fertiliser. So maybe it wasn't as good as we thought 50 years ago.

Meilin Lyu
And what about like biological control? In terms of insects? Do you use that in the garden? Like pesticides, or?

Interviewee
No, we don't use pesticides, herbicides or insecticides. So we are not officially organic, but we do organic permaculture, regenerative agricultural practices in our garden. We stimulate people to use, we are not that rigid except for fertilizer and pesticides, herbicides, insecticides.

Meilin Lyu
And maybe what do you think are some current challenges or opportunities you see for my city garden?

Interviewee
I would love to expand because I think expanding the right fit for us. To attract investments and seizing ground, especially in Netherlands, it's really hard because it's so packed.

Meilin Lyu
Do you see competitions perhaps that from other allotment gardens, or other community based gardens

Interviewee
I think we stimulate each other from all the urban farming initiatives, so teach people about what is good consumerism, why organic is for instance, is important. And your neighbor has a fruit picking garden also profits from it and if people come here. I think I supermarket is more competition for us than fellow gardeners.

Interview 11 (Water Irrigation Expert and Greenhouses, Aqua for All)
The vast majority of greenhouses in the Netherlands are large scale - commercial growers for primarily the international market. Residential community greenhouses are rare, to be honest I know only one which really fits the term. My experience is that these are mainly for leisure/ gardening purposes, and they do not have any commercial scope. I believe that these residential greenhouses do not share the same problems as commercial greenhouses considering any sustainability issues. For example, commercial growers need to limit nitrogen and phosphorus leeching, they need to maintain a certain water quality of their drain, they have issues with enough freshwater during droughts and energy prices (and therefore the production of CO2 to increase crop production) are sky high at the moment. All these issues are not - as far as I know - of any issue with residential greenhouses since they don't focus on mass production, their focus is on leisure/gardening. Residential have a minimal drain, they can use tap water since they don't need a lot, they - likely - wont have any issues with nutrient leeching since fertilizers are applied to a minimum. And energy is probably not a problem since they don't have additional lightning installed.

Interview 12 (GrowX Vertical Farming, Founder)
I do see opportunities for these kind of community-based greenhouses as social project, but no value in producing food in small scale projects. It will raise costs of food dramatically and thus make food equity and justice a lot lower than today. I holland I call these initiatives rich people toys and greenwashing, it doesn't help feeding the world at all and just distracts from real and good solutions. Local community should not grow their own food.

Meilin
Could you elaborate on the model and technology of grow X vertical farming? Why is it considered a promising urban farming system? And how is it different from other greenhouses?

Interviewee
So when we are talking about greenhouses, we see it as one layer with glass. Probably some extra light, but not always needed. So I think it was really vertical farm, not greenhouse farming. If you look at all the vertical farms around the world, what we differentiate in is that we have lower investment, lower operating costs, energy costs, and our personnel costs, labor costs, because it's all automated, since our cost is really low, so we can really start competing with urban agriculture, or greenhouse agriculture.

Meilin
What kind of technological continuities or like discontinuities from the industrial greenhouses regime, in terms of technology?

Interviewee
We developed the whole farm ourselves, So all the technology that's in-house developed, so we developed our own climate system, only the lights we buy from a light supplier. And all the rest of the in house developed. So we build our own robots, our own transportation system, our own harvesting robots. So the whole system until packaging is in-house developed. And of course, it's in a closed environment circumstance. So we can do with more or less anywhere. And we also make the ferry modelers so easy to scale and put around the world, in small modular units, so we made small cells. So it's not one big farm as we're going to build it, but it's all going to be smaller units that are built to create a farm.

Meilin
And how do you posit Grow X in the greenhouse or in the urban agriculture industry? Can you compete with other industrial actors?

Interviewee
We are only start-up, so we are only one and a half years old. So we have really started in the fields. Hopefully, before the end of year, we will have one large vertical farm. So a 5000 square meter farm in the US, and for the next year, at least six of these vertical farms, hopefully, up to 12 per year after that. So I think we are today's startup scale company, we developed the technology, we are finalizing our own research. By the beginning of next year, we should be one of the major players in the market. We should be competing with existing companies. It looks very, very simple. Because we are much more efficient in in different ways. We are cheaper, lower cost. And we are we can scale vertical farmings, like five times faster.

Meilin
But do you think like your model of this vertical farming can also be adapted at the home level?

Interviewee
No, I don't believe in small scale farming because I think scaling and makes the customers lower. So I think every vertical fund that is smaller than three, four or five times square meter has a higher cost. I think at the end, it's about being affordable food to the people. So I don't believe in small-

scale city farming because the cost price of such easily are four or five times bigger than in a large vertical farm. And it makes food for people very expensive. So I don't think that's a very smart way of going forward.

Meilin
But if we consider like people now generally have more free time and they prefer more individualized service, like they want to implement having some nature in their home. In terms of the social aspects, do you think like this is feasible for like in the future development?

Interviewee
I think you are talking about 3-4% of the people who believe this and will do this. I mean, there are many growsets, small-scale in-house grow sets that's valuable in the markets. But if you see people who buy them, they use them for one to three months, and then they end up somewhere in the corner. So I don't think there are many people. And that's definitely less than 1% of the population that really wants and really does grow their own food. So I think it's an icon, of course, it's possible and it's doable. But there are many, many things in the market today already that can do that. You see, that none of them is really long term successful. So I do not see that in long run, making any impact on food systems and feeding the world.

Meilin
And so it has been mentioned, from the website that there are still environmental and economical challenges involved. And maybe what are the next step of GrowX, in becoming more sustainable and circular.

Interviewee
So for us, what we do now is each of farm that we build we want to add the aerobic digestion, what we see is everyone in the world where we want to build a farm, whether is Asia, East America, also in Europe, energy costs, of course, is the biggest chllanege for vertical farming. Vertical farming by definition uses a lot of energy, because it's indoor and uses light, so it costs energy, there's no way to get around that. What we see is that there's also a lot of organic waste available. And organic waste is available at all the clients where we deliver our own products. So we produce a climate, vegetables, we sell through either a restaurant or a supermarket chain, or food service company. And all these companies have huge demand for organic waste. So we see in a circular economy, in a circular solution, that we can gather to organic waste from our clients for aerobic digestion, which gives us our own energy, but also our own water and also our own nutrients. And also we can produce our own CO2. By doing that we make own farm circular, really 100% circular, this is at the moment what we are developing.

Meilin
In what other aspects are GrowX interacting with the local community, government and the University?

Interviewee
We are setting up a research institute where we for the next 10 years, we have a budget of 100 million to do research for vertical farming. So it's five locations in the world 10 million per year on budget for research, we really want to change the vertical farming industry. So we are definitely interacting with universities in Singapore, Dubai, South Africa and Europe, the university like the AMS Amsterdam university under different aspects. And it is also about circularity, also on AI, also

in genetics. All of these aspects, we interact with university research and over research, it will also be a kind of living lab concepts. I would like to do in all big cities where we build our GrowX house to interact with the community. We think it's very important that to present to people what vertical farming is, and also show that they can look and feel what the future of food could be. So I think it's really important, we are a metropolitan producer, and we produce for the people in the city, that's why we live off the city and to connect with the city.

Meilin
How in this interaction with the local communities can also potentially benefit like low income and less privileged residents?

Interviewee
That's what we focus on. For example, in this in-house device thing, I think it's all for the high-end people and we should make food affordable and we should not focus on the 10000 or 2 0000 people living in the canals or in the big houses, they all eat organic food these days and they all spend a lot of money for that. We need to focus on people that are outside the city, that are in the suburbs, there we need to change the food system because if we want to make a change in the food system, we should not go to those high-end people, so we really need to lower the price of food for people. So for us, in our basic statement is making food affordable for everyone, so we do not end up with high-end vertical farming that no one can pay.

Meilin
In terms of the variety of the foods in GrowX, Can you grow all kinds of vegetables?

Interviewee
Today it's limited, but within the leafy greens there are a couple of hundreds, so we can various mixes, we can make mustard mixes, we can make all kinds of salads but it is all leafy greens, We can also adjust the nutritional content of these leafy green, so we can meet nutritional standards for Asian people, what they need in Africa or Europe, or in the U.S. We can focus on getting more vitamins E or B, so that's where we are today. But of course, full power researching different things, such as lentile, which is a protein containing products and there is a huge opportunity within a year to have the first large scale farm that produces protein. We are also testing the peppers, these look very very interesting in the long term. You know that pepper cannot that peppers cannot grow outside especially in Holland. But we think that this is a solution around the world for acceptable cost-price to produce it's cheaper, local and sustainable. Of course we are testing and learning things in the future but also we do not believe that vertical farming is the only solution for a food problem. We should also look at the protein can be changing the world, of course it is huge, in order to change the food system, we have to look at stop eating animals, looking at cultured meat. So there are different kinds of opportunities.

Meilin
Do you think the startup itself has impacted the local agricultural policies in some way?

Interviewee
I think agriculture, the use of land has radically changed in the coming ten years. In countries like Holland, there will be a mass change. I'm talking to Wageningne University about the social impacts. I think we don't need land to produce food anymore. And that will be a huge change. I also think we need land to capture Co2 and to recognize biodiversity. Agriculture, Climate would

change dramatically. I know there are four or five companies in the world at the moment, producing soya proteins and it is lower price than soya planting around the world. And it will be a huge impact, because if we are done importing soya from Brazil, the whole country will chang, the politics will change, deforestation will change. And those things are going to happen in the next four to five years. So, things are changing, in Holland, farmers are very important, but if we do not need the farmer to produce food anymore, then it will be a big change.

Interview 13 (Plantui Indoor Greenhouse Device, CEO)

1) What does Plantui, the offering of indoor gardening device, mean for consumers, their cultures and ideological inclinations?

Good question and for that it's difficult to answer because very often when we ask the same question. Customer answer is "good and happy feeling" whatever that means. Of course we are happy about that. Maybe that's one reason why those customers start with one device and continue buying second, third, fourth. We have customers with 10 devices. we are not just producing Plantui solution because at the same time we are a technology enabler for other companies (Bosch smart grow).

2) Why are plants grown from Plantui device more nutritious (4 times more vitamins) than plants in supermarkets? Any scientific-evidence supporting the claim.

We have been testing (external Eurofinns lab) and comparing plants you can buy from grocery stores to Plantui cultivated plants. This development is continuous. What is unique for Plantui is the growth process divided by the phases and every phase has different irrigation and lighting recipe. This is also patented technology. Co-operation with Helsinki and Turku Universities has been continued since 2013. I assume that you know well the example of the power of lighting and different spectrums.

3) Can Plantui device achieve food sufficiency/food security per person? And how can Plantui justify the claim that it is only a rich people's toy and not benefiting low-income consumers.

As always when new technology is coming to market it takes quite many years until it's mainstream and volumes are high enough for a cheap prices. Somebody needs to take lead and then afterwards we have solutions for many different categories and different customers.

4) Technologically speaking, what kind of technological continuities and discontinuities have Plantui adopted from the dominant industrial greenhouse innovations?

Finland and Netherland are leading countries in greenhouse technology but here in Finland we have mainly 2 special problems to solve. Temperature is not a problem. We have during winter zero sunshine and during summer 24 hours. So that's nice. Well known thing is that plants, berries, herbs etc have more vitamins, more intense taste in northern part of Scandinavia and our researcher in Norway and Finland has been wondering out why? Finally we found it but because greenhouse technology is pretty traditional it takes long time to change culture there. We choose our way to go to customers home directly.

5) Do you think with the rise of smart indoor greenhouse devices, it has a bright future to scale-up and scale-wide in societies, perhaps competing with mass market food production?

Future is always complicated to forecast and I need to say I wish it because it's most sustainable way to produce greens. Scaling up is not so complicated as you might thing from

technology point of view. To start new wave (fashion) of growing things at home indoor is more complicated and needs more offering and bigger players like Bosch. That's also reason why we are also technology enabler.

6)Apart from the commercial interest, what are some positive societal impacts have Plantui brought? Do you think it has also influenced local (European) food policy in some ways

Not yet I think. In my opinion we are just at the beginning of the path of revolution.

7) Does Plantui also consider sustainability dimension in terms of production?
We already have a couple of partners in China which are producing some components to us. Main purpose at the moment is to keep made in Finland/ Europe as a Plantui brand topic even sometimes it could be cheaper to produce more components somewhere else. We think sustainability is very important and long delivery chain is bad for CO2 footprint.

Interview 14 (Managing Director Food Venture)

I am not in a position to comment on community-based greenhouses.

Interview 15 (Intern at aquaponics greenhouse)

Meilin
Could you briefly describe the aquaponic system you have?

Interviewee
Today is really hot inside. The setup is really simple, the plant floats in the water and not all of them grow well. Another type of setup is that we have water reservoir underneath since the water does not irrigate well from above; a layer in between, and then soil. Another example is that we also put pebbles together with the soil, so not all the water get into the plants and they could have some space to breathe as well. This area used to have lots of ships and it still is heavily polluted, that’s why we can’t grow food on the ground because it has heavy metal.
Interviewee
aquaponic system means that if it's using like big fish tanks which has fish the fish will provide nutrients into the water, the water response upstairs in the greenhouse and this nutritious water will make plants grow plants can get everything they need from the water and it actually counters a lot of waterwaste because you can recycle the water you don't have to throw it away aquaculture like the fish a lot of water waste fresh in the water, fish need fresh water to live in of course, by getting a water plant essentially filters water gets all the nutrients and dirty stuff out of the water and the water can be reused things as clean water for the fish, so it is a closed cycle and sustainable of course. It is also the cycle where ammonium is produced into water by fish excretion when they poop actually. Bacteria will actually transfer or convert that ammonium first. The nitrate actually the main supplements would let them grow, the bacteria on the systems I don't know if you've seen them but it's mainly using water to hydroponics part of the aquaponics. The period that will settle in the water around the pebbles are simple that we use the media beds or the

wicking beds will transfer all the nutrients is extremely nutritious parts which can be used for the plants, but for the living system as well. It's mainly based on bacteria just fighting the transfer between the excretion fish and plant intake. That's one of the most important parts

Meilin Lyu
and so what kind of fish do you use?

Interviewee
We use African catfish because it's easier to keep them catfish they mainly live in murky water they are not that picky about their surroundings, it's easier to keep them like I said, fish are one of the the most sensitive parts of the system of course because it's actually hard to keep fish alive than the plants. Whenever you go to have murky water, the pumps go out oxygen level goes lower, something to fish will suffer. So you need fish that are sturdy and can make it. And if you're supposed to eat fish as well in a way, depends on what you want of course, but it's mainly just providing food , but we eat fish as well. We have consumed fish, yes, we barbecued them, but actually they are quite delicious

Meilin Lyu
And what kind of crops you grow up in the greenhouse?

Interviewee
It depends, we are still getting the hang of it, we are looking well what what grows best, we grew rhubarb, pok soy, the Asian plant, a lot of hot peppers, tomatoes, different kinds of lettuces, herbs actually because we have a restaurant over here which can take up like miints, we are supposed to deliver a lot the hot peppers as well, we have a ventiliation, which was constructed from previous greenhouse park, and people who made the greenhouse were not entirely knowledgeable about like ventilation information so it can be really hot like you just experienced yourself, so we need to find plants can actually withstand temperatures and those climates, high temperatures are sometimes used for the growing purpose of plant but there are limits to what certain plants can withstand. I took a lot of hot peppers home actually, we consumed the fish with Metabolic and with the company as well. Whatever we can deliver to whomever we're still not really on a commercial level intended there to actually be there at some point, we're still like searching what's the best configuration of the greenhouse and fulfill that time we are just producing low level of vegetable.

Meilin Lyu
How was your greenhouse originally set up, was it inherited from the previous greenhouse?

Interviewee
Yes, we have a horticultural expert that has been changing it for the last two years, mainly in COVID period. Firstly, it was mostly set up a lot of Dutch bucket system, the Dutch buckets are mainly just buckets of earth, with a small pipe like a drainage pipe, you just let water dripping from

top and when it's right up until the point the drainage pipe higher drainage pipe will siphon it off. So there's a constant level of water in the systems, it's the most easiest way of irrigation. We don't use it that much anymore, we have six networks right now and one of them is the Dutch bucket system. But the previously before he took over, it was only this bucket system and it was only covering the wall in a sense so there was a lot of areas not in use. Right now we try to mainly stack them above each other and use different systems so we can first of all just experiment with all the different systems and what works over there, and we do education courses as well, so that to show the different configurations that are out there. Well, they could have done it in center as well but they just didn't I don't know why. But yeah, I would say that is the main difference wth the previous greenhouse and I believe they mainly had a mono culture back then where they grew mainly lettuces or something. I know it was only one kind of plant, maybe it was tomatoes, and now we try different plants to search for what is the best configuration.

Meilin Lyu
What about the energy usage in the greenhouse?

Interviewee
Yes, we have two pumps, of course, which pumps water upstairs, which is the best setup, of course, because it's actually quite high from water, all the way upstairs uses relatively a lot of power, instead of a lot of the aquaponic systems on the internet are smaller in scale. And they just use small pumps to pump it from like table-high or something, and then rapidly, we'll let it flow back a lot more water a lot higher. Then again, it's not an amazing amount of energy, we use a very simple electronic pump. And the building has solar panels, which already covered this kind of energy. There are a lot of solar panels in De Ceuvel, so there's more energy produced here, so we actually providing back to our grid. So when it comes to power usage, we are doing alright. But because we're coming back to the grid, it will be a negative co2 in a way, because we have green energy here, so in the sense we take away our part of the co2 emission in the Netherlands.

Meilin Lyu
And what do you think are some societal impacts this greenhouse has been providing to the local community?

Interviewee
Right now, it's mostly educational. I did a tour for school today, actually, I had one earlier this week. And there are a few plan this month, in the next two months. We are trying to reach children right now, from 8 to 17 years old. Just to get them involved in the possibility surrounding alternative systems growing in cities, actually, as well, were part of Foodie, Foodie is an European project, where certain companies from different cities in Europe are just having an initiative to educate the youth around the possibilities of alternative systems actually, we did this way, we just tried to show the children what De Ceuvel is because De Ceuvel used to be a shipyard in the 50s. This part of Amsterdam actually, as a whole was mostly industrial for a long time, they just left it like this because a lot of the industry went abroad to different countries and outside of Europe.

And this part was not in use at all. And at some point I believe in 2014 The Amsterdam municipality started to project re envisioning these kind of places to get them from like an industrial, non-use place into something that will provide quite the opposite, provide entertainment food, water, energy. So that is this whole area as well like the Hispanic part is the restaurant here and with the greenhouse, there are a lot of energies with solar panels, we treat the water, we are treating urine with magnesium and extract substance that is rich in phosphorus. We get urine from this restaurant actually, it is mainly male urine, because females tend to use a lot of anti-conception, this kind of discrimination is the way. That is the most impactful thing for the community, I would say that this area is a symbol of what is possible, and we try to show that to the surrounding, it's actually Internationally known, a lot of tourists as well. And the idea is to be large enough, the greenhouse at least, to provide large amount of food as well, at some point, we already given back to the grid, to the energy grid, but we want to do large amounts. So we can actually show that it's possible.

Meilin Lyu
Do you think Metabolic has also impacted the local policy at some points?

Interviewee
I think this is a nation, in the sense that this flows from a chain that was already there in policy, but at some point, like the Green Party, has been in power for a long time and a lot of critiques towards the Green Party as well, because some people say they're not progressive enough anymore. But they are they're Green Party, So they then treat these kind of projects as beneficial, and they want to promote those kind of projects. But the municipality was already looking for these kind of place to revision dirty parts of the town. And this floats out of it. And it wasn't the other way around, this is not changing the policy, but the policy is providing this kind opportunites. There are also governmental financial subsidies, but I cannot give you an expected answer.

Meilin Lyu
Do you think this concept of aquaponic system and the greenhouse is getting popular around Holland?

Interviewee
Not really. The Netherlands are a really big food provider and exporter as well actually. And they mainly use, they use high-tech systems and mostly hydroponics. And in the best, for example, nearly The Hague, they have rows and rows of greenhouse, where it's 30 degrees all the time, where they are producing large amounts of food, but not really in a sustainble way because you need a lot of power to keep the temperature that high all the time, and they waste a lot of water, they put in all these artificial nutrients. And that is the norm because it's mainly commercially-driven and they just want to export as much as possible. But then in the way I say that there's more attention for these kinds of projects as well for aquaponic systems and smaller-scale initiatives like in communal sense for example, we have smaller markets where only bio products are sold and these kinds of places fill that void. But it's still a long way to go before this large

industry, this agricultural industry is, not like replacing, because it's so big, and so impactful, and so subdominant in the Netherlands, it's hard to compete with them. But there's more attention for smaller scale aquaponics, but I wouldn't say that it's like rockets speed, but on the rise just getting there.

Meilin Lyu
And do you think the vegetables taste better here than the organic store and supermarket?

Interviewee
Yeah, it's like in an organic store. There are a lot of organic stores actually, that goes to the local farmers, small scale farmers. And in that sense that is actually on the rise in the Netherlands. There are a lot of farmers who do conventional farm techniques but don't use any chemicals or any nutrients, but just are ecological, which they only using natural predators for pest, like wasps for example and they lay larvae. They're not allowed to use any animal products as well. And that is even a step further, but there are a lot of farmers that are just biological, like doing it in the old school way and growing in the ground, not using any chemical. And those vegetables really taste good as well, but you have to go to the smaller shops. There are a lot of big supermarkets in the Netherlands, like Albert Heijn and Lidl, they say they go to the local farmers but they are not. You can really taste the difference with their product, because that is not tasty at all.

Meilin Lyu
Okay, and maybe as an intern, why do you work here? And if you encounter difficulties in greenhouse, who do you look for?

Interviewee
I like to work here because you feel good, I want to be involved in sustainble movements. it's interesting to see what is possible and contributes to this project, I love working with the children as well and even though they can be hard to be around sometimes because they are so energetic. It's nice to see that some of these information actually sticking and I really hope they just take it home and think about it, maybe they can be pushed into this direction of possibility. Whenever I encountered problems here at the greenhouse, the horticultural guy has helped me and guided me, I don't have the background, necessarily. to be going off on my own. I just studied future planet study, like biology and politics and social sciences. We got a lot of information in the University, and we actually touched the topic of aquaponics but never enough to be running the system on your own. A lot of practical know-how. But yeah, there's only this guy around and I think the best way to learn is do-it-yourself. But it's quite easy to understand system in a way that it's just pipes and buckets of water and fish and in a sense, when you know the configuration. I think the hardest thing to manage would be the bacterial level and the chemicals, what would it be the consistency, like ammonia and nitrate. And there's a delicate balance that needs to be placed to provide a sense of life as well. To manage that's actually the most dfficult part and afterwards the system runs itself. The pumps just continuously pumping and going to system, we just have to just look at the plants once in a while if there are no leaks, that is the major part.

Interview 16 (Founder, small greenhouse and garden grower)

Meilin
From the photo album of Wim Bijma, I could see that not all vegetables are grown in greenhouse, some are grown with traditional farming practice, which types of vegetables are grown in greenhouse at Intervieweeand why?

Interviewee
The vegetables are doing very well in the greenhouse like tomatoes and cucumbers, we have some herbs so that we continue a little bit more in the winter period, and other vegetables normally are growing in the greenhouse in spring like spinach and looking at the greenhouse it is not so big, and outside the field is much bigger. That's because vegetables from outside, there's always more taste and they grow slower than in the greenhouse.

Meilin
What is the motivation to grow „forgotten“ vegetables and how does Intervieweedifferentiate from other greenhouse growers?

Interviewee
I always much as possible use old-fashioned seeds, they have low production but has the original taste. Many vegetables are manipulated on the size, but not on the taste.

Meilin
They're forgotten because they're not very common in the market?

Interviewee
Well, 10 years ago, it started eating more vegetables was becoming popular and more popular than before.

Meilin
From an article in 2014, it is said that Intervieweeuses „unheated“ greenhouse, as a counter practice to high-tech tomato greenhouses, could you explain the reason behind it?

Interviewee
Well, those really commercial growers are definitely high tech, they grow for high production and they use special plants. I grow my own plants from seeds and they are very low production. But taste and everything is better, so that I can make for a better price. And that is the reason that we grow this kind of tomatoes.

Meilin
I could imagine growing 25 different seasonal vegetables would require technical control for different temperatures, humidity, water, etc. How does Intervieweemaintain technical control for different plant requirements? Would that cost a lot more energy than greenhouses only practice monoculture?

Interviewee
The temperatures, we usually only grow the vegetables of the season and they are all the same temperature. We don't use heating, everything is growing like the old-fashioned days.

Meilin
On the website, you have mentioned that soil is very important for taste guarantee of vegetables, as an expert in greenhouse growing, do you think there are also risks of metal contamination or pollution problems when selecting plots of land in urban agriculture?

Interviewee
We use a lot of material from natural fertilizers, we do not use chemical fertilizer it means that it was also growing slower.

Meilin
But you think like you cannot grow this anywhere. For example, there's a factory near you. Like would this be dangerous?

Interviewee
We don't know. We don't have anything about pollution. Because big diversity we don't have not so many, or almost nothing of insects. And in the greenhouse we put some predators.

Meilin
Knowing that Intervieweesupplies to restaurant and catering company for fresh produce (no later than 1 day), do they also offer a higher economical compensation for this speed of delivery? In terms of beet growing, why is it difficult to achieve growing seven types of beet?

Interviewee
Most of the products are, but not all of delivered in one day. If you buy some vegetables in the supermarket that can be more than a week old and in plastic. It's mostly older.The restaurants serve very high quality meals with a lot of types. I have grown for a long time so it's all about opportunities. It's easier to grow one vegetable but that's not interesting for me. Some vegetables need a little bit more specific fertilizer, like cabbage, for example. the way we give them a little bit more of that fertilizer.

Meilin
In 2016, Intervieweehas also become a training company, what kind of agricultural trainings do you provide and who are the targeted trainees?

Interviewee
We give trainings to students, because you'd need to work for sometimes like a few months, sometimes a little bit longer to understand how you have to manage with all these different types of growing vegetables, like planting, weeding, watering.

Meilin
Yeah. Like the students are from the Waegeningen University or other agricultural university?

Interviewee
That depends, everybody who's interested is welcome.

Meilin
Does community greenhouse growers also seek for consultation?

Interviewee
Showing them how to work with radish, for example. I teach them, practice them for a short time. Really every hour is something different.

Meilin
Finally, as an expert in agricultural training, what do you think about community-based greenhouses, where residents and volunteers grow their own vegetables and circulate in the community?

Interviewee
I don't know. Well, I don't know really the right answers. Some are starting their own company, some are ongoing working by another company or they find out all this nothing for me. So it depends. There are a few people invovled. There are different kinds of people like to grow vegetables. A lot of them are like to do it for their own, and also they have small gardens and they deliver a few for customers. The only thing I do is growing for restaurants.

Interview 17 (Action Researcher Rural Innovation, WUR)
Meilin Lyu: To start off, you mentioned that there is an enormous network in Almere, could you elaborate more on this actor mechanism, this interaction model with the local community, government, entrepreneurs and private companies?
Interviewee: I think there are about 100 plus local community initiatives in Almere.

Meilin Lyu: In what ways have research at WUR facilitating the development of community-based greenhouses or urban agriculture in general?
Interviewee: Me and another colleague Jansma have been working and researching with Almere urban agriculture initiatives for 10-15 years. We sometimes also organise workshops as a group together with the local residents.

Meilin Lyu: In your years of experience with Almere initiatives, how do you think community-based greenhouses are currently being perceived, do they have potential to be scaling wide?
Interviewee: One problem is that when our research project has stopped, the initiative ceases to exist as well. So, I think it is important that government help to keep the sustainability of these kinds of projects.

Meilin Lyu: Do you think there has been involved with a lot of governmental bureaucracy in setting up a community-based greenhouse?
Interviewee: No, I don't think so.

Meilin Lyu: In the city of Almere, I know there are the Oosterwold project, in longer run, do you think these types of community-based projects are successful, how can they improve to become more sustainable and circular?
Interviewee: I think it is difficult to maintain the social project if it just stays social. It also needs financial and economical aspects to be self-sustainable. Because if it only stays social, people could get bored.

Meilin Lyu: Would they continue to be developed as an alternative agrofood network, or have the potential to cause transformative transition in food production, in a way that they could compete with industrial actors locally?

Interviewee: I think it is possible but it is very difficult for community-based greenhouses to have transformative impacts, because it is very difficult to have a large variety of crops, mostly can only focused on one or two crops in greenhouse production. A few years ago, we had a social project did the similar thing, he sold to the auction house, which then are being further sold off to sellers, but he couldn't provide a large number of vegetables since he cannot focus on too many. ONZE is a well-known greenhouse in the area, mainly for recreational activities, but they only focus on self-consumption. A lot of people working at ONZE are from the former Dutch colony, Suriname. They grow in greenhouse for tropical vegetables and fruits.

Meilin Lyu: From a top-down level, how has local government supported the development of initiatives in Almere?
Interviewee: food production is not the primary goal in community-based projects in Almere, people do it for many different reasons, mostly recreational, can also be educational, for socialisation, etc.

Meilin Lyu: In what ways do you think the local community and local residents in Almere has affected food system and practices in terms of policy-making?
Interviewee: I think it is very difficult to tell for community-based greenhouse impacts at policy level.

Meilin Lyu: Do you think it is possible to transfer this Almere model elsewhere in Holland?
Interviewee: Yes, I think it is possible. Not only in Almere, there are also community-based projects in Amsterdam and Den Haag. Because there also have lots of spaces can be developed.

Interview 18 (Culemborg Greenhouse Houses Architect)

Interviewee

Several aspects were very important that reducing the amount of energy used in heating and cooling. The second aspect was using as much biobased ecological materials as possible now non-toxic materials or toxic materials are not not used, they are forbidden; then every street or block of houses has a common space, a common garden space, so you do join the main part of the garden with each other, it's not a private use. So, you have to interact and to discuss how to use and this garden. This community is car free so, the cars are on parking plots on the periphery of of the whole neighborhood you can drive with your car in front of your house to load some stuff or to bring your groceries home something like that, but then you have to put the car back on the parking place and yeah this I enjoyed, still enjoy it very much also after 20 years not to look at the cars when you look into the street, and it's very safe for small children so they can play. And then, there's kind of water management in this neighborhood that Rainwater is collected and put into small ponds in the neighborhood, and the whole sewage system is divided in black water and gray water you know the difference: like black water is really from your toilet and grey water is kitchen and bathroom and this water is also cleaned into neighborhoods to close loops and not to move your pollution to other places. When you cause a pollution you solve it in the place where you live in. And another very important aspect was that the future inhabitants develop the houses by themselves that they are not commercial developers,who want to earn a lot of money but that people have the possibility to have some influence on the design of the houses and that's a keep affordable the house, in financial sense. So my colleagues and me in the discussion round, we get some people who wanted to live here and then we developed these houses but in a completely transparent way, so he pays that amount of money for the plot, for the ground, he pays that for the house and that for us as architects. Our main goal was to make houses which gives you a lot of contact with nature, with the elements (some rain and wind), from the year that spring, summer winter, so you can experience this changes very much. And what you now see is one of the typical aspects so with the weather, it's nice you open up your house, the house which is well-insulated and you open it up and you enlarge your living space with the sun, green, light and air and yes, it's a special quality.

Interviewee

The second aspect is that the greenhouse is a kind of an umbrella which covers the house and so no rain comes to your house and to the roof and the facade, so you can materialize in a different way. And so you don't have to paint your windows and you don't have to use silicone to seal it. And this is recycled wood, this was used in ships in the loading spaces of ships. So we bought it used and then gave it a second life in

this project. So that's the second aspect that we develop this further on in the other project over there. And in the meantime, I think greenhouses are hard shell, which protects the house. And these steels (the supporting structure) are not very sustainable materials. As you see it's steel, aluminium glass, so it is very energy intensive in the production. But it's also on the other hand, it's very durable. So it lasts for a really long time. And the core, the house, under the greenhouse, you can build a very soft bio based materials like clay, recycled wood, even cardboard, stuff like that could be used, so you can compensate what you what you put into the skin and non-sustainable materials, on the inside by using very sustainable bio based materials.

Interviewee
And the third aspect is that it's a thermal buffer in wintertime. So you have reduction of your transmission losses, warmth that you lose your skin. And that's also about 30 to 40% reduction of energy losses. And such a greenhouse only makes sense if you combine all these aspects, if you want to build a greenhouse or integrated greenhouse only for energy saving, that would not work, then you can better develop a passive house, you know the concept of a passive house, which is to have this synergy effects in mind enlarging your space, special space, green contact with the elements to have the umbrella effect that the house is covered, you can use different materials or bio-based materials, very sustainable materials. And you'll have some energy reduction in wintertime when you have to heat your house. So as a combination of all these aspects makes this concept sustainable and durable and very fine to live in.

Meilin Lyu
I also saw water tower on the way is it also part of the living project?

Interviewee
Exactly. That it's about a company puts water here from the ground and distributed in the whole region. And the water tower is a problem, because it has to be renovated and this since 20 years is a discussion ongoing about how can you use a water tower in economical, sustainable way. So there is now somebody who wants to put a house on top of the water tower, but I think it's crazy. But okay. And the water company also there is a company, A network in this neighborhood for heating the houses with heat pumps, the heat pump is placed by the water tower. And water that is drawn from the ground is cooled for some degrees with a heat pump to bring it up to a higher temperature. And then it's distributed in the surrounding for heating the houses in winter. And it's also really very sustainable way to heat houses, with heat pumps. This is a huge heat pump and it's a communal heating network, you can call it. So that's another integral path. And on the other side of the road, there's this town farm and its vegetables are produced in a sustainable way. They also have a greenhouse, they have a small shop, it's open some days in the week. And there are also people employed, we have a handicap, mental or physical disabilities.They also have a small cafe and this is a very prominent social aspect. On this town farm, people gather and buy local biological products.

Interviewee
And are these glass panels also be used for greenhouses or just for architectural home use?

Interviewee
The background of the whole construction, we thought here in Holland, we are world champions in building greenhouses. When you come by plane, you also maybe you saw them in the west of the country. In The Hague there are a lot of square kilometers. They are totally covered with greenhouses. We have a very developed and efficient technology of greenhouses. So we thought this is not too expensive, and it's of high quality. So we decided to try this in a housing concept. For example, these aluminium rods, for a gardener who has a greenhouse, it's very important that he gets as much sun as possible. So these rods should be as small as possible. And also, the glass is only four millimeters thick but it's hardened glass. It's very strong. It could withstand hail and thunderstorms. And it's really very strong. And only here in the construction, the steel you see, that's so heavy because this is not a real greenhouse but it's a living space. So because of the regulations from the government, we had to make very strong construction. And that's really a pity because if you look at real greenhouses, they have very light and filigrain structure with less material in it. But what I wanted to mention is that the effort to have very small rods in a very small tiny construction gives the gardener more light so this results in more cucumbers and tomatoes and paprika and stuff like that, but there's also an aesthetical component because architects always try to, at least good architects, to use as

less materials as possible, and that's also now in the whole discussion the last 10-20 years that we have to save our environment and be very efficient with resources steel and aluminium and what to use it in a really efficient way, very slim construction, very same with less material in itself. Some aspects of what the gardener in the greenhouse wants, what's the architect wants, and what we have to do for the environment nowadays, are on the same line, goes into the same direction. But we also have later realized project of a kind of greenhouse with good insulated box in it, I call it, for older people with dementia and they stay there during the day and they can work in the garden that's very good for their mental health to work and to plant, and also with animals.There we made the whole construction from wood and wood as a biomass material is much less energy , t's much more energy efficient than steel, you know steel you really need a lot and a lot of energy to produce steel. So we made some steps good direction to replace the steel construction for wooden construction as a bio-based renewable material.

Interviewee
Do you also grow foods under your greenhouse?

Interviewee
We did on the terrace above but you also have to follow it very closely. And when you go with holidays in summer, it's always a problem. So it was last time last year we don't do it anymore. But it's mainly on the roof terrace, it's very it's possible and very good to do. What we have here for example we have Kiwi, they don't really get ripe. But here we have grapes and it's always very nice, we have a lot of grapes at the end of the summer. But we could do it more more efficient.

Meilin Lyu
Would it get too hot if you grow on the roof terrace?

Interviewee
No. because the thermal climate here on the ground floor it never gets hotter than on the outside. So it's 30 degrees outside, it's 30 degrees here. And that has to do with very good ventilation. So you see this huge windows on top and windows here and then the door. So there's ventilation, and what works really extremely good is in summer when it's really hot, you close this inner glass door during the day, so it stays cool inside and in the evening you can open it to eat here and and during the night, cold fresh air goes through the house and open their three huge doors, so the cold air goes through the house and cools the construction. So in the morning, it's really very nice, cool. And if you have another highest hot day, then you close the doors. And it's some people think we have an air conditioning on the inside, but it's not true. So it stays actually, if you use it in the right way it stays cooler, in your hot periods.

Meilin Lyu
Is there any discomfort living this kind of house?

Interviewee
Oh, yeah, you have to clean the greenhouse sometimes it's quite some work to wash away the dirt on the glass. So we as architects, we are very glad with this concept, it works as we planned it 20 years ago. And yeah, the main subject was indeed overheating in summer. And we put a lot of our efforts and be also made usage of advanced computer models who can predict temperatures in summer and that all worked out very well. So we have also no shading devices, you can see that that says a lot about the thermal comfort, otherwise you would put shading textiles under the glass or even better above the glass, but then it also gets dirty and exposed to wind and rain. So you mainly or mostly place your shading device under the glass.

Meilin Lyu
And this is content as a social experimental living project?

Interviewee
Yeah. So for sure, there are only a few houses in the world according to this concept, and maybe in the Netherlands, it's the only one and in Germany there is a private housing, in Scandinavia there are some private houses. But we have built 18 houses here. So it's really quite unique.

Meilin Lyu
And is it going to be applied in wider context?

Interviewee
Yeah, during 20 years, but what I've seen is that during the last 20-25 years, greenhouses are much more integrated into office spaces, great art rooms, was also where it has stairs and elevators are located, where people gather, where there is Cafe and canteen, and the greenhouse is also part of the climate concept of the building. So that it's used for refreshing air, with plants with water, even small ponds, something like that. And that it's used for energy reduction for using solar energy, for example, that's what I've seen, but not in housing, not really in housing. But in office spaces, you see during the last 20 years, a lot of intelligent use of greenhouses.

Meilin Lyu
What do you think are the social characteristics of the residents living here?

Interviewee
People come here because of environmental awareness. And what's also clear in the meantime, is that it offers a lot of quality. You don't have to be environmentally aware to see that your children, for example, can grow up here very nice and in a variation of environment which is interesting and also safe because there are no cars or at least only a few cars in the neighborhood. So a lot of people want to buy a house here but it's not possible anymore, even they are not especially environmentally aware. So it's as simple as that. This neighborhood offers a lot of quality, living quality. Yeah, they are Dutch people but a lot of people for example here in this row, people even came from Amsterdam to live in such a crazy house, they moved from Amsterdam to here to live in such a house so. Our clients weren't people here from the town, they came from all parts because they saw the quality and special aspects there are also a lot of people still I think who say that it's completely crazy and doesn't work and it gets too hot in the summer and cleans the glass and they want to have normal normal houses and that's okay. We don't want to convince everybody about such a concept but it's also the a lot of people don't want to look further and to explore the possibilities, they are so narrow minded, so the people who often come here and live here and want to live here, they have a different view on on environmental aspects and the role of humans in it and try to anticipate on problems and that's it what you can say overall.

Meilin Lyu
When initially you formed the planning for this area, do you also think about food production?

Interviewee
Yeah, it's of course, the town farm on the other side of the street was a part of the whole concept food production. The plants and trees here in the plan was designed, according to some principles of permaculture. So the surrounding is edible, apple trees, plums, cherries, nuts, a lot of walnuts. So that's also part of the concept. But the thing about is we are not really used to use this resources and a lot of people are busy and they are also busy as normal people when they have small children and in summer you go with holidays and then, the fruit is ripe and then nobody harvests the fruits. So here also people live in a fast pace and we are a part of this Dutch industrial country with a lot of speed in life. You are not on an island where we live completely different way. That's always the problem.

Meilin Lyu
And what do you think how has the whole project impacted the local policy?

Peter
I don’t know exactly about the local policies, but during the year we have visitors from all over the world from Asia, European countries and America, these people are often policy-makers from communities who heard about and want to learn how did we developed it. So in this sense, this community has quite a lot of impact I guess. The interesting thing about it is, I already mentioned the conservation of energy and using good materials, and all these aspects are a part of national legislations now, so it is nothing special anymore. But the people who come here, the commissioners would like to learn the self management and

self-sustainable aspects of this neighbourhood, the open spaces and things like that, how to manage the apple trees.

Interview 19 (Towards Nature Permaculture and Community Gardens (Owner))

Meilin Lyu
What do you think are some important principles Towards Nature are aspired to?

Interviewee
My company builds on permaculture principles, Permaculture is a design concept of sustainability of humans and environments together, creating human settlements, human life on this planet in sustainable design and I work towards sustainability inside the city and outside the city in a different parameters to create sustainability, but I refer that my company's base is permaculture.

Meilin Lyu
How do you define the concept of permaculture? Is it any type of urban living urban agriculture can be counted towards that concept?

Interviewee
Any urban agriculture, no, Permaculture from the name, permanent agriculture. It means that people work with nature, cooperating with nature, but sustaining themselves on this planet based on planetary rules and the design come with importance that we can design upfront before we establish something or before we transform something in that direction, we have to design first with using the learning from natural resources and implemented based that. So the current, any urban establishment doesn't count as sustainable, because from the building type, building functionality, to landscape design, landscape management is designed based on consumer concepts, which we are in. So the consumer concept, the world at the moment, is our main destruction point, because we are going in the wrong direction and so we are trying to find ways to repair damage and find another way that we can live sustainably.

Meilin Lyu
From the website, there are different permaculture zones, is it kind of like an idealistic expanding system?

Interviewee
Zones are like a guidance. It's a design based on how the nature function with the scientific observation. In 1970s, Bill Mollison and his colleagues from the university, David Holmgren, they come up with this concept that we design our environments, living environments, based on some principles, based on some rules. And this zone just gives clear guidelines. Which kind of elements must be what parts of the design, which part of the design, but for what part of elements, we need to locate it works together. For example, if, let's say the zone starts at zero where people live and extends outwards 12345. And this is design, looking into nature, and how we can live in harmony with nature, because structural, So you know when number goes on is that the people live in the house, but the house itself is functional, functional sustainable, for example, does it create its own energy, because it recycles water. Save its water from rain, and also the house itself and what's the connection with the house with the landscape. Inside the city It's already there are cities that we can think differently, but then building urban establishment, to design totally centralized designs at the moment, all the water recycling comes from a far location, all the electricity comes from a centralized location and all the sewage system, all the switches, toilet, everything filtered in far locations, this is centralized system. But in the localized system, then we localize the house itself does all these functions we don't need to transport because now the systems become obsolete, but our consumer base system to make an economy out of it, we keep going in that direction because all our life is based on the economy. To transform the system into more productive living, we need to start designing based on more sustainable zoning system just give the guideline, zone 1, they're even more active, they eat outside, they play their children play, and then your first round of herbs and kitchen needs in Zone one. And when you go Zone 2, so the chickens and all animals can start being in the design; Zone 3 has more trees more orchard like forests; Zone 4 and 5 refer to wild nature if the land is available. But the designs can be done in different ways depending on the landscapes. Fields and flat lands can change the design, and the water being all

kinds of natural elements, we look at these elements and then design it in a way that we can make use of zones give clear guidance which parts of it element so in what part of the design.

Meilin Lyu
Towards Nature has many experience was like community based garden, are they around Amsterdam region?

Interviewee
Yes.I have designed and built eight of them in Amsterdam over around the city, in north there are two. Now we finished another one in the north, in the east there is one, and in the west there are four.

Meilin Lyu
Why do you think people are interested in like doing this kind of project with Towards Nature?

Interviewee
Because there's a new awareness growing, this awareness says that something's wrong what we are doing, a lot of species are dying, becoming a thing. Also, we are surrounded with unhealthy foods, our health is going not so great, healthy food and healthy lifestyle becoming more popular between people that we need to keep our immune system as strong so that we can live healthy and long. So this kind of awareness brings the question on the current system, how we live, with what kind of conditions we live , and how we can transform that we as a human species don't bring ourselves into kills, either by disease by war or by general natural-related reaction that what we are doing to nature, reactions coming back from nature. We call them natural disasters. For example, floods, forest fires, in 2001 it was totally disaster year even in Greece and Turkey, I am originally from Turkey. And also a lot of floods happen in Northen part of the area in Holland. Because these things doesn't happen. like, it happens in a natural cycle, but in human environments these are accelerated because how we design our landscape, we design based on how much money or how profitable, but we don't think of the rest of the world designs of landscape are not relating to where they are located. They don't play natural aspects in the environment, but only they believe how much profit they're gonna make. This is why the reaction from the nature, its racing ecological disasters, like flooding is totally human-made, because we build on the line of waterways and afterwards when the landslide or water flooding happens, pushes up all the places where people live, and then people die becomes natural reserves, but these are all coming from originally, by the way we act on this planet, so the planet is reacting with their natural cycles, and then we need to find different way. So, the awareness levels are growing. And the people are looking for different ways to transform their environment. And the people in their living environment, they want to create something more nature friendly, and they want to become more productive, which means at least they want to learn how to grow vegetables, have someplace to take care of some plants, maybe even animals, for that they're looking for places, public places to build social contact. So, then community garden happened naturally that people get together and then they look for solutions what to do in this area and in Amsterdam, people know me, my name with my company that I have done already before community garden, they find me and we make fun and I have the experience design doing it by hand, I help them to create this community places, so that people are looking for change and this change direction sustainability, but not yet on the main coming.

Meilin Lyu
Do you also have a team with you?

Interviewee
My company is one-person company, but I have different working styles for different subjects. For example, if I have to transfer a private person backgarden, I hire people to help me but I designed the concept, I agree with the customer and then doing the job physically. I hire people to work but if I work for a community garden, if I design a community garden, I open the jobs to the community members, for example, some people are out of jobs, they are looking for jobs to do some either voluntary or paid help. The money I receive from the government or the subsidies during the community garden, I pay them or I hire people to do it. But the design is always coming from designers discussed either private people or community people, or also I do school gardens, also with the school management. I know people that can work with me, they have other jobs, I call them with this amount of money and time and ask them if they want to come.

Meilin Lyu
How do you bridge between community and the government?

Interviewee
The gap is quite big. People are always ahead of the government in terms of awareness, the government are mostly trapped inside their regulations legislation. So, to allow people and give subsidies to the people, who are more aware in the understanding of nature and our healthy lifestyle, there is a gap. So, to bridge that gap, I I create my design knowing the legislation and how to either go around them because by legislation we cannot create any community-garden, because you cannot plant a tree you cannot change public place to private group people, and all the legislations protect some certain area being that areas. For example, a park isn't defined as a park, a group of people cannot occupy the park forever, but "everybody" is unknown, so knowing that legislation, but finding ways to become available, designs help them, help people to bring the projects to the government and government make design with the cost attached, they can process it easier, because their system is built on the plan and the cost. If you have a plan in cost in such a way, the governmental system works easier. So, I bridge that gap with my visual design and also with the plan or the financial aspect, when is it gonna be done, things like like all the planning that I provided to the government. Subsidy benefit obective from the government, I do, based on whatever plan. My main goal is to make it easy for governments to understand what we are doing and eliminate the dangers of their inflations they say no, and to find a way to implement.

Meilin Lyu
How is technology integrated in your design?

Interviewee
Technology, no, I don't use much high-tech. Let me say this way, my technology is related not to machine. My technology related to how the nature systems work, my aim is to create natural environment which is sustainable by itself without human interaction can try, regenerative way of landscaping. So, the way, not only design, but the techniques I use from permaculture, permaculture bring the techniques, looking at the Nature and Scientific facts tell us some some information. This information we use it for our designs inside for example planting some flowers or herbs or berries, I just don't but put earth but underneath I ground up mostly some clay. I placed wood inside, wasted wood from the city garden, fallen trees, certain spieces, some of them are used, some of them are unused. I use them and bury them inside the ground to provide like wood and earth and then the plants coming and the plant take the water and the nutrients from the roots and in all the years. So, without implementing an irrigation system, with using this technique from permaculture, I overcome the cost of implementing high-tech irrigation system. It says automatically by rain, my way of looking at it, if it is open place, public space, community garden in open place without using any electrical machine, How I can sustain the place with natural aspects, that is my function. But it is not like a greenhouse, where irrigation system is needed, In general, again, buying a pump and totally depending on electricity, the people collect the rainwater from the roof of the greenhouse, I put it in big rain barrel, and I direct the rain barrel from outside to inside of the greenhouse. And there I create a reaping system on the ground. And then it's controlled by the people, then they want water they open this up. And then waters are automatically rainwater, there's no electricity, but it can be done totally on all electrical equipment as well. But of course, it needs first of all, it is the maintenance because the machines work in electricity is something we depend on. But if you do it the other way, with rainwater, you can totally sustain the cycle of the greenhouse irrigation. So this is my way of looking at it, technology is not always about electrical equipment. Technology is also some techniques that we use that sustain by itself, like collecting rainwater from own roof, instead of taking the drinkable water from the tap. Because Amsterdam a tap water is one of the best quality in Europe. And if you use this very nice filter for watering our plants, you are wasting a lot of money and resource. So instead of this I use rain water, I just recycle it in a different way that we don't need any electrical. This is more my echo. But if any electrical equipment is needed, the cost attached to it and the maintenance, I put it in the plan and then technical company comes in and does the maintenance and then government can pay them. But my preference is why not use the other one that is so automatically waters and we don't need an electrical equipment.

Meilin Lyu

What kind of crops vegetable crops do communities grow and can they achieve self sufficiency for food security?

Interviewee
for people living in cities, their knowledge of plants are very limited. They are at the moment in a learning stage, relearning how the vegetables plants grow and they aim to teach children. So the crops they grow is mostly what they know like tomatoes or some salad, strawberry may be some garlic or onions, these kind of thing, what they immediately eat, and also their interest sometimes go watching YouTube videos with different vegetables and that they can practice different experiments. But sufficiency in the city is not only with having an allotment, the small square meters, it should be connected by outside of sustainable community. There I'm busy, I'm trying to create a real permaculture design sustainable community, I have designs for that. And this is my next level of achievement I want to do. So create around the city a sustainable community, which is totally by design productive and In and out, there must be direct communication, thresholds must come from us and also must be grown inside cities in most public areas. For that internal city structures matter, they organize must be transformed in a way that is allowing people to become sustainable. However by law, they are encouraged to become consumer. We are not encouraged to become sustainable, because the system requires or the government's take care of the people, then people pay to the government, that is the system at the moment. But sustainable way of changing the system is making people more productive, transforming their area. And they are building system. From centralized to localized system. Maybe whole area can be sustained by water, easily in the public area, with a special watering system, rainwater collecting, filtering and pumping back to the houses. And at the same time is located we can create vegetables in the gardens. But for this kind of structures, our system must be thinking first of all, and afterwards are, our governmental systems roles and legislations must change to a sustainable direction. Because at the moment, we are encouraged to become consumer, we need to produce a lot of products. And we need to sell it to each other, we need to create services, you need to give it to each other, that the money can circulate. This is the monetary-base system. So to change the system into sustainable direction, First of all, this legislation must change but that is very unlikely, because the change is that we need to wipe off the government. Again, this is not possible. I mean, maybe possible, but I'm just thinking is not the short term possibility. Instead, people must initiate projects that create sustainable communities inside the cities and also immediately surrounding cities, that the connection between communities can start and the food and knowledge transfer can begin. So, for that, we have a chance, but that is also blocked by the legislation of land definition, land in all Western countries defined by law, what it is, it is either grassland, forest land which is unproductive or farmland, that is where you grow monocultural crops or orchard. There are nothing in between to create a sustainable community, we need another definition. That is the community is aiming to live on the land, another legislation, another definition must be created that people can create their communities. People are looking for solutions for them. That's why always the outcome of Sustainable Communities separate the food production area from living area, that this is the wrong decision. Because Land Type is either crop-growing or living. People do not have a definition that they can live with the place that they can become production. The legislations must change this is the biggest book on sustainable level of development.

Meilin Lyu
and do you think the communities you have been in contact with, they already know each other and they are coming from similar social backgrounds or have similar motivation?

Interviewee
People not necessarily know each other, but they live in the same area. As I mentioned, like our system is built on consumer based system and bring monetary systems as a first priority. So the all the living places in the cities are designed to separate people from each other. That will come to space as a living place, an apartment for example, and then expect them to connect later and become fine between each other. That is the way it is. But what we need is we need to have the socializing before and what people need and then build it up. There's a difference in two directions. At the moment, people live in the same area by faith or maybe sitting in the cafeteria they live nearby know each other maybe. But most of them first time meet, even they live 10 years, 20 years in the same neighbor. The community garden allow people to know each other, sharing their differences, even they are from different backgrounds. So it is also a social aspect, having a community garden, this is not about only sustaining them or making them self sustainable area.

But this helps them to get to know each other, learn their learn how to grow, and maybe harvest them socially, have connection that they can be together, eat together, cook together, maybe preserve things together, or making jams or any pickles or things like that these small activities, or even I give composting workshops, this is very enjoyable for people, because they exercise at turning the compost over together. For five people, this becomes very fun for them. This way of connection, bring the people together. Because they learn each other, even they live next door. They never talked. But these kinds of activities, make some connect. And then social, loneliness, social differences all can be solved in this community. And I see that the places I designed, it's already happening. A lot of people getting together, doing activities, composting workshops. And harvesting may sometimes be organizing dinners and things like that. It's all happening. But we need more of a lot more.

Meilin
And maybe one last question.Do you have plans to integrate greenhouse into this community garden picture, which goes ensure a higher productivity?

Interviewee
So green greenhouses, by legislation, you need a permit, you can't build a greenhouse, if you want even all the neighborhood one they need to pay some fee for permission and this is a long procedure, one of the community I designed just applied for that. And they it took them one year to get greenhouse permit for four by six meters small greenhouse, this is very basic measure of greenhouse and they had to pay for the fee for permission only without the cost of the greenhouse. So, creating greenhouses is good for starting vegetations to make the lifetime longer and stuff. But I believe the direction for us to become sustainable, the greenhouse development outside of the cities already very bringing out a lot of products that may be efficient and looking good, but the nutrient wise they are not high enough on the nutrient level. I prefer we have more local, directly from earth, open air if possible to create some instead of greenhouse. But greenhouses also play a role for me that it is expensive season, we can grow more warm climates plants inside. There are also benefits of getting greenhouses, but I I wouldn't go into direction that more and more greenhouse production should be introduced in the city or outside. We need to instead create more and more put forth that helps the climate change, global warming and the greenhouses collect the water first of all, and covers the ground and it's more negative impact for the greenhouse. And that is creating the main global warming problem. because it reflects the sun, I believe more we need to create more land-based equivalent input for the example that brings, First of all, diverse and perineal ecosystem, minimal maintenance, and not dependent on electricity or any other technology. But the greenhouse requires money to build, requires money to maintenance and also think about it globally, if you have more and more and more and it means instead of we are planting trees and food forests, we are covering your greenhouse.

Interview 20 (Das Kas Kantine (Amsterdam, Greenhouse cooperative))
—Could you briefly describe the greenhouse system you have?
We are Volunteers based cooperative, this is the third year we are opening since we had moved one time. It is run by 2 people. Sometimes we organize pizza nights. We also have a bike where we gather food surplus from different shops and businesses and redistributed somewhere. Outside we have a communal garden, where people could enjoy and play volleyball.

—What is the size of your greenhouse?
200 square meter

—What type of crops do you grow?
Spinach,courgette, leek, chard, broccoli, red beet, radish, dill, red onions, carrots. For example, the time of growing chard depends on the weather, It takes 3 months to grow one chard, and after that we take the leaves and leave the root in the soil. The tomatoes are grown in a small glasshouse, we use the tomato crops that appear larger in size. None of us are farmers, also the volunteers, we learn by doing.

—From where did you adopt this technology and set it up?

Everything is reused, from containers, the solar panels were donated by company which are broken, that's a lot of waste being thrown, so we do a lot of recycling, so they are low-tech. They were being set up normally by people who are knowledgeable about something. The glasses were secondhand brought.

—How did this idea come about in the first place?
I was a development worker before, I didn't want to make any debts, so I think maybe I can build a greenhouse with waste materials. So that's how I started.

—In the website, you describe this type of greenhouse as „off-grid" technology, what does it mean?
There's no sewage system, not connected to any utilities, just the field.

—What are some important principles Das KAS Kantine is aspired to? e.g. sustainability, energy usage, promotion of green jobs
We are social enterprise but we also have social impacts. We fight against climate change, and loss of biodiversity, we recycle materials, mange food waste and cook with the neighbourhood. We create gardens and strengthen local knowledge and social networks.

—Why was it no longer open?
Because we are still negotiating for contracts for the restaurant. This is the first time we are on municipality ground, normally I'm on temporary free plot of land because it's not used. Because of the antitrust law, the municipality is not allowed to give something cheaper for normal company, so that there's a fair competition for everybody. Before it's allowed but now it's not for the social enterprise. The glasshouse is not currently open for visitors, we grow baby seeds inside and after we grow them outside in the garden or give away.

—Do you receive support from the government?
No. It's not a good idea because it's not sustainable. So we try to manage ourselves.

—Were there a lot of technical difficulties involved?
The legal recognition is more strict than before, it takes a lot of times to get approved. Technical is our passion, our job, so there's no problem.
—What about water irrigation system and energy usage, were they used efficiently, with circularity concept?

—What is warm compost? was is the benefits for crop growing?
The compost is heated because of the medium. To make hot compost, you need special relations between nitrogen and carbon, certain bacteria they eat everything and they heat up until 60 degrees. We use them to make baby plants, because of this process, weed seeds are killed, that's why it's good. Otherwise we use just cold compost.

—Do you think this concept of small-scale or community-based greenhouse is getting popular in Amsterdam cafes or in Holland?
Yes, greenhouse are public spaces and getting more popular. They are multifunctional, transparent, mobile, it's very good. They are of course more productive but that's not the point, they are just for baby plants and herbs.

—What do you think offering of such greenhouse system for cafe vegetable/herb production means for local people and residents? any societal impact?
Well we have 30 volunteers to collect food, they enjoy workshops.

—What is the next step for Das KAS KANTINE with the greenhouse?
We don't really know, maybe we will make climate club, doing everything good for the climate, like producing food and making food, every two weeks. We also teach people how to grow plants.

Interview 21 (Volunteer, Das Kas Kantine)
I am a volunteer here and my friend working here ask me to come. I work like 1-2 hours everyday and I work nearby in restaurant. I also consume vegetables here, like potatoes, they are not like the supermarkets, very tasty because they grow naturally.

Interview 22 (Bejo Seeding Company, staff)

We are one of the first Dutch seeding company. All seeds are organic, we guarantee 96% rate of success, and seeds are managed by quality control, we also eliminate unwanted bacteria. We do not directly sell to communities, normally on a large scale to large-scale growers and wholesalers, who would then distribute to smaller gardeners. We also develop new species only when the demand is large, for example our erasmus asparagus is newly developed, it is purple in colour, soft, and can be eaten without cooking. Farmers are generally concerned about GMOs, we test out new products at universities, and farmers could also request new features, such as adding of different vitamins.

Interview 23 (Greenhouse Floriada Expo, staff greenhouse expert)

Greenhouse Staff
I was working with Koppert Cress before but I'm not into these community-based greenhouse topics to be honest. This exhibition is about Dutch Agriculture as it as it and about the fact that it is a way of growing with very low impact on environment, that is what we want to explain to people that the Dutch horticulture industry is quite efficient.

Meilin
What about the energy consumption and water irrigation?

Greenhouse Staff
So, 60% of the water that is being used is from the rain. And the all the water what is used is, if the water is not absorbed, this is common practice in Dutch horticulture, if the water is not absorbed by the soil, it's collected in the gutter, cleaned and reused again, this is all the greenhouses in the Netherlands, common practice. And then you would say, Oh, the water use is not sustainable. But then a Dutch tomato in a greenhouse, one kilo tomato needs five liters of water. And in Spain, they need 50 litres for traditional farming. So we only use 60% of rainwater, that's true. But then we only need five liters for one kilo of tomatoes. So that is quite sustainable I would say.

Meilin
And what about the Co2 you also pump gas inside?

Unknown Speaker
yes. So most Dutch growers, I don't know if you're like into environment and everything. In the Netherlands we have lots of windmills and solar panels, but they only contribute to 5%. All the windmills in the Netherlands, you see, and solar panels, only contributes to 5% of our energy demand. And the Dutch growers, they supply the energy with more than 10% With VKK (?) is a machine. It's just a big old engine, and that produces heat for in the greenhouse, then it produces co2 because it's an engine for in the greenhouse, and electricity for in the greenhouse and beyond. So also for 10% of the households. So that's quite efficient, so only trumpeted gas. So it's now of course, with the conflict in Ukraine it's difficult. So one grower, he has a big old engine, he makes electricity for his greenhouse, and he sells electricity to the net. So that's good. Then you use the heat to warm up his greenhouse. And it uses the CO2 to use in his greenhouse. So it's quite efficient.

Meilin
And when you talk about growers, you ta mean medium big size growers, like not really about small scale greenhouses.

Greenhouse Staff
No, it's never small scale in the Netherlands.

Meilin
And what about like when you build a greenhouse? Is it sustainable with glass, the steel and the structure?

Greenhouse Staff
So but I don't see the relevance in it to be honest. I mean most houses are built with concrete. Yeah. So and people want to live in that. And people are still buying iPhones, cars, and then the structure of a greenhouse is not sustainable. Well, mostly when it's built, It's for 30 years. So that's the sustainability is in long-term. And then when you come back to the growing aspect in the greenhouse. So that's what this is all about. So in the Dutch greenhouses, in the last 15 years, we've dropped our use of chemicals with 95% in 15 years. So then if we would say, oh, a greenhouse is not sustainable, because you know, we need iron and glass, then okay, we stopped with the greenhouse, we start, you know, shifting the production to more sunny areas, to like Spain or something, then we need 50 liters of water instead of five. Then we use soil instead because when you're growing in the soil, you also extract all the energy from the soil. So when you grow in a greenhouse, you need less pesticides. Because normally when you grow in the soil, and you want to do the next crop the year after, you have to make the soil free of diseases. So, in the past, chemicals have been used for that. But when you grow in a greenhouse, you don't grow in the soil. So you don't have to make yourself Yeah, so the soil is always free of diseases from the past. So that's why you can grow with we have a complex to grow with 95% less chemicals. So that is it, you know, the whole greenhouse concept is very sustainable.

Meilin
But this kind of targets is it sets by external pressure from the government or the greenhouse industry itself?

Greenhouse Staff
So currently in production, most buyers, bigger supermarkets and things, they have higher standards than the government has. So then there is pressure from the buyers. But we also have quite strong regulations from the government's. But currently in flowers and vegetables, also the regulations from the bigger companies like you know, Albert Heijn, the bigger supermarket, they also have very strict regulations, which are, stricter than government regulations. But regarding the gutter, this is also obligated by the Dutch government like a gutter like that. But I don't know if it's common practice in the European Union as a whole.

Meilin
And what about the taste? Do you think it tastes better?

Greenhouse Staff
Well, this always a discussion. Oh, it's better from the like biological. They say it's better. Because in this greenhouse, we don't use any chemicals. Okay. And we are still not able to call this biological or organic. But we don't sell this because they are only for showcase, that this produce are grown without the use of chemical pesticides, which we are not allowed to call it organic.

Meilin
And what's the reason for that?

Greenhouse Staff
Because it's not grown in the soil. Because if you want to call it organic, you have to grow it in the soil. But then you're extracting elements from the soil. And on the long term, making the soil less and less fertile. And with the greenhouse, you create a perfect environment, so you can grow more efficient. So it has a lower footprint, but this is still not organic. And that's a big discussion, then. But then organic from the soil, that's sometimes better tasteful. But the major differences is in varieties and not with greenhouse or not greenhouse, or organic or not organic. The most difference for taste is in the varieties itself. In the genetic specifications of the greens. Just like the Dutch they are tall people and it's just the genetics, which are decided to be more or less sweet.

Meilin
So you don't believe in community-based greenhouse?

Greenhouse Staff
I don't believe it. It's just not my subject at all. I mean, I've grown up on a tulip farm, so it's just not my subject at all.

Meilin
But do you not get influences from Almere, the neighborhood?

Greenhouse Staff
I think community greenhouses, you know, I don't think anything relevant to say about it. I think it's good for like for leisure and knowledge for people who are interested. But, you know, to produce, to see it as a way of producing foods. I think there's just not enough I would say. But then for how much percentage of their own food do they produce?

Meilin
Well, it depends if they really into it, it can be 100%?

Greenhouse Staff
I'm just I'm not into the subject. It's not I'm not against it. But you know, a greenhouse, this size is too small anyway. So, because people do, asking what is to do with greenhouse? And I would say, Well, if you want to do this full time, for this area, it's, it's more, only it's better for people to be involved to understand and to learn that, then it should be the target.

Meilin
But what about some ethical principles that greenhouse companies are aspire to? Because they don't really include communities participation

Greenhouse Staff
Well, the ethical principle is that they produce food, and if you don't have food, you die. So that's quite a major thing, I would say. And if you would let people in, about sanitation protocols, they are quite strict. You don't want any diseases, infections, bacterias. You just you don't want any people in your greenhouse at all. Only if they are there for work. So that's the problem, if you're not able to, because if you will have an infection in your greenhouse, and then your crops will die. Because you've invited people to explain about what you do, then you have a very big problem. And the problem is so big, that if you would have diseases in your greenhouse, it will not only affect your annual profitability, it could also affect the profitability of all your greenhouses in the Netherlands. Because once something wrong is found in another country, let's say like in Germany, they find a tomato with the bacteria, then they could possibly close the borders for tomatoes, from the Netherlands, and then it would infect all your neighboring tomato growers. So therefore, you don't want people in the greenhouse because you want to protect the foods, so it's very hard, but it's about food and about food safety.

Meilin
But do you make it also affordable to the consumers?

Greenhouse Staff
The foods in the Netherlands are the most affordable vegetables in the world! We have Okay, we have you been in the supermarket?

Meilin
There are still people in the Netherlands who cannot afford food

Greenhouse Staff
That's what I don't think that's up to the growers themselves. You know, they try so hard to make it more and more affordable, it has comes to more political questions about should some things be more subsidized

or not. It's not for a grower. You know, the growers they don't they make slight razor thin margins. The margins are razor thin! Because it's a market, it's a free market! So it's not for a grower to decide because then he would go bankrupt but margins are razor thin. It's more the chain behind the grower. What's taking the profit. The traders and the supermarkets, they are taking more for profit than the growers himself.

Meilin
Okay. And do you think the price is competitive compared to Mediterranean regions?

Greenhouse Staff
I think so. Yes. I've always understood that that our prices are very competitive.

Meilin
Are there also vertical farms in greenhouses?

Greenhouse Staff
In greenhouses there are implementations of vertical farms. We do not have one here but we have display over there to demonstrate the possibilities of vertical farming.

Meilin
And in terms of harvesting, is there robots or AI? Can they be harvested by technologies or still by people?

Greenhouse Staff
The length of tomatoes can be 20 meters. So it just keeps on growing, growing and growing. And then you move it a little bit to the side. So there's a big old stamp just laying in the gutter. Yeah. And then only the top leaves, that's what is produced the tomato. And then there's a robot picker, who was stripping off the leafs. Okay, so there was coming more and more about, you could argue maybe it's not going fast enough? Maybe it shouldn't come at all. Is it ethical? Are they taking jobs? I wouldn't know. These are all questions I could ask.

As you could see, we also have drones to detect moths, if they hide behind the leaves, eventually still they would be caught by the drones. We use substrate (rock wool) for our green peppers, normally the substrate can be used for one season, that is from January to December, after we dispose them and the plastics. If we consider the sustainability dimension, plastic per pepper is not much. We also have LED lighting if the lights are not enough, to reduce light pollution, all the side glass has automatic shades, perhaps only a little light is lost through gaps between these shades. Also, we have leave-picking machines. As you can see from this exhibition, all of these features are now the common-practice in the greenhouse industry.

Meilin
And what do you think are some existing challenges for greenhouse company?

Greenhouse Staff
So for like four years ago, one could say that the use of of gas to produce electricity, energy, want and co2 for the greenhouse was relevant. Now it's becoming more and more of discussion, we already use Geothermal, so using geothermal heat, currently 7% And that should definitely increase. That will be less dependable, you know, because we have a fight with Ukraine and Russia. So that's a major conflict in the coming years.

Meilin
Okay. And how do you do you also interact with the university research?

Greenhouse Staff
Well, I would say yes. Very much. Yeah. But it's because it's all people from the industry, who work here and were involved in this project. Iit's people from the universities that are involved and want to show people here, so yes. But it's only because it is we are on the Floriada Expo. So of course, you know, university would like to be involved it only makes sense to do so.

Community Garden Volkstuinvereniging Klein Grondbezit, community garden grower
We live near Dordrecht and we rent a piece of land here, about 250 euro for one year. We grow tomatoes, cucumbers, and peppers inside at a greenhouse. Because they are grown better inside, hopefully something can grow. We eat ourselves and we give it away, we also make vegetable can foods and store them in the fridge. I think it costs me 800 euro to build this greenhouse, I built it all by myself, I tried it and if it's not alright I try again. I took me 2 weeks, for 3 to 4 hours everyday to build it. Outside we grow potatoes. We get the water from the river just beside us, we use cow's excretion as fertilisers, it's very quiet here and the birds singing and flowers growing. We know De OudeBeer around here, I had been 2 times, it's good guys there. There are also people from Middle East in our community garden.

Interview 24 (De Rijke Sterrentuin Community-garden Grower)
In my tiny allotment, I grow raddish, East Indian cherry with edible leaves, zucchini, beans and garlic. I do not plow or pluck out the grass since I think they are parts of the biodiversity. Also if you dig deeper in this region, it is hard clay underneath and you would loose nutrients and the ground does not drain easily. I am vegan so I also do not put any fertilisers from the animals', for this allotment I have put 400 litres of compost which I have purchased elsewhere, and the worms inside would do the work. I also have used some of our own biological compost deposited around the corner. I think self-growing things like herbs are super healthy and I have busted started 6 months ago. I chose here because I live close by, about 15mins by bike and 3 mins train, because this community-garden does not prefer people with cars, I pay for this allotment 25 euro per year, which is nothing. I have encountered huge snails problem, which I attempted to surround brushes around the plants. The cats in this neighbourhood would chase the birds away. Some other growers are more serious growers, as you can see, the green net covered over is intended for herb growing, crossed reed sticks are for grapes.

I chose to grow my own because there are a lot of pesticides in supermarket vegetables but it is also expensive if I buy from organic food stores. Our community garden is getting more popular and a lot of people are on the waiting list. The general rule is that your crops cannot grow higher than 40cm or otherwise it would disturbs other allotment in receiving sunlights. I think the idea of putting a greenhouse here would be nice, but because I have to move in the future and it does not worth the investment.

Interview 25 (Tuincomplex Tuinvereniging Kringloop Grower)
Our community-garden complex is 25 years old, and it is my eighth year working here, previously this area belonged to a farmer. In my plot, the size is about 250 square meters, from May to December it satisfies about 50% of my diet, in winter months, I consume more potatoes and frozen beans and cauliflowers harvested in summer. Every tenth meters in our community garden you could find a water pump that pumps water 25m below the surface from our nearby river, it has rich minerals in it. The pump has to be handled manually and my pump for example is connected to an overhead sprinkler system to water the plants. My grandchildren love to come here and pick strawberries. I have two greenhouses, I grow cherry tomatoes, tomatoes, and other types of tomatoes like Jack Johnson, Columbian ones, beetroot, corns, forest onions, beans, peppers, chilis, and watermelon. I normally cultivate these baby plants at home with LED light and after I put them in my greenhouse, if the production is too much I give them away or I put them for compost. Another example is with Aubergine, I didn't have production last year but I have a lot this year by putting them outside, because I think sometimes the greenhouse is too hot for the plants, but outside has the problem of slugs, which they can eat 3-4 of my plants. That's why I also create a small pond here in my allotment, sometimes I look for frogs in our nearby river since one frog could eat over hundreds slugs a night. The first greenhouse I got from the previous allotment owner, which I purchased 150 euros and this greenhouse is 25 years old. Since I also wish to expand my production, I got a second greenhouse. At Kringloop, we taught every grower to have their own compost, since „Kringloop" stands for „closed loop", we also attempts to plant different fruit trees like apple, pear and walnut to increase biodiversity in our area. In the surrounding area of individually-leased allotments, we only moan the grass when necessary, in this season May we moan very less to keep the organisms. There are many different varieties of plants which I do not know, I would use PlantNet App to identify the species. For example, comfrey bocking 14 is a type of wild plant very beneficial to the land, even putting some of its leaves to your land can enrich minerals content and they also do not invade others. We also have many animals as parts of our

biodiversity, such as reindeer, beaver, fox, many different types of birds and butterflies from the nearby national parks.

The whole area of Kringloop is about 4-5 hectares, about 80% of growers have small greenhouses and we have about eighty growers here, either they have half a garden (78 euro per year) or a whole garden (156 euro per year), plus a membership fee (30 euro per year). But every gardener has his or her own ways of gardening, some like to dig, one woman also has started her social project for handicapped people to be involved in urban farming, others like me do not dig the ground, instead some use straws, hays, or wood chips to make the ground stay intact, so it stays dry and does not get cold in the winter. I know one grower once bought worm compost and green compost 20km away from here, in order to improve the structure of his soil. One grower surrounded his allotment with enclosed wooden branches, this method can be efficient for garden since it prevents snails, but it is actually not very good. One of the problems at Kringloop is that we have only a few water pumps, and subsequently many growers have plastic barrels to store water. Another problem may be that the farming work is not very accessible to elderly, our chairman who also has an allotment here is 88 years old, and has some difficulties. Additionally, we also have four commissioners, who come here three times a year to inspect the healthiness of the land, if the allotment has problems, gardeners must listen to the suggestions or otherwise they would report to the board and the gardener would be expelled. For example, one owner has bean monoculture, the quality of soil could worsen and also affects neighbouring land. Our main principle here is that one is free to grow anything, but it cannot have an impact on his neighbours.

I am already retired, previously I was a Economics teacher at a secondary school, I chose to come here because it is not far from my home, I would like more time to be outside, I do not do it for economic values nor food production, just for hobby especially given there are many snails, and I enjoy the social contact. Especially because of corona, a lot more people are getting interested in our garden and they would like to stay outside and contact with people. We are a big complex and we do not have the danger of infection.