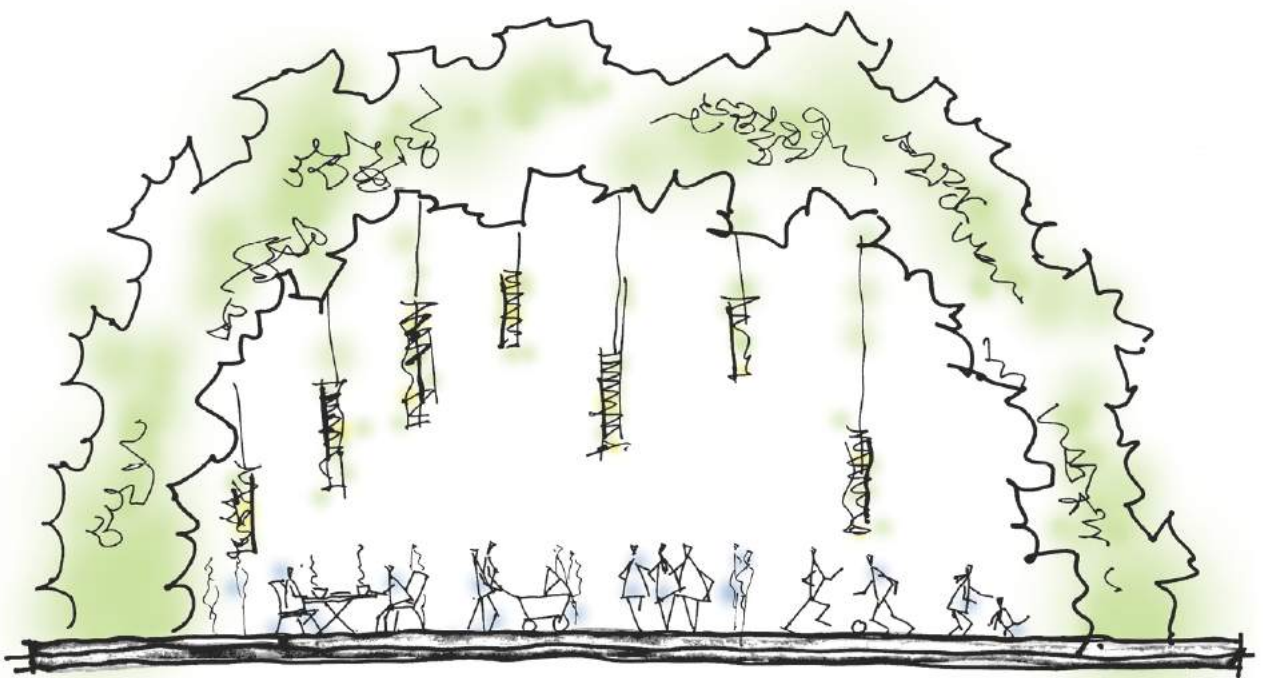


GROWING AROUND

To Integrate Urban Agriculture into Public Space
and Enrich Its Spatial Potential



Department of Architecture and Civil Engineering

Urban Challenge Studio

Author: Yang Yang

Examiner: Joaquim Tarraso

Supervisor: Emilio Da Cruz Brandao

Master thesis in Architecture

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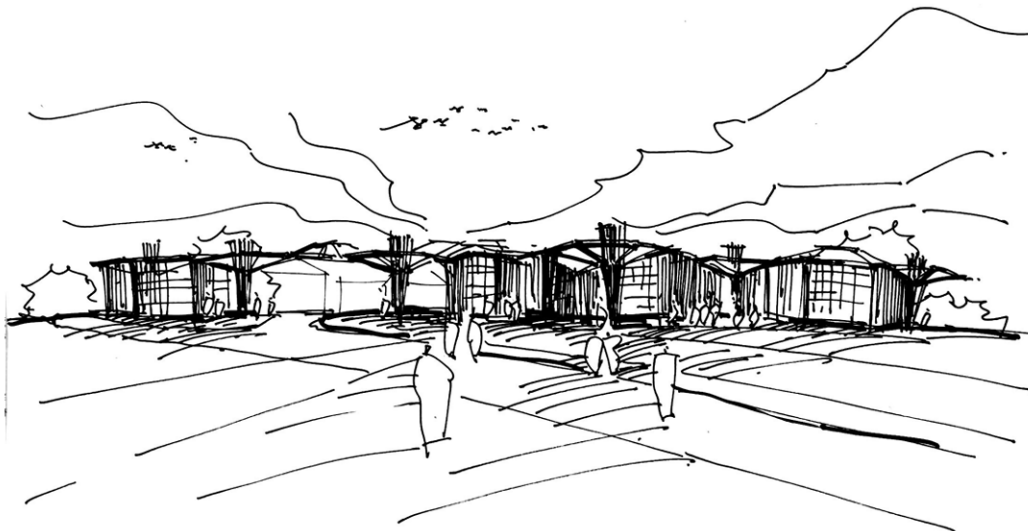
Abstract

Urban agriculture has been considered as an additional source of food to respond to the challenge of urban food supplement, as well as environmental problems caused by existing global food systems. With rising awareness, a growing number of people have become participants in urban cultivation instead of being passive food receivers. At same time, many people have started to explore various ways to adapt farming activities within urban contexts.

The main purpose of this master's thesis is to explore an architectural system that can provide space for both urban food production and citizens' public lives. As for the aims, firstly, I want to take this chance to gain an understanding of urban farming and design an architectural system that could be treated as a productive food growing space, a well-defined space for multi-activities and a type of architectural structure that has good performance regarding flexibility and adaptability.

The main method of this master thesis is Design by Research. It departs from theoretical understandings of food supply challenges and urban farming. After that, the author of this thesis will focus on urban agriculture and building prototype exploration. Eventually, a showcase that combines urban farming space and public space to create a sense of a lively city life will be located in Heden, Gothenburg.

This master thesis includes two outcomes. The theoretical part is about the knowledge of food systems and urban farming. The other part reveals new thoughts about urban farming development through a showcase. I expect this thesis to help me gain a profound understanding of urban agriculture and the relationship between city life and architecture. I also hope it will help increase reader awareness and broaden their horizons about integrating urban farming into city life.



Thesis Introduction

Purpose

The main purpose of this master's thesis is to explore ways of integrating agricultural cultivation into urban space from the perspective of architecture and urban design. To achieve this goal, a modular building system, that can contain food growing and public activities simultaneously, will be designed. It aims to reunite citizens with fresh food and benefit urban sustainable development with a local food system. There are three basic criteria that the researcher wants to achieve. The first is to provide appropriate conditions for growing food. Then, it also has great potential to arrange multi-activities. Eventually, the structures could be easily expanded according to different building scales or different construction conditions.

Main Question

How can urban agriculture be integrated into public space and enrich its spatial potential ?

Sub-Question

Is it necessary to develop urban farming and reintroduce a local food system as a food source supplement into a city ? What are appropriate solutions for accommodating urban farming and public space simultaneously from an architectural perspective ?

Background

Urban agriculture has been considered as a potential solution with which to address urban food supplement problems

and sustainable development. Compared to the current food system in the city, a regional food system will decrease resource consumption and pollution during global food transportation. Although there are many practical experiences related to urban farming, the situation is still far from stopping our efforts. To be specific, urban farming is about transforming and adapting agricultural cultivation to fit urban contexts rather than simply moving farmland from rural areas to cities. That means if people want to expand urban agriculture, they need to not only develop urban farming in suburbs, unused land and greenhouses but also change the type of growing and space to utilise urban space efficiently and innovatively.

Method

The main method of doing this master's thesis is design by research, but the combination of different methods is also necessary to collect information, define possible directions and keep deliberating the thesis as a whole. To be specific, case and literature studies are used for collecting data and theoretical understanding urban farming. At the same time, design references broaden my horizons and inspire me for developing project design and spatial configuration. Context analyses help me to define the problems and opportunities, and they also help me to frame the thesis structure and organize the materials. Although the site is just a location for showcasing the concept, it still defines the functions, flows, and space

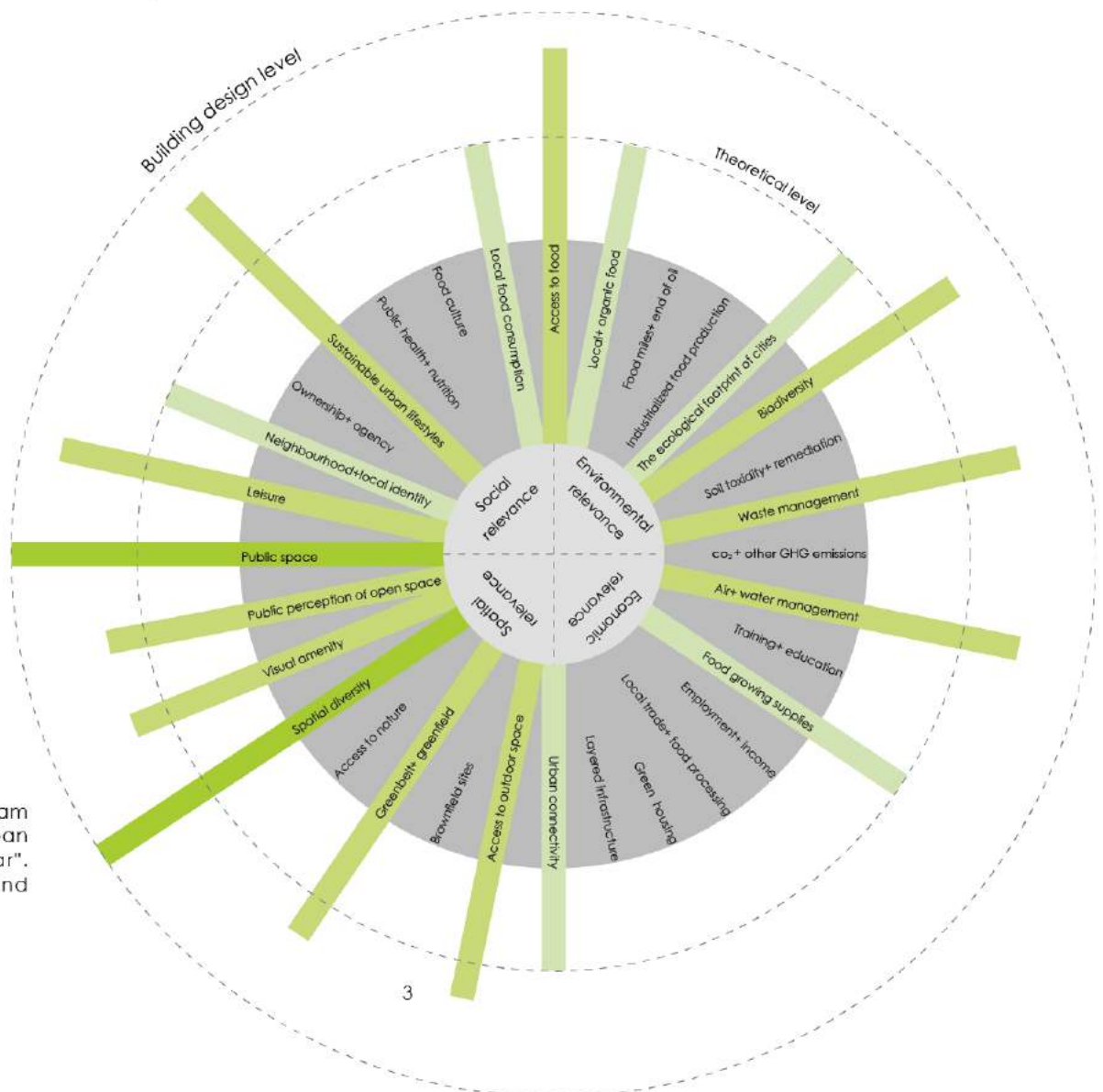
Thesis Introduction

of showcase. Observation, sketches, and models also play an important role in doing this thesis. The concept of Growing Around is a result of long-term observation. I am trying to combine the feeling of being in nature with design innovation to introduce a sense of nature into the city with artificial structures. Sketches and models explore different configurations of prototypes and narrow down the possible directions for final design.

Delimitation

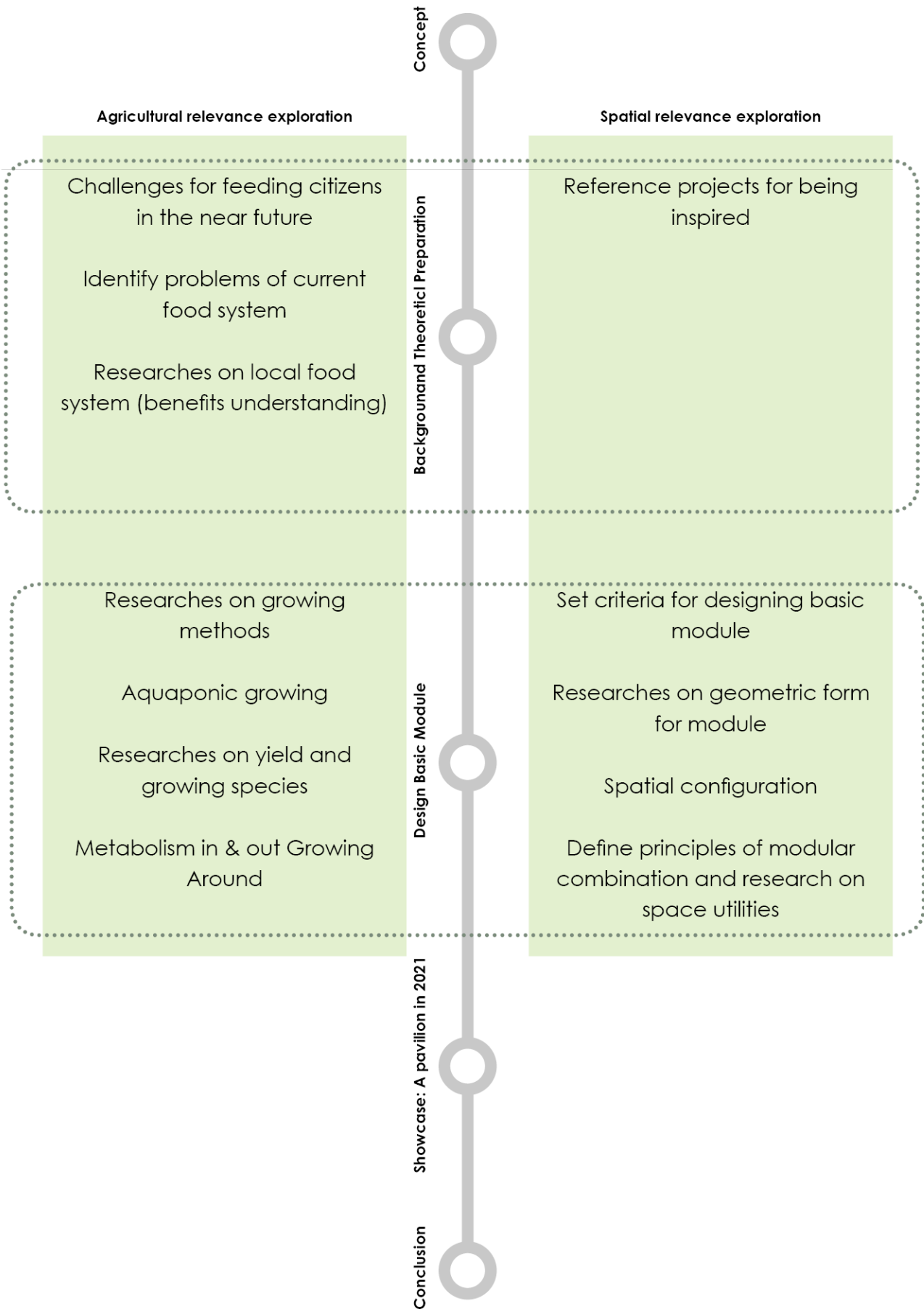
Theoretical knowledge and design limit the master's thesis exploration. The main focus will be on the spatial relevance of developing urban farming. At a conceptual level, the thesis focuses on comparing global food systems and local

food systems to define challenges of food supplement and reasons of developing urban agriculture. During the proposal design step, taking hi-tech growing methods as the selected cultivation solution to approach modular building system which can accommodate growing space and public space simultaneously. Spatial configuration and spatial quality are prior criteria to define the design. The showcase wants to display and test the possibilities of using the modular system to connect urban cultivations with urban life closely, rather than aiming to update the selected site.



Delimitation diagram bases on "The urban food systems star". (André Viljoen and Katrin Bohn, 2014)

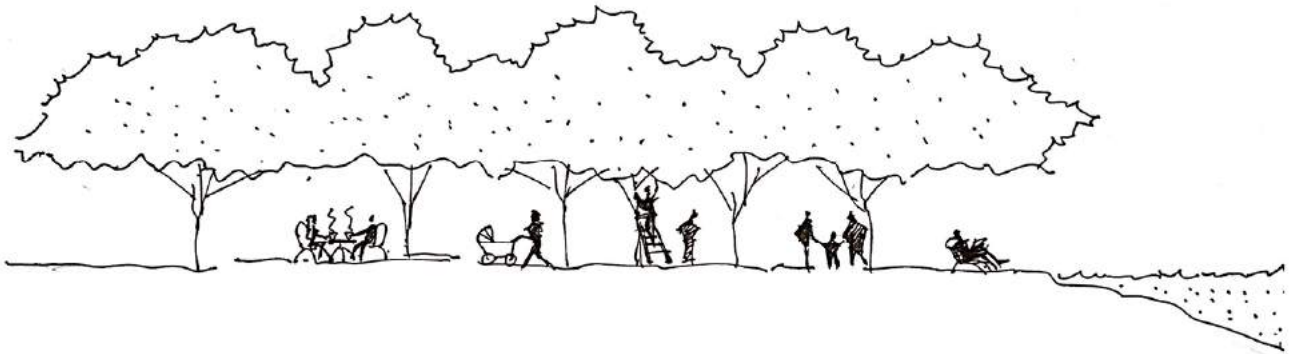
Thesis Process



2

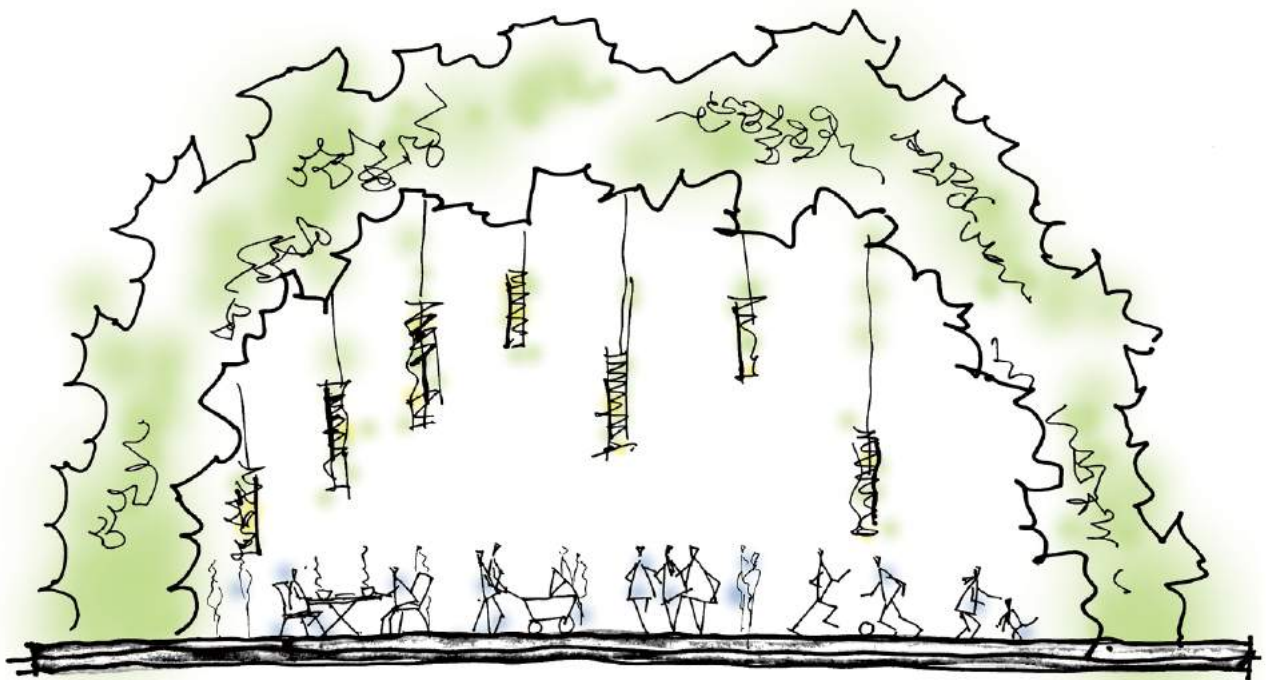
CONCEPTS

Concept

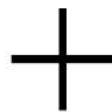
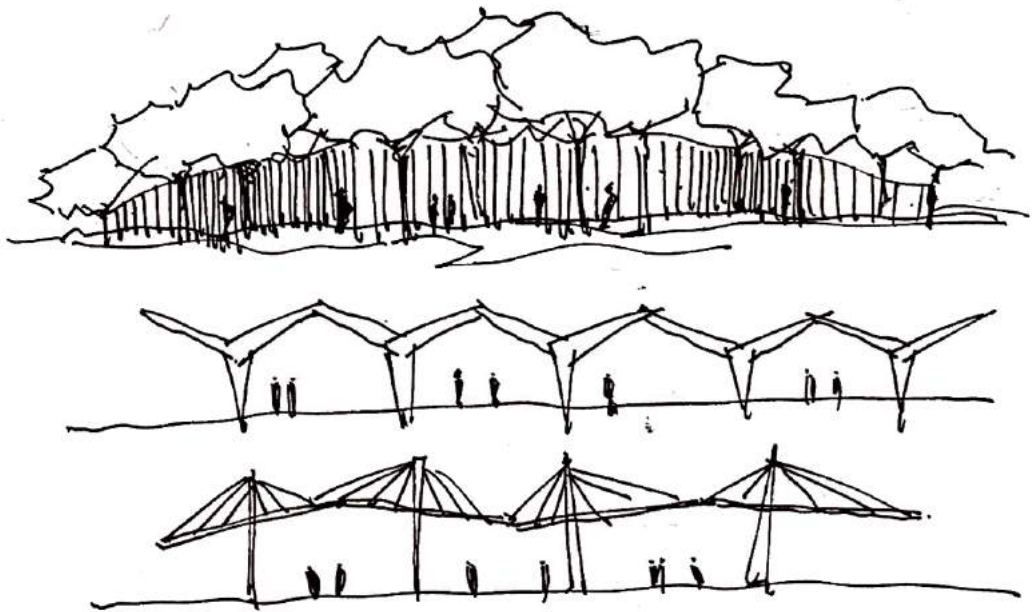


People would like to visit forests to get a sense of nature. In the forest, there are continuous spaces underneath the tree-crowns. These spaces spread out horizontally and enable multiple activities to happen. When people are in the forest, they are surrounded by trees and plants, and they can also hike, wander, go on picnics and breath fresh air.

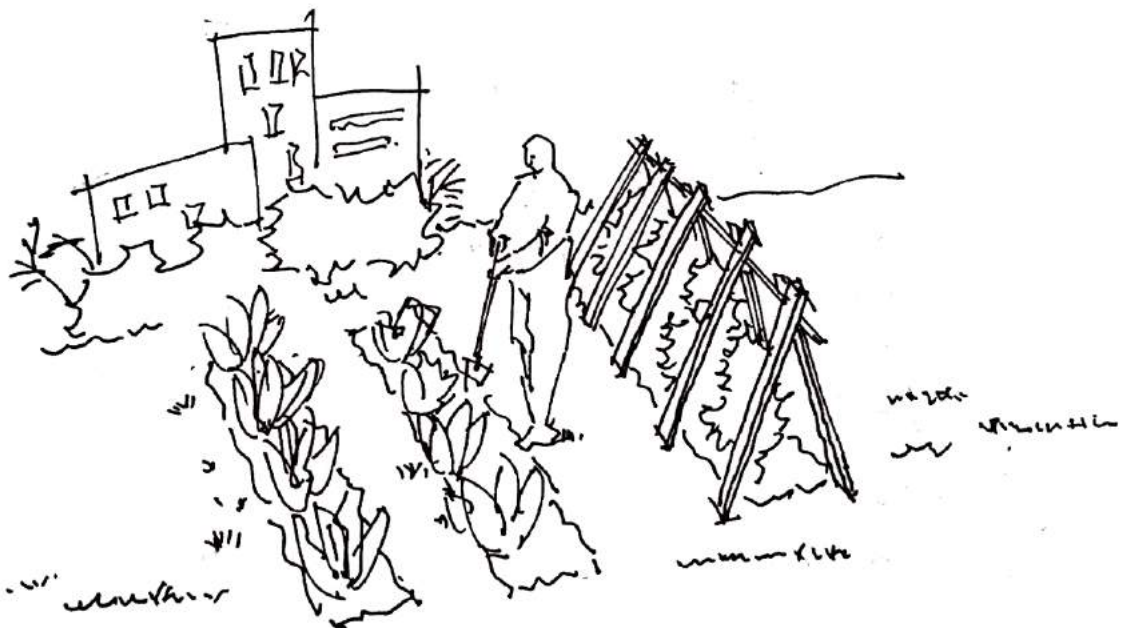
Growing Around wants to simulate the sense of a natural forest with canopied manmade structures to create public space for citizens. Moreover, the project tries to combine building structures with urban farming facilities to provide the experience of being surrounded by fresh vegetables.



Concept



Combine canopied structures
with urban farming facility



3

BACKGROUNDS

Challenges for Food Supplement

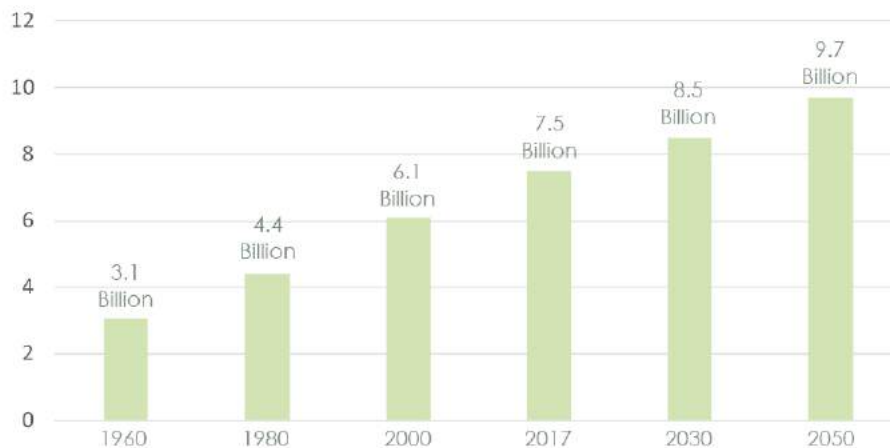


Figure 1. Trend of global population growth (sources: the data before 2017 are taken from the History Database of the Global Environment, the data for 2017 comes from www.worldometers.com, the predicted data is taken from the UN's Department of Economic and Social Affairs)



Figure 2. Percentage of urban residents in world population (Data are taken from the United Nation)

Global population growth directly stimulates increased food demand. Particularly in urban areas, urban residents account for more than half of the total population. This causes changes in lifestyles and consumption patterns. At the same time, in combination with income growth, it may accelerate the ongoing diversification of diets in developing countries. While the shares of grains and other staple crops will be declining, those of vegetables, fruits, meat, dairy, and fish will increase (FAO, Food, and Agriculture Organization of the United Nations, 2009). Therefore, economic development enables people to enjoy diverse food resources and indirectly results in a booming food demand.

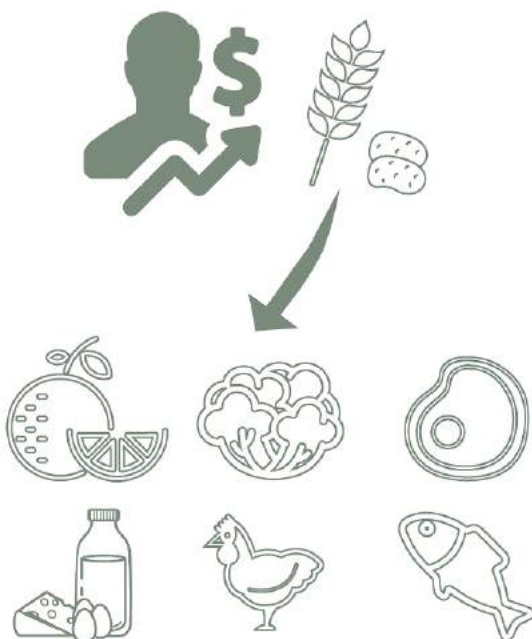


Figure 3. Economic growth leads dietary structure changes

So that, due to global population growth and economic development, global food production should increase by 70% by 2050 to meet the expected food and feed demand. That will be a big challenge for humans to face in the near future.

Challenges for Food Supplement



Figure 4. A global food system is a double-edged sword. It brings various food choices for people, however, it also makes many negative effects for earth.

37.6%

earth surface has been classified as agricultural area

Data source
(Max Roser, 2016)

30%

Global energy consumption is shared by food production and related industry

Data source
(FAO, Food and Agriculture Organization of the United Nations)

70%

Water on earth is used by global food system

Data source
(FAO, Food and Agriculture Organization of the United Nations)

33%

greenhouse gas emission comes from global food system

Data source
(Scialabba and Muller-Lindenlauf, 2010)

On the other hand, the present food system is based on global production and distribution. This system brings various food choices to people, but it also requires the consumption of much energy and produces a significant amount of pollution. In contrast, the Earth is not able to provide endless resources and space to increase the food production scale to satisfy predicted food demand with only a global food system. Humans must find new and sustainable ways to balance the relationship between human development and the capacity of the ecosystem to ensure food security.

Opportunities from Urban Farming

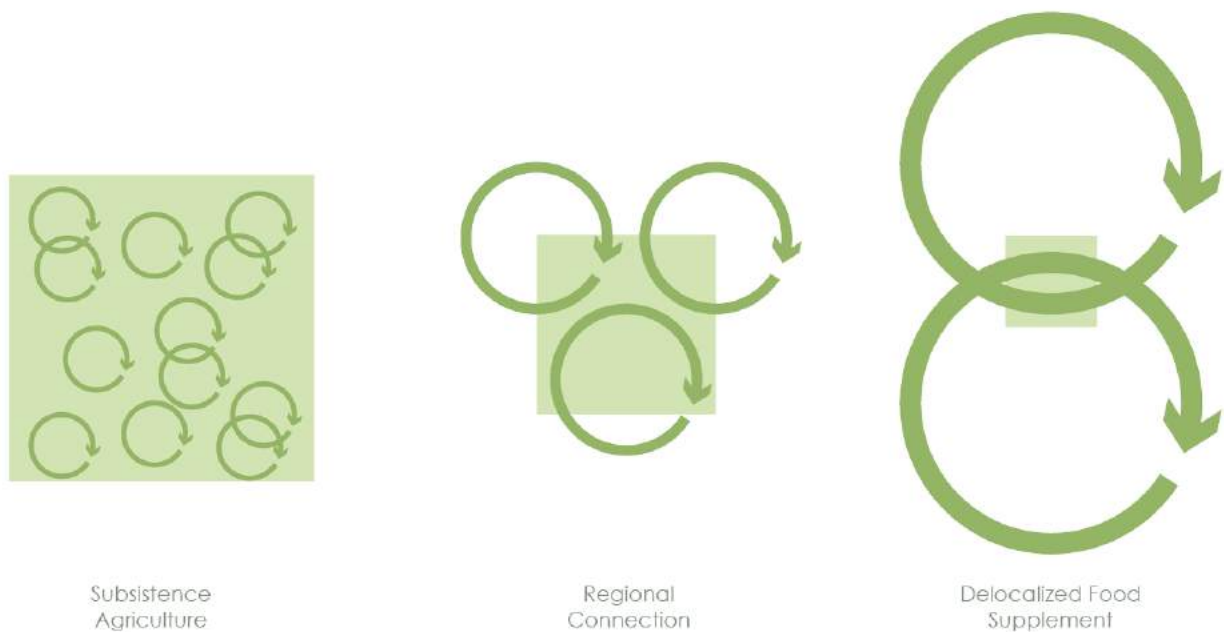
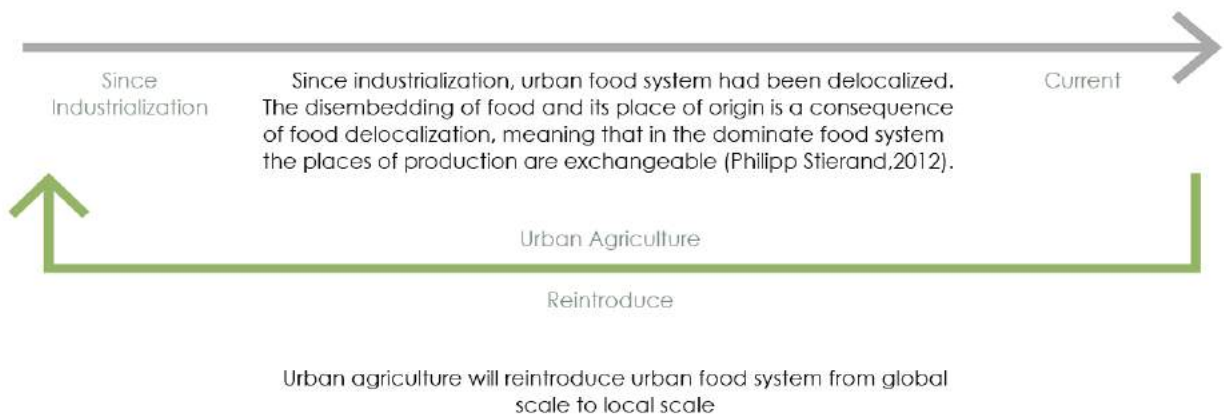


Figure 5. Urban food system shift in scale (Philipp Stierand, 2012)



Urban farming is generally considered to be an available solution that can be used to provide food to feed people. Compared to the global food system, which the downsides are that it could be delocalized, disconnected, and redundant (Philipp Stierand, 2012). While urban farming is an attempt to reconnect citizens with a local food system to provide more fresh and healthy food

and decrease energy consumption and pollution that results from global food transportation. Moreover, the local food system is also able to shift citizens from receivers to participants, increasing employment opportunities, improving flexibility and adaptability to meet diverse interests, and promoting biodiversity in city areas.

Opportunities from Urban Farming

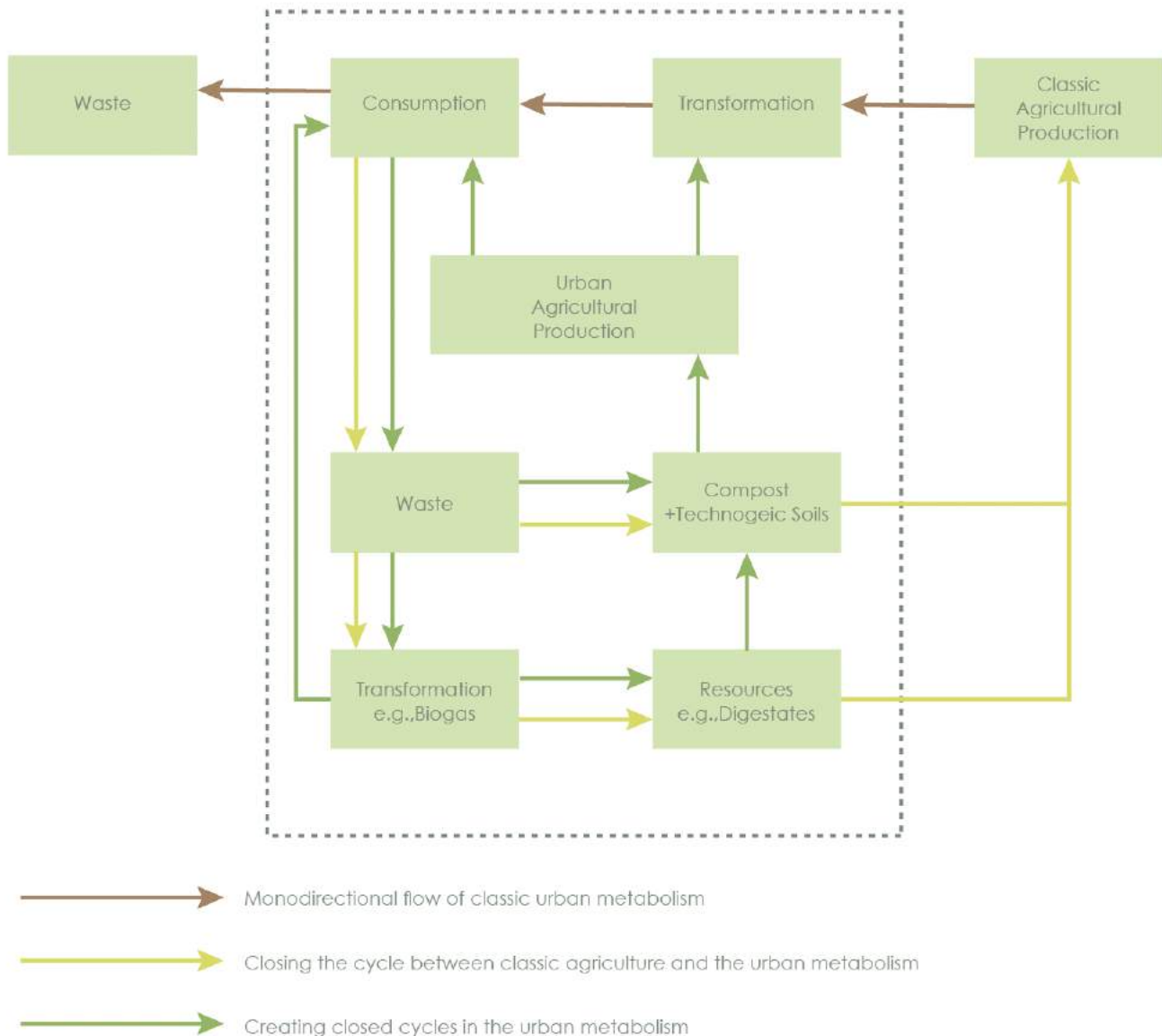


Figure 6. The role of Urban Agriculture in an ideal resource circulation system. The red lines mark the existing, predominantly linear resource chains; the green lines indicate resource circulation through Urban Agriculture. The systems indicated in green are responsible for the biological primary production. (Thomas Nehls, Yan Jiang, Conor Denneby, Xinmin Zhan, Luke Beesley, 2016)

The last but not least, with well-constructed infrastructure and industrial facilities, urban farming could benefit urban metabolism with circular resources flows in many ways. Therefore, urban farming also can promote urban sustainably and help balance people's requirements and the capacity of the ecosystem.

4

**CULTIVATION
SOLUTIONS**

New Growing Typologies

Hi-tech growing typologies:

As technology progresses, urban farming could be highly productive and resource efficient. Furthermore, growing space could be developed in the vertical direction. Hi-tech urban farming is able

to fit the city's limited space well and with diverse opportunities. Therefore, the project will develop food production solutions in a technologically-advanced way.


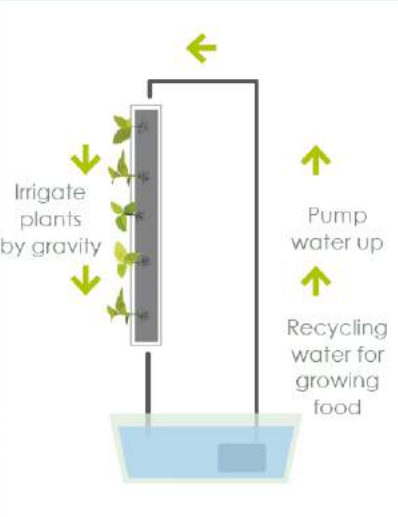
Patented urban farming systems	Basic growing concept	Features
 <p>ZipGrow, United States</p> <p>Picture retrieved from https://il.wp.com/caratanam.com/tanaman/wp-content/uploads/2015/12/Jenis-Tanaman-Hidroponik.</p>		<ul style="list-style-type: none"> • Vertical growing panel • Hydroponic or aquaponic growing system • Recycling water for growing food • Equipments have good adaptability • Space utilization is efficient • Can grow 16 species

Figure 7. ZipGrow growing system


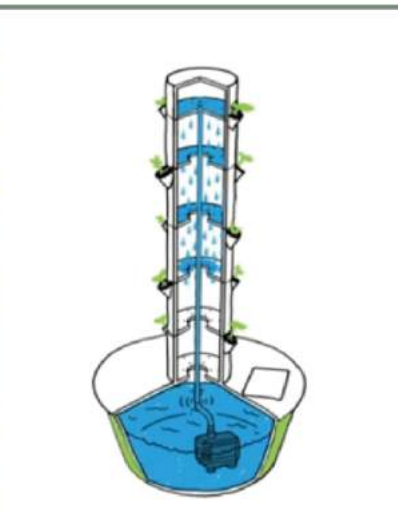
Patented urban farming systems	Basic growing concept	Features
 <p>Tower Garden, United States</p> <p>Picture retrieved from https://www.urbanfarm.org/blog/2016/01/19/renata-chalmers-on-tower-gardens/</p>	 <p>Similar growing strategy with ZipGrow's model</p> <p>Picture retrieved from https://www.youtube.com/watch?v=l7EzYmO9u8M</p>	<ul style="list-style-type: none"> • Aeroponic growing system • Recycling water for growing food • 95% less water compares with conventional organic farming • 90% less space utilization compares with conventional organic farming

Figure 8. Tower Garden growing system

New Growing Typologies



Patented urban farming systems	Basic growing concept	Features
 <p>PlantLab, Holland</p> <p>Picture retrieved from http://smartcityembassy.nl/initiative/plant-lab/</p>	 <p>Manual control light, temperature, nutrients, humidity and airflow for growing according to specific species habits</p> <p>Picture retrieved from http://www.plantlab.nl/plant-paradise/</p>	<ul style="list-style-type: none"> •Horizontal growing panel •Manual control growing conditions •Can grow a large amount of species •1m² growing space produces 200g fresh vegetables or fruits

Figure 9. PlantLab growing system


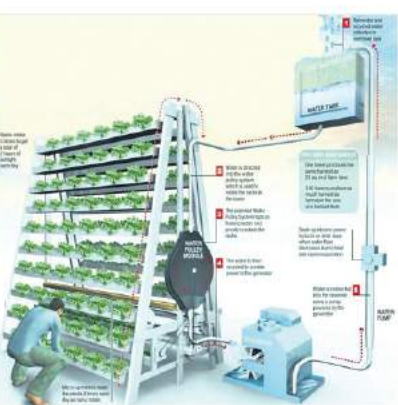
Patented urban farming systems	Basic growing concept	Features
 <p>Sky Green, Singapore</p> <p>Picture retrieved from http://www.designstack.co/2015/03/vertical-farms-for-new-agricultural.html</p>	 <p>Diagram of growing method</p> <p>Picture retrieved from http://studioprzedmiotu.pl/the-skys-the-limit-for-singapores-first-vertical-farm/</p>	<ul style="list-style-type: none"> •Horizontal growing panel •Recycling water for growing food •9m tall tower •One tower could produce 8.4kg productions a day •Only 40w electricity is needed to power one tower

Figure 10. Sky Green growing system

Basic Hi-tech Growing Principles

Nowadays, many technologically-advanced growing typologies could be categorized in hydroponic systems, aeroponic systems, and aquaponic systems. Growing Around would like to select aquaponics as the basic model to design the whole food production system. Because, compared to the other two systems, aquaponics is self-sufficient nutrients growing method. Furthermore, it is possible to create many closed-loop resources flows within this method to optimize resources efficiency.

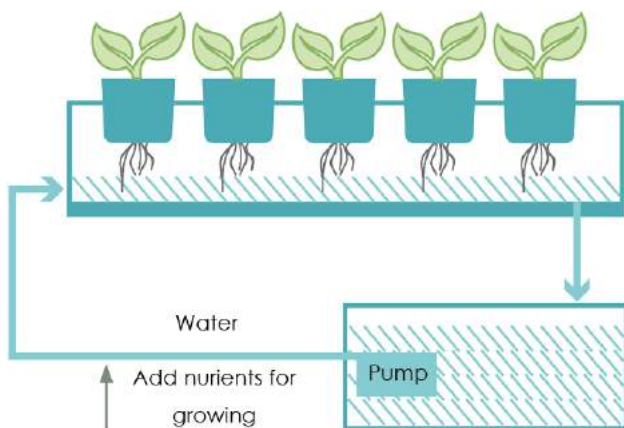


Figure 11. Hydroponic growing systems

Hydroponics is a subset of hydroculture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent (Wikipedia)

Advantages:

- Soil-less cultivation
- Recycling water usage, whole usage is 90% less than conventional cultivation
- Less diseases, therefore, without pesticides and harmful chemicals
- Yield is greater than traditional agriculture using soil

Basic Hi-tech Growing Principles

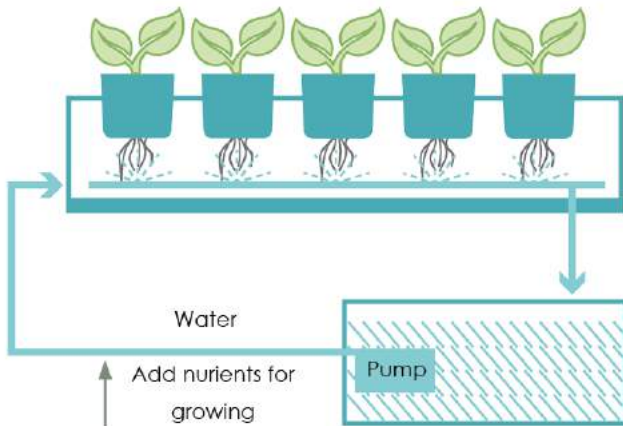


Figure 12. Aeroponic growing systems

Compare with growing plants in the water by hydroponic system, plants in aeroponic system do not need growth medium. Roots are fed by nutrients-rich mist or spray.

Advantages if comparing with hydroponic system:

- Roots are exposed in the air directly to benefit plants growth
- Roots are able to absorb nutrients more efficient
- Only using 2% water consumption of a traditional agriculture

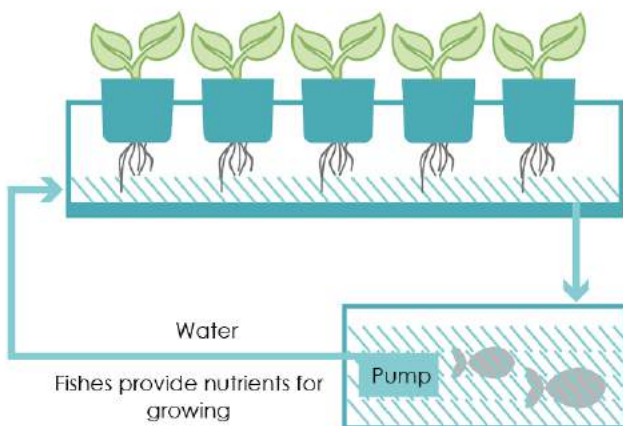


Figure 13. Aquaponic growing systems

Aquaponics create a symbiotic environment which combines fish growing with hydroponic growing systems together to achieve a natural ecosystem and a nutrient-rich water recycling process.

Advantages if comparing with hydroponics and aeroponics:

- Do not need artificial fertilizer
- Self-purifying water during the growing process
- Providing fishes for the meals
- Lower intensity of work for managing growing process

Growing Facilities & Yields

Growing Around chooses ZipGrow, a patented vertical panels as standard growing base for food production. This kit has 3foot, 5foot and 7foot three height growing towers. According to official introduction of this growing facility, this facility is so light and portable that the adaptability of that is really good. Moreover, the yield of it also could be considerable.



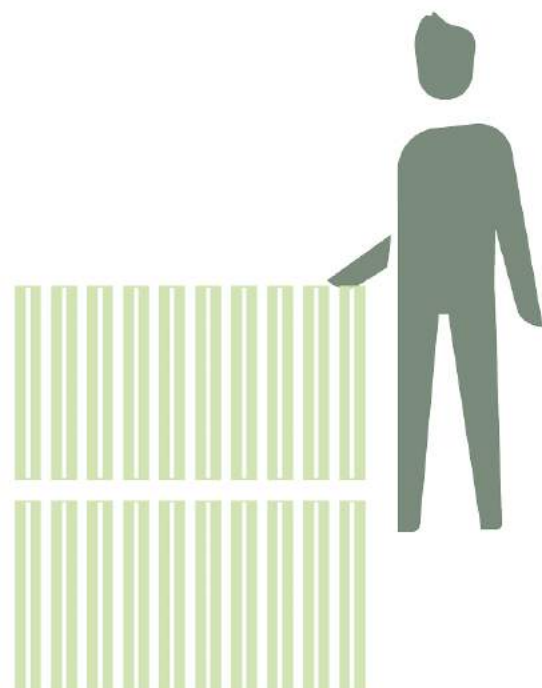
Figure 14. Single Tower

Number of Towers		Cycle Time (wks)	Quantity per Tower
212	Greens	5.0	3.5 lbs.
129	Herbs	5.0	40 oz.
Total Greens lbs./ wk		148.4 lbs.	
Total Greens lbs./ 50wk		7420.0 lbs.	
Total Herbs oz./ wk		1032.0 oz.	
Total Herbs oz./ 50wk		51600.0 oz.	

Figure 15. Diagram of Production Quantities (Data are taken from ZipGrow)

According to the diagrams above, a single 5-foot height tower is able to produce 0.7lbs≈317.5g greens or 8oz≈226.8g herbs a week.

If take 500g vegetables and fruits daily consumption per person, which is recommended by Swedish National Food Agency for keeping healthy food manner, as the standard to calculate production scale. 15-20 growing towers could produce enough vegetables for a person to eat a week.



Growing Species



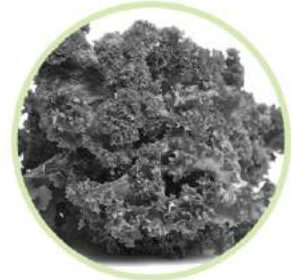
Oregano
Yield: 1.13kg/Tower
/8-week turn



Swiss Chard
Yield: 2.5kg/Tower
/5-week turn



Kale
Yield: 1.8kg/Tower
/5-week turn



Mustard Greens
Yield: 1.4kg/Tower
/5-week turn



Arugula
Yield: 1.36kg/Tower
/5-week turn



Cabbage
Yield: 0.9~3.6kg/Tower
/5-week turn



Cilantro
Yield: 0.68~1.13kg/
Tower
/5-week turn



Rosemary
Yield: 0.22kg/Tower
/5-week turn



Bok Choy
Yield: 3.3kg/Tower
/5-week turn



Lettuce
Yield: 3.3kg/Tower
/5-week turn



Strawberries
Yield: 0.22kg/Tower
/A-week turn



Basil
Yield: 1.36~1.81kg/
Tower
/5-week turn



Mint
Yield: 1.4kg/Tower
/5-week turn



Chives
Yield: 1.36~2.67kg/Tower
/5-week turn



Fennel
Yield: 2.67~3.63kg/
Tower
/5-week turn



Parsleys
Yield: 1.36~1.81kg/
Tower
/5-week turn

Close-loop Urban Metabolism Process

Aquaponic growing systems, recycling food waste processes, rainwater utilization and solar energy utilization enable Growing Around to create a cradle-to-cradle process between food production and food consumption. Besides, these hi-tech solutions build closed-loop resource flows between Growing Around and the city to improve resources efficiency in city areas.

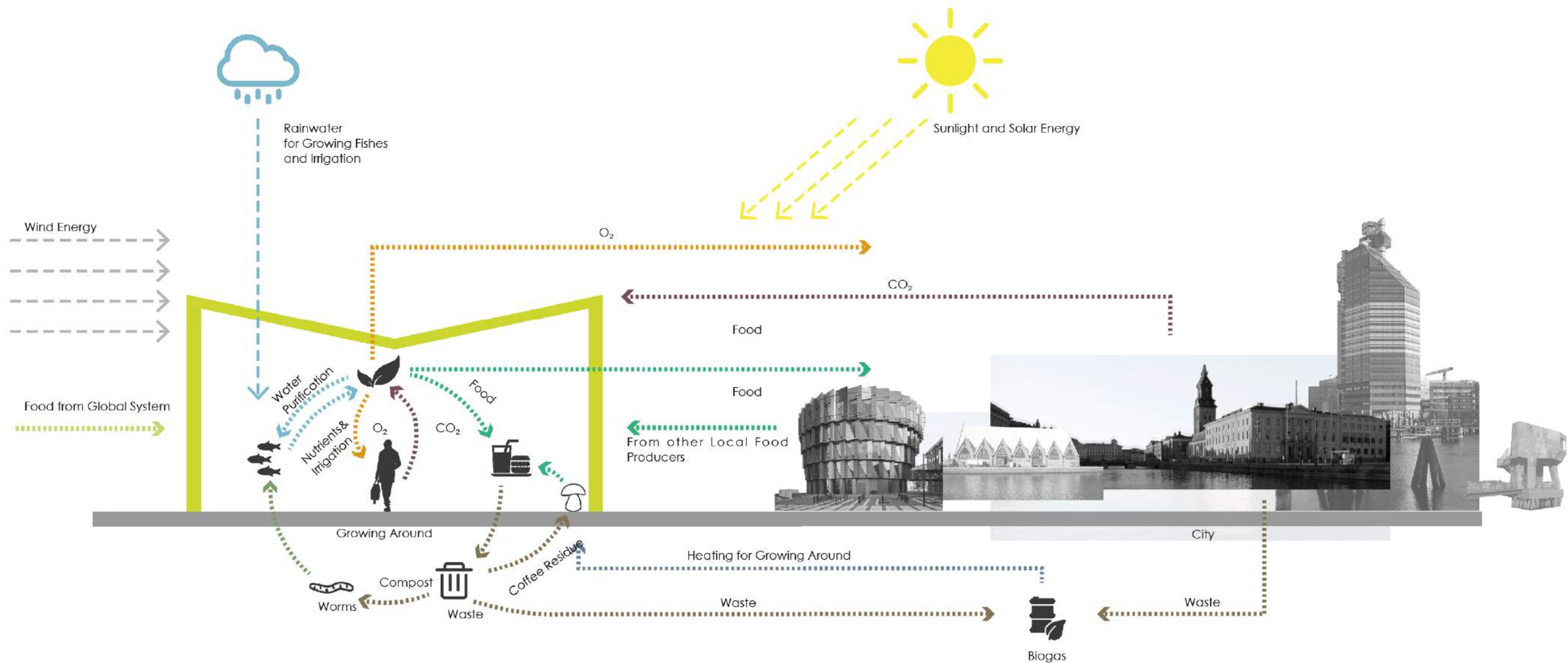


Figure 16. Close-loop metabolism process in& out Growing Around

5

**DESIGN
PROTOTYPES FOR
THE MODULAR
SYSTEM**

Conceptual Model

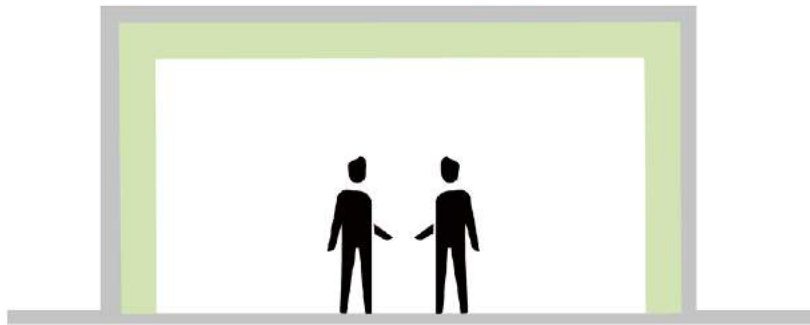


Figure 17. Conceptual graphs of spatial configuration

In the buildings, people usually use horizontal space. Walls and ceilings are not able to be used by individuals, but growing facilities can be designed to utilize space efficiently. In this way, space for urban farming and space for multi-activities could be accommodated in one space simultaneously. Additionally, combining these mixed using space with modular building system enable the Growing Around could be applied

according to different building scale and different construction conditions. Therefore, there are two criteria for developing the basic unit of the modular system. Firstly, inner space is as big as possible for containing urban food production and multi-functional activities. Then, the structures could be expanded easily.

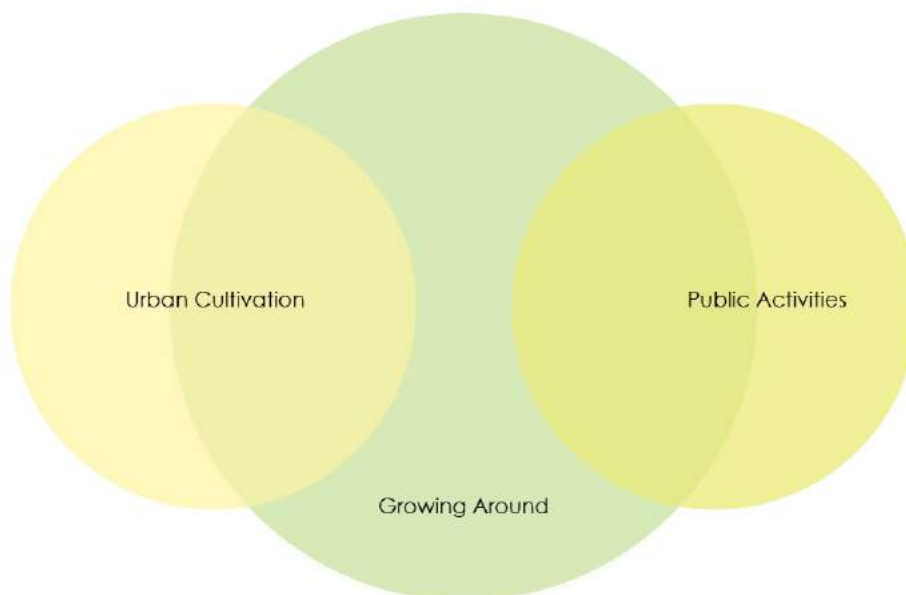


Figure 18. Conceptual graphs of spatial utilities

Inspirations of Hexagonal Buildings

The hexagon is a geometric shape that widely exists in nature. It is not only a solid geometric structure but also is a good-looking pattern. Growing Around used hexagons as basic elements to design a modular architectural system. The idea of

designing a modular system mainly aims to enable the project to be adapted according to different building scales and diverse construction conditions.



Figure 19. Orquideorama, Colombia, Plan B Architects + JPRCR Architects
Picture retrieves from <http://www.archdaily.com/832/orquideorama-plan-b-architects-jprcr-architects/500ec10828ba0d0cc7000261-orquideorama-plan-b-architects-jprcr-architects-image>



Figure 20. Tang Palace, China, Atelier Feichang Jianzhu
Picture retrieves from <http://www.archdaily.com/77892/tang-palace-atelier-feichang-jianzhu/50128ef928ba0d67170005aa-tang-palace-atelier-feichang-jianzhu-photo>

Advantages of Hexagons

According to some research studies, there are three characteristics decide hexagon is an excellent geometric form to develop the modular system. Firstly, hexagons can be assembled in into different shapes without leaving gaps between units. Then, with the same amount of materials, hexagons can be used to build the largest possible inner spaces compared to other geometric forms. Thus, it is a cost-efficient form. Finally, hexagon could be sub-divided into triangles, that the geometric variations of this form are diverse.

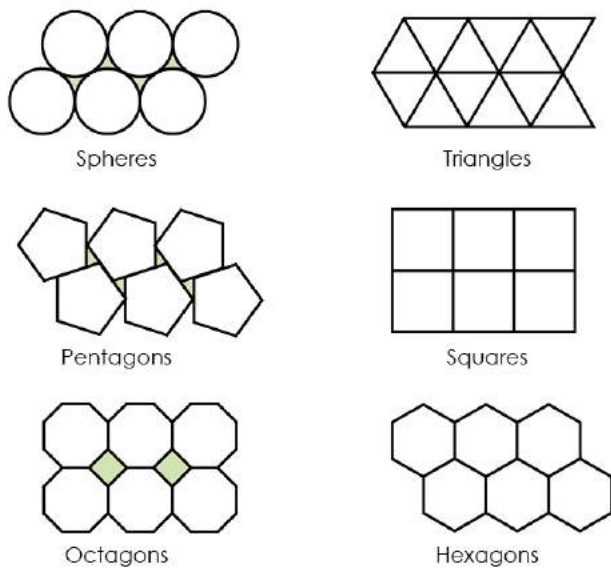


Figure 21. Comparing combination of different geometric forms, there are only three geometrical figures with equal sides that can fit together on a flat surface without leaving gaps: equilateral triangles, squares and hexagons. They do not need additional solutions to make a closed space.

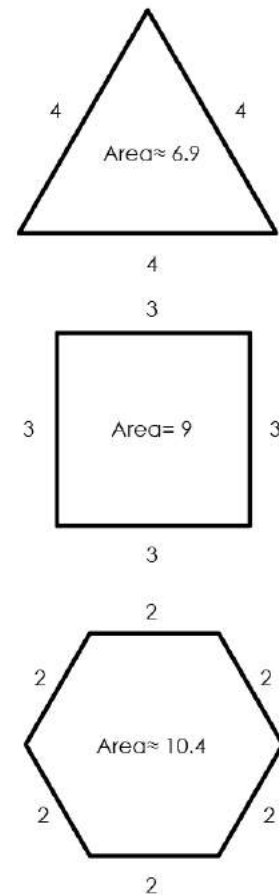


Figure 22. Within same perimeters, hexagon occupies the largest area among geometric forms above. That means hexagon is possible to create larger indoor space for activities when it shares same amount of construction materials with other forms.

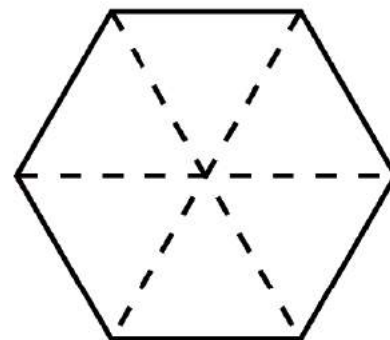
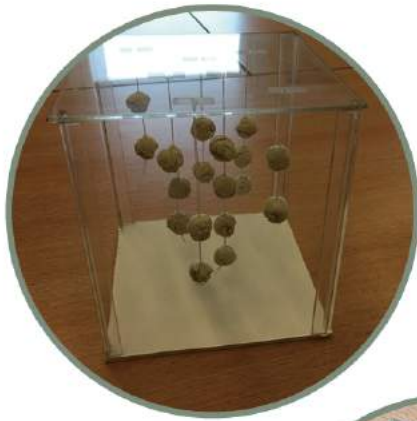


Figure 23. Meanwhile, hexagon could also be sub-divided into triangles. The combination could be diverse when consisting hexagonal space according to these triangles.

Spatial Configuration

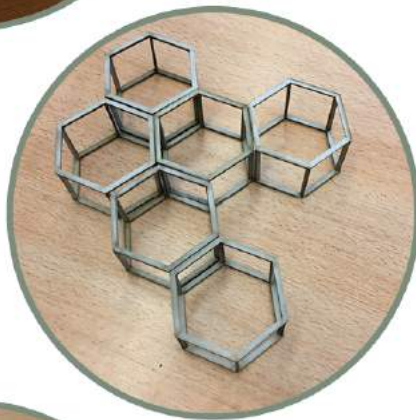
There are some explorations relate to define spatial configuration for the prototype.



Suspended structures & effects



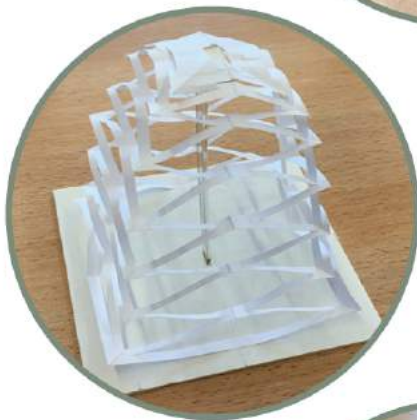
Suspended structures & effects



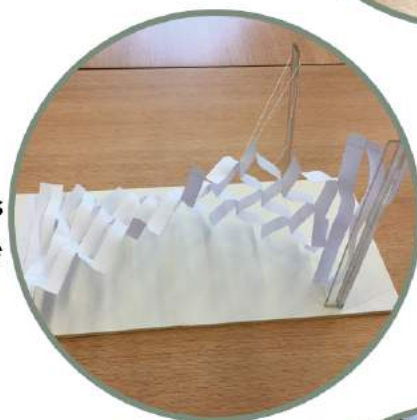
Centralized hexagonal units



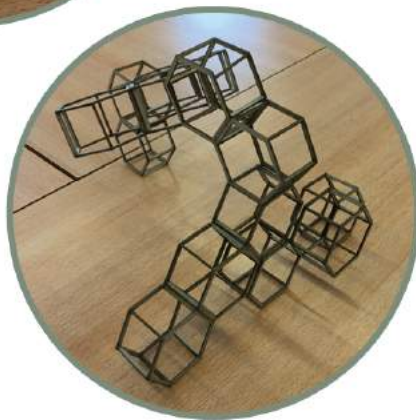
Dispersive hexagonal units



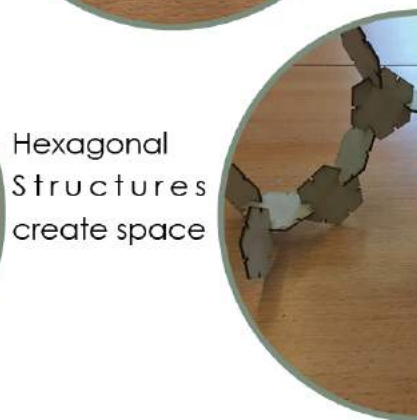
Polygon Structures create space



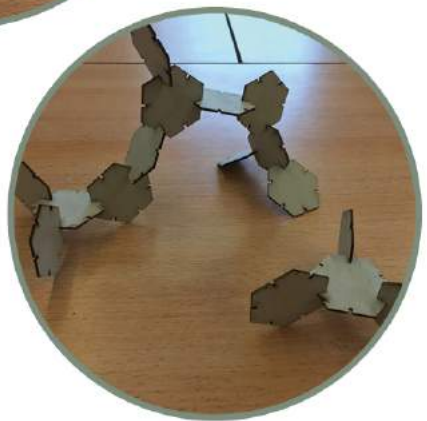
Polygon Structures create space



Hexagonal Structures create space



Hexagonal Structures create space



Spatial Configuration

Defining spatial configuration for the modular building system.

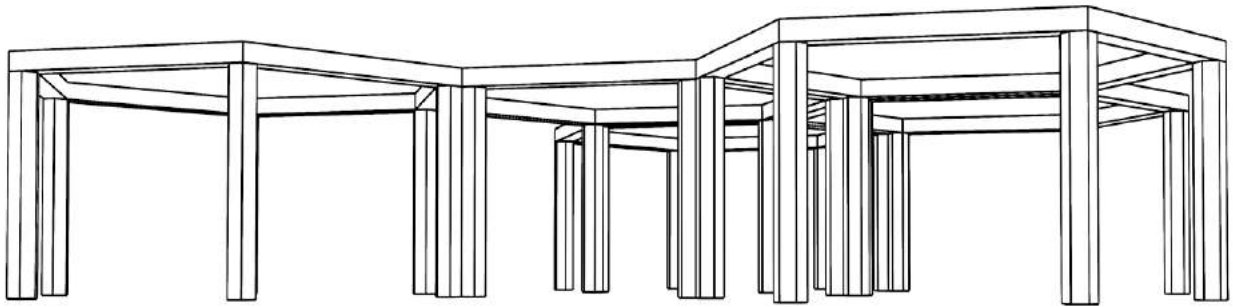


Figure 24. Pillars at fringe of hexagons

Too many vertical pillars create barriers to destroy the spatial quality and share the space for activities.

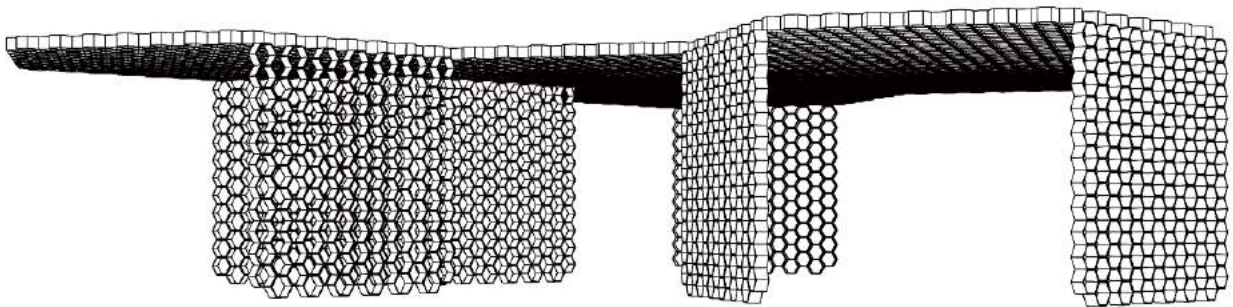


Figure 25. Hexagonal components to shape a space

Load-carrying structures share too much space for activities.

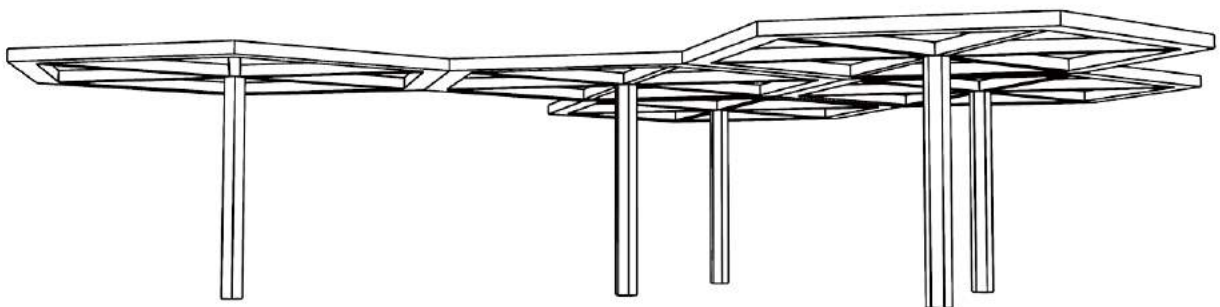


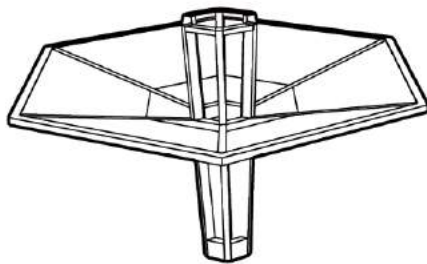
Figure 26. Pillars at center of hexagons

There is a plenty of space under the roof to show great potentials for developong multi-activities

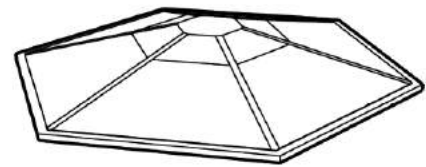
Components of Prototype

A single unit is the core element of the modular system. It could provide space for accommodating one or two activities with urban growing to meet the living requirements and produce fresh food on a community scale. When the basic modules are combined, they create diverse opportunities to combine different activities with urban farming for meeting

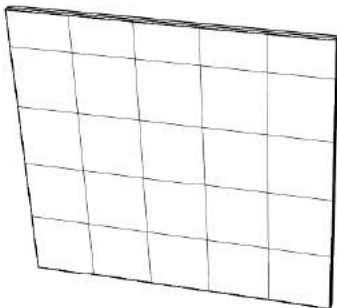
multi-functionalized urban space setting. There are only two types of canopies, three types of exterior walls and base act as standard components to consist the modular building system. These simple components could be assembled according to different building scales.



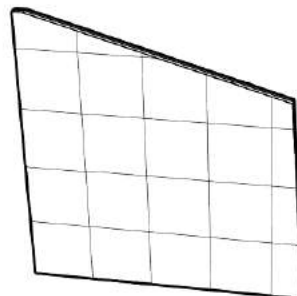
Pillar supported canopy



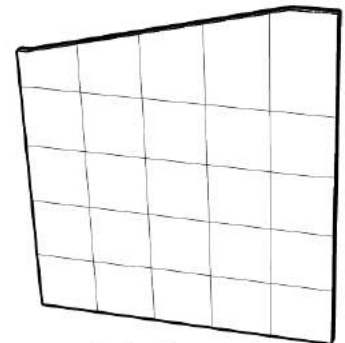
No-pillar canopy



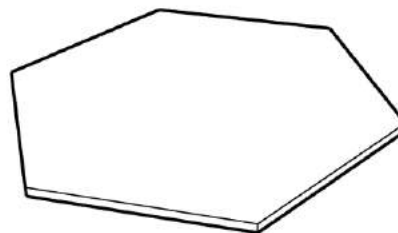
Exterior wall A



Exterior wall B

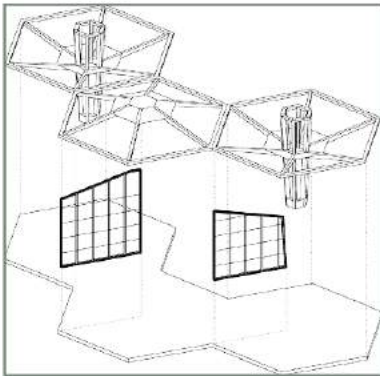


Exterior wall C

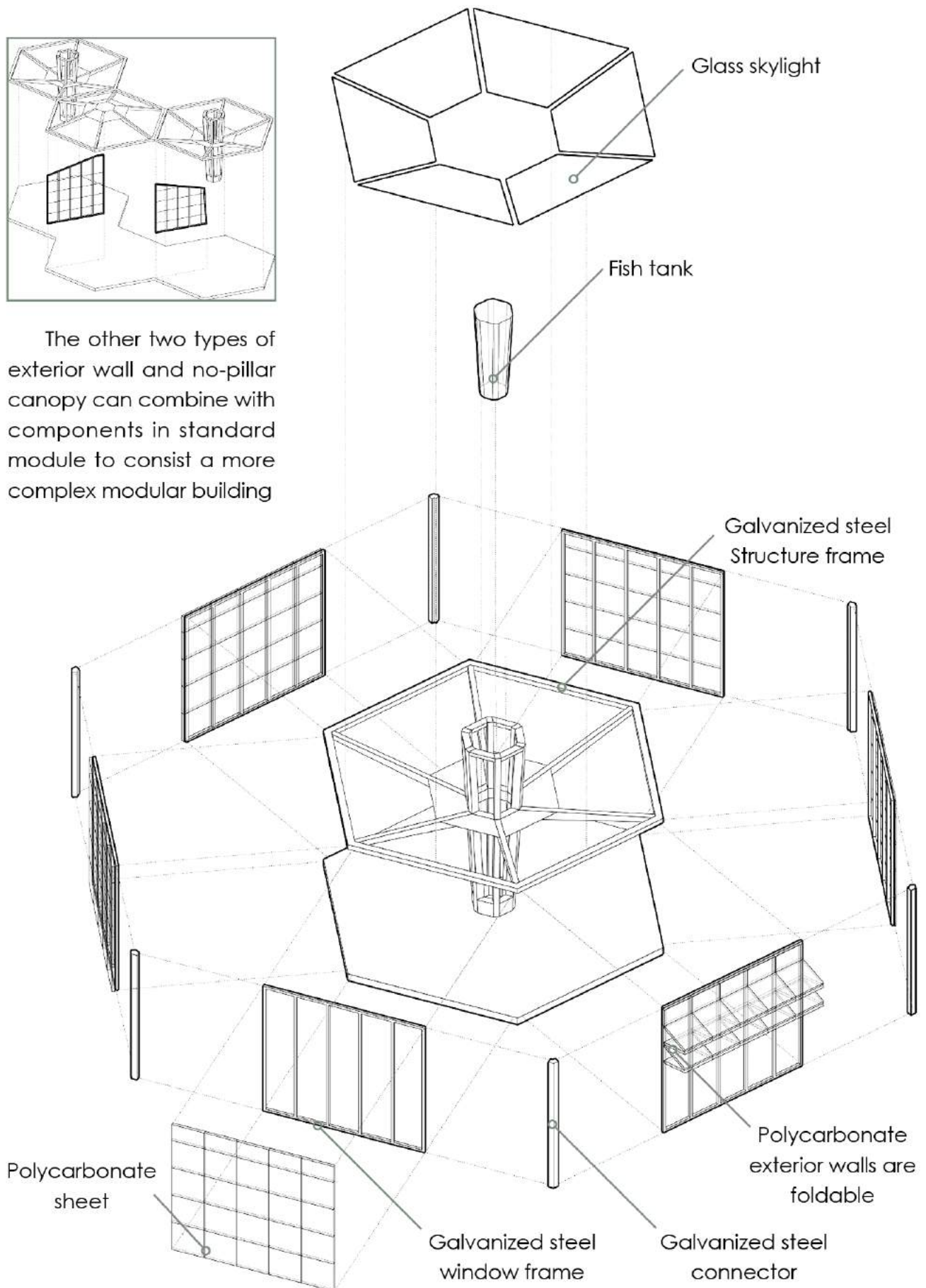


Base

Components of Prototype



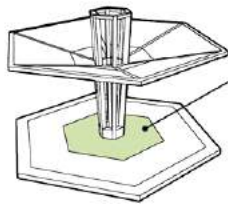
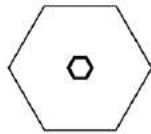
The other two types of exterior wall and no-pillar canopy can combine with components in standard module to consist a more complex modular building



Principles of Combination

The space under the roof could be categorized into space for growing facility, space for movement and space for multi-activities. Moreover, space can be optimized during combining of units. There are two principles for units combination.

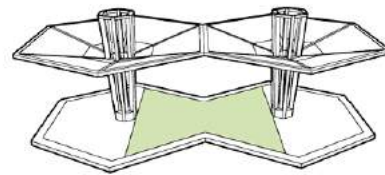
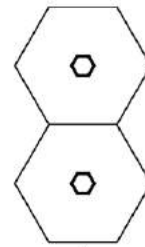
- Exterior walls can be arranged along sides of equilateral triangles.
- The pillar could be taken away. The canopy is tensioned by adjacent units when it connects with at least two other units which are supported by pillars at disjoint sides.



Multi-activities Space

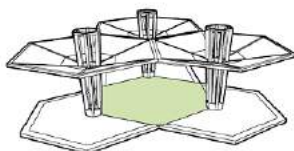
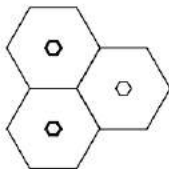
One unit

Space is limited by pillar



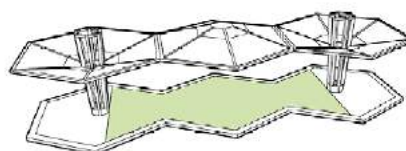
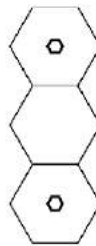
Two units

Space for activities is larger between pillars



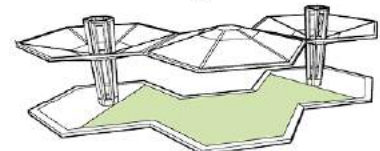
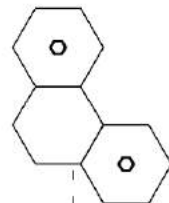
Three units

Pillars create barriers for space utility



Three units

Space is optimized when no-pillar canopy is tensioned by other pillar supported canopies



Three units

Space is optimized when no-pillar canopy is tensioned by other pillar supported canopies



**SHOWCASE
—A PAVILION IN
2021**

Site

A pavilion will be designed for showcasing the modular building system, which could combine urban farming with public space design in 2021.

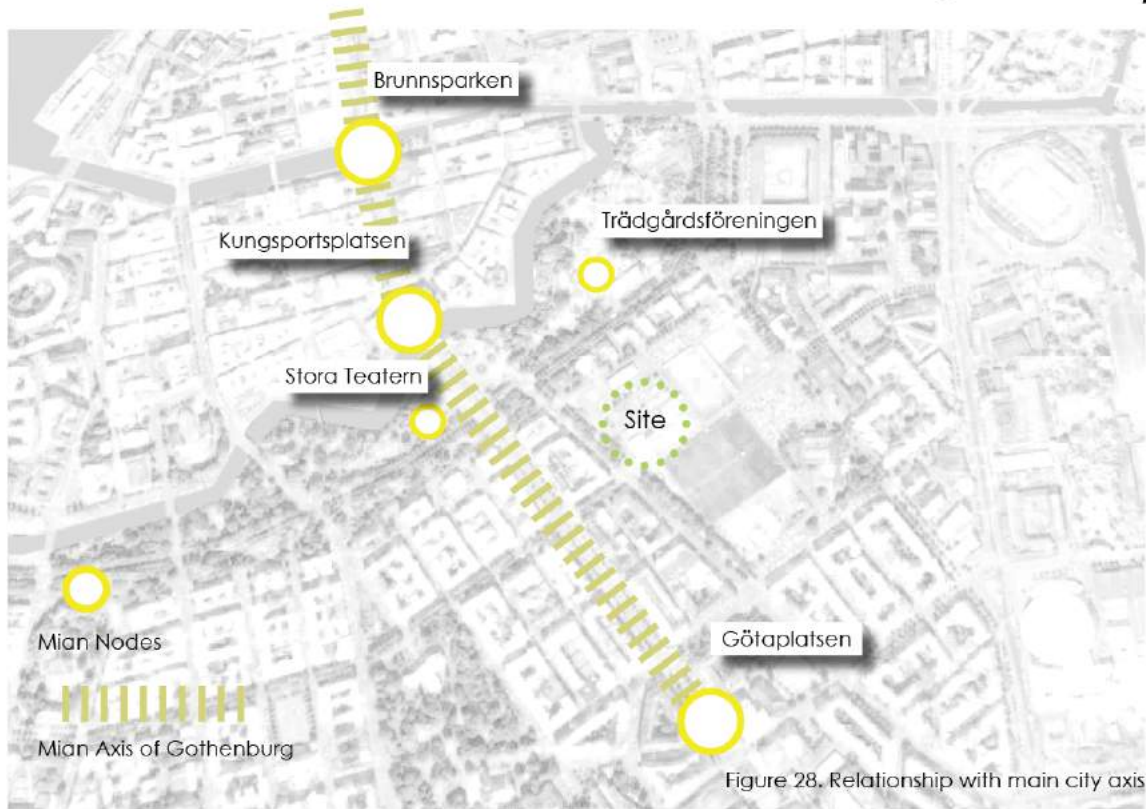
The showcase will be located at Heden, Gothenburg. The site is next to one of the most important commercial avenue in Gothenburg. Therefore, it has excellent accessibility so that people can

visit the pavilion from other areas of the city conveniently. Today, Heden is almost the largest open space in Gothenburg's center. However, it does not have enough infrastructure for diverse public activities. Parking lots, sports fields, unused land, and temporary buildings share the existing area. Thus, Heden is also treated as an underdeveloped site in Gothenburg.



Figure 27. Location of the Pavilion.

Site Analysis



Site Analysis

At present, the site is surrounded by a bus station, sports fields, car parking and an old warehouse. The space is not used efficiently. Furthermore, there is a bus pathway goes across the site. It would bring air pollution that would impact food production so that the showcase

will instead the pathway with pavement and green area, and all bus lines will go through Södra Vägen instead of crossing the site.





Promoting Heden programs have been discussed between municipal government and municipalities for several years. The

New Heden Program

rebuilt program aims to develop Heden to be a living room of Gothenburg, which could provide space for sports activities, public meeting and displaying the city's culture. Some competitions and research studies have been done by different groups. They all show efforts to renovate Heden and mark Heden as a diverse public space.

The pavilion tries to combine food production and food gastronomy activities with conditions of the hypothetical site to add new experiences and update Heden.



Figure 31. ADEPT - Kragh & Berglund Landskapsarkitekter - Moe & Brødsgaard (Göteborgs Stad)



Figure 32. MA Arkitekter - EGA ErikGiudiceArchitects - Sydväst - Transsolar - Stiba (Göteborgs Stad)



Figure 33. Wingårdhs - Erséus arkitekter - Beijing Turen Design Institute - Atelier One - Atelier Ten (Göteborgs Stad)



Figure 34. Nyréns Arkitektkontor mfl (Göteborgs Stad)

Plans

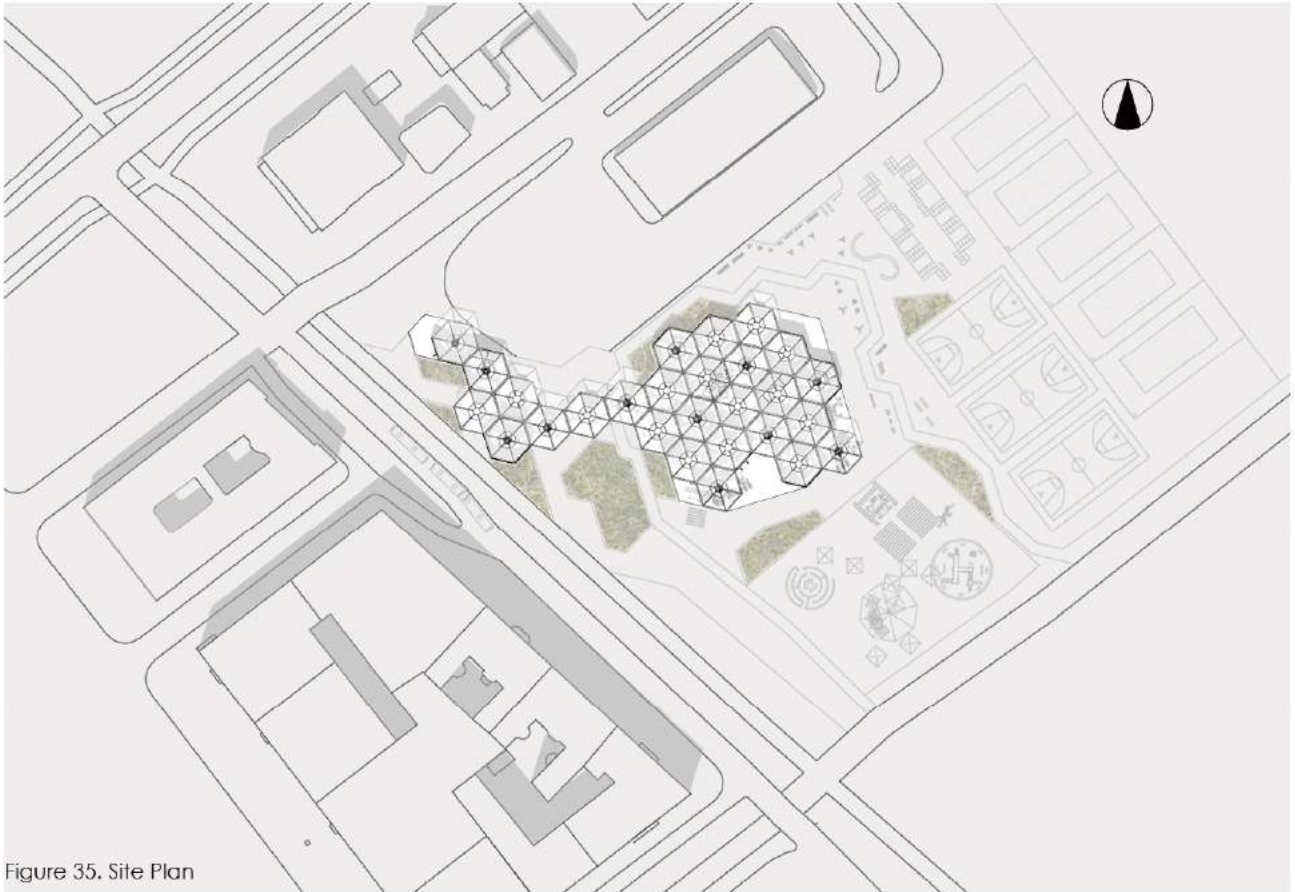
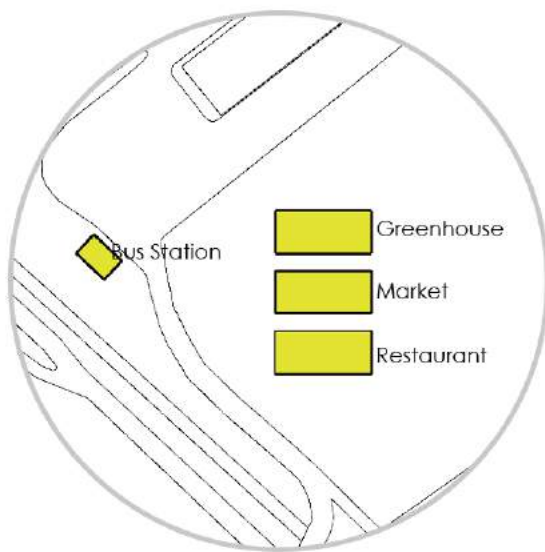


Figure 35. Site Plan

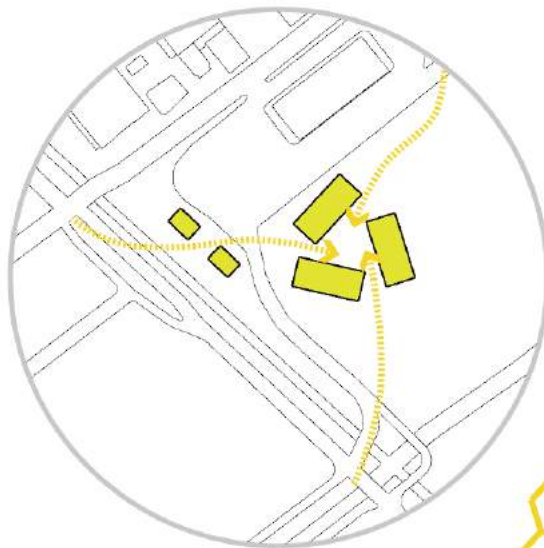


Figure 36. Ground Floor Plan

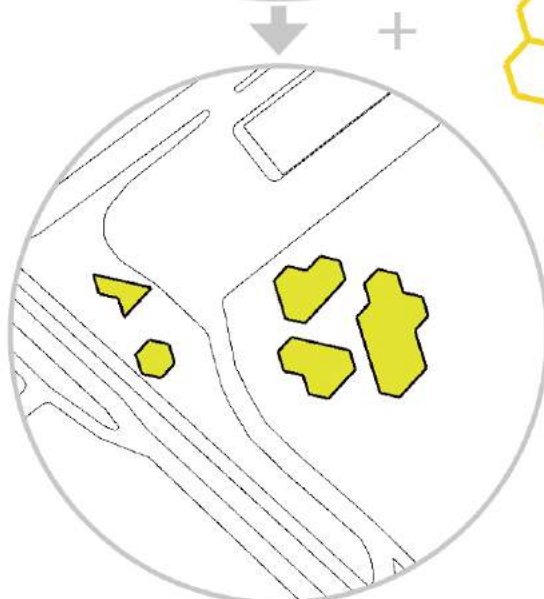
Project Generation Process



- 1 Greenhouse, restaurant, and market are three main functions of this pavilion. They target to connect food production with food consumption directly and conveniently.



- 2 Rotating functions' squares to fit site conditions. To guide people to visit Growing Around though different directions, the pavilion creates three access points. These accesses points intersect and form a public space in the center of the showcase.



- 3 Adding a hexagonal grid to optimize the pavilion's configuration.

Figure 37. Project Generation Process

Explored View of Pavilion

The pavilion is arranged to have 1,300 growing towers that could produce at least 260kg of fresh food a week. Additionally, the greenhouse has horizontal growing racks that could produce diverse produce for people. Therefore, the whole quantity of production is considerable. The pavilion does not aim to achieve food self-sufficiency. There will still be a need to get food material from other producers, but it will decline the dependency on acquiring food from other sources.

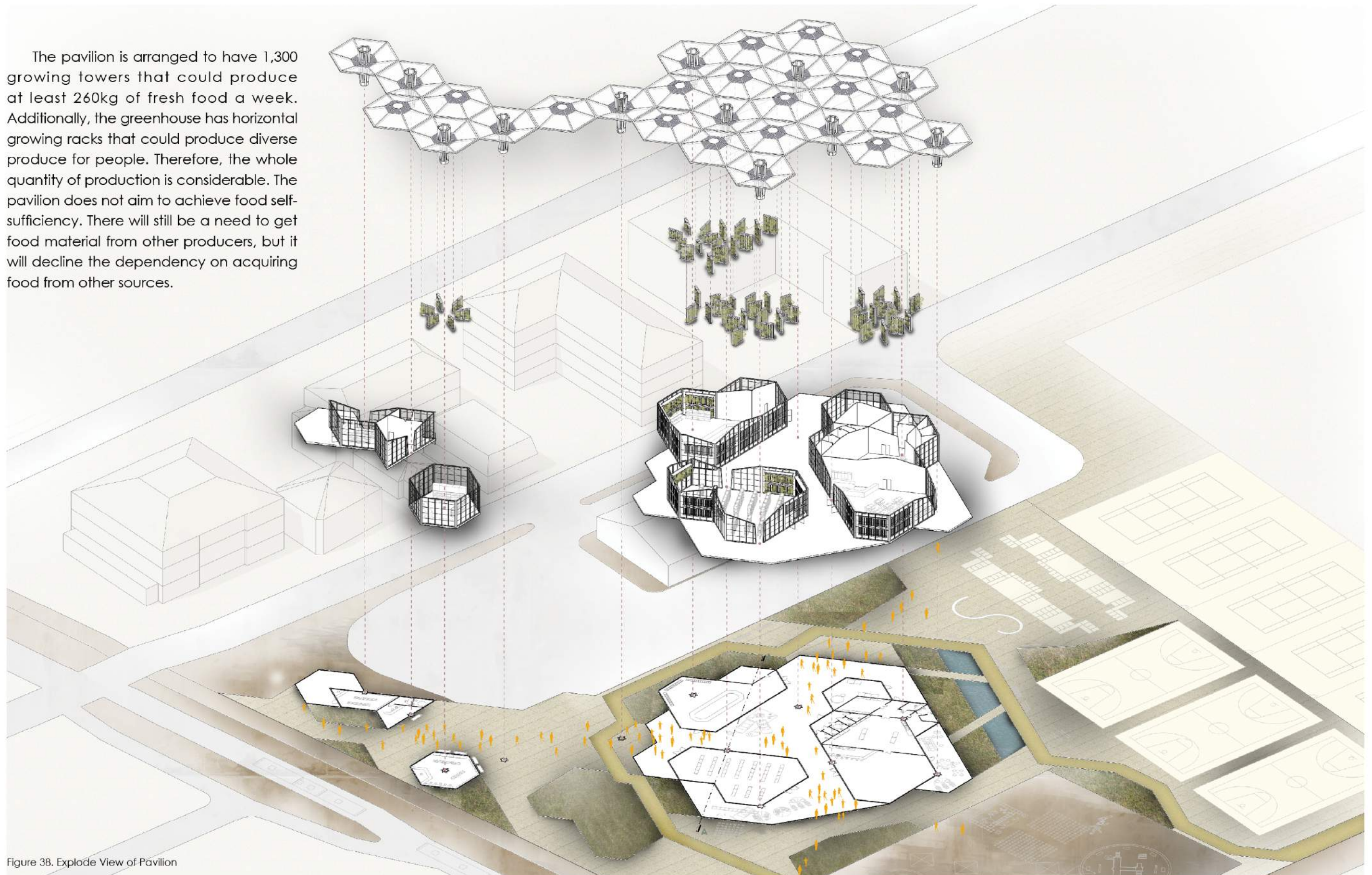


Figure 38. Explode View of Pavilion

Interior View of Market



Figure 39. Interior View of Market

Section

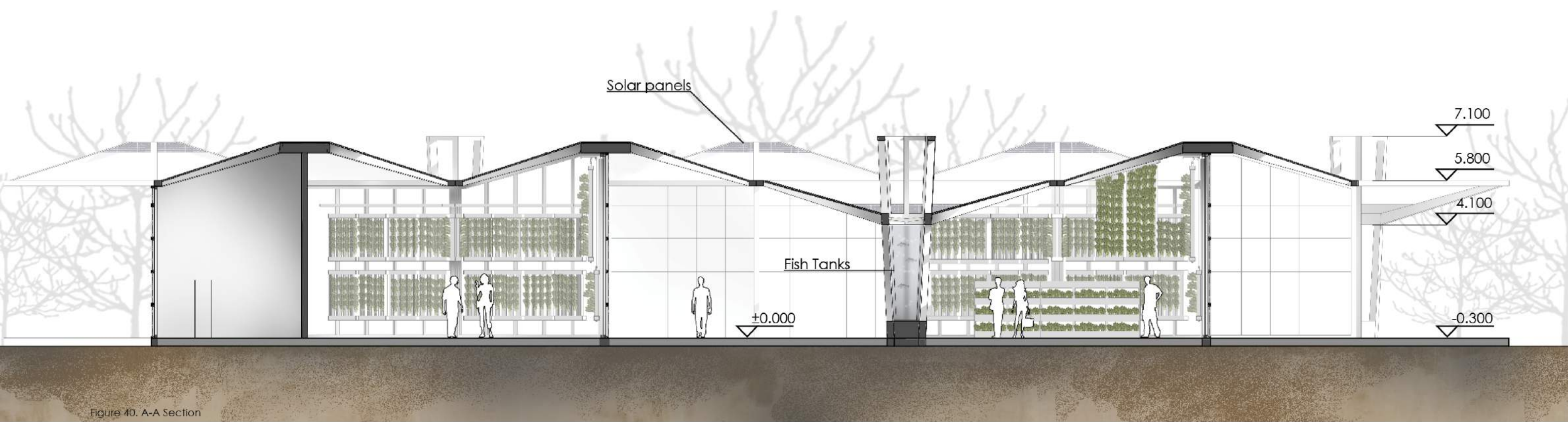


Figure 40. A-A Section

Conclusion

Nowadays, urban farming is commonly considered as a promising method to ensure food quality and food security. The eager of developing urban farming to improve food security and benefit other aspects of urban development is increasing continuously. On the contrary, current urban agricultural practices mainly occur in the suburbs of cities with similar growing typologies in rural farmland. This method may not fulfill the potential of urban space and the scale of food production to reunite people with fresh food materials.

The author of this thesis explores urban farming development from the perspective of architectural design. Especially, the author emphasizes the efforts on spatial relevance exploration to discuss the way of creating diverse opportunities for urban agriculture development. To connect city cultivation to citizens, the author of this thesis tries to integrate it into urban life and daily living space to create a spatial media for urban food growing opportunities.

Growing Around shows a modular indoor urban farming system to achieve goals above. Within this system, building configuration, building function settings, food production scale could be changed according to different construction conditions and various requirements. It tries to show its advantages in fitting urban farming into urban context through excellent flexibility and adaptability. Ideally, if addressing this system at different places of a city as many as possible, a local food system which could provide fresh and healthy food and contribute to sustainable urban development can be achieved. However, urban farming development needs multi-disciplined cooperation. One-side efforts would not succeed. Many aspects of our society, such as policies maker, architects, urban planner, engineers, food producer, and so on, are required to be involved in implementing the movement.

My master's studies experiences and the process of doing this thesis triggered my interest in exploring urban farming development. As an architect, I think, there are still many opportunities and areas which relate to spatial relevance direction of urban farming developing for me to study and research in the future. I also have great enthusiasm to continue my efforts in this field.

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Figure 41. Posters for Open Seminar