Digitarian Food Park

| Research Booklet |

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CP

Complex Project

Content

Abstract

The these is to explore new possibility to consolidate daily living and food experience in 2100 Amsterdam. Food is one of the essential elements in daily life. We eat and consume foods everyday. However, since the industrialization and automatation of the induxtry, food industry has become one of the most destructive system in the planet in terms of global warming and climate change. For upcoming future, there is a need for feeding ourselves with sustainable way.

It is a miracle to sustain this industry this far with destroying the planet. 35% of the land is already being used for food production and the 35% of the forest disappeared. Meanwhile, it is using 70% of fresh water which accounts for only 1% of total water in the Earth. In distribution perspective, while the agricultural product is transported, 50% of them are being thrown away. By the time costomers get an apple in the supermarket, the apple lost its antioxidant and have only sugar. Human becomes professional to destroy both the planet and their body at the same time. However, a bigger problem is that most of people are not aware of those facts and being defined by monopolized industry dyanamics.

The fact is that we need more food will not be changed but It is not feasible anymore to develop agriculture industry horizontally. It is important to use new agricultural science technologies more and more. Vertical farming, Controlled Environment Technology and Cellular Agriculture. These techologies use less space and can be stacked so it is durable to be located in urban contexts where more tha 70% of people will live in. Using these new technologies, architecture can provide more transparent and active place in urban area. In the place, people will expreience most advanced and sustainable food experience. Furthermore, the building itself will be able to encourage public health with balanced nutrition recommendation.
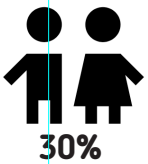
Problem Statement
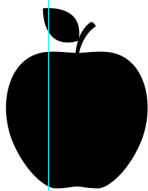
+ 30 Types

11 Months Old
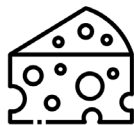
No Antioxidant

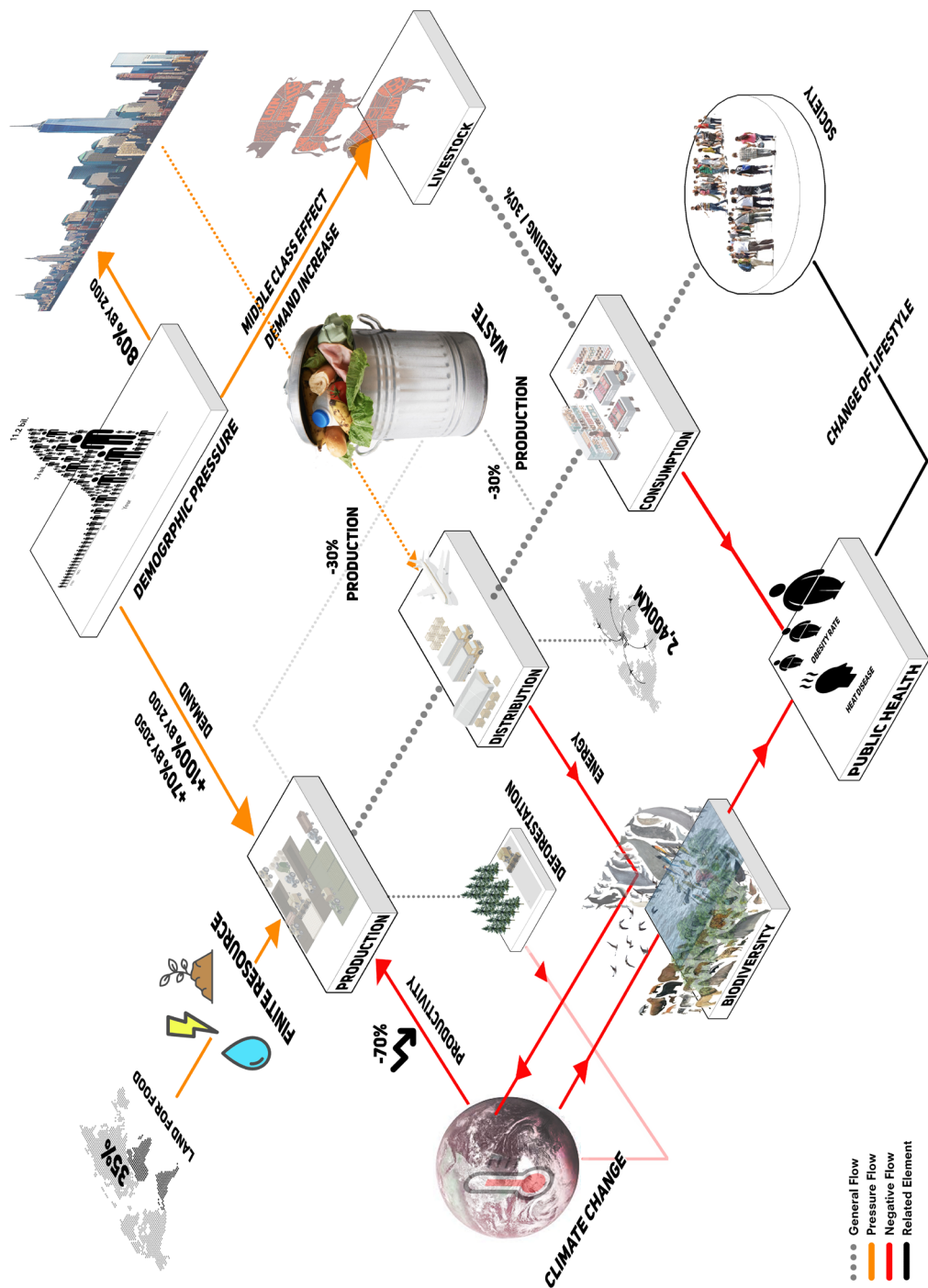**A Ball of Sugar**
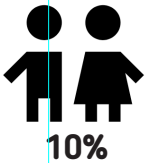
10%

From Supermarket

30%

From Trees

Although we think that we know what food are and what we are eating everyday, if anyone tries to take a look underneath of a blanket one would notice that we hardly have any knowledge of foods.

Foods are raw ingredients. It has been related to culture and healthy life. It used to have deeper meaning than now. However, it becomes mere object on racks of franchise supermarkets.

Even in 2100, it is evident that we will be eating foods like what people do in 2019. There will be an apple, a loaf of bread, a slice of cheese and milk. Unlike the past that we used to want more foods and cheaper ones, now society needs clean and healthy foods for all.

We are lack of proper environment to achieve the society we want. Daily life has been casted away from food production and results from it are covered with decisive labeling. Therefore, it is not enough to call making sustainable industry as an solution. It is required to bring sustainable industry into a city where majority of people will live in the future.

DEMOGRPHIC PRESSURE

80% BY 2100

MIDDLE CLASS EFFECT
DEMAND INCREASE

LIVESTOCK

FEEDING / 30%

WASTE

PRODUCTION

SOCIETY

CHANGE OF LIFESTYLE

-30%
PRODUCTION

CONSUMPTION

11.2 bil

DEMAND
+70% BY 2050
+100% BY 2100

PRODUCTION

-30%
PRODUCTION

DISTRIBUTION

2,400KM

PUBLIC HEALTH

OBESITY RATE

HEAT DISEASE

FINITE RESOURCE

LAND FOR FOOD

35%

DEFORESTATION

ENERGY

BIODIVERSITY

PRODUCTIVITY

-70%

CLIMATE CHANGE

········· General Flow
▌▌▌ Pressure Flow
▌▌▌ Negative Flow
▌▌▌ Related Element

Complexity of Current Foodscape

Foodscape we established is complex and unsustainable. Production, Distribution and consumption, this single linear process affects to various elements and social symptoms. The productivity of the agriculture is dropping because of the climate change induced by human developments while we need more food and more productivity to feed increasing population. The climate change will affect to biodiversity which is influencing public health and the public health is affected by food consumption style and choices. Even if we can change either of the systems in sustainable way, there would be still problems and it is unexpecting to be sure, the solution would be fitted into conventional stiff system. In order to tackle the problems and provide new envorionmentm we need holistic situation in new context with new technologies and new lifestyle.

The Lack of the Pool

 Let's see current challenge more specifically and its required resources. In future, more than 70% of people will live in urbanized area. Those people who move into cities do not prefer to become farmer. Since 1900's the number of farmers is drastically decreasing and between 18~25 years old people also don't want to be a farmer. In fact, the life of small shareholding farmer is miserable. In the Netherlads, there are only 2% of farmers in the population. We cannot expect any solution out of 2% of population. Double of current production is needed for 2050 and there is still no solution for 2100 food requirement. We need more food and we need more people to think and come up with sustainable solution for the future.
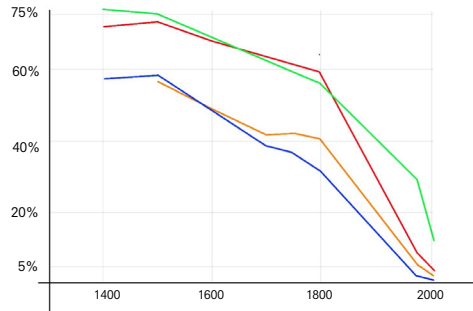
More People move to the city and Less people Want to become Farmers

2018

 X2
2050

 X?
2100

11.2 bil.

7.4 bil.

Year
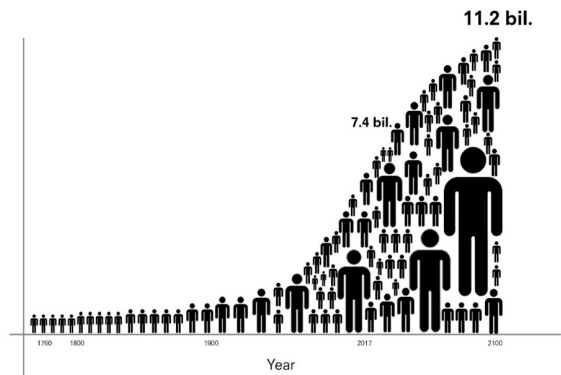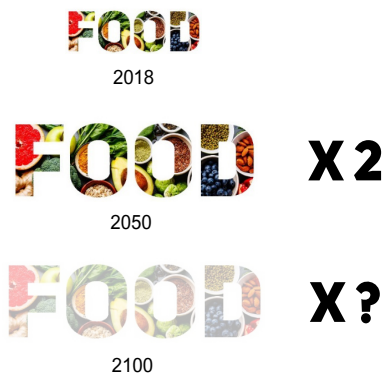
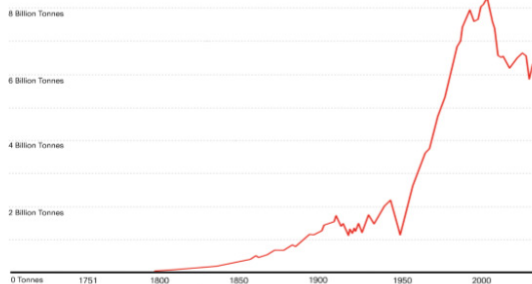But, We need more food for increasing world population.

35% of the planet are already being used for Food

27% - Livestock

8% - Crops for Human

Co2 Emission & City Development

8 Billion Tonnes

6 Billion Tonnes

4 Billion Tonnes

2 Billion Tonnes

0 Tonnes   1751   1800   1850   1900   1950   2000
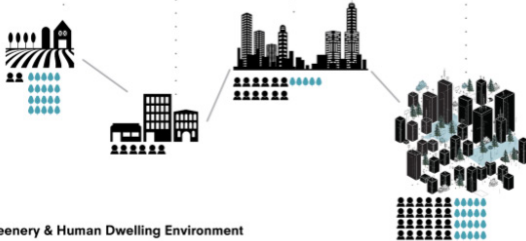
- Living in Countryside

- Urban Sprawl - Urbanization

- Industrial Revolution
- Densification of city

- Introducing Landscape to Urban Area

**Greenery & Human Dwelling Environment**

The agriculture industry has been developed in horizontal way. It is as simple as a puzzle game. If we need more food, it would take up another land next to it and starts to cultivate again.

With this method, it already becomes 35% of whole land and it case deforestation and degradation of arable land. 27% of production area is being used for livestocks' feeds. It will increase due to increase of middle class that will wants more meats and dairy products especially from India and China. Meanwhile, we are losing the vast area of forest which is the most effective solution to counterclimate change.
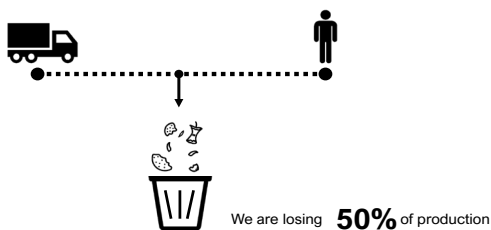
There is a effort to tackle climate change in urban design and architecture level. Co2 emission and urban development clear shows causality. but after 20's a notion on the greenery has been changed from something to protect and keep to one to combine with human habitats. Various studies prove keeping greenery close with human routine can induce higher productivity and satisfactory in urban life. Therefore, there are many creative attempt to combine greenery with building and public open spaces.

It is clear that food industry can be an huge aid to this global trend by using new technology and paradigm shifts on food consuming style.

Where is The Food Production?

Consumption

+

Production

17th cen
_____
20th cen

Consumption

+

PRODUCTION?
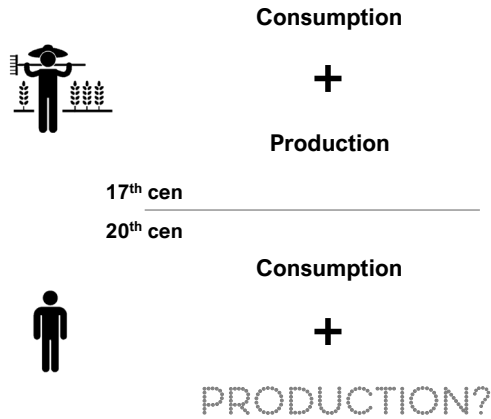
Food travels **2,400km** to come to our plates

We are losing **50%** of production

In the past, most of people were agriculturists. They were related to agriculture and food business in some ways. Food was just food. It was cultivated from the farm and brought and cooked by family. However, the production has been disappeared and home cooking is put in coma status. 70% of foods are already processed and no one cares where it happens and comes from.

So, Where is the food production now? Where is our food coming from? In case of fruit, sometimes it travels 2400km from consuming country. Thanks to that, we can get oranges, strawberrys or pineapples in near supermarkets regardless of seasons Otherwise tropica food could have become christmas prenst or other special occasions. It emits green house gas while it is delivered. Futhermore, it emits green house gas and 50% of production becomes food waste only during distribution.
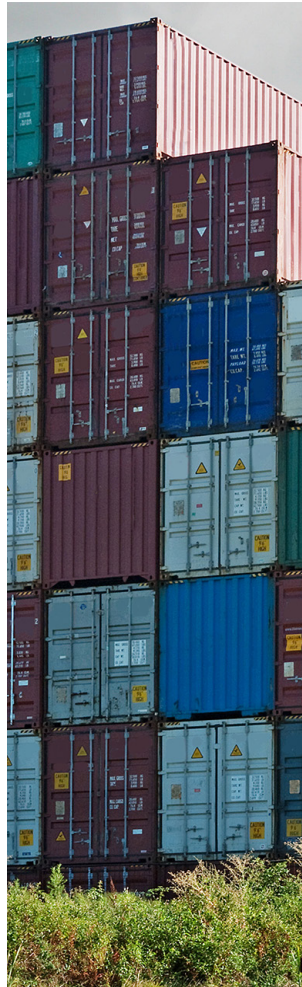
Food as a Killer

Food is simple. It is a raw ingredients
but also the most powerful killerin the planet.

👫
+

FOOD

↓

Healthy Life

Every one would know food has a huge relationship with healthy life. What you eat affects how you feel tomorrow. In asian country, people believe sickness cannot be cured with food cannot be cure with medicine either.

Not only for nutrition wise, but also in cultural perspective. Vibrant cultural environment has to be rooted from deep food culture.

However, current society is suffering for diet-related diseases induced by too much food. Obesity kills more people than wars and there are more obesity people than one suffering for malnutrition. It means we are consuming foods and distributing food wrongly and foodscape we have built is not our ally to enjoy healthy life style and cure the diseases in current society.
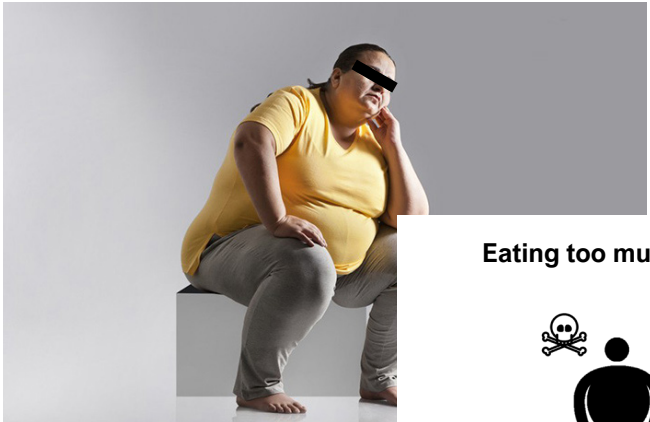
Eating too much kills more people than war

2.8 mil.

30,000

Obesity has become a world wide major problem of public health.
It kills more people than war, genocide and traffic accidents
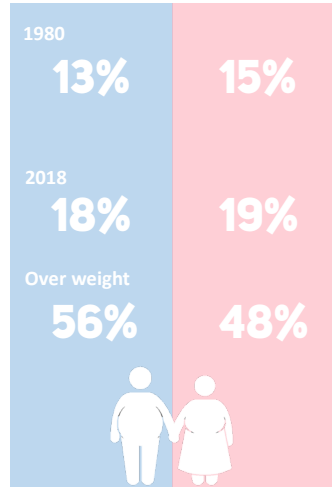

More Obesity than Malnutrition

1.5 Bil.

925 mil.

Obesity in the Netherlands

1980 13%	15%
2018 18%	19%
Over weight 56%	48%

Children Obesity

> 30%
EU

> 20%
The Netherlands

Overweight

Obesity

Nutrition Facts

Serv. Size 1/3 cup (56g)
Servings about 3
Calories 90
  Fat Calories 20
* Percent Daily Values (DV) are based on a 2,000 calorie diet.

Amount Per Serving	% DV*	Amount Per Serving	% DV*
Total Fat 2g	3%	**Total Carb.** 0g	0%
Sat. Fat 1g	5%	Fiber 0g	0%
Trans Fat 0.5g		Sugars 0g	
Cholesterol 10mg	3%	**Protein** 17g	
Sodium 200mg	8%		

Vitamin A 0% • Vitamin C 0% • Calcium 0% • Iron 6%

Requirements

1. **Name of Food**
2. **Nutrition Facts**
3. **Origin of Ingredients**
4. **Trans Fats**
5. **Net Quantity**
6. **Allergic Info.**

....

Font size

Nutrition Facts

↓

Calories(16)

↓

Vitamins, additives....

Labeling is an critical element that affects to public health bucause it is the most distinctive sign to interact with customers. It shows nutrition values in the products. However, only few of people care this. Majority of people decide their purchase with name of products of brands. We are already exposed to dangerous publi health situation while we are doing grocery.

 In supermarkets, we are bombared with foods and processed products. we need to choose carefully out of this vast choices. Amount of sugar, fats or fair trading. Although for now we do not care much of foods because it is everywhere. But we should not take everything you want. Your choices can affect climate change, global warming and even your own health. Current grocery space is really similar to war situation where we have to avoid and use caution every moment.

Climate Change

Consumers

Public Health

What If?

We Know what the problems of foodscape.
Now, it is time to ask what if anvd find solutions
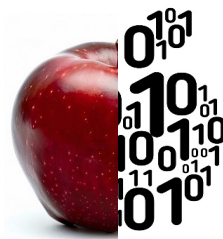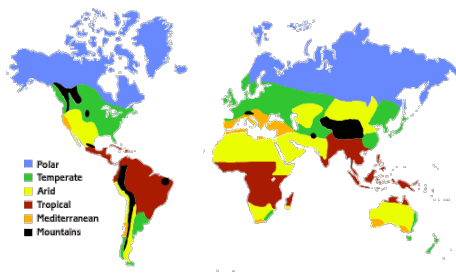
Selecting Climate

Agriculture business is slaved by climate condition. With vast area of land, crops are getting sun light, rains and winds. However, 30% of it production is lost due to climate related disasters. So, What if everyon can choose their own productive climate for crops their culture usually use.

Digitization

WIth an single apple, one can see problems and possibilities of future of the food industry. The world is connected with strings such as shipping, airplanes or cars. Those are lethal to global warming. However, what if we can digitize the apple's cultivation information and share the information of it and we can produce identical apples in different places.

From
7th cen.

From
Himalaya
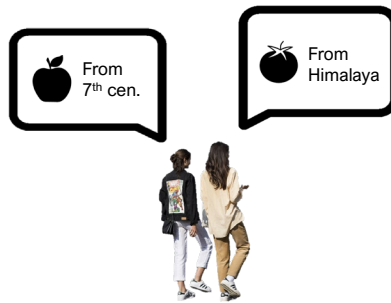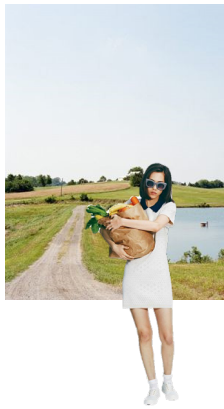
The Freshest Food

 Food can tell us many things besides taste or color. It also shows freshness that people can immediately feel. Fresh and healthy food can be felt by human instinct.
 What if we can do grocery in the farm? If we can get our food right out of roots. We can assure freshness and cleaness of our food and it will be the wat to retrieve interity of our own food on the table.

Identity

Although food represents diverse cultures, it was not able to represnet individual. However, there is a different preference and taste between individual even on single products. What if we can choose our own food from way of production to which of the climate. Then, it will encourage spread of food culture and we can build firm platform with vibrant environment.

The New Paradigm of Food Style

We will produce our foods differently
We will consume differently

The Fallacy

What is good foods for us? We want our foods to be organic, clean and tasty. Like the image above, that medival small local scale of agriculture has ruled our mind telling grace of nature and efforts of farmers and its value as a gift and rewards for labour and time out of nature. However, if this way of business will be continued, it will be not enough to feed people and it is drastic to farmers who use this method to make profits. This is a fallacy

The Advent of New Technologies

Vertical Farming   **Conventional Farming**
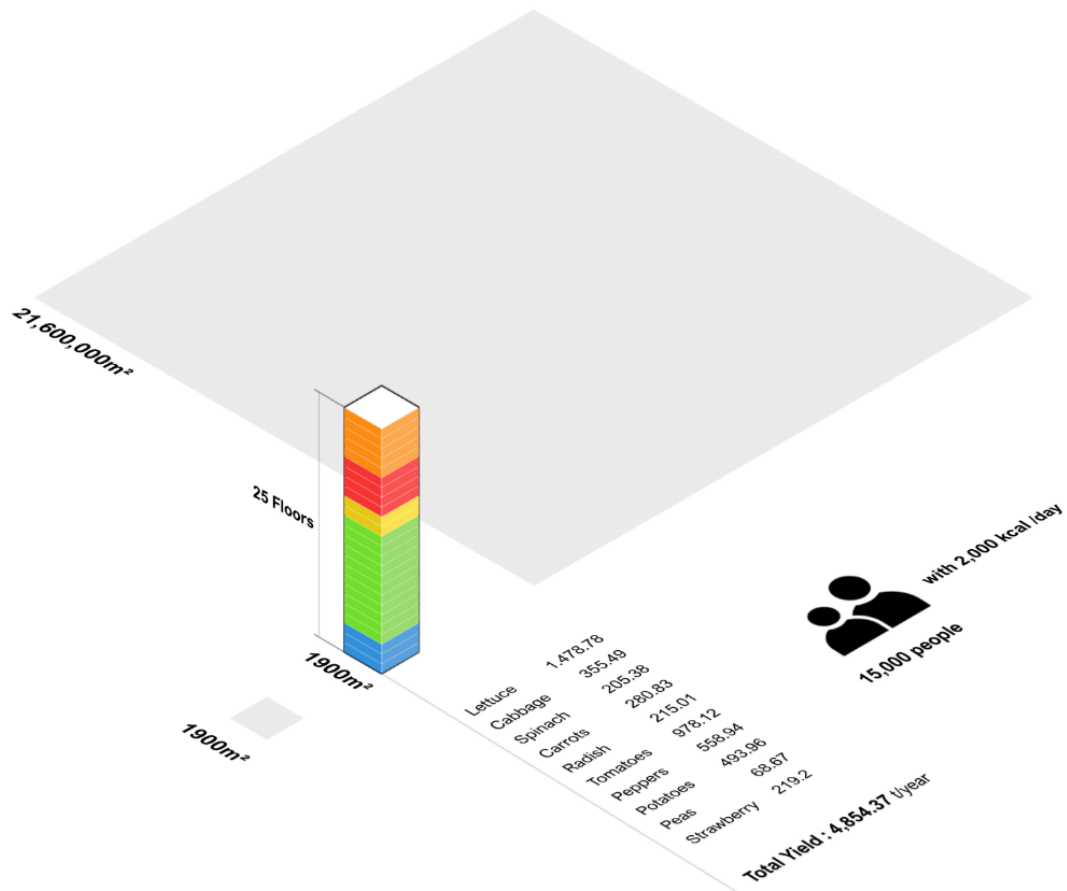
95% Less

No Soil

50% Less

Comparison of Two Ways of Agriculture

21,600,000m²

25 Floors

1900m²

1900m²

Lettuce   1,478.78
Cabbage   355.49
Spinach   205.38
Carrots   280.83
Radish   215.01
Tomatoes   978.12
Peppers   558.94
Potatoes   493.96
Peas   68.67
Strawberry   219.2

with 2,000 kcal /day

15,000 people

Total Yield : 4,854.37 t/year

When it comes to agricultural science, poeple immediately think GMO or processed food. However, agriculture science has been in the front line of food security and increasing food productivity. The new adventing technology can produce much more food and use less resources and more sustainable than conventional way of agriculture. In terms of efficiency, it is obviously better in every way. A research done by German aerospace deparment managed to build typological model to feed certain amount of people with vertical farming technology.

What will Happen?

Upcoming Future

Farmers
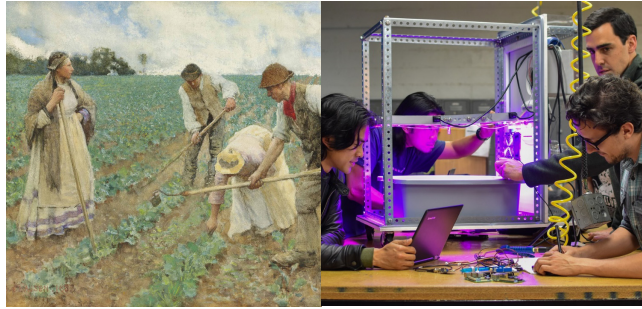
Food PC

Food Data Center

We need to overcome the fallacy and change paradigm we used to have. We need our food production site in urban area in the future and other supporting infrastructures are needed to be established.

In the future, Farmer will be urbanist, robotist, computer scientist and civil engineer. We need food pc that can produce food in the house and We also need food data center to secure and keep food growing data.

Food Scenario for 2100

- New Challenge & New Trend -

- Consumption -

- Production -

Ego   **Eco**

WHATS NOT WORKING

WHAT WORKS

Closed Ecology for Food Production
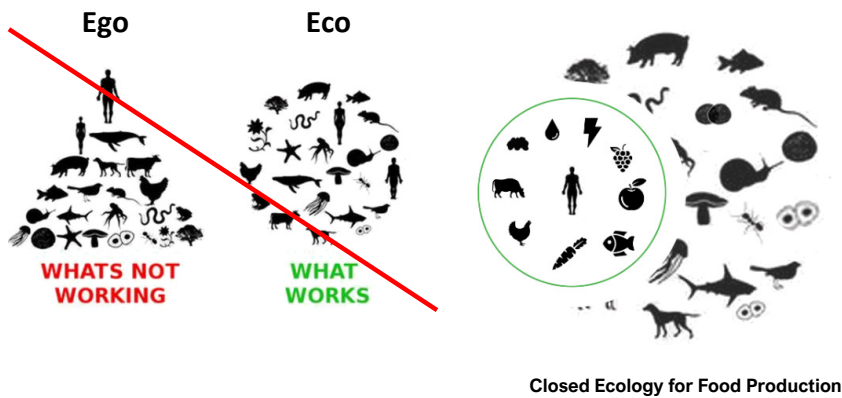
Closed Cycle

Since industirialization period, that was the golden age of the development itself, Human starts to develop around nature and transformed the natural one to processed one which is easier to use to human industry. That was the start of anthropocene. However, it is only accelerates bigger problem and Eco and harmonious thinking has bee arised. That was not enough at least for the food industry. We need closed system using good science and let nature be nature.

Fiber / Vitamins   Carbohydrate   Protein & Fat   Using By-Product

Good Science

Agricultural science is developing the way that doesn't change a typical diets or eating habits but they are looking for sustainable way to keep out taste and nature both together. In the early stage, vertical farming technology was not able to produce staple food such as potatos or wheat but now the technology become able to produce each foods that contain nutrition we need everyday.
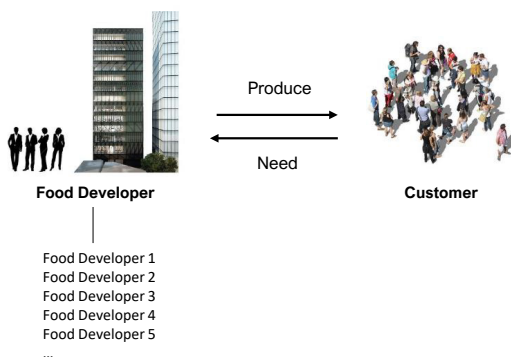
New Challenge & New Trend

Harvesting

Vertical Farming

+

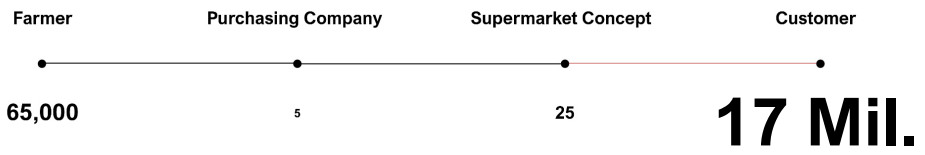**Digitization & Computerization**
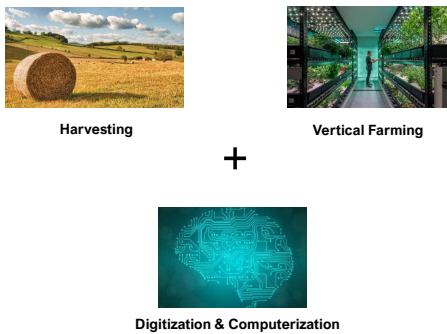
New Trend

With new arising technologies, typical paradigm on food industry will be totally changed in 2100. We will be still eating vegetables, meats and fruits but we will produc it differently. Vertical farming technology will make production areas can be stacked each others and digitization and computerization technology will make cultivation process more efficient and faster than before. In the future, the food we used to know will be produced in controlled climate, by robots and machine and scientists. This buisiness and industry will be standing on the front line of technological field.

Food Developer

Produce

Need

Customer

Food Developer 1
Food Developer 2
Food Developer 3
Food Developer 4
Food Developer 5
...

New Business Model

Those trend will lead to new business models. One of them is the advent of food developer. Those will look for perfect place or building to install vertical farming technology inside of the building. It will change a relationship customers and farmers. those new farmers will lanalyze and listen to customer's preferences and will produce exact food they want. This is totall opposite way of working with current system. In case of the Netherlands, there are 65,000 farmers who are working for only 5 food purchasing companies instead of 17mil. public.
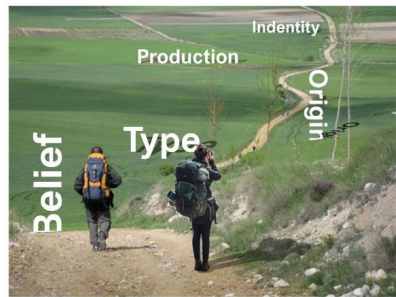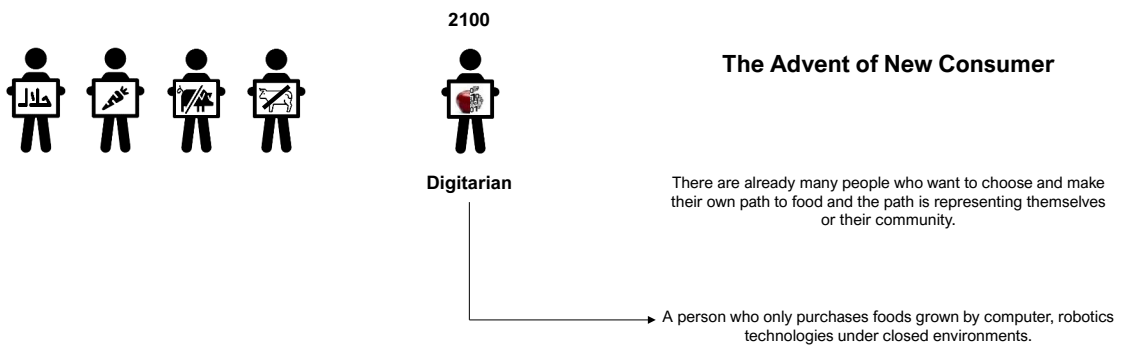
Farmer	Purchasing Company	Supermarket Concept	Customer
65,000	5	25	**17 Mil.**

1950's   **Current**

Climate Change

Consumers

Public Health

Education for Children

Indentity

Production

Origin

Belief

Type

Exploring Own Food List

2100

Digitarian

The Advent of New Consumer

There are already many people who want to choose and make their own path to food and the path is representing themselves or their community.

A person who only purchases foods grown by computer, robotics technologies under closed environments.

 A supermarket typology hasn't been changed since its invention. Supermarkets in 1950's and current are mostly identical. However, in 80 years, following changing trend in business sector, there will be transition in consumer wise. We have found that it is important to have a platform place to interchange and develop food related activities. This is also because the new arising of new cosumer style. It is already happening among few of people such as muslims, vegetarian or depends on personal belief.

 Those people are caring more than other people when they purchase their grocery. They are reflecting personal belief on foods. When this concept is expanded to futher, it is not that difficult to expect that there will be digiterian consumer group who will only purchase digitally produced food. They will check a label saying digitally produced under the controlled climates. Vertical farming, digitazation of farming, and possibility and feasibility to bring food production into urban context, those are coorborating the need of food platform-like space in the future where people will get integrity of food and can be sure they are having clean and healthy food and helping the nature everyday.
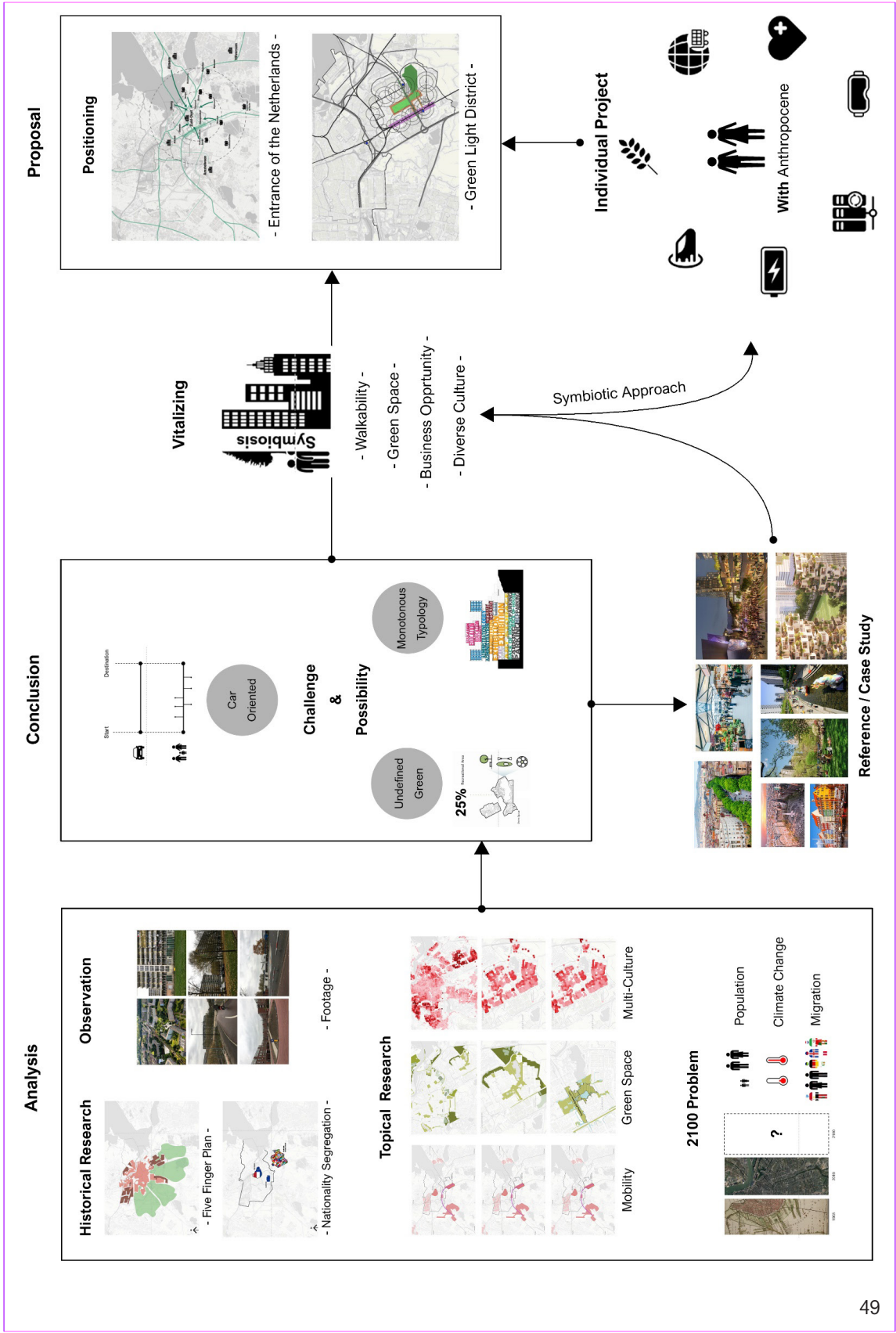
GAASPERDAAM & NELSON MANDELA PARK
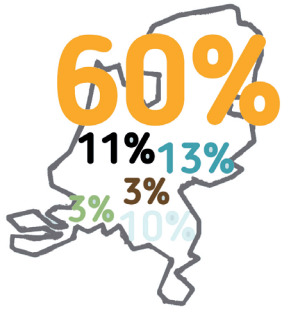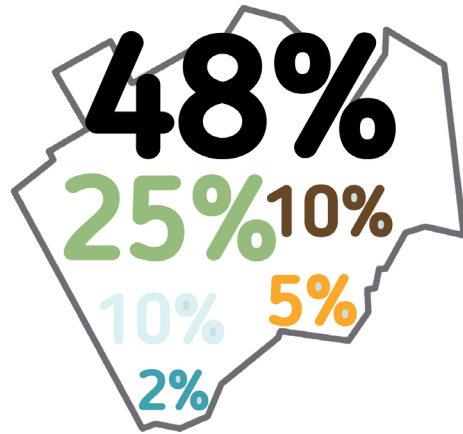
ZUID-OOST 2100

Master Plan

Zuid-Oost

Analysis

Historical Research

Observation

- Footage -

- Five Finger Plan -

- Nationality Segregation -

Topical Research

Mobility

Green Space

Multi-Culture

2100 Problem

Population

Climate Change

Migration

Conclusion

Car Oriented

Monotonous Typology

Challenge & Possibility

Undefined Green

25%

Vitalizing

Symbiosis

- Walkability -
- Green Space -
- Business Opprtunity -
- Diverse Culture -

Symbiotic Approach

Proposal

Positioning

- Entrance of the Netherlands -

- Green Light District -

Individual Project

With Anthropocene

Reference / Case Study

Possibility of Zuid-Oost

Land Use Data of Zuid-Oost Region

The Netherlands
60%
11% **13%**
3%
3% 10%

Zuid-Oost
48%
25% **10%**
10% **5%**
2%

Amsterdam
12% **41%**
12% **25%**
7%
3%
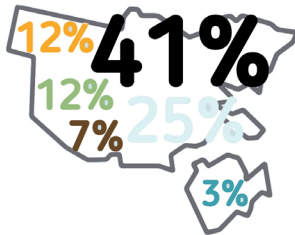
84,000

Legend
- **Agriculture**
- **Urban Area**
- **Landscape**
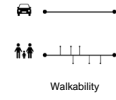- **Water**
- **Infrastructure**
- **Recreational**
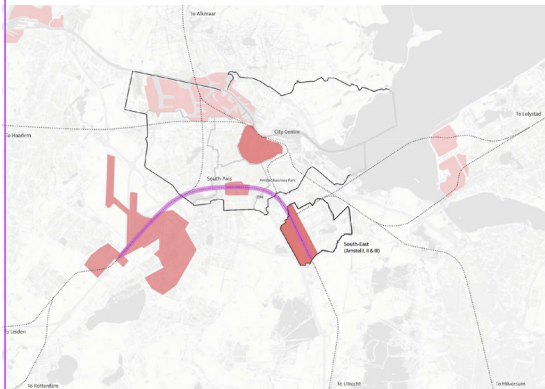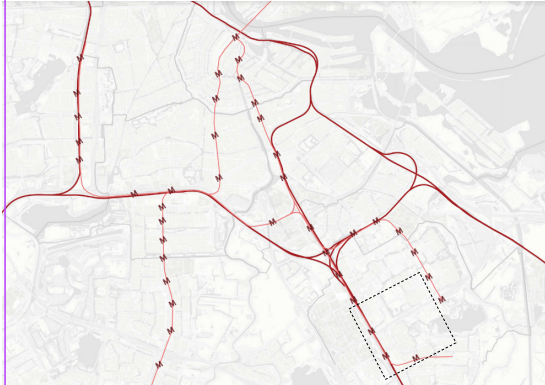
Zuid-Oost

Thematical Research of Zuid-Oost
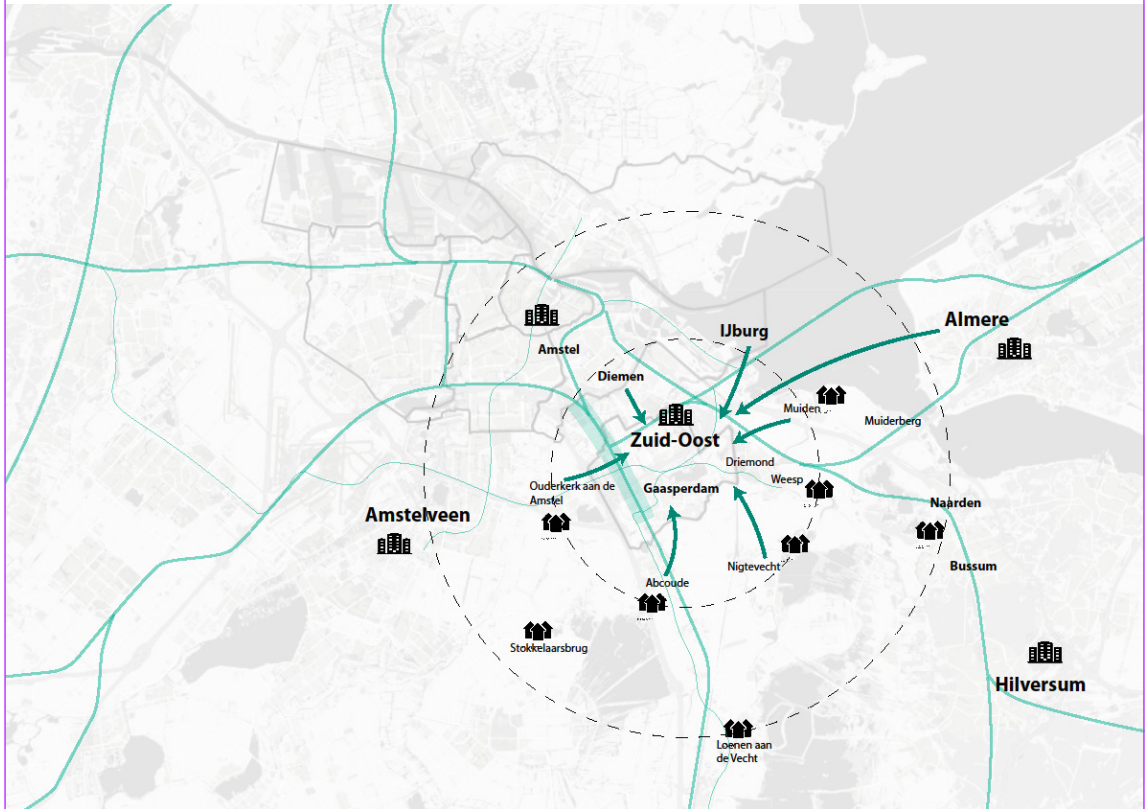
Gegraphical Role of Future Zuid-Oost

Mobility Analysis

Business Opportunity

Connectivity / Accessibility

Walkability

Green Space Analysis

Immense Green Area

25% Recreational Area

Usage of Green Area

New Green Area / Undefined Green Area

Challenge of Green Area

Societal Analysis

Social Segregation

Gentrification

Typological Segregation

Possibility

Business Opportunity

Connectivity / Accessibility

Immense Green Area

25% Recreational Area

Usage of Green Area

Challenge

Walkability

Challenge of Green Area

Gentrification

Social Segregation

Rembrandt Park

Vondel Park
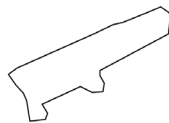
Musee Park

Sarphati Park

Artis Zoo

Ooster Park

De Nieuw ooster

Park Frakendael
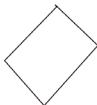
Nelson Mandela Park

Gassperpark

Amsterdam Centre / Amstel

Amsterdam Zuid-oost

Potentials and Challenges in Zuid-Oost

Zuid-oost has been one of the unfavored neighborhoods among the Netherlnads. Even though the initial plan of this urban area was not supposed to be like current situation. The region is a new attempt to bring new residential typology following the radiant city of le corbusier. However, due to several geographical occasions, it have become somthing else than they expected. There are several misunderstanding in the zuid-oost area. High-rise residential didn't fit in to dutch culture and wide road systems for vehicle wasn't attractive as much as amsterdam's small and human scaled road profile.

However, there are also good and unique elements in the region. Since majority of people are having foreign backgrounds and it will give the city a good foundation for exotic culture and life style. It make dutch people leave the city but also it become a proper place to have its own uniqueness. Thanks to high-rise development, it has the vast area of green public spaces compared to other regions in Amsterdam. In highly densed Amsterdam region, it is hard to make this amount of green area for public.

Therefore, the city has potentials in terms of green areas and exotic cultures but also has challenges that how any intervention can make the region to recover its reputation and combined together with other Amsterdma region with its own unique geographical importance.

Master Plan

Through analysis, it was possible to find geographical importance of Zuid-Oost, Schiphol Corridor which has high connectivity with the airport and the govenrment intention to develop this line with innovative business. Therefore, it is evident there will be huge business district's development. Meanwhile, it is important to keep the region's advantage that the vast area of green public space which can serve as sports place and event places and introducing the mixed-use residential type. Eventually, the master plan is to establish where high-tech business and natural vibe are breathing together in highly urbanized area.

Sport Activity

Culture Event
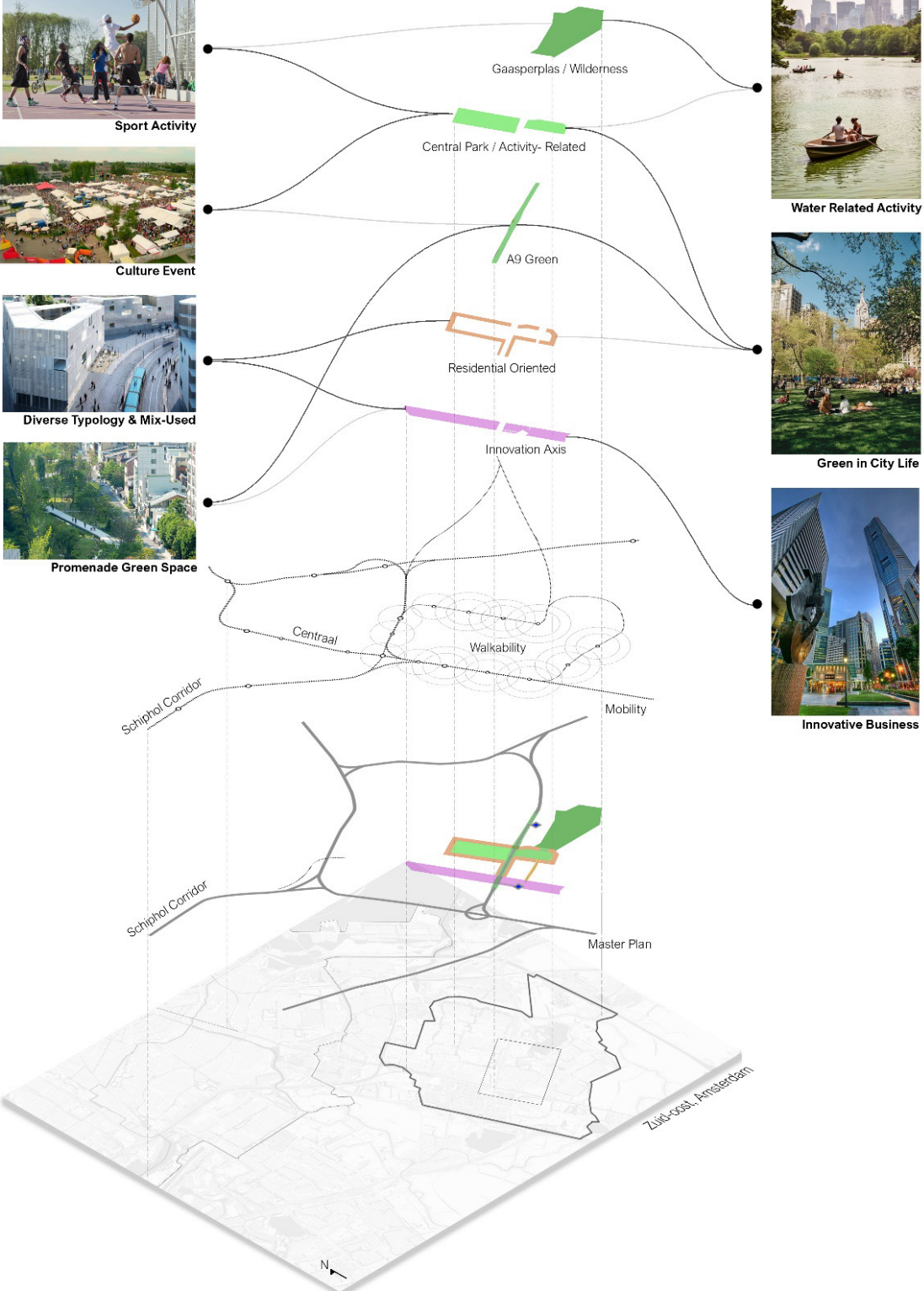

Diverse Typology & Mix-Used
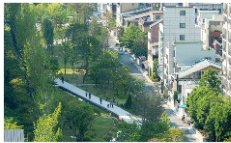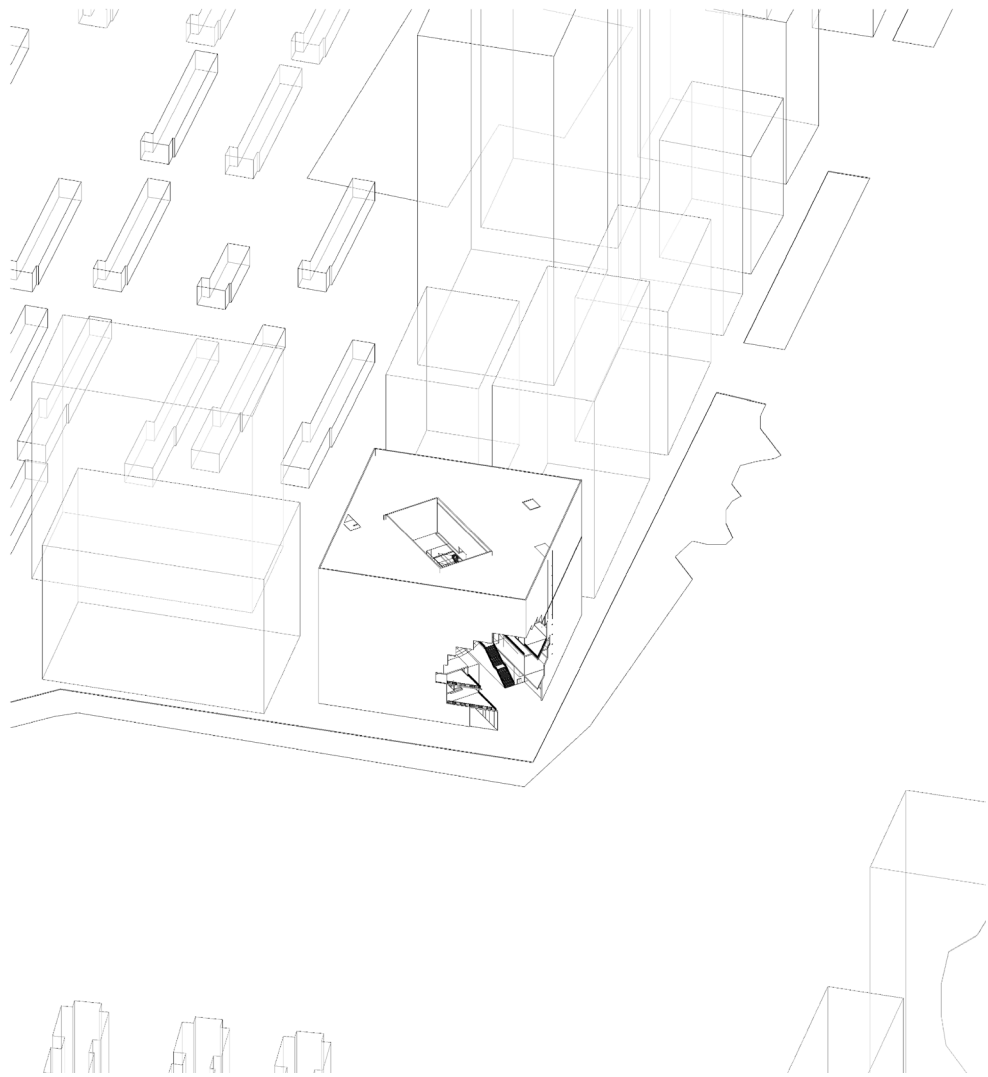

Promenade Green Space

Water Related Activity

Green in City Life

Innovative Business

Gaasperplas / Wilderness

Central Park / Activity- Related

A9 Green

Residential Oriented

Innovation Axis

Walkability

Centraal

Schiphol Corridor

Mobility

Schiphol Corridor

Master Plan

Zuid-oost Amsterdam

N

Design Proposal

- Concept
- Site Analysis
- Design Process
- Experience

Vertical Farming

Mass Customized Food Hub

Production

Food Hub

Production

Distribution

Pilgrimage
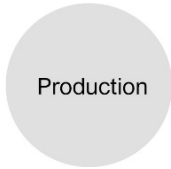
Production
+
Consumption
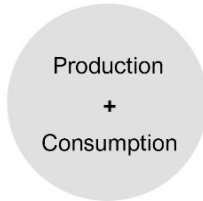
Defining

Market
Restaurant
Cultural Space

Consumption

Consumption
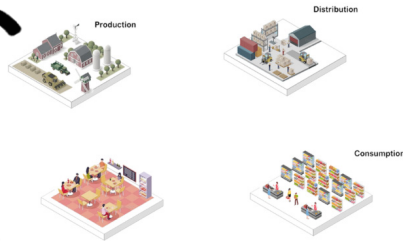
Being Defined

Health   **Society**

Orientation
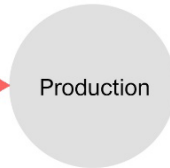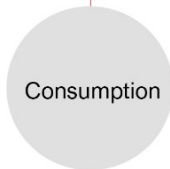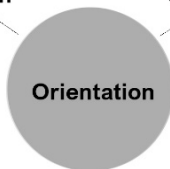
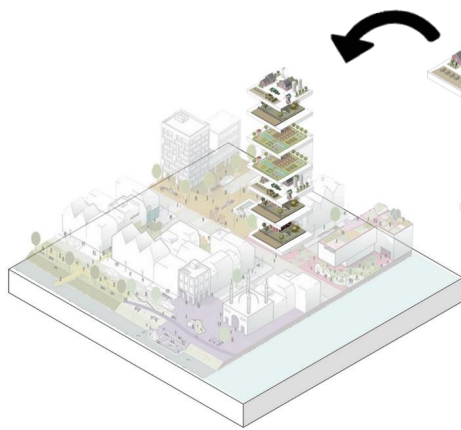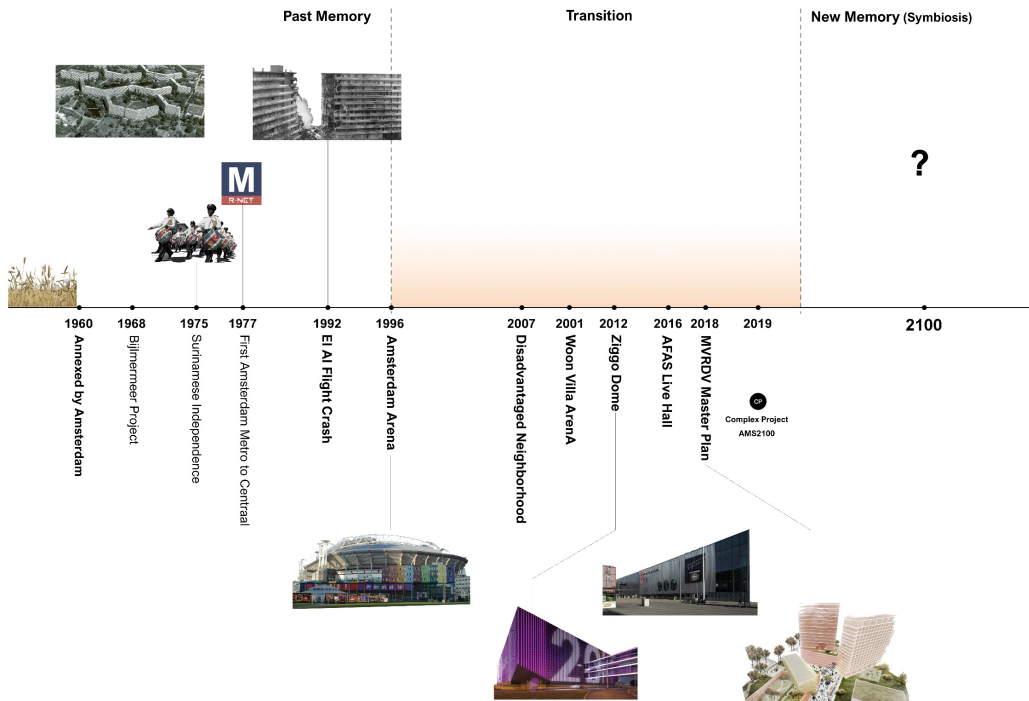**Person**

Production + Distribution + Consumption + Execution

Concept - Urban Industrial Foodscape

Have seeing other case studies, even though new designs tried to introduce vertical farming technology in urban context but there are still areas that people cannot have choices. The design proposal will allow to people choose their food from production way to crop types and it will encourages sustainable food culture and small exotice cultures as well. In the future, cities will need its own food production building and related public space where peopl can learn about the new technology, exchange from knowledge to cooking recipe and digiterian culture to others.

It will be totally different environment to one that we usually think of agricultural area. There will be no soil of farm, it will not need sunlight. The building itself will become farmlands and it will represent human understanding toward nature. Required elements will be only produced to supply foods to the city with exact amount of resources in closed ecology. Therefore, it is dear to provide industrial atmosphere and new technological experience zones for public. Food will not be a gift from nature. It will become manufactured results of human understnading in 2100.

Past Memory   Transition   New Memory (Symbiosis)

?

| 1960 | 1968 | 1975 | 1977 | 1992 | 1996 | 2007 | 2001 | 2012 | 2016 | 2018 | 2019 | 2100 |

Annexed by Amsterdam
Bijlmermeer Project
Surinamese Independence
First Amsterdam Metro to Centraal
El Al Flight Crash
Amsterdam Arena
Disadvantaged Neighborhood
Woon Villa ArenA
Ziggo Dome
AFAS Live Hall
MVRDV Master Plan
Complex Project AMS2100

Site Analysis

   The Zuid-Oost region has been an outsider among Amsterdam region. It was acceler-ated since Suriname's independence and increased inflow of population from Suriname. It became arrival city where it provides opportunity to foreigners to adapt to the country and its culture. However, increased crime rates and unfavored neighborhoods, those left unforgettable reputation on the region. But, having looked recent governmental develop-ment in the region, it is clear to see it is trying to change its reputation by using collective memory-based events such as stadium for sports events and music hall for concerts and shopping areas. Therefore, it becomes important to introduce a proper event for encour-aging the trend and public reputation.

   Using the proposal as a anchor and link program between existing activites such as Mandela Park and Gaasperplas(Water related activity zone). The location will be perfect place to connect neighborhoods and different urban events.

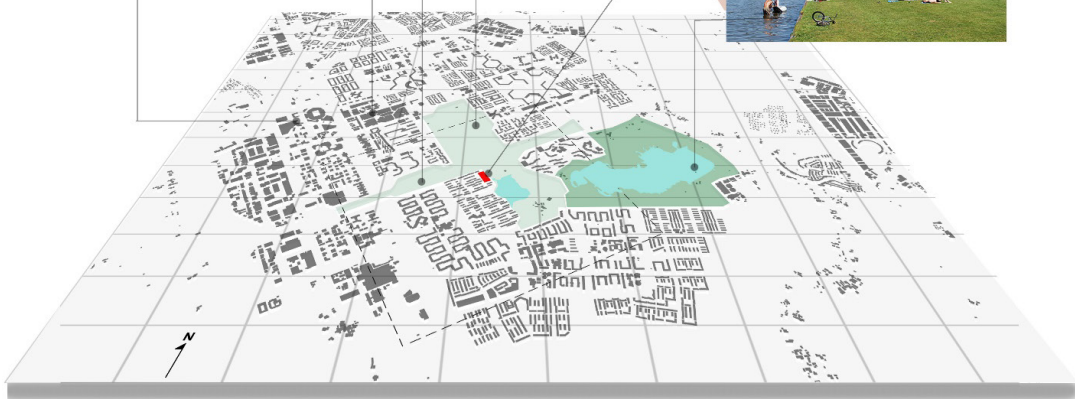Concert, Sports Events   Shopping   Outdoor Activity   Water-Related Activity
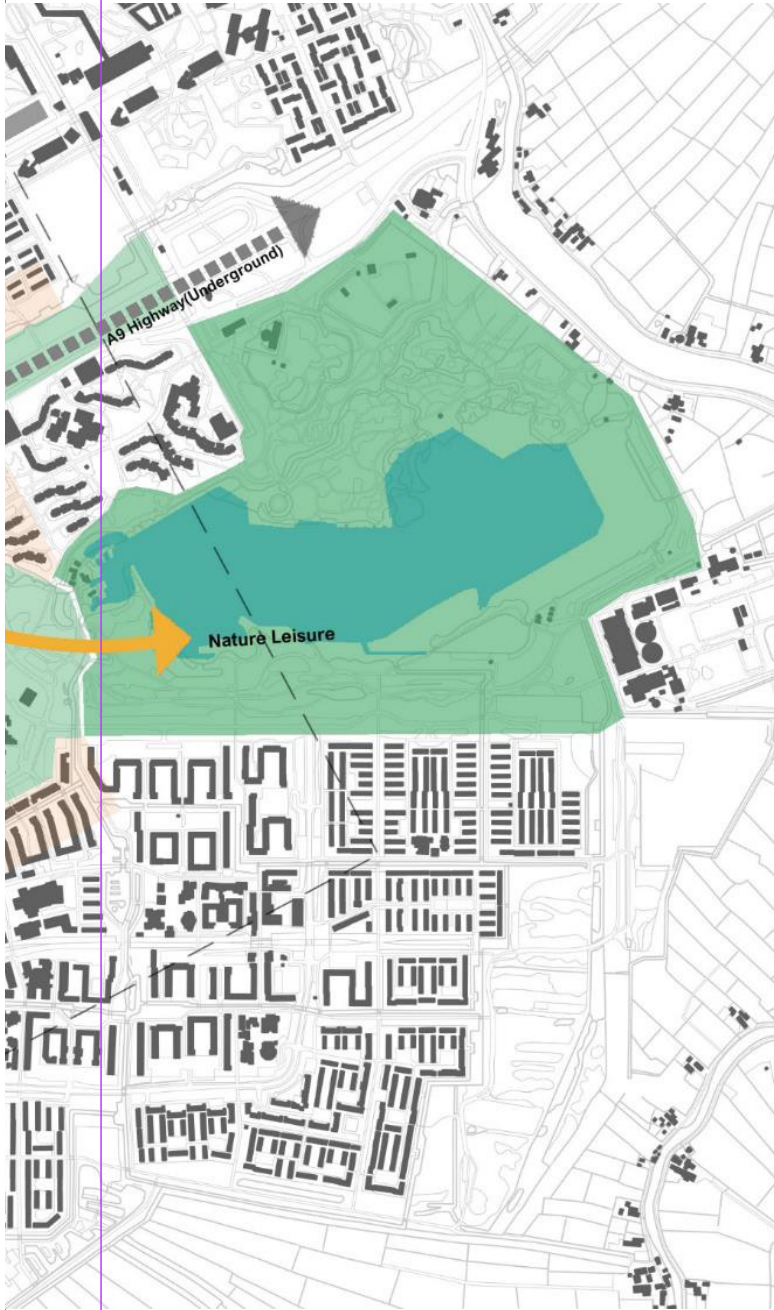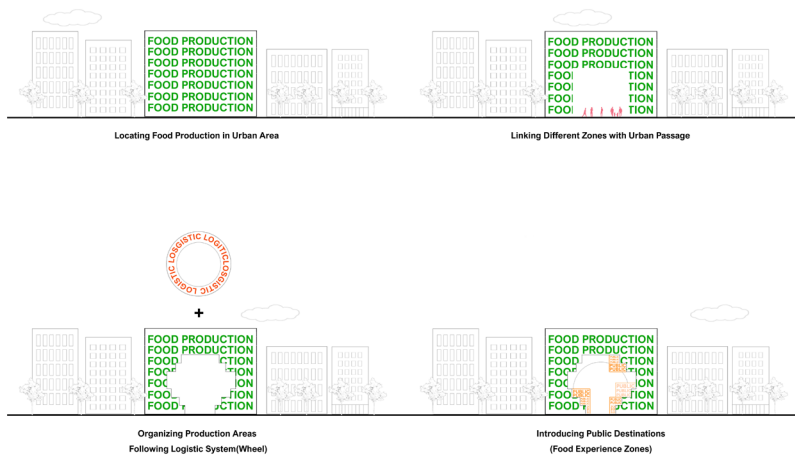
Food Culture Event

SITE

N

The proposal will be located on the border of huge green area and it will link two different food production zones which are shooltuin and urbanfarming zone which used to be single stroy dutch housings and it is closed to tunneled A9. So, there is advantage for logistic purpose.
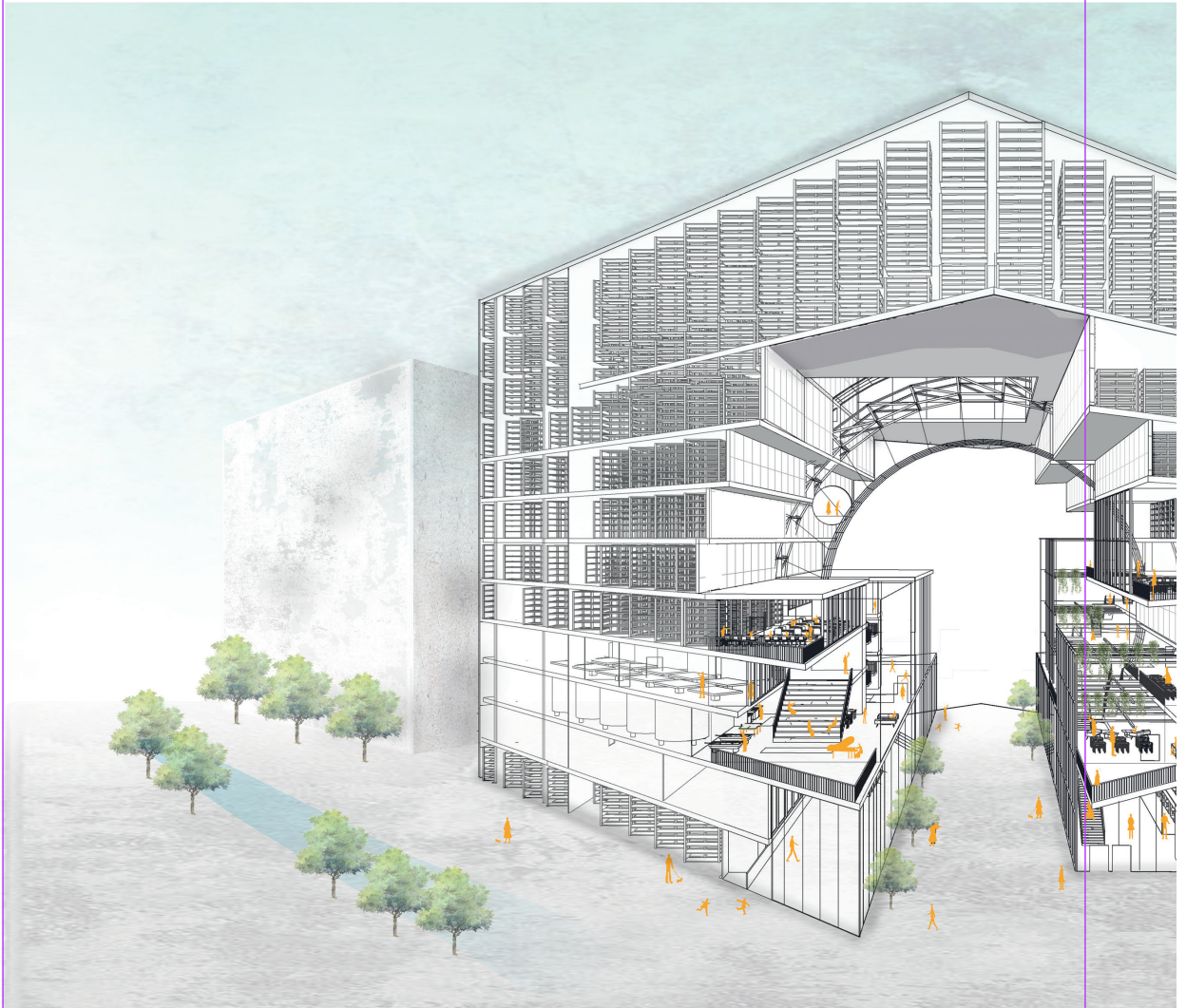
A9 Highway(Underground)

Nature Leisure

Design Process

Locating Food Production in Urban Area

Linking Different Zones with Urban Passage

Organizing Production Areas
Following Logistic System(Wheel)

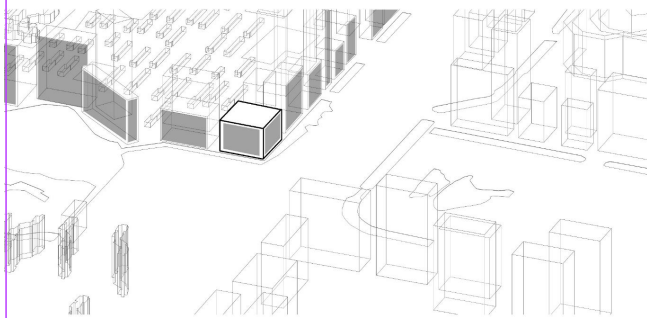Introducing Public Destinations
(Food Experience Zones)

The main idea of the project is to suggest urban integrated food experiencing zone where people can be aware of food production status, new agricultural science and related activities in their daily lives. While the building let its space to be integrated with urban texture, it provides industrial spatial atmosphere for agriculture business.
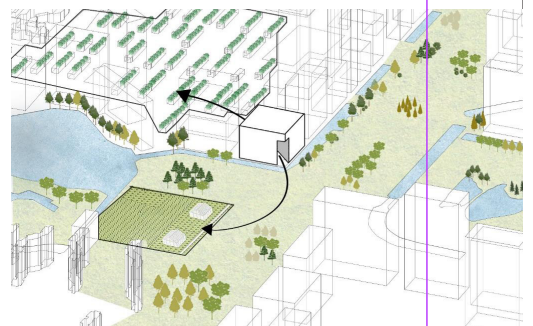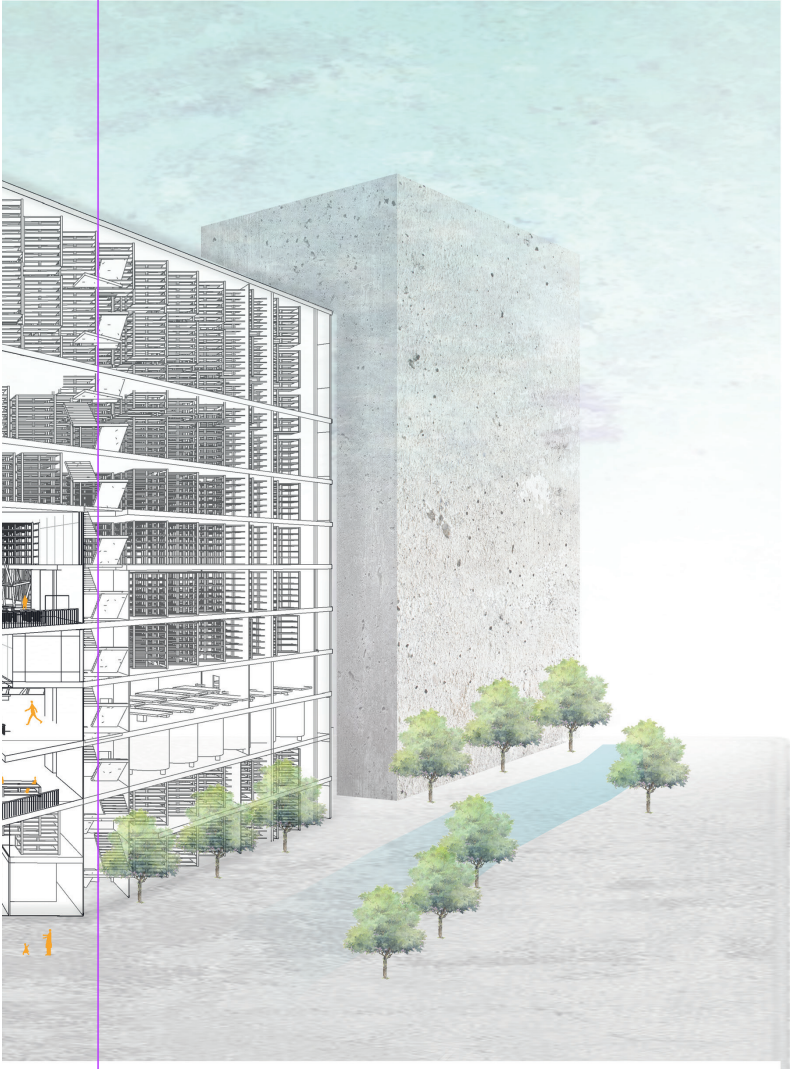
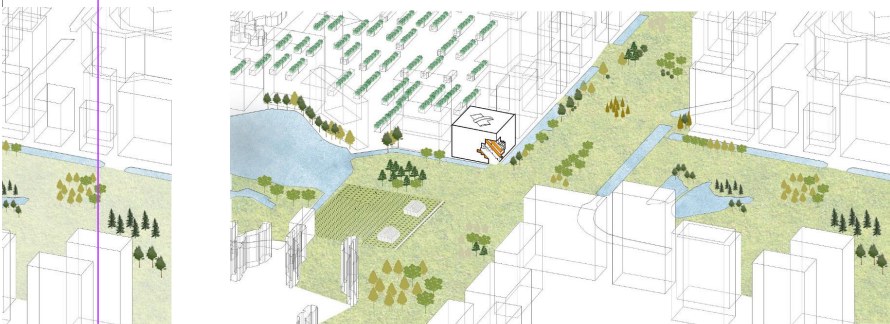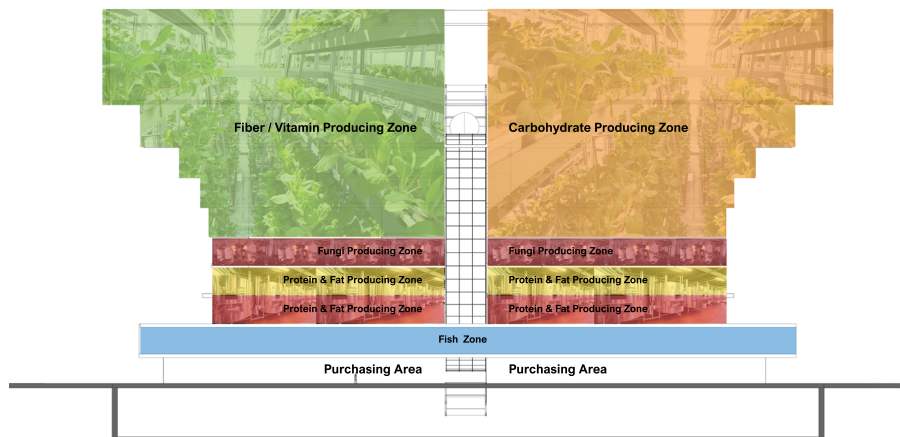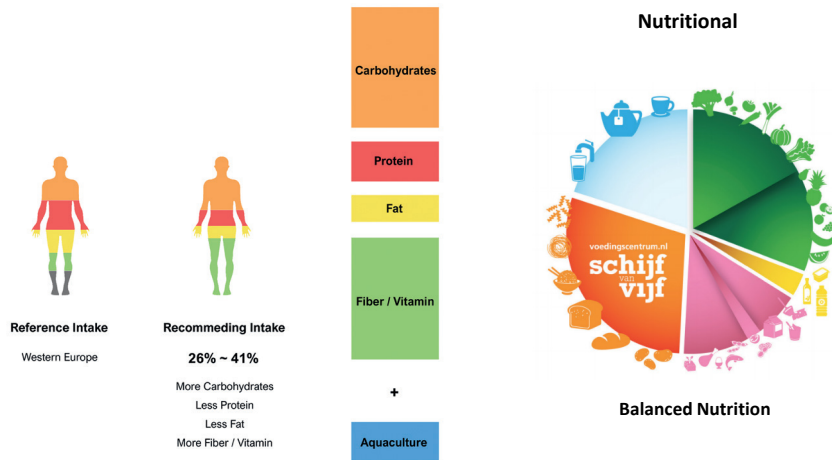# Integration with Urban Context

1. Following the Master Plan

2. Linking Two Differnet Zones

3. Making Introvert Destinations

Reference Intake
Western Europe

Recommeding Intake
26% ~ 41%
More Carbohydrates
Less Protein
Less Fat
More Fiber / Vitamin

Carbohydrates

Protein

Fat

Fiber / Vitamin

+

Aquaculture

Nutritional

Balanced Nutrition

Fiber / Vitamin Producing Zone
Carbohydrate Producing Zone
Fungi Producing Zone
Fungi Producing Zone
Protein & Fat Producing Zone
Protein & Fat Producing Zone
Protein & Fat Producing Zone
Protein & Fat Producing Zone
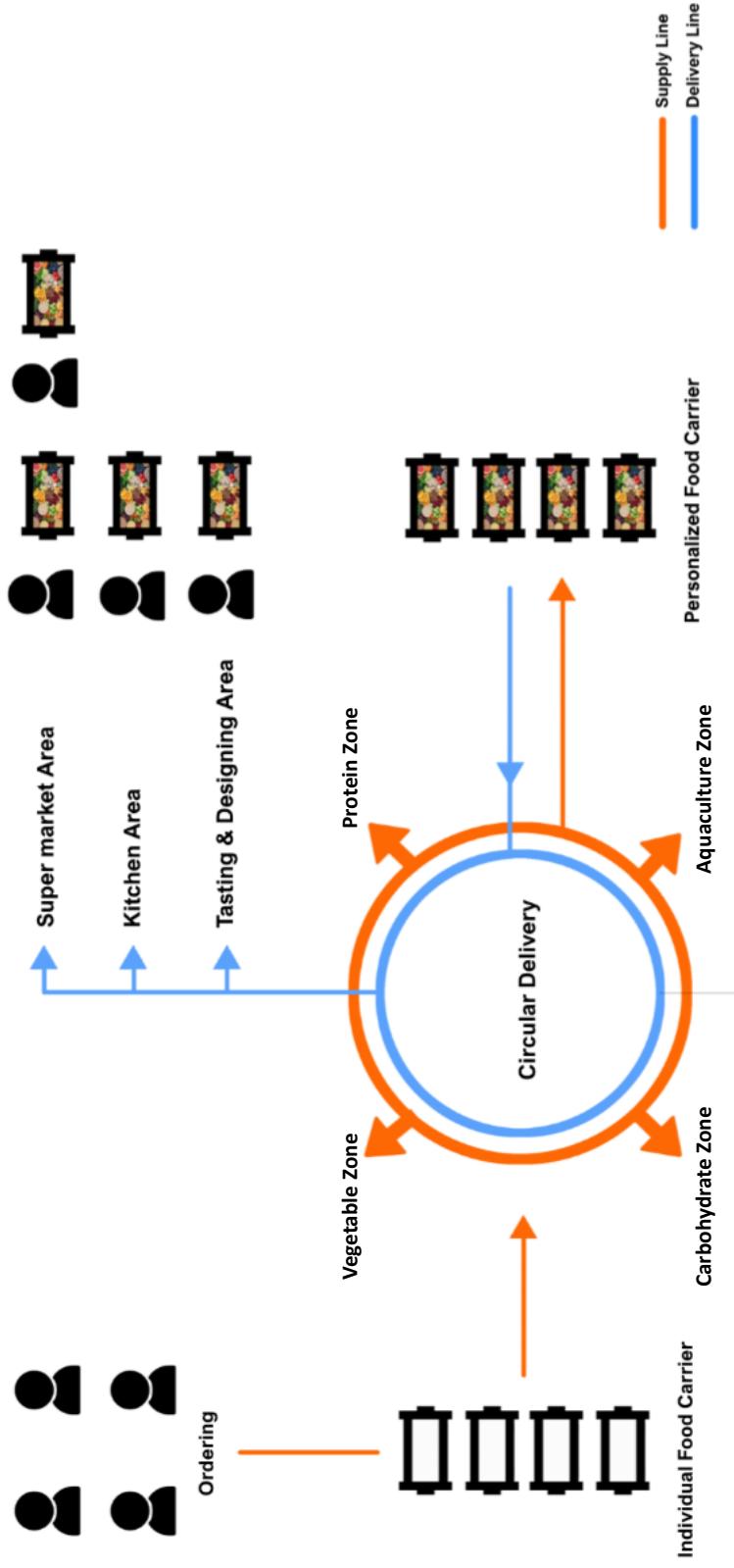Fish Zone
Purchasing Area
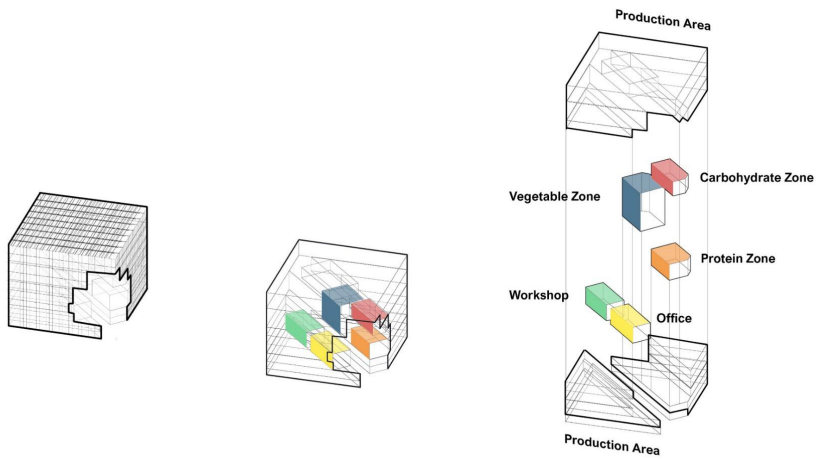Purchasing Area

Architecture and Public Health

There has been no building for food production and selling together but the new trend will make it possible in urban context. The notion on foods will become about nutrition value and based on that, building should be able to symbolize and encourage public's balanced diets.

While encouraging public health by producing adequate amounts of nutritions, it will provide mechnical aesthetic such as beauty from engine or machanical objects. It is showing shapes as it should be and make harmony between different elements in terms of systems.

Typical System Diagram

Ordering

Super market Area

Kitchen Area

Tasting & Designing Area

Protein Zone

Vegetable Zone

Circular Delivery

Aquaculture Zone

Carbohydrate Zone

Individual Food Carrier

Personalized Food Carrier

Supply Line

Delivery Line

Perspective and Space Organization

Using production areas as envelop, facade mateiral gives opportunity to organize introvert food experience zone where people can experience contrast atmosphere to outdoor vast green open space meanwhile the project does not lose constant interaction with urban context with urban center passage,
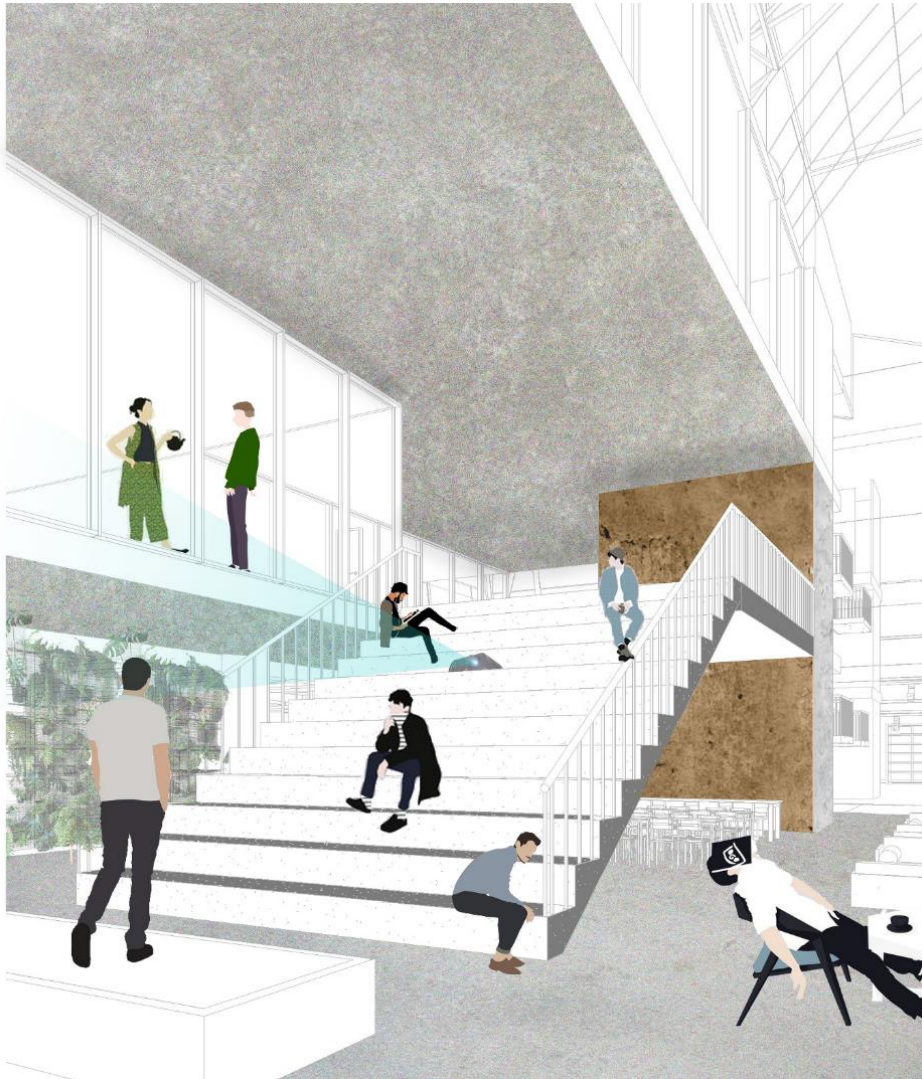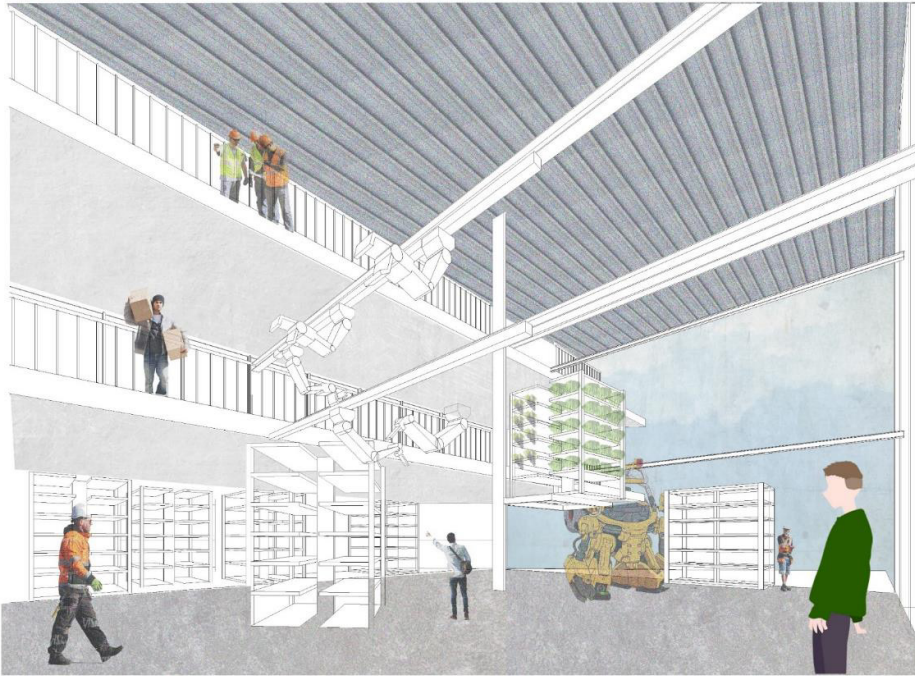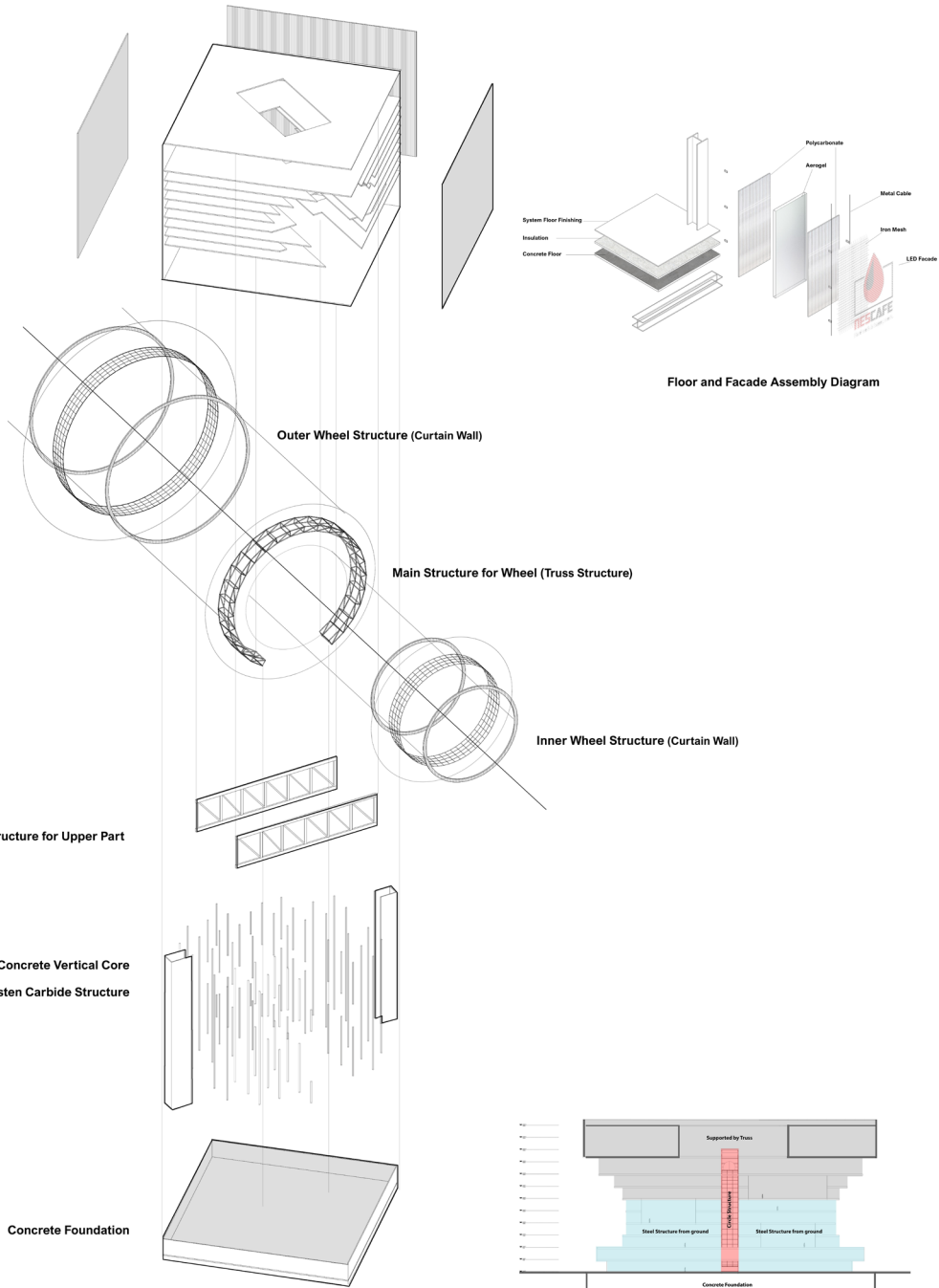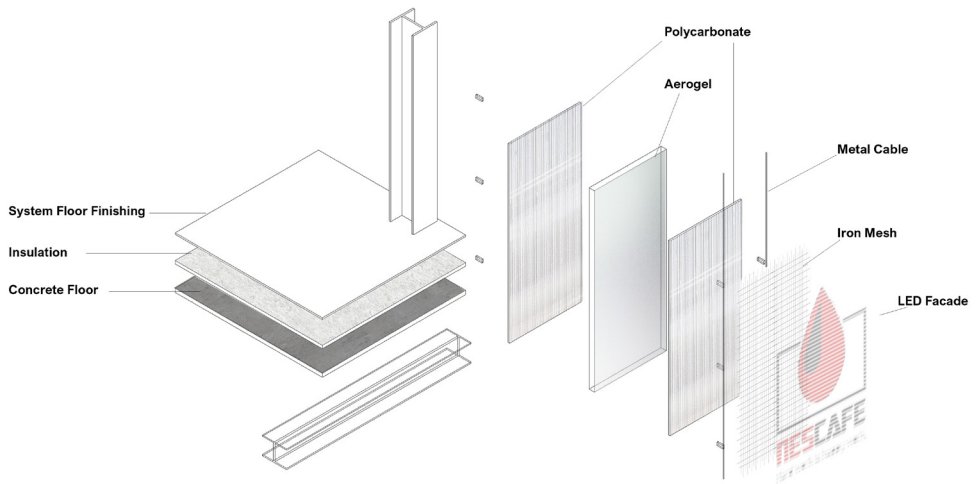
Structure Diagram

Secondary Structure Scheme

4718860 Joon Hyung Park

Polycarbonate

Aerogel

Metal Cable

System Floor Finishing

Iron Mesh

Insulation

Concrete Floor

LED Facade

Floor and Facade Assembly Diagram

Outer Wheel Structure (Curtain Wall)

Main Structure for Wheel (Truss Structure)

Inner Wheel Structure (Curtain Wall)

Truss Structure for Upper Part

Concrete Vertical Core

Tungsten Carbide Structure

Concrete Foundation

Supported by Truss

Steel Structure from ground

Steel Structure from ground

Concrete Foundation

Primary Structure Scheme

Facade Element

System Floor Finishing
Insulation
Concrete Floor

Polycarbonate
Aerogel
Metal Cable
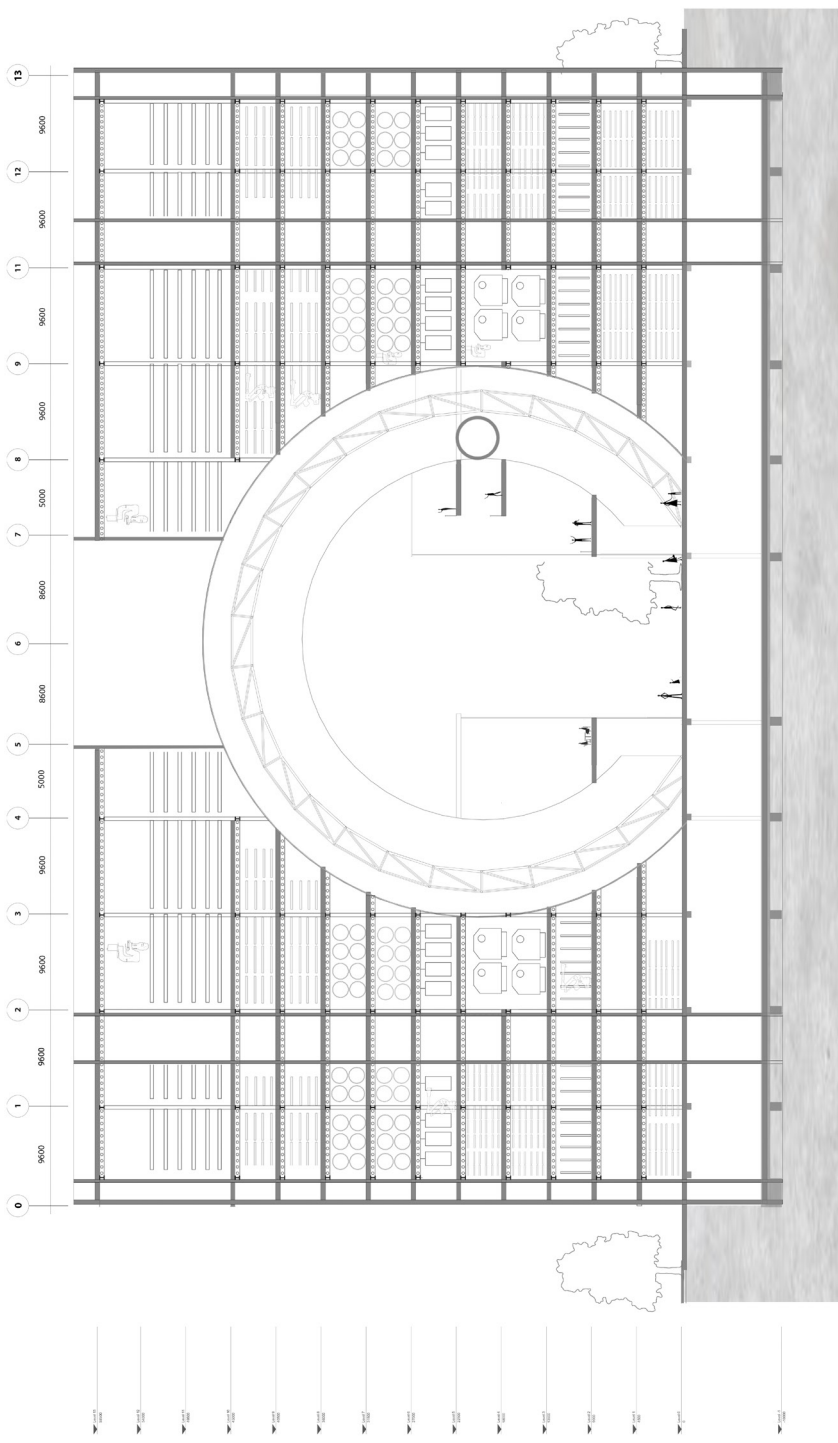Iron Mesh
LED Facade

Source: British Nutrition Foundation (BNF)

Source: Washington Apple Commision

Source: www.cdc.gov/niosh/updates/upd-11-04-15b.html, National Institute for Occupational Safety and Health (NIOSH)

Source: Economic Structure and Agriculture Productivity(2012)

Source: Projection of UN population division(2015)

Source: UN, food and agriculture organization(FAO)

Source: www.unwater.org, FAO, Agricultrue trends and challenges

Source: www.cuesa.org, CUESA (Center for Urban Education about Sustainable Agriculture)

Source: FAO, World Agriculture towards 2030/2050

Source: www.internetgeography.com
FAO, Damage&Losses from climate-related disasters in agricultural sectors

Source: Sir George Clausen, R.A., R.W.S. (1852-1944), Hoeing Turnips, https://www.kickstarter

Source: Data center of Carastro&Associate, Vertical farm in Kameoka, Japan

.com/projects/992471915/digital-farm-lab