FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND

Master Thesis Presentation
Francis Liesting
1. Fascination
2. Food Tomorrow
3. Location and Program
4. Food System and Building
5. Design and Integration
1. Fascination
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW

A NEW COOPERATION BETWEEN CITY AND HINTERLAND
Food Tomorrow
Relation between City and Hinterland
Chronic Micronutrient Deficiencies: Zinc, Iron, Vitamin A, Iodine, Selenium
Growth / Mental Development, Disease, Disability

Undernourished (C,M,AM)
36 Million deaths / yr
Macro & Micronutrient Deficiencies: Carbohydrates, Protein, Fat (Energy/Protein Maln) 1000 day window Growth / Mental Development, Disease, Disability

Undernourished (C,M,AM)
36 Million deaths / yr
Macro & Micronutrient Deficiencies: Carbohydrates, Protein, Fat (Energy/Protein Maln) 1000 day window Growth / Mental Development, Disease, Disability

Chronic Micronutrient Deficiencies: Zinc, Iron, Vitamin A, Iodine, Selenium
Growth / Mental Development, Disease, Disability

29.2 Million deaths / yr
Micronutrient Deficiencies: Iron & Zinc
Diabetes, Heart Diseases, Hypertension
Diet Related Health Burden
Rapid urbanisation
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
GLOBAL FOOD PRODUCTION MUST INCREASE **70%** BY 2050 TO MEET OUR NEEDS

[Source: FAO Statistics Division 2009]
What happens when an infinite-growth economy runs into a finite planet?

The availability of cultivatable land is limited and expected to decrease up to 20% by 2050.

[Source: Sheeran 2009]
YIELDS WILL BE SHORT IN DEMAND UP TO 25% IN 2050

[Source: Sheeran 2009]

FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
Food security?
It might seem alarmist, even tasteless, to mention food security in the West when we appear to be enjoying the greatest era of abundance in history.
It might seem alarmist, even tasteless, to mention food security in the West when we appear to be enjoying the greatest era of abundance in history.

Food security is something we tend to associate with the developing world, and considering how many people worldwide face starvation every day, worrying about our own food supply seems almost obscene.
Quote Carolyn Steel

It might seem alarmist, even tasteless, to mention food security in the West
when we appear to be enjoying the greatest era of abundance in history.

Food security is something we tend to associate with the developing world,
and considering how many people worldwide face starvation every day,
worrying about our own food supply seems almost obscene.

Yet the two phenomena are directly connected.
Both are the products of a food industry gone mad,
that bears any relation to the people it evolved to serve.
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
This map illustrates the origins of the fresh fruits and vegetables available in an Albert Heijn Supermarket in the center of Rotterdam on November 22, 2010.

All imported produce is subject to import tariffs, which add to the final cost consumers pay. Additionally, the “food miles” and embedded energetic costs of transport can be high, particularly if crops are shipped by air freight.
Governance of Value Chains

Farmers: 3,200,000
Suppliers: 160,000
Semi-Manufacturers: 80,000
Manufacturers: 8,600
Buying Desks: 110
Supermarkets: 600
Outlets: 170,000
Customers: 89,000,000
Consumers: 160,000,000

[Source: Griekvink 2003]
Distribution of Value

- 4% workers
- 20% growers
- 23% transport (farm to European port)
- 12% EU tariff
- 12% ripener/distributor
- 29% retailer

(Source: Pimbert (iied) 2008, Banana link 2010)
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND

Resources

Waste & Losses

Agricultural Production

Processing

Retailing

Consumption

Biological Response

TRANSPORT

TRANSPORT

TRANSPORT

Middlemen

25%

75%

Agricultural Production

Processing

Retailing

Consumption

Biological Response

PRODUCTION COUNTRYSIDE

PRODUCTION CITY
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND

PRODUCTION COUNTRYSIDE

PRODUCTION CITY

Resources

Waste & Losses

Agricultural Production

Processing

Retailing

Consumption

Biological Response

TRANSPORT

TRANSPORT

TRANSPORT

25%

75%

25%

75%

Agricultural Production

Processing

Retailing

Consumption

Biological Response

Resources

Processing

Consumption

Retailing

Waste

Energy

Middlemen

Produced & Consumed

Transported & Distributed

Processed & Distributed

Consumed & Distributed
3. Location and Program
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
A NEW COOPERATION BETWEEN CITY AND HINTERLAND

PROGRAM

200 FAMILIES

HYDROPONICS

Aquaponics

AEROPONICS

Fish

Herbs

Legumes

Legumes (Feed)

Beverages

Fruit

Vegetables

Herbs

Legumes

Legumes (Feed)

Beverages

Potatoes

4.038 m²

3.313 m³

2600 m²

10,000 m²
HYDROPONICS
HYRDROponics
HYRDROPONICS
AQUAPONICS
AQUAPONICS

Feed

Faeces

FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
AQUAPONICS

Feed

Faeces

Bacteria

nutrient rich water
AQUAPONICS

Feed → Purified water

Faeces → Bacteria → nutrient rich water

FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
AQUAPONICS

Feed

Purified water

Faeces

Bacteria

nutrient rich water

FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
AQUAPONICS

Feed → Purified water → Nutrient rich water

Faeces → Bacteria → Nutrient rich water
Why these techniques?

Compared to conventional farming:

- 90% less fresh water [Source: Grant 2012]
- up to 60% less nutrients (fertilizer) needed [Source: Nasa 2006]
- Shorter turnover times
- Higher yields
- Can be grown anywhere
## Why these techniques?

### Example of Tomatoes

[Source: Nasa 2006]

<table>
<thead>
<tr>
<th></th>
<th>Conventional farming</th>
<th>Aeroponics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28 days</td>
<td>10 days</td>
</tr>
<tr>
<td><strong>Transfer to grow area</strong></td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td><strong>Crop cycles</strong></td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>
Foodprint

<table>
<thead>
<tr>
<th>Conventional farming</th>
<th>The Urban Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.460m²</td>
<td>38m²</td>
</tr>
</tbody>
</table>
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
Composition and Division of Program
4. Food System and Building
WATER

Waterbalans

11% Extern drinkwater
10% Zwartwater
90% Grijswater
6% Externe biomassa
6% Digestaat
100% Effluent uit bioreactor

Drinkwateropslag
89% Condens
5% Geconcentreerd afvoerwater
6% Groente

Kassen

Vergister

Bioreactor

Gietwateropslag
Warmtesysteem
CO₂-neutraal wonen

Koelen en verwarmen
Warmtewisselaar
Koude of warme lucht
Koud of warm water van en naar aquifer

Collectief warmteregelsysteem
Bronmanagementsysteem
Laag calorisch verwarmingssysteem (ZLTV)

8° Thermische massa
(in aquifer)

18°

25°

FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND

- Solar Panels (3,160 m²)
- Solar Collector (3,160 m²)
- Rainwater Collection 3,942 m³ per year
- Rainwater Collection 12,860 m³ per year
- Biomass digester (DESAR CONCEPT)
- Collection of grey and blackwater plus kitchen waste
- Vacuum toilets
- Excess warmth greenhouse
- Storage of cold and heat
- Solar energy
- Water
- Fertilizer
- Biogas / CO2
- Food
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW

A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND
FOOD AND THE CITY OF TOMORROW
A NEW COOPERATION BETWEEN CITY AND HINTERLAND