Master of Science in Architectural Engineering

FEEDING THE CITY

- Urban Farming for Garak Market in Seoul -

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Seoul National University

The Graduate School

Department of Architecture & Architectural Engineering

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- Urban Farming for Garak Market in Seoul -

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Abstract

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Food plays a key role in our daily life. It has a powerful influence on regional and cultural development patterns. The urban-rural relationship is intrinsic to cultural development. The city relies on the countryside to produce food and sustain the urban infrastructure. Historically, rural and agricultural areas, have played a major role in feeding cities.

The City is continually expanding and has become our main habitat. This is primarily due to the impacts of intensified globalization. Approximately half of the world's population resides in cities. Urbanization has rapidly changed the face of the earth and the state of human life. By 2050, it's estimated that the urban population will double. This will create an exponential increase in the amount of food consumption.

Seoul is a prime example of globalization. After the 1960's there was a drastic increase in Seoul's population. This was a result of changes made in the existing economic and social infrastructures. However, the rural areas in Korea did not develop at the same rate. There is a large gap between the supply and demand of food production and consumption. Rapid industrialization and urbanization patterns have strained arable land and as a result the farming population is in decline. The self-sufficiency rate of grain is now approximately 20 percent. Consequently, South

Korea has become more sensitive to the world food market due to its increasing dependence on imported foods. It is impossible to maintain self-sufficiency, in relation to food production and consumption patterns. At this rate, food security will become unstable and will have an increasing effect on life, both physically and mentally.

This thesis aims to propose an architectural design solution that will address the disconnection between food and urban development patterns. This proposal does not focus on economic, social, or political processes, but attempts to make a contribution in preparation for feeding the city of Seoul in a sustainable manner. Recently, some alternatives are being considered for stable food supply. These proposals deal with conserving and promoting agriculture policy, overseas agricultural base development, R&D, urban farming, etc. One of these alternatives, urban farming, was considered as a way to supply food to the city, introducing agriculture into urban areas in a sustainable way under the scope of architectural design.

Garak Market was considered as an experimental design facility for urban farming. It is a primary source for residents to access food in the city, however, most of the food is produced in rural areas or is imported from abroad. Garak Market is the biggest wholesale market in Seoul, and is the epicenter of food distribution. This design experiment, proposes adding an urban farming function to the existing market. It will allow the market to function as a food production facility as well as a food distribution facility. Furthermore, this proposal will serve as a starting point in solving the decline in self-sufficiency, more particularly food security and reconnecting urban life to food in South Korea.

Keywords: Food, Self-sufficient city, Market, Urban farming

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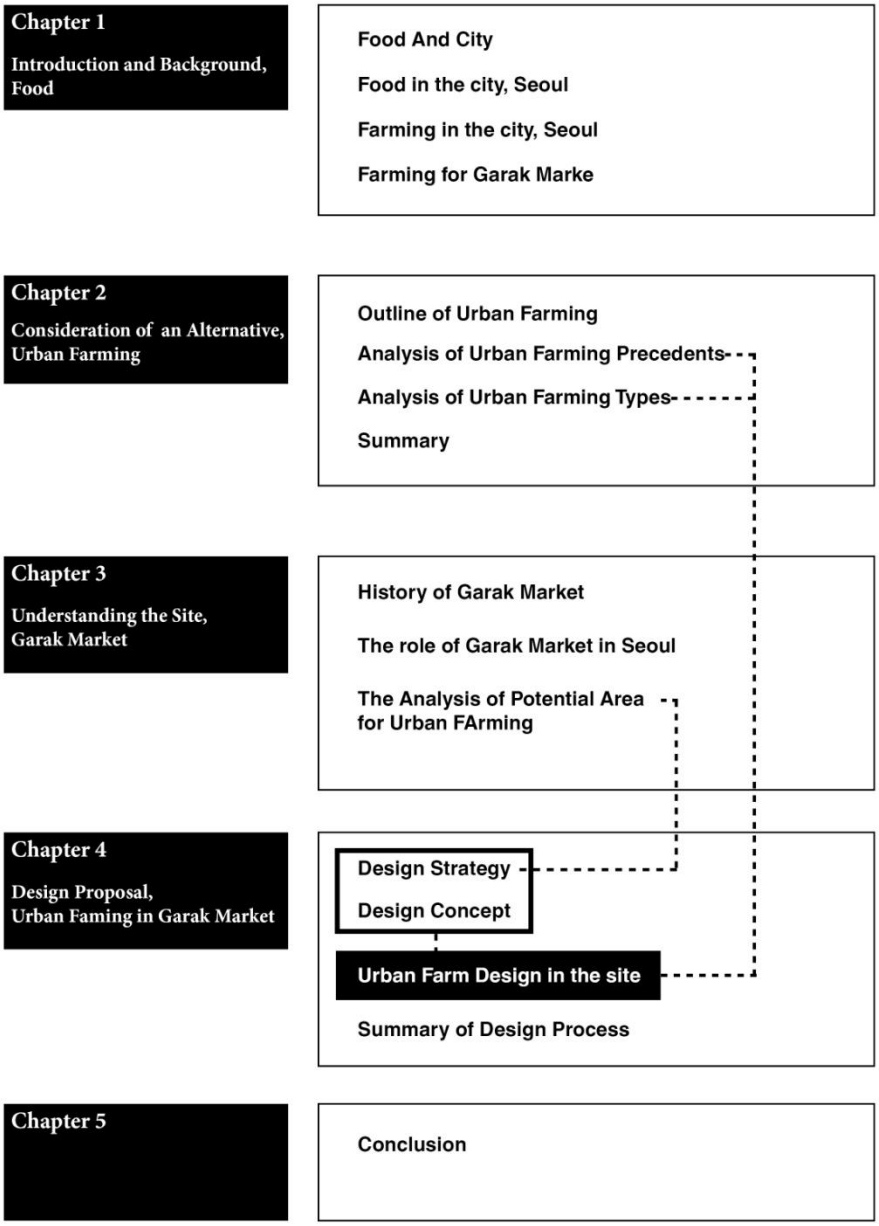
Contents

List of Tables

List of Tables

Structure


Chapter 1
Introduction and Background, Food
Food And City
Food in the city, Seoul
Farming in the city, Seoul
Farming for Garak Marke
Chapter 2
Consideration of an Alternative, Urban Farming
Outline of Urban Farming
Analysis of Urban Farming Precedents
Analysis of Urban Farming Types
Summary
Chapter 3
Understanding the Site, Garak Market
History of Garak Market
The role of Garak Market in Seoul
The Analysis of Potential Area for Urban FArming
Chapter 4
Design Proposal, Urban Faming in Garak Market
Design Strategy
Design Concept
Urban Farm Design in the site
Summary of Design Process
Chapter 5
Conclusion

Chapter 1. Introduction and Background

1.1 Food and City

1.1.1 The Food Relationship between Urban Settlement and their Food Source

Food has had a significant impact on human existence since the process of feeding oneself was the primary job for the great part of human history. Food has also played an important role in the development of urban area and its settlement.

Historically, The advent of farming encouraged human beings to evolve from hunter-gatherer to farmer and to settle and cultivate together in the vicinity of their settlement. The expansion of farming culture changed civilization. Farming made denser human populations possible, thereby supporting city development.[1] In early times of city development, cities raised food sources within their settlements. Although rural area played a greater role in food supply as cities grew larger, urban area was still closely related with their food.

However, since the growth of modern industry, cities have been drastically expanding due to the impacts of fast urbanization and agriculture has become more industrialized. Those circumstances have distanced people who lives in urban area from their food source.

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[1] Bairoch, Paul,Cities and Economic Development: From the Dawn of History to the Present, Chicago: University of Chicago Press, 1988, p3-4

The current rapid rate of change in the relationship between our life and food are unprecedented in history. Carolyn Steel says in her book, Hungry city, *"The origins of agriculture are obscure, but what can be said with some degree of certainty is that before farming came along, there were no cities."*[2] That is to say, farming and farm land are a source of urban existence and the urban and farm areas are inextricably linked.

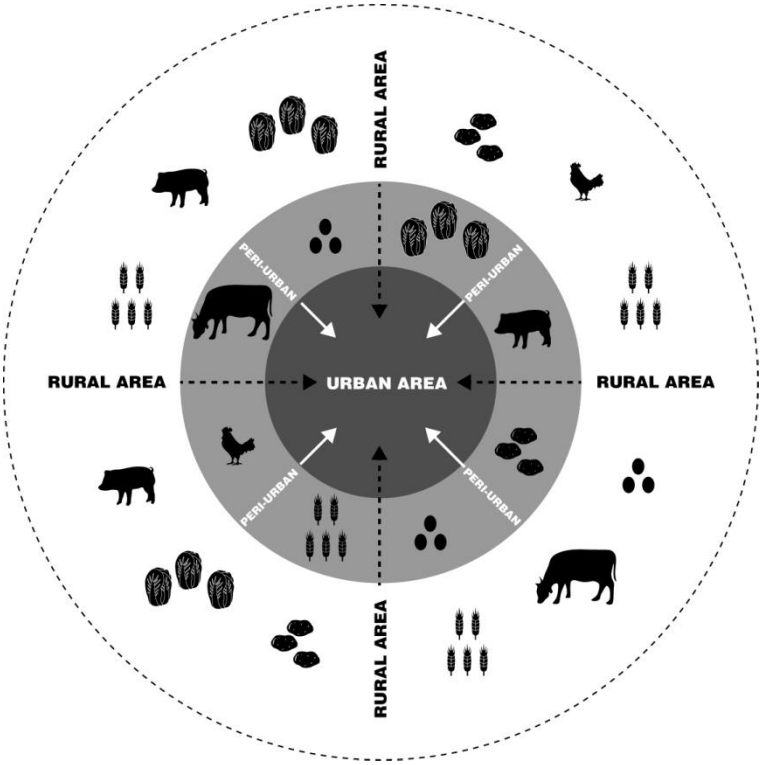

Fig. 1-1. Food Relationship between Rural area and Urban area

[2] Carolyn Steel, "Hungry City : How Food Shapes Our Lives", London : Vintage Books, 2009, p 10

1.1.2 Emerging Food Issues in Current Context

There are diverse issues relating to food production, distribution and consumption based on industrialized food system. Even though the current food production and distribution system does deliver abundant food to some countries at an affordable price, it has caused serious problems of health, economy, environment, community and culture. Such issues being related with food as below demonstrate that the current food context in our life is not sustainable.

(1) Food Security

The FAO[3] defines food security as follows: "Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." Since many countries experienced food crisis in 1973 and 2008, food security became the conversation topic. International grain price, not only for rice, but wheat, bean, corn, and other grains, has risen sharply and the situation of international grain supply is unstable as the demand of grain is exceeding supply. This issue is related with self-sufficiency which refers to the capacity to produce most or all the food in regional or national level enough to meet the demand. Food-insecure countries normally have little food production ability due to a shrinking agricultural sector or poor environment to produce food. These countries have a tendency to depend on food

[3] FAO stands for the Food and Agriculture Organization of the United Nations.

import and are vulnerable to the unstable world food market. In these days, the climate change makes stable grain production difficult. The demand of grain for bio-fuel and stock feed is highly increasing and even some emerging markets, like in China and India, have joined the demand and consumption of grain, thus this situation is expected to worsen.

(2) Food Safety

Food safety relates with the illness caused by food. The concerns of food safety include the origins of food, food hygiene, food additives and pesticide residues, as well as policies on biotechnology. For example, the chemically dependent farming techniques and the application of genetic engineering to food production by industrial agriculture have an ecological side effects and pose a health threat.[4]

(3)Food Mile

Food miles is a term which refers to the distance that food is transported from the time of its production until it reaches the consumer. This means that the more the distance is increase, the more fuels and the storage time needs. For this reason, food miles have a bad influence on the environment, such as global warming. An increase in food miles is due to the globalization of trade; the focus of food supply bases into fewer, larger districts; drastic changes in delivery patterns; the increase in processed and packaged foods.[5]

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[4] André Viljoen, Katrin Bohn and Joe Howe, 'More Food with Less Space: Why Bother?', in André Viljoen (ed.),CPULs, Continuous Productive Urban Landscapes, Architectural Press, 2005, p 21

[5] Christopher L. Weber, and H. Scott Matthews, ' Food-Miles and the Relative Climate Impacts of Food Choices

(4) Low-quality Food : Fast Food / Junk Food

Fast food and junk food are regarded as low-quality food patterns. Fast food is the term for food that can be prepared and served very quickly, and Junk food is the term that has little nutritional value, and is high in fat, sugar, salt, and calories. These food patterns are under criticism for their negative health effects like obesity and the cultural degradation of eating patterns away from traditional foods.

(5) Food waste

Food waste is food material that is discarded or inedible. There are numerous causes of wasted food, and they occur at all stages of food production, distribution and consumption. The significant problem is that amounts of food, still edible, are trashed away when it doesn't meet standards for quality and appearance or just when it has passed its best-before date. Tristram Stuart says in his book, Waste, *"40 to 60% of all fish caught in Europe are discarded because they are the wrong size, species, or because of the ill-governed European quota system and an estimated 20 to 40% of UK fruit and vegetables rejected even before they reach the shops mostly because they do not match the supermarkets' excessively strict cosmetic standards."* [6] Surplus production, producing more than what is actually required, often happens and food is simply disposed. This food waste resulted from the industrial food supply system to meet the global marketplace demands.

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in the United States', Environ. Sci. Technol., 2008

[6] Tristram Stuart, "Waste : uncovering the global food scandal", New York ; London : W.W. Norton & Co, 2009

1.2 Food in the city, Seoul

1.2.1 Urbanization in Korea

The Korean economy has grown rapidly in a very short time. In the past few decades, the Korean Government has actively used urbanization strategies in its high economic growth policy, and a large-scale influx of rural populations into urban areas has accelerated the urbanization process.

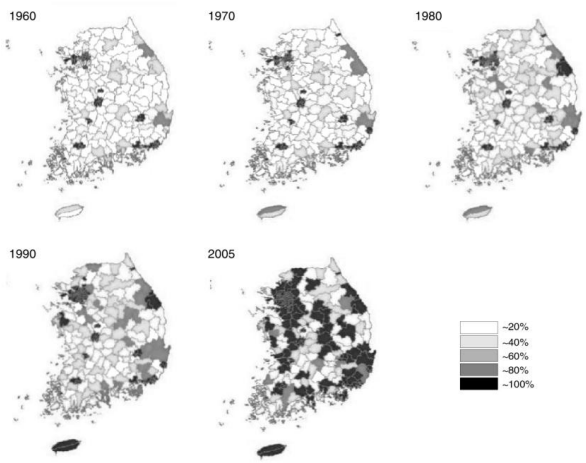

Fig. 1-2. Change in Urbanization Rate of Cities and Counties in South Korea
<Source: Urbanization and Urban Policies in Korea by KRIHS with World Bank>

After the Korean War, the government put higher priority in the rehabilitation of the industrial sector. This development policy began the imbalance between rural and urban area. In 1961, the Industry-lead approach was made under the high economic growth policy with an export-oriented industrialization strategy.

This policy led to the structural change of economy from an agrarian country to an industrial country, and the full-scale drift of farmers from rural areas toward the cities.[7] The ratio of urban population extremely increased from 50 per cent in 1970 to 91 per cent in 2012.

Among the cities in South Korea, Seoul is a prime example of global industrialization and urbanization. Just before the high economic growth policy was started, Seoul was half the size of its present size and the population was one-fourth of the present.[8] Since that time, the population and size of Seoul has greatly increased and become a giant metropolis. In 2012, Seoul had 10.1 million people, approximately 21% of the total population of South Korea

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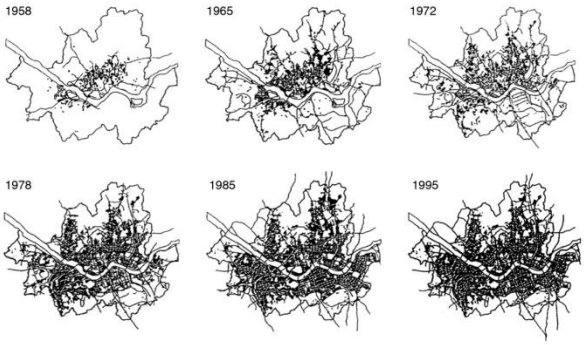

Fig. 1-3. Expansion of Built-up Area in Seoul
<Source: The Seoul Urban Master planning toward 2011>

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7 Sung-hwan Ban, Pal-yong Moon, Dwight H. Perkins, "Studies in the modernization of the Republic of Korea: 1945-1975", The Korea Development Institute, 1983

8 Hae Un Rii, Jae Seob Ahn, " Globalization and Urban Transition : Urbanization and its Impact on Seoul, Korea", Forum on Urbanizing World and UN Human Habitat II, 2002, p 47-52

1.2.2 Shrinking Rural Area in Korea

As result of Korean industrialization and urbanization, agricultural area has continued to shrink, not staying in line with the increasing urban scale. While the nation's population increased greatly from 25 million to 31.4 million at the rate of 25.6 per cent, farming population grew from 14.2 million to a maximum of 14.4 million in 1970 at a rate of increase of 1.4 per cent. These figures indicate that a huge volume of the population moved into urban areas under the accelerating economic growth, and the growth of the farm population clearly lagged behind the nation's population growth. The huge gap between rural area and urban area continued and, in 2010, the percentage of farmers was only approximately 7 per cent compared to the total population.

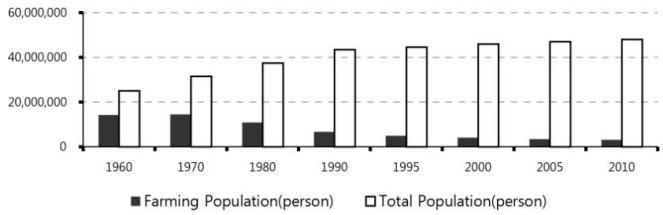

Table. 1-1. Comparison Farming and Total population in Korea
<Source : Adapted from Korean Statistical Information Service (KOSIS), 2010>

Even worse, Among the farming population, the young and middle age classes who are available manpower to farm, drastically decreased compared to the old age class. This means that there are fewer manpower who are able to engage in farming. The arable land also kept decreasing. More than one-fourth of farmland

has disappeared within 40 years. These changes mean that the agricultural sector in Korea has shrunk and been inadequate to meet a large demand of food sources in urban area.

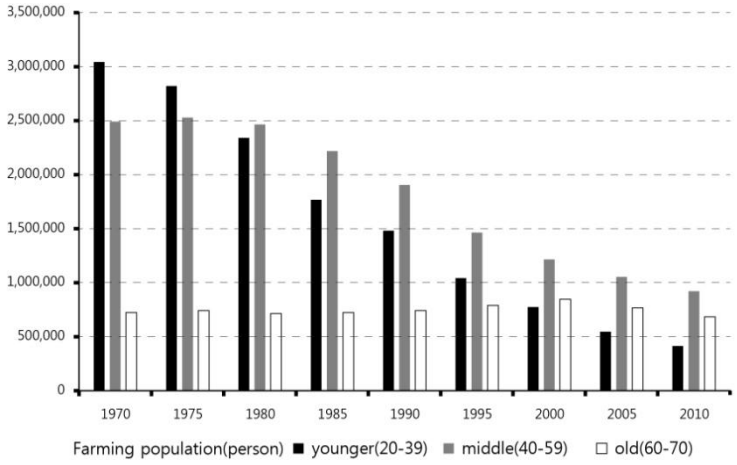

Table. 1-2. Comparison Farming generation in Korea
<Source : Adapted from Korean Statistical Information Service (KOSIS), 2010>

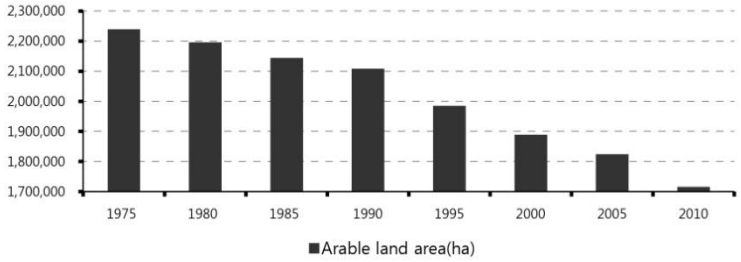

Table. 1-3. Changes of Arable land in Korea
<Source : Adapted from Korean Statistical Information Service (KOSIS), 2010>

Furthermore, with the recent Free Trade Agreement such as the U.S.-South Korea FTA and EU-South Korea FTA, South Korean has become a greater subject of the global food system.[9]

1.2.3 Current Food Source in Urban Area

In terms of self-sufficiency, South Korea is increasingly dependent on the importing of food source, rather than their *foodshed*[10] due to shrinking agricultural sector. In particular, the grain self-sufficiency rate, which was over 70 per cent during the mid 1970s, is now approximately 23 per cent including feed grains. The sufficiency-rate of food grains were approximately 45 per cent in 2012 and rice takes up most of this figure.

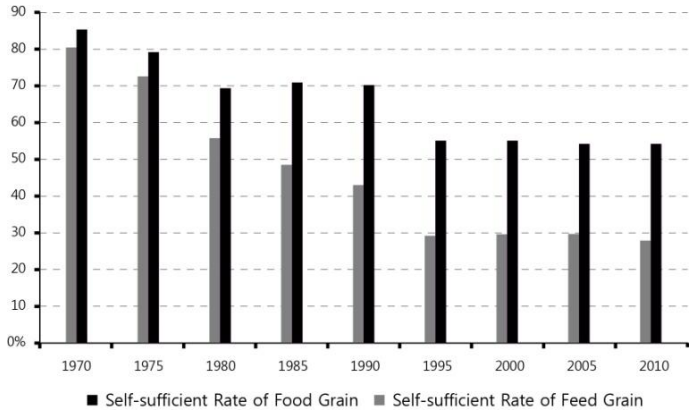

Table. 1-4. Changes of Grain Self-Sufficient rate in South Korea
<Source : Adapted from Green Growth Indicators, 2012>

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9 Byeong-Seon Yoon, Won-Kyu Song and Hae-jin Lee, "The Struggle for Food Sovereignty in South Korea", Monthly Review, May 2013, Monthly Review, 21 June 2013 : vol.65-1

10 The term is used to describe a region of food flows, from the area where it is produced, to the place where it is consumed.

Without rice, The sufficiency-rate of other grains, such as wheat, bean and corn, is seriously low. Most of these grains come from abroad. Recently, even rice, the staple food of Korea, has been imported, and the rice self-sufficiency rate remained approximately 84 per cent during the past 2 years. Although it was responsible for bad weather, the conversion of rice paddy for cash crop also affected the drop of domestic production of rice.[11]

Then, the questions can be raised "where do we get food sources from?"or "what food sources do we eat?" The following diagram shows the self-sufficiency rate and the major importing food sources, in weight standard. Even though some food sources are mainly produced in our *foodshed*, their self-sufficiency rate are also decreasing. More concern is that staple food like, rice and cabbage for *kimchi*, are high on the list. It shows that food security is worsening, and that urban area, especially in the biggest city in Korea, is disconnecting from their food sources.

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[11] Tae-Gyun Park, , "Rice self-sufficiency rate of 80% for three consecutive years, food security alarm", Joong Ang Daily News, 9th Nov. 2013, retrieved 10th Nov. 2013 <http://article.joins.com/news/article>

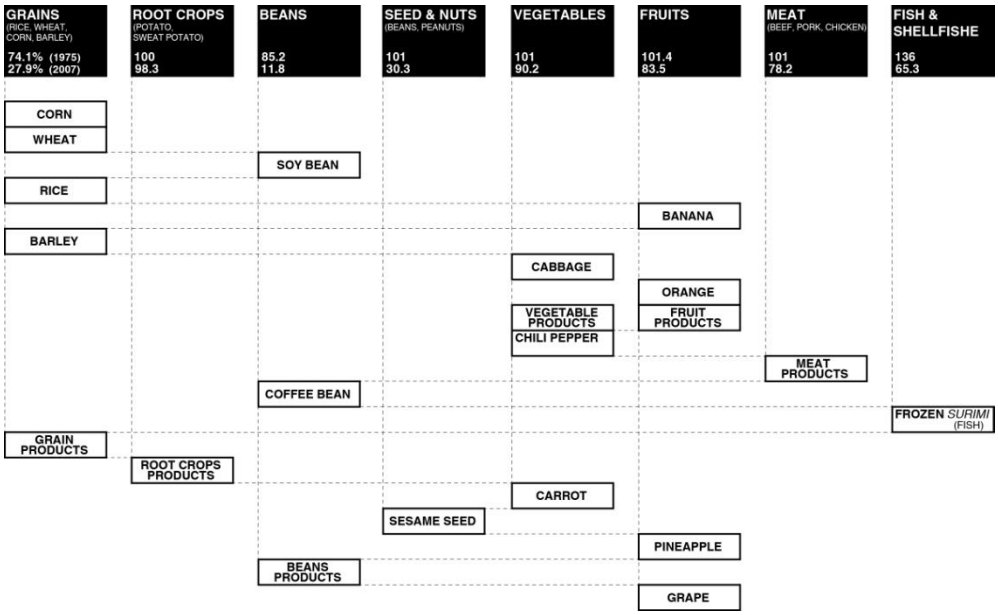

Fig. 1-4. Self-Sufficiency rate and Major Importing Food Sources
<Source : Adapted from Korean Rural Economic Institute(KREI) /
Ministry of Food and Drug Safety(KFDS)>

1.2.4 Prediction of Food Situation in Seoul

Now, the agricultural sector in Korea seriously shrank and the food self-sufficiency rate is critically low. As a result, it is quite difficult to feed the cities, especially Seoul, with its own food sources. Even if Korea, increasing food source from overseas countries, is not an effective and sustainable way because it will make its food situation sensitive to the unstable world food market, and its people more disconnected from their food. By 2050, it is estimated that twice the number of people will be living in cities, therefore there will be twice as much as food consumed. [12] Due to this, Korea will face a problem to feed its cities.

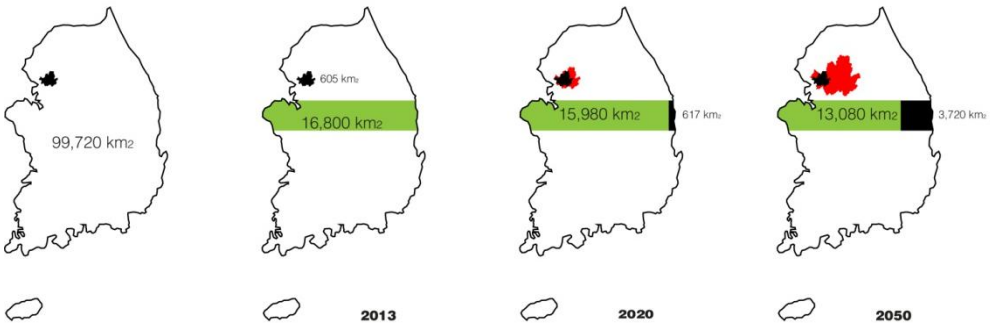

Fig. 1-5. Outlook of Arable land in South Korea

For this reason, this thesis aims to propose the architectural and urban design solution for overcoming the issue above. Even though this proposal is not a

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[12] Carolyn Steel, " How Food Shapes Our Lives", London : Vintage Books, 2009, < http://www.ted.com/talks/carolyn_steel_how_food_shapes_our_cities.html in April 2013

macro solution with economic, social and political ways, it will make a contribution to work through the unstable food provision and reconnect urban settlements to their food with an architectural alternative, farming in a city.

1.3 Farming in the city, Seoul

There are some alternatives being considered for food provision, such as the conserving and promoting of agriculture policy, overseas agricultural base development, R&D, urban farming, etc. One of these alternatives, urban farming is an alternative within the architectural and urban design scope.

Urban Farming is not only for producing food in urban settlements for self-sufficiency, but also to connect people who live in urban area with their local and regional food systems, and to promote healthier and more sustainable lifestyles. Recently, there have been various attempts to grow food in urban area all over the world. These attempts exploit urban space, for example, vacant lots and building structure with diverse and site-specific urban farming types.

In this design experiment, the capital and most urbanized city in Korea, Seoul, will be dealt with as the starting point for expanding farming in cities. Rather than dealing with the whole area of Seoul, it will select the specific site for urban farming to be integrated into the city infrastructure of its food system network.

1.4 Farming for Garak Market in Seoul

Before rapid urbanization and industrialization in South Korea, there was a close rural-urban relation in the traditional market. After this, there is a great distance between them, due to industrialized agriculture and modernized markets. Currently, food consumption and production are physically and mentally separated in markets, as production is completely in rural areas, while consumption is mostly in urban areas. In this context, this thesis deals with the current modernized markets as a potential design experiment facility.

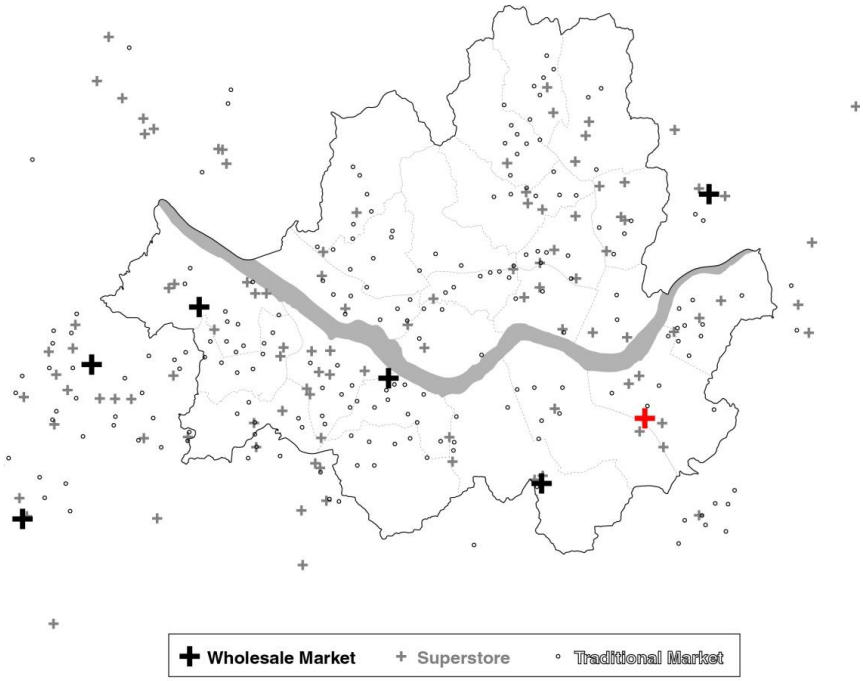

Fig. 1-6. Markets in the City, Seoul

There are a lot of markets in Seoul, such as quasi-traditional market, commercial superstore, wholesale market, etc. One of them, Garak Market is chosen as a design experiment site. This market is the biggest whole market in South Korea, and has been the epicenter of food provision for city dwellers in Seoul since it opened in 1984. However, it has just played a intermediate role for food source distribution. In this design experiment, by adding the urban farming function to Garak Market, it will not only be a food distributor, but also a place for food production, community and education as a social market. Furthermore, even if this experiment tends to focus on a fragment part of Seoul, rather than a more cohesive whole city, it will be a starting point to overcome the expected unstable food provision, and to connect city dwellers to their food.

Fig. 1-7. The Current View of Garak Market

Chapter 2. Urban Farming as an Alternative to feed a city

2.1 Outline of Urban Faming

Urban farming can refer to any agricultural activities, including crop cultivation, livestock, and aquaculture that take place in an urbanized area. It has existed since the begging of the city itself, and continues to serve many functions in today‘s cities. In recent years, there has been a tremendously increasing interest in urban farming. This has primarily been in response to concerns about food security, food safety, food mile, and low-quality food, and environmental degradation caused by current industrial agriculture. Farming in urban area can result in environmental, socio-cultural and economic benefits. It has woven itself into the fabric of what makes a city healthy.

There are primary environmental benefits from organic urban agriculture – preserving biodiversity, tackling waste and reducing the amount of energy used to produce and distribute food. Urban agriculture offers the potential to use organic waste for composting, thereby reducing the need for land-fill. Food is being transported further than ever before, often by air between countries on opposite sides of the world, while local crop varieties are replaced by a few commercial types popular with supermarkets. This pattern of growing ‘food miles’ is far from

sustainable, its by-product being increasing air pollution, notably of major greenhouse gases such as carbon dioxide, increasing road congestion and noise, and increasing stress. Urban food production that supplies food locally can be an alternative to overcome the unsustainable food system.

One of the strengths of urban food production is its capacity to make a practical and highly visible difference to people's quality of life. Urban farming do more than just provide city dwellers with locally produced fresh food. It can improve community health with providing recreational environment to coming and cultivating together with their neighbors, and revitalizing the home-cooked meal and changing their eating habits. Garmett told that 'food growing projects can act as a focus for the community to come together, generate a sense of 'can-do', and also help create a sense of local distinctiveness – a sense that each particular place, however ordinary, is unique and has value.' [13]

[13] Garnett. T, Growing Food in Cities. National Food Alliance, London, 1996

2.2 Precedents of Urban Faming to feed a city

2.2.1 Victory Gardens

Victory Gardens were fruit and vegetable gardens at private residences and public parks in the US, U.K, Canada and Germany during World War I and World War II to reduce the pressure of food supply to the public.

During World War I, food production had fallen dramatically, especially in Europe, where most of agricultural labor had gone to military service and remained farms devastated by the war. In March 1917, Charles Lathrop Pack organized the National War Garden Commission and launched the war garden campaign. This idea was that the supply of food could be greatly increased without the use of land and manpower already engaged in agriculture, and without the significant use of transportation facilities needed for the war effort. The campaign promoted the cultivation of available private and public lands, resulting in over five million gardens and foodstuff production exceeding $1.2 billion by the end of the war. During World War II, American home gardeners, through the federal government's Victory Garden program, supplied 40% of the nation's fresh produce, while simultaneously maintaining pre-war commodity production policies favoring large agricultural interests.[14]

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[14] Endres AB, Endres JM, "Homeland Security Planning: What Victory Gardens and Fidel Castro Can Teach Us in Preparing for Food Crises in the U.S.", p 7, University of Illinois, USA, 2009

Fig. 2-1. Victory Gardens in World War

2.2.2 Garden Cities of To-Morrow

Fast forward to the 19th century when a movement was begun for garden cities, a method of urban planning initiated in 1898 by Sir Ebenezer Howard in the United Kingdom. This proposal showed a decentralized city layout sprinkled with an abundance of public parks and pastoral open space that included orchards and was laid out in a radial pattern with wide boulevards and spatially differentiated land uses. It was a pastoral view of the city and the opposite of overcrowded and dirty cities of the time. The city is shown as a centralized site of 1,000 acres and surrounded by agricultural land of 5,000 acres to support a city population of 32,000. Within the centralized city, there would be parks small and large, orchards, small dairy farms, and other types of productive landscapes.[15]

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[15] April Philipsen, "Designing urban agriculture", p 8, New Jersey : John Wiley & Sons, 2013

Although his proposal was not well received due to its perception as an utopian socialist ideal, his overall goal for the garden city which was to bring nature back into the city is impressive. In his vision, farming was not only a means for sustaining the city's inhabitants; it generated an image of an orderly, self-sustaining, and socially cohesive community.[16] The garden city principles offer some insight into developing more sustainable communities and cities that incorporate farming into urban infrastructure for self-sufficiency and reconnection of food in urban area.

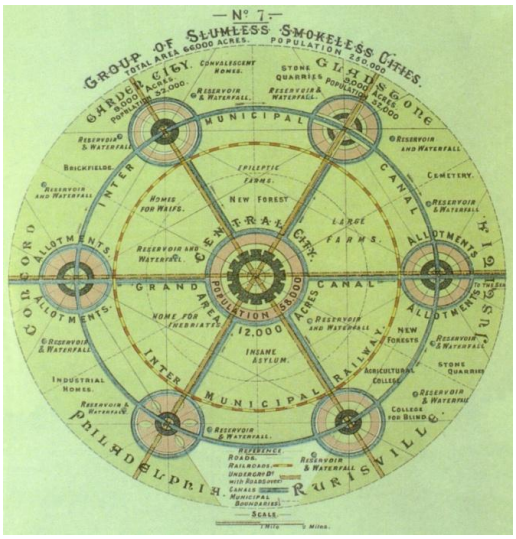

Fig. 2-2. A Plan of Garden City for the Self-Reliant City

2.2.2 Cuba, Habana

This Cuban case-study will be a broad analysis based on their urban

[16] Andraos Amale, Wood Dan, " Above the pavement-The Farm! : Architecture & Agriculture at P.F.1 edited by Amale Andraos & Dan Wood.", p 169, New York : Princeton Architectural Press , 2010

farming history. In spite of their unique background, this case can be a classic example as their urban farming is completely integrated with urban structures and dwellers.

1) The Beginning of Urban Agriculture in Cuba

Since the 1820s Cuban agriculture has been dominated by sugar production and in the 1860s Cuba became the world's largest sugar exporter. After the revolution in 1959, and its agrarian reforms, sugar continued to play a dominant role. Cuba's agriculture and food industries were heavily dependent on imports.

Cuba, the largest island of the Antilles and the only remaining Western socialist society, has experienced two absolutely extreme situations in the last two decades. On the one hand, it experienced the most intense economical crisis of its history after the collapse of the Soviet Union, their main trading partner; on the other, it suffered the severe strengthening of the US blockade. As a result of this combination, one of the most severely affected areas has been food supply: it is estimated that there was a 67 per cent reduction of food availability in 1994. Electricity generation was also drastically reduced, affecting food storage capacities; fuel and parts for maintaining transport vehicles, oil and other inputs became scarce commodities.[17]

Over the next decade, the island, where 80 per cent of the population lived

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[17] Jorge Peña Díaz and Professor Phil Harris, 'Urban Agriculture in Habana: Opportunities for the Future', in André Viljoen (ed.),CPULs, Continuous Productive Urban Landscapes, Architectural Press, 2005, p 136

in cities, was forced to rely on its own resources and then underwent an extraordinary agricultural revolution, as government-sponsored agriculture converted suburbs into community-run farms, and cities including the capital Havana into a maze of *organopónicos*, high-yield market gardens inserted into every available open space and tended by local residents. State-owned land was parceled out to anyone willing to cultivate it, with amateur farmers given government training, advice, seeds and equipment. Crucially, the government also departed from its communist principles in order to allow farmers to sell their produce on the open market. By 2003, over 200,000 Cubans were employed in urban agriculture, and although the island remained short of meat, grain and eggs, it was approaching self-sufficiency in vegetables, producing over three million tons annually - more than had been available before the crisis.[18]

2) Characteristics of the urban agriculture in Cuba, Habana[19]

Since the introduction of urban agriculture in Cuba in the 1990s, a number of distinct categories have been defined, determined by size, location, users and yield. The size of urban agriculture sites in Cuba relates both to their location in the city and the type of urban agriculture practiced. At the scale of a city one can observe the relative distribution of urban agriculture sites in relation to each other

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[18] Carolyn Steel, "Hungry City : How Food Shapes Our Lives", London : Vintage Books, 2009, p 313~314

[19] André Viljoen and Joe Howe, 'Cuba: Laboratory for Urban Agriculture', in André Viljoen (ed.),CPULs, Continuous Productive Urban Landscapes, Architectural Press, 2005, p 147-149

and to other urban land use. At the scale of a single urban agriculture site, layout, form and materiality can be observed, and finally, at the human scale, the edges across which interactions occur, between citizen, cultivator and cultivated landscape, can be observed.

Type	Size	Location	Farmers	Use of Crops	Yield
State farms for producers consumption *'Autoconsumos Estatales'*	10,000 m^2 or more	Peri-urban	Voluntary cultivation by workers	Feed state workers, Support daycare centres, Homes for elderly, Facilities for new born babies, Surplus sold to workers	1996: 0.34 kg/ m^2.yr 2000: 0.6 kg/ m^2.yr
Community gardens (plots) *'Parcelos'*	Less than 1,000 m^2	Urban or peri-urban, vacant lots, unexploited area within educational or health facilities (State owned or private)	One person or family	To supply cultivator or family	1996: 1-2 kg/ m^2.yr 2000: 8-12 kg/ m^2.yr
Community gardens (intensive cultivation garden) *'Huertos Intensivo'*	Typically between 1,000 m^2 and 3,000 m^2	Urban or peri-urban, state owned or private land	One person or family, several families or co-operative	Feed producers and for trade	1996: 1-2 kg/ m^2.yr 2000: 8-12 kg/ m^2.yr
Urban Community garden *'Organopónicos Populares'*	Typically between 2,000 m^2 and 5,000 m^2	Vacant urban sites, not suitable for direct agriculture use, require imported soil and containers	Groups of individuals formed into a collective (Institutional technical support and advice)	Produce for trade and small-scale consumption by producers	1996: 3 kg/ m^2.yr 2000: 20 kg/ m^2.yr
High yield urban gardens *'Organopónicos de Alto Rendimiento'*	Typically over 10,000 m^2	Government allotted vacant urban sites, not suitable for direct agriculture use, soil and containers for growing brought in	Commercially viable work centres or co-operatives	Produce for sale to the population and tourist sector	1996: 12 kg/ m^2.yr 2000: 25 kg/ m^2.yr

Table 2-1. Types of Urban Agriculture Site in Habana[20]

(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

[20] <Table 1-5> is based on the situation in Havana but is typical for the country as a whole.

3) Urban Agriculture at the City Scale[21]

Urban agriculture sites tend to be found on the urban fringe and in the city centre adjacent to major through roads. Local conditions alter the relative distribution of urban fariming.

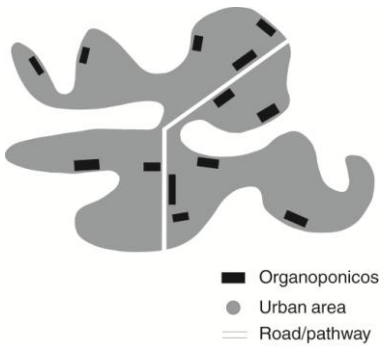

Fig. 2-3. Tendency of Urban Agriculture sites in Cuba
(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

Havana has a European urban character with a compact core and a less dense, at times dispersed, edge. Its historic quarter is dense and most buildings do not exceed four or five stories, squares mark urban centres and the sea provides an edge. Derelict plots of land in the city centre have been converted into small-scale urban agriculture fields. These small plots are dispersed within the city's historic fabric as a form of the city's means of food production.

Moving out from Havana's centre, as the city de-compacts towards its edges, larger urban agriculture sites are found and often adjacent to industry or new

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[21] ibid, p 149-151

residential developments. The largest urban agriculture fields, typical examples of peri-urban agriculture, are located on the urban periphery adjacent to main access routes into the city.

2.3 Case-study for Urban Farm Type

There are several ways to produce food in an urban setting —some private, some public, some institutional—and innovative technological advances adapted to a variety of urban location, such as school, community center, family homes, apartment, plots, parks, and restaurant. These forms have physical characteristics according to their occupation of urban space. This chapter will divide these forms into ground type, roof-top type, facade type, mobile type, and hybrid type, and analyzed with their resource, participant, and achievement.

2.3.1 Ground Type_ Cuba[22]

'Organopónicos populares' are the most visible type of urban agriculture and contribute the most to the horizontal intensification of a site, although not the largest by total area or output. They are high yield urban market gardens, run commercially by their operators, selling vegetables from the ‘farm gate’. In areas

[22] ibid p 153-154

where vegetable production has been established, there are often floral *organoponicos*, producing cut flowers and garden plants.

The size of *organoponicos* vary depending upon site availability and the number of people farming them. Cultivation is entirely manual, often using self-made tools. The smallest *organoponicos* have a cultivated area in the order of 500 m2, which corresponds to the maximum area one person can work. The typical *organoponicos* is with three people cultivating 1200 m2 of raised beds. Significantly larger *organoponicos* do exist which has a planted area of 3400 m2 and a correspondingly larger workforce.

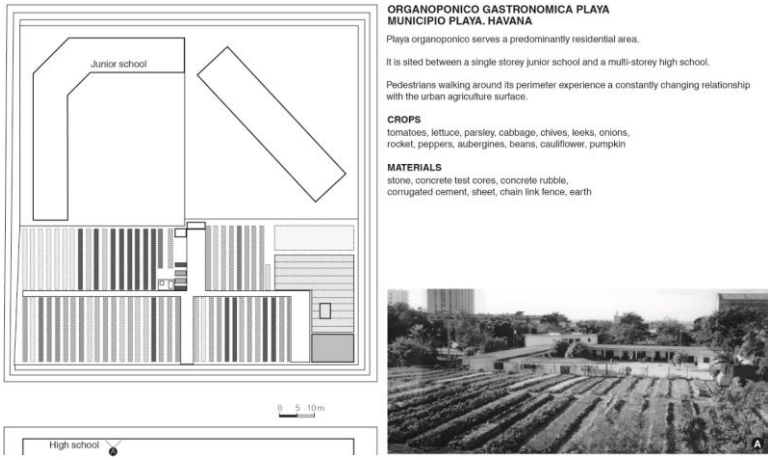

Fig. 2-4. *'Organopónicos populares'* in Habana
(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

'Autoconsumos estatales' are similar to organoponicos, but are sited within the grounds of factories or other institutions and supply their local food needs. *'Huertos'* or *'Parceleros'* form another category and are small-scale plots usually

cultivated by a single family.

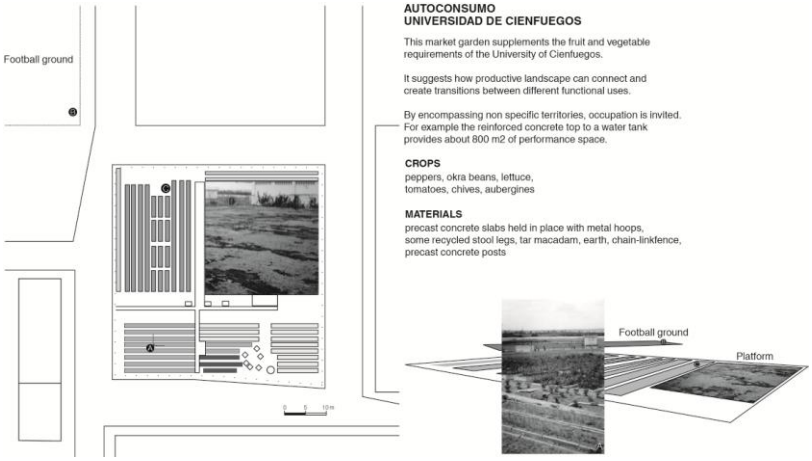

Fig. 2-5. *'Autoconsumos estatales'* in Cienfuegos

(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

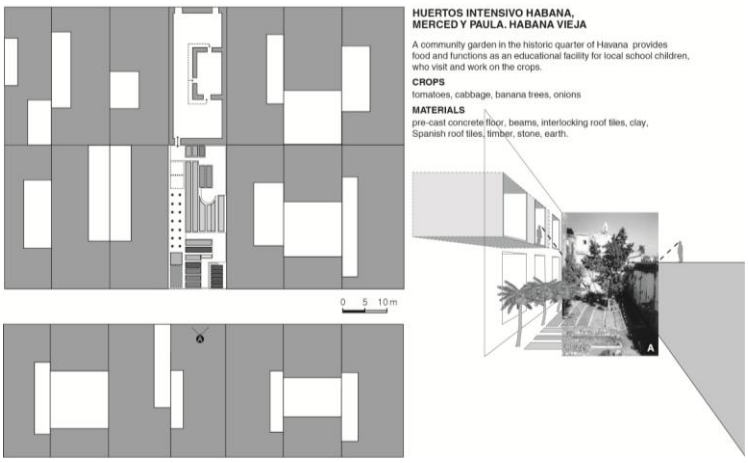

Fig. 2-6. *'Huertos'* in Habana

(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

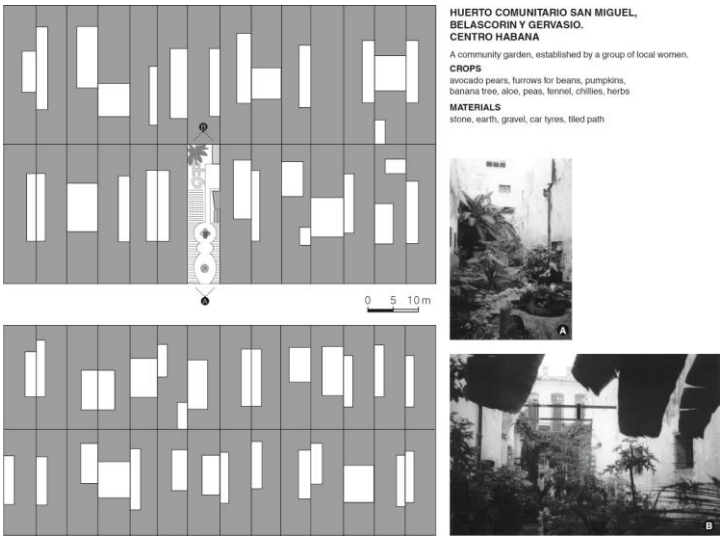

Fig. 2-7. *'Parceleros'* in Habana

(Source: CPULs-Urban Agriculture in Habana: Laboratory for Urban Agriculture)

In reality, the differences between these categories are blurred. Nevertheless they do provide some insight in to the different forms of urban agriculture.

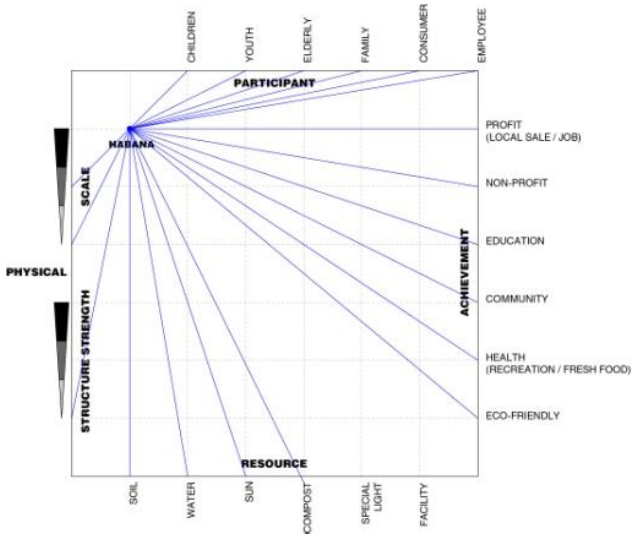

Fig. 2-8. Evaluation of Ground Types in Cuba

2.3.2 Roof-Top Type

1) Outdoor Farm on Building Roof-Top_ Brooklyn Grange Farm[23]

Brooklyn Grange is the rooftop farming and intensive commercial urban farm in the US. They operate the world's largest rooftop soil farms, located on two roofs in New York City, and grow over 18 tons of organically-cultivated produce per year. In addition to growing and distributing fresh local vegetables and herbs, they also provides urban farming and green roof consulting and installation services, and partner with numerous non-profit organizations throughout New York to promote healthy and strong local communities.

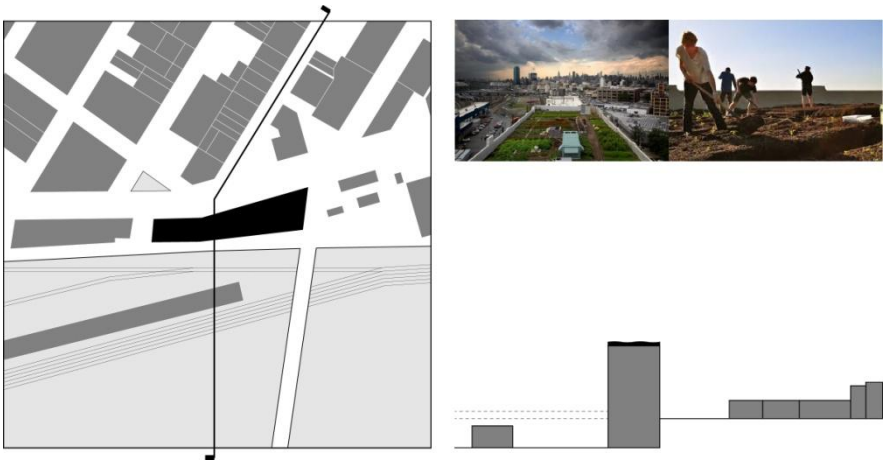

Fig. 2-9. Brooklyn Grange Farm in NYC

[23] http://www.brooklyngrangefarm.com/

Brooklyn Grange says "The city will always rely on rural farmers for the bulk of our food, and the relationship between urban and rural communities must be celebrated. But having farms inside the city limits which take advantage of unused roof space is an opportunity not to be missed. Roof farms have the potential to improve urban quality of life, create jobs, increase access to healthy fresh foods, and provide environmental and agricultural education to those of us who live in and love the city."

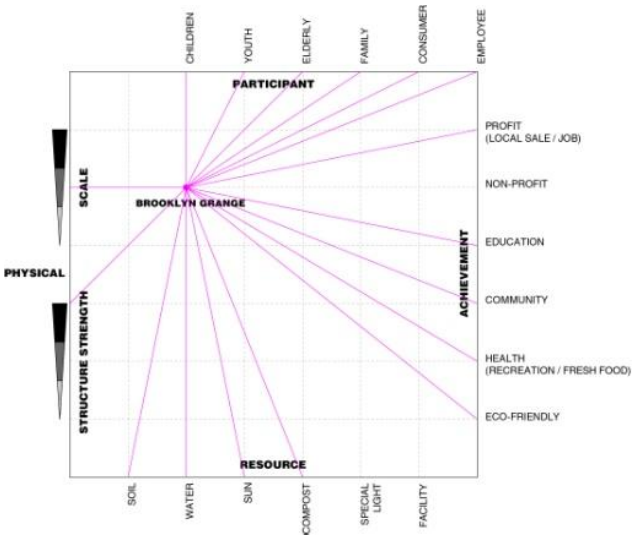

Fig. 2-10. Evaluation of Brooklyn Grange

2) Indoor Farm on Building Roof-Top_ Local Garden in Vancouver

"Local Garden" converted a roof parking in the heart of downtown Vancouver to Vertical Farm. With their vertical growing technology, they can grow and harvest up to approximately 1,600 kg of fresh, healthy greens every week within a smaller environmental footprint and use less overall energy and water, no matter what the weather or the season. They have four large volume retail locations, local restaurants and retail shops, and there is so much demand for local food from their neighbors. To being environmentally effective, they have a delivery point maximum within 25 km and deliver their product in twice a week with amalgamating the orders.[24]

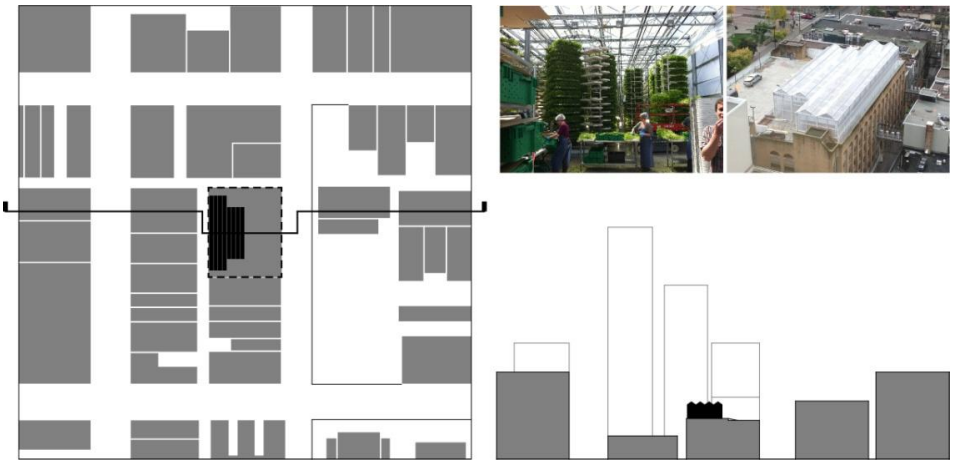

Fig. 2-11. Local Garden in Vancouver

[24] http://www.localgarden.com/

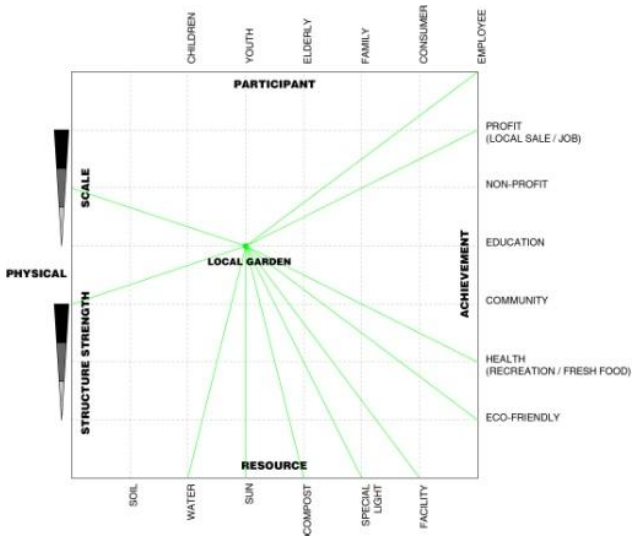

Fig. 2-12. Evaluation of Local Garden

2.2.3 Facade Type_ Edible Green Curtain in Japan

Japanese firm Kyocera, eco-friendly company, installed the growing edible green curtains along their company's exterior walls. As the curtains produce vegetables for use in the company’s cafeteria, they also keep the buildings cool, reduce energy consumption, mitigate carbon emissions and provide a calming, shaded view for those working inside. The project to insulate and shade their office and manufacturing buildings began in 2006, as part of the company’s energy conservation and global warming prevention activities. After just a few years, this installation became over 740 square meter of green curtains. The functional foliage is guided by netting, placed over the walls at an angle appropriate to its exposure to

the sun.[25]

Fig. 2-13. Edible Green Curtain in Kyocera company

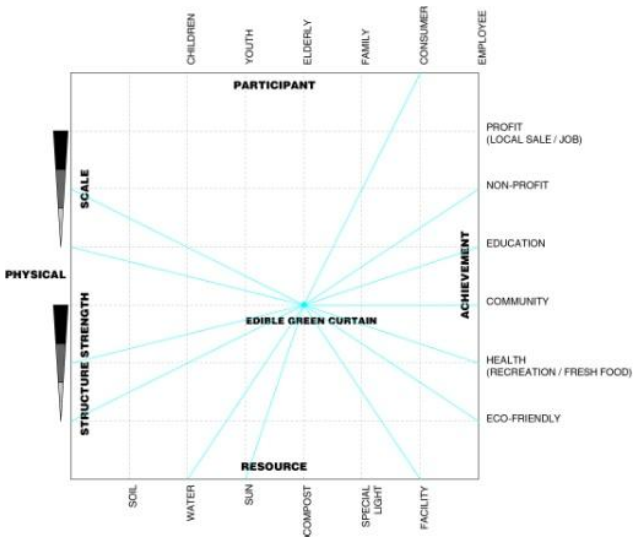

Fig. 2-14. Evaluation of Edible Garden Curtain

[25] http://www.greenbiz.com/news/2010/08/24/kyocera-edible-green-curtains-take-bite-out-energy-use

2.2.4 Mobile Type_ growUP box

The growUP box is a shipping container farm which has a slight footprint of only 14 square meters and can produce approximately 100 kilograms of fish and 400 kilograms of lettuce per year. It was installed in the Marlborough Playground, a not often-used urban plot, as part of the Chelsea Fringe Festival. It was planned by Kate Hofman and Tom Webster, to turn a car park in central London, into a sustainable urban farm using a specially modified shipping container and greenhouse. It uses the hybrid technology system called *aquaponics*, which uses the method of cultivating plants in water, while synthesizing the practice of raising fish. In this method, a rooftop greenhouse can be provided with nutrient-rich water by the fish tanks, and the fish tank also can be provided with water cleaned by plants. The sustainable system requires the mere input of fish food and minimal energy to power the pump system, thereby remaining devoid of soil, chemicals and pesticides. The growUP box represents an option for a viable of scale farming in the increasingly dense and environmentally isolated cities.[26]

Fig. 2-15. growUP box in n the Marlborough Playground

[26] http://www.kickstarter.com/projects/katehofman/growup-an-aquaponic-urban-farm-for-london

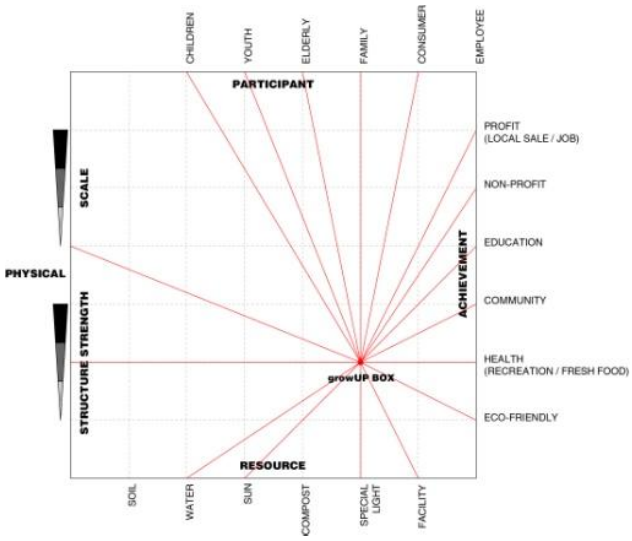

Fig. 2-16. Evaluation of growUP Box

2.2.5 Hybrid Type_ Pasona Urban Farm in Tokyo

Kono Designs created the urban farm in 2010, in a nine-storey office building in the middle of a busy intersection in Tokyo's metropolitan area. Instead of building a new structure, an existing 50 year old building was renovated, keeping its structure. The project consists of a double-skin green facade, offices, an auditorium, cafeterias, a rooftop garden and urban farming facilities within the building. The green space totals over 4,000 square meters with 200 species including fruits, vegetables and rice that are grown, harvested, prepared and served at the cafeterias within the building.

Fig. 2-17. Transformed Pasona Urban Farm

Fig. 2-18. Cultivating Employees in building

The building has a double-skin green facade where flowers and orange trees are planted on small balconies. From the outside, the office block appears to be draped in green foliage. Inside the offices, using hydroponic and soil based farming, crops and office workers share a common space. For example, tomato vines are suspended above conference tables, lemon and passion fruit trees are used as partitions for meeting spaces, salad leaves are grown inside seminar rooms and bean sprouts are grown under benches. Plants hang in bags surrounding meeting desks and there are vines growing within vertical cages and wooden plant boxes around the building. The main lobby also features a rice paddy and a broccoli field. These crops are equipped with halogen and LED lamps and an automatic irrigation system. An intelligent climate control system monitors humidity, temperature and breeze to balance human comfort during office hours and optimise crop growth during after hours. This maximises crop yield and annual harvests.

Employees of Pasona HQ are asked to participate in the maintenance and harvesting of crops with the help of agricultural specialists. Such activity encourages social interaction among employees leading to better teamwork on the

job. It also provides them with a sense of responsibility and accomplishment in growing and maintaining the crops that are ultimately prepared and served to their fellow co-workers at the building's cafeterias.

Besides creating a better work environment, Pasona Urban Farm focuses on educating and cultivating the next generation of farmers by offering public seminars, lectures and internship programs. The programs empower students with case studies, management skills and financial advice to promote both traditional and urban farming as lucrative professions and business opportunities. One of the main reason for Pasona to create an urban farm within their headquarters in downtown Tokyo was aiming to reverse the declining trend in the number of farmers and to ensure sustainable future food production. Currently, Japan produces less than one-third of their grain locally and imports over 50 million tons of food annually, which on average is transported over 9,000 miles, the highest in the world. As the crops harvested in Pasona HQ are served within the building cafeterias, it highlights 'zero food mileage' concept of a more sustainable food distribution system that reduces energy and transportation cost. Japan's reliance on imported food is due to its limited arable land. Only 12% of its land is suitable for cultivation. Farmland in Pasona HQ is highly efficient urban arable land, stacked as a vertical farm with modern farming technology to maximise crop yields. The project believes in the long term benefits and sustainability in recruiting new urban farmers to practice alternative food distribution and production by creating more urban farmland and reducing food mileage in Japan.

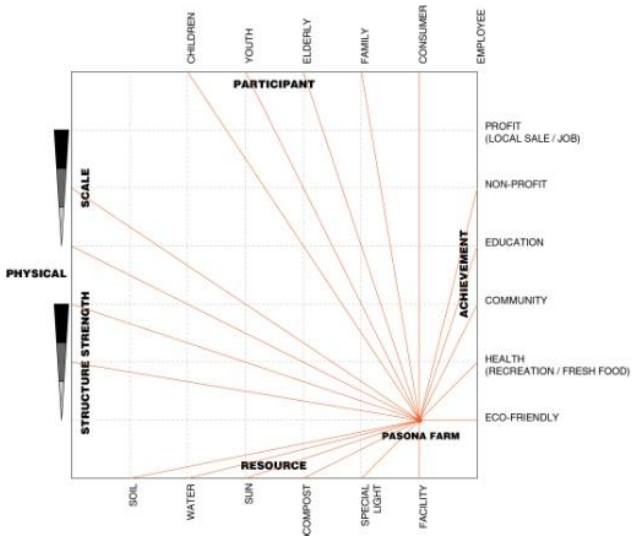

Fig. 2-19. Evaluation of Pasona Urban Farm

2.3 Summary

According to analysis, physical characteristics are based on the occupation of places, however, their forms are not unique or independent. Similar forms can be seen in different contexts of space, and there are overlaps and similarities between the types. It indicates that the traditional farming type was varied in form and size and adapted into the site, and these different types also can be mixed or hybridized.

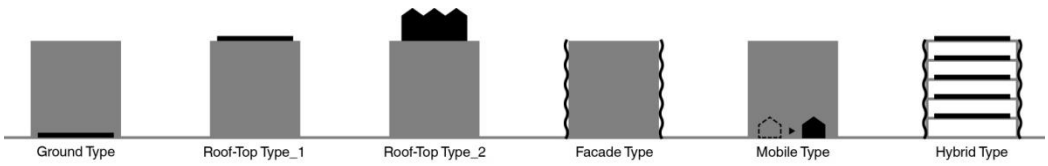

Fig. 2-20. Types of Urban Farming

Each case can also be evaluated with physical characteristics including structure and scale with participant, achievement and resource. This evaluation can be mapped with components above. This map shows the engagement with each other. This interdependence and resiliency will be factored into the design experiment.

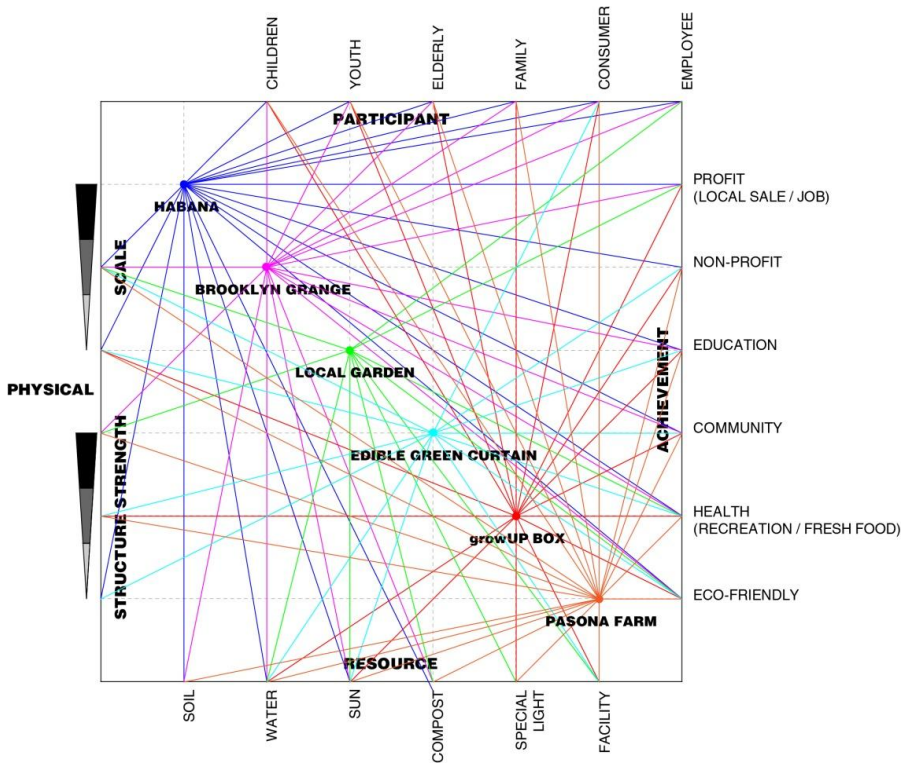

Fig. 2-21. Evaluations of each cases

Chapter 3. Understanding the Site, Garak Market

3.1 History of Garak Market

3.1.1 Opening of Garak Market

In the 1970s, Most of the agricultural products from the countryside shifted to Seoul, due to the rapid economic development and concentration of population. At the time, even though there was the agricultural marketing system, the distribution of agricultural products was significantly distorted as the quasi-wholesale markets thrived, surpassing scale of the institutional market. In that situation, both producers and consumers were the victim, with the violent price fluctuations and consumer price instability.[27]

In order to solve this problem, The Seoul government planned to construct Garak Agricultural & Marine Products Market by the Policy of comprehensive agricultural and marine products distribution center in 1980, and then Garak Market opened with the corporation of existing institutional wholesale markets and quasi-wholesale markets in 1985.[28]

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[27] Seoul Agro-Fisheries & Food Corporation, 15 Years of Garak Market, Seoul: Seoul Agro-Fisheries & Food Corporation, 2000, P 86-87

[28] Seoul Agro-Fisheries & Food Corporation, Sourcebook of Statistics in 2009, Seoul: Seoul Agro-Fisheries & Food Corporation, 2009, P 8-15

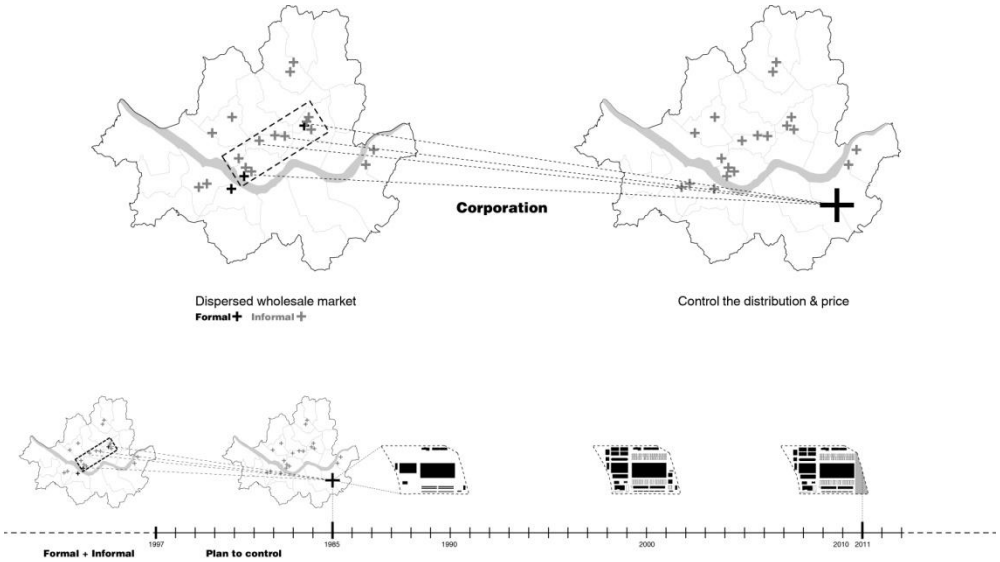

Fig. 3-1. Corporation of Wholesale Markets and Opening of Garak Market

3.1.2 Expansion of Garak Market

Garak Market was planned to deal with an average of 4,680 tons of food source transaction per a day. In 1986, after one year of opening, the amount of transaction was 3,585 tons per a day. However, this rapidly increased, exceeding 7000 tons in 1991 and reached 7980 tons in 2008 per a day.[29] Currently, the amount is approximately 7,300 tons per a day, nearly twice as much as first planned.

Currently, approximately 140,000 people use Garak Market in a day, and 14 per cent of them are workers. Approximately 42,000 vehicles visit this market in

[29] ibid, P 109

a day, and about half of them are transport trucks. [30]

The site area is 543,451 square meters. At first, the total floor area of buildings in this market was approximately 197,000 square meters, but the area increased by 35 per cent. Including all of temporary installations, Size increase will be 64 per cent.[31]

These figures indicate that the frequency of use and amount of transactions have twofolded with demand, as the city, Seoul, has been increasingly urbanized and industrialized.

3.1.3 Reconstruction of Garak Market

After 25 years from the opening of the market, however, various problems arose. Due to outdated facilities, maintenance costs have considerably increased, and public safety is a risk. Also, excessive supply of products has created traffic congestion in distribution. Not only that, but lack of parking space caused heavy traffic and inconvenience for market traders and the public. To solve those problems, the Garak Market Modernization Project was promoted, and the project progressed in 2008 to redevelop the market on the current site. From 2011 until now, the 1st phase of reconstruction is under way. [32]

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[30] ibid, P 250

[31] Chang Soo Lee, "The stage-by-stage redevelopment plan research of Agricultural ＆ Marine -wholesale market-Focusing on the redevelopment project of Garak Market", Master's thesis of Gachon Univ., 2013 ,p 12

[32] http://new.garak.co.kr/

In 2006, the Seoul government decided to transfer the slaughterhouse to the countryside as there were complaints from nearby residents. Since, the function for livestock products has reduced.

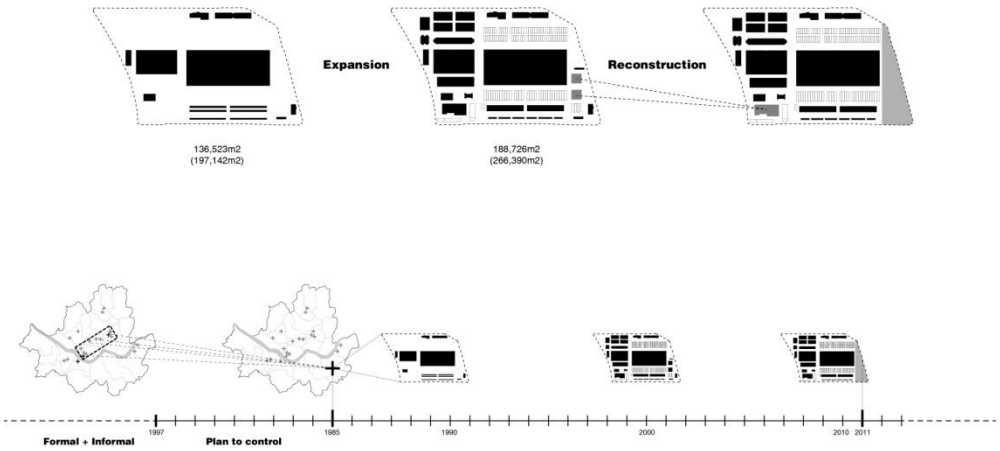

Fig. 3-2. The expansion and reconstruction of Garak Market

3.2 Role of Garak Market in Seoul

As Seoul has been increasingly urbanized and industrialized, the role of Garak Market in distributing food sources to city dweller in Seoul has grown. The frequency of use and amount of transaction are twice more than the time of its opening. This market is the biggest market in Korea, dealing with 34 per cent of the whole amount of transactions of Korea.[33]

3.2.1 Outline of Food source in Garak Market

Garak Market is the main wholesale market in Seoul, controlling most food sources: vegetables, fruits, marine and livestock products from national and international areas. Diverse food sources from areas of production are distributed to the city of Seoul through Garak Market. The greatest amount of transaction is currently vegetables, which sits at 81.5 percent. Fruits are 13.3 percent and marine products are 4.8 per cent. Livestock products decreased to 0.4 per cent due to transferring the slaughterhouse.

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[33] Byoung Sung Lee, "Change of the transaction amount in Garak", Agrinet.co.kr, 12th Mar. 2012 retrieved 10th Oct. 2013 <http://www.agrinet.co.kr/news >

Fig. 3-3. Food source and its origin in Garak Maket

3.2.2 Food Source Distribution Process of Garak Market

The consumption and production of marketed food are spatially separated. Production is generally in rural areas and consumption primarily in urban areas. Marketing is the process that allow produce to be moved from an area of surplus to

one of need with physical infrastructure, wholesale market.[34]

The function of the wholesale market normally can be divided into four, price formation function, physical distribution function, information collection function, and supply control function. Firstly, Price formation function relates with buying and selling, including price formation, payment, finance and risk sharing. Secondly, Physical distribution function means movement of food, including gathering, dispersion, storing and preserving, and transportation. Thirdly, Information collection function means that wholesale market company or administrator collects information of distribution and then provides the information to producer, intermediately wholesaler(commission merchant), and retailer. Lastly, supply control function means that wholesale company and intermediate wholesaler control the supply and price, according to market condition.[35]

In this process, food reaches the consumer by a complex network, involving production, assembly, distribution and retail stages. Garak Market has a key part in assembly and distribution.

The distribution flow can be divided into two depending on whether it includes auction or not. In one flow, food products are firstly listed and put up for auction through a wholesale market company, and then intermediary wholesaler, or a designated bulk buyer purchases food sources at a competitive price. In the other flow, producers can sell their products to an intermediary wholesaler directly. At the

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[34] J. D. Tracey-White, "Wholesale markets: Planning and design manual", FAO, 1991, P 1-2, retrieved 10th Oct. 2013

[35] Seoul Agro-Fisheries & Food Corporation, 15 Years of Garak Market, Seoul: Seoul Agro-Fisheries & Food Corporation, 2000, P 84-85

end, food sources are distributed to retailers or direct merchants and then reach consumers by a complex network.

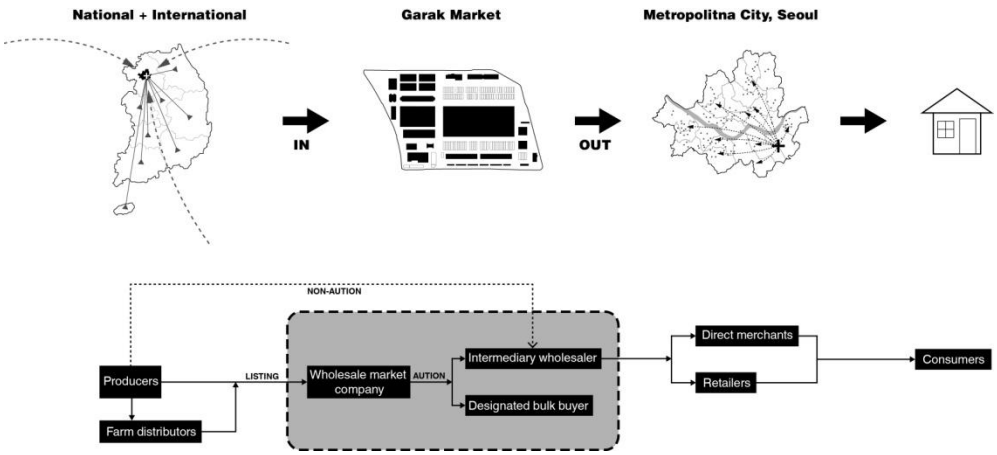

Fig. 3-4. The Distribution flow of food source to Consumer with Garak Market

3.3 Potential Area for Urban Farming in Garak Market

As stated above, Garak Market is in the reconstruction stage. To make this urban faming proposal will not be temporary scheme, the further situation of this market should be considered. In the right part of this market, the 1st reconstruction is in progress and the existing market is still playing a key role in distributing food in Seoul. Considering these condition, the left part of this market can be chosen as a design experimental site. Even though there are some supporting facilities, three buildings for food sales, and huge space for parking which are still used, these structures can be designed sequentially from beginning to end with the reconstruction process.

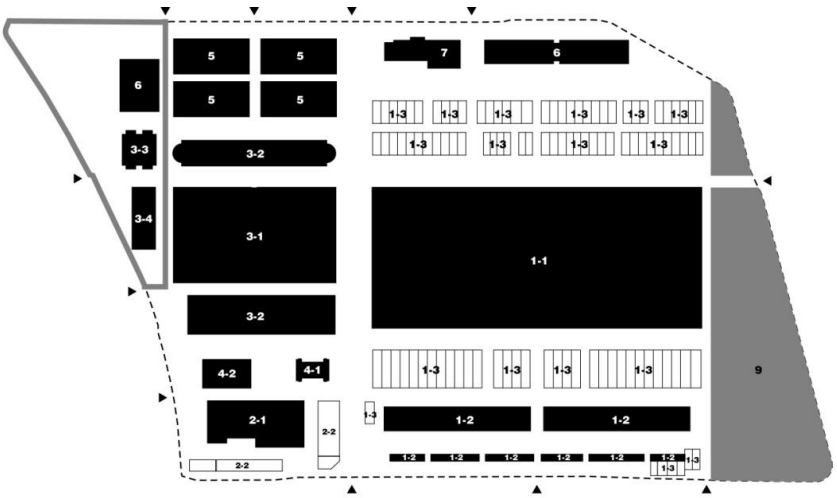

Fig. 3-5. Main Facilities in Garak Market

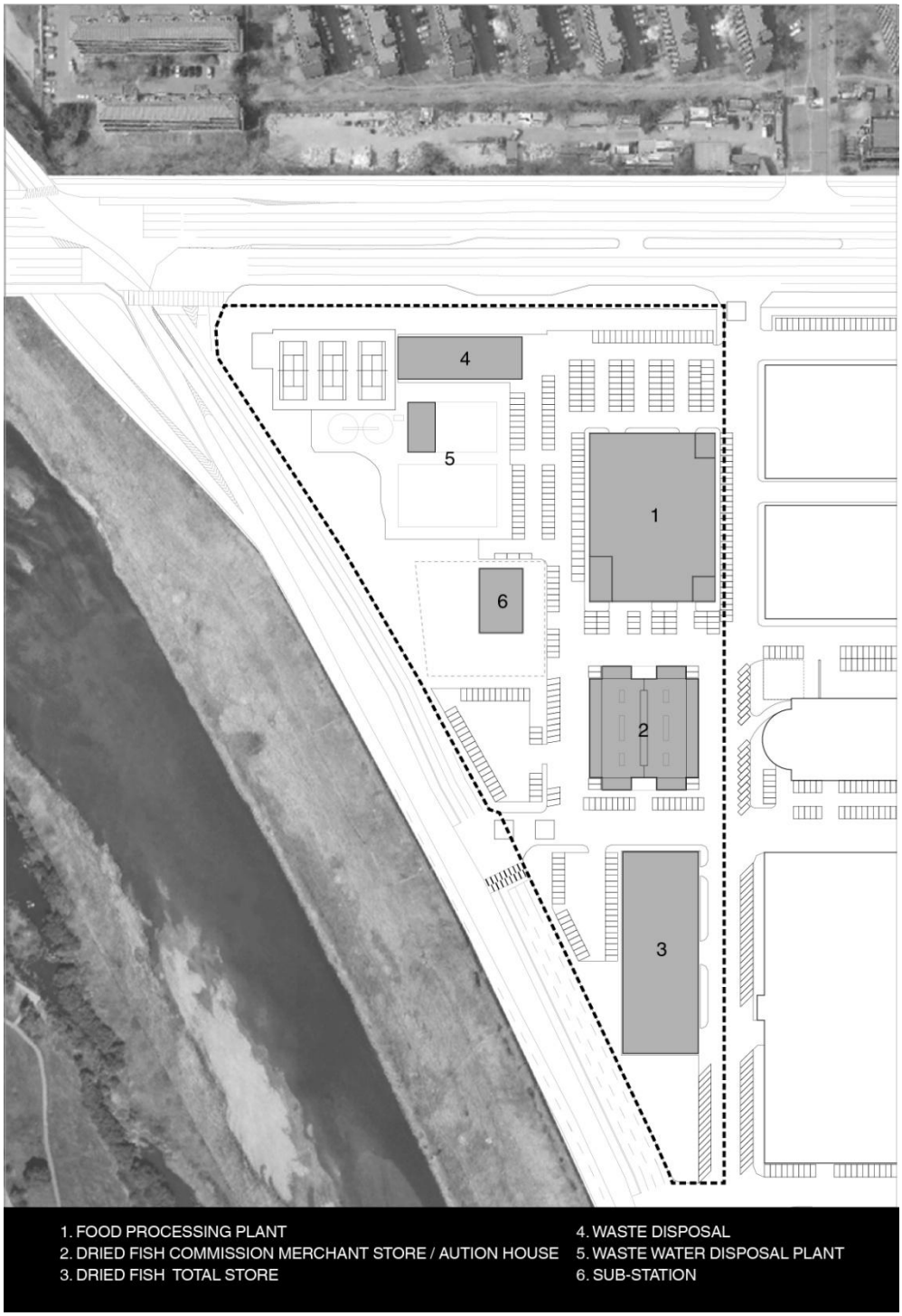

Fig. 3-6. The potential site for design experiment

Chapter 4. Design Proposal

4.1 Design Strategy

: Considering the Different Contexts in the Site for Urban Farming

As for the first way of the urban farm design experiment, the diverse urban contexts around the site will be deliberated. Firstly, Garak Market is the main factor as the site is a part of this market and in terms of food supply for the city, Seoul, it continues to be a main food provider together with urban farm. The second context is a residence area of the neighborhoods. The residents can be considered farmers to produce food and consumers to buy local food from urban farm. Lastly, Tancheon, a river, is the particular context. Although this river is mainly used for walking and exercising, it has a potential to be used for producing food in urban area.

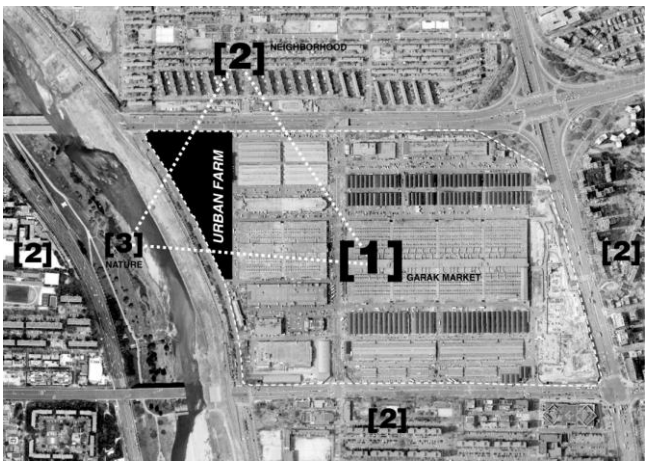

Fig. 4-1. Urban Contexts around the Site

4.1.1 Garak Market for a Local Food Producer

Garak market has been the biggest wholesale market and the epicenter of food distribution in Seoul. Its role for food supply from farmlands to the whole city, Seoul, can't be replaced by this urban farm proposal in this stage. This thesis propose the role division of Garak Market that is a food distribution to the whole city, Seoul in logistic system and local food provision with urban farming.

With this proposal, Garak Market can keep supplying Food from farmland to whole area of the city satisfying the huge demand of food. At the same time, this market can supply food to neighborhood with urban farming. This coexistence of local food production and global or national food distribution in market can be an alternative to sustainable food supply system in urban area.

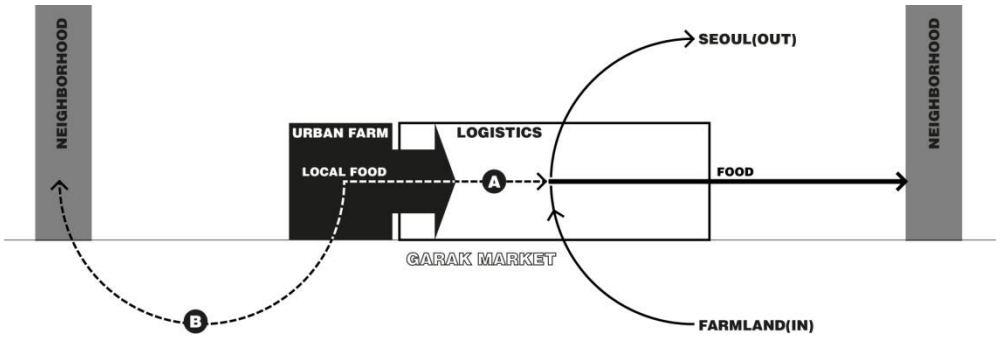

Fig. 4-2. Strategy 1_Local Food Producer

4.1.2 Garak Market for a Socio-Community Place for Neighborhood

One of the strengths of urban farming can act as a focus for the community to come together. The aim of this strategy is to consider socio-community aspect of urban farming, such as communication, education and health. Urban Farm in Garak Market can not only play a role in local food producer, but also socio-community palace through farming together. There are residence area and schools around this site. The neighbors are potential urban farmers. Especially, children enjoy and learn about food producing it by themselves.

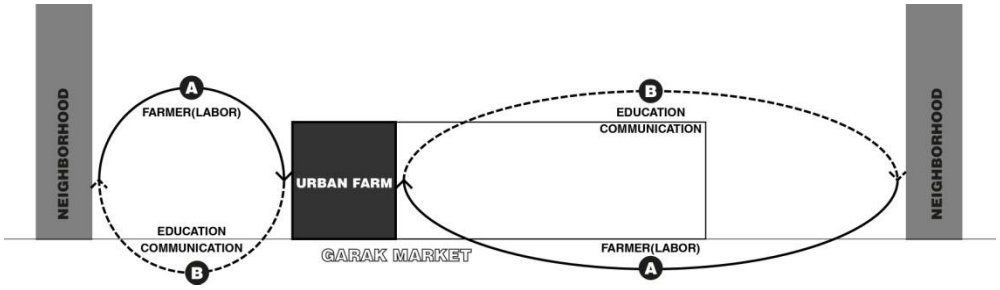

Fig. 4-3. Strategy 2_Community Place for Neighborhood

4.1.3 Expansion of Urban Farm to Urban Void

The particular urban nature, Tancheon, can be considered as urban void from the point of view of urban farming. It has a great potential for farming. Jac

Smit said in his book that 'large tracts of public or quasi-public land that are reserved for landscaping or urban extension purposes can provide significant space for urban agriculture. Examples include universities, schools, factories, churches, ports, airports, hospitals, prisons, military bases, parks, and recreation areas.'[36] By the expansion of urban farming to this river, urban farming in Garak Market can be more comprehensive to feed the local residents.

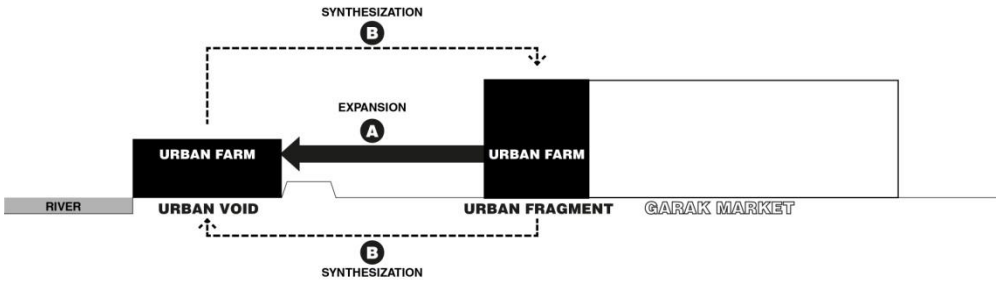

Fig. 4-4. Strategy 3_Expansion of Urban Farm to Urban Void

4.1.4 Maintaining Urban Farm to New Garak Market

Garak Market is in the reconstruction stage. To make this urban faming proposal will not be temporary scheme, the further situation of this market should be considered. Considering the reconstruction process and the condition of new market, this design experiment will be progressed to maintain this urban fragment

[36] Jac Smit, Urban Agriculture Food, Jobs and Sustainable Cities,

adapting farming function sequentially to this market from beginning to end.

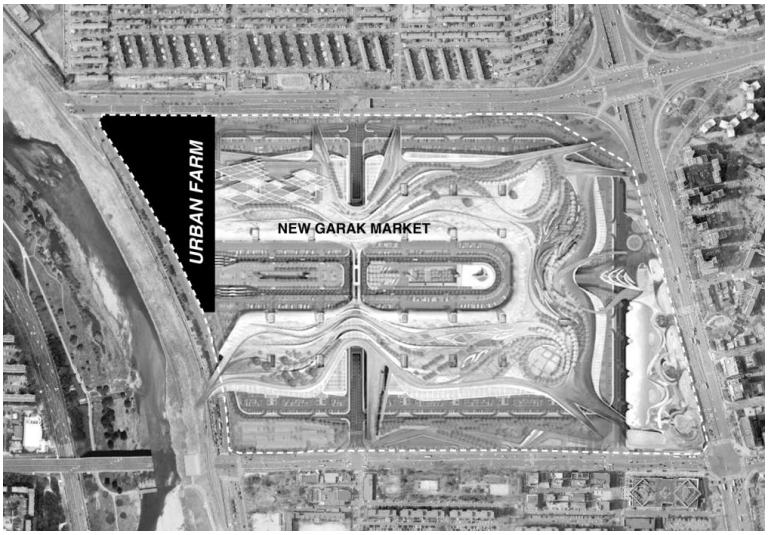

Fig. 4-5. Strategy 4_Maintaining Urban Farm to New Market

4.2 Design Concept

: Adaptation of Modules and Transformation of the Existing Buildings

There are mainly two design concepts. The first one is to set up the special modules. The modules are Green House Type and Raised Bed Type and the distinguished features between them are growing source and space, such as soil or water and growing outside or inside. These are not totally new designed but different in size from similar modules used all over the world. These modules are designed not just for the site, Garak Market but used for urban area generally. The size of Green House Type is 2300mm by 5000mm as same as parking area in order to make a space sharing with cars in urban area. Although the size of Raised Bed Type can be different depending on a situation where it would be installed, this size also is set up as same as Green House Type to experiment as a early stage of design proposal. This module type is arranged with the special equipment that can be shared, by doing so sharing space can be made.

Another design concept is to reuse the existing building in the site. There are main three buildings that will be transformed to be used for urban farming, such as part farm, laboratory and education center, etc. These transformed buildings will be filled with programmes of food-related events including special activities for schools and families and forge a new way of urban living with urban farming.

4.2.1 Modules for Farming in Urban Area

(1) Module Type A_ Green House Type

Farming indoors is not a new concept. Commercially viable crops such as strawberries, tomatoes, peppers, cucumbers, herbs, and a wide variety of spices have raised from commercial greenhouses for a long time all over the world. Most of these greenhouse facilities can produce crops year-round with well-monitored conditions that ensure optimal growth rates for each species of plant regardless of weather. Fish can also be raised indoors with plants by special technology.

The first module type is a green house type and Its size is 2300mm by 5000mm as same as parking area. Although it can be installed on the ground or buildngs in urban area, the purpose of setting up the specific size is to put this module on the parking area in order to share space with cars.

This module is movable with truck and prefabricated. The structure of this module is aluminum frame and both long sides are foldable. This foldable wing can give a prevention and ventilation, and make a possibility to connect with other module. The surface is made of transparent plastic in order to get natural light and this module also uses artificial light for supplemental lighting. The inside space of this module is divided two part, grow bed and passsage. The passage needs at least 80cm for passing, however, the width is set up with 1 meter for enough work space.

The grow bed is filled with water, so called *hydroponics*. *Hydroponics* is a

soil-less methods of growing plants. This offers opportunities to provide optimal conditions for plant growth and therefore, higher yields can be obtained compared to open field agriculture and it doesn't need to use an inert medium that supply all nutrient elements for optimum plant growth .[37]

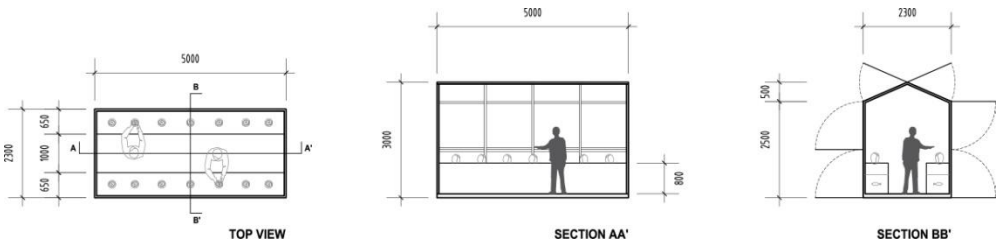

Fig. 4-6. Green House Type (Module Type_ A)

[37] University of Kentucky - College of Agriculture, "Hydroponic Lettuce", 2012

(2) Module Type B_ Raised Bed Type

This module is a raised bed type producing crops in the open air like, quite similar with *organopónicos* in Cuban case. Although its size can be different depending on a situation where it would be installed, this size also is set up as same as Green House Type to experiment as a early stage of design proposal. It can be also installed and fixed on the ground or buildngs in urban area.

This module uses conventional crop growing methods with soil and growing sources, such as natural light, water and compost. Although harvest would be less than Type A, it can give a chance to contact with neighbors and natural environment to urban settlers.

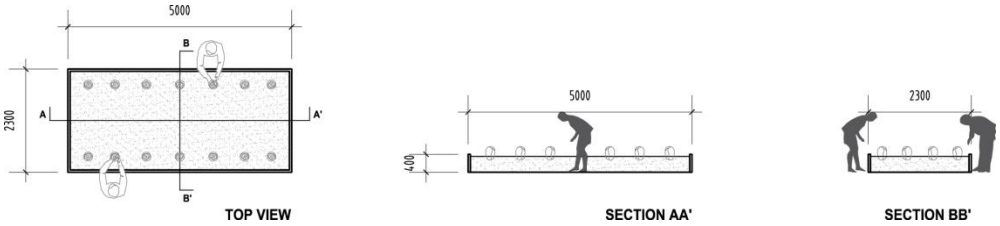

Fig. 4-7. Raised Bed Type (Module Type_ B)

4.2.2 Space Sharing System with Modules

(1) Combination of Module Type A and Car Park Platform

Greenhouse Type can be expanded in scale with a combination of modules in the width direction and height direction. The combination in the height direction have a potential to make extra space that can be shared. The more modules are combined, the more in-between space is formed. There are two different shared space. The space that formulated by direct connection of modules can make enough interior work space, and the other combination with foldable wings can make flexible exterior or interior space for carrying crop or just passage.

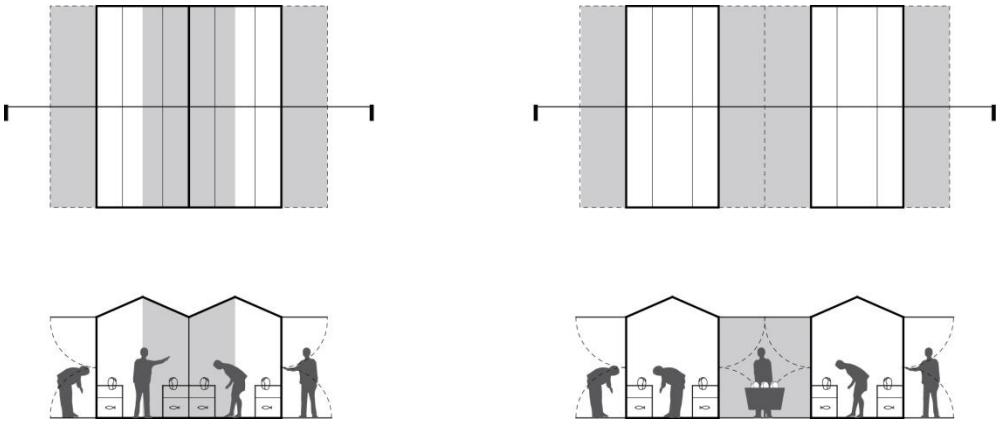

Fig. 4-8. Combination of Module A

This module is same as car parking size, 2.3 meter by 5 meter, to make space sharing in vertical way. Urban area is hugely occupied with vehicles. This sharing methods with car parking can give a chance to for urban settlers to grow their food in a lack of space. This space sharing system needs a special platform to support up the module and can be expanded along with the module combination.

Especially in Seoul, the main residential type is an apartment house and there are a great number of parking area. Except for underground parking lots, people who live in apartment house can get their own farm or sharing farm with their car parking space. The installation of this system can make a chance for apartment residents to get close with their neighbors.

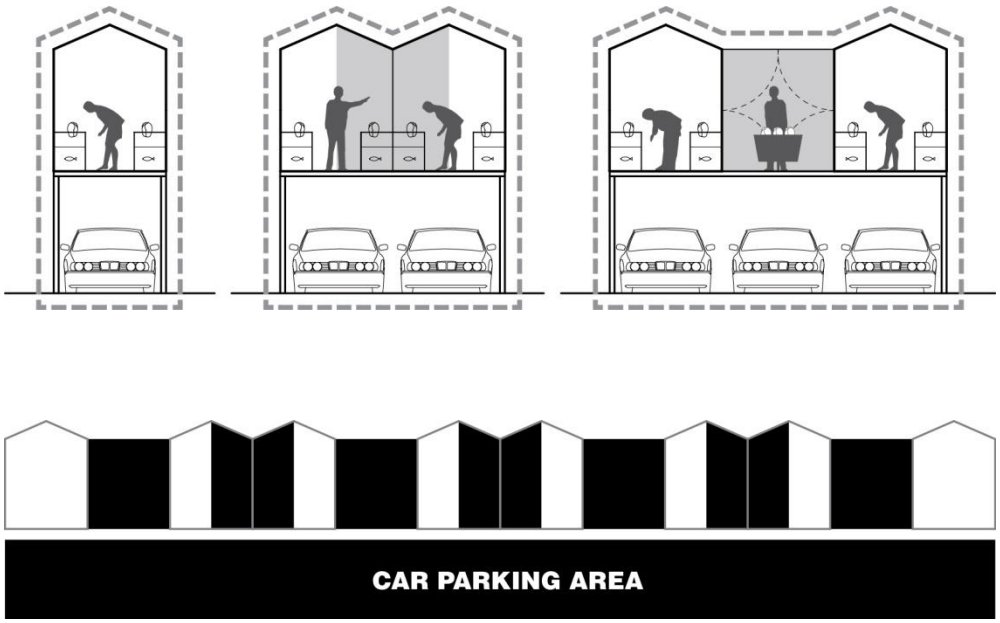

Fig. 4-9. Car Park Platform with Module A

(2) Rain Water Collector (Parasol) with Module Type B

For the type of raised bed module, water is critical. Even though water can be provided with tap-water, the special rain water collector is proposed for sustainable way. This installation can also provide shade with parasol shape and include a bench for farmers to have a rest together and a storage to keep their farming tools. Although urban farming itself provides a socio-communal benefit, the rain water collector can give a more chance to get close to neighbors when they share this installation with each other. Figure 4-13 shows that the more modules are arranged with that pattern, the more opportunities to share space increase.

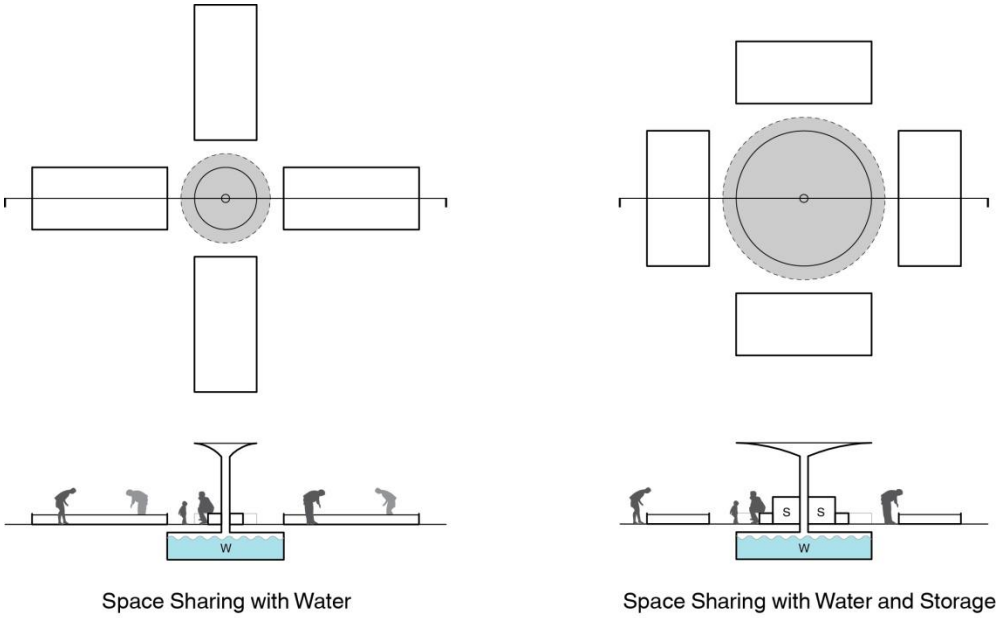

Fig. 4-10. Combination of Module B with Rain Water Collector

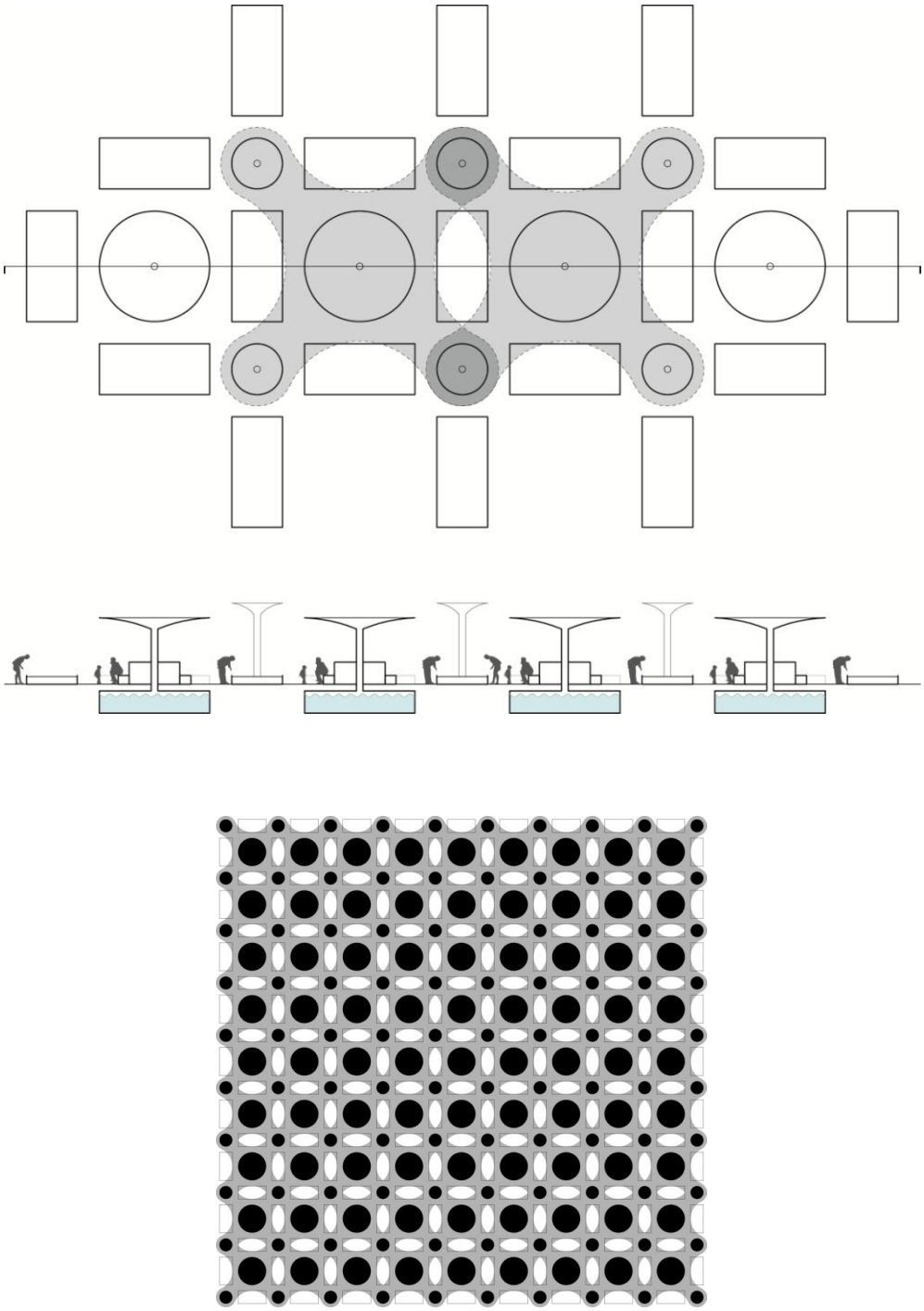

Fig. 4-11. Expansion of Sharing Space

4.2.3 Reuse of the Existing Buildings for Urban Farming

The other design concept is to reuse the existing buildings in the site, adapting to the purpose of farming. There are three main buildings and supporting facilities. The main buildings will be transformed and major structures of these buildings will be maintained, the supporting facilities can be reused for farming support facilities, such as food waste disposal and compost producing plant .

Building A has three stories and rooftop and its size, 68 meter by 50 meter, is generous to practice farming in or on this building. There are four cores and two freight elevators that can carry crops in sufficient quantity. Building B is 68 meter by 50 meter in its size and has two stories and rooftop. The first floor is store and second is storage. There are particular space in the middle of building for auction which is similar to courtyard. This particular space has a potential to raise livestock. Building C is 81 meter by 30 meter in its size and has one stories and rooftop. According to the reconstruction of Garak Market scheme, car entrance and road are planned in the middle of this building.

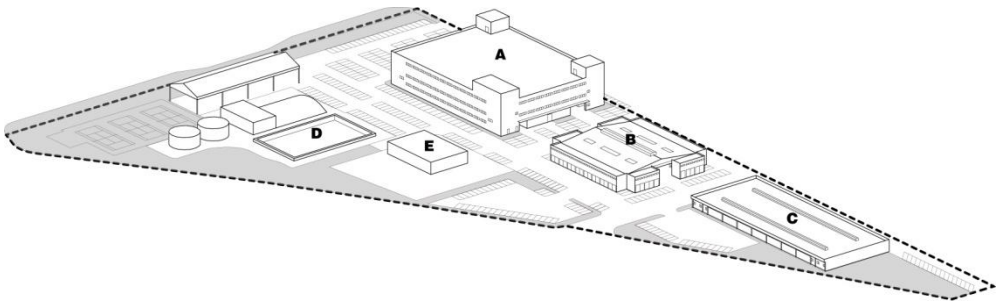

Fig. 4-12. Existing condition in the Site

4.3 Design in the Site

4.3.1 Programme Layout with Urban Context

In this site, the programme for urban farming is mainly divided two, commercial farm and community farm. Urban farm can provide not only income earning with commercial farm but also recreation, relaxation and communication with community farm. These two programme is arranged by consideration the urban contexts.

Residence area and Tan Cheon is considered for community farm. The community farm is designated toward residence area to make residents more accessible to the farm, and the plan for expansion of urban farm to Tan Cheon affects the location of community farm toward this river. In this community farm, a diverse group of people in a neighborhood comes together to raise and consumes food for themselves. The existing builds in the area, where community farm is planned, is transformed to support facilities, such as education center for farmers and children, urban farming laboratory, restaurant and kitchen which use food from this farm, and flea market to exchange and sell food, etc.

For a location of commercial farm, Garak Market is considered. Along with this market, this commercial farm maintains the relationship for food sales, playing a role in providing food to local residents without food-mile rather than selling food far away. The existing build in this area is transformed to serve

commercial farm and lands around the building is also used for farmland to sell products.

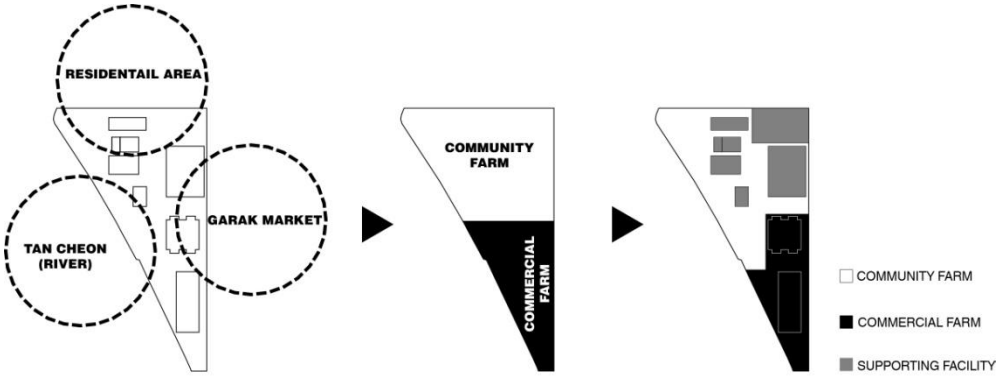

Fig. 4-13. Urban Farming Programme in the Site

4.3.2 Adjustment of Modules and Space Sharing System

The modules will be adjusted to the site according to farm characteristics. Raised Bed Module Type is mainly disposed for community farm to make a more chance to encounter neighbors, while Greenhouse Module Type which can produce food steadily is put on the transformed buildings to produce food commercially.

(1) Greenhouse Module Type and Sharing Space in the Site

The existing parking lot is maintained except for part of community farm. These parking lot is used for farmers and visitors. Greenhouse Module Type is

mainly installed with parking flat form. These combination will make space sharing between farming and parking. The existing facility that was used for water disposal is reuse for fish farm with Green House Module Type. For the commercial farm, this module mainly is used for steady food source production.

(2) Raised Bed Module Type and Sharing Space in the Site

Raised Bed Module Type is mainly disposed in community farm. Each person or family can have a designated plot. By doing so, a diverse group of people comes together to raise and consumes food for themselves and socializes with their neighbors. Rain Water Collectors also give them a chance to get along with each other.

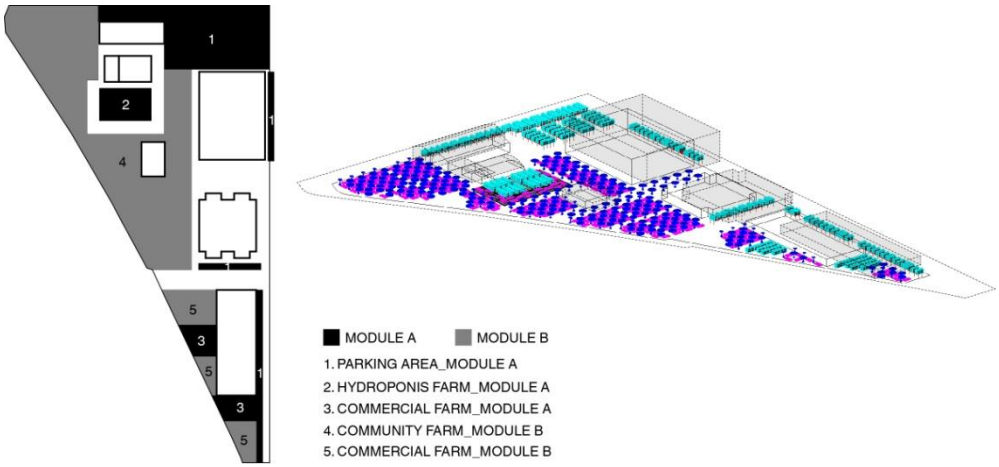

Fig. 4-14. Module Arrangement in the site

4.3.3 Transformation of the Existing Buildings

The transformation of existing main buildings are pictured in figure 4-19. The building was designed inside and outside, focusing on appropriate placement of program elements with respect to their function which is community farm support or commercial farm.

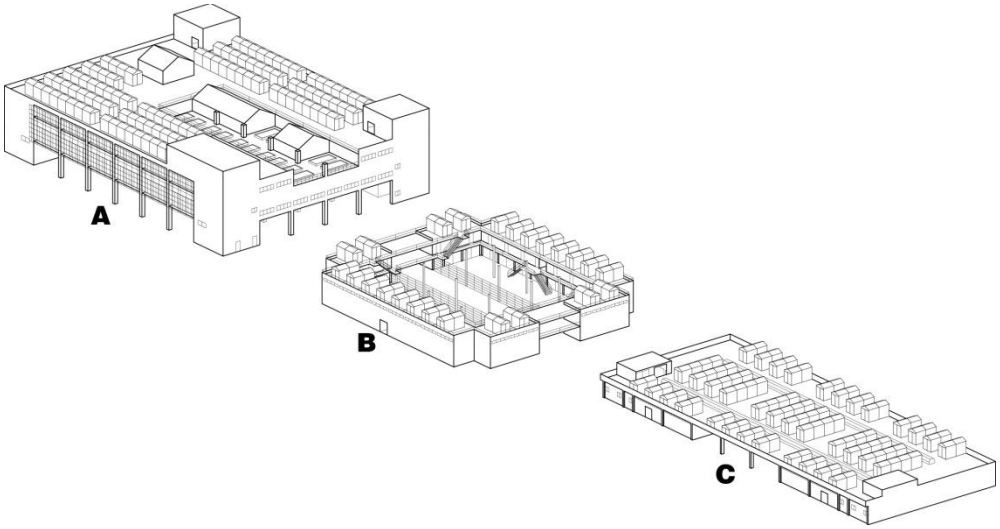

Fig. 4-15. AXO of Transformed Buildings in the Site

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(1) Transformation of Building A

Building A, it was food process plat, is transformed to mainly support community farm. The first floor walls were removed to make open public space. To let sun light from the roof to this huge space, 68 meter by 50 meter, three big skylights was installed. The programme of first floor is a flea market. Food which are cultivated from the community garden can be sold or exchanged in small scale.

The programmes of second floor are restaurant, cooking school and store of seeds and farm tools. The restaurant can easily get local food sources from urban farm and it also has herbed beds inside. The cooking school is planned to give a chance for people who usually don't cook their meal. In this school, people can get information that how to cook with locally produced in this urban farm. Urban farmers can get seeds and tools for farming from this special store.

In third floor, farming education center for children and urban farmers, and laboratory will be located. In this education center, school students around this site and elementary urban farmers can get a chance to learn how to grow food sources by urban farming experts who research and develop the skill and method of urban farming in laboratory. There are theory tutoring in classroom and experiential tutoring at southward terrace with raised bed types. This terrace was made by partially removing walls of third floor. On the roof top, there are several green house modules to research urban farming with laboratory. A special facade is installed to grow plants.

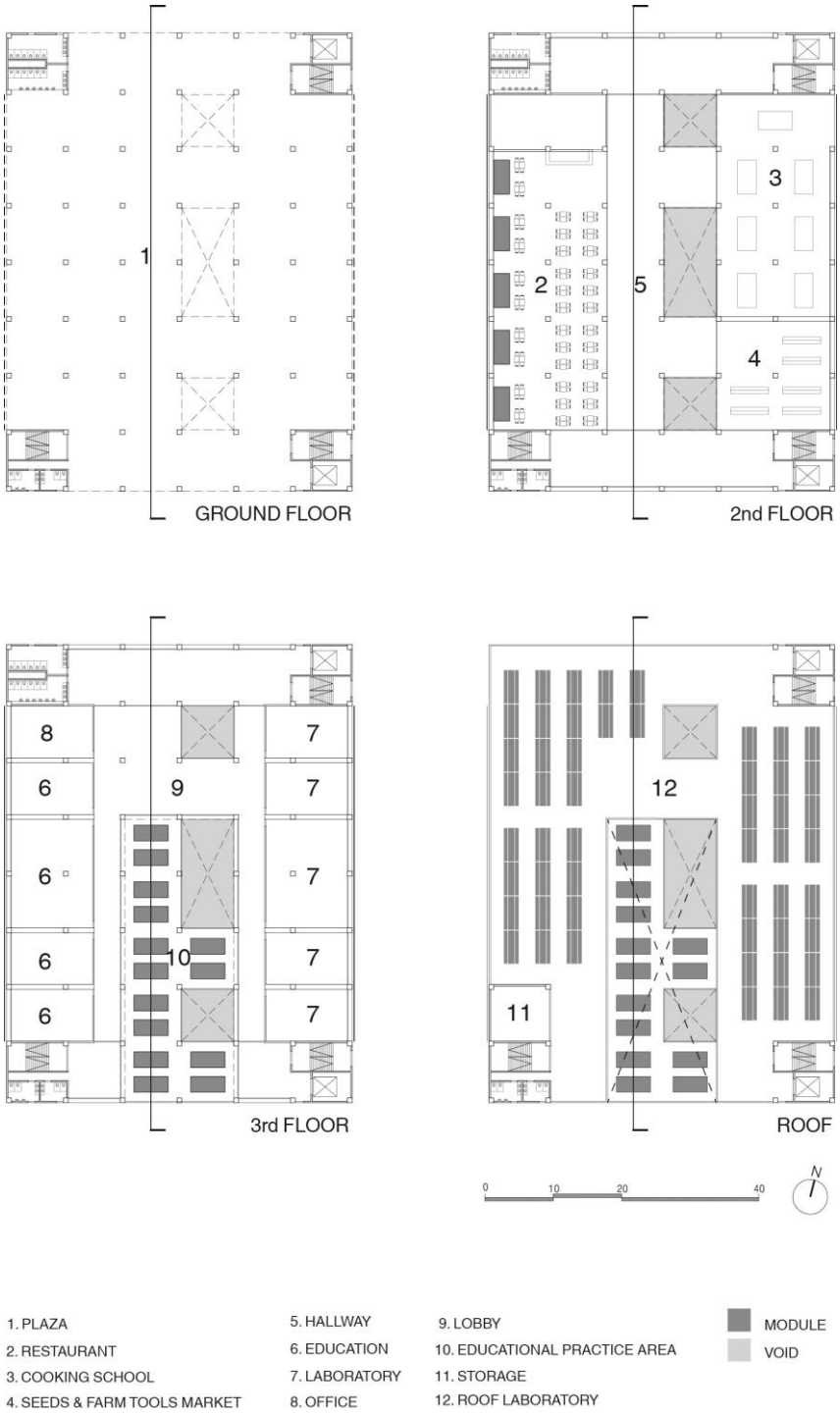

Fig. 4-16. Plan of Transformed Building A

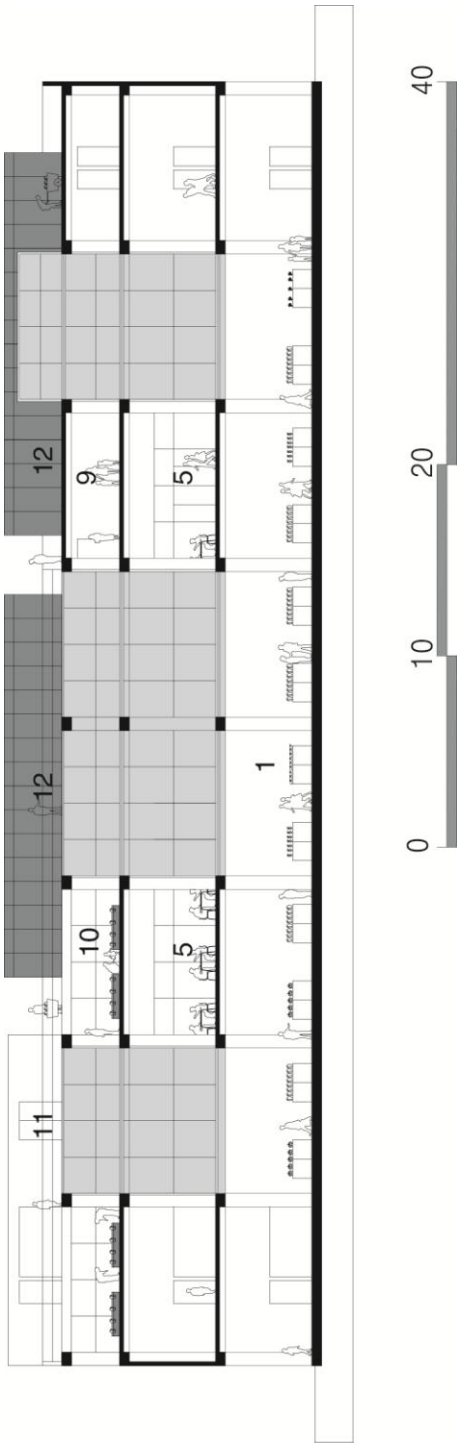

Fig. 4-17. Section of Transformed Building A

(2) Transformation of Building B

Building B, it was dried-fish store and auction house, is transformed to a commercial farm for producing vegetables and eggs. In the middle of this building where was used for auction, is transformed to raise chickens for local supplying of fresh eggs. People can experience how to be chickens raised and chickens hatch eggs before their very eyes through the passage. On the second floor, there are food stores that sell vegetables grew on the roof top and eggs.

(3) Transformation of Building C

Building C, it was dried-fish store, is transformed to a commercial farm for producing vegetables. There will be a plan to make vehicle entrance in New Garak Market. Considering this plan, the middle of this building space is transformed to open space and is used for passage for a while. The programme of first floor is food stores and these stores grow food sources on the roof top with green house modules.

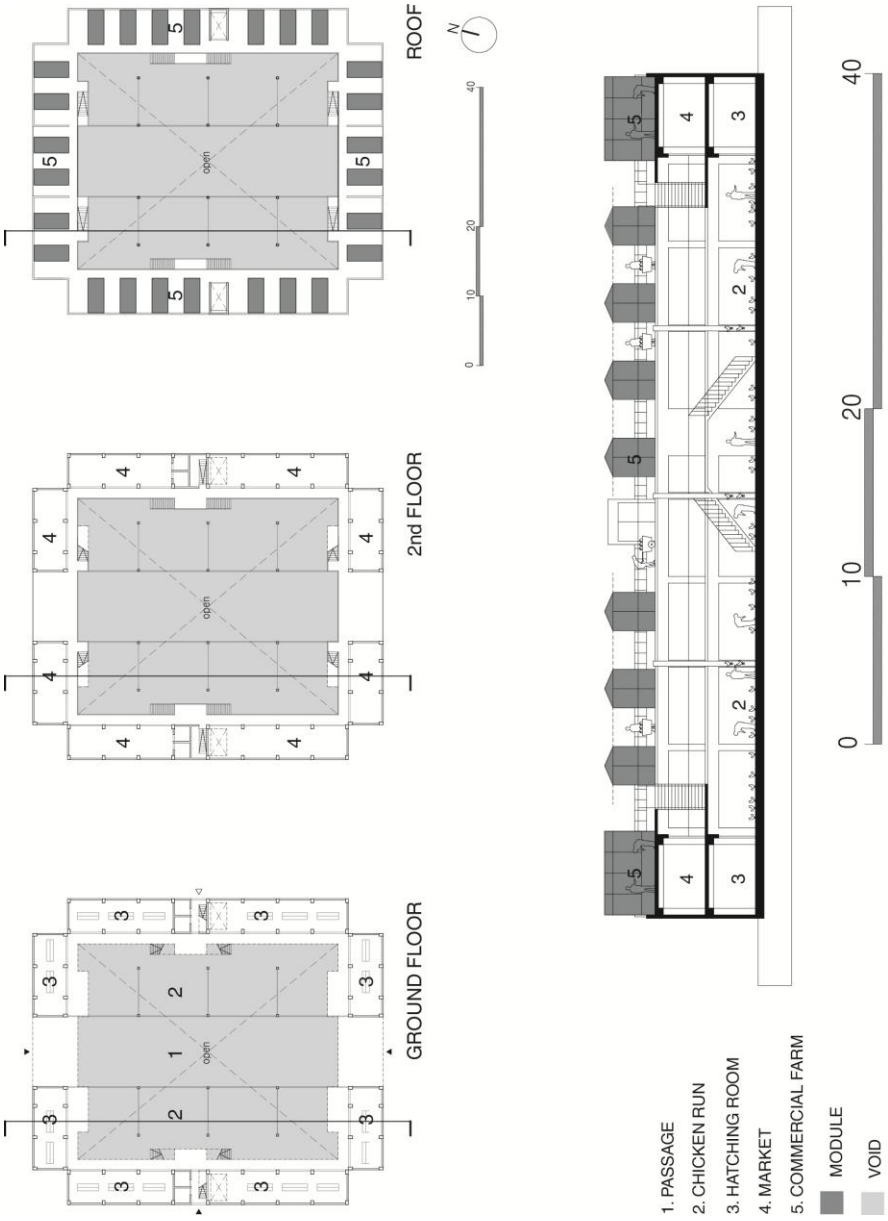

Fig. 4-18. Plan of Transformed Building B

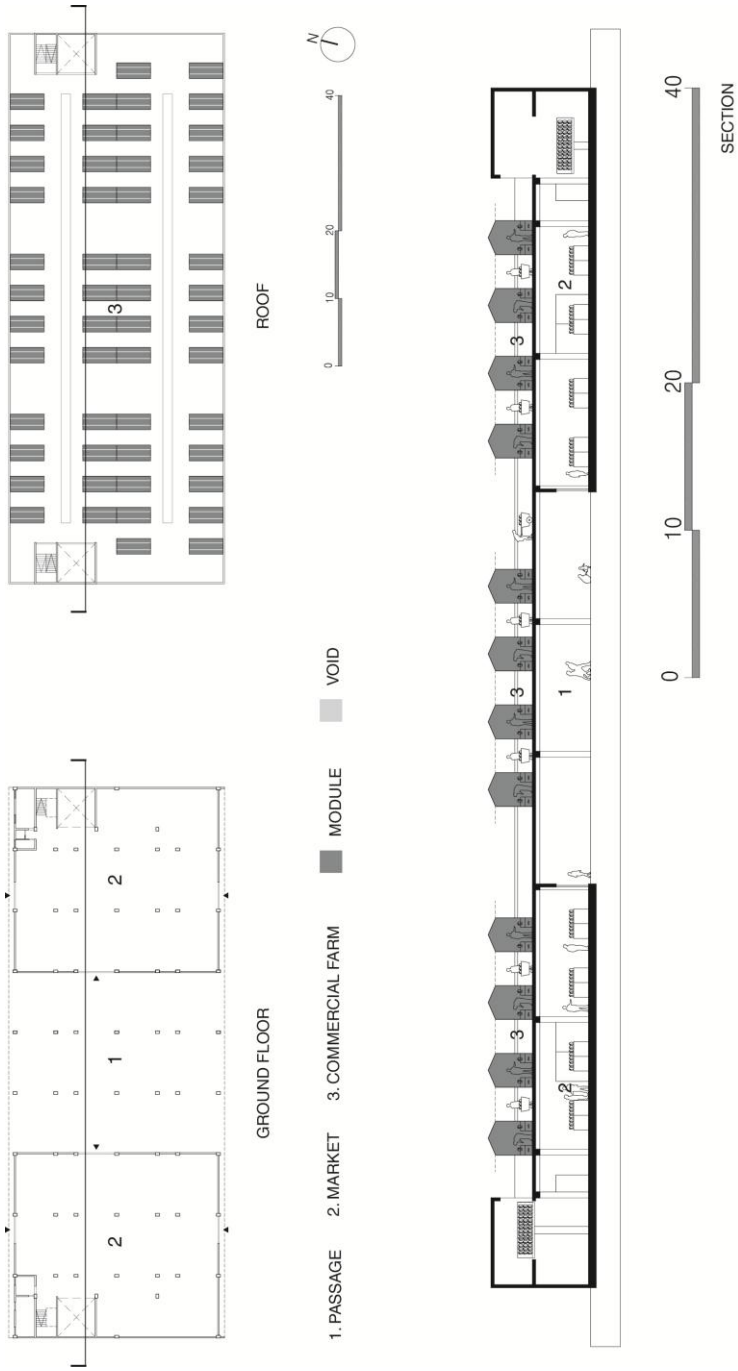

Fig. 4-19. Plan of Transformed Building C

(4) Transformation of Supporting Facilities

Aside from the main three buildings, there are supporting facilities, such as sub-station, waste disposal, and water disposal plant. These facilities is also transformed or maintained to support urban farming. The sub-station is reused for making compost and waste disposal is maintained. The food waste from Garak Market is collected at waste disposal and compost is made by this food waste at reused sub-station building. Water disposal plant is also reused for big fish farm. In here, by arranging Green house modules and connecting it to fish farm, vegetables and fish can be grew at the same time with *hydroponics* system.

4.3.4 Summary

The site was selected within Garak Market to maintain the urban farming system, considering the reconstruction of this market. The site has a particular urban context, such as market, residence area, and nature. Before designing urban farm in this site, different contexts was considered and the design strategy was established. There was the design concepts to make standard modules to use it widely in urban area and to reuse the existing buildings sustainably. With these strategies and concepts, Urban Farm in Garak Market was designed.

In this design experiment, two different urban farming types, community farm and commercial farm, are proposed in the site. Each farming types are planned to use specific modules. This division of adjustment of faming type and module doesn't intend separation of food production in urban area with urban farming. These diverse urban farming factors can make the positive effect when they help and affect each other.

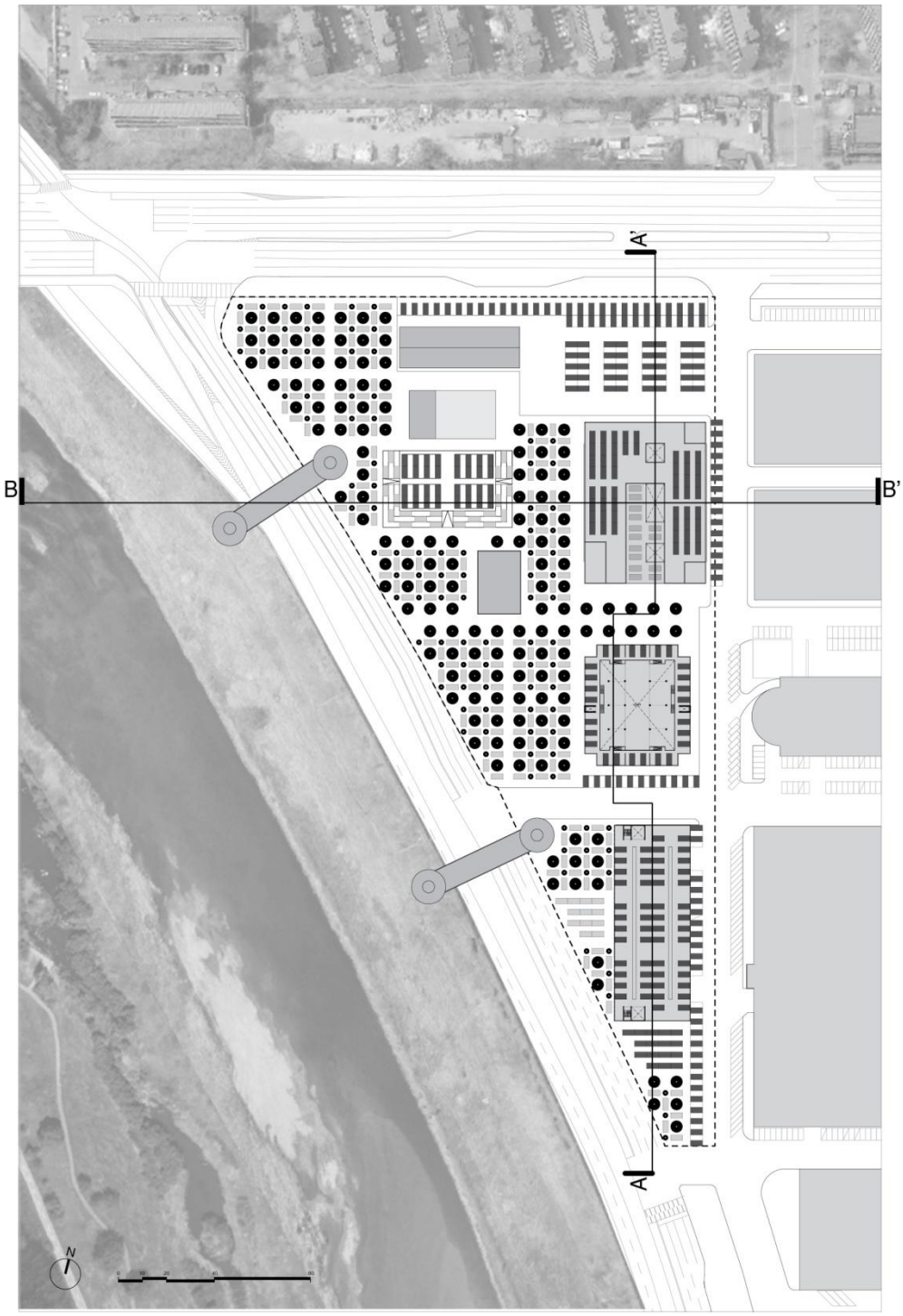

Fig. 4-20. Site Plan of Urban Farm in Garak Market

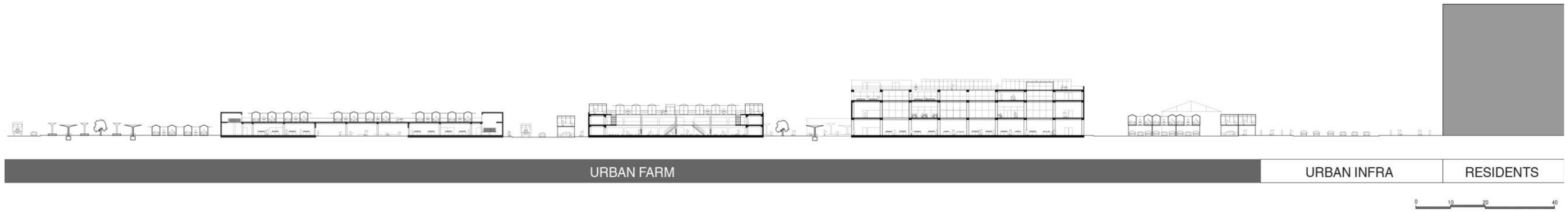

Fig. 4-21. Site Section AA'

Fig. 4-22. Site Section BB'

Fig. 4-23. View of Community Garden

Fig. 4-24. View of Transformed Building B

Fig. 4-25. View of Roof-Top Farm in Building A

Chapter 5. Conclusion

This thesis proposes an architectural solution in relation to food production and consumption within urban settlements. Food plays a key role in our daily lives. Urban areas are dependent on food production in rural area. Rapid industrialization has caused South Korea's urban climate to develop at an increasingly quicker rate. Urban areas, especially Seoul, have developed at an incredible rate and in response the scale of food demand now overwhelms the capability of food production in rural areas. The increase in urban migration has also resulted in a decrease of rural development and population. This has forced South Korea to become more reliant on consumer goods imported from outside nations. If this trend continues, the connection between urban and rural areas, in relationship to food supply and consumption in South Korea, will become more and more strained, both physically and mentally. Urban farming is a proposed alternative to mitigate this issue. This alternative was explored in detail in the Garak Market design experiment in Seoul.

Chapter 2, looked at precedents and the potential of urban farming through a series of analyzes and practical case studies, which were categorized accordingly within their existing urban infrastructures. The precedents displayed the adaptability to context and provided viable solutions in relationship to urban farming. Furthermore, they revealed the potential of seamlessly integrating urban structures with agriculture. The analysis of these case studies revealed each project must remain sensitive to the existing context and that the formal resultant is entirely

dependent on context. Although, similar forms can be displayed in different spatial contexts. There are overlapping similarities between typologies. Each case was evaluated in relationship to the participant, achievement, and resource. This evaluation served as a foundation for the urban farming design experiment at Garak Market.

Chapter 3, compares conventional markets to the modernized market system. This comparison revealed that even though modernized market systems are more efficient, it creates a larger separation between food and urban life. This comparison led to a more detailed investigation into the existing food distribution system in Garak Market. It showed that Garak Market is the biggest wholesale market in Seoul, and plays an integral role in Korea's food distribution systems. However, most of the food in this marketplace are either produced in domestic rural areas or imported from abroad. The proposal seeks to find a sustainable solution that will decrease the local dependence on imported goods. It also attempts to incrementally integrate urban farming into the everyday functions of the existing market. This proposal does not consider large scale reconstruction but rather to use urban farming as a compartmentalized design component that will add value to the existing market.

This design proposal attempted to add urban farming into the existing market through a series of four design strategies and three design concepts. Each design strategy, remains sensitive to the existing context surrounding the site. The first strategy attempted to transform Garak Market into a local food producer. The second strategy looked at the possibilities of making this market a socio-community

center for the local neighborhoods. The third strategy looked into introducing urban farms into surrounding public spaces. The last strategy focused on maintaining an urban farming system post reconstruction of the marketplace.

The first design concept was a module system with two simplified units that could be easily used and replicated in generic urban areas. The second design concept focused on a spatial sharing system within these modules. This allowed for more intensified social and environmental interaction. The final design concept sought to reuse the existing buildings in order to further transform and develop the site.

The urban farm in Garkak Market was designed to cope with the current food situation in South Korea. Although, urban farming is not the best solution, it can be viewed as a viable alternative for food security and restoring food relationships in urban areas. Furthermore, adding food production functions into the existing markets allows markets to function as a food producer as well as a food distributor in a sustainable manner.

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국 문 초 록

자급자족 도시를 위한 가락시장의 도시 농장화에 관한 연구

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인간 생활의 기본요소인 의·식·주 중 식(食)은 우리의 삶에 밀접하게 관계되어있다. 단순히 인간의 생명을 유지하기 위한 '먹는 행위'뿐만 아니라, 각 나라 또는 지방의 독특한 문화의 형성에 큰 기여를 해왔다. 농촌과 도시의 관계에 있어서도 식(食)은 굉장히 중요한 역할을 해왔다. 오래 전부터 도시는 자체적으로 식량을 생산할 능력이 부족했기 때문에, 그들의 식량을 농촌에 의지해왔다. 이는 역사적으로 도시의 먹거리를 위하여 농촌이 큰 역할을 해 온 것임을 알 수 있다 .

근대 이후 전 세계적인 산업화의 영향으로 도시화가 빠르게 진행되면서, 대부분의 도시들은 끊임없이 팽창하고 있으며 세계인구의 절반 정도가 도시에 거주할 정도로 도시는 우리의 주요 거주지가 되어가고 있다. 2050년에는 도시에 거주하는 인구가 현재의 두 배에 이를 것으로 예측되어지며, 이는 곧 도시의 거주민들을 위해 현재의 두 배에 달하는 식량의 공급이 필요할 것임을 시사한다.

우리나라의 상황도 역시 마찬가지이다. 특히, 1960년대 후반 이후 서울은 도시화와 산업화로 인한 본격적인 사회구조적 변동이 일어난 이후로 그 크기와 인구가 꾸준히 증가해왔다. 그러나 도시의 식량 수급을 담당하는 농촌의 곡물 생산량은 확장하는 도시와는 반대로 감소하고 있다. 국내의 농지면적과 농가인구는 꾸준히 감소하고 있으며 우리의 주식인 쌀을 비롯한 곡물 자급률도 꾸준히 감소하고 있어, 대부분의 식량에 대한 수입 의존도가 증가하고 있는 실정이

다. 이에 따라, 국제 식량시장의 변화에 민감해져 식량 안보적 차원에서 불안정한 상황이 예상되며, 우리가 먹는 음식들은 물리적·심리적으로 우리의 삶 속에서 점점 멀어져 갈 것이다.

본 논문은 예상되는 도시의 불안정한 식량 수급 상황과 우리의 삶 속에서 점점 멀어져 가는 음식과의 관계에 대하여, 건축적 디자인을 통하여 이를 극복하기 위한 해결책을 제시하기 위한 것이다. 이는 경제적·사회적·정치적인 차원에서의 거시적 식량확보 방책이기 보다는, 미시적인 건축 디자인 실험을 통하여 국내의 식량자급률과 우리의 삶과 먹거리의 관계 회복에 기여하고자 하는 것이다. 현재 안정적인 식량 확보 방안으로 농업의 진흥과 보호 정책, 해외 식량기지 개발, 신 농법과 종자 연구, 도시농업 등 여러 가지 대안들이 논의되고 있다. 이 중 도시 농업은 건축적 디자인 범위 내에서 기존의 도시 조직을 이용하여 자체적으로 식량을 확보하고, 이를 통하여 우리의 삶과 먹거리의 관계를 개선하는데 도움을 줄 수 있는 가능성을 가지고 있다.

도시 농장 디자인 실험을 위한 시설은 시장이다. 시장은 도시인들이 먹거리를 구할 수 있는 중심지이다. 하지만 주요 역할은 도시 외부에서 생산되는 먹거리를 도시에 분배하는 매개체일 뿐이다. 이러한 기존 시장의 역할을 바탕으로, 서울 각 지역으로의 식량보급 거점 역할을 해온 가락동 농수산물 도매 시장을 대상지로 선정였다. 본 디자인 실험은 먹거리 분배라는 기존 가락시장의 역할 위에 도시농업을 통하여 자체적 생산이라는 새로운 기능을 추가하여 도시의 자급자족 능력을 배양하고, 주민의 생산 참여를 통하여 도시인들의 삶과 먹거리의 관계를 개선하는데 목적을 두고 있다. 나아가 국내의 감소하고 있는 식량 자급 상황, 예상되는 불안정한 식량 확보 문제, 그리고 우리의 삶과 먹거리의 관계 개선에 도움이 될 것이다.

주요어: 먹거리, 도시 농업, 자급자족 도시, 시장
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