

# Crop Chain Market

Reassemble the “Food Supply Chain”  
in an experimental spaces dedicated to food

Daniele Tanzi 4490606

## INTRO PROBLEM STATEMENT

An important part of our life and a fundamental aspect of the human being existences is represented by food as edible product and all the activities related to it.

In the economic climate we are living today the prevalent attention is focused on what we use, consume and waste during our daily life. In particular the theme of food consumption is nowadays placed at the center of this topic, given by the high excesses of the western countries.

The intricate society hierarchy and the detachment of people from rural activities, leads individuals to have not anymore the possibility to discover the origins of food by themselves. We have completely delegated the role of providing food to a chain of sellers and distributors, and, for this reason, individuals became uninformed on how food is produced and brought to ours plates.

Starting from this picture, I decided to investigate on the “Food Supply Chain” in order to identify where the problems lie.

The strategy of the last decades, due to the high demand of edible products in urban contexts, ended in a complex network layout. However, before arriving to its final urban destination, the food products start their paths in the rural zones, far away from the place where they will be sold. In the rural areas the first phase of the “Food Supply Chain” takes place: the **production**. Periodically, the edible products are harvested, packaged and delivered to industrial manufacturing areas where the goods are processed. The **processes** are the second phase, and consist in the selection of the harvested products by size and weight. Within the same location, the items are cleaned, packaged and stocked in large refrigerated hangars. Few days later, the articles are transported toward urban areas into the **retail** activities. Here, finally, the consumer is able to access the final food products.

From this picture is evident that this network is clearly based on transportation. This division and dislocation, spread out on local, national and international markets, clearly produces many waste of resources, as materials, spaces and time. Concretely, this means that the end product is less fresh, more expensive for the consumer and has a higher impact on the environment than before. Especially for its transportation emissions and needed packaging materials, nowadays food is always less affordable.

Moreover, even if the final product is close to the consumer in the city, as already stated, the developed retail formats are not involving the costumers to be part of the edible product evolution processes that is bound by the industrialized network and so hidden behind the final displayed items. The consumer is not used anymore to going where the food is produced, affecting both his knowledge about what he is eating and the cost of the needed transportation.

## OBJECTIVE

For these reasons, I strongly believe that, with the nowadays technological changes, a new building typology should be developed, where all the phases of the “Food Supply Chain” should be elaborated as one: production, process and retail.

The objective is to develop a building typology that could host a space entirely dedicated to food, where all the unnecessary phases are removed, saving on time, resources and costs, and avoiding all the possible wastes related to transportation and processes. In addition to the evident economic benefits, within this new space the consumer could achieve a stronger awareness on how massive quantities of edible products are produced. The project aims indeed to create a space build up from innovations and technology, where fresh local food, respect and knowledge about health are cultivated and taught.

## RESEARCH METHODOLOGY

Starting from the idea of a “Food Supply Chain” based on a complex network, the research was firstly developed by **disassembling** this network in single phases, and by **analyzing** the ones where architecture has a significant impact: production, process and retail, and the spaces related to them.

For this purpose an analysis was made on the most efficient technical systems involve in the food field today, the architectural spaces that host these activities and the network of resources that are flowing between this spaces. The survey has been delineated as an investigation on the possibilities to combine different food stages under the same architectural envelop. It results in a **reassembling** of the this element in a more compact “Food Supply Chain”, in order to lower the time spent between the production and the consumption, reducing the use of space thanks to the innovative production techniques (as hydroponic and aquaponics systems), and up-cycling the waste produced in order to generate other valuable resources.

Therefore, the used methodology consists in Disassemble – Analyze – Reassemble, and the design takes care of the third part: the Reassemble

Moreover, the research pointed out the importance of the products movement in the existing situation, mainly achieved throughout transportation and systems. For this reason a new type of movement is also introduced as a key element for the unique space designated for the new reassembled “Food Supply Chain”.

## DESIGN STRATEGY

The design strategy takes care of the reassembly of the three element of the “Food Supply Chain”. In order to achieve this goal three main principles were set as the basis and foundations to generate this new architectural typology.

The **first principle**, as already stated, is to reassemble the “Food Supply Chain” fundamental phases under a unique architectural envelop. The potential of the reunion is to share spaces and resources between the different phases. This provides a balanced overall network that reuses exhausted resources, as water, heat and biomass, for a different purpose. It result in an up-cycle flow that needs only few inputs from the external environment. This reunion leads to the abolition of unnecessary waste for transportation.

The **second principle** is to bring the reassembled “Food Supply Chain” envelop within the urban boundaries, where people live, work and move. This guarantees many positives aspects for the urban environment. On the technical point of view, it removes any kind of transportation, reduces the urban waste of packaging materials, lowers the carbon dioxide percentage in the air and controls greatly

risks of floods. On the social prospective, it affects inhabitants' behavior on reducing the waste of food, it generates a new public space that lives in symbiosis with the greenhouse temperature effect, and it opens the access to the production process to the consumers, now, one more time, part of the process, and more aware of how his food is produced.

In order to achieve this new location within the city borders, the building layout has to be flexible and adaptable to any selected context. For this purpose a scalable and modular element has been designed and used as an essential tool to fulfill the resulting voids of the urban grid, where the new typology can be placed. This core element, embodied in the structure of the building, can also shape its volumes in relation to the mass demand of products for the specific urban circumstance.

For instance, I decided to choose Amsterdam as an experimental site for my project, thanks to Dutch greenhouse horticultural background. In particular, the selected site is the Marineterrein area, an urban void completely surrounded by water, where the proximity to the city center arises the value of its potential, and where the proximity to water enhances the emptiness of the site.

The **third principle** is to replace the transportation infrastructure that, in the actual supply network, works as connection between different phases and location. Within the new unified building, the transportation, as previously intended, has to change its face and meaning. The new needed transportation indeed acts only in the movement of the products through the building within the right time span. The facility used for this purpose is a rail system, an optimal solution to succeed in generating all of the different stages of one product at the same moment and in different positions of the building.

## PROJECT

The development of the project starts from the proposal of an architectural element that can embrace the required spaces of the production, processes and retail: **the structure**.

This element is composed by a CLtimber material, and is design to host and link all the technical systems and spaces required by the project, as the skeleton does for the vertebrates animals. In order to do that, it has to be modular and flexible to several different configurations, and it has been studied as easy as possible to assemble without any additional elements. This modularity also guarantees possible and future extensions.

The real potential of the structure lies in the possibility to using it as a hooker for all the other needed elements of the building, such as walkable floors, walls, systems, facades.

Moreover while the structure remains the same, the function that it host can change in relation to the spatial need.

An addition value of the structure design lies in its visual permeability, which allows the visitors to look through all the different functional spaces, and have an overall picture on how this new typology works. The possibility to watch and be part of the entire strategy is used as an important tool to increase and provide a stronger awareness about food production, and to reconcile the user with it.

As already stated, the structure represents the core of the design, and the key element for the success of a reassemble "Food Supply Chain". However, another essential element, which derives from the initial analysis, is the movement, here, embodied in the new element of **the rail**. The main function of this device is to move the items trough the different stages of their life and to bring them throughout the entire building toward the consumer.

This element also acts as space boundaries, especially from a visual point of view. Its constant and rhythmic presence through the entire building make it a symbol of the new typology, and with its strong visual impact it defines spaces and functions. Moreover the rail works as a secondary structure, supporting several devices in the different part of its course, from pots for items growth in the production phase to retail display.

The rail could also be seen as the red thread of "Food Supply Chain", travelling through the different phases of production, process and retail, and acting, indeed, as the movement infrastructure that I

wanted to change. With this new way of transportation also the three phases of food change their aspect and are re-elaborated within a new and unique building.

### **Production:**

Starting from the analysis of the most innovative techniques used nowadays in food supply chain, the project starts with the design of the production phase. It is based on an “urban diet” that is composed by different products that are producible with the hydroponic and aquaponic techniques and within an artificial environment. The volumes of the production part derives from data collected by a hypothetical visitors and neighborhood demand. For this purpose a mathematical algorithm has been elaborated in order to get track of the volumes of the production and the resources needed by the demand of a certain amount of people. The parametric algorithm, in collaboration with the modular structure, allows to have an overall pictures of the first dimensions of the building but also to estimate possible scenarios of future expansion of it.

The hydroponic system, a soil-less technology, in cooperation with other systems as water, heat and lights, creates the perfect environment for the growth of the green products. Thanks to the rail device, the hydroponic pots are brought within a specific time span from the seeding to the transplanting laboratories, toward the harvesting points. The growing products, depending on the travel rail length between the laboratories, travels at a certain velocity for 24 hours in order to reach a certain point of the production line at the precise maturation day. To give a production line example, a selected product as the lettuce starts its path the 1<sup>st</sup> day at the seeding laboratory where it is planted in the hydroponic pot, the 25<sup>th</sup> day will be located in the transplanting space where it is relocated in a bigger pot. The 45<sup>th</sup> day the already mature green lettuce will be at the harvesting point where it will be sold or moved to the processes sector.

The required laboratories for the production, where the visitors have the possibility to access, can be managed by specialist workers or by robotic devices that take care of the processes.

Another production device is the aquaponics system that can growth many kinds of fishes, shrimps, oysters and mussels. Working in symbiosis with the hydroponic system, the aquaponics fishes eat some nutrients that are left inside the water by the plants roots meanwhile they clean it in order to be used again.

These advanced techniques has been selected to lead a more secure, healthier and constant production, that can work for the whole year. For this purpose different climate ambiances are created, and controlled with heating systems powered by sustainable resources (heated up and powered by Combine Heat Power systems that is boosted by methane, generated by bio mass fermentation inside a bio-digester tank).

As a first action to increase the consumer awareness, within this first phase the user can already choose if being part of the production, by manual activities (seeding, transplanting, harvesting), or not, taking advantages of the mechanical techniques.

Moreover, at the end of the production phase, part of the items will be moved directly to the retail, where the user can harvest it and take it home, while the another part will be moved to the second phase, the processes.

### **Processes:**

Sorting, cleaning and packaging are the processes present between the production and a specific retail formats. This space is dedicated to the installation of industrial manufacturing machines that processes the harvested mature products and prepare them to reach the display line. These equipment divides the items by size and quality before entering in a cleaning and packaging

procedure. At last, the packages arrive in a gathering display shelf, already part of the food display retail format.

### **Retail:**

In this new building typology, as already stated in the research conclusions, the three main themes of the food path and the technical systems are joined together with the social and public realm of the retail portion. The position of each phase settle an organized layout that guide the visitors through the life span of the products toward the access to the mature food that is gathered in the various retail formats.

Three retail experiences have been designed to let the costumer choose different ways to approach the food consumption. These spaces are fully thought to engage different human perceptions as sight, touch, smell, sound and last but not least: taste.

The only retail format that uses the industrial processing devices above mentioned is the **food display format**. From this format the user can easily pick up the finished, cleaned and packed product and take it home. The display is indeed located in the end of the sorting, cleaning and packaging processes. Even if the final product is not much different from the one you could usually find in any exiting supermarket, the evident difference clearly emerge both in price of the product, way cheaper that usual, and in the possibility to see, at the same moment of the acquisition, the procedure behind it and where it comes from.

Another space dedicated to the mature food is the **kitchen point format** that are involving direct culinary activities as salad bars and restaurants. They are placed at the end of the production line of different products. Here the costumer can choose directly from the pots the favorite green product or from the pools the fish that is going to be cooked from the chef and few minutes later served and tasted. This retail format manually process the products.

The **harvesting point format** is the most direct place where the public can have a full experience in contact with the production line. It completely skips the second phase of the processes. In this precise position many mature products are ending their production path and the individuals are allowed to harvest directly the plants and fishes from the pots or the pools, buy it, and take it home. It is the most interactive retail format where people use their hands to act as tool.

With this new building typology production, processes, retail and culinary experiences are combined together in other to be part of the same atmosphere and let the visitors walking by all the phases and be informed on the products life span. The efficiency of reassembling the production phases in the unique design strategy results in a project that investigates on the strong connection between food products and the architectural disciplines. The thesis aims to develop a critical project, and as such it tries to propose an alternative scenario to an existing situation.