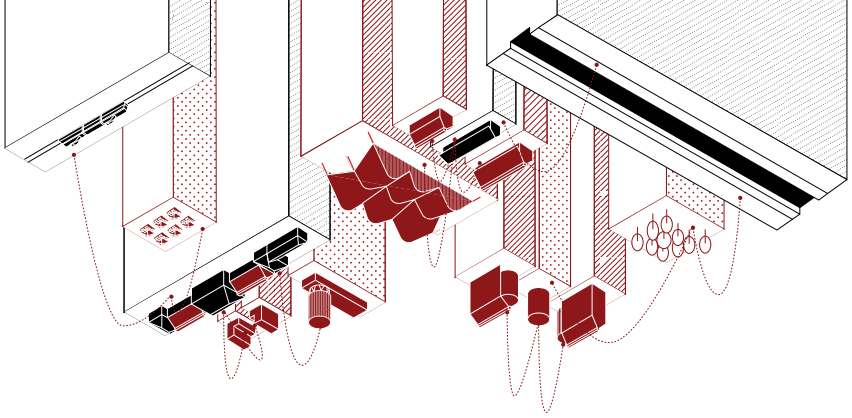
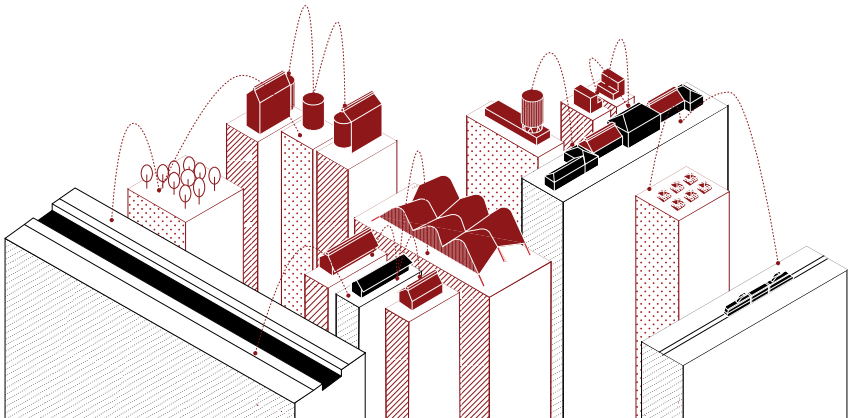


THE FOOD SMART CITY

IN THE FRAMEWORK OF THE CIRCULAR ECONOMY

A morphological and functionalist approach for the revitalization of **Porta Genova** in Milan.



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MSc Architettura, Costruzione, Città

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THE FOOD SMART CITY

IN THE FRAMEWORK OF THE CIRCULAR ECONOMY

A morphological and functionalist approach for the revitalization of **Porta Genova** in Milan.

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Candidate

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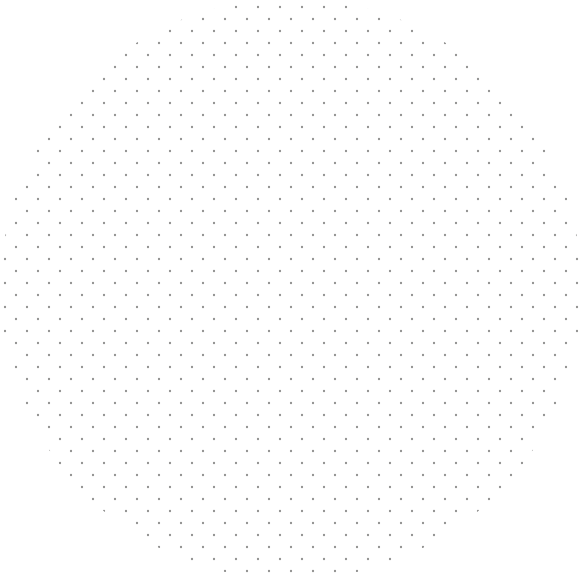


Preface

Impressive data show that cities all over the world are devouring 75% of Earth's resources. At the current rate, the urban population is predicted to be double by 2050, meaning the 70% of the total global population, thus raising serious questions about how cities could feed themselves in the future. This thesis was moved by the urgency of addressing this topic and the reasoning about how food could foster the revitalization of the disused or abandoned areas. Two main themes were discussed to tackle these issues.

The first one is strictly related to food. Since ancient city-states, food and animal routes have historically shaped the urban morphology. The reasoning about food led to the choice of the city of Milan as a case study for this work, since it is one of the leaders in the contemporary urban food policy scenario. Taking advantage of the moment of great visibility given by EXPO 2015, the city of Milan, in fact, launched an international protocol aimed at tackling food-related issues at the urban level, and developing new resilient urban systems, to be adopted by as many world cities as possible. The Milan Urban Food Policy Pact and the EXPO experience were interesting drivers for the project.

The second theme regards the choice of Porta Genova as the specific area for the project. Its revitalization is part of the larger reordering vision of seven railway yards, with the aim of fostering innovative urban spaces and reconnecting several areas of the Milan inner periphery. The place, formerly occupied by the railway, is an interesting urban slice which divides the district of Tortona-Solari and the area of the Navigli. The presence of two important ways of transportation, the railway and the Naviglio, makes it the perfect place for the reasoning about food and city. The site is a place of barriers, well-shaped by its boundaries, the Naviglio, the walls and the railway, still very accessible from different parts of the city, but also a place of empty places.

The project set the goal to reach three main objectives:

- Study how food can influence the urban morphology and the architecture;
- Find a solution to manage a vast empty space in the city of Milan, as part of a wider system;
- Design an original system of food production in urban environments, which could be used as a device to foster renovation of degraded or abandoned areas.

The project was approached through three topics: administration, retail and production of food in the city. These macro-topics were declined in three architectural projects within the framework of the circular economy. The first topic transforms the former railway station in an innovative place of catering, with specific attention to the new food habits and the delivery methods. The second one renovates and expands the former railway warehouse, placing a food market. The third one proposes a novel prototype of vertical farm, a future food hub, which serves the other two spaces. The quite small scale, the compactness and the low construction budget of the farm (compared to similar concepts) supports the attempt of making it a replicable prototype.

The three projects are connected by a general redefinition of the entire area of Porta Genova through a new agricultural park, with urban gardens and crops, bridges, a fish basin and a new water reservoir, the Darsena Nova.

All the buildings are also designed with the specific purpose of being circular, with completely dismountable wooden and metal structure. The general organization of the masterplan is also thought as a closed-loop system of energy and resources.

This thesis represents an attempt to discuss an urgent topic such as that of resource scarcity together with a more traditional study on the urban morphology. The project shifts from the macro-urban scale to the architectural and construction level, considering different aspects of sustainability, innovation and culture. The final outcome can be read as a suggestion for future similar interventions or a provocation to try to approach the urban and architectural project under new perspectives.

La città, un mondo artificiale, dovrebbe essere tale nel senso migliore: fatta con arte, configurata per i propositi umani.

(Kevin Lynch, Paolo Ceccarelli (a cura di), 1964).

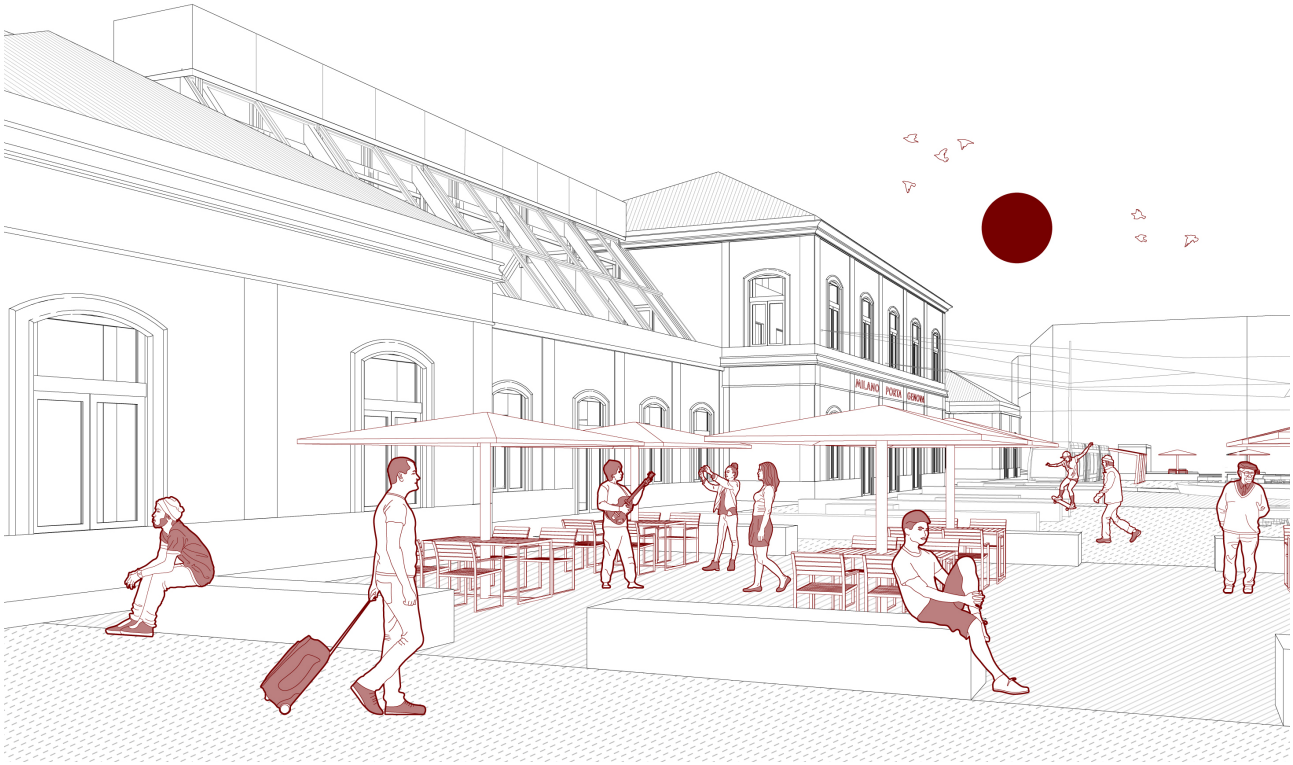
CHAPTER 01

Milan in 2030
Three scenarios for the future

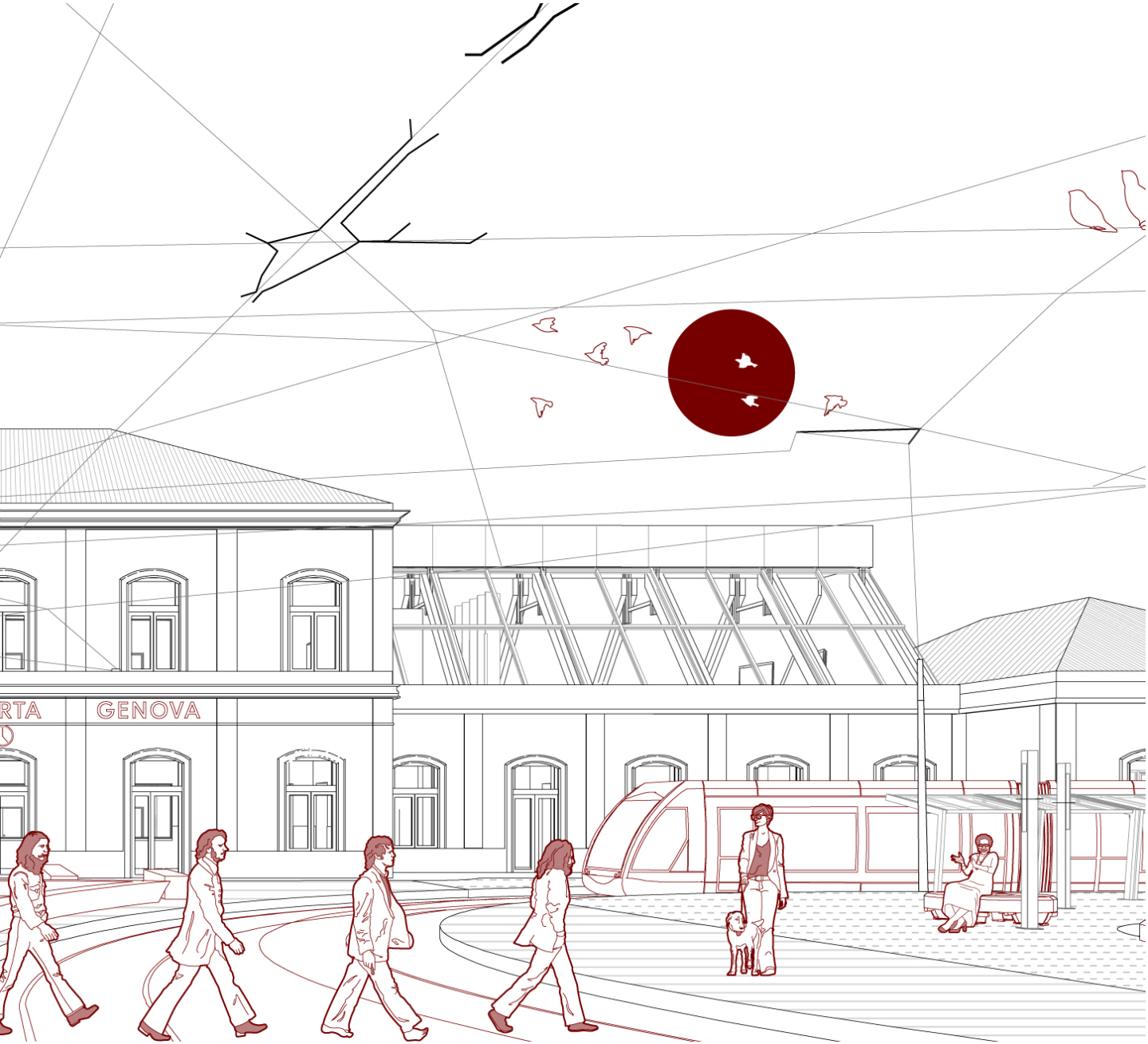
Incoming order for a better future

The whistle of the tram accompanies me while I emerge from the metro station. I am late. My boss, chef Miguel won't be happy at all. I try to hurry, but the square is full as usual. I would like to yell at the guy that accidentally crosses my way with his luggage, but I don't have time for that. The waiters are already cleaning the tables for the inauguration of the new restaurant.

How could I have been late on such an important day? At least the station is well connected to the city. Despite my delay, I saved some time using the metro.




MILANO


RTA
GENOVA

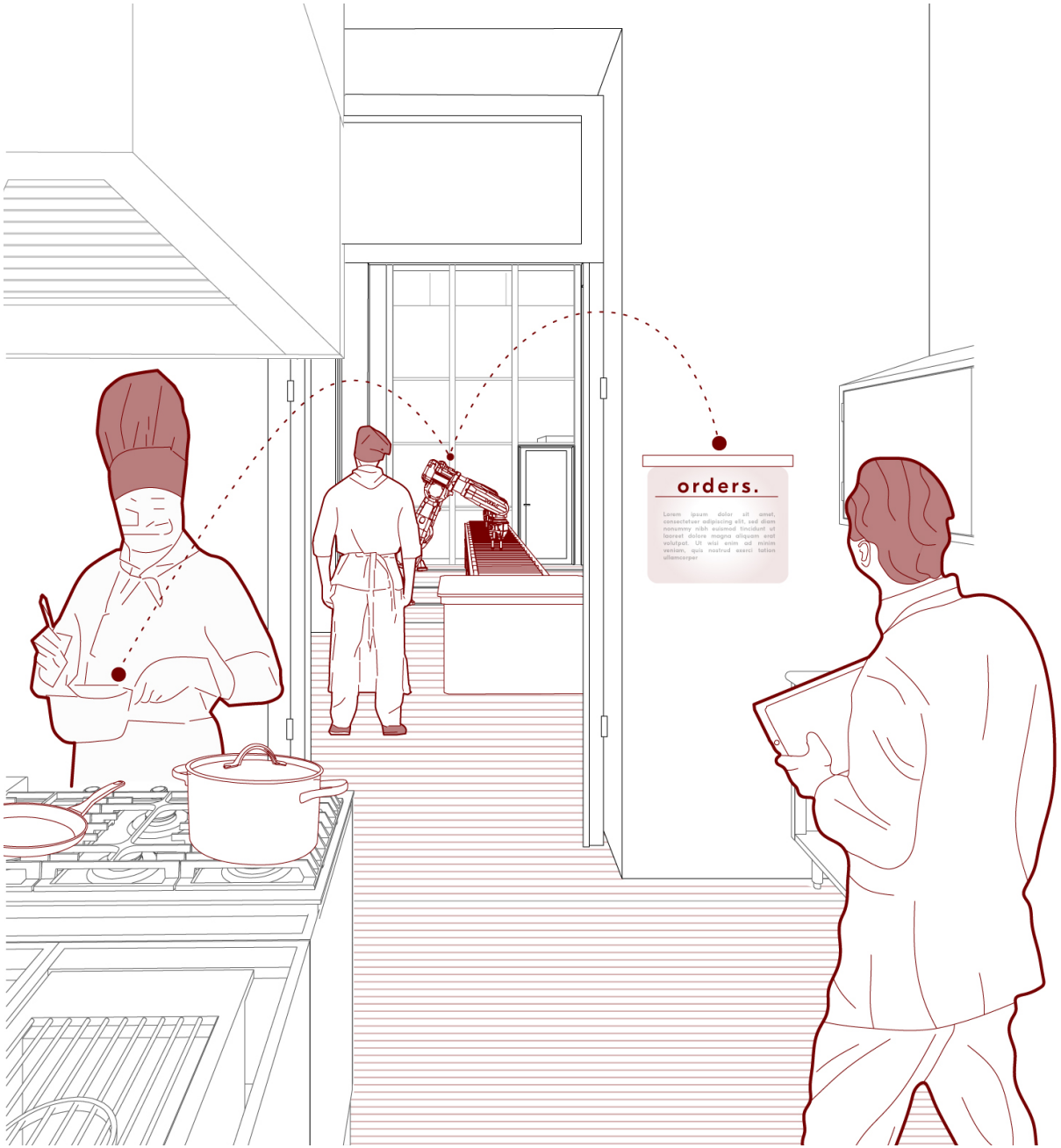
«Hey, you! Watch out!»

I am so focused on myself, that I almost bump into an old man, sitting to the side of the fountain. The reflection of the facade of the station in the water is always fascinating. It is probably the spot I like the most, a corner of calm meditation in the chaos of the square.

I can't believe that this place used to be so empty and lifeless a few years ago.

I cross the door of the hall and I am finally inside. There is excitement here, too. The waiters are running up and down the tables to prepare everything on time. A few curious people is walking around, trying to get some glimpse of the new restaurant. Even if the function of this place has changed, it kept the same atmosphere, the same excitement for the journey. The journey into food, in this case.

I rush to the changing room and wear the uniform. As soon as I step into the kitchen, Carlo, the sous chef stops me.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«Why are you arriving just now? Do you know what time it is?» he says worried.

He is not as strict as chef Miguel, he would understand my troubles, but I prefer not to tell him. I have to be professional.

«I am really sorry. I will work twice harder today, I promise.»

He shakes his head as he indicates the door of the kitchen. «Go inside, he is waiting.»

Before entering, I just cast a quick glance to the hall. It is fascinating to see it from the other side. It is like being in a robot and being able to look the world through its eyes. This kitchen is not very different from a machine, though.

I put aside these thoughts and open the door. I am ready for the worst, but chef Miguel is so focused on what he is cooking that he barely notices my presence. I take the tablet from the shelf and get closer to him.

«You are lucky. I am too busy to care about your delay» he says without looking up. «We already have a lot of incoming orders on the board. Go and check the load in the food court» he adds.

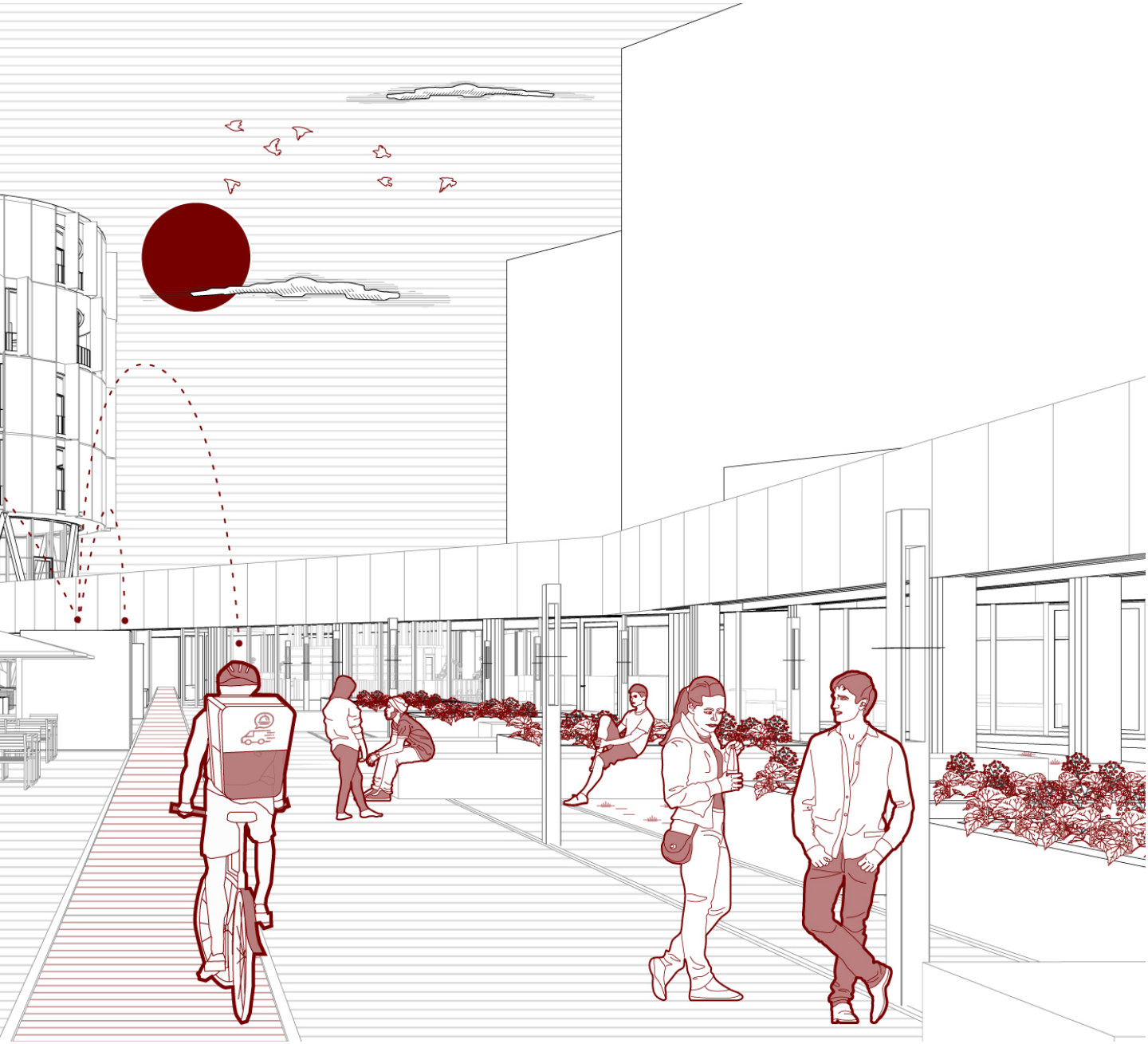
I nod. «Yes, chef.»

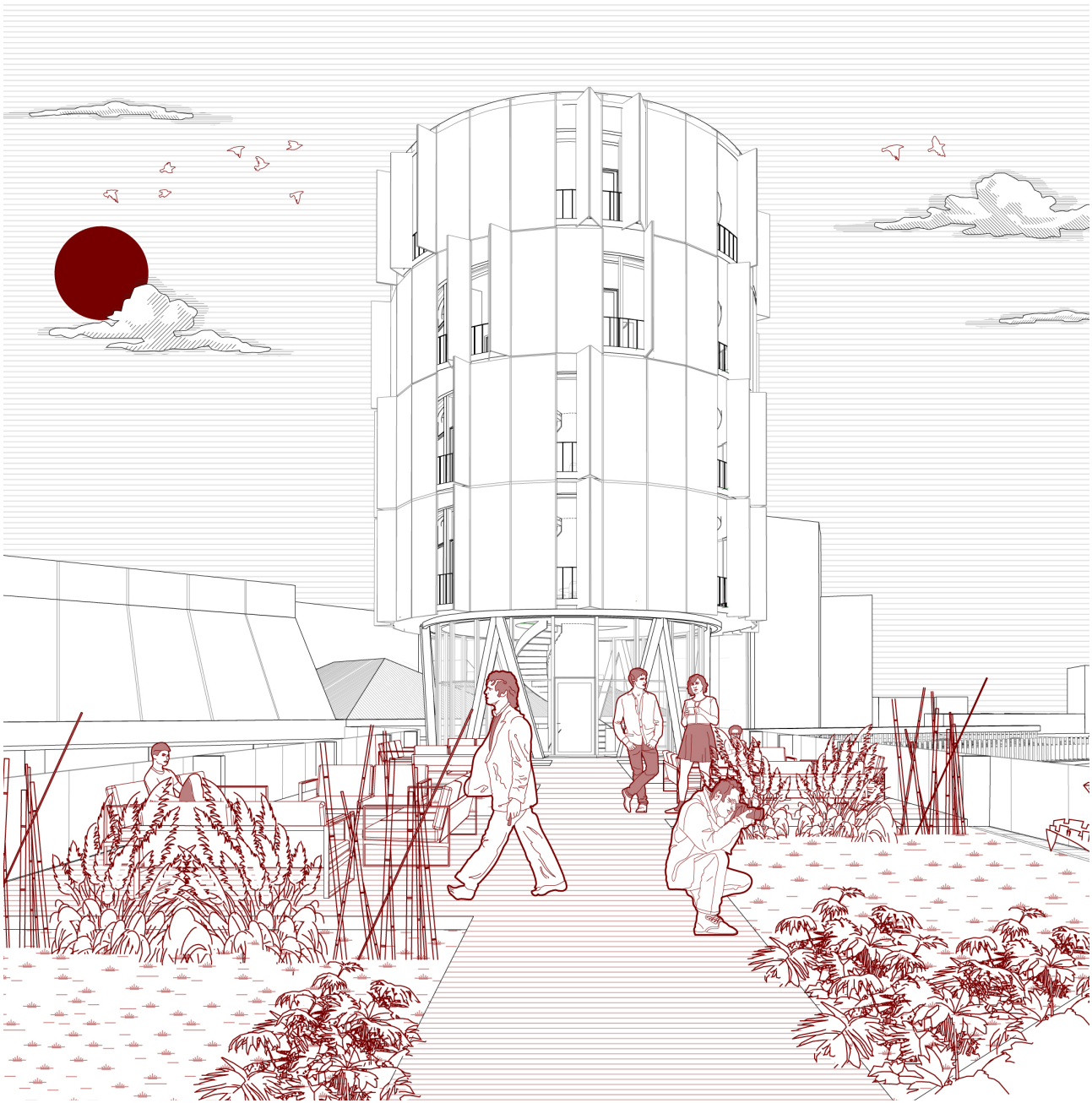
It is still awkward to find a robot in a kitchen, but I must admit that this system is amazing. Once the order arrives in the kitchen, the chef prepares it and then place it on the conveyor roller, where the robots pack it for the delivery. I am not surprised that Porta Genova has become the heart of the food delivery system of the entire city of Milan. Food riders and cyclists have recently increased a lot, thanks to this solution.

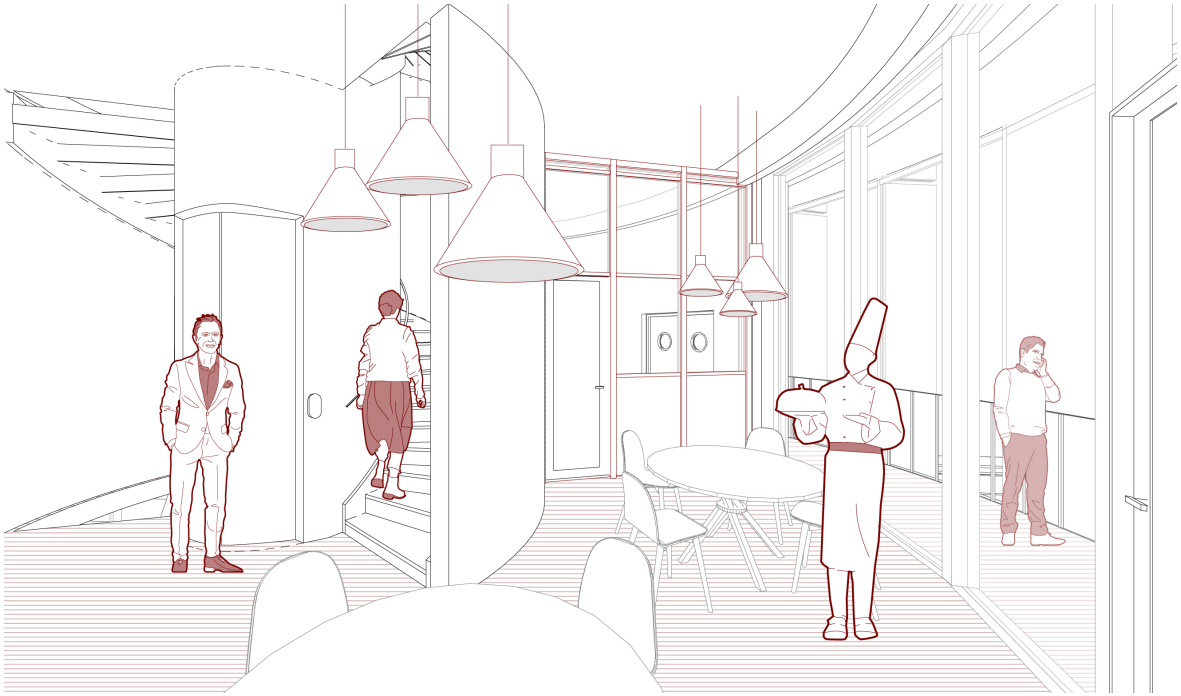
The food court, as the designer called this place, is not much different from the other square. The atmosphere is more relaxed and the noise from the street is almost non-existing, but there are still a lot of people. During the day it is a beautiful public park, but during the night it becomes one of the coolest place in Milan these days.

Paying attention to the bike traffic on the cycle lane, I cross the new sleeve of the station. The culinary tower looks impressive from here, but not as much as the view that you can have from its top. It quickly became a new landmark for this place.

I can see the train already. It moves on the old railway during the night, but it is







completely autonomous and solar-powered. The beeping of an automatic forklift stops as soon as it approaches the train. I step forward to check if everything on the load is correct. I still get amazed at looking to the fruits and vegetables that come from the food hub. They look so beautiful and perfect, only the best for chef Miguel.

I am heading back to the kitchen when I receive a notification on the tablet. Jang Liu, the responsible of the building wants to talk with me in the tower. I take the public bridge and reach the roof garden. It is always nice to see the station from this higher perspective. From here it really looks like a machine, where every piece is perfectly synchronized. I pass by a photographer. It is common to find them here recently. It is a beautiful place with the green roof and the view on Tortona.

I enter the culinary tower and go up to the second floor. I find Jang Liu waiting for me in front of the elevator. He looks nervous.

«What's the matter?» I ask.

«Luca is ill. I need to check if everything is ready for the inauguration, but I don't have any free personnel left. I have already spoke with Miguel, I need you for the next hours.»

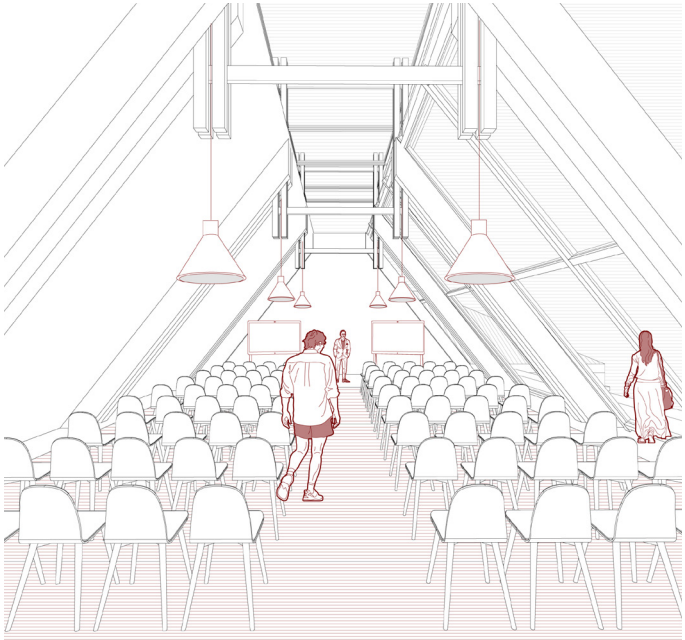
This is unusual, but at least I won't have to hear the chef complaining for one day.

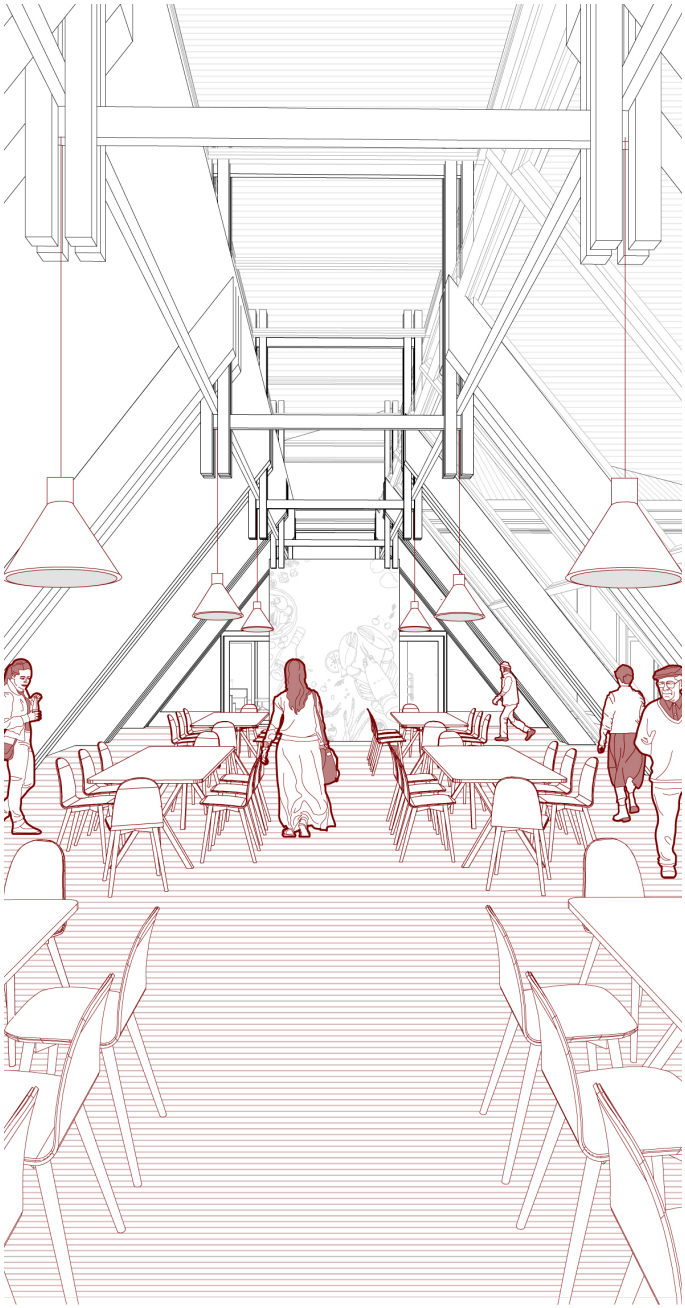
«What should I do?»

«Just go around the station and check all the rooms.»

With all this up and down I will probably be dead by tonight. I start to control the tower and then go back down to the station through the spiral staircase. The social rooms along the corridor of the left wing are almost ready. There are still a few students who use them to study. I tell them to leave in maximum half an hour and I move forward to the first floor.

Three technicians are finishing to assemble the screens in the conference room, while the panoramic room on





the other side is still a mess. For once, I am the one who gives orders. I tell the workers to finish and clean everything as soon as they can. The event is starting soon.

The inauguration is almost over when I can finally sit down at the cocktail bar. It is late and most of the people have already left the place. I am tired, but I want to try the robotic bar before going back home.

I order a drink from the screen on the counter and wait for the machine to prepare it. Outside, the train is gone. At this time it would probably be heading to the market. I check the time and I realize it is even later than I thought. I finish the drink and leave the place, rushing again to catch the last metro.


drinks.

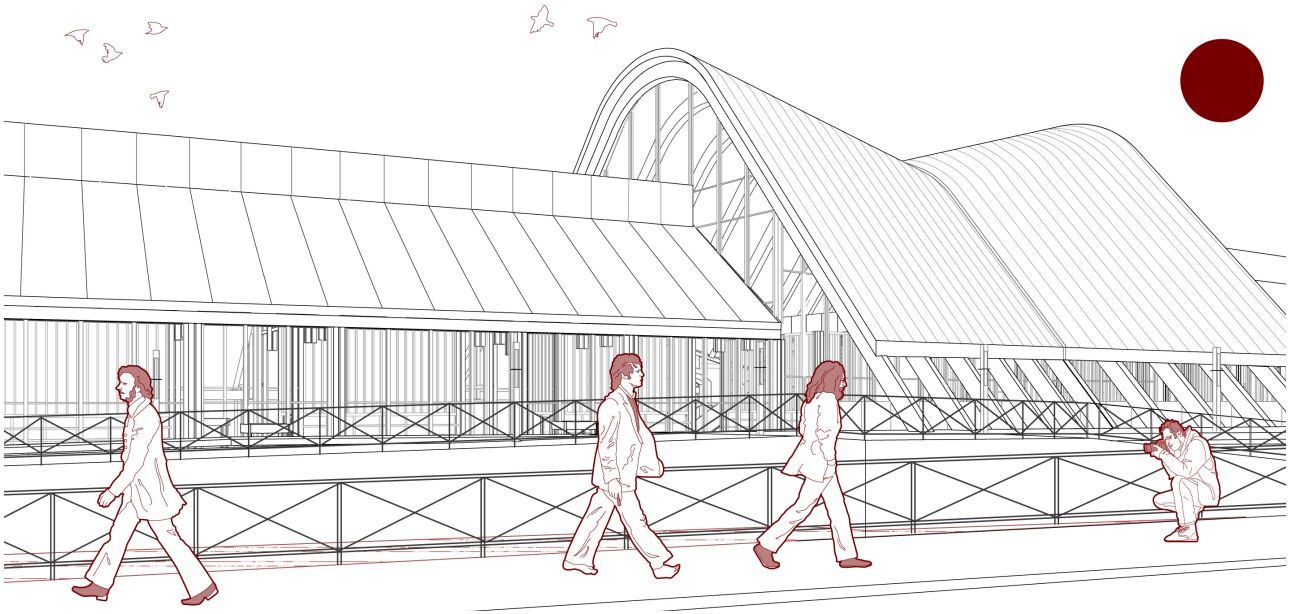
Where should I place this?

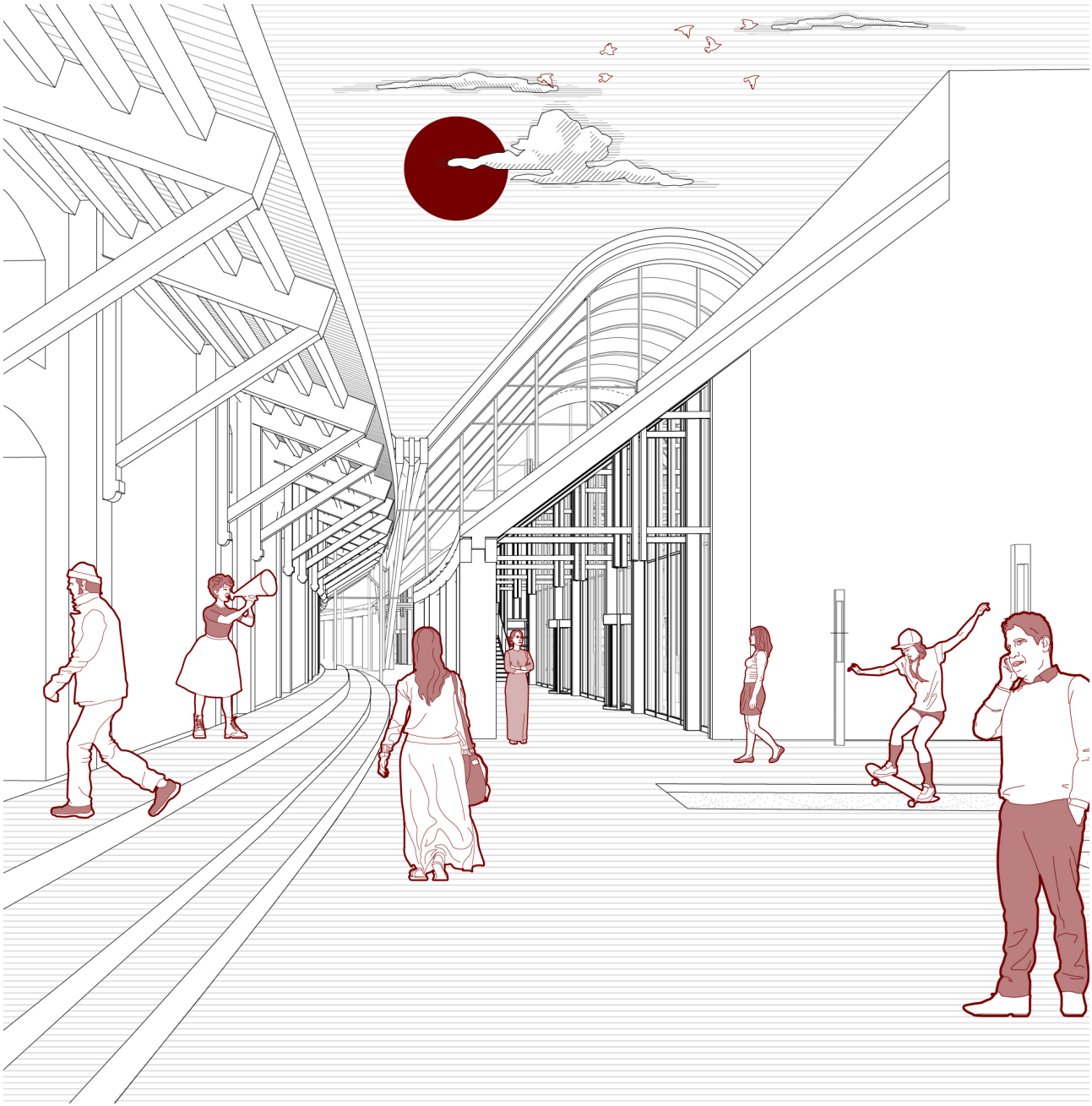
The red sun is still burning in the sky even if the day is almost over. With this extremely hot weather, it is even harder to work. Especially when you have so much water around you, but you can't jump into it. I would probably never swim in the Naviglio even if I could.

I know there are some people who love to swim in the Darsena Nova during the summer. I like watching them while I work.

Even if evening is coming, I start working. At the beginning I hated to come to work so late, but now that it is so hot during the day, I am happy to have this timetable.

As I cross the street to go to the market, I notice that there is a photoshooting of some sort. I have never seen anything like that here before they built this place. I suppose it is ordinary now.





People of every kind are coming to visit this place.

The former rail yard of Porta Genova has been the pilot project for a huge transformation of Milan. There is space for everyone here.

As every other day, I cross the pedestrian bridge that connects my district with Tortona and I move towards the market. If you asked me a few years ago about the future of this place, I would have probably said that it was going to become worse. I used to come here when I was younger. I liked the old warehouse and I usually played hide and seek with my friends.

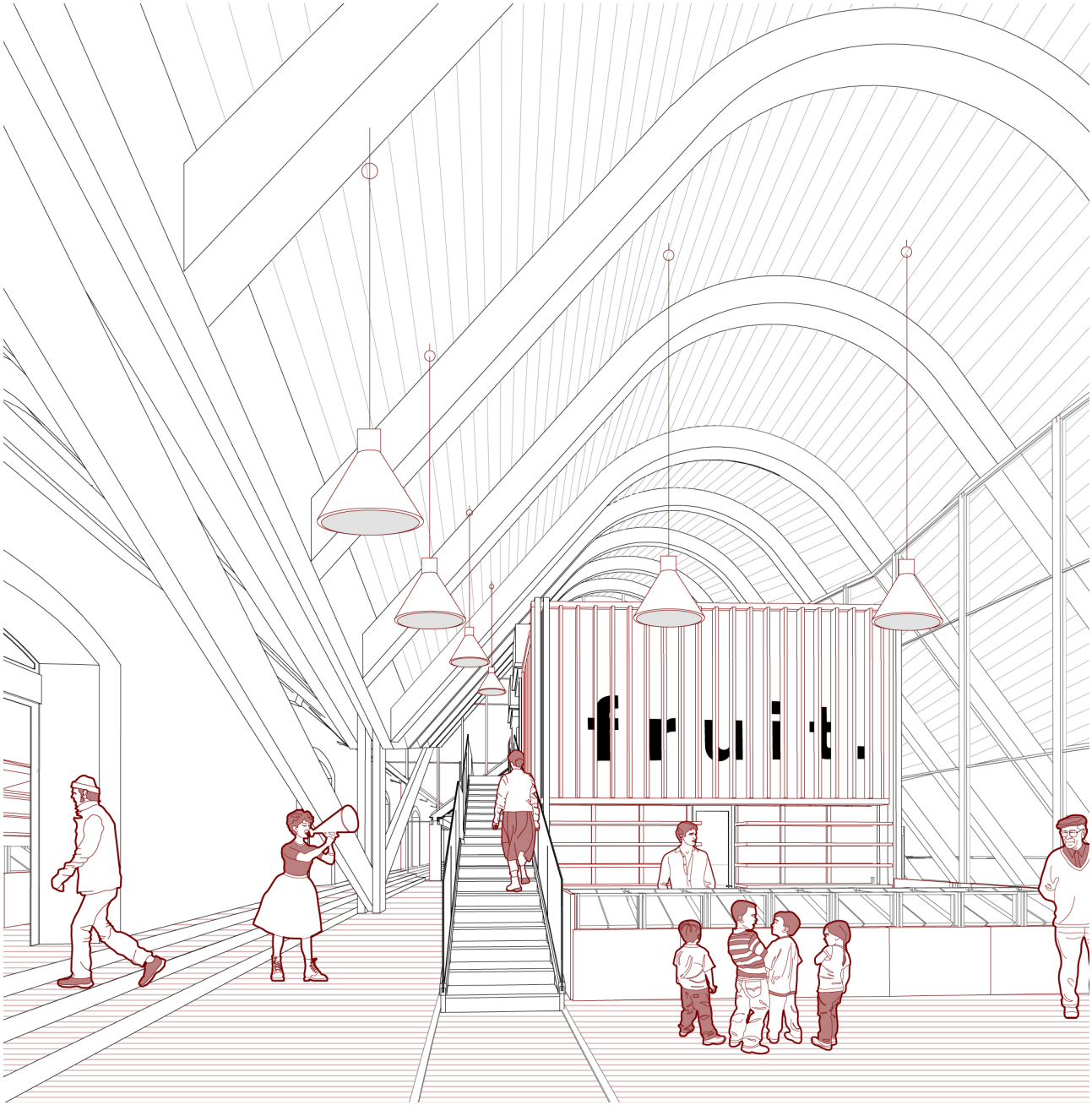
I remember the first time I entered the building. There was this long navy, with a series of shut doors on both sides and a beautiful wooden roof. The walls were painted black, but there were spots of lights coming from different holes in the roof. I thought it was fascinating and magical.

Nowadays, where once there was a desert of concrete, there is a beautiful square and the biggest covered market of Milan. I really like the way the architect designed this place. He kept the original building and enhanced its magical atmosphere. The new parts are similar, and their roof seem to play with each other, just like I used to play with my friends. There is a group of kids who use to come here when I begin to work. They skate on the benches even if some people complain. I personally find them funny. If people take control of the public spaces in their own way, it means that those public spaces work. It is better a lively place like it is today, then the abandoned desert that it was before.

Even if my job is mostly outdoor, I like to go across the market. I like to enter from the central hall. It is a sort of continuation of the external square, always full of people. I love the smell of fresh food which accompanies me while I walk. The structure of the building is really impressive, and I read somewhere that it is possible to disassemble and reuse every single piece. They call it circular architecture, I guess it is only one of the innovative aspects of this market.

I come closer to the fruit stall and say hello to the vendor. He is almost my age. Employees here are all young.

«Another hot day, isn't it?» he asks,


fruit.

nodding at me.

«I am lucky I work in the evening. How are things going around here? Still full of orders?»

He takes a deep breath and laughs nervously. «People love this idea of ordering food from home and they are flooding us with work. Not that I complain, of course.»

«I must say that I ordered from home too, yesterday. I was just going to the collection area before starting to work.»

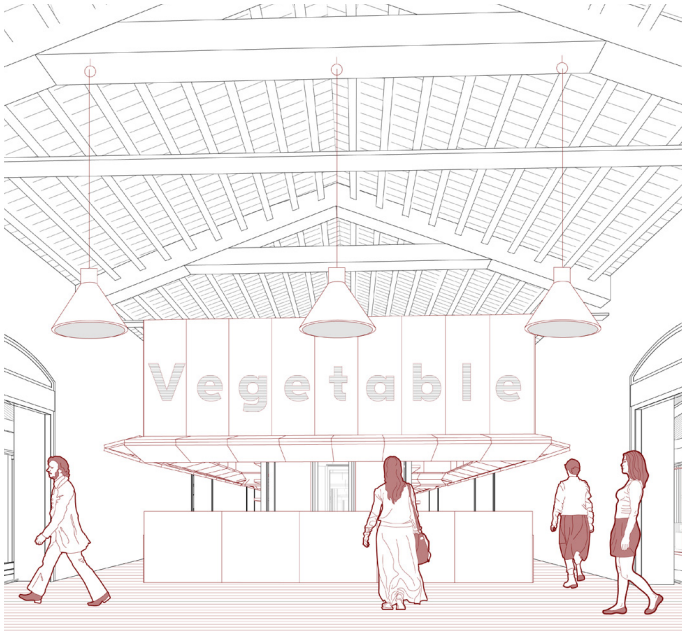
«Don't tell me» he laughs. «Do you know which fruits are coming today? I have some orders to complete.»

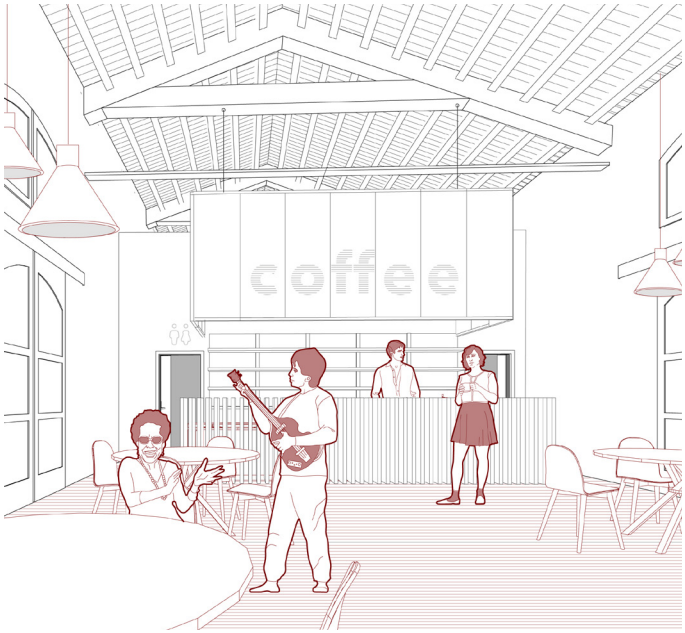
«Not really, I am only the goods unloader.»

«Nevermind. Have a nice evening.»

I say goodbye and head towards the old warehouse. Some of the market stalls are already closing. I am always fascinated by these structures. They can be closed as boxes and then opened during the day. They are also perfectly integrated with the rest of the building.

The collection area is just at the end of the warehouse, directly accessible from the old part of the market. There are big screens that show the codes of the or-





ders and the location. It's the first time that I try this service. I am lucky. Since it is almost closing time, i can skip the line.

I check the clock. I still have a few minutes for a quick coffee. The bar is still full of people. A singer is performing, and a nice music is ringing out the entire place. People always come from the Darsena Nova for a short break, especially with this hot weather, so there is always someone here.

I pass by the new wing of the market and look inside. I am really fascinated by the wooden structure that forms a grid above your head. It reminds me of some Japanese temple that I visited some time ago. Every piece of the structure interlocks with each others in a perfect way. The stalls are connected to this system too. I also like the fact that the designer kept the trace of the old rails in the pavement. It gives this place an industrial look and also reminds of the past.

I finally reach what I like to call "the backstage" of the market. The other side of the square, the place where the dirty stuff happens. I can't really define it as dirty, but when people go away it is where goods are sorted. There is a special electric train that arrives here from the food hub. In the market, the fruits, vegetables and fish are sorted and then stocked in the warehouse. My job is to move and catalogue them. I also have to load the trucks to bring the food to different places in the neighbourhood.

«Where should I place this?»

A guy who I have never seen before stands in front of me with a big box.

«This goes in the truck over there» I say, indicating the means behind my back.

«Are you new?» I ask, when he comes back.

«Yes, it is my first day. I don't know how you can do this.»

«It can be hard at the beginning, but it gets better. Trust me.»

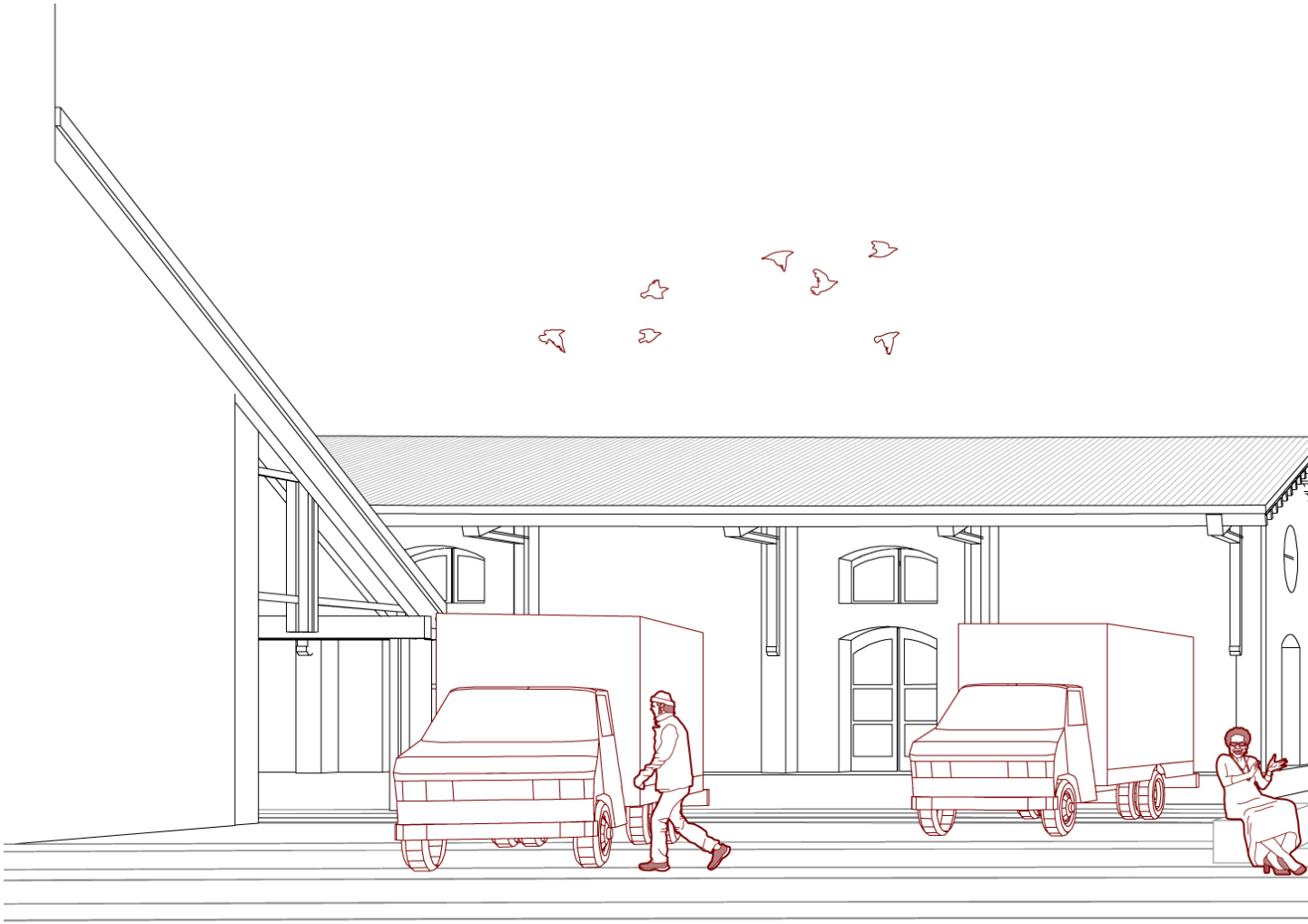
He looks at me, confused. «What do you like of this job?»

I have never really thought about that before. I just let my mouth speak for me. «I like to walk here, to be the man in the shadow that helps the market work. I like watching people and things. Everyday I notice some small detail about this building and I appreciate once more the amazing work they have done here. All this make the work easier, maybe it can

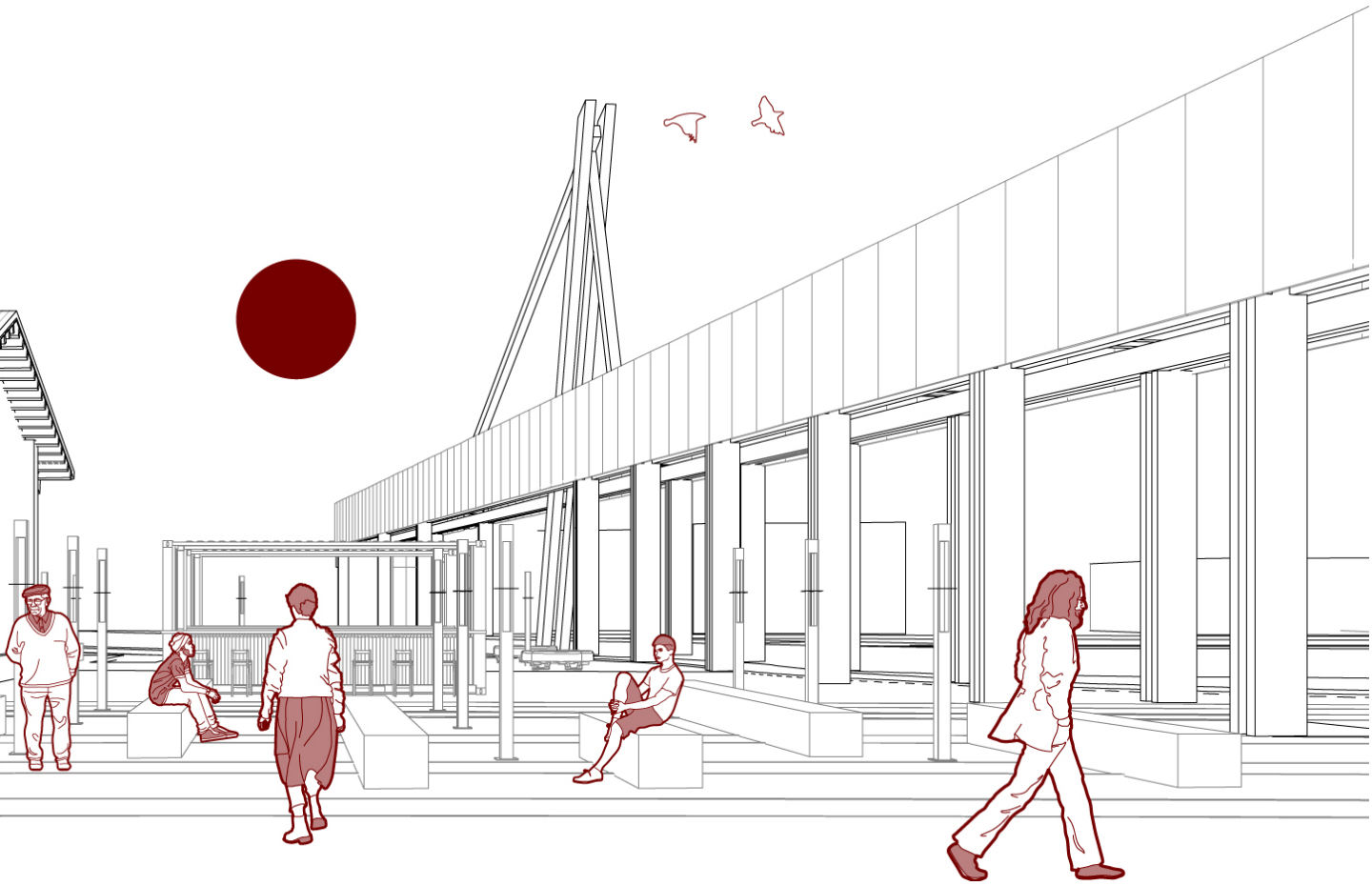
help you, too.»

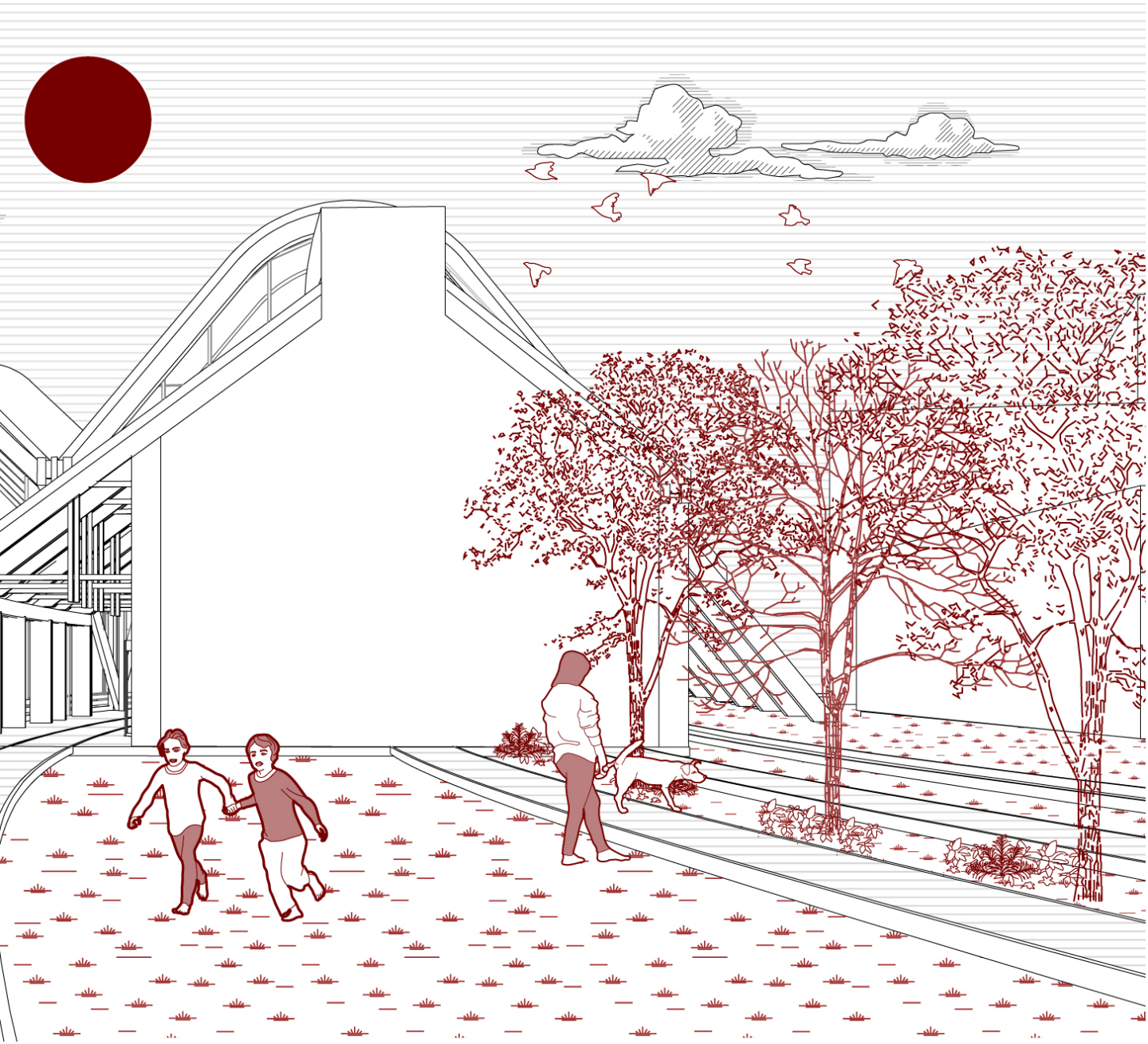
«I will try to take your perspective. Thanks for the heads up.»

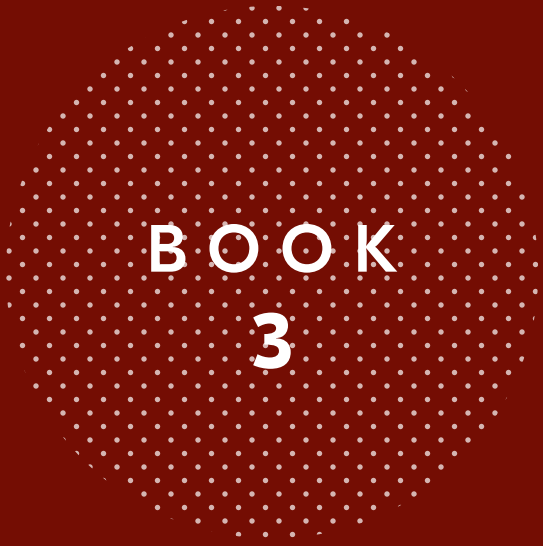
Once I finish, early in the morning, I usually like to walk in the park and visit the public market. This part is opened also to other producers of the hinterland. The stalls are mounted above the basement of the demolished section of the warehouse.



It is always nice to stay here when people start to gather, and the stalls are assembled. There is a peaceful atmosphere. It is the best way to end my day. I walk till the end of the market, I take the stairs and cross the Naviglio Grande, while a new day is starting in the market.







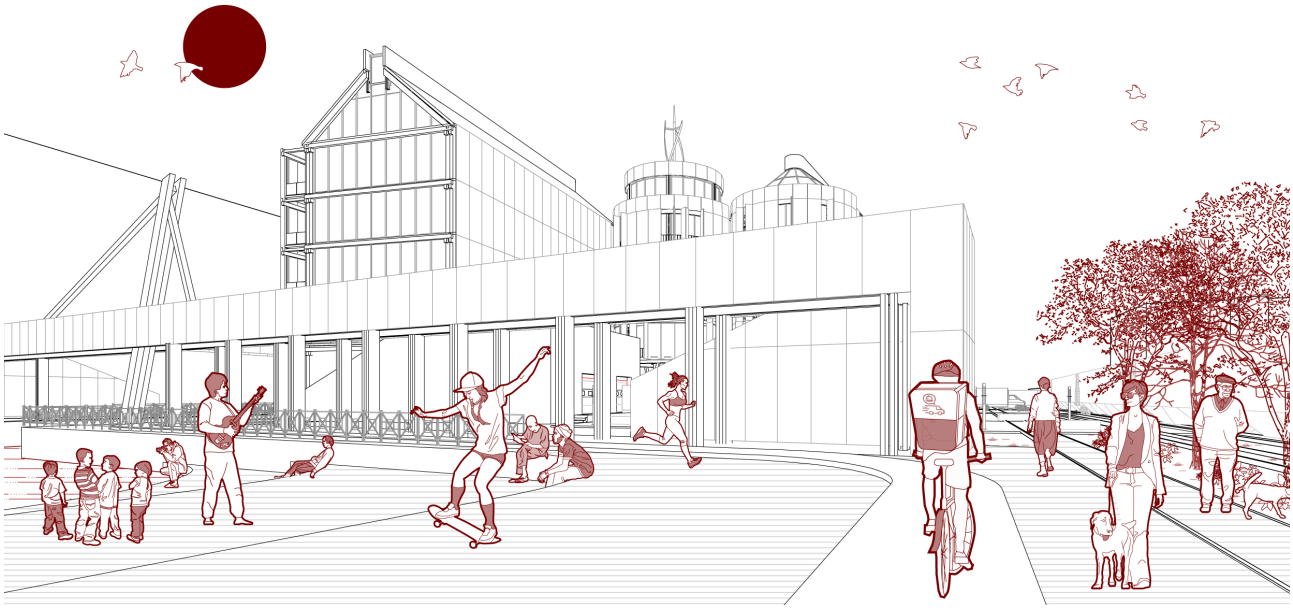
Fully operating system

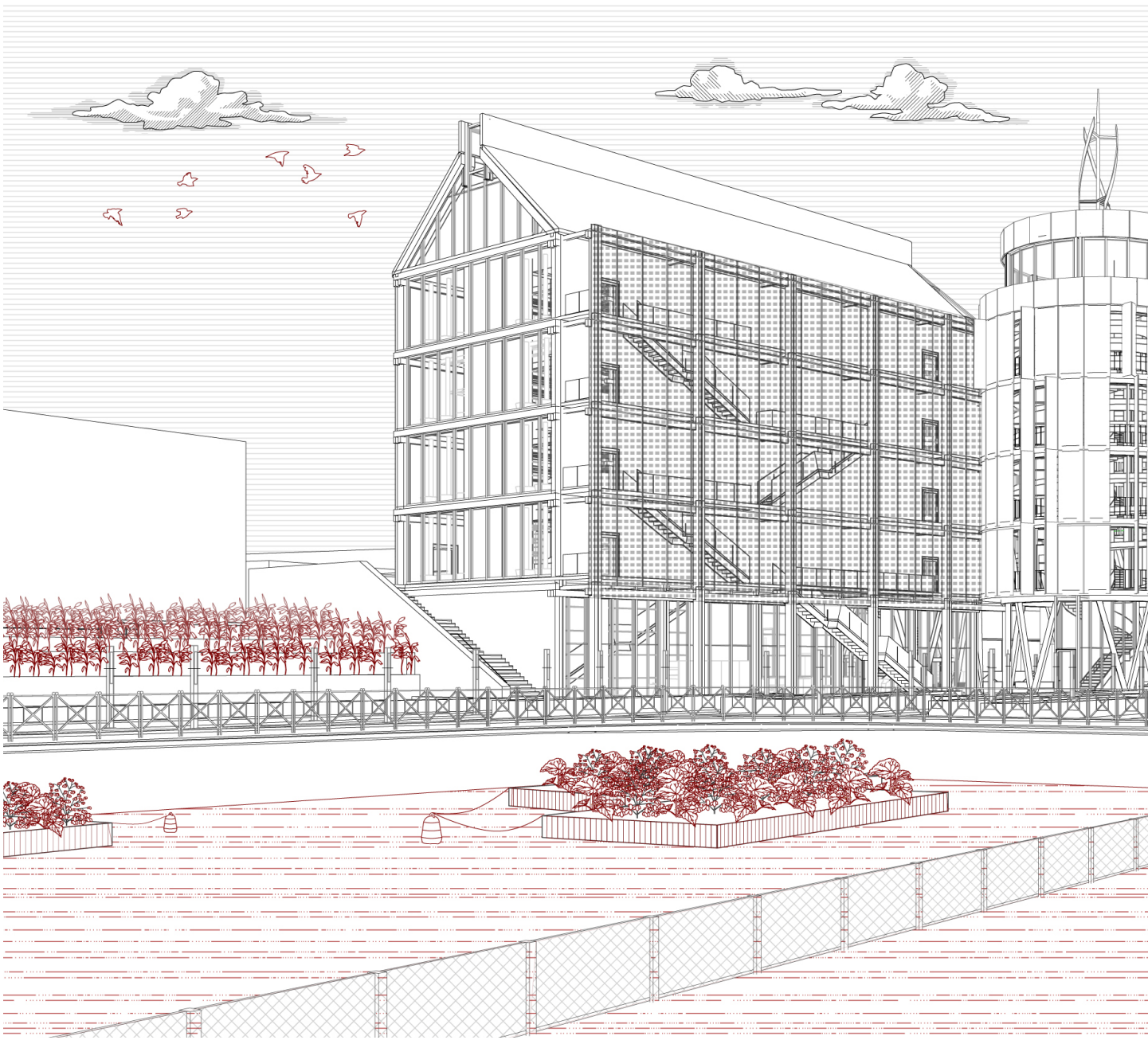
The phone chimes. I stop reading for a moment to check it. I was early, I wanted to take some moments before the inspection started. The phone says it is time to go.

I close the book by Despommier and I put it back in my bag. It is strange to read this book now, in front of this building. A perfectly functioning prototype of vertical farm finally built.

I stand and look up. The building is impressive. I came from the other side of the Naviglio and I crossed the bridge to reach this side. The food hub reflected in the water looked fascinating. I noticed that the floating crops in the fish basin are growing well.

I didn't expect this building to be so integrated in the context. The transparent photovoltaic panels on the double facade were shimmering with the sun





partially reflecting on them. I especially liked the external staircase. It was like a plant growing on the facade. What a better analogy for an urban farm?

Now that I look at the public space around it, I notice that the agricultural areas are well integrated in the park, too. People are starting to take care of the place and I heard that a new guerrilla gardening association has taken control of the green areas. Last week there was a public sowing, that involved the citizens.

Now I look again at the building, from a closer perspective. I remember the drawings hung on the walls of the office of the architectural firm when I visited it. To see it from real now is different. It is not any more a concept, but a reality.

My role today is very important. I can decide if this place will become the model for the future generation of urban agriculture or if it will fail like other experiments before. The farm has been operational for six months already and the data that I collected are positive. This is the last check before the official certification.

While walking to the entrance, I look

around. The Darsena Nova is already full of people. It has become a very good place to walk through. Once crossed the round porch, I reach the other side of the square. The urban gardens are flourishing and healthy.

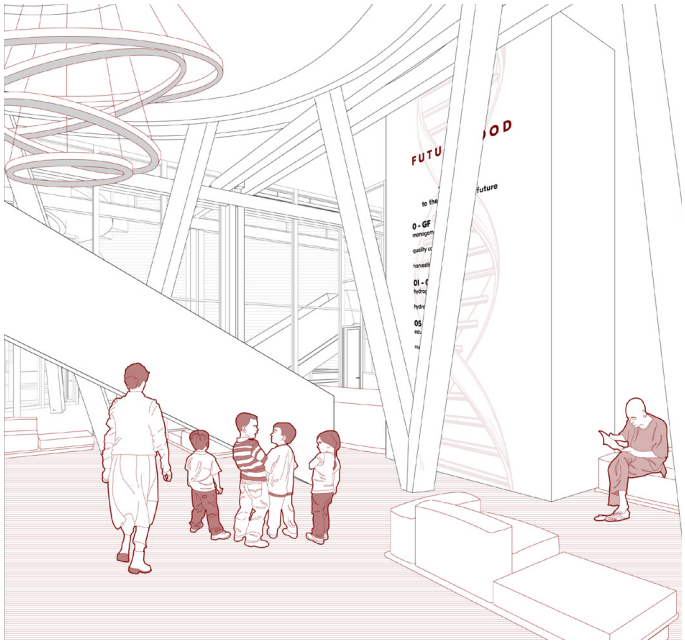
As planned, I enter the south building. The round hall is even more spectacular then the external space. The farm is different from what you would expect. On the front wall, just next to the reception, there is a welcoming announcement with the number of floors. A group of kids with their teacher is waiting for a guided tour in the nursery.

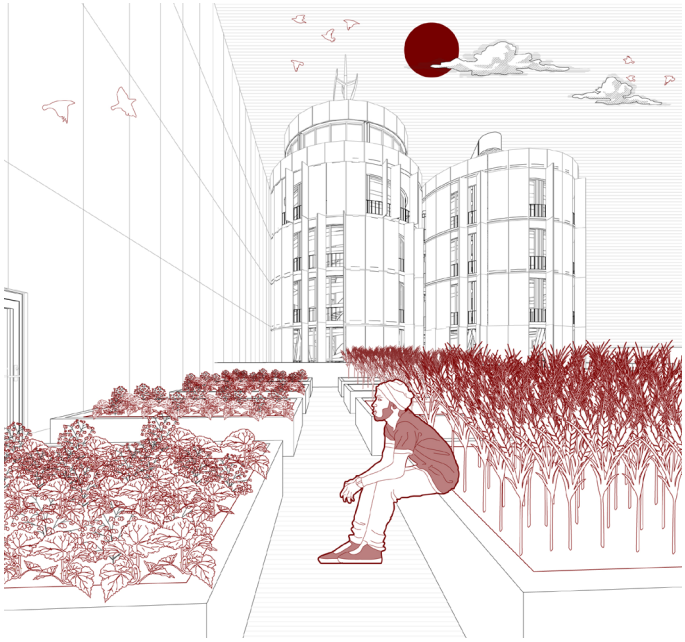
«I am here for the inspection» I say to the receptionist.

«Perfectly on schedule» she replies. «The responsible of the structure will guide you through the complex. He will arrive in a few minutes. Please wait here in the meantime.»

I sit on the sofa next to the stair and watch the projection on the wall. It shows holographic images of the food production process. A nice way to entertain the visitors.

«Good morning, welcome to the future food hub» says the man. He is wearing a



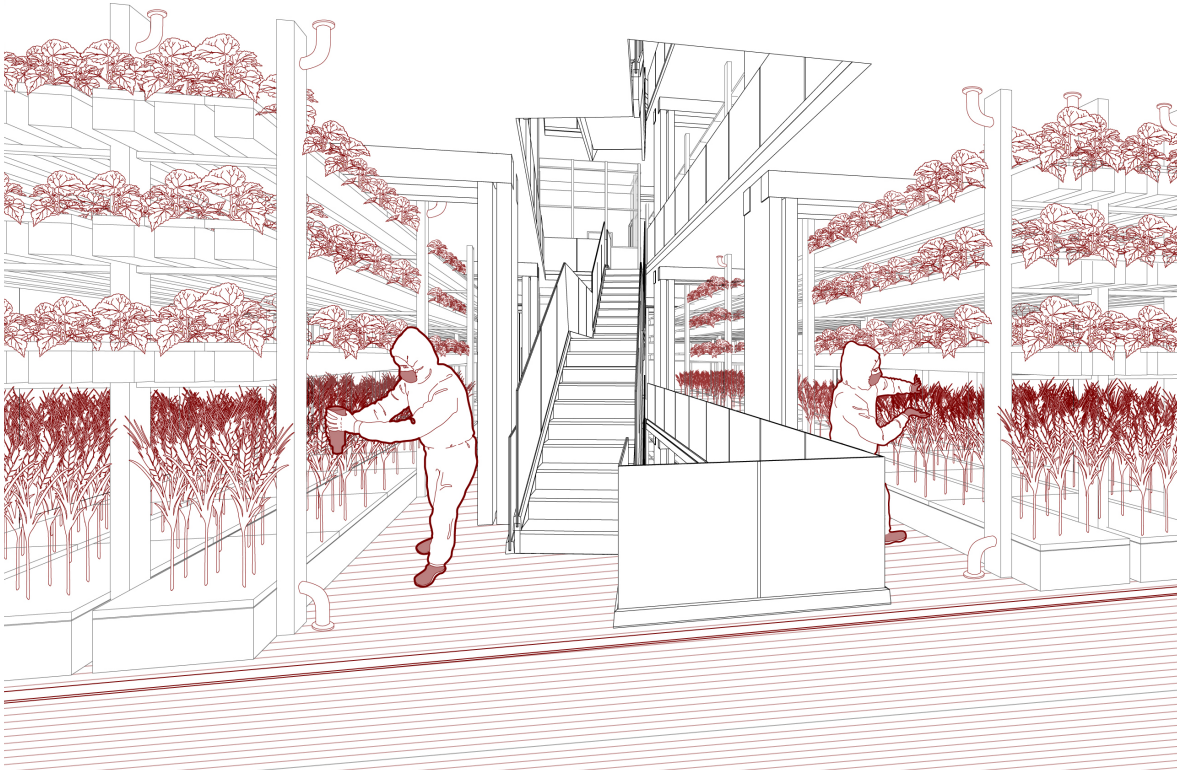


tight elegant suit.

«Here we produce food for the market, the station and some restaurants of the neighbourhood. It is the first building of its type in Italy and one of the most complex buildings built in Europe in the last years.» He indicates the door behind the reception. «This way, please. I would like to show you the external crops before moving to the hydroponic farm.»

We reach the second floor through the central staircase. I look above and I am impressed by the diagonal stairs structure. The void goes up till the last floor. A cone of light comes from the roof skylight. Most of the complex is blind because the plant grow up with LEDs.

The first space that we visit is the terrace on top of the warehouse. Planting crops here is a nice way to use the roof. I start checking the safety and health conditions and then we proceed to the

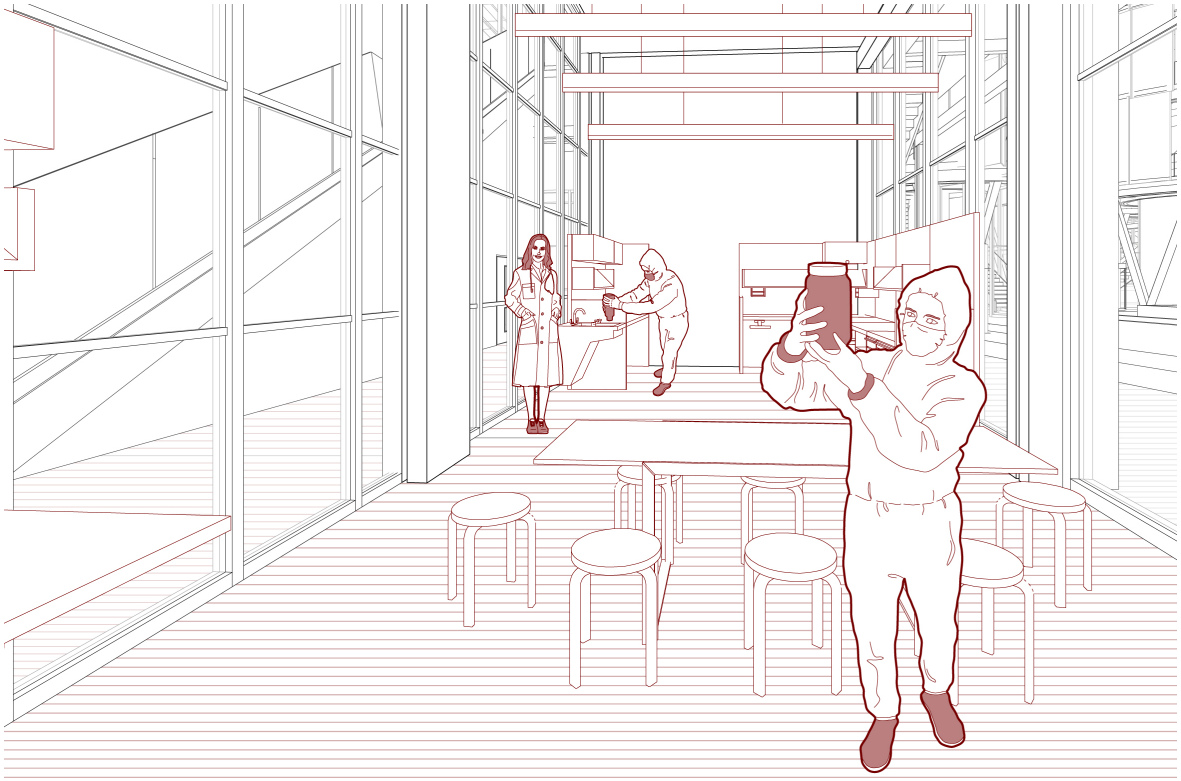


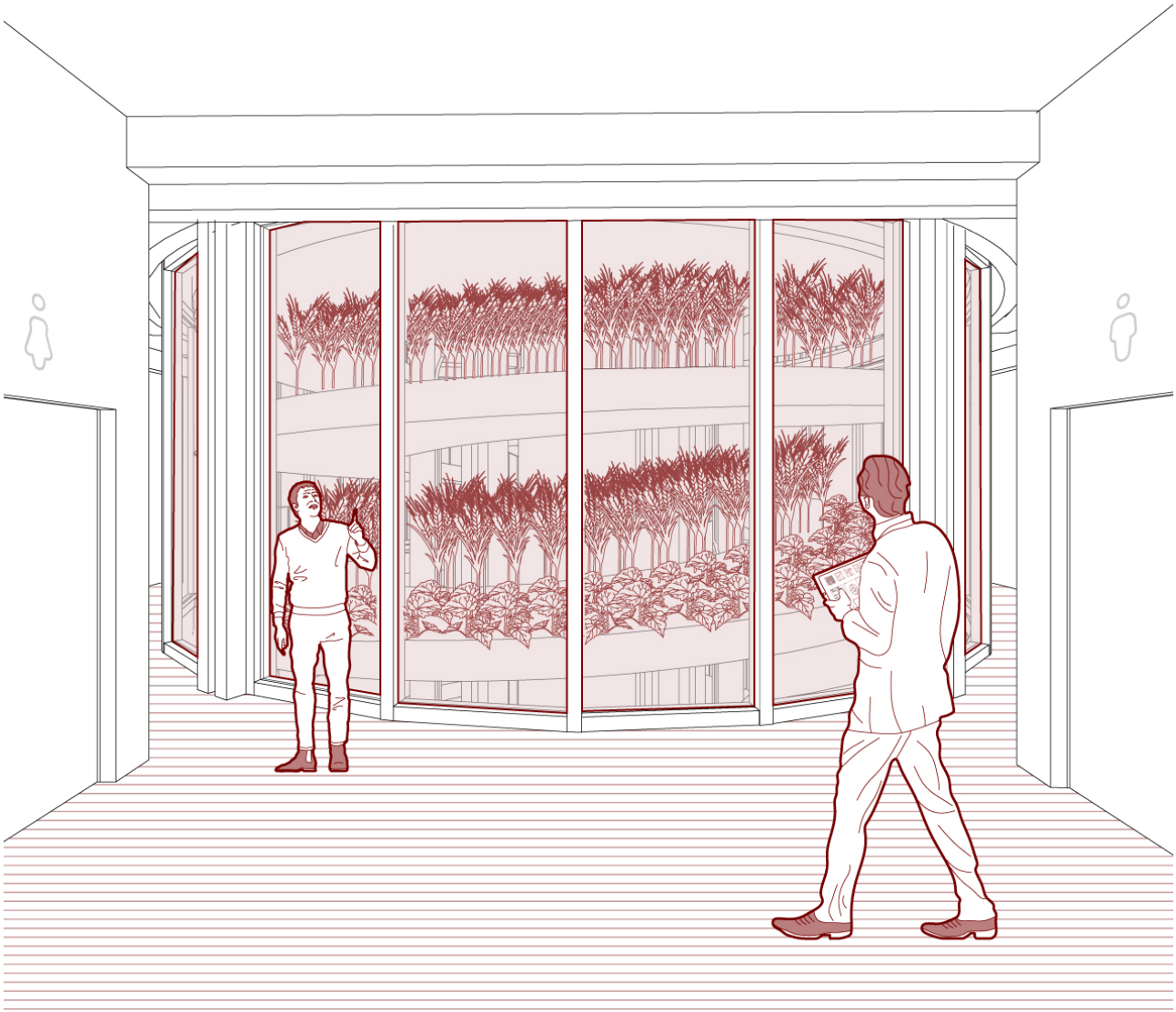
hearth of the building.

«The hydroponic farm is divided in two sectors» the responsible explains. «In this first area you can find the hydroponic grain crops, the aeroponic trays and the vertical farms. The water taken from the fish basin is first directed to the top of the building, to the nursery, then it passes through filters and reaches the aeroponic trays. The same water enriched by nutrients is used at the base of the system in the hydroponic tanks.»

Once I controlled the first sector, we move on to the rest of the floor. We pass by the control office and the toilets and we stop in front of a circular window.

«The big spiral you see behind the window is our vertical hydroponic system. It is an innovative solution that has been developed by NASA for the Mars colonization. This is the first real application of this system on Earth. The plants





are transplanted at the top floor on specific trays and they gradually move down through gravity. The water flows down the spiral. At the base it is filtered, cleaned and then pumped back at the top through the central core.»

«A very interesting system. I saw the project but I didn't know the details. It's really impressive.»

«We are very proud to host such an innovative system in our complex. We believe it is the most efficient and innovative way to produce food in the urban environment. Now, if you may follow me, we can visit the nursery.»

«How do you move the trays to the harvesting area at the ground floor?» I ask, while we go up the stairs.

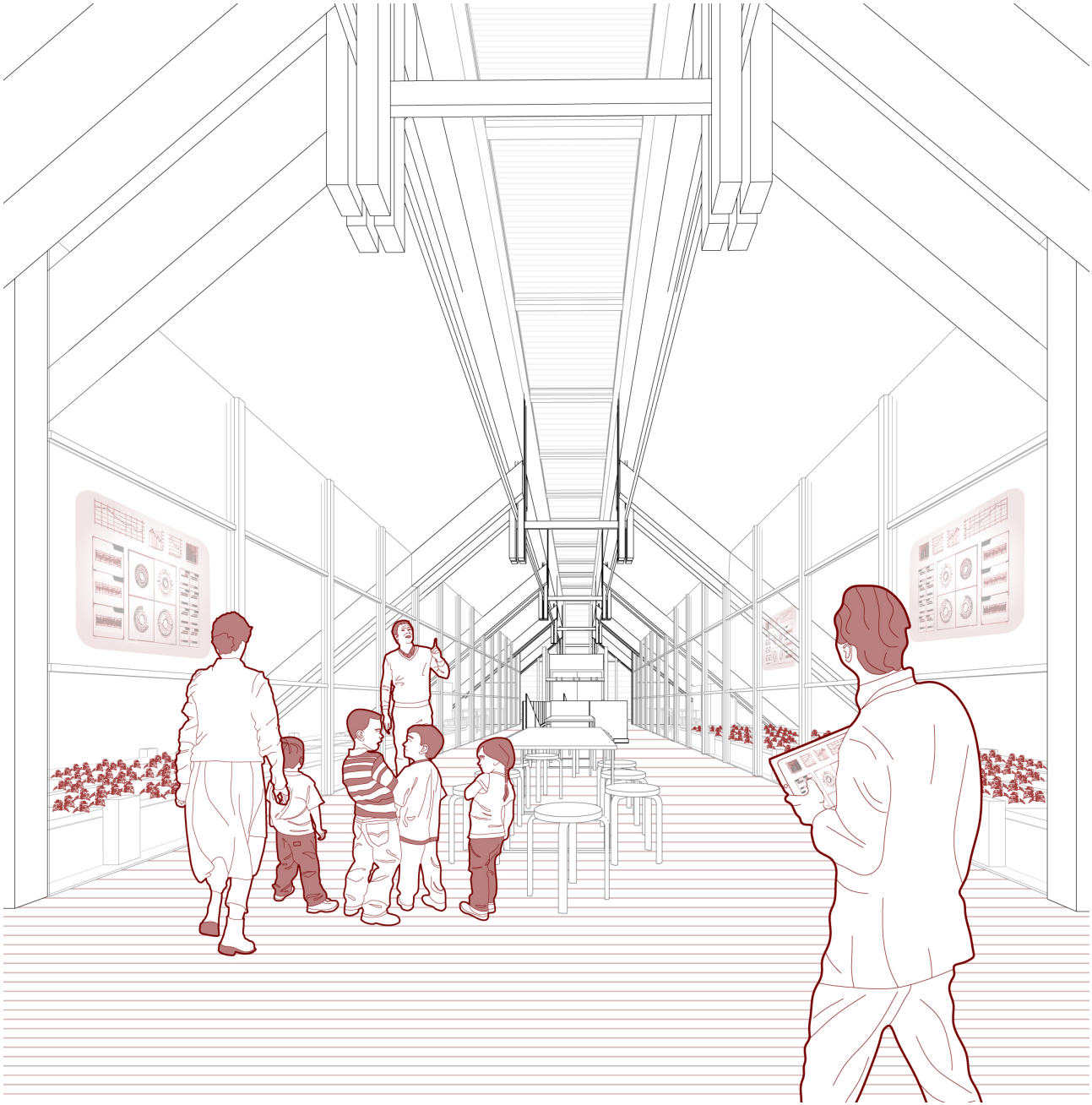
«The trays are moved by an automatic crane and placed in the lift. They are then taken to the harvesting area, where some samples are analysed by the quality control lab. They are eventually sent to the warehouse. The other lift is used to carry the transplanted plants from the nursery to the hydroponic farms.»

When we reach the last floor I can see the system in action. Everything is automated and synchronized, the crane slowly takes the trays from the openings in the dark rooms and place them in the elevator, ready to reach the lower levels. The germination areas on the side of the nursery are well sealed and monitored through specific screens.

The check is almost over when we bump into the same school group of the ground floor. One of the employees is telling them how the project was conceived. He will later bring them to the tables, where they will prepare some small plants for the nursery.

While I come back down to the entrance, I can't help thinking that this should be the future of our cities. More spaces like this should be built and this innovative process should become the norm. In this way the land would finally take back its natural properties and our cities would become independent and self-reliant. I believe we can take back control over the world, we just need to let this change happen.

Here and now.

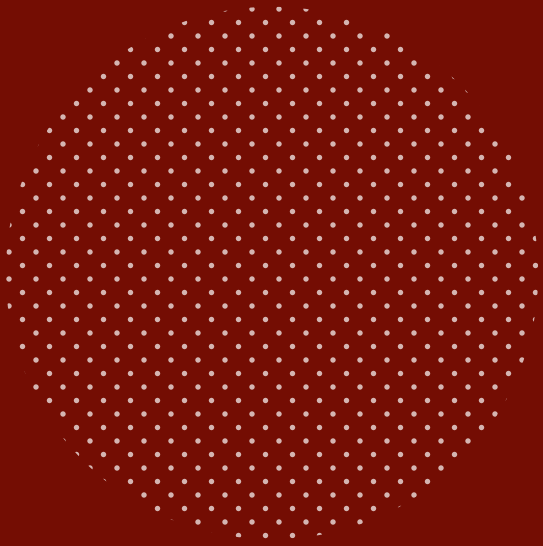


The design intention behind the current industrial infrastructure is to make an attractive product that is affordable, meets regulations, performs well enough, and lasts long enough to meet market expectations.

(William McDonough, Michael Braungart, 2002).

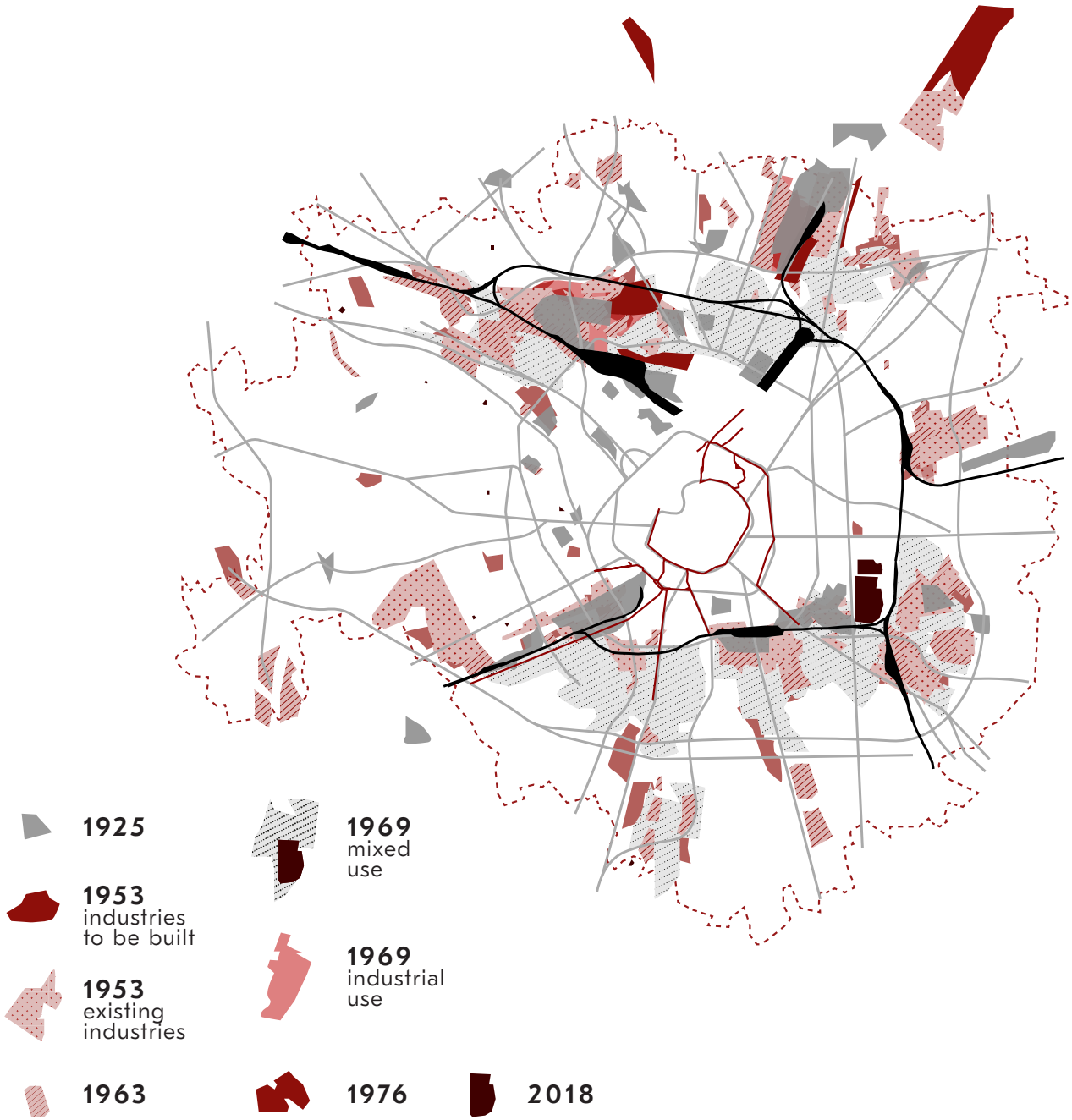
CHAPTER 02

Milan
The city and the production



Historical analysis of industrial zoning in Milan

1884 - 2019



Industrial zoning in Milan

The first plans and urban planning directives

From the end of the XIX century the city faced a development problem and delineated new and precise guidelines for its urban planning.

In 1884 the municipality decided to implement a master plan designed by Cesare Beruto. This expansion plan prepared by Beruto expressed the intention of an organic urban development through expropriations for public utility as well as new streets and squares.

The main problems to be addressed concerned the interests of industrial development and traffic throughout the city. Beruto didn't plan any interventions in the historical centre, neither he solved the problem of welding between the expansion areas. and the central ones. He proposed the demolition of the ramparts, turning them into an urban flowing line, and the positioning of public buildings without specific criteria.

Hence, a real zoning is missing, since the plan proposed just an undifferentiated development without precise planning. It severely compromised the layout of the city and its relations with the surrounding area under the pressure of building speculation and the construction of a railway belt that enclosed the whole city. Beruto drew up a

Milan is today identified as the capital of Made-in-Italy, of fashion and design, but it is also a former industrial city. Nowadays, in the contemporary urban fabric, it is possible to read the traces of a season that is now complete - abandoned areas, masterpieces of industrial archaeology - as well as the signs of an active and vital reality - headquarters, research and production hubs.

second version of the Plan in 1889 which focused on Piazza del Duomo as the geometrical centre of the city of Milan. In contrast with the previous static view of the city, here there was an attempt to connect the city centre to the new urban structure. Unfortunately the idea was suppressed by the commission for economic reasons.

The 1889 plan turned out to be insufficient for the development of a large industrial city of the XX century and for this reason the municipality decided to formulate a new plan. Between 1909 and 1912 the engineers Angelo Pavia and Giovanni Masera were commissioned to draw up a new plan. The population had already considerably increased and the urbanized area of the city doubled since the first plan, but there was a big lack of services. The industries were mainly located beyond the city walls, along the railway belt, but in an absolutely chaotic manner. Nevertheless, the Pavia-Masera plan completely neglected the problem of public services. Not a single new garden was planned but only a few squares or tree-lined avenues were realized. No areas were reserved for schools, public housing or collective services.

The Fascist period and the zoning

Starting from the 20s of the XX century, the municipality began to outline the possibility of increasing the area of expansion of the city, moving from a mono-centric development like an oil spill to a poly-centric development with the creation of suburban cores with attached communication networks and services.

However, the chaotic development of Milan in the early years of the fascist regime forced the municipality to announce a competition for the general project of the town planning and expansion plan. Albertini set up an urban planning office to screen the projects presented for the final draft. Six years of work were needed before the plan was completed, but the purpose at the base appeared clear: the plan was absolutely lacking of ideas and it was focused on the urbanization of the whole territory, thus creating a dense mesh of avenues, streets and squares to meet private interests.

This was a plan in which no restrictions were placed on private property, because no area has been reserved for public use. The dense road network that, in the designer's intentions, should have facilitated communications actually further congested the centre with the result of encouraging speculation.

The purpose of the General Master Plan (PRG) of expansion was to guarantee a targeted development by creating a series of main radial axis, using the old provincial roads. The new expansion plan tried to solve

Historical map of the Beruto plan, showing the centre and the expansion area (1889).
Boriani, Rossari (a cura di) (1992).

Historical map of the Albertini plan, showing the city centre of MIlan (1930).
Pesenti (2018).

complex traffic and roadway problems in the suburban area, as well as to improve the conditions of the centre, which however was not susceptible to too radical reforms.

Railway communications were also part of the plan. Milan had three main stations for travellers and five freight stations. The expansion plan provided also the trace of the future waterways in the southern, eastern and northern boundaries of the municipal area. The type of approach aimed at developing the communication routes between the centre and the periphery, as well as between the city and the rest of the territory was crucial to identify the productive areas.

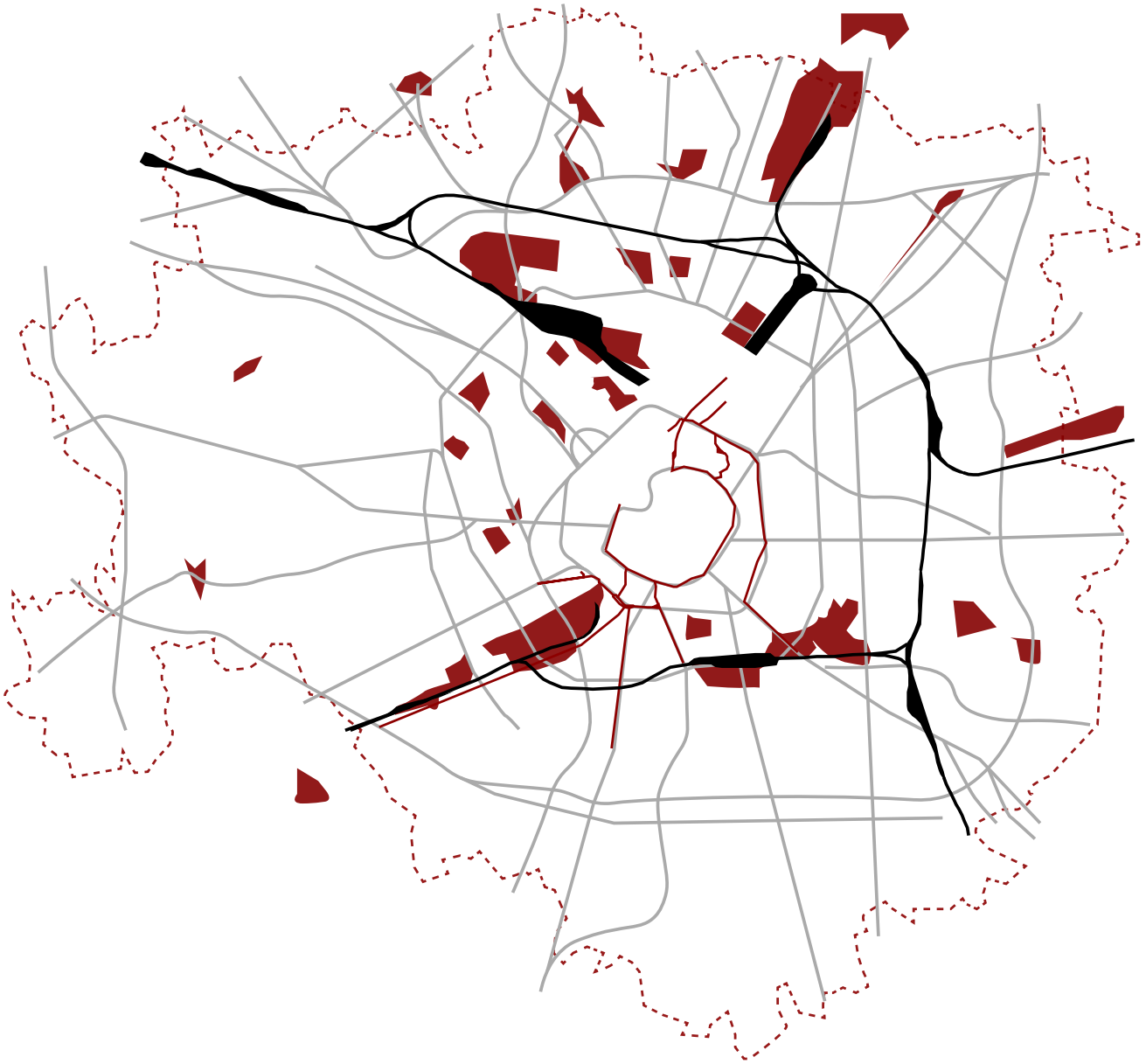
The 1926 Plan began to lay the foundations for zoning, addressing the practical needs of placement of services and sorting of functions, especially to bring order to the previous chaotic distribution of production and industrial areas. The Plan encouraged a building specialization with the creation of districts for industry and workshops, close railway junctions and energy sources, as well as neighbourhoods of worker's homes, in proximity and in connection with working areas. Indeed, every kind of activity and building found the most suitable location and had advantages to its development. The chaotic promiscuity was therefore avoided, and more appropriate building codes were defined in each area for the different kinds of construction. The plan regarded in particular the areas intended for large industrial buildings, which had their own needs, often in contrast with the general regulatory norms.

The new PRG did not take into account the directives contained in the premises. Despite the plan offered the opportunity to create a polycentric development, Albertini kept following the previous concentric expansion concept. The plan was published in 1934 and arose lively criticism for the adopted methods and solutions. In 1935 the High Council of Public Works appointed a commission for the study of possible variations to the new plan, but, due to the previous publications of partial plans by Albertini, agreements were already in place between the Municipality and private investors, causing a large cost to the municipality.

The post-war period

Since the bombings during the Second World War seriously damaged Milan, the National Liberation Committee (CLN) decided to promote a free competition of ideas for a new PRG, which would address both the issues of reconstruction and develop-

1925
Existing industrial areas in Milan (on the right page). Personal reworking.



ment. Ninety-six projects were examined by a special commission. The main points which emerged from the competition regarded the relationship between the city and the region, a possible resizing of the city and an industrial decentralization with the proposal of satellite quarters for workers, while the expansion lines towards north/north-east and north-west were maintained and the tertiary functions were placed in the historic centre.

The rules also required specific space for greenery both inside and outside the urban area, as well as more social services. Some projects also suggested a subway network that was connected to the railway and served the whole territory, new urban roads following the main axis and a motorway network as the continuation of the territorial structures.

The most interesting proposal which respected the guidelines was presented in 1946 by the AR group (United Architects, which included Albini, Belgioioso, Bottoni, Cerruti, Gardella, Palanti, Peresutti, Pucci, Putelli and Rogers). The group proposed to create a new business district as an alternative to the outsourcing of the historical city centre. They planned to break the radio-centric shape of Milan that caused the congestion of the centre, recovering the relationship with the territory.

The plan was adopted in 1948 and in the same year the municipality decided to make use of the provisions contained in the Legislative Decree (DL 1 March 1945 n ° 54) which allowed the possibility of drawing up the reconstruction plans, i.e. special plans for war-hit areas despite the General Plan. This provision was adopted for two central areas and for three expansion zones in the north. Several modifications were then made to the plan, which was eventually implemented in 1953. However, the reconstruction plan based on Albertini's drawings allowed building speculation to have the upper hand on the new ideas emerged from the competition.

Some merits of the new PRG were:

- the zoning that allowed to organize and rationalize the growth of the city;
- the creation of the business district which was supposed to relocate some of the tertiary functions;
- the concept of two equipped axis at the intersection with the business district that was supposed to solve the traffic congestion of the city;
- the suppression of most of the demolitions;
- the proposal of a regional plan to coordinate the growth of the Milan hinterland.

On the other hand, some negative aspects were the legal expedients and building speculations. Both these aspects led to the failure of this plan, which however was not complet-

ed in all its aspects. The plan also failed in respecting the environmental values, while not preventing severe destructions in the historic centre. Indeed, the industrial and productive areas were relegated from the plain to large peripheral areas, in contrast with the request to integrate these functions into the territory. Large public areas were then squandered in favour of private interests. The plan, though born from a careful analysis of the territory and its needs, didn't take into account the industries located around Milan, which often interfered with the expansion of the urban grid.

Years	ha	% of industrial area on the municipal territory	% increase
1936	1140,1	6,3	-
1954	1861,8	10,2	3,9
1963	2068,6	11,4	1,2
1968	2120,0	11,7	0,3

Industrial surfaces, percentage compared to the municipal area and absolute increases in the four thresholds 1936, 1954, 1963 and 1968.
- Villani (1977).

Years	Workers	Increase
1927	204.171	-
1951	322.838	118.667
1961	427.403	104.565

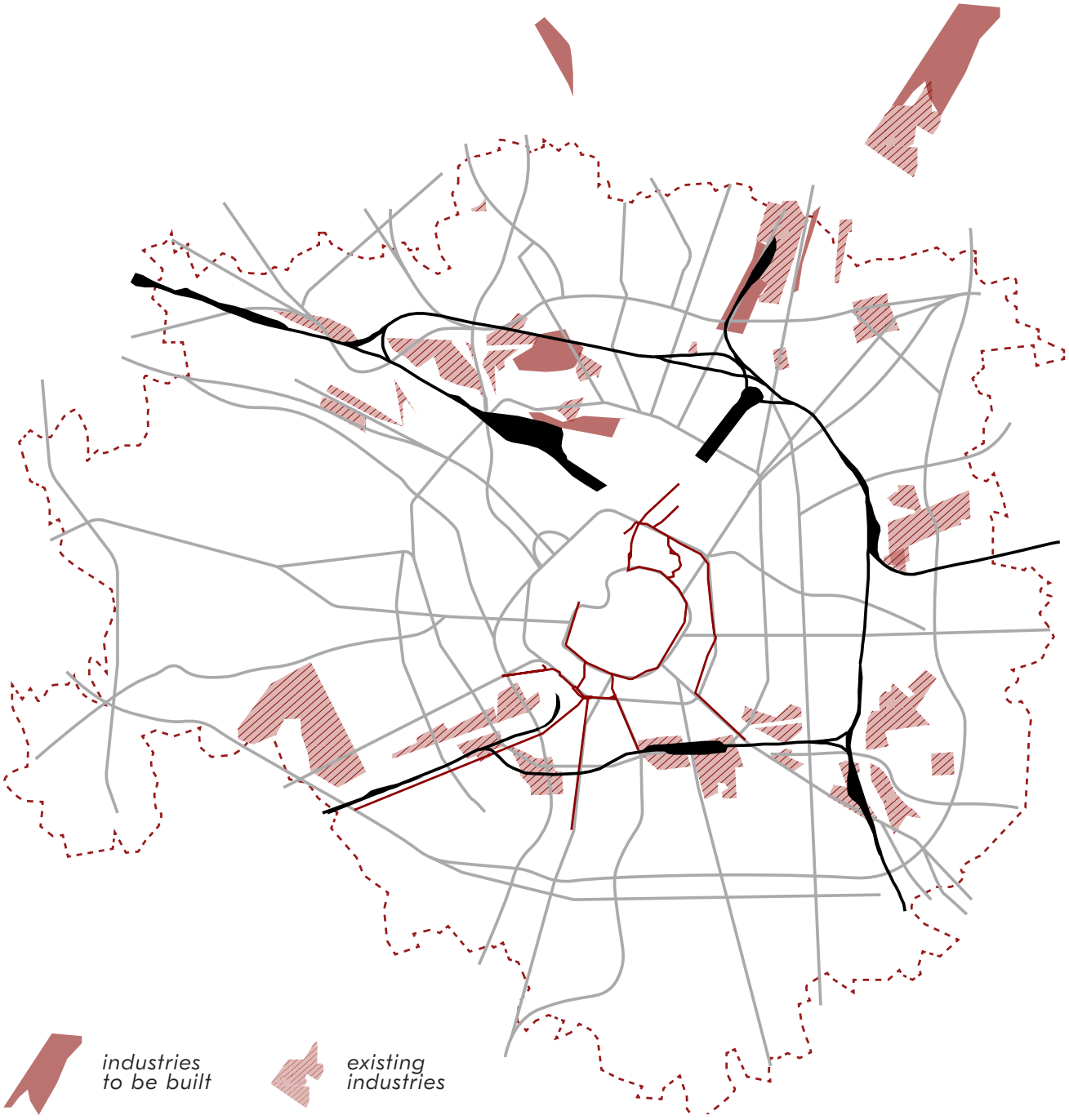
Increase of workers in 1927, 1951 and 1961.
- Villani (1977).

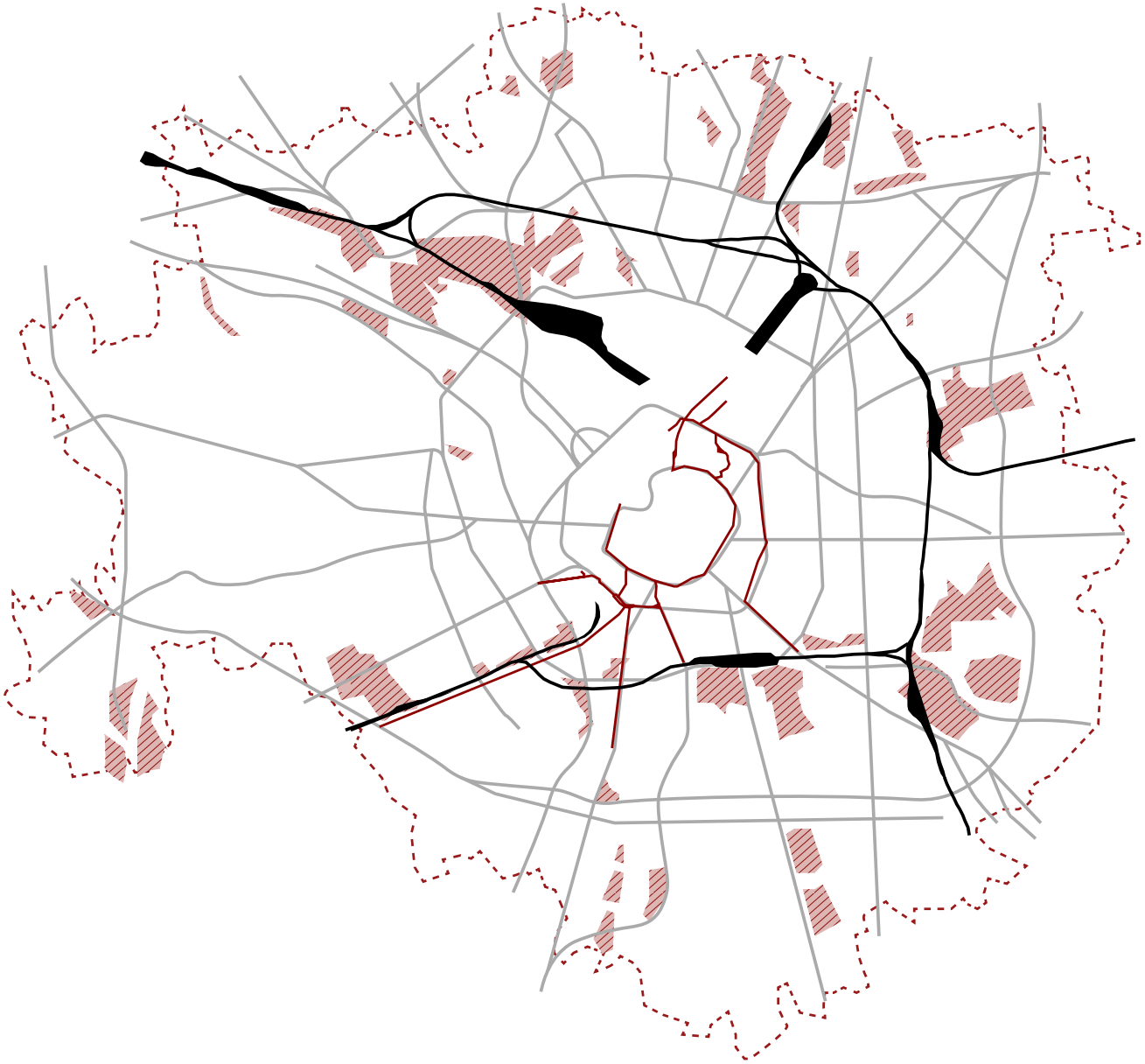
Years	Increase
from 1927 to 1951	4.527
from 1951 to 1961	10.456

Average annual increase in workers
- Villani (1977).

1953
First PRG of MIlan (on the following left page).

1963
Variation to the PRG (on the following right page).


industries
to be built
existing
industries



The economic growth in Italy and the increase in population

The economic boom in Milan led to a significant demographic growth, mainly due to immigration from the countryside and southern Italy. Immigration was also due to the growth in the city's productive and industrial activities, which increased the request of workers.

The lack of green spaces and public services in the city centre became more evident and there was a transformation of building use, with a consequent increase in the tertiary areas. A variation to the PRG (the so-called shadow variant) was therefore necessary.

In 1963 professionals and teachers of the Polytechnic coordinated by three supervisors (Caccia-Dominioni, Barbiano di Belgioioso, Gazzola) were involved in the process of redefinition of the PRG. The variant was never implemented and in the same year another one was drawn up by the municipal technician Hazon. This one was established an increase in services and in the settlement capacity up to 300,000 units. There was still a fragmentation in the industrial areas scattered around the city centre, but close to the main railway and road junctions.

At the end of the sixties the industrial areas were compacted, creating vast productive areas mainly in the northern area and in the southern area.

During the Seventies the population growth didn't stop, and at the same time some social and economic changes happened. In 1976 a new general variant was drawn up for the town planning. It expected a building expansion of 80,000 rooms, and a restructuring of 130,000 rooms, carried out mainly in the centre. As it regarded the traffic, the construction of the third subway line was envisaged, and a railway bypass was created. In this phase a decentralization of the industry was evident, since the plan included the transfer of the activities to the periphery or the neighbouring municipalities. The continuous demographic growth and the increase in the number of workers were the engines of this decentralization.

The territorial government plan for the future of Milan

From the first decade of the 2000s, the city experienced a profound renewal from an architectural and urban point of view, with the realization of several projects that aimed at redeveloping en-

tire areas and large districts (such as the Bicocca Project). Milano started to project its image in Europe and in the world thanks to important international competitions attended by architects such as Renzo Piano, Norman Foster, César Pelli, Massimiliano Fuksas, Arata Isozaki, Daniel Libeskind, Zaha Hadid and Ieoh Ming Pei. All these projects have modified and redesigned the layout and the outline of the metropolis.

In 2005 the municipal administration approved the first Territorial Government Plan (PGT) which defines the structure of the entire municipal territory. In March 2019 the new PGT has been approved, which includes five main objectives to be achieved by 2030:

- a connected, metropolitan and global city;
- a city of opportunities, attractiveness and inclusion;
- a green, liveable and resilient city;
- a city, 88 neighbourhoods to call by name;
- a city that regenerates.

1969
Variation to the PRG (on the following left page).

1976
Variation to the PRG (on the following right page).

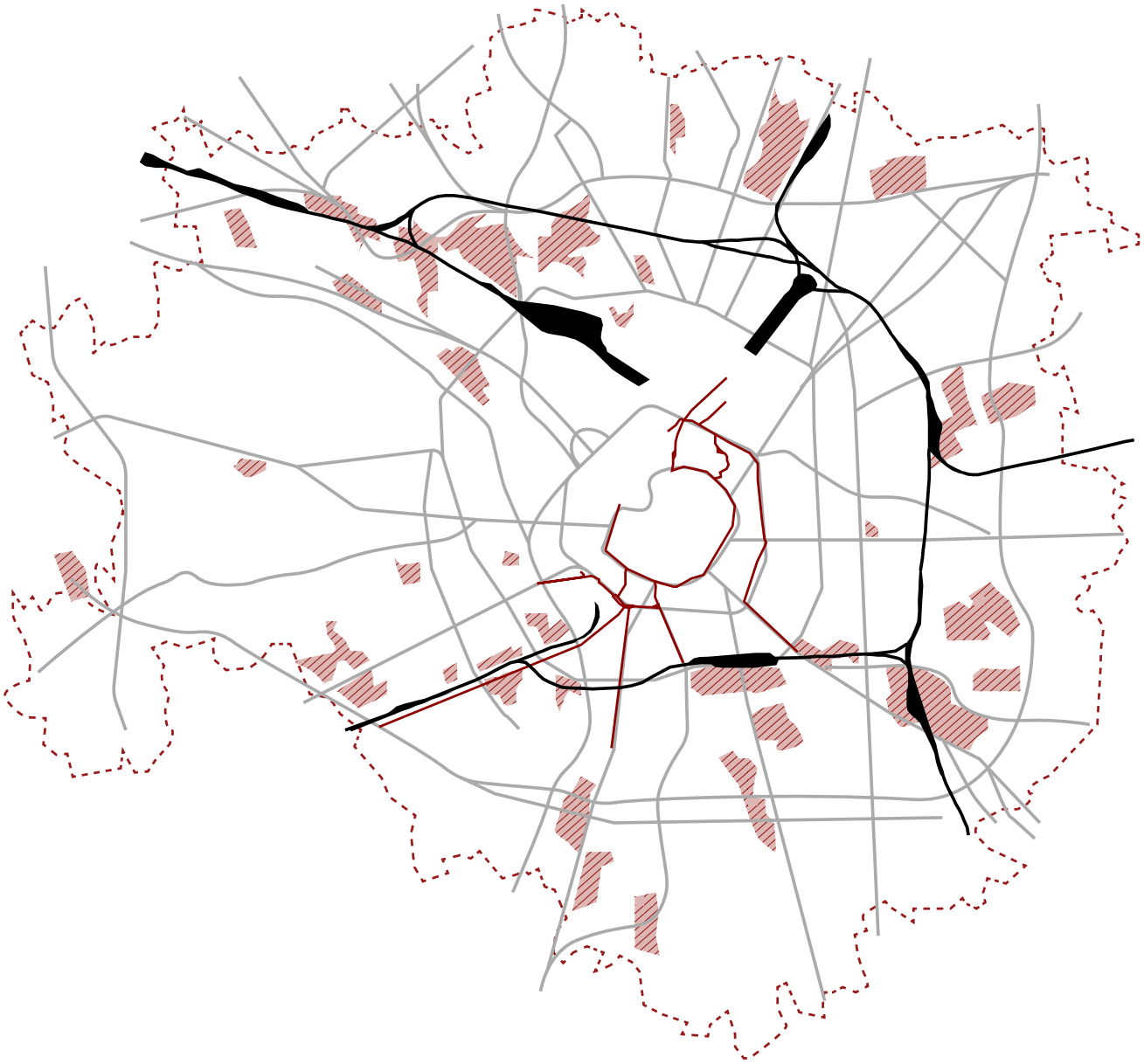
The objectives of the new Plan established the direction of the future urban development of the city and were aimed at overcoming the physical, social and economic distances between the city centre and the suburbs.

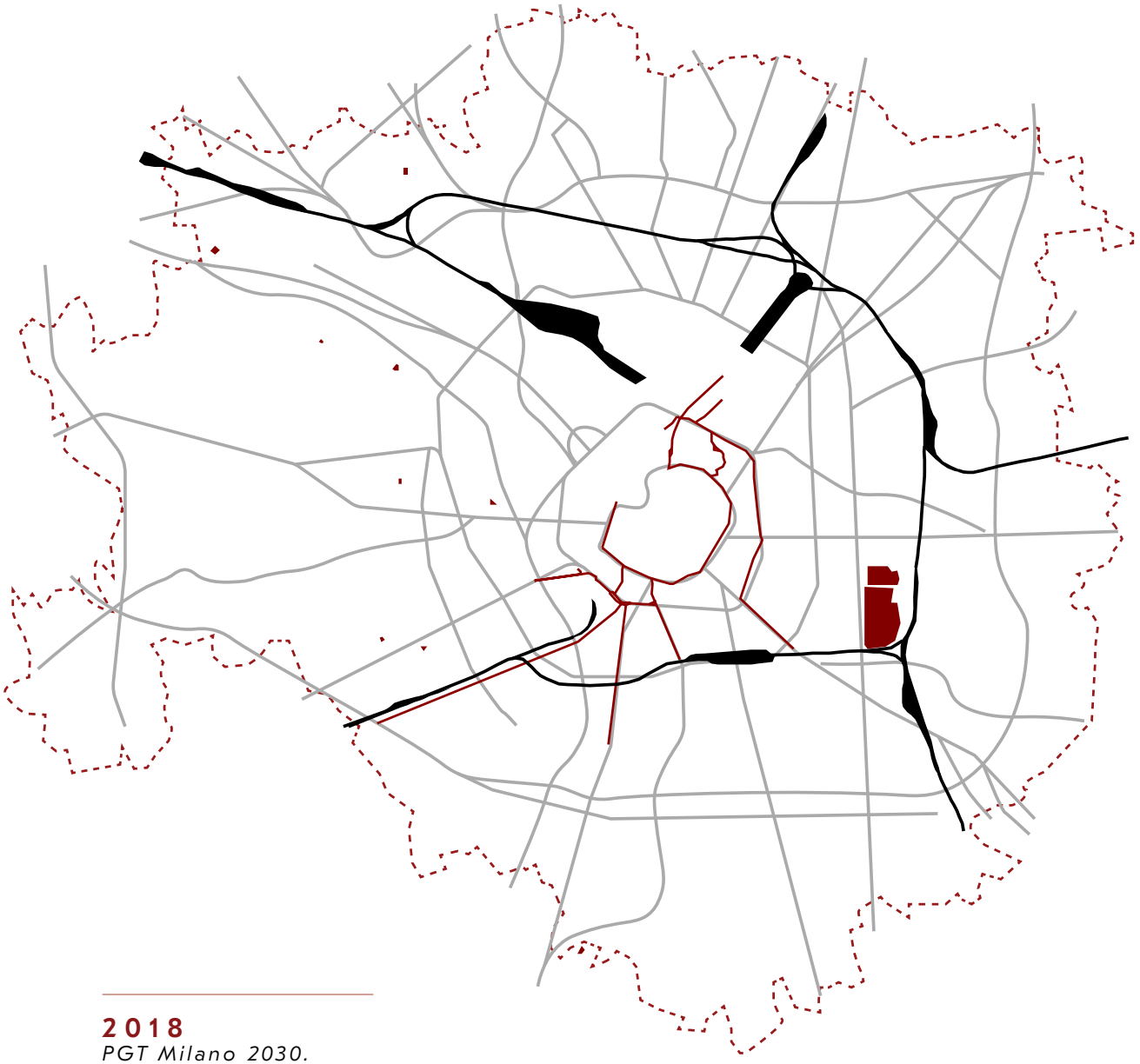
1963			
Zone	*ha*	*% compared to the area of the strip*	*% compared to the total area*
NC	*-*		
I	*2,9*	*0,5*	
II	*272,9*	*12,7*	*13,1*
III	*749,1*	*21,4*	*36,2*
IV	*1043,7*	*8,9*	*50,4*
Total	*2068,6*		

1968			
Zone	*ha*	*% compared to the area of the strip*	*% compared to the total area*
NC	*-*		
I	*2,9*	*0,5*	
II	*256,6*	*12,7*	*12,1*
III	*753,5*	*21,5*	*34,1*
IV	*1107,0*	*9,0*	*52,2*
Total	*2120,0*		

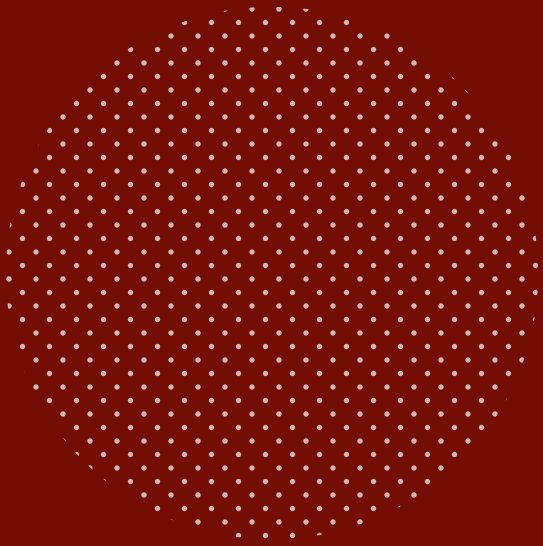
Distribution of industrial areas in the municipality of Milan in 1963 and 1968, identified by zone, from the central nucleus (NC) to the most peripheral zone (IV zone)
- Villani (1977).


industrial use
mixed use

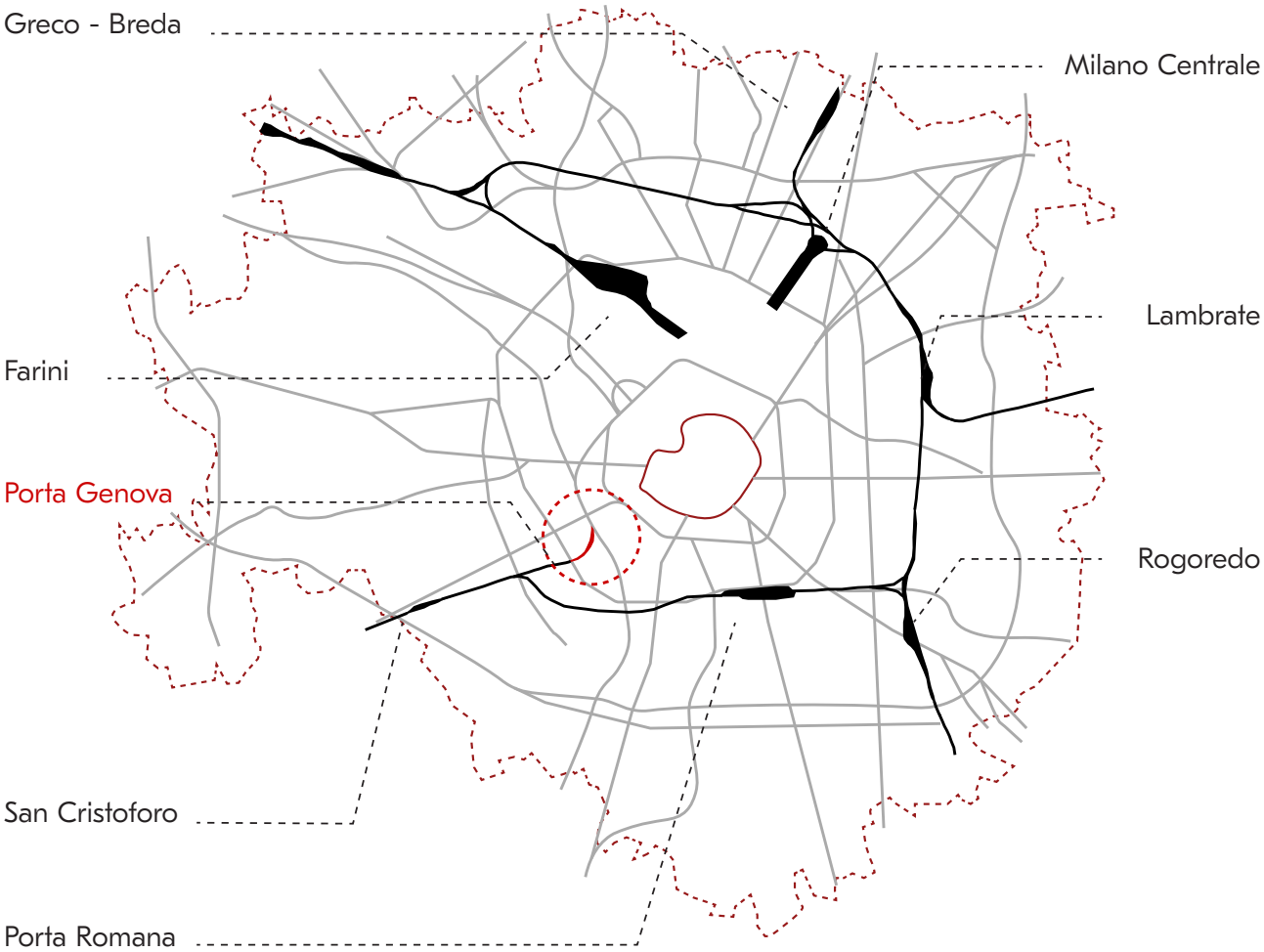




2018
PGT Milano 2030.



The rail yards in Milan


Greco - Breda
Milano Centrale
Lambrate
Farini
Porta Genova
Rogoredo
San Cristoforo
Porta Romana

The disposal of the railway areas

The refurbishment of abandoned former industrial areas is a current topic of discussion in many urban areas around the world, especially in Europe and America. The rail yards are included in this category of industrial areas, even if they are more easily subject to design proposals because of some specific features:

- they are usually in well urbanized central or semi-peripheral areas;
- they are quite accessible;
- they are mostly empty or partially occupied by low quality building, which don't have historical or architectural obligations;
- they are not much polluted and the environmental remediation is easier;
- they are managed by public actors - usually the municipality and the company which owns and manages the railway system - with the aim of maximising the benefits for the community;

The redesign of these areas is an opportunity to rethink large parts of the city as well as the public mobility network. Unfortunately, especially in the Italian scenario, sometimes the project of renovation of this areas missed the chance of becoming part of an overall

The railway has always been a very powerful infrastructure, which has been able to create a very strong connection with the urban fabric. «The city and the railway often established a synergic and complementary relationship, which sometimes turned into a very complicated coexistence»[1].

Since its invention, the railway has determined how much and in which way the city expanded. Depending on the shape of the railway system, being it linear, circular or like a belt, the city grew up in different ways or sometimes it became an obstacle to the growth of the urban area, as it happened in Milan at the end of the 19th century.

1 Personal translation from Rosaria Battarra (2010).

1884 - 1911

The railway belt.

From the station of Porta Genova, the Milan railway continued for about 100 meters and then, after a big curve it reached the Porta Nuova station (the actual Centrale) through Scalo Sempione, thus creating a closed belt around the city.

1931

The open belt and the new central station.

The railway belt was preventing the city from expanding further, so part of it was demolished, closing also the line at Porta Genova. The new central station was built. The city began to expand again and the people started to migrate from the historical centre to the new periphery.

TODAY

Disused railway yards and active stations.

Seven former railway yards were dismissed and they are currently at the center of a discussion about their refunctionalization. Their position and surface represent a very intersting opportunity for the city's future development.

Personal redrawing of the railway network.
De FInetti at al. (2002).

Italian railway system development in 1865, 1876, 1885, 1905.
Selvafolta, Castellano (1984).

Systematization of the Milan railway system according to the government plan, 1907.
Selvafolta, Castellano (1984).

integrated view for the future development of the city, being limited to temporary or local interventions.

The railway system of Milan

As already seen in the previous section of this chapter, Selvafolta and Castellano reported that between 1861 and 1881 Milan was the centre of a quite large urban area, with an increasing demographic growth and increasing number of manufacturing activities, as well as well developed crops and light industries. As it emerged also from the study of the urban planning, the development of the industrial areas was mainly supported by a very efficient railway system, whose northern part was founded in 1874.

In 1884 the tramway network was the driver of the expansion of the suburban areas of the city. When completed at the beginning of the 20th century, the railway system reached its maximum length of 2000 km, thus becoming the most important infrastructure of the Reign both for human passengers and for goods.

In 1911, since the urban population grew up to 500.000 people, new suburban railway lines were created to increase the flow of supply from the countryside. The system of the railway yards worked around the central station, which in this historical period was still located in a different area and known as Porta Nuova. The urban plan foresaw the creation of a new branch to reduce the traffic on the central station and connect the new Sempione and Rogoredo stations through Porta Ticinese and Porta Genova. The station of Porta Romana handled the traffic coming from Pavia and Piacenza. From 1898 and 1902, a commission headed by Luigi Rossi studied the final organization of the railway system, considering the character of the traffic to the stations and the yards, as well as predictions for the future and a possible improvement of the infrastructure.

In 1910 the need for a bigger central station became more urgent, thus leading to a discussion and a competition which ended up with the construction of the station we know today. De Finetti et al. argue that the new monumental head station created more troubles than those that it solved since it was not able to work as the centre of the railway network any more and it was also 800 metres farther from the previous station.

In general, the railway system of Milan owes its shape to two main European methods:

» the old French fashion of creating a belt

around the city, instead of crossing it;
» the German fashion of the head station, such as Leipzig.

The path towards the reuse of the railway yards in Milan

Milan was one of the first cities in Europe to plan a reorganization of the railway system. In 1980s the plan for the railway passer started to involve other urban areas to transform around it. The most important one is still the Garibaldi - Repubblica area, around which several real estate projects have been and are still being realized.

The interest of the city of Milan for the disused railway areas became official in 2005 when the municipality signed an agreement with FS s.p.a group to enhance the metropolitan railway system while reusing those areas[2] which were not necessary related to railway purposes any more.

In 2007 the municipality signed the Program Agreement and set up the commission to prepare the variant to the PRG. The railway yards were now labelled in the new plan as Areas of Urban Transformation (ATU) and some hypoth-

2 According to Battarra (2010), the surface of these railway yards and disused areas is about 1.300.000 m². The areas are represented in the chart below.

Area	*Disused area (m²)*	*Public area (m²)*	*Instrumental areas to the transformation (m²)*	*Total*
Farini-Lugano	*499.021*	*10.595*	*141.523*	*651.139*
Romano	*186.050*	*0*	*30.380*	*216.430*
San Cristoforo	*140.885*	*11.405*	*13.500*	*165.790*
Porta Genova	*87.838*	*5.709*	*0*	*93.547*
Lambrate	*68.882*	*948*	*0*	*69.830*
Greco-Breda	*65.981*	*0*	*5.097*	*71.078*
Rogoredo	*22.570*	*0*	*0*	*22.570*
Total	*1.071.227*	*28.657*	*190.500*	*1.290.384*

The railway areas in Milan defined by the Program Agreement - Battarra (2010).

esis of programmatic guidelines were established.

In order to make the agreement effective, in 2009 the management of the yards was included into the new territorial government plan (PGT) and a variation to the 1980 regulatory plan (PRG) was completed. The latter foresaw that the strategies to tackle those problems should be different according to the specific features of each area: location, dimension, urban context, morphological structure or accessibility.

«Within a system perspective, the choice of the activities and their settlement weights is made in blocks through a mechanism of equalization, which is allowed by the presence of a single owner»[3]. The idea of the municipality was and still is the creation of an urban functional mix, whit a reserved percentage dedicated to social hosing or collective functions. Montedoro also reported that the municipality was also planning productive functions for these areas in order to make Milan more competitive in the international market.

«The quantitative magnitude of the land resources involved requires a thorough evaluation of supply and demand of the actual capacity of absorption of these new interventions [...]. And all this in a medium to long-term perspective that has to consider the variation of the decision-making system and the stakeholders»[4].

The new municipal council run by Pisapia reviewed the PGT and the program for the railway yards leading to a delay in their refunctionalization. The new version of this plan has been recently approved and envisions the plan of Milan for 2030. Most of the volumes to be built are allowed in Farini and Romana yards, which have the largest surface, thus making the rest of the areas - already surrounded by dense urbanization - more permeable and porous.

Participatory activities, workshops and public competitions

After the agreement with the municipality of Milan and the approval of the Regione Lombardia, FS Sistemi Urbani has promoted a phase of consulting and involvement of the population to define priorities and targets for the development of these areas. *Dagli Scali, la nuova città* was an inclusive and participatory activity aimed at defining a strategic view for the city starting from the future development of the yards.

3 Personal translation from Rosaria Battarra (2010).

4 E. Mussinelli, C. Marchegiani (2012).

the city of connection,
through the enhancement of the transportation network.

the city of living,
aiming at transforming the city in a vital multicultural environment through urban functional mix and innovation.

the city of cultures,
by fostering cultural activities and heritage.

the city of green,
by creating quality public spaces and protecting the environmental features of the city.

the city of resources,
through diversified productive sectors and stronger economic position at an international level.

Personal reworking.
FS Sistemi Urbani, Workshop Report. Il processo, la sintesi dei risultati, le voci dei protagonisti (2016).

The first step was a workshop organized in December 2016, which was followed by the exhibition of the results of the workshop and some initial scenario for the future. The workshop activities mainly revolved around the following topics:

- the city of connection;
- the city of living;
- the city of cultures;
- the city of green;
- the city of resources;

Two competitions has been held about the future of the yards, in 2016 and 2019. The first one ended up with five scenarios proposed by different teams:

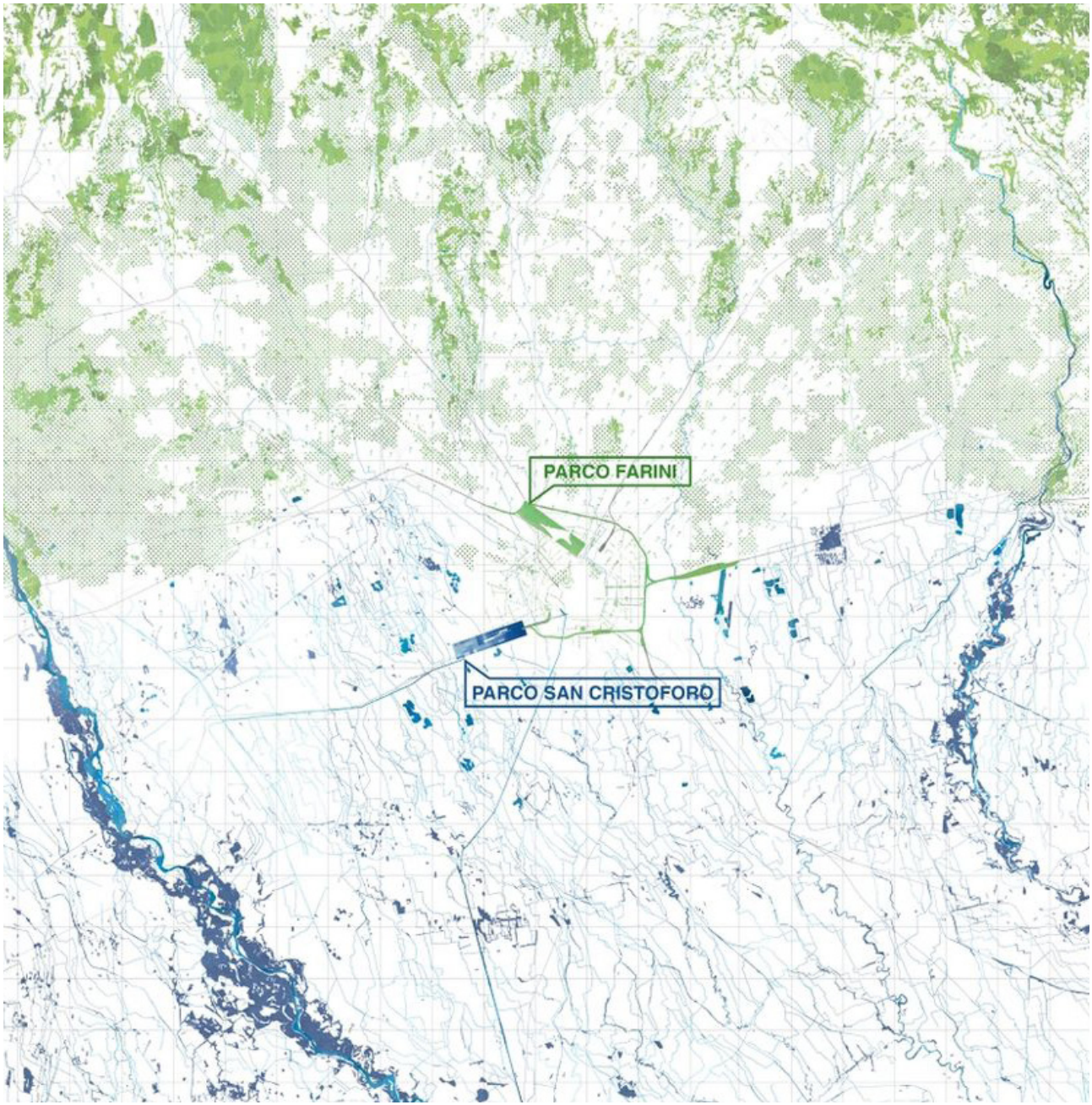
- the green river for Milan, by team Boeri, which aimed at covering the 90% of the available surface with green forests;
- Milan rebirth, by MAD architects, which proposed to create micro-cities with new infrastructures;
- sustainable life, by team Mecanoo, which aimed at creating a sustainable circular city;
- Miracles in Milan, by Miralles Tagliabue, which identified the water as the connecting element;
- Seven beautiful "broli", by the team led by Cino Zucchi, which suggested urban parks able to redesign the land and the urban territory.

The winner of the latest Farini competition is the project *Climatic agents* led by OMA, together with Laboratorio Permanente, which imagined two different environmental startegies, a green scenario with a park for the Farini yard and a blue one with a linear system of water purification for San Cristoforo.

«The project is part of the strategy of the municipality of Milan to adapt to the climate change and urban resilience through the reuse of trees and water ponds which can cool down the air of the city and reduce the impact of pollution on health»[5] said Dominique Perrault, the President of the Jury.

5 http://www.scalimilano.vision/concorso-scalo-farini/il-team-oma-e-laboratorio-permanente-e-il-vincitore-del-masterplan-concorso-farini/ (retrieved on 10th June 2019).

Climatic agents representation from OMA website. https://oma.eu/projects/scalo-farini (retrieved on 10th June 2019).


PARCO FARINI
PARCO SAN CRISTOFORO

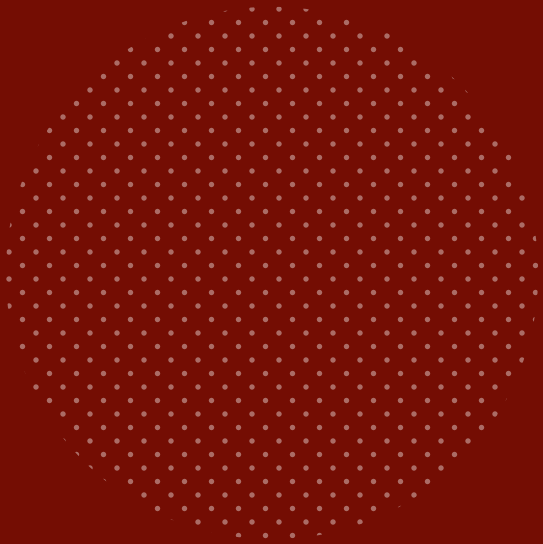
L'analisi della periferia scopre l'esistenza di un mondo: un mondo articolato di forme, di temi e di problemi spesso non risolti, ricco di memorie e frammenti.

(Motta, Pizzigoni, 1991).

CHAPTER 03

Milan

Porta Genova as a case study



Porta Genova
historic development
1884 - 2019

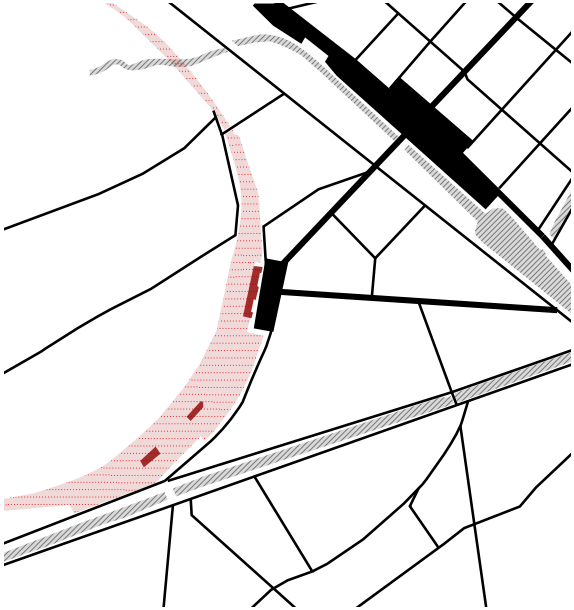
As the premises for the projects for the XVII Triennale show, the old station of Porta Genova is the remaining part of the cut western branch of the railway belt. Once disused, the station will leave space for new commercial or tertiary functions, which will also have to redesign the square as a new urban public space.

The station will leave empty also a long tail of land, which is currently occupied by the warehouse and the rails coming from San Cristoforo. The railway currently creates a sort of independent and inaccessible island, which also blocks the view from the Naviglio to the Tortona district.

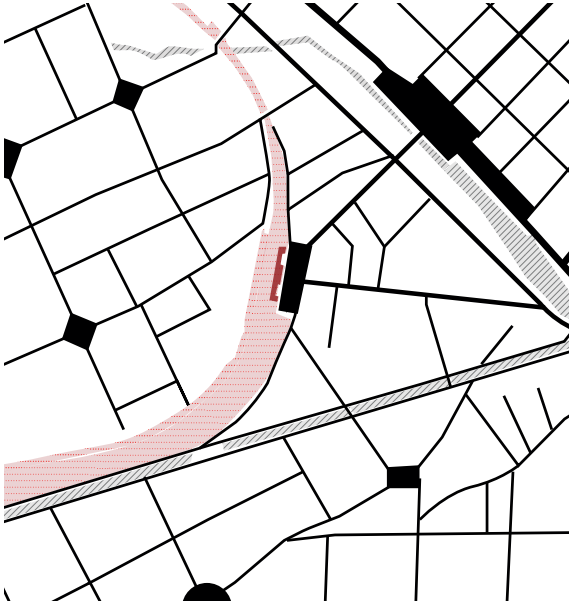
Before going deeply into the analysis of the project area, I would like to make here a short historical description of how Porta Genova developed from the 19th century till nowadays.

Historical picture of Porta Genova taken by Paolo Rosselli.
Triennale di Milano (1987)

Historical picture of Porta Genova.
www.milanoneisecoli.blogspot.com/2014/09/quando-la-ferrovia-circondava-la-zona.html (retrieved on April 2019)



Above - *Porta Genova in 1884.*
Below - *Porta Genova in 1931.*



1800
The construction of the station

In the last decades of the 19th century, the district Tortona-Solari was a rural area, characterized by some main agricultural settlements and a few buildings along the Naviglio Grande. The area was also crossed by the Olona river, that ended in the Darsena, of which only a few traces remain today in the footprint of via Solari and via Valparaiso. Thanks to the new railway Milan-Vigevano and the foresee of the entrepreneurial bourgeoise, the district developed into an industrial site. The construction of the station of Porta Genova began in 1865, former know as Porta Ticinese until 1873, thus completing the railway belt in 1884. Along with the station, the new residential area began to take shape.

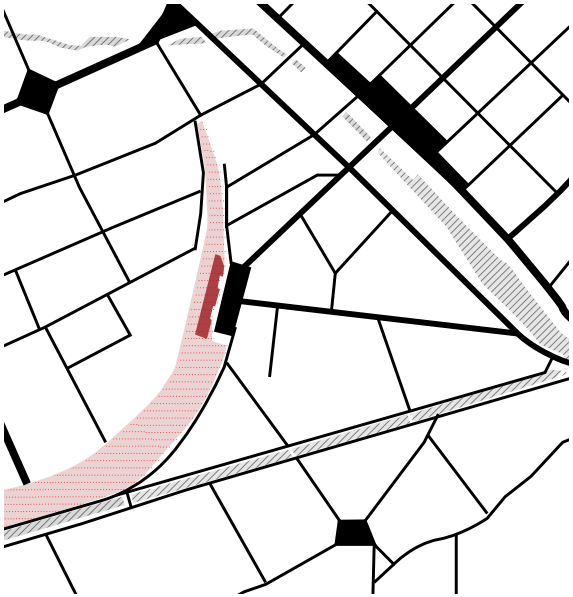
1900
The growth of the Tortona district

As already discussed before, the migration process from the city centre to the new periphery brought to the definition of new urban plans: Piano Beruto and the following Piano Masera, starting from 1884, redrew the south-west area of the city. The most regular blocks were

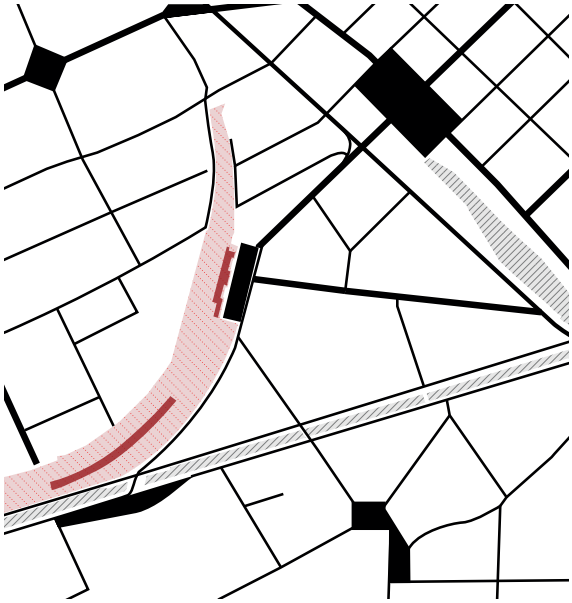
those built along via Solari and via Borgognone, whilst the new settlements surrounding the railway area had to follow a predefined footprint. The facades of the Bordoni elementary school and the Rosario church shaped the image of the main square of the district. In 1906 Giovanni Broglio designed and built the *Società Umanitaria* neighbourhood for 600 workers, a new innovative model for the city with highly aesthetic, hygienic and sanitary values as well as facilities for the residents. The industry developed to define a homogeneous urban landscape, like in the case of CGE plants along via Bergognone and via Tortona. An organic system of productive buildings, residential area and social spaces defined the identity of the district Tortona-Solari.

Between the two wars
A residential and productive area

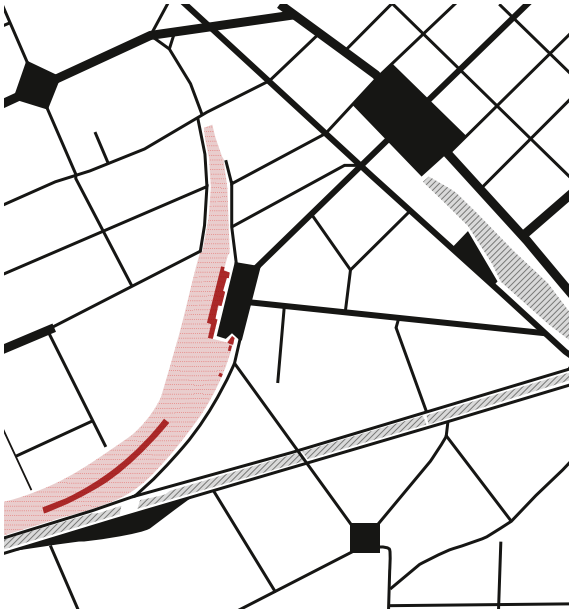
The increasing number of inhabitants of Milan (700.000 in 1920s and 1.200.000 in 1938) and the economic growth called for a modernization and renovation of the infrastructural system. As reported by Raffaele Bagnoli, the Solari area developed later compared to other areas of the city, because of the double belt of the railways that blocked its natural



Above - *Porta Genova in 1946.*
Below - *Porta Genova in 1965.*



Above - *Porta Genova in 1990.*
Below - *Porta Genova in 2000.*



expansion.

The district grew faster once the Olona river was controlled and directed towards the Naviglio Grande as well as the railway belt was demolished. New architectures began to appear, such as the building by Giò Ponti in via Leitizia or the building designed by Portaluppi in front of Solari park. During the war part of the Rosario church was bombed, while the rest of the district didn't suffer from major damages. In this area, in April 1945 the National Liberation Commitee (CLN) was founded.

After the war
The expansion of the district

In 1950s the district began rapidly to expand again together with an increase in its population. The last free areas were filled by new residential blocks and some former industries were replaced by new buildings. Between 1950s and 1960s, the public buildings interventions, started in 1938 were completed along via Gimbellino and via Segneri. During 1970s most of the buildings, former run by the *Società Umanitaria*, were bought by the Milan municipality and the church spaces were reorganized, thus turning it into the reference point for young people and families of the district.

1970 - Today
A post-industrial district

Starting from 1970s the factories were dismissed and replaced by new activities. The leading intervention of this process of de-industrialization was the exhibition of photographs about fashion by Superstudio in 1983 inside the former coach shed of Porta Genova. Other similar interventions followed this one, thus creating a cultural mix of activities related to art, design, communication, digital techniques and fashion.

In 1990 the Milan municipality bought the ex – Ansaldo spaces, where the laboratories of La Scala theatre and a museum took place. During certain events, such as the Fuorisalone, the area is alive and full of activities.

An urban tissue without order

In a general analysis of the urban periphery, Motta and Pizzigoni stated, that from the historical maps of this area it is not possible to recall a defined urban form and a precise idea of the city. What emerges from this analysis is a substantial formal immobility, showing no elaboration of an urban design or continuity in the development. Even if the fields, farms, rural streets and tree lanes where replaced gradually by different public objects and industries, none of them created a new order in the urban tissue. The growth of this part of the city did not follow any scheme and it was more a matter of quantity than quality. Every new intervention is different form the previous ones and referred to a different culture. The construction of the periphery is generally different form that of the historical city and it lacks stability and definition, especially because they occur during a shorter period. Hence, the historic maps can't represent a continuous flow of development, but only a fixed image in a precise moment.

The real useful content that it is possible to find in the urban plans is the drawing of the streets. Through the Beruto plan, then the Masera and finally the Albertini plan, the grid of the streets shrank till the block was small enough to be occupied by one single building. The following plans were farther form the design of the city and they barely followed the application of certain rules, while the 1979 variant to the PRG of 1953 defined a more precise zoning, transforming the rules into reality.

Map of Porta Genova area in 1884.
www.geoportale.comune.milano.it/sit/open-data/

Map of Porta Genova area in 1930.
www.geoportale.comune.milano.it/sit/open-data/

Map of Porta Genova area in 1965.
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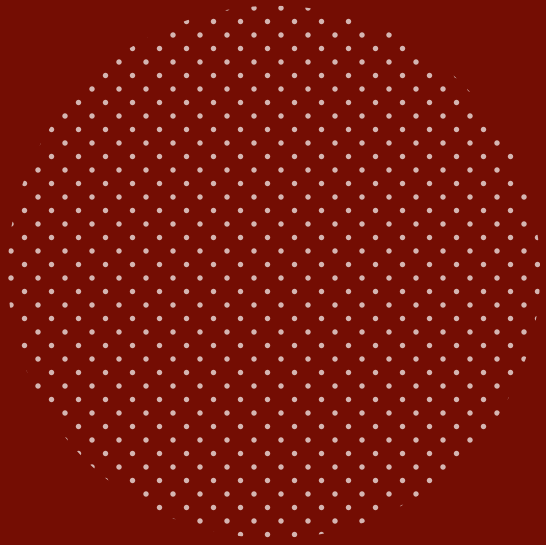
Map of Porta Genova area in 1972..
www.geoportale.comune.milano.it/sit/open-data/



Thematic survey

When I first visited the area, I reached it with the metro and I came out within the train station perimeter. The first impression was the feeling of being inside a closed island, surrounded by walls, locked doors and gates, which were clearly defining the places where I could go and those where I couldn't.

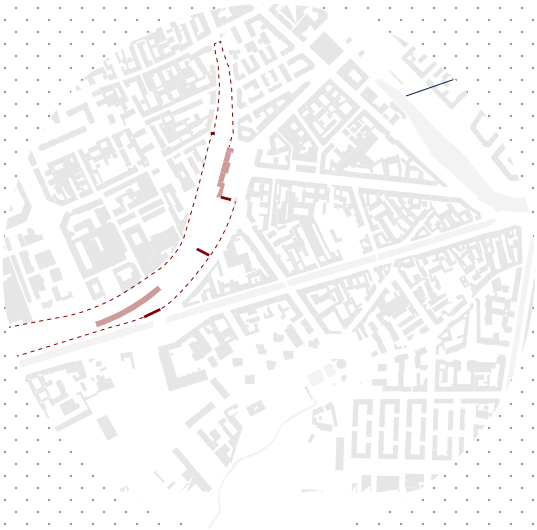
The barrier was not just physical, I had the impression that the entire place was not perfectly functioning. A few people were waiting in front af a train which was out-of-service. In my eyes, Porta Genova looked like a weak and ill organism, which was making a last attempt to survive to its inevitable death.

Porta Genova is today:

- a place of barriers, a deep cut in the urban fabric which separates two vital and active parts of Milan;
- a place of gates, where you can't access;
- a place well shaped by its boundaries, the Naviglio, the wall and the railway; a place which people are trying to take back;
- a place where food and social interaction is important;
- a place which is easily accessible from different parts of the city;
- a place of empty places.

Barriers

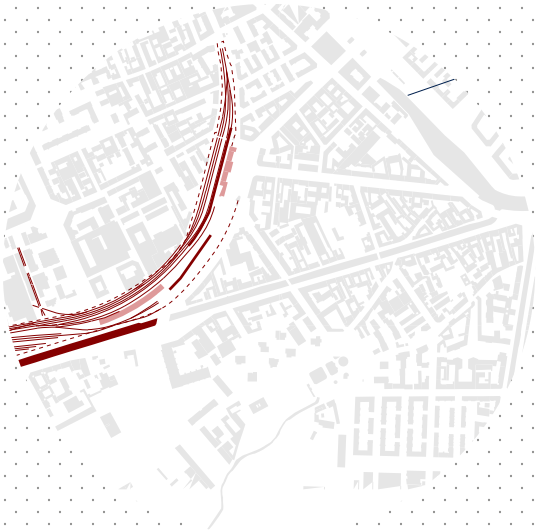

di Milano Porta Genova
gio pedonale temporaneo



Gates


Passerella ciclopedonale
NICE Club


ALLO SCALO DI PORTA GENOVA
SELF SERVICE AUTO E MOTO



Boundaries


2
DA
19.00m
26.40m

Food sequence


Yù

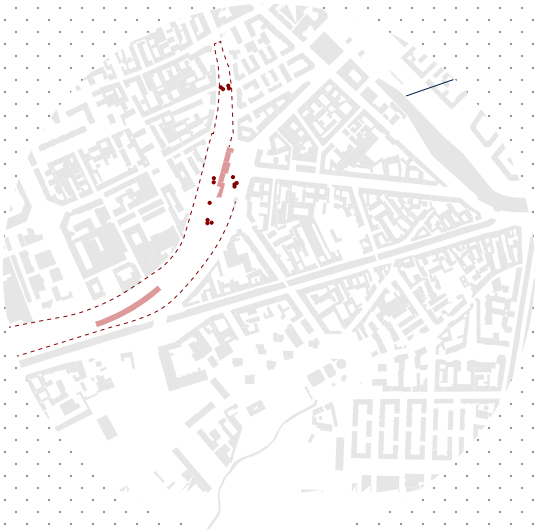

BUONA FORCHETTA
Buona Forchet


Redondo Iglesias
Redondo Iglesias


BLUES CANAL


PRIMA

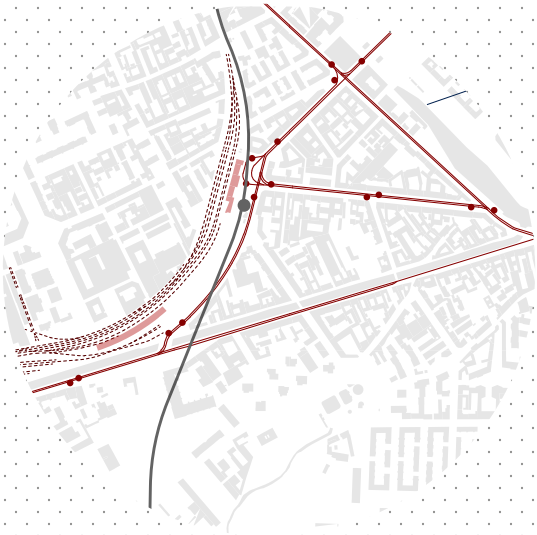

anema e cozze
SEA&PIZZA



Appropriation


TRENO
PROGETTO
COSTRUIAMO


TRENORD



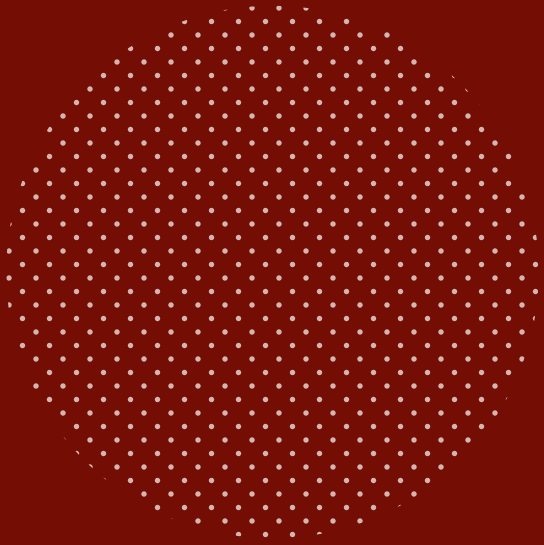
Mobility


LA FESTA DEI FRESCHI
FERMATA TRAM
0-24
P


0-24


TRENORD
2

Empties



Urban analysis through tematic maps

A city of fragments

In their book *Frammenti della città,* Motta and Pizzigoni discussed the shape of the contemporary city.

When talking about Milan, and specifically about Porta Genova, Giambellino and Lorenteggio, they argued that the confusion in the expansion of this areas is due to the overlapping of different uncompleted plans with different urban visions.

They described the urban fabric of Milan as made of fragments, arguing the lack of any historical cause that could explain why they mixed in such way. A possible explanation for the image of the city of today is that planned cities are different from the real one and those buildings or areas which are built according to plans then remain as isolated fragments in a more complex tissue, where they get to live next to other architectures.

This process is also the result of the «disintegration of the urban shape», which «originated from the block, in the lots deformation, in the fragmentation of the road curtains, in the deformation of the courtyards»[1].

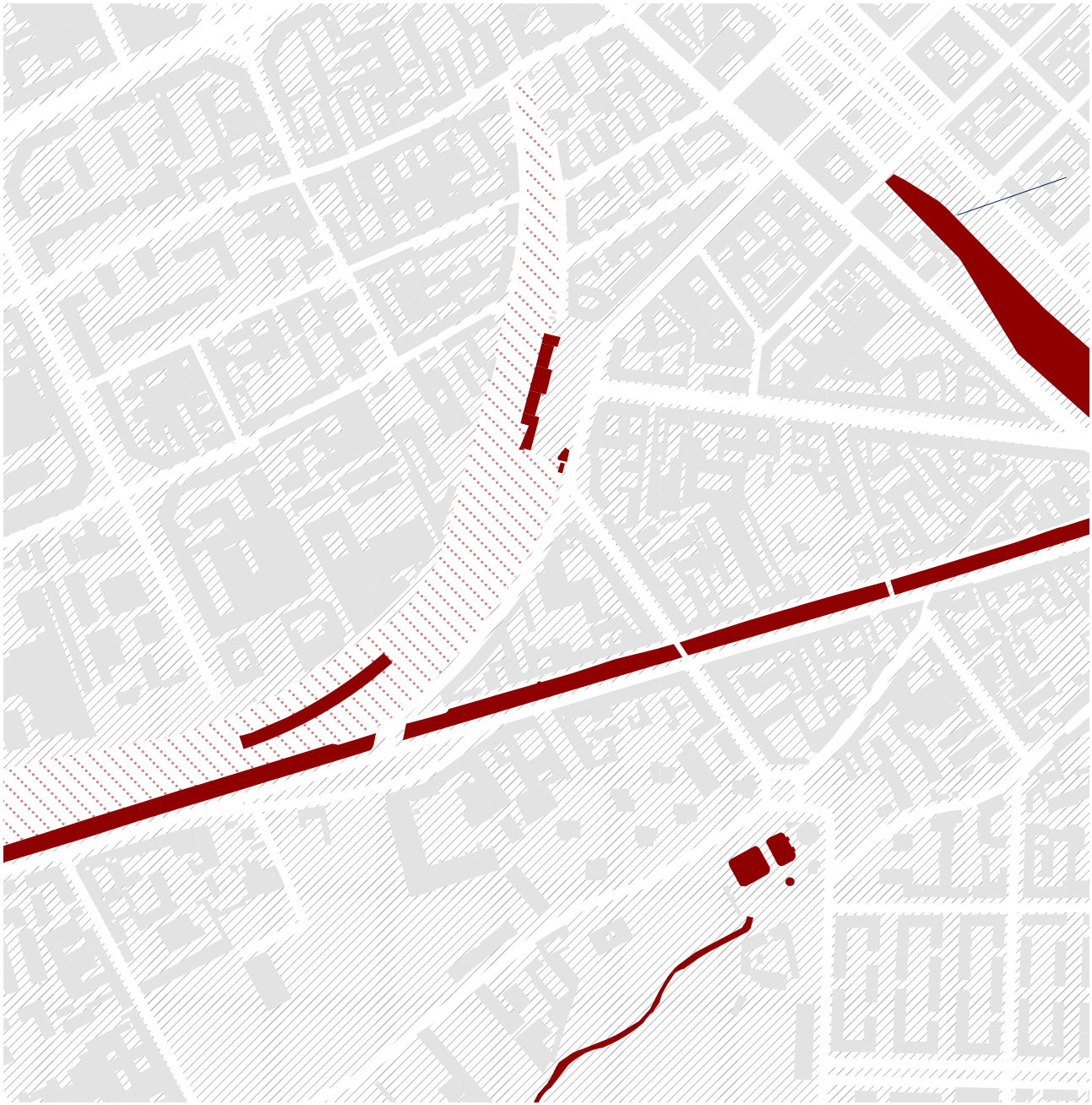
The left-out fragments have an autonomous existence, unlike classical times when they lived according to their mutual relationships.

The question raised by the authors if it is possible to define a theory starting from these fragments of the city. I found this approach of reading the urban fabric through its fragments very interesting as well as using them as basis on which to build up future transformations of the city. At this point the designer has two choices, whether to rebuild the lost unity among those fragments or to create a new reality.

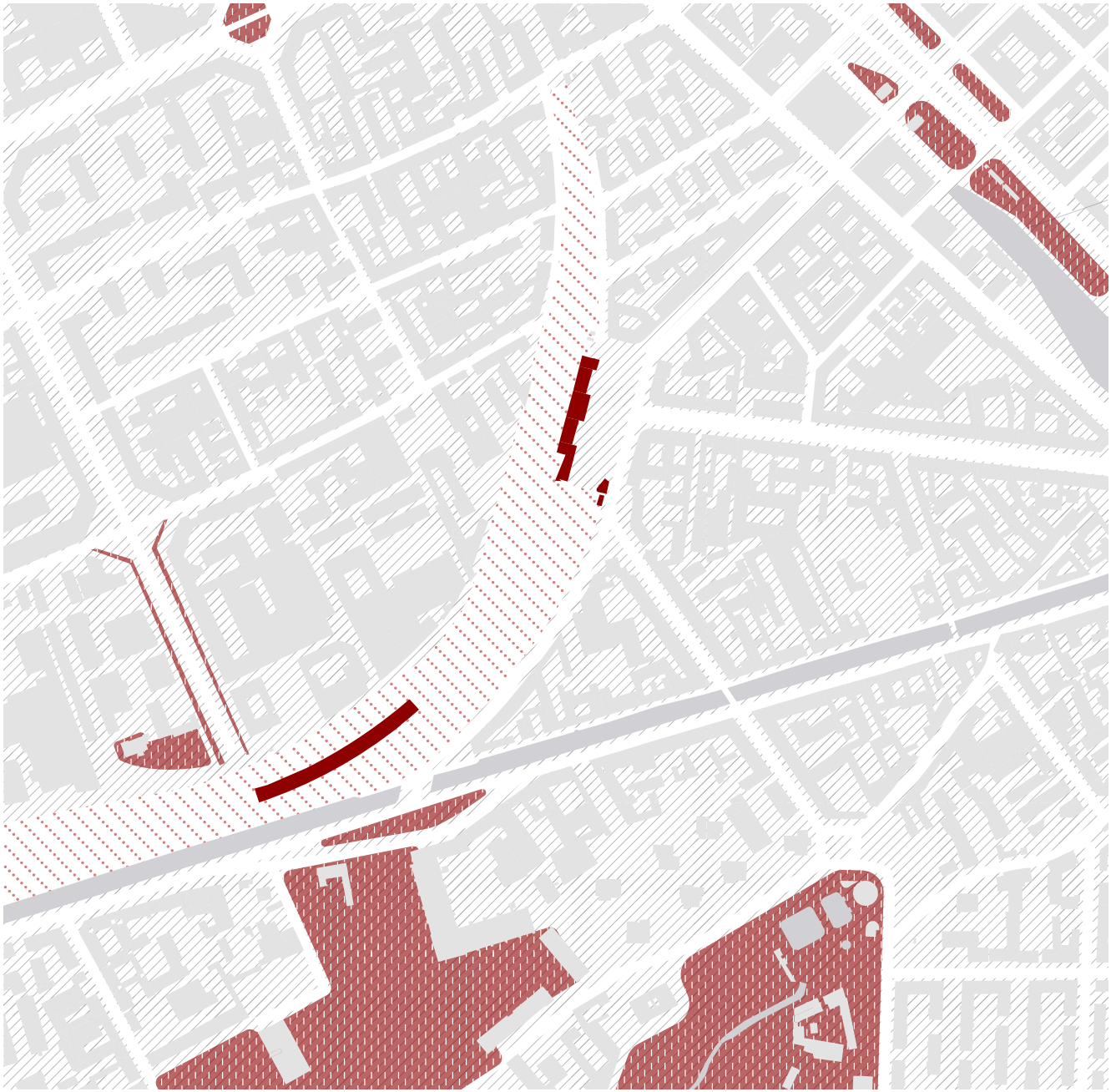
Keeping these ideas in mind while looking at the following thematic maps it might be intersting to find new meanings to the urban morphology that defines the area of Porta Genova.

1 *Motta, Pizzigoni (1981).*

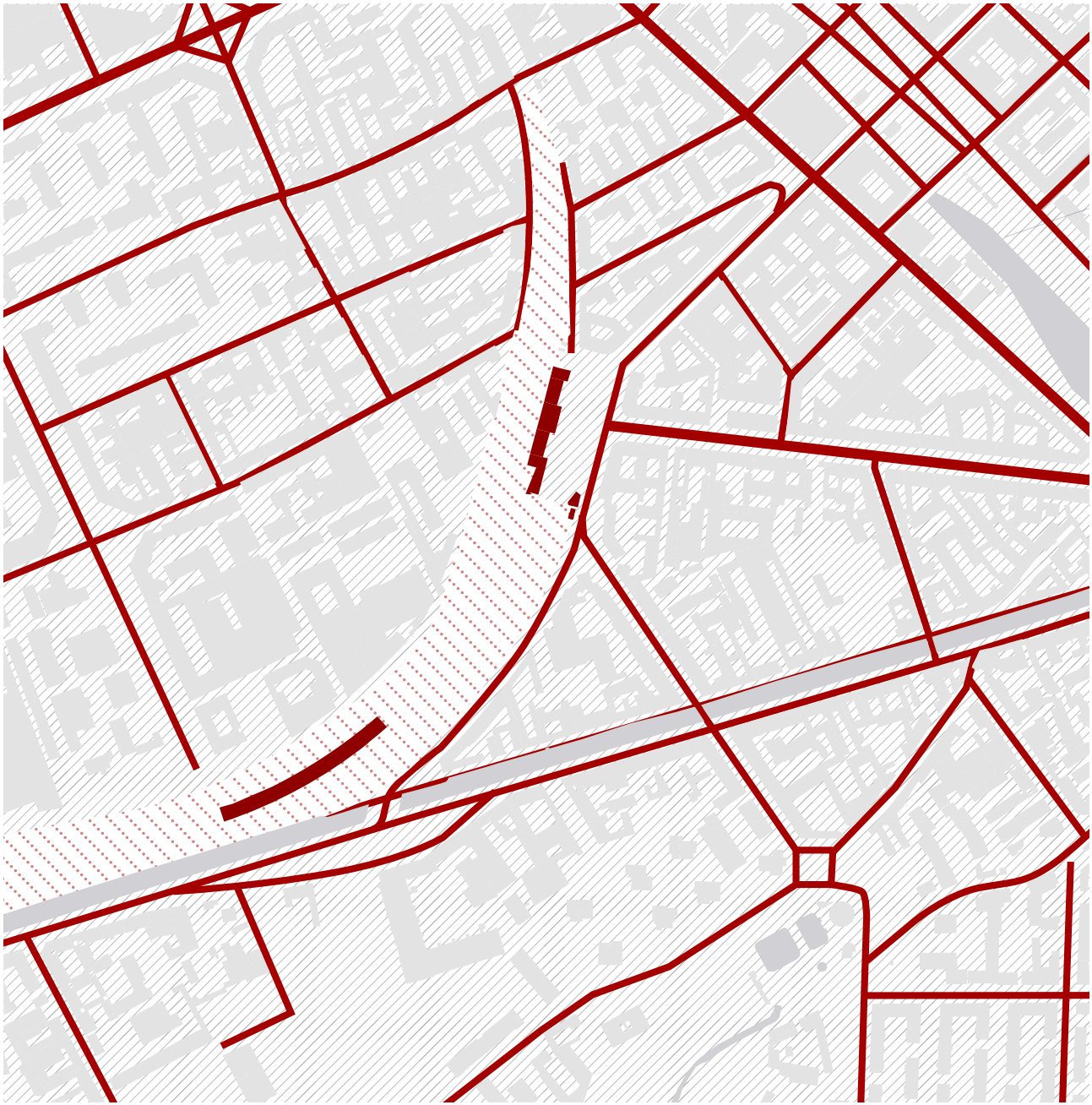
Built and empty spaces



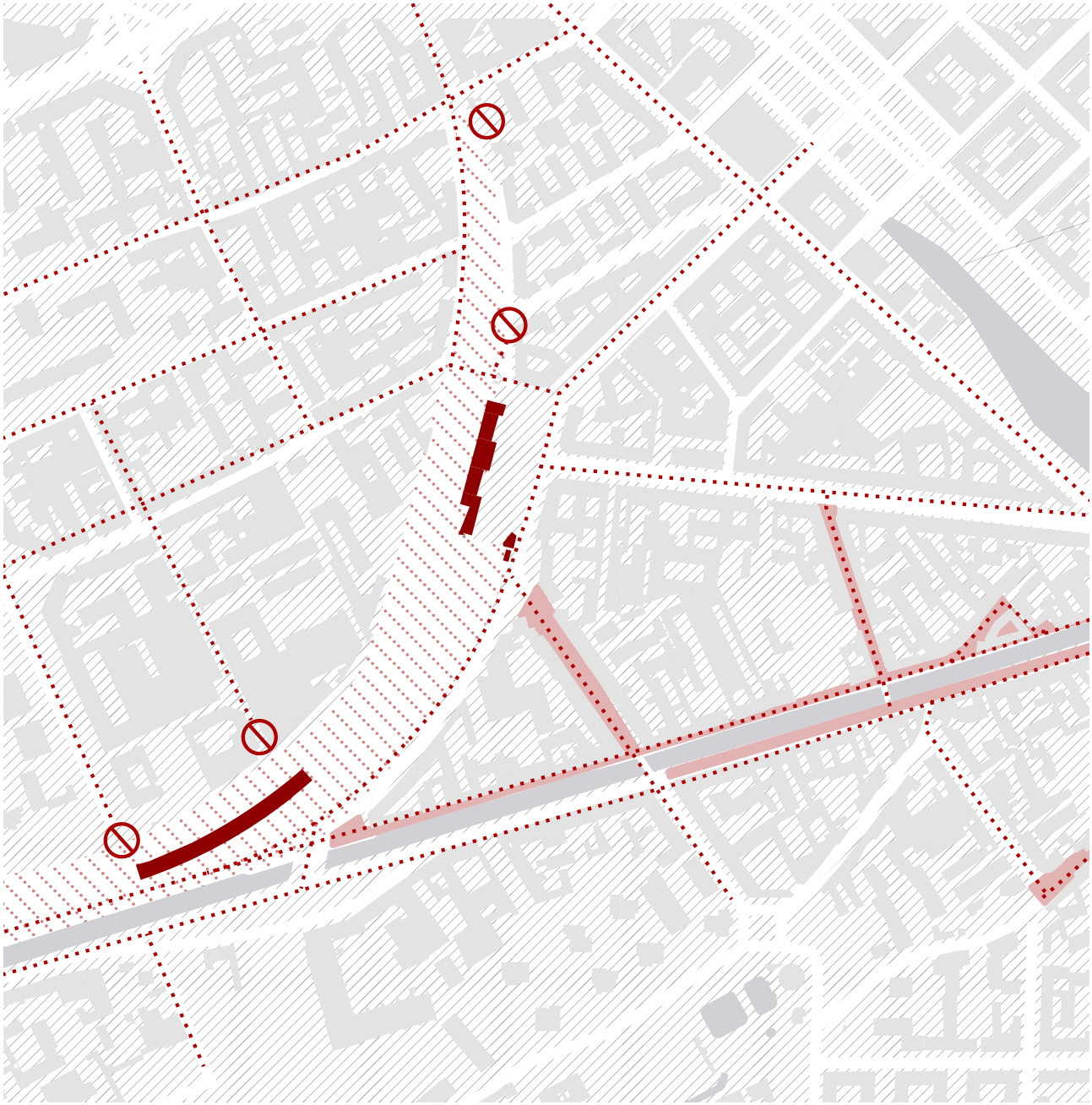
Water



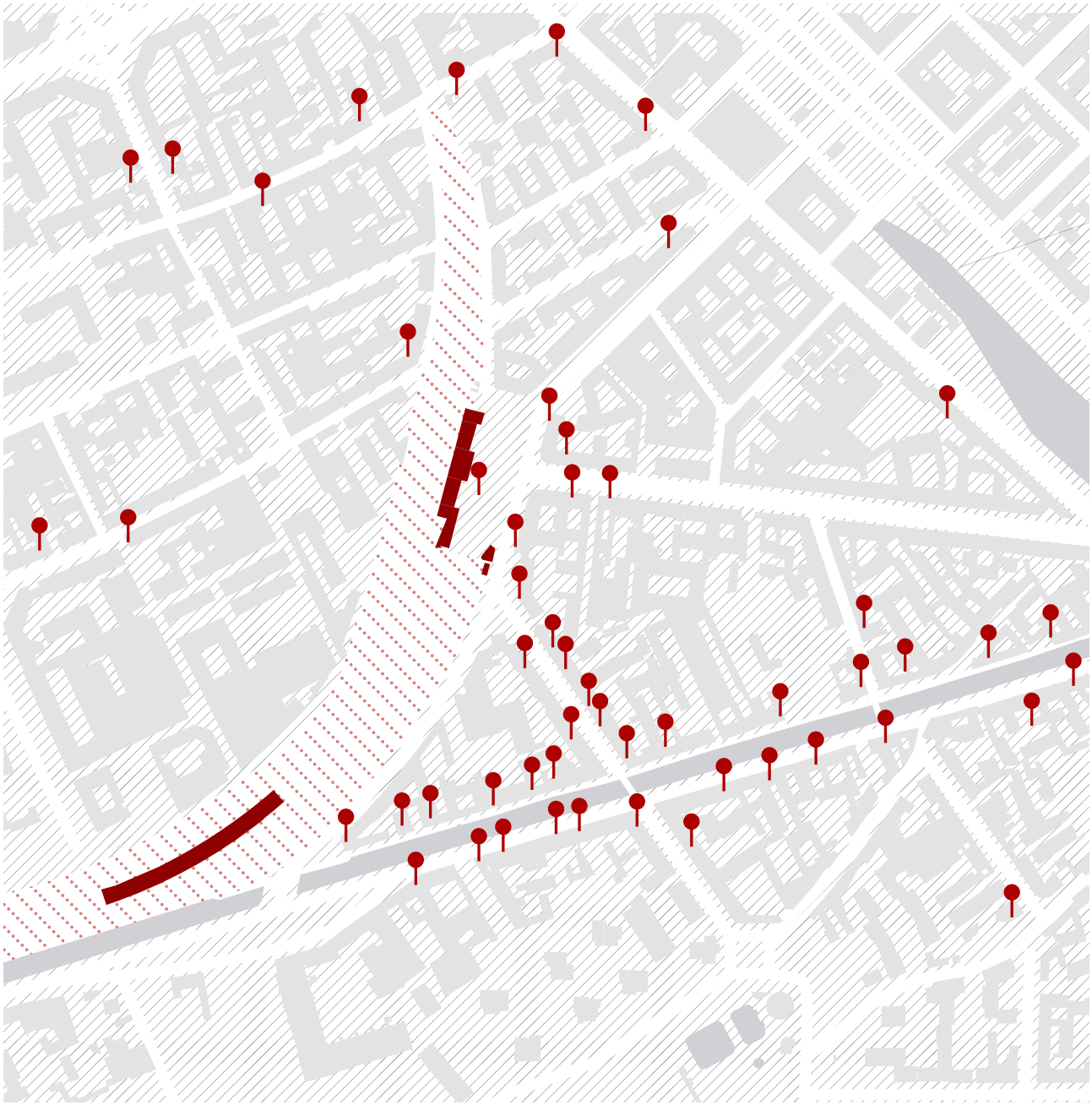
Public open green areas



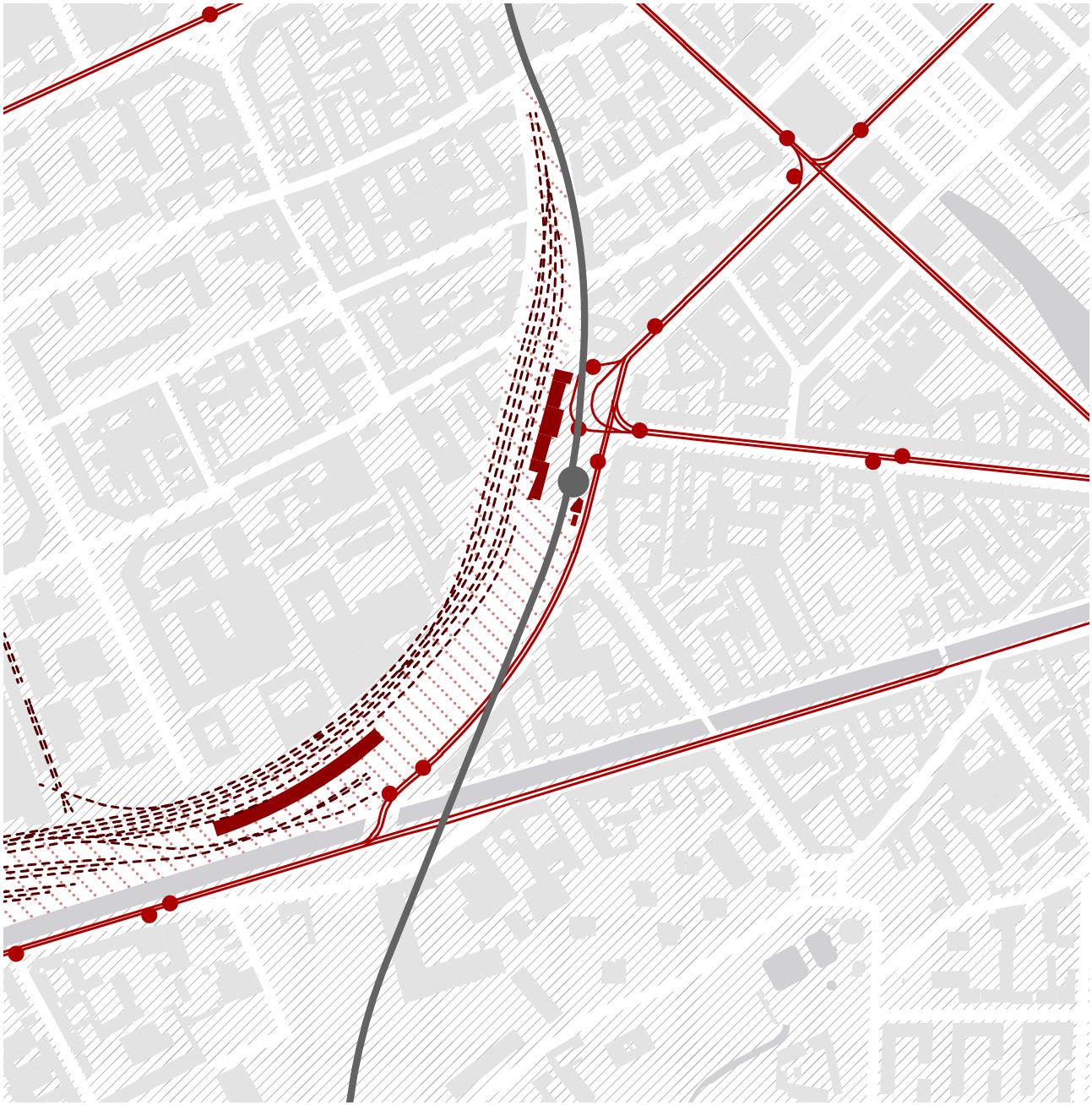
Street network



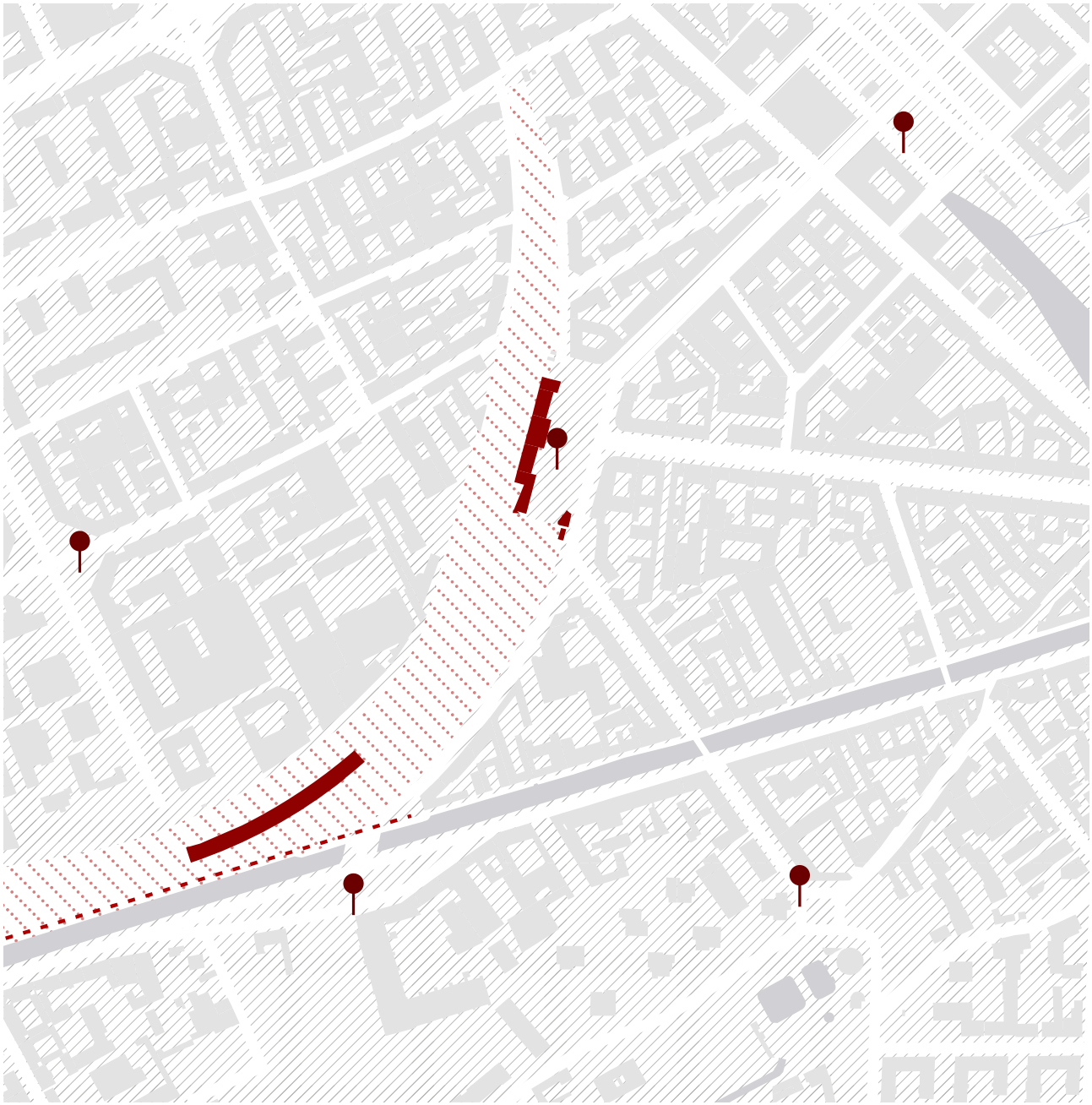
Pedestrian routes and gates



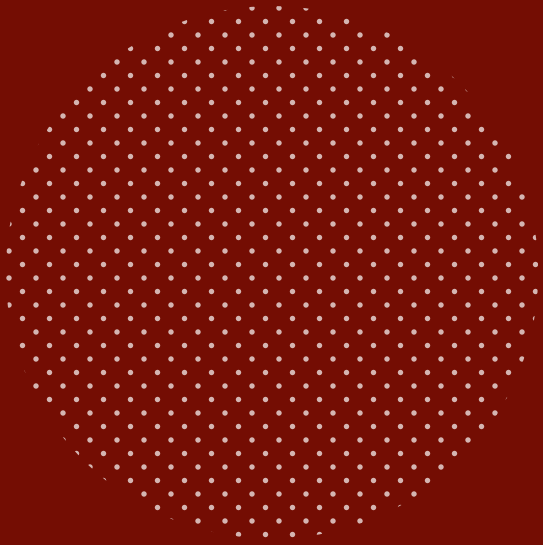
Food and drinks



Public transportation



Bicycle lane and bike sharing



Real estate analysis

In parallel to the maps, I analysed the real estate context of the area, trying to figure out which were the involved stakeholders and their mutual relationships. The most important actors of the process of revitalization of this area are mainly the municipality and the FS group which owns the property of the land. Given the soul of the project, I also considered other smaller stakeholders, among which the food delivery companies.

The SWOT analysis confirms most of the things that I have already mentioned with the maps and the survey. The area is profoundly cut and separated by the rest of the city with no clear development.

MILAN MUNICIPALITY

The city government together with Trenitalia called a competition to redesign the area of the city within the former Scali ferroviari, dismissed railway stations.

UNIVERSITIES (POLIMI, UNIMI)

The theme of the rail yardsi is an open discussion withtin the academin environment. The main faculties involved in the process might be those related to construction, urban planning, engineering, agriculture and biology.

FS GROUP

Ferrovie dello Stato is the italian railway company owner of the land and the building of the station of Porta Genova. It has recently launched a competition to redesign the area of the rail yards of Milan.

CARIPLO FOUNDATION

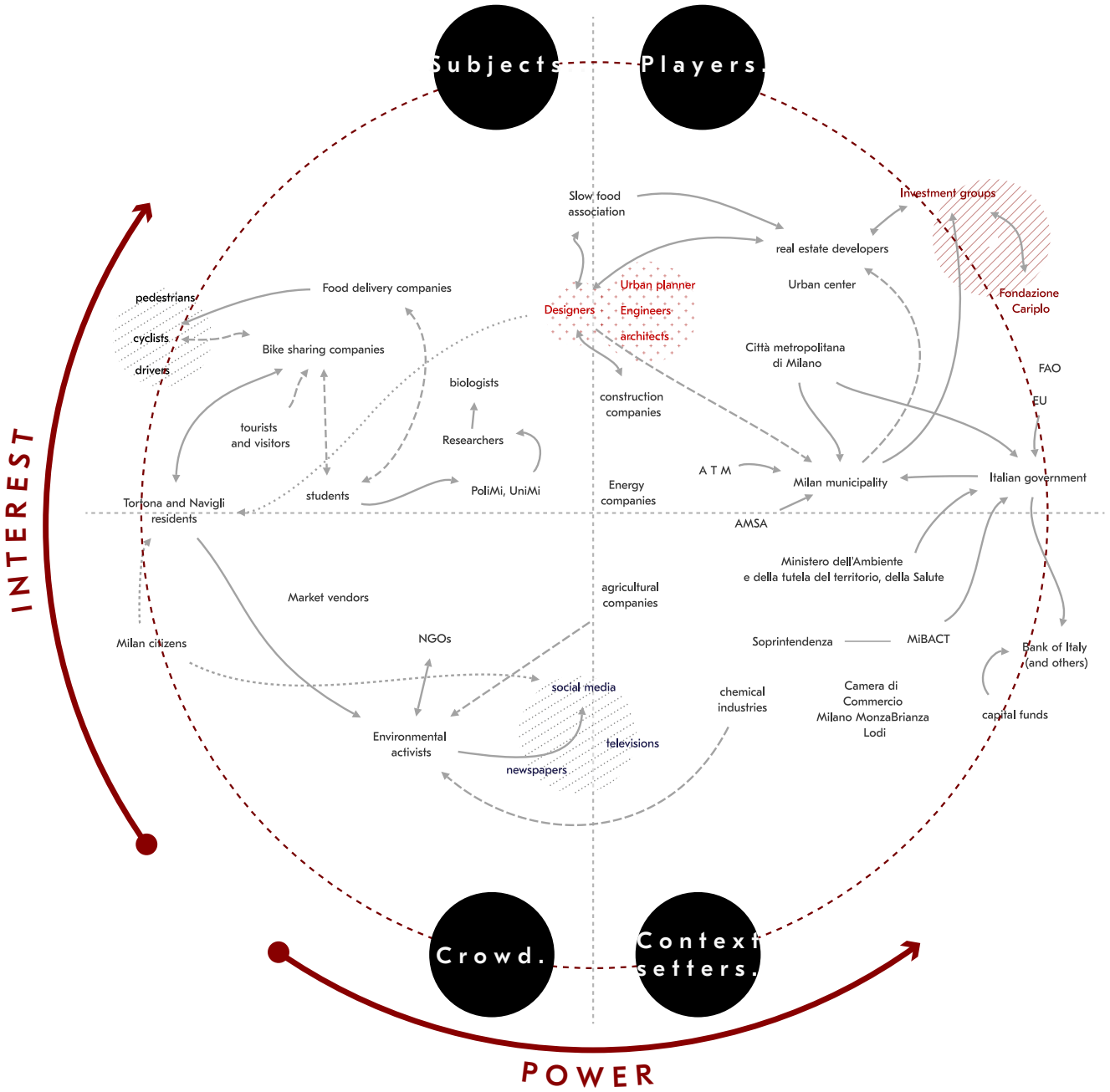
It is one of the financial supporter of the Milan urban food policy pact and the EXPO. It might have interest in developing a project in the area, since it will be related to food production.

FOOD DELIVERY COMPANIES

The project will involve directly these companies that radically change the approach to food consumption.

SLOW FOOD ASSOCIATION

The slow food organization might be intersted in the development of new spaces within the city.



Stakeholder analysis

ECONOMICAL ISSUES

1. The presence of international events that attract people

2. The proximity of Tortona, the fashion district of the city, which brings investments

SOCIO-CULTURAL ISSUES

3. The presence of industrial heritage

4. The pedestrian area of the Navigli is one of the centres of Milan nightlife

ENVIRONMENTAL ISSUES

5. The presence of the water axis of the Navigli and the Darsena

ARCHITECTURAL ISSUES

6. Recent high quality interventions of building renovation

MOBILITY ISSUES

7. The area is very well connected by bus, tram and metro

SOCIO-CULTURAL ISSUES

1. The railway creates a barrier and an unsafe place

ENVIRONMENTAL ISSUES

2. There is a lack of green areas along the Navigli

MOBILITY ISSUES

3. Most of the streets are interrupted by the railway and there are no connection between the two sides

SOCIO-CULTURAL ISSUES

1. Take advantage of the urban and industrial heritage

2. Enhance the use of the waterfront of the Navigli

ENVIRONMENTAL ISSUES

3. Increase of biodiversity (flora and fauna)

ARCHITECTURAL ISSUES

4. Refurbishment of dismissed industrial sites of the station and the good wharehouse

MOBILITY ISSUES

5. Recovery of the navigation along the Navigli

6. Enhancement of bike sharing and autonomous driving

SOCIO-CULTURAL ISSUES

1. Railway as a deep cut in the city

2. Social degradation (drug, homeless, ...)

ARCHITECTURAL ISSUES

4. Risk of speculation

STRENGHTS **WEAKNESSES** **OPPORTUNITIES** **THREATHS**

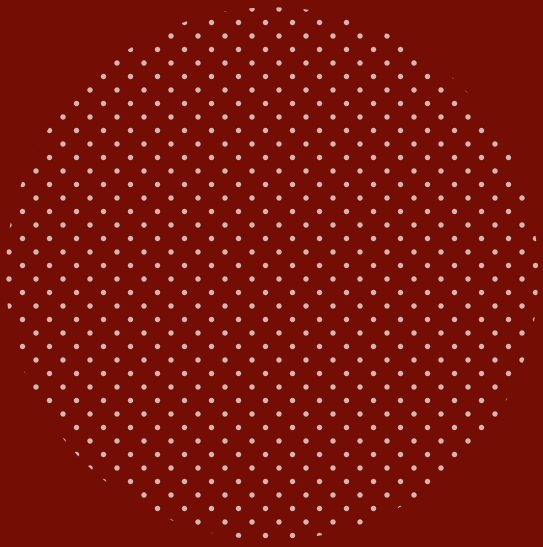
SWOT analysis

Food shapes cities and through them it moulds us - along with the countryside that feeds us.

(Carolyn Steel, 2008).

CHAPTER 04

The role of food in the definition of the urban morphology



Food and the city

«Cities, like people, are what they eat»[1].

When we think about cities, we usually immediately imagine buildings and streets, but they are not just made of concrete and steel, they are inhabited by real people (more than 50% of the global population), who depend on the natural world to be fed.

Our hungry cities

Rephrasing the words of Carolyn Steel, the cities as we know them today are devouring the 75% of the Earth's resources with the number of urban population that is expected to be double by 2050, reaching the 70% of the total global population. The traditional ratio between countryside and urban population was flipped in 2006, when the latter became predominant.

1 *Carolyn Steel (2008).*

Describing a city through food should be our primal concern to invert a process that is not so slowly devouring our planet. For a long time our eating habits had nasty consequences somewhere on the planet, in places that were ignored because distant or out of sight, but luckily a new consciousness is arising along with the threat of the destruction of our planet.

Food had always shaped the city in a way that is even more important than we might think. One of the biggest problem before the invention of the railway system was supplying the city with fresh food coming form the countryside. This bound with the countryside had always been fundamental, since without farms and farmers cities would have probably never existed. Thanks to the new technologies and transportations, today's cities no longer need the support of the countryside, which they relied on for over 10.000 years. They are therefore free from links and can be built in unlikely places like the Dubai desert.

This uncontrolled growth of the cities has brought many positive aspects, as well as negative ones. As all the other living organisms, the cities needed energy and food to grow, thus causing this severe consumption of resources that in-

evitably will end up in their lack by 2050. As several studies indicate, the future is urban, so there is an urgency to reconsider the food production chain. As architects and humans, we have to think holistically by using the food to shape the city of the future and changing the way we look at them and build them.

«Town and country never separate like oil and water. They are at the same time separate yet drawn together, divided yet combined».

(Fernand Braudel, 1981, quoted by Carolyn Steel, 2008).

Town and food

As Steel reports at the beginning of her book *Hungry City*, the city and the food has always had a close relationship. The way they were built mirrored the landscape that fed them, since, for example, railways and markets followed the food routes. The plans of London by Ogilby (1676), which is visible in the following page, perfectly shows how the urban tissue of the city reflected the animal routes of the past.

Going back in time, we find that the very first human settlements were founded near the fertile land crossed by the River Tigris and Euphrates. Cultivation and civilization were thus strictly related to each other (same origin from the latin "cultus") at the point that fields and vineyards were considered as much important a the streets and the buildings in the ancient city-states.

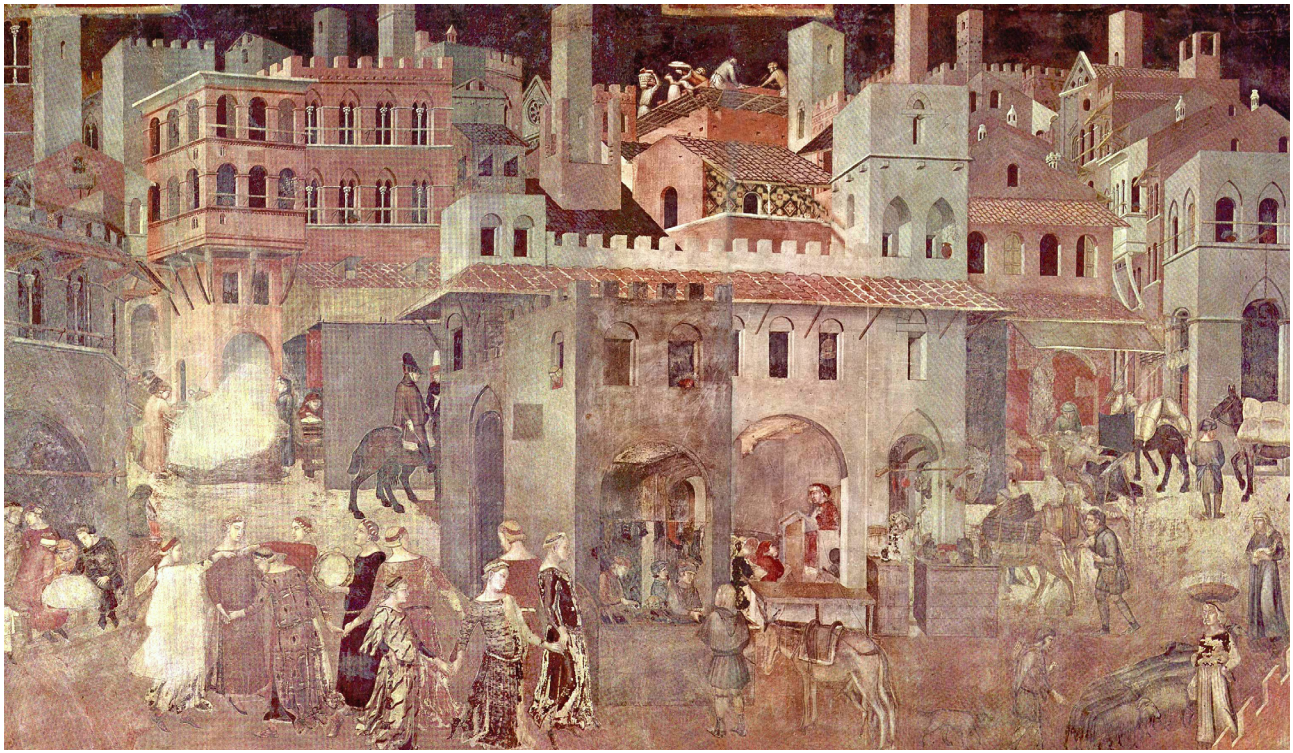
The concept of private property itself, which is a fundamental principle in the city, derives from a rural need, because the land needed to be protected, since it required hard work.

This relationship between the town and the countryside is different from culture to culture. Taking the Romans and the northern European people as an example, the former practiced agriculture, thus fostering the creation of big cities, while the latter preferred to hunt, thus leading to the feudal system, which was more respectful towards the rural environment.

Despite those differences, the city and countryside coexisted in harmony in the XIV century, as also shown by Lorenzetti in the famous painting *The allegory of the good government*. The countryside provided the town with food and it was common to find animals in the streets.

In the XV century the appreciation for the countryside increased as it was seen as the man-made landscape, which supplied the needs of the growing cities.

Ogilby's map of London (1676).
www.commons.wikimedia.org



The Allegory of the good government, Ambrogio Lorenzetti (1338- 1340).
www.commons.wikimedia.org

In the XVII century the relationship was still strong, even in urbanized countries like the Netherlands[2], where the countryside was connected to the cities through a complex network of canals.

The scale of the pre-industrial towns remained quite small to make easier the supply of food. Goods transportation also influenced the morphology of the rural hinterlands.

The real change occured in the 18th century with a harsh debate about whether the growth of towns had a positive or a negative effect on the countryside. If grain made the ancient city, meat made the industrial one. This process of industrialisation created an irreparable gap between the feeders and the fed. In the 19th century, the main issue was not how to feed the city anymore, but at what cost.

After the war, battery farming was introduced and the production was increased. Nowadays, the total global production has increased by 145%, yet 850 million people all over the world are still facing hunger. The production in the developed countries, such as USA and Europe, has also changed, relying mostly on foreign good importation. An impressive datum shows that 70% of British landscape is farmland, but food is not produced anymore. The countryside has earned an extremely high real estate value, thus forcing the government to transform it into a beautiful environment for the city dwellers to visit it.

The example of Britain is emblematic of the current situation. The 38% of food eaten is imported (the number grows to 95% for the fruit), which includes also more than a half of indigenous goods that could be naturally cultivated on national soil.

How we should feed ourselves in the future

Since it has been observed that the western patterns of urbanization are spreading worldwide, the question becomes, therefore, how Europe should feed itself in the next future.

Especially in western world, the agribusiness has changed, too, and it is now focused on large-scale mono-cultural productions. Steel points out how recent experiments on genetic modification, inbuilt obsolescence and maximization of production are causing more damages to the environment than agriculture has ever done. Deforestation, soil erosion, water depletion, air poisoning and pol-

2 Half of the population of the country already lived in urban areas. Steel, 2008.

lution are just a few of these negative effects.

Another problem that it is strictly connected to the contemporary and future food production is energy. Like other industrial sectors, oil is the primary source of energy, but it should be soon replaced by more sustainable and natural sources like sun and wind. This will imply a complete reconstruction of the way we produce and consume food. The most urgent problem when talking about the food production chain is not, according to Steel, how we will feed ourselves in the future, but how we should change the way we eat now.

The new food economy of scale

«You can have your Ford any colour you like - as long as it's black».

In a provocative way, Steel cites Henry Ford, recognizing in these words the transformation of the contemporary food production industry. And just like a traditional manufacturing industry, agribusiness is applying an economy of scale to increase productivity and meet the people's new requests.

As already mentioned above, supplying the city has always been a critical issue, that determined the way the city evolved and grew up. The modern agribusiness has therefore evolved according to the city dwellers' requests of cheap, standardized food and the production is mainly focused on that.

The entire food supply chain of the goods we eat today is driven by economies of scale. Food businesses are increasing the scale of production and lowering transaction costs by reducing the number of suppliers. This process is happening along with a international definition of quality standards, that help producing companies to increase efficiency.

The contemporary phenomenon sees the food industry moving towards a more concentrated structure, where the gap in the rate of return of smaller and larger firms is becoming wider and wider[3]. The increase of efficiency is also bringing a reduction in the diversity of food produced all over the world, that is necessarily affecting our habits and diets.

In our new "global village", as Steel defines the contemporary world, we eat the same food, supplied by the same companies, we buy it in the same shops, thus making the laws of competition theorized by Smith (the concept of the

3 *Trienekens, Zuurbier, 2008.*

hidden hand of commerce) no longer applicable. We are assisting to a critical power shift from producers, such as farmers, to those who controls the supply chain.

This represents an inversion of the traditional process through which the city was fed. The biggest problem shared by modern small suppliers, producers and retailers is to rely on an old conception of the food system. Its supply was a vital aspect of the city life in the past and many places around the world had laws to prevent anyone from creating a monopoly in this sector, either by gaining a large share in the market for a single type of food, or for being the bigger operator in one of the phases of the supply chain.

As explained before, today the situation is inverted and this market is controlled by big conglomerates or, as the American social scientist Bill Heffernan called them, "food clusters". These large powerful companies acts up and down the entire food chain, according to the so-called "vertical integration", which was exactly what the traditional laws tried to avoid[4].

The city is still built around food

Along with these changes in the food production industry, there is an interesting development of supply spaces within the city. It is again emblematic the fact that independent food shops in Britain are closing at a rate of more than 2000 per year. According to data, if they will keep respecting this rhythm of failure, there will be no one left by 2050. The reason behind this impressive numbers traces back to the invention of the supermarket, whose typology was first introduced in 1970, profoundly transforming the British urban landscape. An invention that perfectly reflects our modern lifestyles.

The success of this new industry lies not only in the ability of providing larger quantities of food, but also of delivering it in a good or, at least, edible condition. We don't know anymore the taste of true fresh food and, as also pointed out by the food journalist Joanna Blythman, we are way too used to what her calls "permanent global summertime", meaning we expect to find certain types of food outside their natural season.

The advent of this new supply space changed also the perception of the city, by ignoring completely the human scale

4 Such as those of Paris in the 18th century to prevent bakers from milling their own grain and millers to bake their own bread. Steel, 2008.

factor, and caused a loss of street life. The European cities have therefore become empty shells, where people no longer animate the streets as in the past.

Despite this effects, it appears clearly that food is still deeply influencing the urban model. Supermarkets have replaced the markets as the centres around which the cities are built and new methods of transportation have also effects on the way urban spaces are organized.

Supplying the city

What makes so easy to appreciate the advantages of this modern food industry is its invisibility. It is hard to understand the efforts that are required to feed the contemporary city and perceive all the negative effects that these efforts have on our lives when the process is almost invisible to the eyes of a "normal" person.

It is not common though to visit the places where the production is concentrated, the "food hubs", which metaphorically are compared by Steel to secret military installations, where nobody is really welcomed.

Nevertheless, it has not always been like that. As also mentioned in the previous chapter, before railways where invented, transportation was a bigger issue than production itself. From the compact dimensions of pre-industrial cities, it is probably more clear how deeply food influenced the growth of the city.

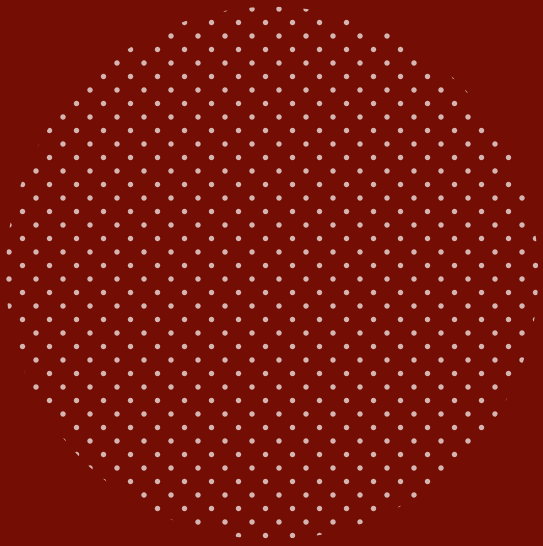
An emblematic example traces back to the Roman times, when the price of transporting the grain by cart cost half the value of the load itself, because of its weight and mass. This made necessary to keep the rural fields as close to the cities as possible.

Fruit and vegetables were, as well, kept close to the city in order to the take advantage of the manure and the human waste, and also minimise the journey to the market.

On the other hand, meat had a great advantage, since cattle could walk to the market, which meant it was possible to raise animals far from the city.

In ancient times, food supply was an administrative issue, controlled by the temples in the eastern cities and by the tribunes in Rome, where the dimension and the complexity of the urban fabric required much greater efforts and costs.

The political necessity of feeding the city has always been recognized, in ancient and medieval cities, as well as in the 18th century Paris and still in our contemporary cities.



Urban food planning

Planners have traditionally excluded food from their studies on the city, by claiming it is mostly a rural issue and therefore outside the planners' jurisdiction. It was this omission to lead the APA (American Planning Association) to publish the Policy Guide on Community and the Regional Food Planning in 2007 as a late amend for having failed to integrate the food system.

Food planning

The first mistake was not recognizing the multifunctional character of the food, that reflects in many different sectors from public health, energy, water, land issues to transportation and economic development, all aspects that planners should legitimately take care of.

Secondly, this omission is not considering the important role of urban agriculture, a traditional practice that never disappeared in the «hungry cities of the global south» and that is gaining new attention in the «more sustainable cities of the global north»[5].

5 *Kevin Morgan, 2009.*

The new food equation

Food planning is starting therefore to become part of the planning agenda both in developing and developed countries. The question is being taken so seriously also because of the new food equation, which considers:

- The increase of the price of rice and wheat between 2007 and 2008;
- Food security as a national issue, after the riots triggered by the food price surge;
- Climate change;
- The escalation of land conflicts, since rich but food-stressed countries such as the United Arab Emirates are buying fertile areas in Africa and Asia, thus establishing a new form of colonialism;
- The rapid growth of cities.

The new food equation has inspired the creation of the *Sustainable Food Planning Group*, with a first conference in Almere in 2009 to debate about theory, policy and practice of food planning. Some cities, first Amsterdam and Toronto, are trying to make a further step by weaving a food policy dimension into existing urban plans and creating new alliances. Such alliances could help this food policy movement to connect with existing campaign such as the World

Health Organization's *Healthy Cities* programme or the UN sustainable development goals.

The pioneer cities that are taking this approach are mostly north Americans, but in Europe, too, the food planning movement is becoming increasingly present and important. Some examples are London, with its sustainable food strategy of 2006, Amsterdam and Milan, where the *EXPO 2015 Feeding the Planet, Energy for Life* was held and the urban food policy pact was signed.

The Milan urban food policy pact

Taking advantage of the moment of great visibility given by EXPO 2015, the city of Milan launched an international protocol aimed at tackling food-related issues at the urban level, and developing new resilient urban systems, to be adopted by as many world cities as possible.

The proposal to be signed during the EXPO was presented in 2014 at C40 summit in Johannesburg by the Mayor of Milan. The Milan Urban Food Policy Pact (MUFPP) process of development was guided by an advisory group, composed by many leading international organizations, and by a technical team, made of several international experts with a strong background of food-related issues.

Logo of MUFPP project.
www.milanurbanfoodpolicypact.org

The Pact was signed on the 15th October 2015 by more than 100 cities, whose number has already grown to 186 today. The protocol suggests also some practical guidelines, that were declined in different kind of local and international projects, events, workshops and conferences. Among such projects one of the most successful was the *Food smart cities for development*[6].

Food smart cities for development

In 2015, the European Year of Development, the European Commission decided to finance the *Food Smart Cities for Development (FSC4D)* project as part of *EU DEAR (Development, Education and*

6 *www.milanurbanfoodpolicypact.org*

The manifesto of Milan EXPO 2015.
www.expo2015.org

Awareness Raising) programme, to foster the role of the cities in changing the way they produce and consume food.

Following the guidelines of MUFPP, UN's development goals, Milan EXPO results, LED Forum conclusions, the FSC4D project was composed by 12 cities over three continents that coordinated their food policy and collaborated in international activities till the end of 2016 to create a common food policy agenda.

The project was led by the city of Milan and involved also the municipalities of Turin, Barcelona, Bilbao, Utrecht, Gent, Bruges, Marseille. The project was also supported by some partners such as the People's Expo, Equo Garantito, World Fair Trade, World Fair Trade Europe, Fair Trade Advocacy Office, Fair Trade Hellas, GRAIN and ACRA. The municipalities of London, Thessaloniki, Dakar and, department of Antioquia and Medellin were also involved as associated partners.

The main purpose of the project was related to what established by the MUFPP, therefore aiming at promoting equal access to the food for everyone and healthy eating, as well as reducing waste[7].

Among its main results, the most important target that was achieved was probably the increased public awareness on the potential of European decentralized collaboration to tackle issues like global hunger and poverty, to strengthen the role of European cities as facilitators in the process of sustainable development and start a debate about post 2015 - development agenda.

Probably the most successful aspect was the exchange of good practices and the creation of a common framework of actions: the *Food Guidelines*.[8]

Policies and activities in Italy

Turin.

In October 2015, Turin proudly host the 3rd edition of the LED (Local Economic Development) Forum. It was an opportunity to gather together experts, politicians, administrators and other stakeholders involved in the food-related policies to discuss local development and define working agendas.

Other events to which the city took part were:

» *International Food Journalism Festival (February 2016),* during which a panel included the presence of the project FSC4D and investigated the experience

7 *(Food Smart Cities for Development Recommendations and Good Practices)*

8 *www.milanurbanfoodpolicypact.org/project.*

of the city of Turin. From this experience the *Food Metropolitan Agenda* was created to grant to the citizens the right to quality food;

» *Terra Madre and Salone del Gusto,* one of the most important cultural and international trade fairs regarding food. Its main goal is to promote and support artisan, sustainable food and small-scale producers who safeguard local traditions and high-quality products, coherently with the principles that move Slow Food activities;

» Presentation of the FSC4D project at the *Cinema ambiente — Environmental Cinema.*

Milan.

In 2015 Milan adopted its own food policy, as the first final step to a path started in 2014 when the Municipality signed an agreement with Fondazione Cariplo aimed at developing a city's food policy on a five-year term.

The policy objective was to coordinate all the other policies dealing with food-related issues from different perspectives: community, welfare, education, environment, well-being and international relations.

The Policy shared some objectives with the MUFPP and it was composed by five priorities:

» Access to healthy food and drinking water to everybody;

» Promotion of a sustainable food system;

» Better education to food,

» Reduction of food waste;

» Support of agri-food research.

Following the principles and the guidelines of the policy, the city launched some pilot projects:

» *E-Town meeting (14 June 2015)*, a workshop held in the city hall, where participants were asked to discuss about the food policy and came out with a subset of questions. The electronic answers contributed to shape priorities and actions for the policy;

» *Smart Voices (28 September 2015),* an event organized during *Suq delle Culture, a festival* focused on the discussion on how decentralized cooperation could foster a sustainable urban development;

» *MUFPP Signing Ceremony (15 October 2015);*

» *Cluster events (19 March 2016),* a twin conference event held during *Fa la cosa giusta* about the restoration of Milan's covered markets as a driver of urban regeneration and a discussion about the food council as indicated by the Milan

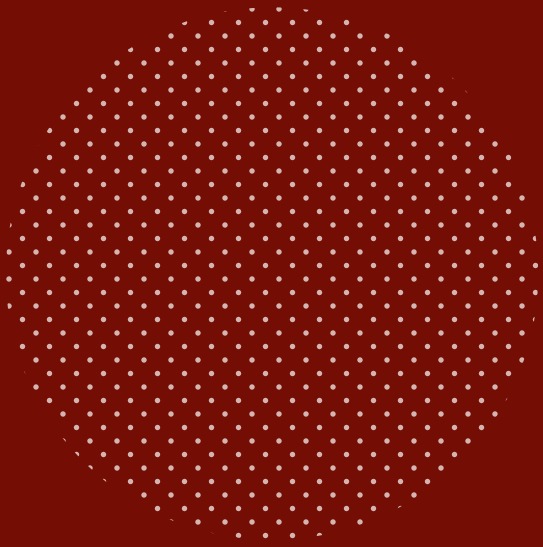
food policy;

» *Local Food Waste Hub (2016)*, an association which promotes the redistribution of food losses at the local level in a space offered by the city government;

Over the last years, the municipality of Milan has also initiated several other actions to reduce food waste. One of these is the waste tax discount, approved in 2018, up to a 20% for those food businesses which donate their food losses to charity organizations. Some actions have also been applied to those part of the food system that can be directly controlled such as the municipal canteens, affiliated to a food bank.

These guidelines raised also the awareness of the Municipality about the necessity of a political organism that could help manage the complex urban food system. This path led to the creation of the *Milan metropolitan food council*, an innovative form of governance with the objective of influencing and modifying the food policies of the city. It was inspired by foreign examples such as Detroit, Belo Horizonte, London and New York[9].

9 *Andrea Magarini, 2016.*



The food smart city concept

This research approach was the focus of discussion during the Governance of Smart Cities Food Agenda in Milan in September 2015. It studied the relationships between food, governance and smart cities.

The concept of food smart city

The concept of smart city and the urban food agenda have quite different backgrounds: the former is neoliberal and business led, it fosters urban growth through technological innovation and ICT; while the latter «emerges from a heterogeneous community and grassroots-based movement that is civic and socially-oriented and increasingly framed through food security discourses»[10].

The objective of the research is to try to analyse critically the relations of these two concepts, as well as the possible integration with each other, since smart technologies have already been used in urban food projects.

As also mentioned above, the question about food have traditionally been excluded from the discourse about the city and its planning. This process is inverting now and many cities around the world are engaged in food and agricultural practice, while political organisms are much more involved in food policies. Urban agricultural is starting to play an important role towards climate change mitigation and reduction of urban heat island effects, attention to diet-related issues is growing, as well as food strategies and policies (those cited in the previous paragraphs are emblematic).

Maye argues that food smart systems require «polycentric governance arrangements»[11] and the same innovative view that is usually expressed in discoursed about smart cities.

The concept of smart city describes an «increasingly pervasive use of computing and digitally instrumented environments that are now embedded into the urban environment»[12]. However the simple integration of smart technologies in the city is not making a city smart, because it also requires a combination with social and human capital. The urban project has also a fundamental role in the transition from a city to a smart city, enabling spaces to manage resource in a more efficient way.

10 *D. Maye, 2017.*

11 *D. Maye, 2017.*

12 *Ibidem.*

From documents, guidelines and pilot projects that were also mentioned above, Melis and Roccella indentify some common design criteria:

» compactness;
» multifuncionality;
» integration of bioclimatic technologies;
» sustainable mobility;
» systemic apporoach;
» simultaneous vision.

On the other hand, urban food systems include the way food is produced, distributed, retailed and consumed in cities. Most of urban research is connected to food security, which requires a stronger and stronger public intervention, since it involves a series of interrelated issues such as public health, economy, ecological crisis. But this issue is not only about that, since the research is also connected to communal, social and mental issues, as well as some growing practices such as the already cited urban agriculture, community, guerilla gardens etc.

The literature that tries to connect these two concepts is quite small. When talking about urban agriculture, the most popular examples regard vertical farming, an innovative concept of food production that uses smart technologies and sensors to control lights and nutrients. There are currently built examples in Asia, North America and Europe, where new architectures have been built or dismissed spaces have been re-purposed. The approach here is to combine the built environment with the new technologies to urbanise agriculture in a more sustainable and efficient way.

Trying to give a shape to this innovative concept of food smart city, the paper defines three main elements to enable it.

The main suggestion is to talk about «enabling systems and governance which include but not exclusively smart city innovations and technologies»[13], rather than physical practices.

From the findings of the project *SUPURBFOOD*, it suggests interventions at a city-region scale to examine and manage urban food systems, such as the creation of a food department. Another key aspect of urban food planning is connectivity to enable spatial synergies and link different urban policy objectives together. It is important to create a network of food and energy to serve as a garrison of the land and at the same time are useful to enhance it.

The final element is circular metabolism, where the outputs are recycled and put back into the process as new inputs.

13 Malis, Roccella, 2015.

This includes some smart city methods, such as metropolitan food clusters or agro-parks.

A final recommendation is to give importance to social practices, since sustainability transition can happen in an easier way when soft changes are normalised by the community. There is an intrinsic need to make a cultural jump towards a smart community, which is characterized by more flexible and horizontal relations.

Energy and food hubs

Another important topic to discuss is the energy that is required to produce food. Energy has always had a crucial role in the urban transformation, for example with the introduction of modern transportation systems of energy, which allowed the cities to sprawl and grew faster. After a loss of social interest in this topic during the last century, there has been a recent rediscovery connected to the theme of sustainability and research of new renewable energies. The latter, along with the new systems of supply (smart grids, district energy systems, district heating...), reinvented the image associated to this spaces.

The new energetic infrastructures reduced their scale and are sometimes integrated with other activities. These new spaces find a perfect agreement with the latest trends in food management, which are trying to shorten the supply chain and foster the local dimension.

The urban project would become again an important tool to design the edges of the smart cities, designing exchange hubs, accessible to the people. In this way the exchange of these two key elements of the social life of the smart city will foster the redesign of the city with spaces to produce, transform and distribute energy and food. These new energy and food hubs, would be multifunctional places, easily adaptable to users, connected to the information network and a model to enhance the land's resources instead of spoiling them, thus combining the concept of smart city and smart land together.

The new spaces to access food

As stated by Sganzetta and Tricarico, in the contemporary global scenario, constantly changing thanks the disruption of new technologies and the reversal of traditional social and political paradigms, the right to access food for everyone should be of primal concern.

This issue is even more urgent if we consider the forecast for the global population growth by 2030 and 2050.

The new logistic and transportation organization is reshaping the way we work, live and consume. The reduction of cost in the supply chain and in the transportation will allow the subjects with the available finances to experiment new forms of production and access to food. On the other hand, the development of the economies of platforms is fragmenting and scattering the stakeholders involved in this new ways of exchange.

The economic crisis has also contributed to transform the traditional models of consumption as well as to arise the awareness of a large sector of the population on the agribusiness effects. Recently it has been observed that people are buying more biological and origin-controlled food and are more careful to environmental certifications. These changes has also influenced the economic stakeholders' choices, thus leading to the integration of those sought qualities within products, as well as to the growth of the interest for practices related to the circular economy, the attention to the raw materials and the use of natural resources.

According to the authors' opinion, it is the new consumers' awareness to lead the citizens to access food in new places, where companies, entrepreneurs and public actors interact with a particular interest to the social and environmental impact. This sensibility and attention is spreading from traditional innovative retailing networks, such as the groups of sustainable purchase, better known in Italy as GAS (Gruppi di Acquisto Solidale).

The future food spaces are determined by:

» actors, from entrepreneurs to public subject and for profit companies that work in food production and distribution;
» factors, in terms of resources to guarantee the economic conditions for these spaces to work.

They also have a spatial dimension, which can be separated in two concepts:

» virtual space, such as the e-procurement platforms, which foster bottom-up practices;
» real space, considering old refurbished places and new ones, which could create a synergy between public subjects and cultural organizations.

The existing markets are often places of inequality and iniquity, which reflects in a denial to access food. The real potential of the market can be identified in different levels:

» as a place of expression of rights;
» as a place of exchange between rural and urban worlds;
» as a place of technological innovation.

It has been observed the tendency of both virtual and physical spaces to change, acquiring new spatial and functional definition, according to the change in the supply and demand requests. The markets are increasingly gaining more importance because of the direct contact between the retailer and the consumer, who can be informed about the origin of the products and the way in which they are cultivated, grown and distributed.

The retailers themselves are more aware and thoughtful, able to exploit their tools, lives and passion for their work. As mentioned above, today's consumers can rely also on a place different form the market, a virtual space.

The purchase on web platforms of food related goods is growing in our fast society, where time is not enough and internet connection is everywhere. Despite being virtual, these platforms should respond to the same customers' requests about the products, describing the territorial origin of the supply and the close contact with the producer.

These two spaces can thrive together if they are organized and planned to satisfy the new trends of consumption and purchase of an increasingly aware customer.

These spaces, which have become the devices to access food, allow also to reach other social and economic objectives. Behind the reason of success of such places, there are usually specific factors and contexts. The example of platform analysed by Sganzetta and Tricarico, *L'Alveare che Dice Sì* in Turin, could benefit from a tax relief since it was defined as a "innovative start-up" by the Ministry of Economic Development.

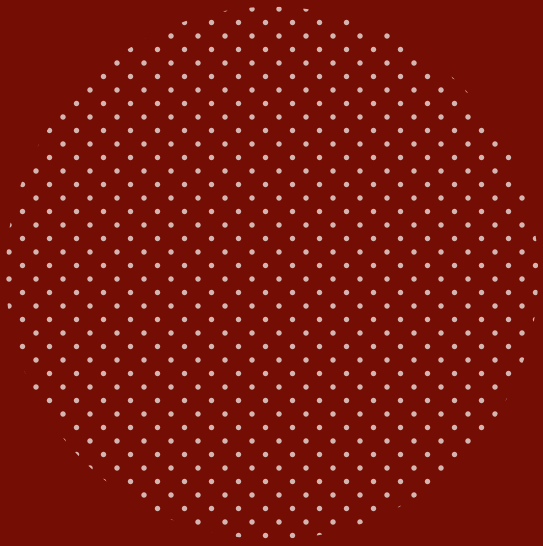
As it regards the real spaces, a great support comes from the policies for the refurbishment of abandoned public spaces for communal and innovative purposes.

In general, the enhancement of relationships and interests among the different involved stakeholders is a crucial element to guarantee the success of these spaces, as well as a fertile cultural environment, such as that of Milan and Turin, which were taken as examples by the authors, a lucky temporal conjuncture and a natural bottom-up organization in response to the citizens' needs. This is a city that is changing its urban shape, as well as its social configuration.

Food is the true fuel of history for two simple reasons: one is natural and one is cultural. The first one is obvious — humans eat to live. The second, and much more crucial, is that people live to eat.

(Niola, 2012).

Food production, retail and consumption in the city



Vertical farming concept

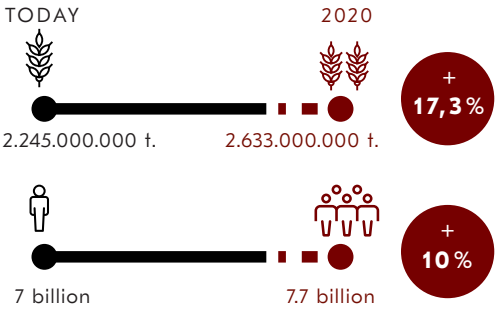
Die of hunger or obesity?

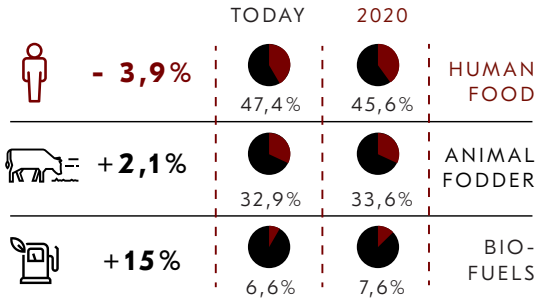
Today in the world

Deaths every year worldwide for:

Feed animal, people or cars?

Grain production in the world and its use

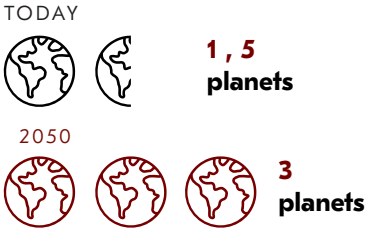




Feed waste or the hunger?

1/3 of global food production ends up in the garbage every year

1,3 billion tons of food are wasted 4 times what would feed the 868 million hungry people



Personal relaboration.
Barbara Buchner et al. (2012)

Following Despommier's journey into the definition of the innovative idea of vertical farming, I will try to highlight in this chapter the most interesting points that inspired my design proposal.

The effects of RCC on agriculture

One of the important environmental issue that we have to face today is the rapid climate change (RCC), which is affecting several aspects of our life and society, including the ability to farm. According to the environmental agronomists' forecast, based on recent data about RCC, the effects of weather on crops will be much more dangerous. It has been predicted that crop failure will become more frequent in places where it is now a rare phenomenon and it will become ordinary rather than an exception in places where it regularly occurs.

The Food, Conservation and Energy act, emanated in 2008 by US Congress, is a signal of the importance of food production on the environment and of the raising awareness of its harmful effects on the farmland. Some examples of recent damages to the farmland all over the world are the polluted ponds in the central valley of Arizona, the increased risk of flooding in the central region of China because of the deforestation, the destruction of topsoil in Bangladesh, which was meant to grow food to feed 2 million people.

The vertical farming concept

As already said before, our cities are like giants, big organisms that need to be fed and farmland are no longer a feasible option. Cities can be compared to natural ecosystems and as such they are suffering health problems, many of them due to the effects of a bad waste disposal and inefficient garbage management. But it is not only the city that is suffering, since traditional agricultural methods has also spoiled the rural environment and the land.

What appears as a possible solution is the vertical farming, which allows to grow food without soil in an urban environment. The hydroponic and aeroponic crop systems work better in multi-storey

buildings, where it is easy to control the indoor environment. If we relied on this new system, the farmland might recover and go back to its original configuration as a natural ecosystem, simply because it would be left alone.

Another advantage of growing crops in an indoor environment is the possibility of controlling carefully their conditions in order to ensure the optimal growth rate for each species of animal and plant year-round. The greatest innovation of this kind of system is that there are no seasons indoors and no bad climate conditions that might ruin the crops.

Growing food inside the same city or the same block would also reduce the transportation travel, thus saving fossil fuel and diminishing the environmental impact.

The vertical farming would prove itself to be a closed-loop system, which will help recovering the waste water and recycle it. Inside the vertical farm, the same water can be reused both for the crops and the showers and drinks of the workers.

Greywater might also be converted into sludge, then processed and sold to the farming companies, where it can be used as high-grade topsoil for crops. Bio-mass is already used to produce energy as well as fertilizer and more plants are being built.

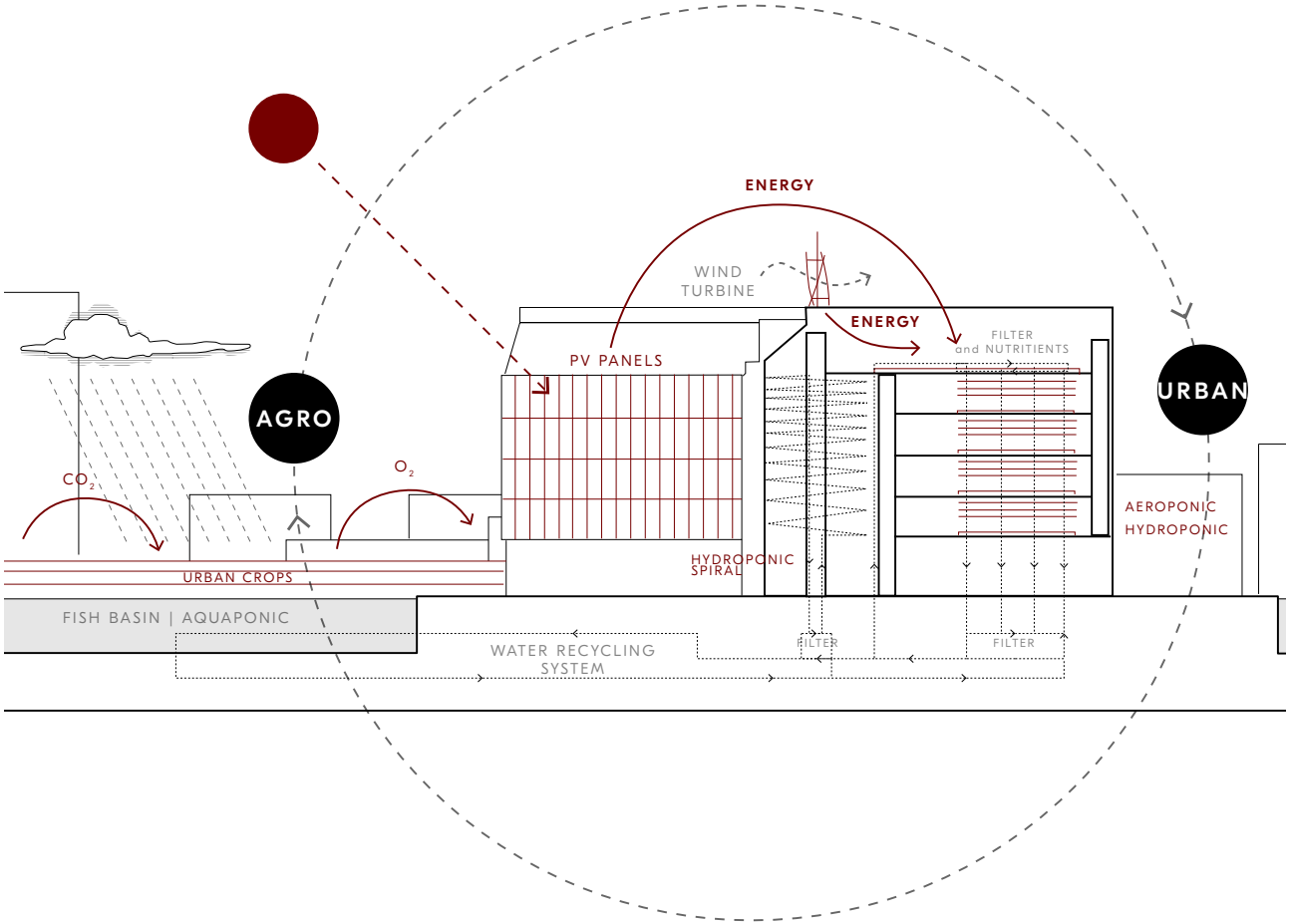
Recycle and self-reliance are therefore two important key-concepts of the vertical farming. This innovative food production system might help today's cities to reach at least a sufficient degree of self-reliance, thus reducing partially their impact on the environment.

Existing technologies, such as the cited hydroponics, aeroponics as well as aquaponics and drip-irrigation, have already been implemented in vertical farming concepts. What it is still missing is a thoughtful urbanization of this innovative ecosystem, which is able to put together the concepts of bio-productivity and zero waste.

Advantages of vertical farming

We consciously decided not to integrate our lives with nature to create the techno-sphere in which we live, but this was at the expenses of the biosphere.

Since, as we have seen, agriculture on soil is no longer a sustainable solution to meet the needs of our population, urban farming can provide a new viable and more sustainable alternative to the traditional methods. Until now we have been



Scheme of the hydroponic system and energy generation of the future food hub for Porta Genova.
Personal drawing

stuck to an old, outdated system of food production, which is requiring more and more land in order to meet the needs of our growing population. The predictions for the future make the decisions we take today even more important if we want to give hope to the future generations.

Behind this traditional methods, there are, of course, some reasons, first of all the fact that the cost of the land is lower. The problem is that the farther from the urban centres we produce food, the biggest the ecological footprint on the environment is.

As other inventions, one of the cons of vertical farming would be the high investment cost at the beginning. It will require some time before the invention is accepted and therefore its price is reduced. Moreover, there would be also a displacement of farmers and a series of abandoned farms to be taken care of.

Despite these negative aspects, here is a list of possible benefits of this new system:

- a year-round production of food;
- no crop failures related to bad weather conditions;
- no agricultural runoff;
- possibility for the farmland ecosystem to restore;
- reduction or complete elimination of pesticides, herbicides or fertilizers;
- reduction of water up to 70-95%, while nowadays the 70% of freshwater is used for agriculture;
- reduction of distance;
- more control on food safety and quality;
- new employment opportunities in urban environment;
- possibility of purifying greywaters into drinking water;
- cattle can be fed from post-harvest plant material.

The construction of a new typology

Starting from the few examples that have been built, considering their different shapes and distribution, the author suggests some guidelines that might help define better this new typology. Despommier imagines a complex of buildings, in close proximity to each other, which host different functions:

- food production (hydroponic crops);
- offices for management;
- control centre;
- nursery for the plants to germinate;
- quality-control laboratory related to food safety issues;
- eco-educational and tourist centre to expand people's knowledge on food pro-

duction;
- green market;
- restaurant;
- aquaculture and poultry to keep separated from the rest of the crops.

Among those guidelines, he also suggests some issues that engineers and designers should consider when designing their version of vertical farm.

One aspect regards the capture of sunlight, through devices that are able to disperse it throughout the crops (parabolic mirrors), as well as the production of passive energy in order to store a reliable source of electricity. Most of the crops would be enlightened by artificial LEDs, thereby requiring a lot of electrical power, that should be produced by the farm itself. The concept should therefore integrate renewable energy sources such as wind turbines, solar and pv panels, geothermal systems.

Another important thing is to employ good barriers to prevent plant disease from spreading, while maximizing the space for plant growth.

Later on, Despommier also gives some indications about possible orientations for the building. In «sun-drenched environments the building should be north-south oriented, narrow end long with three to five floors»[1].

1 *Despommier, 2011.*

The social impact

As already mentioned, the author believes that «the city has grown helter-shelter, and its insatiable and out-of-control metabolism produces nothing more useful than lethal bubbles of heat and contaminated air and water laced with the by-products of its mechanized infrastructure»[2].

If metropolis has become a synonym of consumption, the right way to invert the process is changing the way we consume. The vertical farming concept will also have positive effects on society. Since it is a prototype, only the involved researchers and a few people will benefit form it at the beginning.

This new innovative process might trigger «the next green revolution», with a general improvement of the access to food and the global health status, especially among children, since one of the most diffused cause of infant mortality is poisoning from contaminated water.

Nevertheless, this invention might also cause a damage to the international commerce agreement related to agricultural products, thereby requiring a re-establishment.

Keeping in mind all this information, if we tried to imagine the city of the

2 *Despommier, 2011.*

future, we would see urban voids of abandoned lots filled with new vertical farm complexes, which would at the same time bring revenues to the city and eliminating the food deserts as we know them today.

Once up and running, the vertical farms will define a new panorama in our cities, proving themselves once again an example of how humans can solve the problems that they have created. Of course, this scenario will require huge investments from public and private organizations before becoming a reality. Following Despommier's words, maybe «the time has arrived for humans to reassess their place in the natural world, embrace and celebrate the difference between us and the rest of the creatures that comprise it»[3].

Utopian experiments?

At the end of her book, Carolyn Steel provokes the reader, by reporting a series of case studies of built and non-built projects, where the city is imagined through a new conception of the food supply chain.

An interesting proposal is coming from China, in the Shanghai hinterland, where the garden city of Dougton is being built. The concept of the city is to create a low-carbon living space, where food is produced in urban farms inside the districts and farming activities are integrated with housing. The designers of the project has followed what they defined as integrated urbanism approach, which can «balance the competing demands of urbanization - economic growth, social well-being, environment - by creating "virtuous cells" that allow them to complete one another»[4]. The idea is to live, work and shop in the same neighbourhood. In this way when people will leave their houses to go to work, farmers can grow plants in the same buildings. In a more complex, and maybe utopian view, the inhabitants will also cultivate their own food.

As also pointed out by Despommier, to assure the success of this new system, local farming must become part of a well balanced, equal and internationally regulated market, where transparency is a key element.

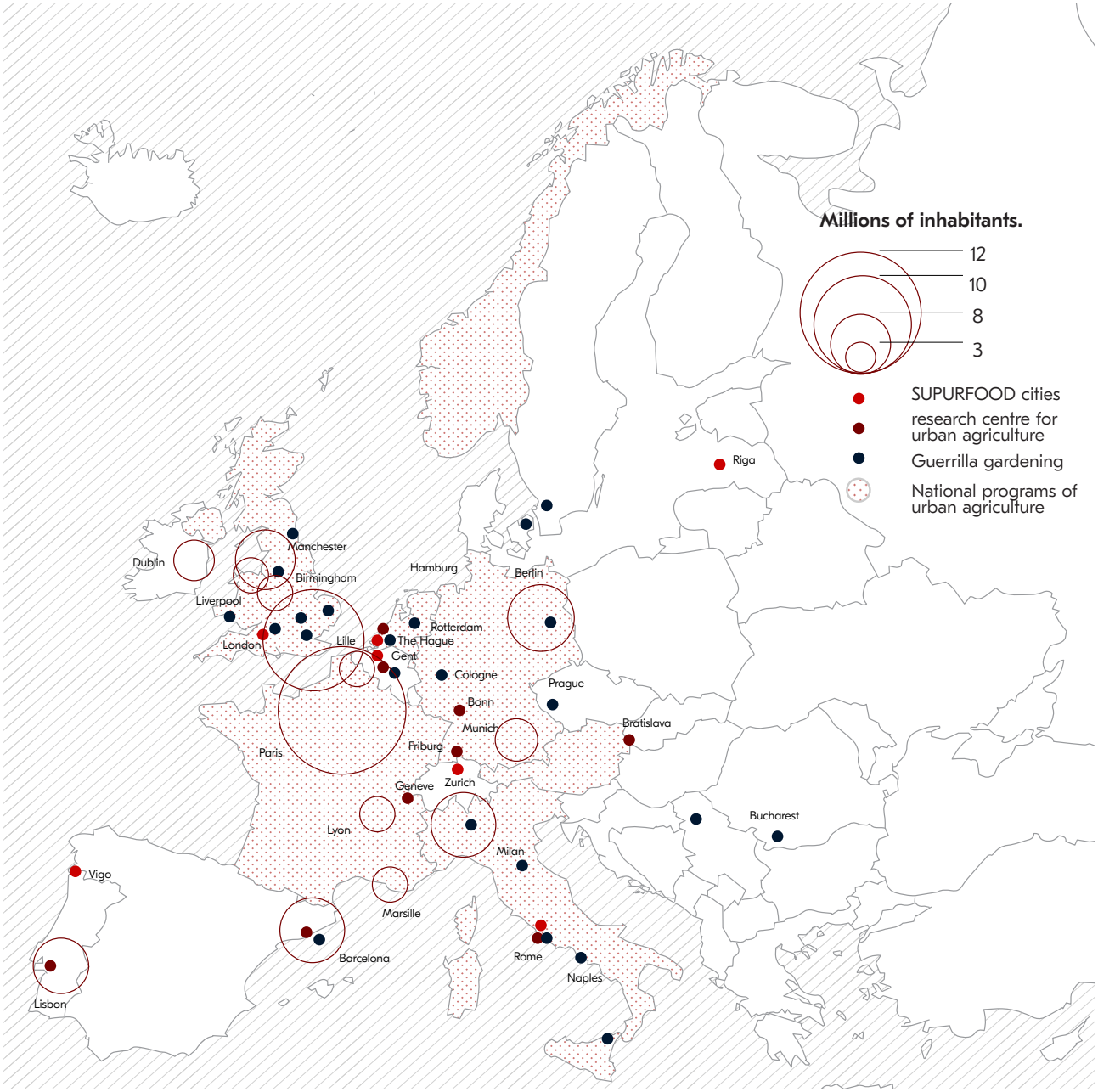
A part from China, there are some interesting examples in Russia, in USA, where the Columbia University has developed a project for a high-rise food factory. MVRDV has also proposed a more utopian and provocative scenario, named *Pig City*, where they imagined

3 *Ibidem.*

4 *Steel, 2008.*

Project name	Location	Year	Designer	Short description	Built
Eden Project	Cornwall, UK	2001	Tim Smith, Grimshaw Architects	A series of EMFTE geodesic biospheres that host different ecosystems	Yes
Sociopolis	Valencia, Spain	2002 - 2010	Guallart Architects	A project for a new shared habitat, which proposes new living typologies, integrated with food production	Yes
Agro Food Park (AFP)	Aarhus, Denmark	2009 - ongoing	William McDonough + Partners, GXN, 3XNArchitects, BCVA	An hub for agricultural innovation, which will integrate urban density with crops to prove the success of an academic-commerical relationship	Partially
Brooklyn Grange	New York, USA	2009	Ben Flanner	A rooftop garden where food and city are in close contact, as well as producers and customers. The products are available at different city markets as well as in some restaurants	Yes
Prinzessinnengarten	Berlin, Germany	2009	Nomadisch Grun association	Reconversion of abandoned area into an urban garden with the concept of movable agriculture. The park also hosts a restaurant and a coffeeshop, whose main ingredients are those grown in the park	Yes
Tenth Acre Farms	New York, USA	2009	Jordan Hall, Bennett Wilson, Adam Wilson	Urban food production in urban voids	Yes
Lufa Farms	Montreal, Canada	2009 -2016	Mohamed Hage, Yahya Badran	Re-use of dismissed factories to grow vegetables and frutis on rooftop greenhouses	Yes
Spiral Garden System		2010	Benet Dalmau, Saida Dalmau, Anna Julibert, Carmen Villar	A spiral public garden for the community to grow food	No
Vertical Farm	Prague, Csezh Republic	2010	Michaela Dejdarova, Michal Votruba	A modular sustainable concept of vetical farm based on solar energy and recycle of rain water	No
The Tower Garden	New York and Orlando, USA	2011	Future Growing LCC	Closed-loop system in a rooftop garden of a restaurant to produce food	Yes
Parasite Farm	Germany	2011	Charlotte Dieckmann, Nils Ferber	Indoor composting system which can be easily integrated in a domestic environment	Yes - prototype
Stacking Green	Ho Chi Minh, Vietnam	2012	VTN Architects, Daisuke Sanuki, Shunri Nishizawa	A private small house, with a green facadewhich allows natural light to get inside, while preventing the internal temperature to rise	Yes
Value Farm	Shenzen Biennal, Hong Kong	2013	Gary Law, Bill So, Sam Wong	A rooftop garden experiment to study the possible environmental and social benefits of the urban agriculture when renovating former industrial buildings	Yes
Home Farm	Singapore and Kuala Lumpur	2015 - ongoing	Spark architects	The next generation of social housing for elederlies that combines housing and food production	Partially - pilot project
Vertical Farm	Expo Milan, Italy	2015	Enea	A vertical greenhouse to grow lattuce and basil with an hydroponic system	Yes
Vertical Garden			VerticalGreen	Copyrighted vertical gardentechnology that allows to transform every wall with ornamental or alimentary food	Yes
Vertical Garden	San Vincente del Raspeig, Spain		Jose Maria Chofre	Vertical green facade on an existing building	Yes
Floating fields	Shenzen, Hong kong	2015	Thomas Chung	A public park with an array of open-air shallow rectangular partitions, some filled with growing fields and others with water on which floated growing	Yes

Case studies
https://barbarafalcone.wordpress.com/tag/agricoltura-urbana/ (retrieved on May 2019)



European urban agriculture, personal representation.
http://archivio.internazionale.it//atlante/agricoltura-urbana (retrieved on May 2019)

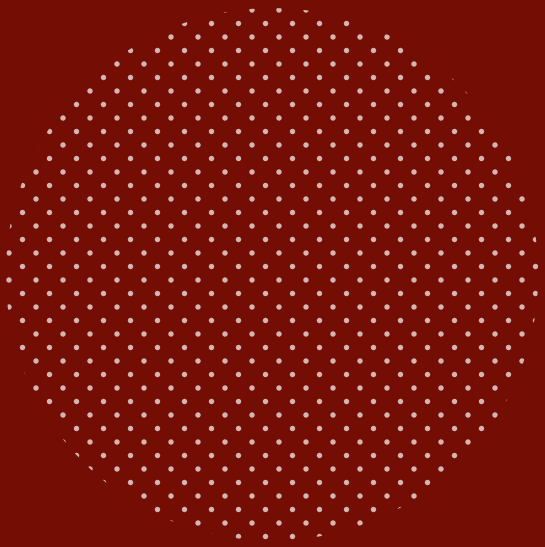
entire cities devoted to food production, with pig breeding placed in towers.

Researching online I found another interesting practice, known as *permaculture*[5], which consists of series of theories and actions aimed at designing sustainable spaces for humans, which can meet their needs in terms of energy and food without harming the natural environment. This view is based on the belief that, by producing food in an ethical and responsible way, it is possible to recreate the perfect balance between man and nature.

This practice goes from small domestic actions such as vegetable gardens or balconies up to bigger settlements and urban centres. Nowadays permaculture academies are spread throughout Europe, one of the most important of which is located in England.

What the existing literature about urban farming and the experiments I have summarized here are trying to suggest is that we should think not only to the people who are living in cities now, but also to those who will come by 2030 or 2050, where resources will be even less. We should learn again how to respect the land, trying to act with an integrated approach, that I like to define with a pun as *Slow food, slow city, slow architecture.*

5 The term permaculture derives from the contraction of two english words, permanent agriculture and permanent culure. It was first defined by naturalist scientist Bill Mollison and agronomist David Holmgren in Austrailia in 1978.



The morphology of the food market

The origin of the market as a physical typology is well explained by Sganzetta and Tricarico. It can be traced back to a precise historical moment when farmers experimented a surplus in the production and consequently they needed a place to store this exceeding food as well as to sell it. In that context the market became the place of exchange, where farmers could sell their products to different types of people. This very first exchanges were paid with money or other goods.

The origin of the market

With the evolution of consumption models and a more complex social organization a new professional figure emerged. The trader, or merchant, became the middleman between the producer and the customer as well as the manager of the economic transactions.

Over time the space of the market acquired also a political role, becoming a potential device for controlling and influencing the people's decisions through price policies or food rationing. This space is somehow still keeping its political power, but mostly it is characterized by a plurality of roles and functions and it is very connected to the land.

The market in the modern European cities

The market has always been a central element in the city, from ancient times till nowadays. Donatella Calabi in her book *Il mercato e la città: piazze, strade, architetture in Europa nell'età moderna,* describes carefully the role of the market in the city during the modern age.

As already mention in previous chapter, the ease of supply was the main reason that defined the dimensions of the city and the market played an important role in this growth as a strategic exchange hub. During the ancient regime, the merchant centres were numerous and the urban quality of a city was defined by the presence and the dimension of its market. Then, it is not hard to believe that this area was one of the most expensive in the city. To underline the

importance of the market in those times, the author cites also the historian Henry Pirenne, who said that without market it was impossible to talk about the city.

Talking about market means also studying the morphology of the places where commercial activities happen and how they can determine a distributive reform of the urban environment, a redesign of both buildings and public spaces. The market in the city can be described as a series of full and empty spaces, a nodal element in a wide mesh net, a place of uninterrupted traffic of people and goods. This temporary nature of the market is what distinguishes it from other places connected to the exchanges and meetings, such as the harbour[1].

The commercial activities and by extent the market determined an important urban renovation in many European cities for both functional and formal reasons. The space, that was necessary to accommodate all the functions that it carried, had a critical role in the reform of the street system of those cities.

The market was often connected to a discontinuity in the urban fabric, it created a sort of urban island, an *insula.* Braudel defined the market as a limit, a barrier, thus arising the question of edges. It is not difficult to find examples of markets built on bridges, for examples. Which place was better to accommodate a place of exchange like a market than a crossing space between two edges? The first architectures on the shores were not part of a planned design, it is only since the 16th century that the architects has started to regularize those spaces, using a clearer geometry, yet defined by previous uses.

The market on the edges

The origin of the market is quite different from place to place, but we can recognize at least four models of settlement:

- a market at the periphery of the city, outside the walls;
- a more central market, an exchange hub;
- a more articulated urban structure;
- a diffused model;

The market was built outside the city walls, in a peripheral location, close to the doors and usually on important crossroads. Here the origin of the concept of edge is clarified, it seems therefore that the relationship with edges is something intrinsic, related to its very historic development and it has remained strong

1 from latin portus, it means a closed, protected space, used as a warehouse or travel stage to exchange goods. Its nature is permanent, unlike markets and trade fairs.

even when the market was integrated in the city. When the city started to grow, in fact, it literally swallowed up the market, by integrating it in the urban built environment.

In the following paragraphs I will report some of the examples of different models of European market that are described by Calabi.

In Venice, the Rialto island was identified as a suitable space for the market and the financial activities of the Republic. The presence of the market had effects on the entire island since most of the political organs moved there, thus making it the new centre of power.

In Paris, the market is again located near the water, on the right bank of the Seine. The Halles were first built by Philippe Auguste in 1183 and then rebuilt several times with different shape but in the same place. Between 1200 and 1300 the entire city is like a giant market, where commercial activities are spread. The real development happened when the market was centralized in one single structure, thus reaching a new commercial and economic order.

In Nuremberg, too, the market was located in the nodal crossing points of the streets.

Somewhere else, like in the German and Dutch cities, the market was a «geographical centre of gravity because equally distant from the production and consumption centres»[2]. In these cases the market was built in a more central location, quite often around a regular site, which became the main urban plaza or the pivot point of a regular series of streets.

The coincidence of sorting and storage places led to a concentration of warehouses and shops, which influenced the relationship between open and closed spaces, resting and walking areas. The definition of market as a nodal space and an economic attraction is even stronger here.

Another different kind of market in the European city was the diffused one, which consisted of several marketplaces scattered throughout the urban fabric. The main difference from the other models was the fragmentation of the purchase.

Disorder and organization

The morphological configuration that allowed the creation of the market was the relationship between a series of shops and the open space in front of them. It originated as a single building

2 Calabi (1993), personal translation.

J. Van de Ulf. The Amsterdam Dam, 1622.
Calabi, 1993.

with many shops or a group of smaller architectures, built over time and with different materials, organized along a path (typically a street or a side of a square). The typology of the market is therefore strictly related to the urban fabric, in the Spanish and islamic towns, for example, the tissue was so dense that it was impossible to build a market, thus leading to the creation of the street bazar.

During the 16th century, new state laws were emanated to organize this natural disorder. These measures defined geographical limits, proper locations and physical spaces for the market. If on one hand this process reorganized the marketplace, on the other hand it arose a series of conflicts and abuses about the property of the soil occupied by the market. The architecture was a useful tool to separate spaces and give more clarity to the intended uses.

Once the space of the market was regularized, it acquired also new functions. The market square became the place of spectacles, events, the theatrical scene where comedies and tragedies were performed. It became also «a space of dissemination and indoctrination».

This century was not only the time of legislation and regularization, but also the time of limit identification. Urban planners and architects of the time needed to set limits in order to design public spaces. The activities that once coexisted were separated and the places were redesigned geometrically. The same concept of regularity and order was applied in the urban planning. It is not a mystery that this was also the age of the ideal cities, where geometry and regularity were the main design drivers.

The market and the square

The market and the square are often overlapped in the modern age, but not always. As already mentioned before, the market has an intrinsic precarious nature, it is not much designed and planned, but it is also the earth of the city.

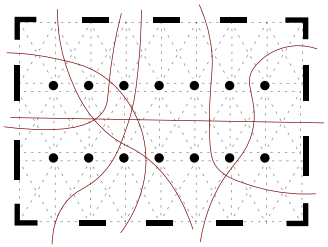
The plaza, on the other hand, is a collective phenomenon, it expresses the need of a «civitas», like Marco Romano would call it, to exchange ideas, goods, news and people.

In most cases, it was the coincidence of the two that originated this typology, through a thoughtful articulation of urban spaces, which were formally and functionally connected, opened and closed.

Market typologies

The market is not a unique typology. There are several types that Donatella Calabi grouped in the following categories.

The covered market.

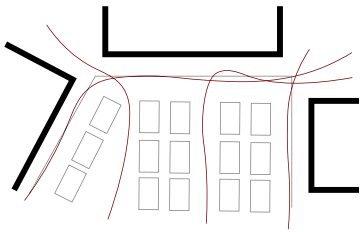


It is a unique building, which can host many separate shops, run by the same person or belonging to different owners. This typology had a great diffusion during the 12th and 13th century. Traditionally it is a long building with a basilica footprint, divided into naves and covered by vaults. The roof is a large structure supported by a small number of pillars, in order to allow the free circulation of people, air and goods.

In medieval times, it was usually not an independent structure, but often the a porch at the ground floor of another building, such as a church. A variation of this typology is the *alcaiceria* (a famous example can be found in Granada), typical of oriental/Mediterranean countries, which designates both the commercial institution and the physical space where this activity is held. Sometimes this space is made of an intricate net of small commercial alleys or a small square surrounded by shops. This typology is declined also in the fondaco, usually a large private building but with public concession, or the arabic *suq*.

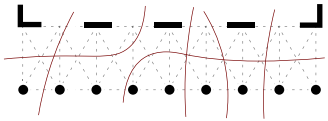
Going back to Paris, an emblematic example of covered market is Les Halles, which after the first reconstruction regenerated its original medieval footprint, but also at the same time redefined the surrounding road system through its relationships with the external open space. The building was redesigned in a more regular way starting from the paths, the hygienic laws and the public decorum and therefore influenced the urban space around it.

The street or square market.



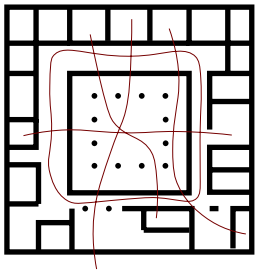
The market was also held in open spaces such as streets or squares. It was common to find European squares named after their function such as Herb square or Market plaza. The boundaries of this kind of space were less clear than the covered typology, more than physically they were defined by law.

Portico, loggia, borsa.



This spaces were usually connected to the market as gathering areas for merchants to exchange goods and mostly discuss about international affairs.

Fondaco.



This already cited space derives from the combination of two typologies:

» a warehouse where goods or animals could be stored while waiting to be distributed;
» a hotel where merchants could rest and meet other people.

It was usually a two or three-storey building with a large open ground floor, often described as a very confused, promiscuous and messy space. The rest of the space was usually divided between private rooms for the owner of the building and public spaces to allow the flow of people, goods and animals.

Decay and renovation of the market

As explained by Sganzetta and Tricarico, the urban market - especially the covered one - had a fundamental role in the city for the access to food. The food supply that came from the crops in the countryside was stored there and sold at low prices. The situation changed with the development of the large distribution and the invention of the supermarket, which reduced their catchment area and caused a commercial and infrastructural decay. Most European cities financed regeneration project to avoid

these places from being abandoned or demolished. The aim of these campaigns was not only the renovation of this privileged spaces for the access of food but also the creation of new hubs to foster culture and local tradition.

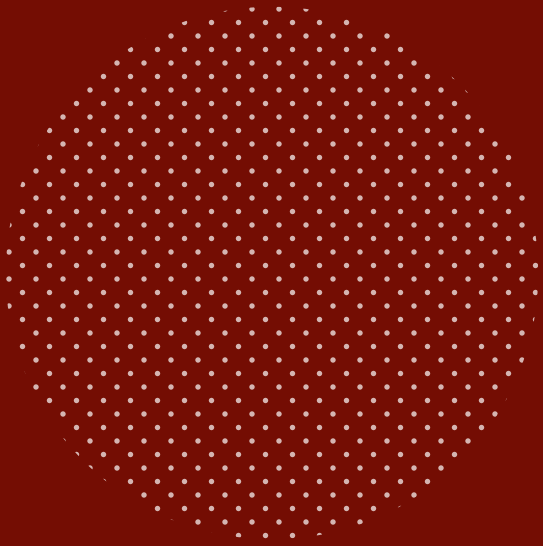
The strategy of Milan: il Mercato Lorenteggio

According to the words of Paolo Seris, the director of production activities and commerce in Milan, the city of Milan has a long history of municipal covered markets - almost 21 in 99 districts. In recent years, the strategy that has been adopted by the municipality tried to regenerate these areas by placing side to side the traditional commercial activities with the new ways of food administration and the social events. The aim of this strategic functional mix is to transform the market into a reference point for the district, where citizens can buy goods or gather together.

A good example is the renovation of the Lorenteggio market. After a deep analysis of the Giambellino district handled by the Dynamoscopio association, the results showed that most of the management difficulties which caused the decay of the market could be imputed to the municipal directives, which were an obstacle to the uses of the space, the price control policies and the food administration. After this period of abandonment and decay, the request of the citizens to preserve the original function of the place was finally considered by the new city council, run by Pisapia. Among the changes inserted by the municipality, there was a specific request to integrate at least 10% of cultural activities. After the renovation period started in 2013, the market became active and accessible again. The success of the process was also guaranteed by the cooperation between the municipality and the local authority, which helped to find new consumption orientation and also new uses required by the citizens.

This approach is part of the largest Food Policy that I mentioned in the previous chapter. These places should help the citizens to access food, but also to raise their awareness and connect more the producers with the customers. The markets have been chosen by the municipality as drivers for the development of a stronger and more aware food culture in the city.

Renovated facade of the Mercato Lorenteggio.
www.mercatolorenteggio.it (retrieved on 29th June 2019)



The new food habits

The food has shaped the city in different ways, last but not least through our culinary habits. The invention of the railway, as we have seen, allowed the city to grow, but it had also a role in establishing «single-class enclaves - social mono-cultures - as the dominant residential pattern»[1], thus leading to wrong food habits.

How we eat

The development of our food habits have also some links with the industrial system, since for instance the modern concept of kitchen, like that embodied by the Frankfurt prototype, is an application of Taylorism. The kitchen is therefore designed to make the activities easier and it is basically organized around the ergonomics of cooking.

Despite some small changes due to cultural traditions, the humans' food rhythms (breakfast, lunch and dinner) are similar everywhere in the cities around the world. The invention of electricity represented a big milestone in the definition of food habits at table since it allowed to delay eating timetables.

Places of consumption

Food has been served in different places through the history. Especially in the western world, the inns represented the nodes of the food network of towns for centuries, where people, and especially travellers, could eat and rest. In the 16th century the new typology of the coffee house defined new urban spaces for social meetings and discussions. The restaurant typology, as we know it today, has become a predominant part of the urban landscape since the 20th century. The impact of these food service spaces in some weak-food cultures, like the UK for example, was big, since restaurants became real substitutes for cooking.

A different story is that of the fast-foods. The American restaurant typology was a response to a fast growing world, where time is a precious resource. Despite the low standard qualities, this typology has the positive aspect of recreating a sense of sharing food with other people.

1 C. Steel, 2008.

Slow food and Slow Cities

The Slow Food organization was founded in 1986 by the Italian Carlo Petrini as a response to the rapid growth of McDonald's food-chain in Italy. The aim of the first slow food campaigns was to fight against «the proliferation of corporate-centred dynamics - that is, the expansion of fast food restaurants -»[2] in countries where there is a strong local food tradition. It is now a global phenomenon, focused on enhancing the local aspects and fostering a sustainable development.

The main goal is preserve traditional food tastes, raising the awareness of the importance of local products, taste education and agricultural growing methods. It contributed also to define the new customers' requests that we described in the previous chapter.

It also supported local economies, since the main idea behind the movement is the "territory", as «a combination of natural factors (soil, water, slope, height above sea level, vegetation, micro-climate) and human ones (tradition and practice of cultivation) that gives a unique character to each small agricultural locality and the food grown, raised, made and cooked there»[3].

Especially in Europe, the Slow Food influence has also led to the creation of a "spin-off" movement «to implement and pursue and alternative urban development agenda»[4]: the Slow Cities. According to the programme ideas, in these places there should be more attention to local history as well to the land and the local context to carry on a more sustainable development.

The movement was founded in 1999 by the mayor of Greve in Chianti, Tuscany, and the mayors of two other Italian cities. The number of cities has grown to 40, the majority of which are located in Italy. Those cities became part of the organization because they complied with a list of criteria. Among these, the most rigid rules regard the dimension of the city, that should have no more than 50.000 inhabitants as well as a series of environmental and urban policies that the town has to respect. The multicoloured panorama of these cities is also reflected in the variety of goals that they have to pursue, which are related to the specific local context ad community.

Some of the criteria established by the movement try to foster economic de-

2 *H. Meyer, P. L. Knox (2006).*

3 *The words of Carlo Petrini (2001), reported by H. Meyer, P. L. Knox (2006)..*

4 *H. Meyer, P. L. Knox (2006).*

velopment through the production and consumption of local food. The Slow Cities are, in fact, required to draw up an annual census of local products. This is also part of the goal of the Slow Food movement to «protect almost-extinct fruits, vegetables, and traditional products or dishes through cataloguing and promoting them»[5].

An alternative urban regime?

The *Slow Cities* movement represents the possibility of establishing new urban agendas that propose a strategy where economy, environmental policies and equity intersect in synergy. It represents an alternative to the corporate-centred strategy that is predominant.

The question is how this alternative approach can constitute a new urban regime also for bigger realities. Meyer and Knox try to analyse the social, political and economic context that support this network, by reporting two examples of German cities, Hersbruck and Waldkirch. Both had already approved a mix of programs and policies before being certified as Slow Cities and presented a very strong sense of community, which was also reflecting in the support for the mayor. The close presence of bigger cities was also a determining factor that contributed to corroborate the local economy and market.

The plausible reading of this data is that movement proves itself successful when there are certain conditions. The analysed cities are enjoying an economic development, rather than a population decline like other so-called shrinking cities, because of their alternative urban agenda. The vitality of their economy is also due to the freedom from the need of attracting a foreign corporate-centred development.

The key of this success is therefore related to different factors and actors: the cities' small size, as well as the close proximity to bigger urban centres, with consequent possibilities of jobs or customers, and the almost homogeneous population. Another important element is the support of a coalition of economic, environmental and political organizations.

This alternative «community-based and locally driven agenda»[6], supported by a cohesive group of public and private actors, is not restricted just to smaller cities. It is hard to say if a comprehensive slow food approach could be possible on larger cities, since the success of the

5 *Ibidem. This idea is part of the Ark of Taste program.*

6 *H. Meyer, P. L. Knox (2006).*

program was also assured by the size of the community. A possible solution, which is already being tested, might be the application of this approach to smaller community, such as neighbourhoods or local groups.

Building a scenario for the future

Since people's relationship with food is always changing, Barilla has carried out an analysis in post-industrial developed countries to try to understand the dimensions and choices that will influence future food habits. The chosen time horizon is 2030, whose temporal distance is sufficient to formulate interesting predictions, but near enough to propose a potentially realistic scenario.

To build its scenario, the group of researchers chosen by Barilla had identified five paradigms which should represent «the megatrends upon which [...] post-industrial and post-modern society develops»[7]:

Changes in demography.

The data that represent the demographic trends of the post-industrial countries show opposite results in contrast with the generalized global population growth. These trends have and will continue to have in the future a huge impact on social and economic structure of these countries. The role of women has also a huge effect on the dietary since they have less time to dedicate to the household and the food preparation. The lifestyle of this increasingly older and profoundly changed population is reflected in the eating habits.

New geopolitical balances.

The wealth level due to the process of globalization in the production is also affecting the way in which people consume food. A crucial role is also played by cities, mega-cities in particular, because of the global role they are assuming. In these places a new food culture, less connected to tradition, is occurring and customers' easier access to food is reshaping eating patterns.

General connectivity in every field.

The total connectivity we are living in today is dramatically reducing the importance of distance and physicality. If on one side this technology is creating a community effect and a network which is bringing people together, on

7 *Barbara Buchner et al. (2012).*

the other hand it is producing the ITSO[8] syndrome. This affects the conviviality, therefore the challenge for the future should be to find a way through which technology can help create social situations and increase human interactions.

Attention to the environmental issues.

The scarcity of resources due to the process of globalization and the population growth together with rapid climate change is raising an alarm for the future food scenario. The growing customers' awareness of this problem is leading to an attention for the quality and origin of resources, as well as the request of more quality products and environmental safeguard by the food industry.

GRIN (Genetics, Robotics, Internet, Nano technologies) technologies.

Within the debate about the role of new technologies in the future of human life, GMOs in agriculture are also playing an important role. The effects they might have on the future is still unknown and the discussion is still opened.

8 *It stands for "Inability to switch off", thus meaning that people always feel the need to be connected. Barbara Buchner et al. (2012).*

The dietary habits

Citing the author of the study, the interactions between these paradigms generate the following forces which will bring conservation or change:

- globalization;
- polarization;
- tribalism;
- sustainable happiness;
- lack of trust;
- convergence around media;
- personalization of consumption;
- lifestyle of single people.

The identification of these forces helped to define the main trends in the dietary habits of people. The analysis starts from the definition of the current situation in order to create tools which will help structure a future realistic scenario.

As reported in this study, today's society of post-modern countries is well described by Jameson as characterized by heterogeneity, fragmentation and difference. The effect of these features is the creation of a society of individuals, where the fear of uncertainty is high. Traditional vertical relationships are replaced by horizontal ones and information has become the most important merchandise. «A society that is charac-

terized by political apathy, the decline of public figures, a frantic search for community, the disappearance of the art of building social bonds; and a desperate worship of the body»[9].

All these social aspects together with the three dimensions of time, space and relationships, reflect the way in which we eat, thereby we can observe different behaviours. The need to be fast and optimize time and production necessarily reduces the time for meals, while the request of contact with the land also leads to more authenticity. Individualism on the other hand leads to a lack of conviviality and community.

Today's trends

The eating habits of the post-modern society can be summarized in a few points:

- the most common food behaviour associates food and pastime, translating the food as «a means of psychological compensation for anxiety and boredom, and its value is often degraded because of compulsive and repeated consumption»[10].
- there is a contrast between those for whom memory of the past is creating a sort of nostalgia and a prejudice against the new culinary methods, and those who are most keen of new food approaches and who are forgetting the traditional value of food;
- an opposite behaviour is also observed with people who are more or less tolerant to innovation, thus leading to a more simple and biological diet or to more complex recipes and food inventions;
- the consumption of food is also divided in exclusive luxury or low cost food and this has both social and qualitative effects on people's habits;
- the time dedicated to eat and produce food is increasingly reducing, thus affecting also conviviality and the culture of share. The effect of this time constraints is the trivialization of food, since you can eat anywhere at anytime;
- there is still room to reach a complete environmental awareness. Many actions are still facing people's opposition because they will result having effects on their individuality. This behaviour is a clear example of the NIMBY[11] effect.

Future trends: 2030 scenario

The dichotomy between health and search for pleasure will require a progressive education aimed at rediscover-

9 *Ibidem.*
10 *Ibidem.*
11 *Ibidem. It stands for "Not in my backyard".*

ing taste and tradition without giving up on pleasure. The initiatives cited in the previous chapter like *Slow Food* are already starting to spread the idea that to live better is necessary also to change lifestyle, based on a balanced diet and proper physical activity.

Another future trend will be the discovery of a proportion between tradition and innovation, surpassing the indifference which is typical of the contemporary customer. In 2030, people will also balance their choices according to naturalness and technological innovations, without exceeding on one side or the other. The challenge for food industries will be to find the right balance between nutritional quality of their products and an enjoyable taste.

Another hope for the future is also the inversion of the process of globalization of tastes, through a new curiosity and a rediscovery of roots, origin of products, authenticity and local food.

The contrast between luxury and low cost food shows that in the future the «total food offerings will have to adhere to growing minimum quality requirements, understood within a broader meaning that goes from food safety to sensory perception, from the nutritional level to the sustainability of the processes underlying it, and from availability and ease of use to facilitating the reduction of waste»[12].

Conviviality will regain importance in the future, since sharing food is worldwide recognized as one of the best ways to nourish social relationships.

Last but not least the attention to the environment will become increasingly important and a fundamental aspect of the dietary behaviour. People will have to understand how much their choices can influence the planet and assume a more aware attitude using resources in a more efficient way and reducing waste. To do so it is necessary to change the lifestyle and make a cultural revolution, to spread more sustainable dietary habits.

As already mentioned, the big topic is and will also be in the future "how" we will eat and not "what", thus shifting from a products-centred view to a more social and cultural point of view.

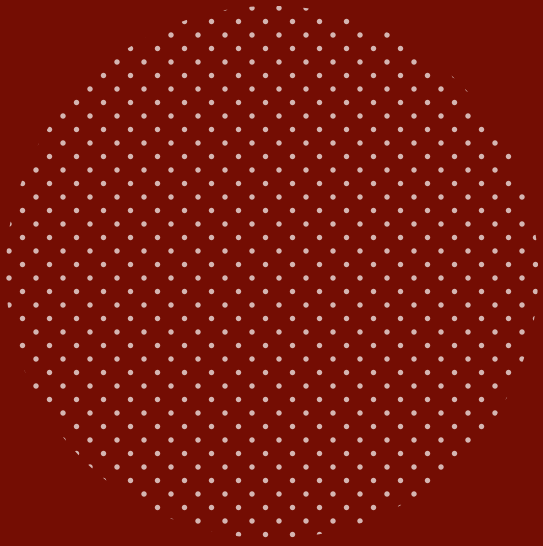
12 Barbara Buchner et al. (2012).

> *The circular economy concept consists of a non-linear process, as opposed to our current way of material consumption and provides a model to close material loops in an economically attractive way.*

(Ellen MacArthur Foundation, 2013).

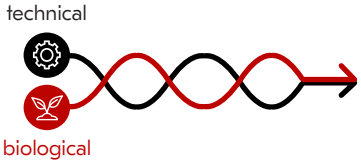
CHAPTER 06

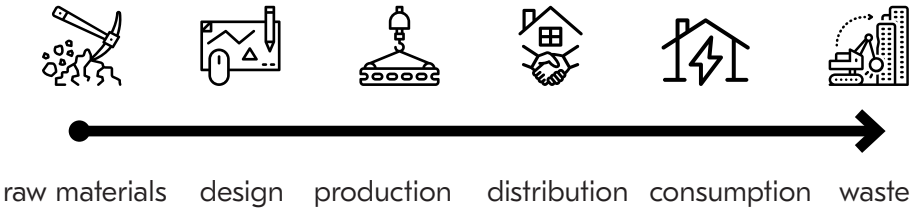
The circular economy in architecture



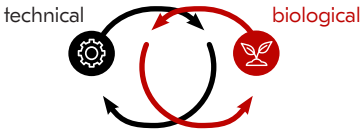
Linear vs circular model

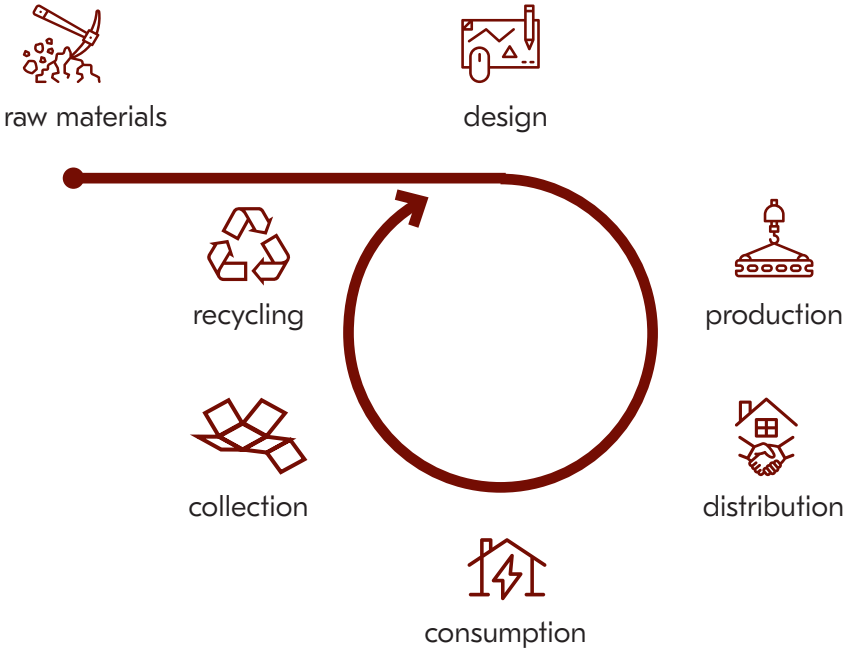
The linear model
Take. Make. Dispose.





The circular model
A living ecosystem





Personal representation of diagrams from Iraldo, Bruschi (2016) and Kubbinga (2018).

At the beginning of the book Cradle to Cradle, McDonough and Braungart perfectly describe how conflincting the concept of industry can appear from different point of views. Environmentalists always defines business as negative and industry as bad and harmful, while on the other hand industrialists think that farmers are an obstacle to production and growth.

The linear economy

The harsh effects of the industrial revolution on the environment were not planned or intended, since the revolution itself was never really designed. «Most industrial methods and materials are [in fact] unintentionally depletive»[1]. What leads the industrial revolution was an economic necessity and the desire of acquiring new capital. The origin of the industrial system that we know today still owes its structure to Henry Ford and his assembly line, which made the production more efficient by bringing the material to the man and not the contrary. Ford's main innovation was to «make a product that was desirable, affordable and operable by anyone, just about anywhere»[2].

The development of the linear concept of the industry was also influenced by the XIX century's idea of a perpetually renewable nature, which was destructive and brutish force to be controlled and civilized. Nevertheless, the problem of today's industry is not the context in which it was created, when people had a different conception of the world and the environment, but the fact it is still operating according to those old principles. Humans' idea of nature have evolved and a new awareness of the risks due to its abuse has arisen, yet industries are still stuck to an old conception of a linear system, also known as "cradle to grave model".

Michael Porter summarizes this approach in the economic model "take-make-dispose", which is based on inputs coming from the use of resources which are considered as unlimited. The effect of this model is a mono-cultural landscape, shaped by the growth of the city and the crops. It is the win of efficiency over nature and still the most diffused model. The growing requests of resourc-

1 *McDonough, Braungart (2002).*

2 *Ibidem.*

es has nonetheless started to question the validity and sustainability of such model in the long term, thus raising alternative approaches, such as the circular economy.

The effects of the linear system

Because of the growing requests of resources and their limited number, prices have started to rise and the prediction for the future is showing that they will continue to increase. The design of today's infrastructural and productive system is aimed at «chasing economic growth at the expenses of other vital concerns»[3]. The effects we are witnessing to, such as waste, pollution, raw products, are all due to an outdated and incorrect conception. Even if we might say that these harsh effects on the planet were not intentional and industries didn't intend to cause such destruction, it is true that continuing to be engaged with what the authors call the «strategy of tragedy» is intentional. The industrialists should instead commit themselves to the design and implementation of a «strategy of change». Somehting is already happening since these trends are convincing businesses and policy makers to move towards a circular model.

3 *Ibidem.*

A "less bad" approach

The destructions caused by the industrial revolutions have recently been addressed with what McDonough and Braungart call «a less bad approach», which is only trying to stem the consequences without changing the source of those bad effects. There is a series of terms that can help define this approach:

- reduce;
- avoid;
- minimize;
- sustain;
- limit;
- halt.

According to the authors of the book, hearing these words in a sentence can only show a lack of real interest in solving this issue. Being less bad «proved to be a fairly unappealing option»[4] from a practical, aesthetic and environmental point of view.

Eco-effectiveness as a possible solution

The strategy the book suggests to change our behaviours is called eco-effectiveness, which means moving from a "cradle to grave" model to a "cradle to

4 *Ibidem.*

cradle" idea.

From an architectural point of view, it means, for example, to create an nZEB building, which can minimize the air infiltration trough sealed envelopes, lower the solar radiation income and consequently also reduce the cooling load.

This kind of building will celebrate natural elements, through the use of sunlight, wind, earth, thus improving the conditions of the people who will work and live there.

The concept of "biophilia"[5] proves that this design approach can have positive effects on industrial productivity, since people love to stay outdoor and connect with natural elements.

This approach reflects the recent general tendency, observed also above while talking about food and dietary habits, of humans to engage more with nature. The strategy for the future should produce a society entwined with the natural ecosystem in a way in which man-made products and natural ones are mutually enriching.

The new design objectives should be:

» rethink buildings like trees, so that they produce more energy than that they consume while purifying their waste;
» plan factories so that they produce drinking water as waste;
» create «a world of abundance, not one of limits, pollution and waste»[6].

Circular strategies

The Co.Project developed by the Ellen MacArthur Foundation proposed an approach called ReSOLVE, which identifies some possible strategies to apply the circular economy principles to the built environment and the construction industry. They can be summarized in the scheme shown in the next page.

A new concept of waste

The circular approach includes also a new behaviour towards waste materials. Waste has always been a big issue, even before the industrial revolution. Pre-industrial cities had a reactive approach towards waste, rather than a proactive strategy. This was possible because most of it was organic and so it could be piled up for a very long timeand then usually used to fuel the food supply chain.

The first troubles with this self-regulatory ecosystem ceased to work when

5 The term was first used by the American psychoanalyst Erich Fromm and later by the American biologist Edward O. Wilson and it refers to the human «tendency to seek connections with nature and other forms of life». (from www.britannica.com, retrieved on 2nd June 2019)

6 McDonough, Braungart (2002).

» *Use and production of renewable energies, turning the buildings into energy generators;*

» *Land restoration;*

» *Resource recovery.*

» *Residential and infrastructure sharing;*

» *Appliances and tools sharing;*

» *Co-housing, office sharing or co-working;*

» *Shared water consumption.*

» *Better performing materials;*

» *Better performing technologies;*

» *New products and services.*

Regenerate

Exchange

Share

ReSOLVE approach

Virtualize

Optimize

» *Tele-working;*

» *Virtualisation of products and processes, through BIM;*

» *Smart appliances.*

Loop

» *Optimization of end-of-life buiding materials;*

» *Modular design of the building;*

» *Remanufacturing of materials.*

» *Optimized industrial process and off-site production, such as prefabrication;*

» *Smart urban design, using urban land vacancy, enhancing quality of urban environments:*

» *Energy and water efficiency;*

» *Reuse and recycle of materials;*

» *Reduction in transportation.*

Personal representation of data from Ellen Macarthur Foundation (2016)

cities started to grow and this almost circular system was not applied anymore. The moment has come for our cities to go back to that system again in order to erase the current threats coming from a bad waste management.

Changes in waste legislation through stricter recycling goals might also help to increase the recycling rate. Nevertheless, the change is not only about the treatment of waste, but mostly on people's attitude. Indeed, there are some interesting attempts of this circular strategy in Vienna, where biowaste is collected and used as fertilizer for farms.

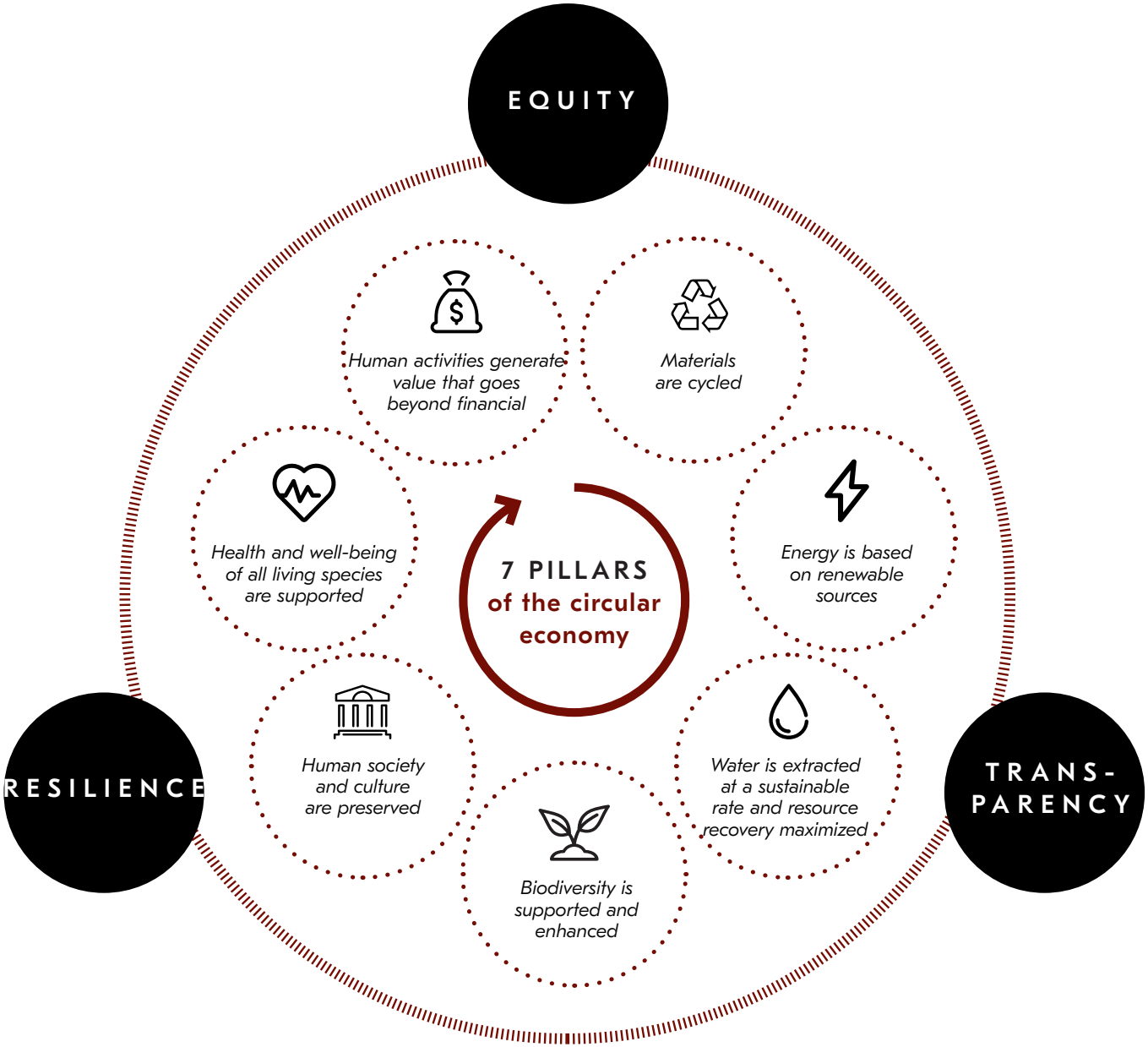
Traditional vs new design criteria

Traditional design criteria can be well represented by a triangular diagram with three elements: cost, aesthetics and performance. The recent sustainable approach like to use the so called "triple bottom line", Ecology, Equity and Economy to integrate the environmental respect into the design. This system seems to work perfectly in theory, but, when it comes to practice, it often appears to be centred mostly on economic issues. Instead of implementing the "triple bottom line" approach into the design, using it as a tool, companies usually calculate their profitability first, and only later «add to that what they perceive to be the social benefits, with, perhaps, some reduction in environmental damage»[7].

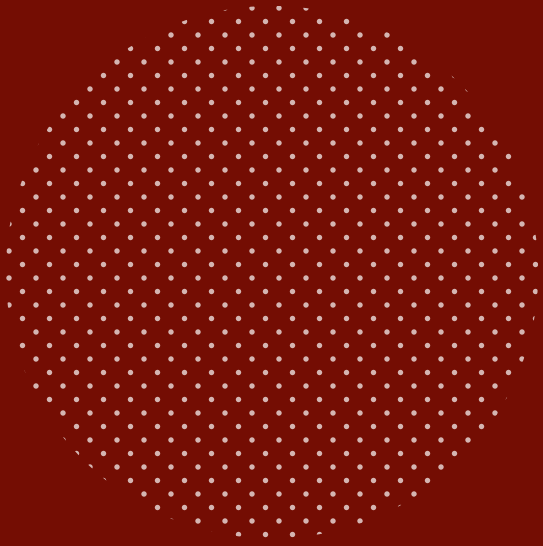
McDonough and Braungart suggest that industries could really make a change if they use a "triple top line" approach as tool to design their products. Starting from the ecological and equity questions, companies might design in a way that could surprisingly turn out to be extremely advantageous from an economical point view.

If the design respects this criteria, it is possible to talk about «an industrial re-evolution». In this process new inventions and machines will enhance and imitate the mechanism of nature, while systems will regulate themselves. We should take advantage of what nature can offer, instead of depleting its resources, so that we can be really effective.

7 *McDonough, Braungart (2002).*



Personal representation of a diagram about circularity.
Kubbinga (2018)



How to be eco-effective

Changing the way of thinking of engineers and designers will not be easy and quick for sure. It is hard to ask to someone who has been trained his entire life in a traditional way, using a linear approach and supporting a "cradle to grave" model, but it is not impossible. I would like here to rephrase the words of Einstein that the authors of the book also cite. He thought that if we want to solve certain problems, our mind and our thinking, in particular, should evolve, surpassing the level we used to cause such problems in the first place.

Eco-effective practice

Since the human mind needs always some product or problem to start putting this eco-effectiveness into practice, McDonough and Braungart propose a five-step approach:

» «get "free of" known culprits», which means to avoid harmful substances and materials in the first place. It is like putting a filter in the designers' mind that make them exclude certain kind of substances;

» «Follow informed personal preferences», which is about an aware and careful choice of materials. In our contemporary world it is harder and harder to understand which products are really eco-effective, thus making more difficult for people to take the right decision. As a starting point, it is therefore important to learn how to choose in a better way when comparing two products or materials. Even if in some cases it might happen that an apparently sustainable choice is not so respectful of the environment, because of lack of a deep research or commitment to the cause, it is actually better than not thinking about the issue at all. When talking about choices, respect becomes a central question in a circular eco-effective approach. Despite its importance, it is yet difficult to quantify it;

» «create a "passive-positive" list» can help in identifying harmful materials and like a technical triage it can assign different levels of urgency to these problematic substances;

» «activate the positive list»;
» «reinvent», which means to start designing to be good, not less bad. If we design a building, for example, we should start think on how we can make it have a positive impacts on the environment, bringing nutritious effects, instead of just reducing the harmful ones that it might have like we are already doing. In this way we are pushing the design assignment further, which includes not «just reinvent the recipe, [but also] rethink the menu»[8].

The codification of the circular model in Europe

Despite its positive aspects, the circular model doesn't reflect the contemporary production system, where waste is present in every step of the process. Despite some practices and policies are trying to reach the target of circularity, the closure of the circle, as Iraldo and Bruschi point out, is still far.

The strength of the circular system lays not only in the recovery and recycling of waste materials, the so-called leakages of the circle, but also in the prediction of those leakages, by reducing the flow and quantity of natural resources entering the economic process. As shown in the previous scheme, the circular model provides a smaller flow of raw materials as inputs in order to allow the capacity of the system to recover a larger part of waste.

This model was first identified in 1960s, with the already cited definition of "cradle to cradle" system. In 2014, the concept was further expanded and refined when the European Commission published the program *Towards a circular economy: the plan for a zero-waste Europe.* The program proposed a strategic roadmap, which provided some guidelines:

» Rethink design and innovation towards a circular economy, which foresaw the possibility of integrating innovation throughout the entire value chain instead at just the end of the life cycle;
» Allocate investment funds for circular projects;
» Mobilize businesses and consumers to support small and medium enterprises;
» Modernize the waste management policy in order to turn waste into assets;
» Fix the target for an efficient use of resources.

The topics addressed by the policies towards a circular economy can be summarized into three main cathegories:

» more precise documentation of the quality of materials;

8 Ibidem.

» better waste management system;
» more investments.

In 2015, the president of the Commission Jean-Claude Juncker announced the withdrawal of the plan, with the aim of having more time to establish a broader and more ambitious approach. In response to the harsh critics about this decision, the European Commission assured that they were working on a more complete package of actions to implement circular economy. The new approach is trying to combine smart regulation and market-based tools to support businesses.

The GEO observatory[9] has proposed some strategies to tackle some issues that are slowing down the process towards a circular economy:

» Solve information asymmetries through PEF (Product Environmental Footprint), which will give specific information about the environmental impact of products and materials in every step of the chain;
» Integrate business priorities in the business strategies;
» Reduce market barriers;
» Change habits and culture, for instance by reducing taxation on recycled products;
» Develop the infrastructures through ICT;
» Adoption of technological sustainable solutions;
» Introduce a more innovative legislation about waste management and material recovery at the end of the life cycle.

Quality of reused or recycled materials

Policies that are being developed by several countries in different years - the case of Nordic countries reported by Linda Høibye and Henrik Sand is emblematic - show particular attention to the technical performance and quality of reused or recycled materials.

In order to foster a circular approach, building regulations in Scandinavian countries are trying to implement strict legislations about materials. It would be asked, for instance, that a certain percentage of the materials used is recycled. The origin of the materials will also be an important issue as well as the traceability for end-of-life cycle. All these information about the material could be collected into database, thus having impacts on waste and environmental effects.

Another important topic is related to the demolition plans which should in-

9 The Green Economy Observatory was founded in 2014 by Bocconi University to foster a dialogue and a collaboration about green economy topics. From Iraldo, Bruschi (2016).

clude a careful removal of dangerous substances, «information about reusable, recyclable and contaminated materials, better supervision and training, and certifying employees»[10].

Impacts of the circular economy

The Scandinavian countries have also collected data from interviews to try to identify possible impacts of policies which foster circular economy. They can affect:

- environment and natural resources, with effects also on greenhouse gas emissions and resource consumption;
- public economic budgets, with changes in the taxation system and the administrative costs;
- financial situation of private companies ;
- export of goods and competitiveness;
- export of knowledge about circularity and new methods and techniques;
- collaboration between countries;

As we have seen the "cradle to cradle", circular model is something which has been discussed about for quite a few years. The raising awareness of the damages to the environment and the drastic reduction of natural resources are influencing not only economic decisions, but also dietary habits and constructive techniques. When fully implemented, the circular economy will radically change our entire social, political and economic organization. From the eco-effective strategies, guidelines and policies that I reported above it appears clear that government and researchers are trying to foster collaboration between countries and go in the direction of a circular system, but best practices are not always the solution. It is not only about technical innovations, thoughtful laws and prescriptions, it is also a cultural issue. A real change won't be possible unless we make up our minds and overpass the outdated and wrong linear model that is deep-rooted in our culture and history.

10 *Linda Høibye, Henrik Sand (2018)*

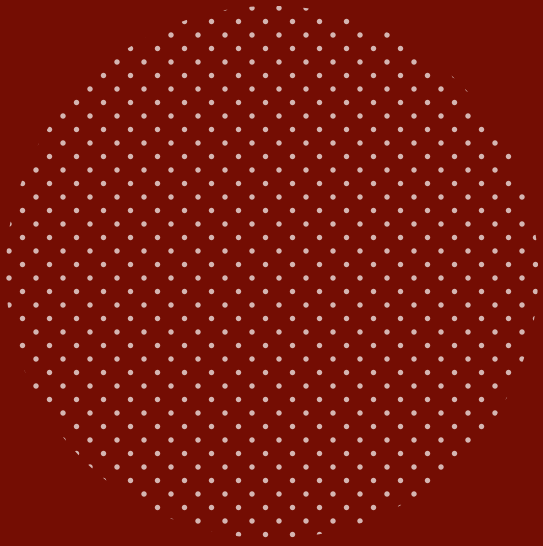
Frearson, (2015). Encore Heureux uses recycled materials to build Circular Pavilion in Paris.
www.dezeen.com (retrieved on May 2019).

The house is a machine for living in.

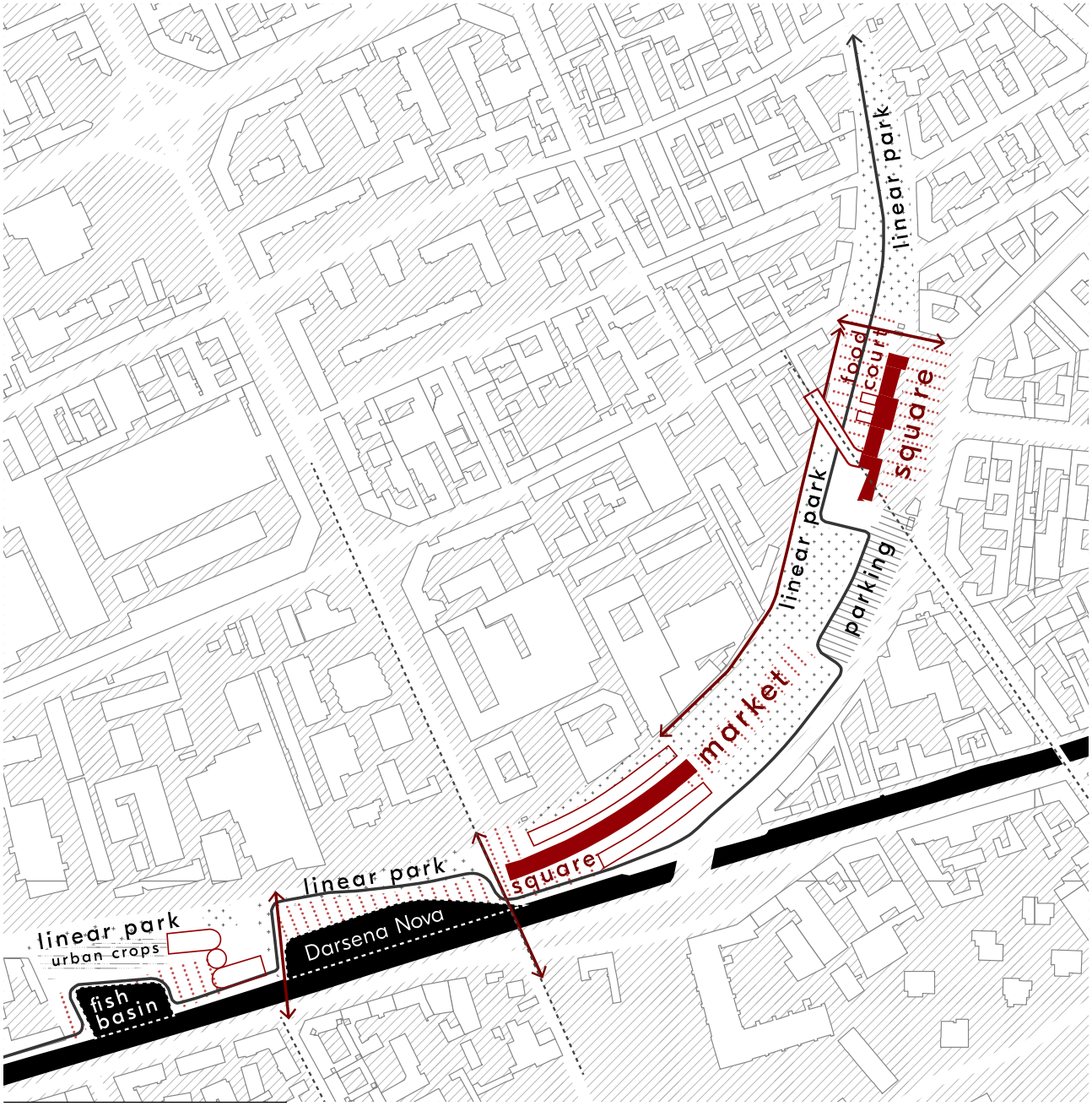
(Le Corbusier).

CHAPTER 07

The project



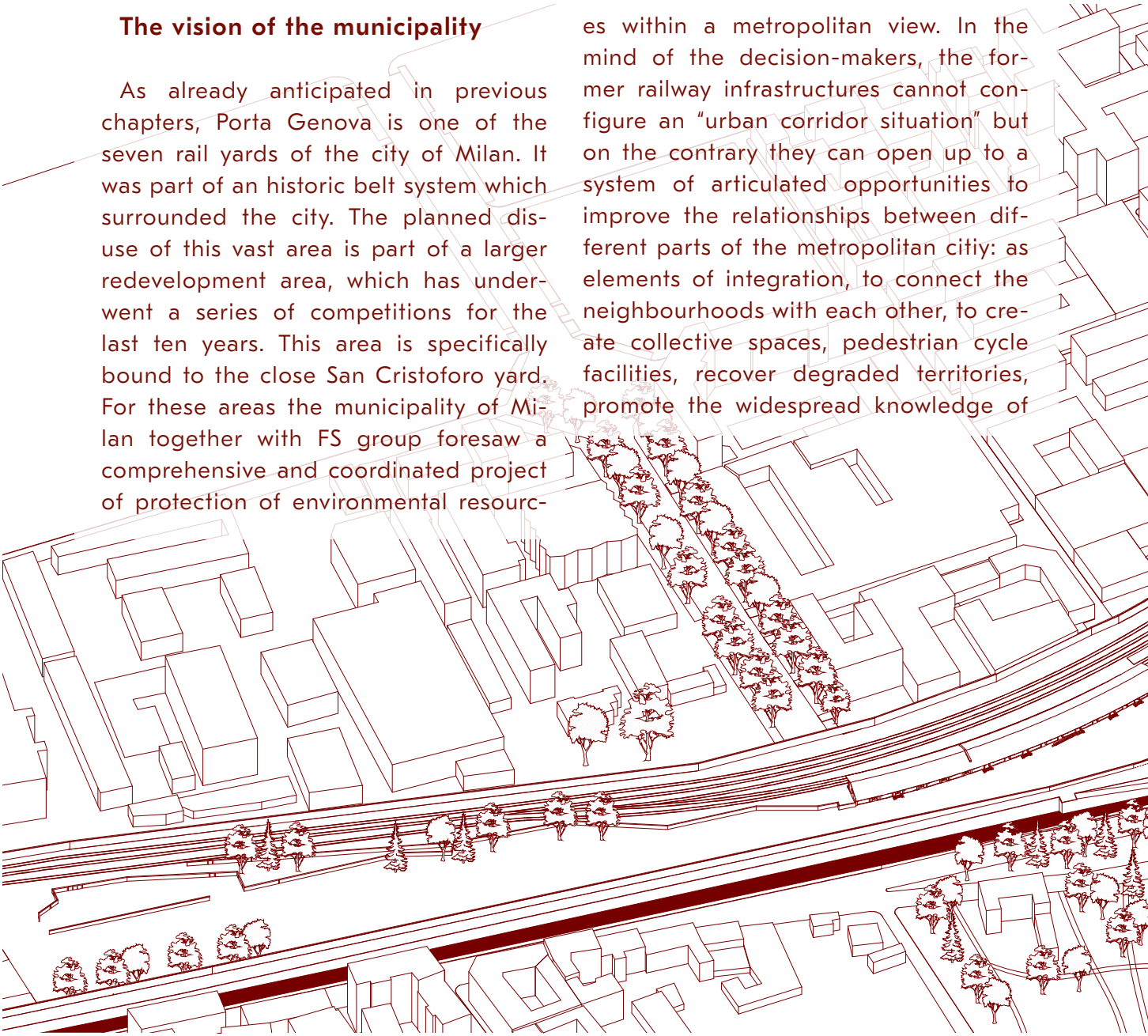
The vision for Porta Genova in 2030

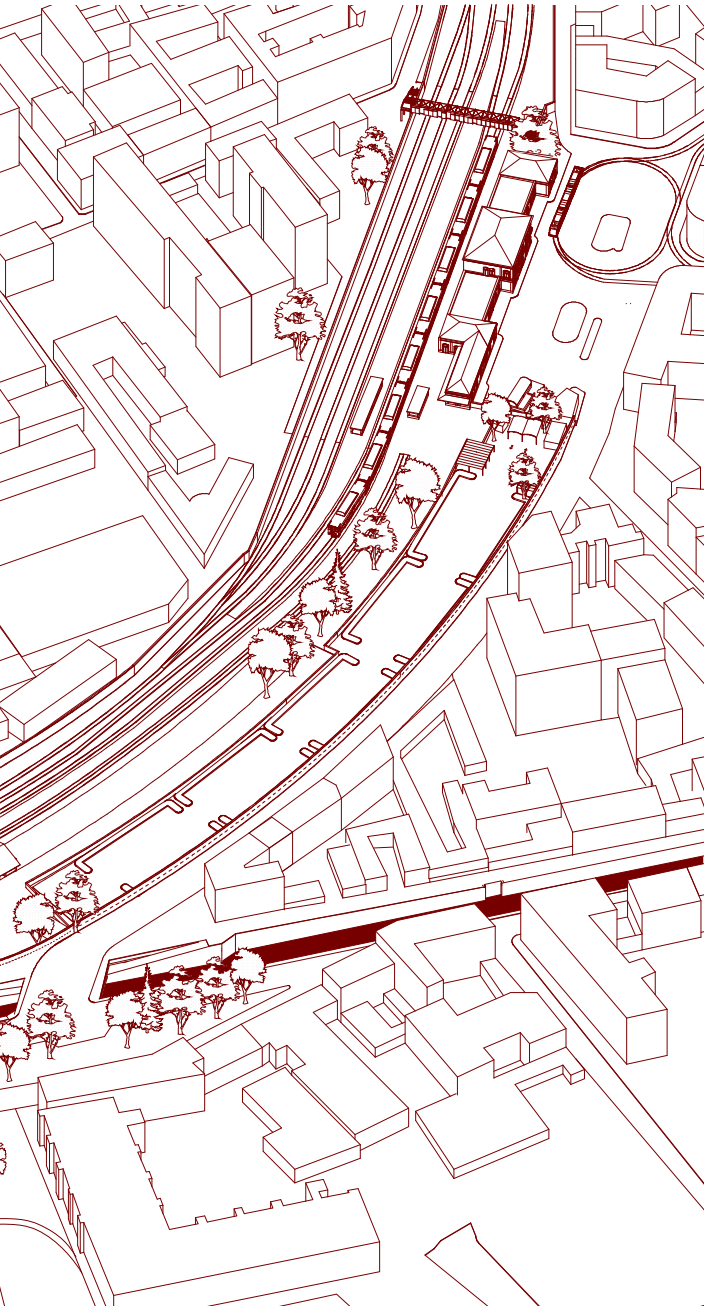


Conceptual masterplan with the new proposed functions.

The vision of the municipality

As already anticipated in previous chapters, Porta Genova is one of the seven rail yards of the city of Milan. It was part of an historic belt system which surrounded the city. The planned disuse of this vast area is part of a larger redevelopment area, which has undergone a series of competitions for the last ten years. This area is specifically bound to the close San Cristoforo yard. For these areas the municipality of Milan together with FS group foresaw a comprehensive and coordinated project of protection of environmental resources within a metropolitan view. In the mind of the decision-makers, the former railway infrastructures cannot configure an "urban corridor situation" but on the contrary they can open up to a system of articulated opportunities to improve the relationships between different parts of the metropolitan citiy: as elements of integration, to connect the neighbourhoods with each other, to create collective spaces, pedestrian cycle facilities, recover degraded territories, promote the widespread knowledge of





Axonometric drawing of the state of art of the area of Porta Genova with the station and the railway warehouse.

the Navigli natural habitat and the agricultural landscape of southern Milan, thus also relating to the rural areas of Lombardy. This ecosystem is an important historical reality, but above all an economic one, for its agri-food role and its increasingly tourist value after the impulse of EXPO 2015[1].

The specific infrastructural character of this area, also very close to the Naviglio, as well as the recent discussion about the yards future renovation and the location in one of the European cities that is most involved in the food policy practice led to the choice of this area for the development of this thesis.

Given the premises, I found interesting to undergo the possibility of designing architectures related to food at the intersection point of two important ways of communications, which were mostly used in the past to bring food from the countryside into the city. As a plus, this approach also met the municipality's guidelines.

The state of art

The total public surface of the transformation area is around 93.547 m^2. The surface of FS properties on the area comprises 20.800 m^2 of uncovered are-

1 Museo Lab 6 (2013).

as and 1.150 m² of warehouse[2]. Most of the surface is therefore free. The station of Porta Genova, which is labelled as place with historic value on the new PGT but without specific prescriptions, the railway warehouse, a part of which has been already demolished, a car parking, and a few other small complementary volumes are the main buildings.

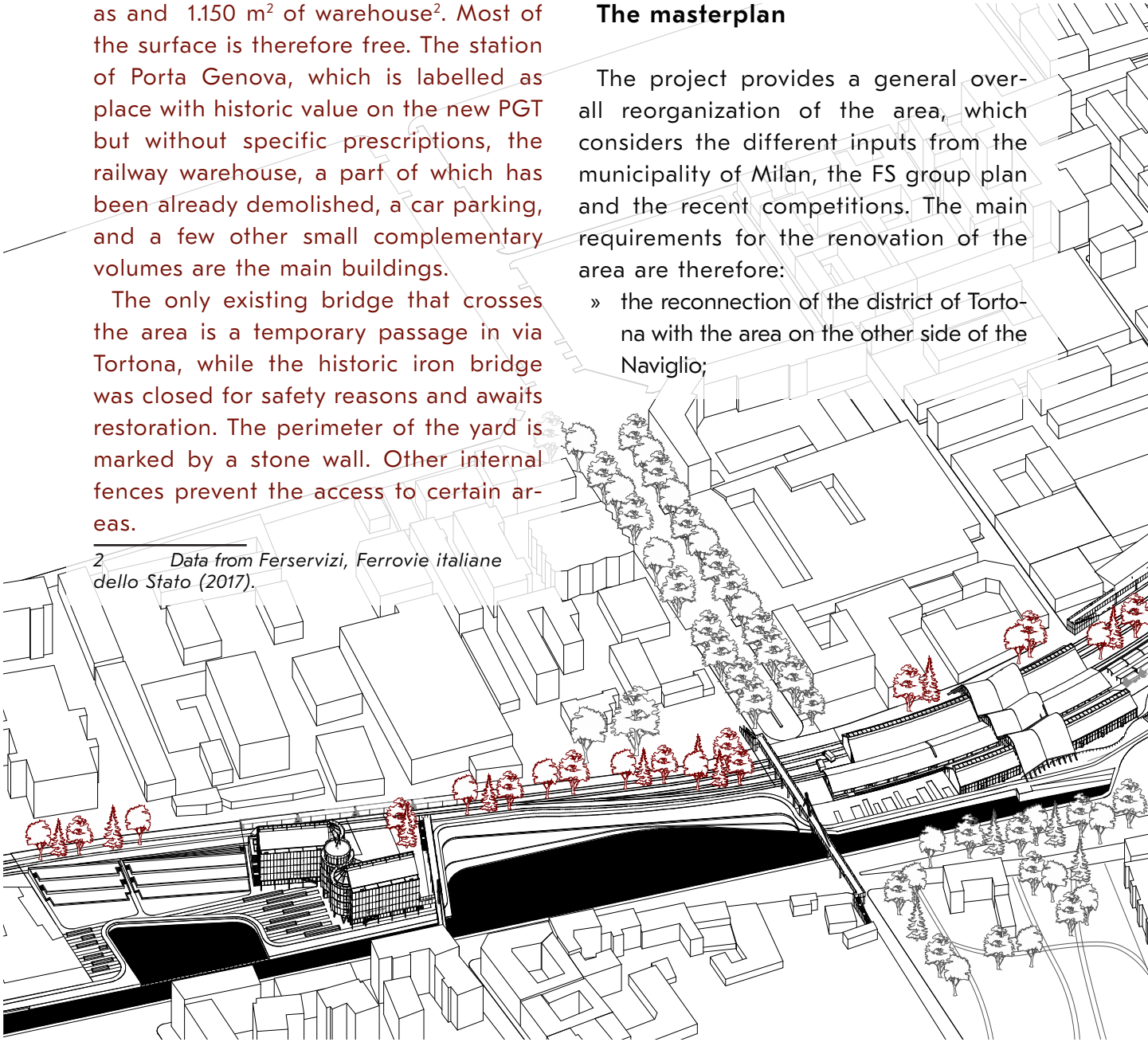
The only existing bridge that crosses the area is a temporary passage in via Tortona, while the historic iron bridge was closed for safety reasons and awaits restoration. The perimeter of the yard is marked by a stone wall. Other internal fences prevent the access to certain areas.

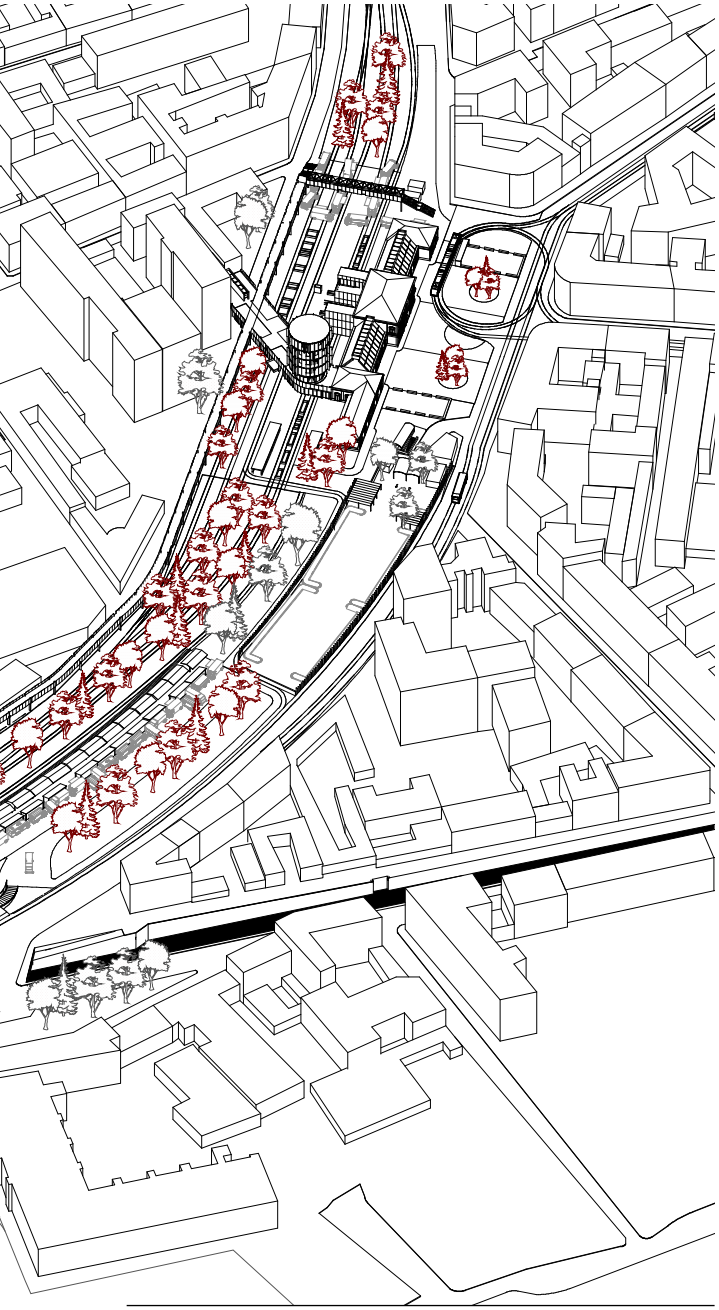
2 *Data from Ferservizi, Ferrovie italiane dello Stato (2017).*

The masterplan

The project provides a general overall reorganization of the area, which considers the different inputs from the municipality of Milan, the FS group plan and the recent competitions. The main requirements for the renovation of the area are therefore:

» the reconnection of the district of Tortona with the area on the other side of the Naviglio;





Axonometric drawing of project for the area of Porta Genova with the new buildings .

» the enhancement of the environmental qualities of the place, also related to the important natural ecosystem of the Naviglio;
» the environmental remediation;
» the preservation of the memory of the railway;

The masterplan shown in this picture and the planivolumetric plan on the following page both illustrates the idea of the project, which consists of an agricultural public park. Most of the available public surface is transformed into green areas and the trace of the rails is used to define the internal paths and the new cycle lane.

The cycle lane

Among the intents of the stakeholders there was also an interest in enhancing the cycling and pedestrian facilities of the city. The existing network of cycle lanes is scarce and not well connected. The idea proposed with this masterplan is to give more importance to this infrastructure and use it as a device to foster urban renovation throughout the city.

Hence, the cycle lane becomes the backbone of Porta Genova redesign. It attaches to an existing line in via Solari, it goes though the entire area, crossing

the new buildings and then it runs parallel to the Naviglio.

The three design topics

The design approach that I followed can be somehow defined as functionalist, since I had specific ideas for the places that I want to revitalise. The entire project is designed as a machine, where every piece is controlled and functions in a bigger system, by interlocking with the other ones. What emerges also from the drawing is the intention to create three main hubs, which also reflect the themes that I have previously analysed.

The former station of Porta Genova is restored and redesigned to host novel functions related to food administration. The sorrounded area is also rethought as a public space with two declinations, a more traditional square and a food courtyard integrated with the park.

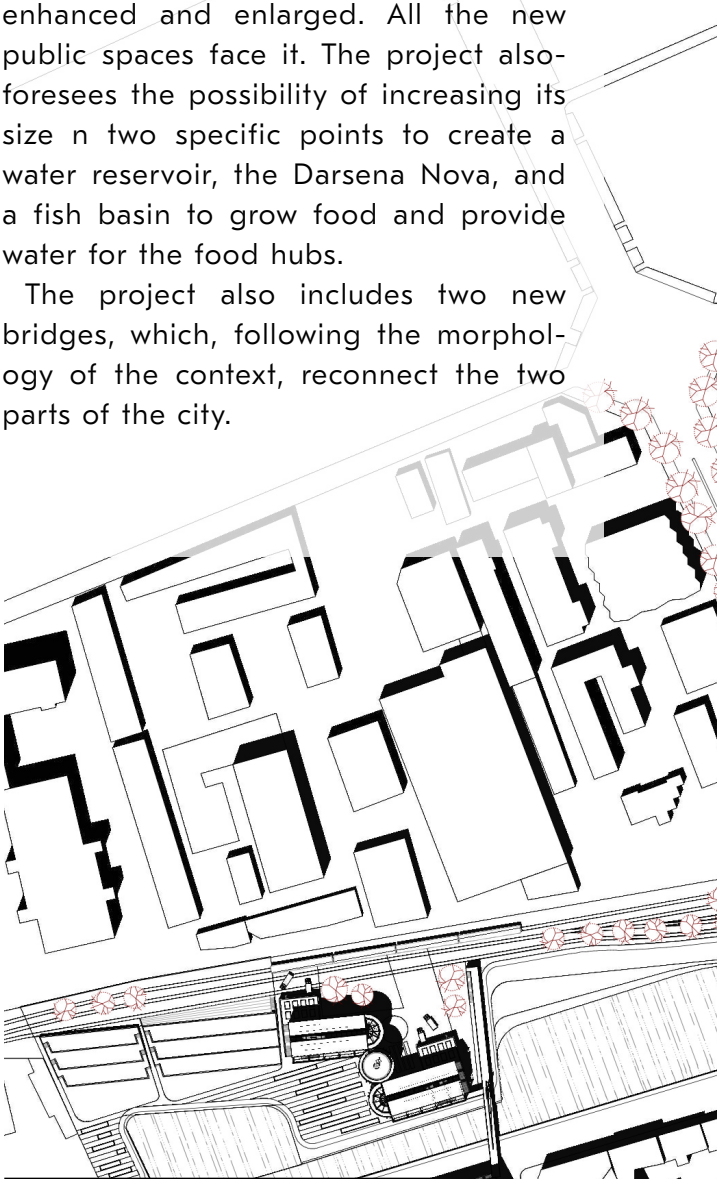
The warehouse is also restored and preserved, while new buildings are added around it. The new function of the place is an urban market, which introduces new innovative retailing systems and spaces.

The last piece of the masterplan is occupied by an innovative prototype of vertical urban farm and related agricultural spaces.

The Naviglio and the new bridges

The important axis of the Naviglio is enhanced and enlarged. All the new public spaces face it. The project also foresees the possibility of increasing its size n two specific points to create a water reservoir, the Darsena Nova, and a fish basin to grow food and provide water for the food hubs.

The project also includes two new bridges, which, following the morphology of the context, reconnect the two parts of the city.



Planivolumetric drawing of the project.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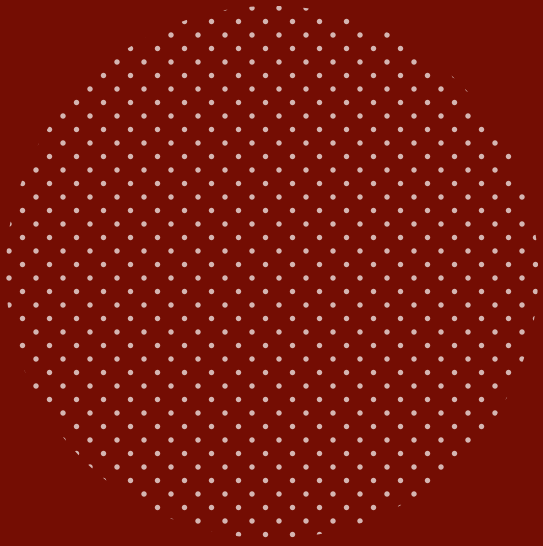
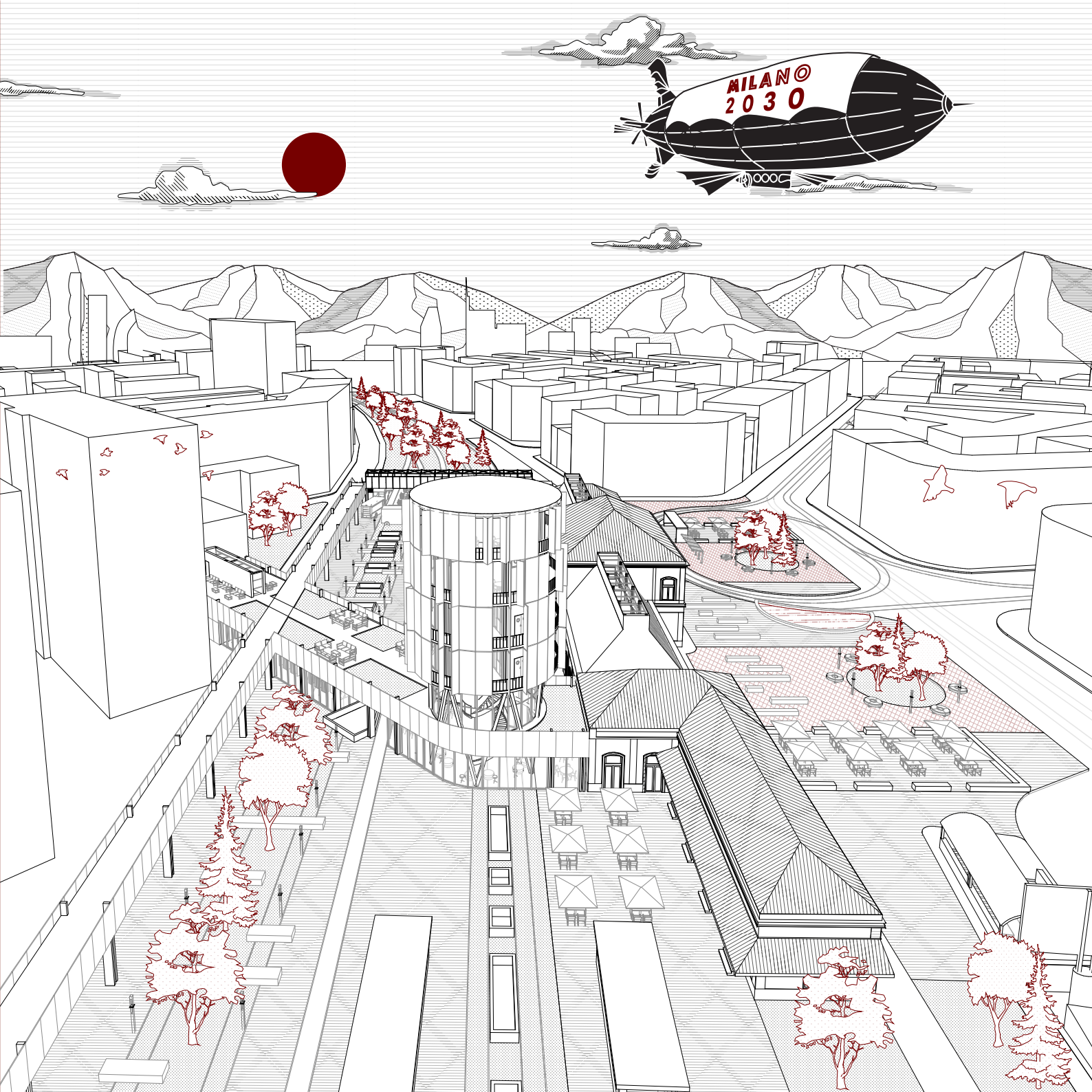


The station


MILANO
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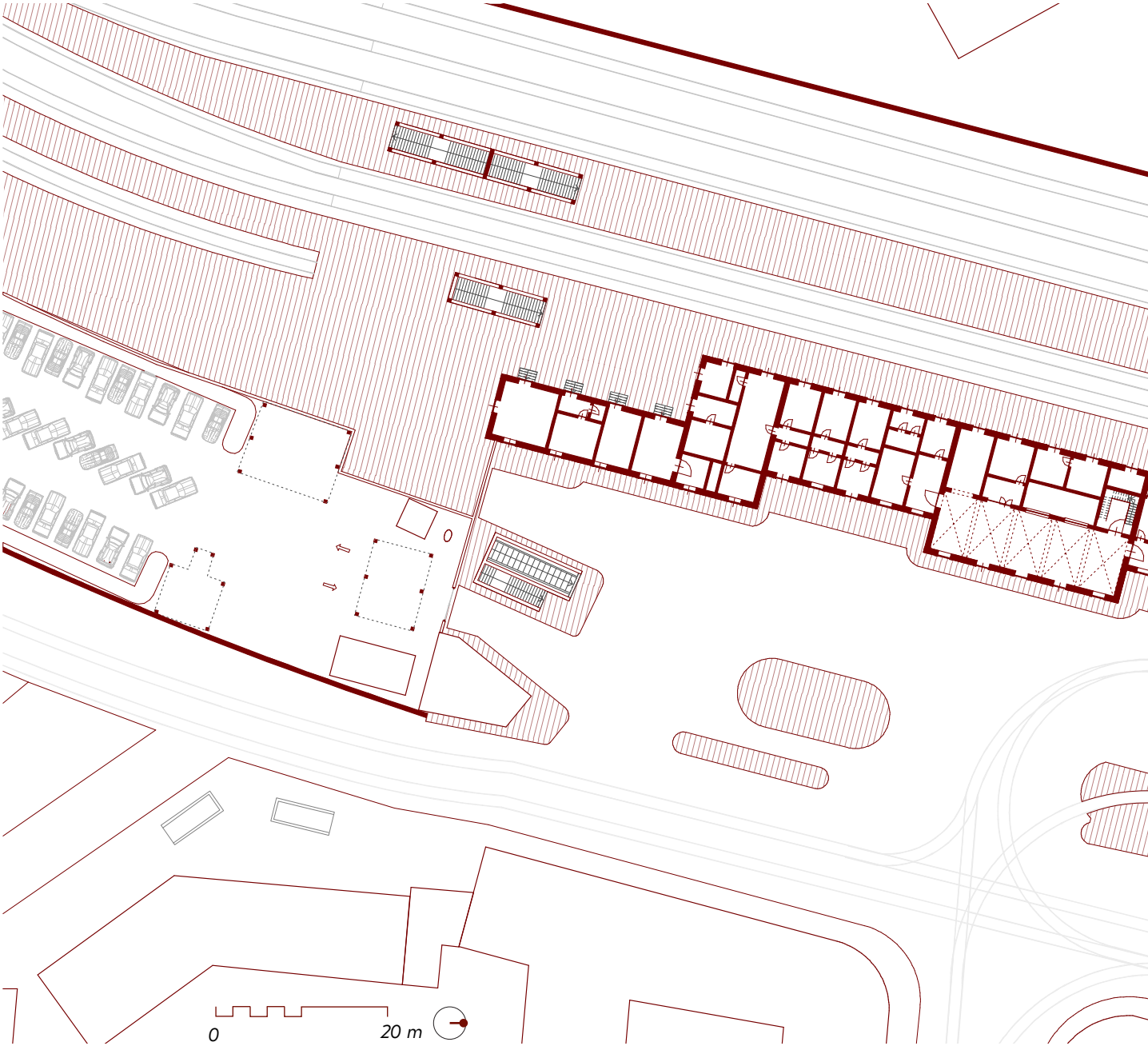
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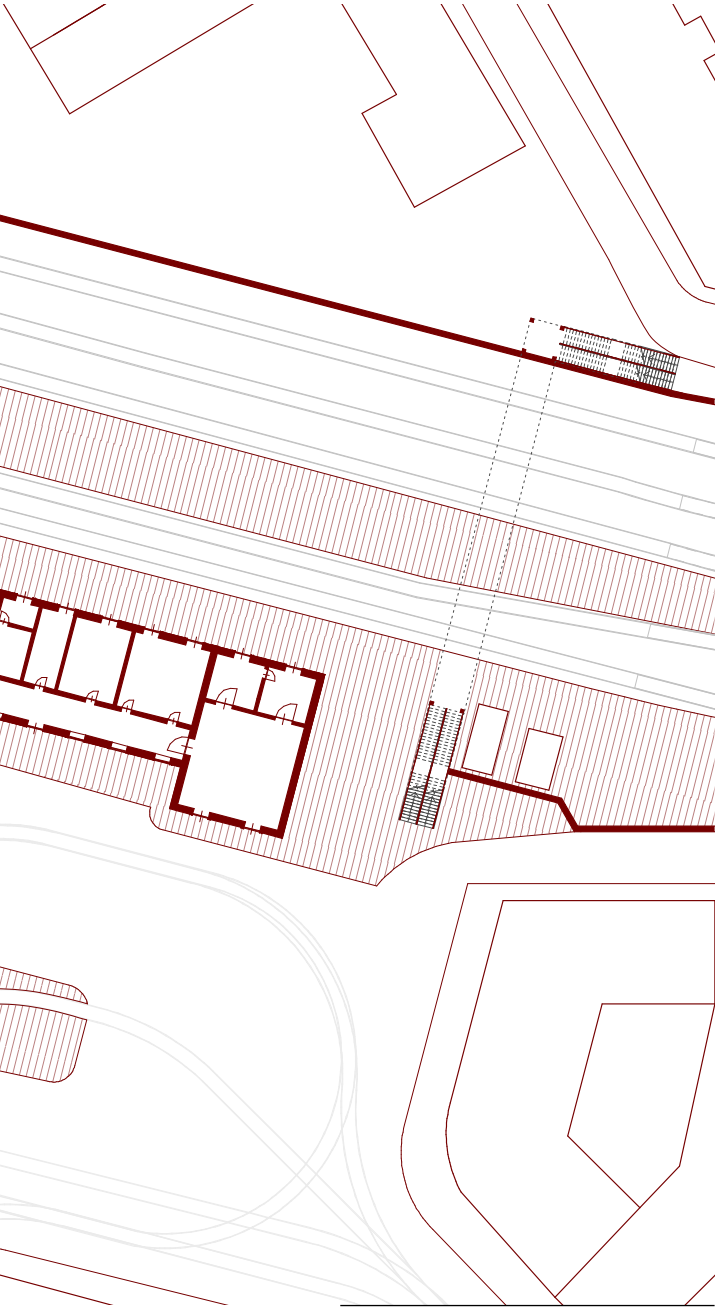


Ground floor plan of the state of art of the station of Porta Genova

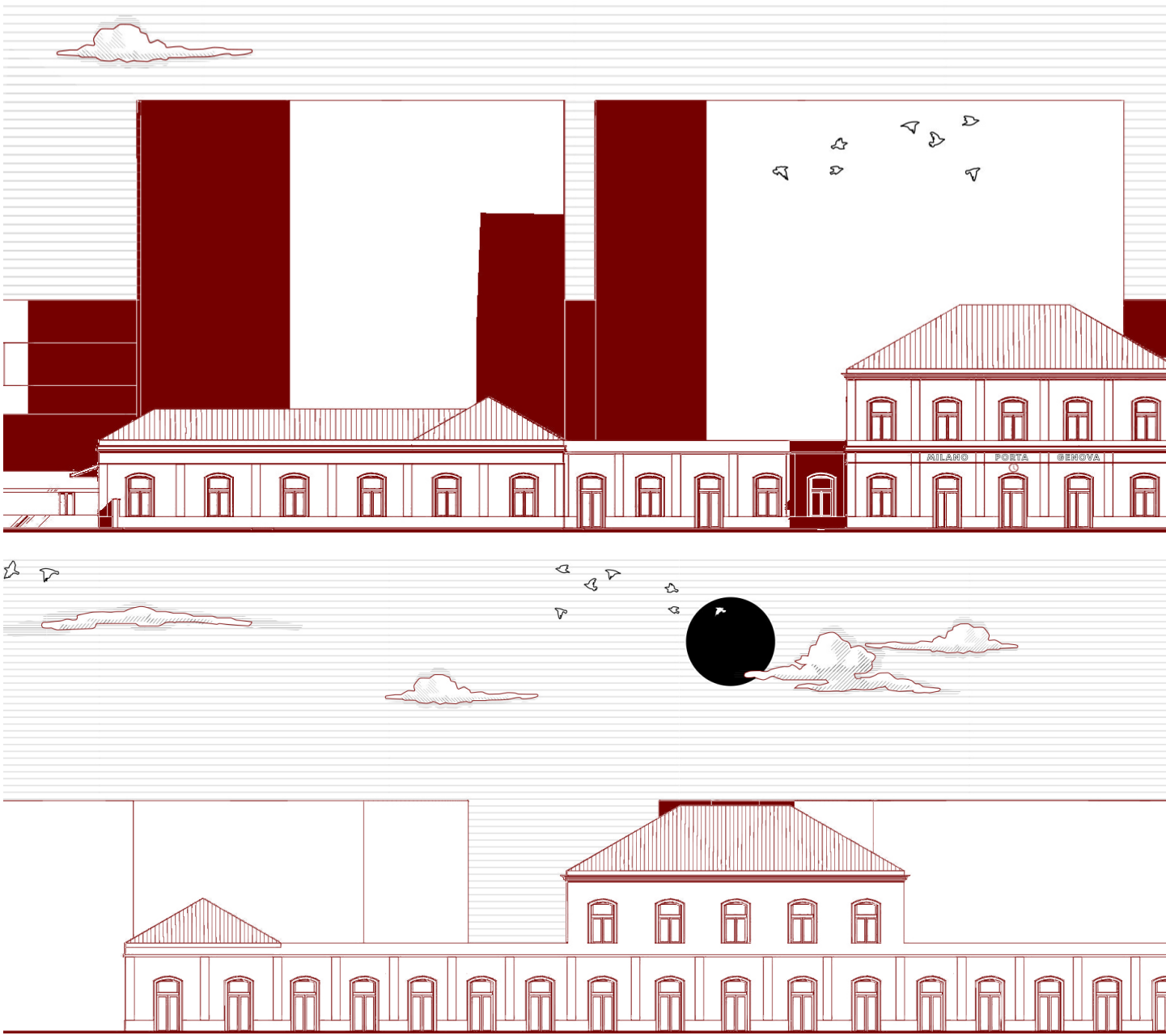
The station of Porta Genova

The former station of Porta Genova is divided into five main areas for a total of about 1115 m^2 on the ground level and 273 m^2 on the first floor. It is composed of a main building, which was constructed to integrate the new railway Milan-Vigevano, and a later addition. The construction of the first part began in 1865 and it was former known as Porta Ticinese until 1873. When it was opened in 1884 , it completed the railway belt. At the beginning of the 20th century a new southern part was added to increase the internal spaces.

The existing internal layout

The volume of the station is defined by three main buildings: a central double storey part and two single storey wings. The central building is the only one accessible to the public at the moment. It consists of a large hall, divided into five spans covered with polycentric barrel vaults, the ticket office and a small shop. From the sides of the main hall it is possible to reach the stairs for the second floor, which is also closed, and the railway.

The internal layout that is visible in this drawing is a relaboration of a typologi-


MILANO
PORTA
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0
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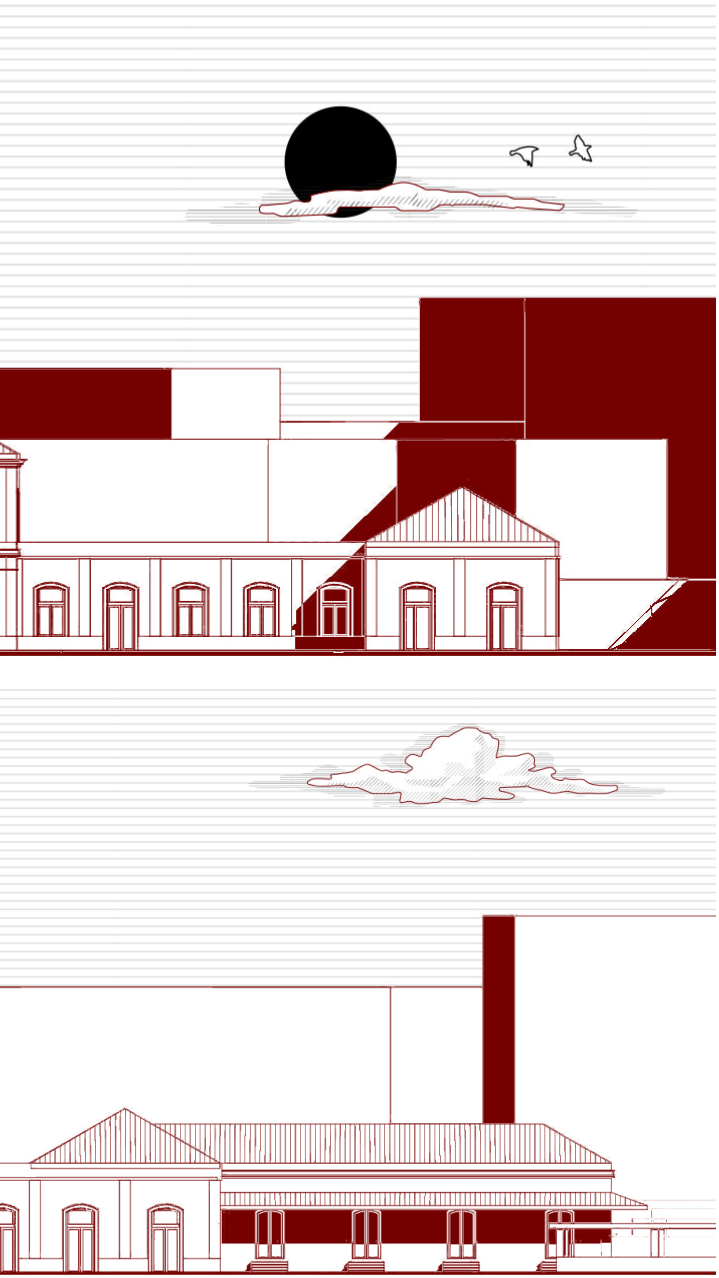


South and north elevation of the state of art of the station of Porta Genova

cal map from Motta et al.[1] and the result of a personal survey.

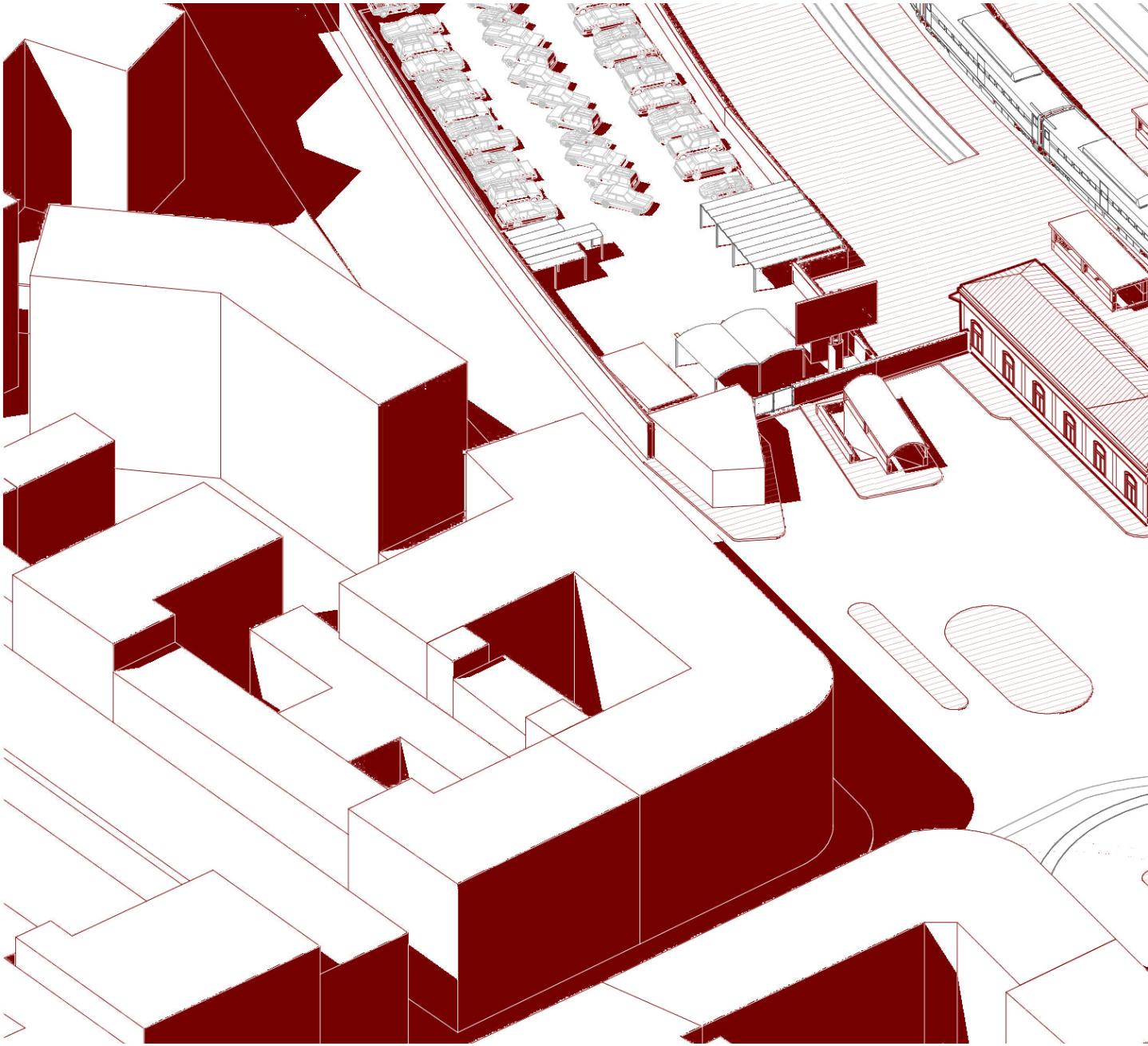
The external spaces

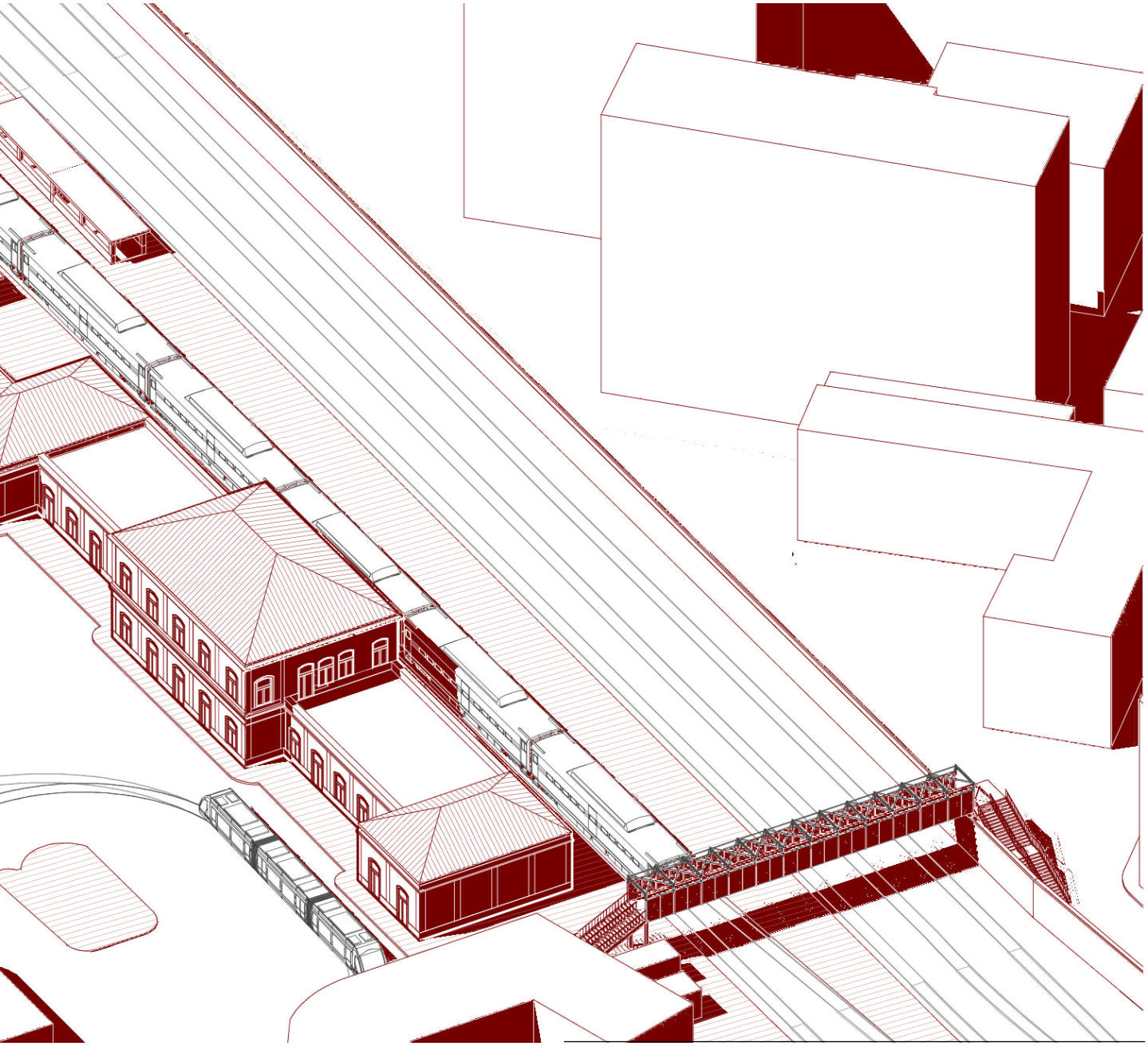
The station faces a public square, which is not entirely pedestrian. The metro station and the tram stop are important urban elements, as well as the rails that cross the square and define its shape. Since a few months ago, the square was almost entirely occupied by a parking for taxis, but in April the municipality transformed it into a temporary car-free space. The pavement has been painted in different colours and some urban furnitures have been added. Via Ventimiglia, which is directly connected to the square, has also become pedestrian.

The facade

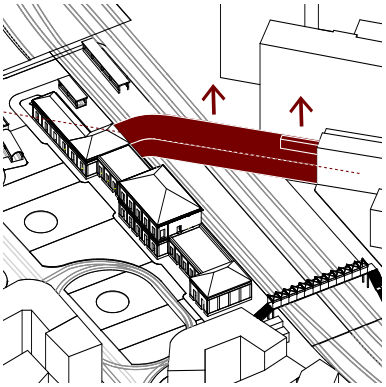
The station has an elegant and simple 19th century facade, which is strongly defined by the vertical rhythm of the pilasters. There are a few decorations, mostly concentrated on the pilasters and the frames of the windows. On the facade of the main building there is a clock and the name of the station. The facade on the railway is pretty much the same, but with less decorations.

1 *Motta, Pizzigoni (1991).*

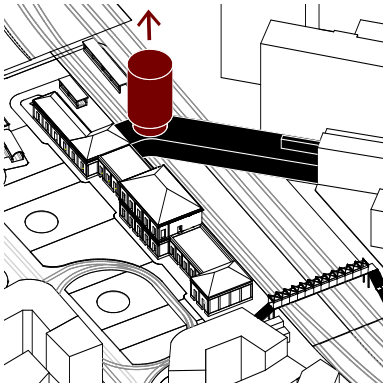




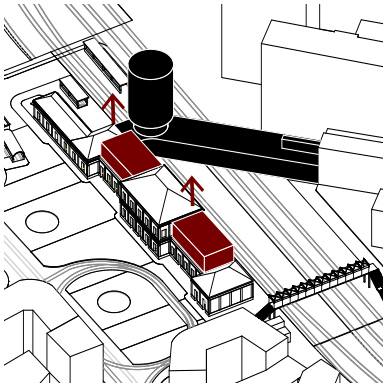
Axonometric drawing of the state of art of the station of Porta Genova.



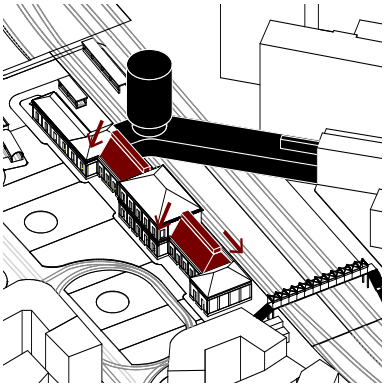
the new wing



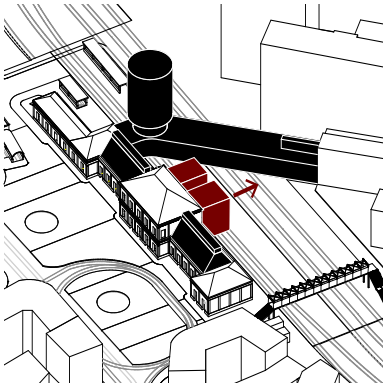
the culinary tower



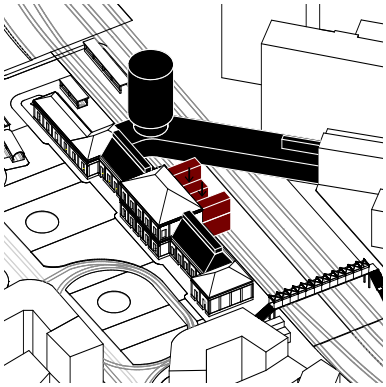
the superelevations



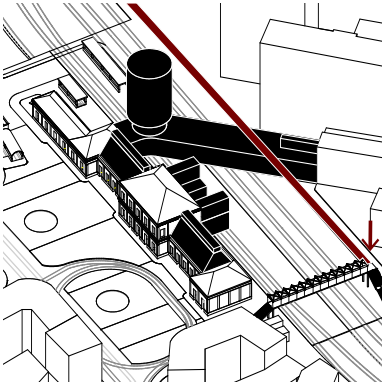
the new roofs



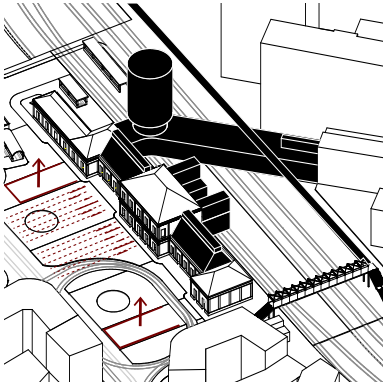
the circulation space



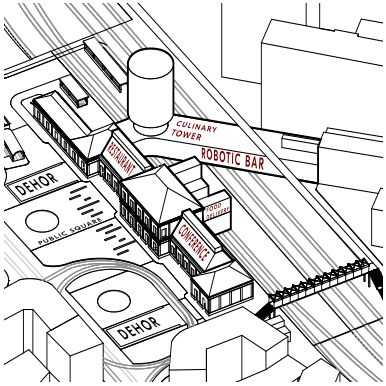
the terraces



the pedestrian bridge



the public sqaure



the new functions

The design intentions

The idea for the new station is to complement the original building with new functions related to innovative food administration activities. The project introduces therefore new buildings, while restoring and enhancing the existing one.

The volumetric concept

From the morphological urban analysis and the surveys, it emerged clearly that the surrounding are has a culinary vocation. In particular, the close pedestrian area of via Casale and the Navigliо banks are, in fact, occupied by a continuous sequence of bars, inns and restaurants.

The project wants to follow the axis of this existing street, to create a new wing for the station. This new branch will connect the southern part of the historic station with the blind facade of an existing building in via Tortona. It is symbolical here the fact that the latter hosts the 'Osteria del binari', which reconnects with the new function of the station. A second smaller volume emerges from the new building to give access to the green roof.

This new building integrates in the morphology of the place by following two main directions: the one of the existing wing of the station and the one given by via Casale and the Navigli area.

A cylindrical tower is positioned at the intersection point of these two directions. The tower emerges from the single storey building below it, which becomes its basement, as an industrial silos, supported by big diagonal trusses. This new volume enhances the vertical rhythm of the facade and represents a new landmark for the station. It becomes also the perspective focal point from via Casale.

The flat roof of the two buildings, which connect the three main corps of the station, is covered by two new superelevations. Inspired by Sant'Elia's drawings and the existing buildings, these volumes are shaped like unique sloping roofs with a long skylight on top. Given the close presence of the industrial district of Tortona, the design of these buildings recalls the industrial sheds and it is the connection point with the other parts of the project.

Another addition is built on the back of the station, where the facade is not regulated. These volumes perfectly come out of the building, aligned to the pilasters of the facade.

The green iron bridge is also restored

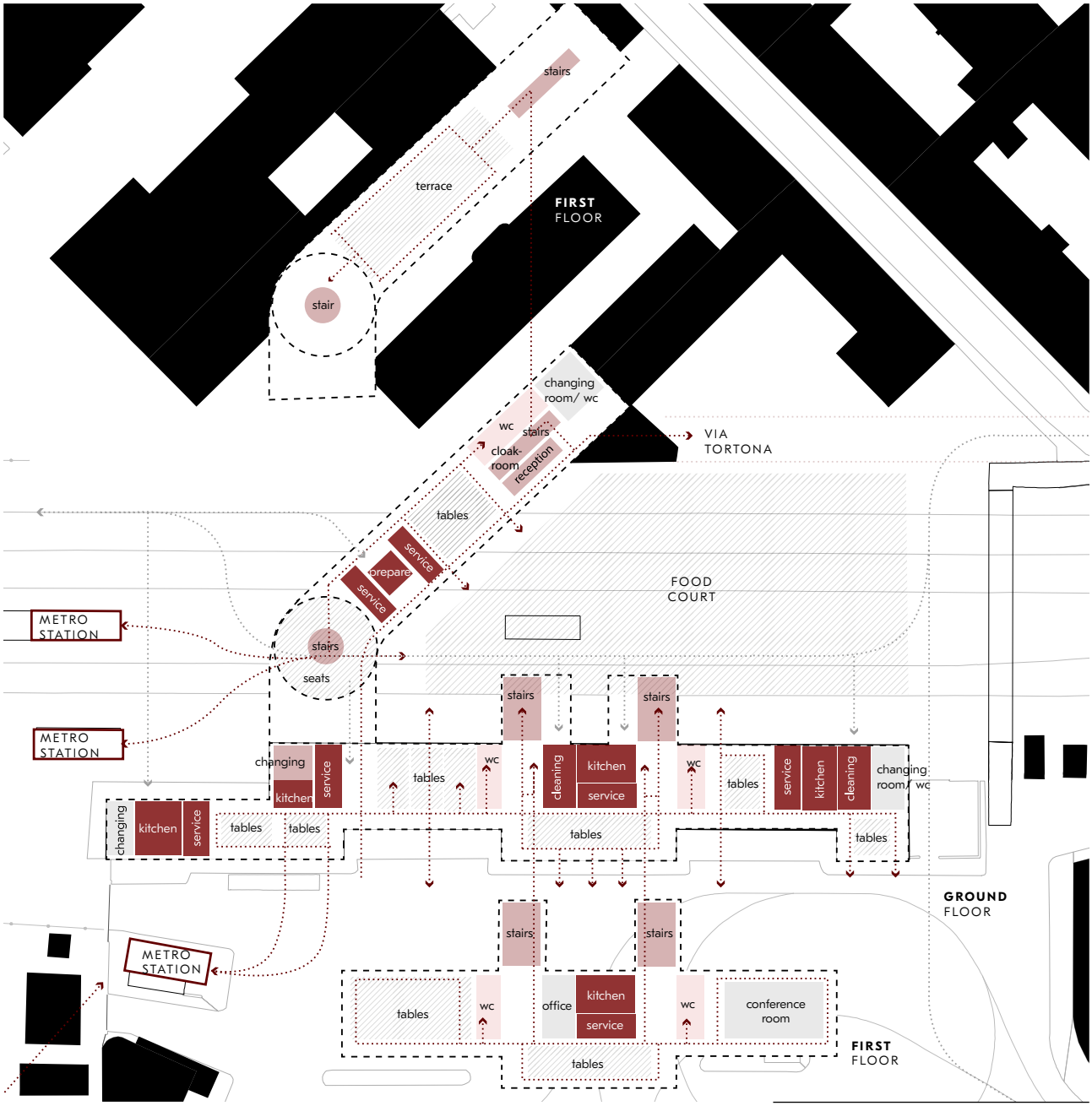


Diagram showing the metaproject for the former station

and connected to a new pedestrian and cycling passage, which crosses the new southern wing of the station and goes to the entrance of the market. The idea of this bridge is to enhance the memory of the railway, by creating an elevated rail which follows the same path.

The square in front of the station is also redesigned to become a complete pedestrian area and complement the internal functions of the building. The space behind the station is also transformed into a food courtyard, with green and public spaces.

The new layout

As the meta-project in the figure shows, the internal layout of the station is reorganized and new functions are inserted. The technical details of the architectural interventions will be explained in the following paragraphs. The existing volumetric subdivision is respected also in the new functions. The three main corps of the station host the kitchens. The hall and the connecting buildings are transformed into the main areas of food consumption with tables and counters.

The addition to the central building host the main circulation spaces and the innovative robotic delivery system. The stairs lead to the first floor, where there is a a control office and a fourth kitchen, connected to the main one at the ground level. The superelevations accommodate another consumption area on one side and a flexible conference room on the other.

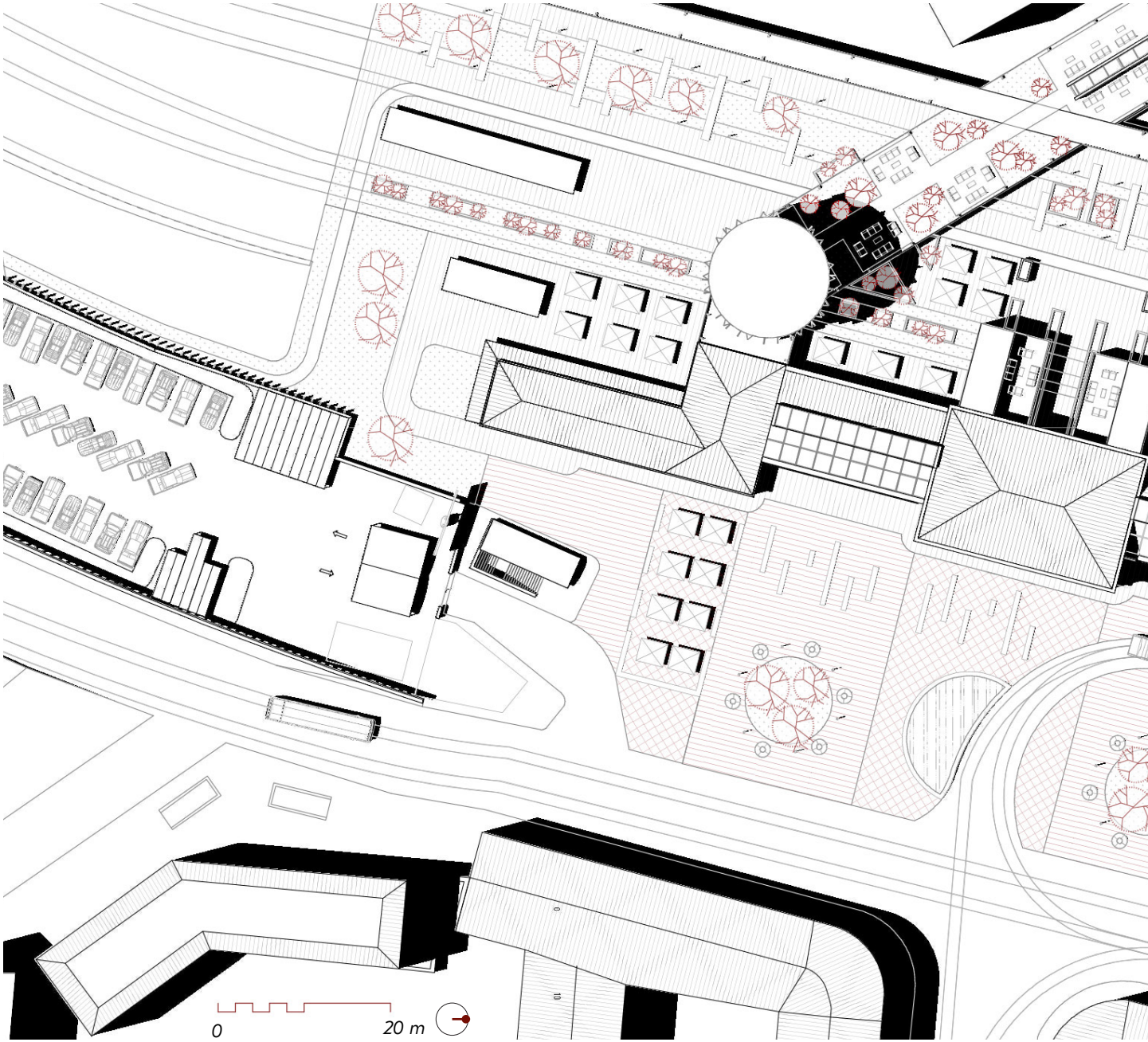
The 20th century building sleeve is occupied by a pastry laboratory with a private space with tables.

The new southern wing accommodates an innovative cocktail bar and it is connected with the green roof above it through the tower or the circulation volume.

The culinary tower hosts different functions. Starting from its base there is a more informal space connected with the bar, then going up, there are different restaurants with a panoramic view on the city. On the first two floors there is also a kitchen, while the other two are served through a dumbwaiter.

The urban connections

The main accesses are placed in close proximity to the metro station exits. Via Tortona is also extended till the new wing of the station. This new way grants access for the customers who come from the Tortona (red line), as well as an easy way for the goods to be delivered (grey line).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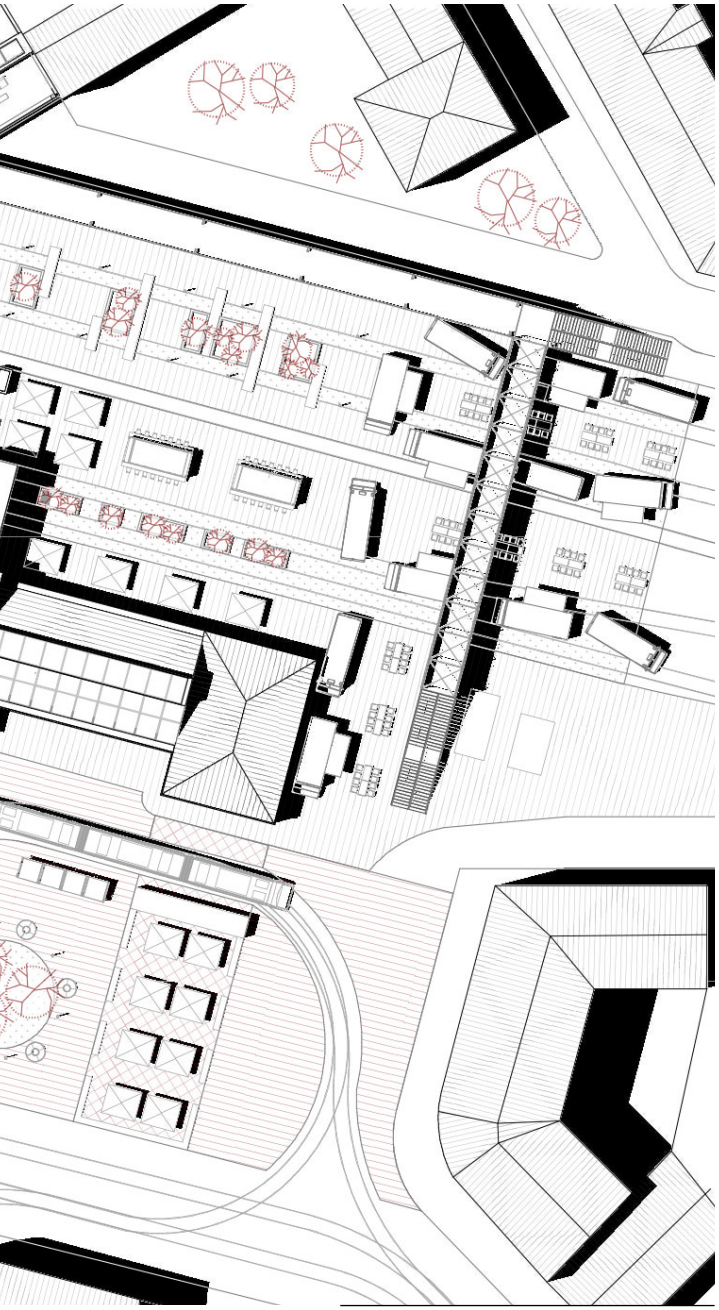


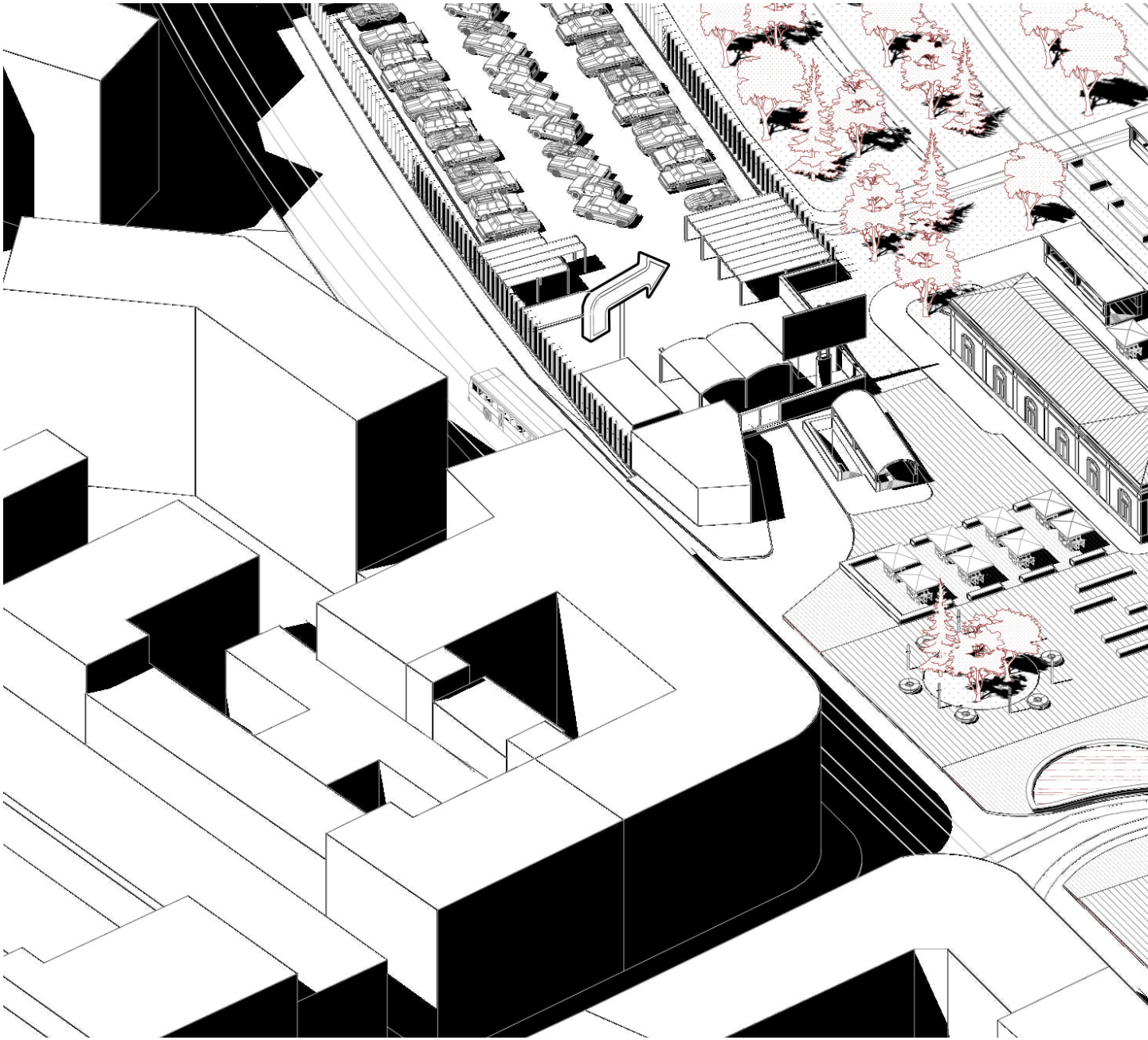
Roof plan of project for the former station of Porta Genova

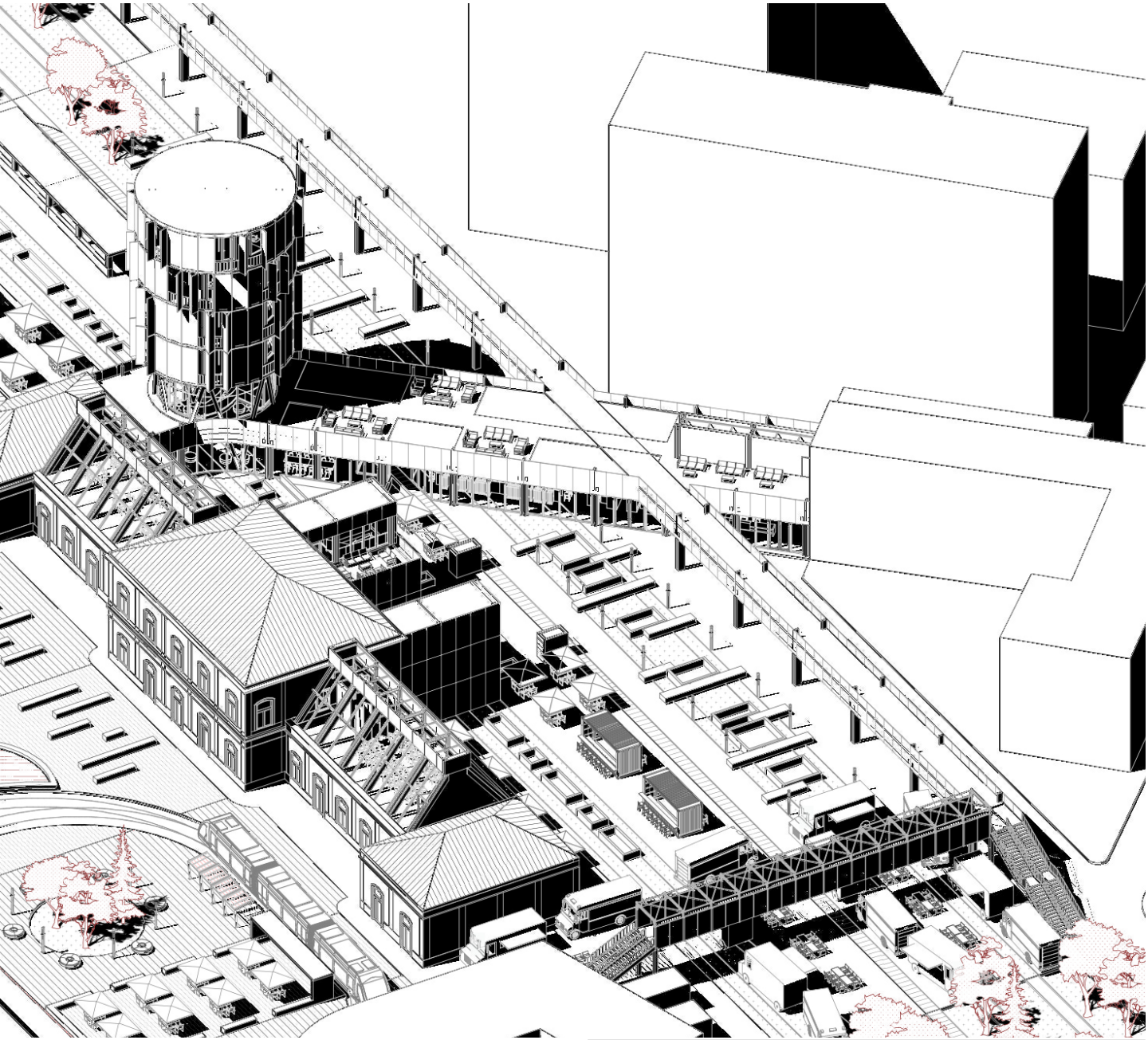
The external areas

As the adjacent planivolumetric plan shows, the project has involved also the redesign of the public space around the station. The design approach that I followed tried to shape the space without considering the existing constraints (parking areas, rails, bridge...), instead of letting those elements generate the morphological rules.

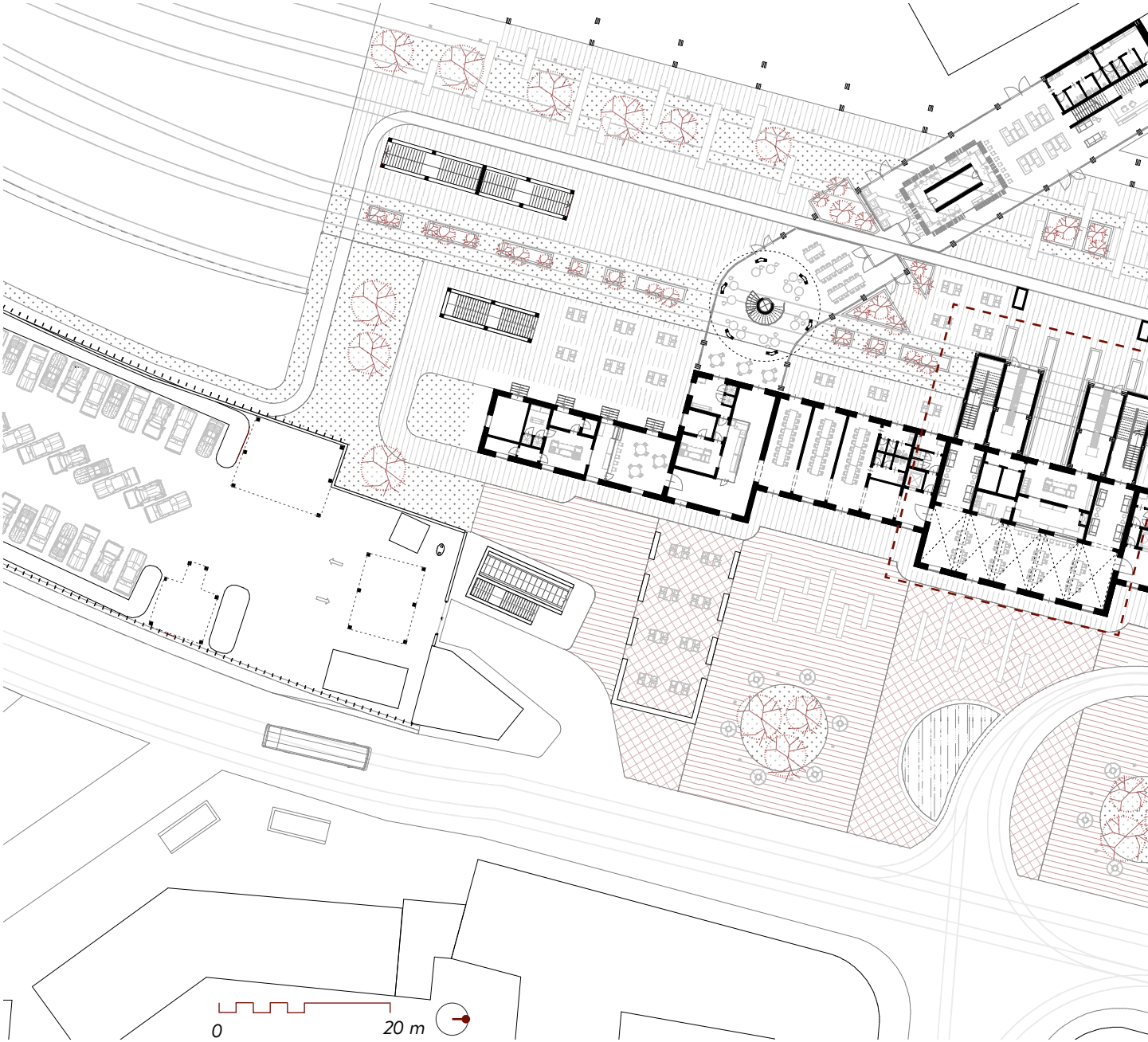
As already mentioned briefly above, the square of Porta Genova is redesigned as a full pedestrian area. The space is divided in seven portions, which follow the division of the volumes of the building. These areas are covered with different pavements and host different functions. Starting from the left, the first one and the sixth one accommodate the space for exterior tables. They are surrounded by benches to ideally recreate a two-dimensional extension to the historic building, in the same way in which the new additions in the back do in three dimensions. The other spaces are occupied by a central semicircular fountain and two circular hoods, which recall the circularity of the tower, using also the same diameter. The benches are also designed to echo the railway.

The backyard of the station is the food





Axonometry of the project for the former station of Porta Genova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Ground floor plan of the project for the former station of Porta Genova

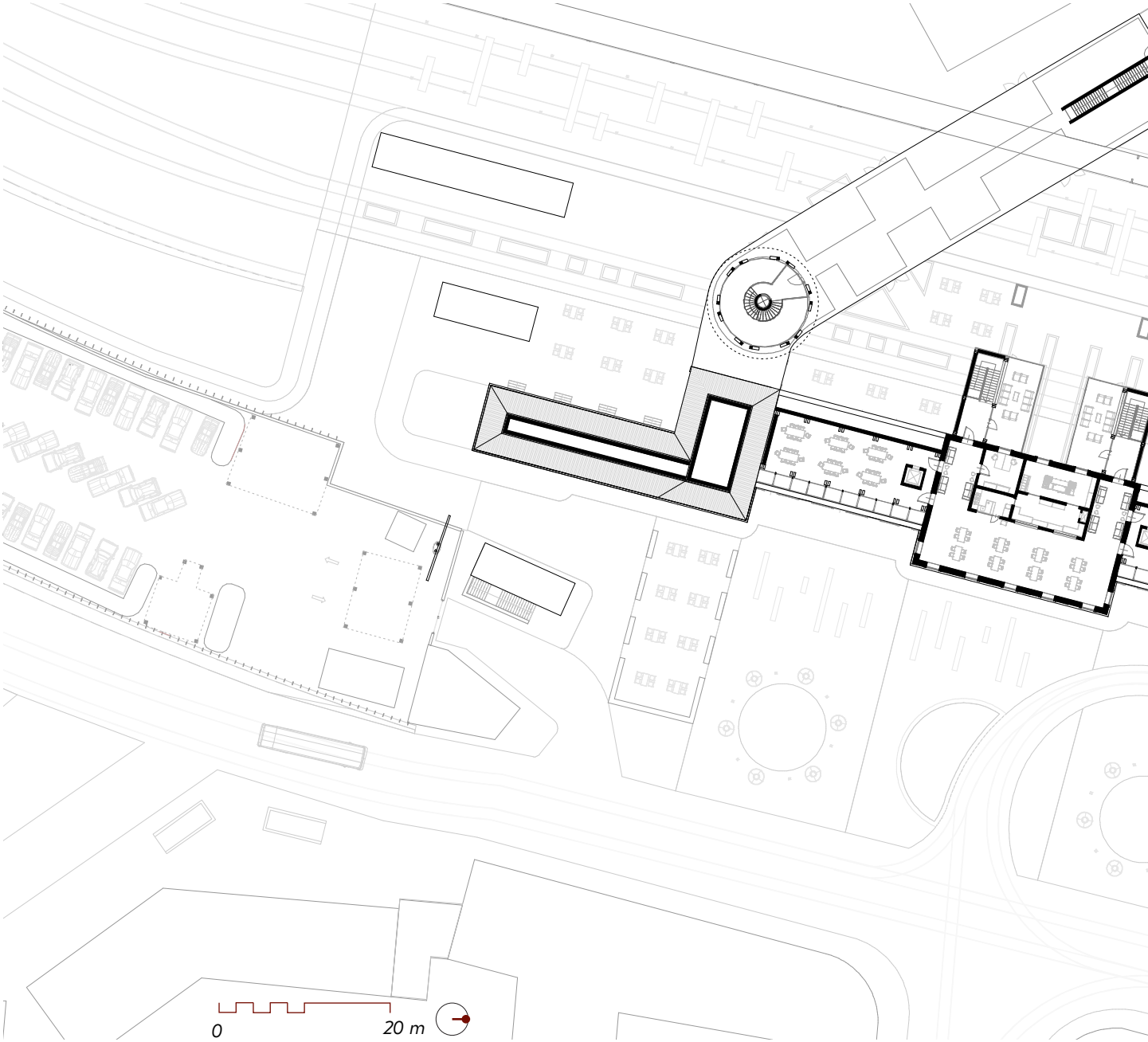
courtyard. The backbone of this space is represented by the cycle lane. It starts from an existing line in via Solari and then follows the trace of the rail. On the side of the cycle lane there are two small cabinets that can be used by private customers to order food or by food riders to take the deliveries. The cycle track then goes through the new building and continues inside the park.

The cycle lane also divides the external areas in two parts. The upper part is more public and connected to the park, while the lower one hosts tables, bars and gardens which are related to the restaurants. The space below the iron bridge is dedicated to street food trades and therefore more flexible and with less furnitures.

The ground floor

Given the lack of historic plans of the station and the existing layout of the spaces, I assumed a load-bearing walls structure. The masonry structural elements, transversal to the square, define also the internal rooms. Most of the internal non-structural partitions are demolished to have bigger spaces.

Most of the activities are concentrated in the main hall, where the former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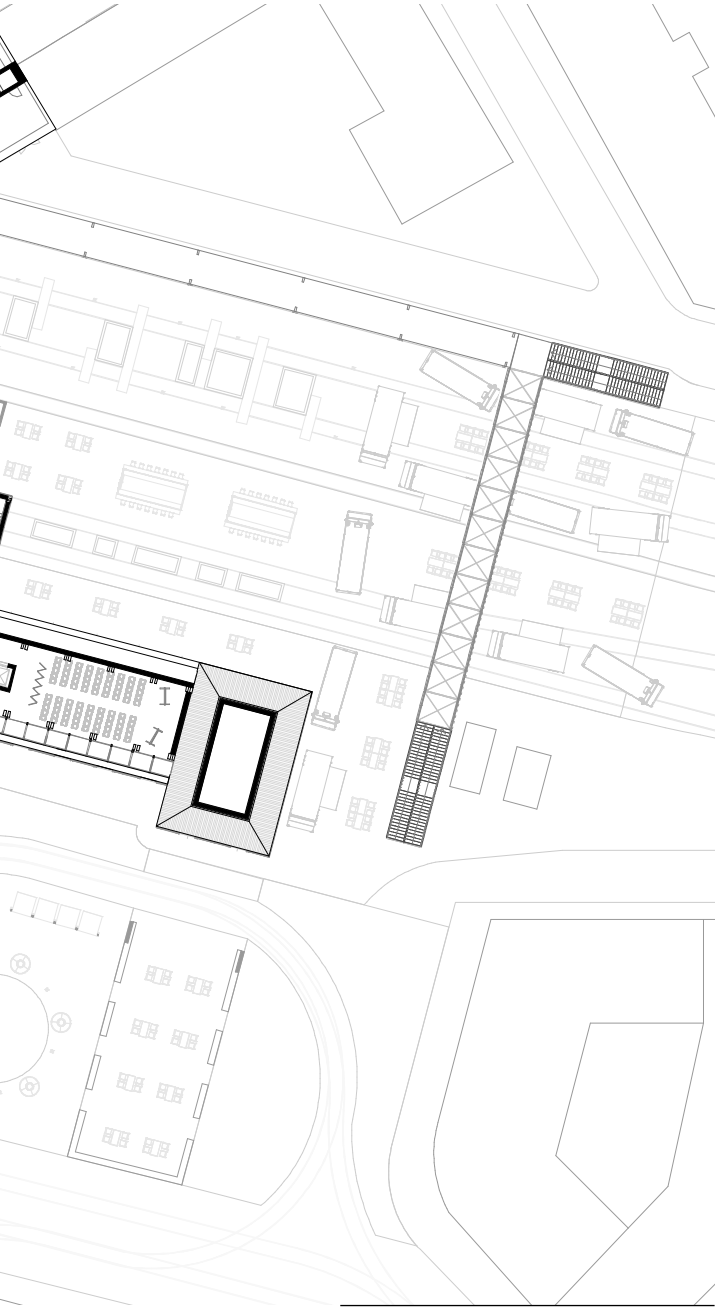


First floor plan of the project for the former station of Porta Genova

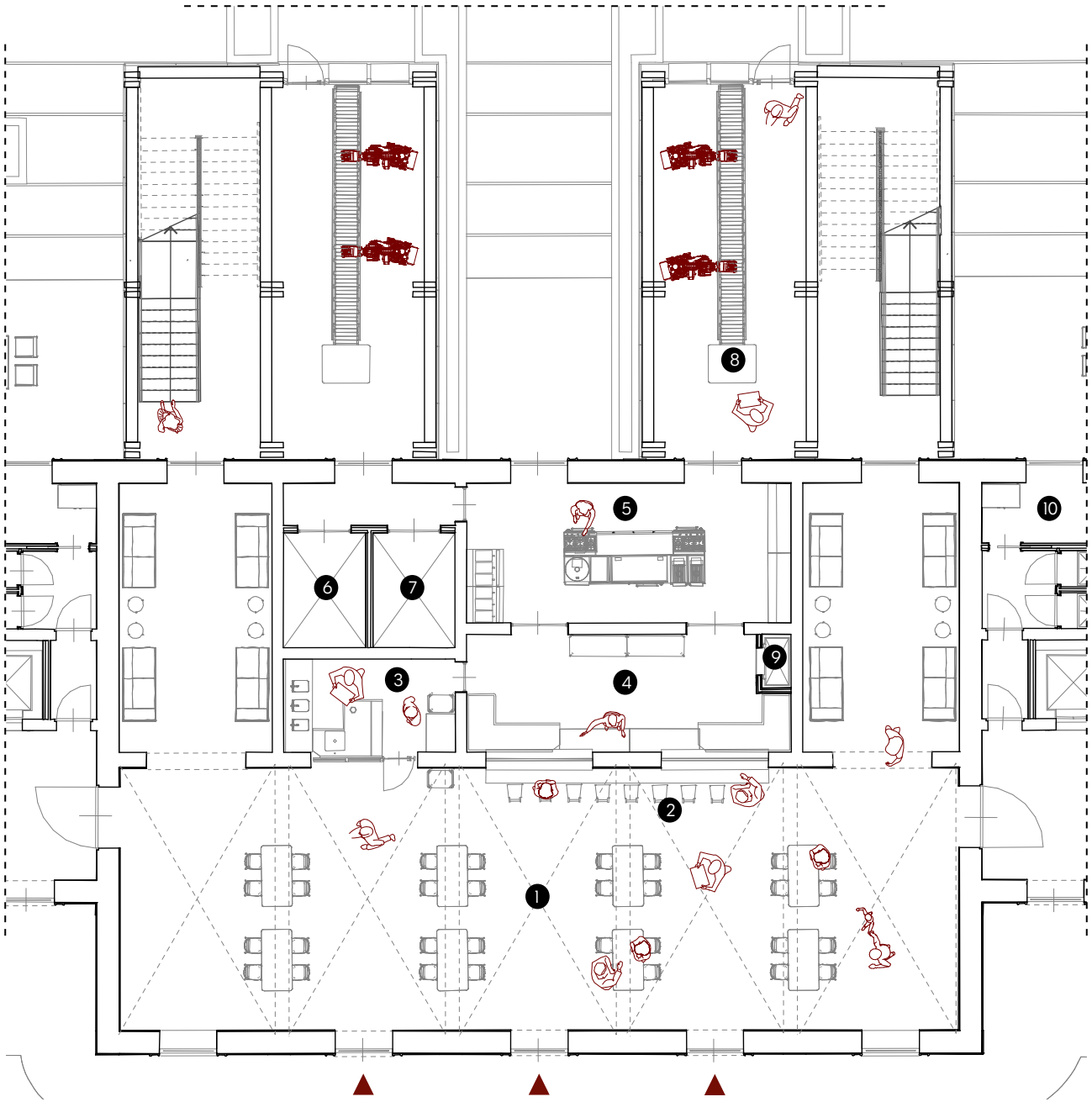
ticket office is transformed into a kitchen. Where once people bought tickets to travel, it is now possible to buy food.

The two side buildings are organized along a main corridor and accommodate tables, toilets and the elevators for the superelevations. The north building hosts a different kind of kitchen with a more private room for guests. The south corp is occupied by a smaller kitchen and the pastry.

From this nodal part it is possible to reach the other new branch of the station, which hosts the cocktail bar. The space is divided into four main areas. The first one is the more informal one, with sofas and small tables around the spiral staircase that leads to the tower. The second one is the social space with longer tables where people can gather together to study or eat. The third part is the cocktail bar, with a specific design that fits in the wooden structure and it is completely circular. The last part is the real entrance to this part of the building, with the reception, the toilets, the cloakroom, the changing rooms and the stairs to go to the green roof.

The first floor

The green roof accommodates also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some other tables and sofas, while providing a complete view on the park and the market. This terrace is accessible from both the entrance of the cocktail bar and from the tower, with the stairs or the elevator.

The rest of the first floor can be reached from the main hall. The new stairs lead to two corridors, from where it is possible to go either to the external terraces or the management office. The rest of the floor is occupied by another kitchen, directly connected to the main one at ground floor thanks to a dumbwaiter. The southern superelevation hosts a large dining room space with a panoramic view on the district of Porta Genova, while the northern one accommodates a flexible space for conferences, events or meetings.

1 *Dining hall*
2 *Food counter*
3 *Cleaning area*
4 *Food preparation space*
5 *Kitchen*
6 *Cold rooms*
7 *Waste collection room*
8 *Robotic delivery system*
9 *Dumbwaiter*
10 *Changing rooms*

Detail of the ground floor plan of the station

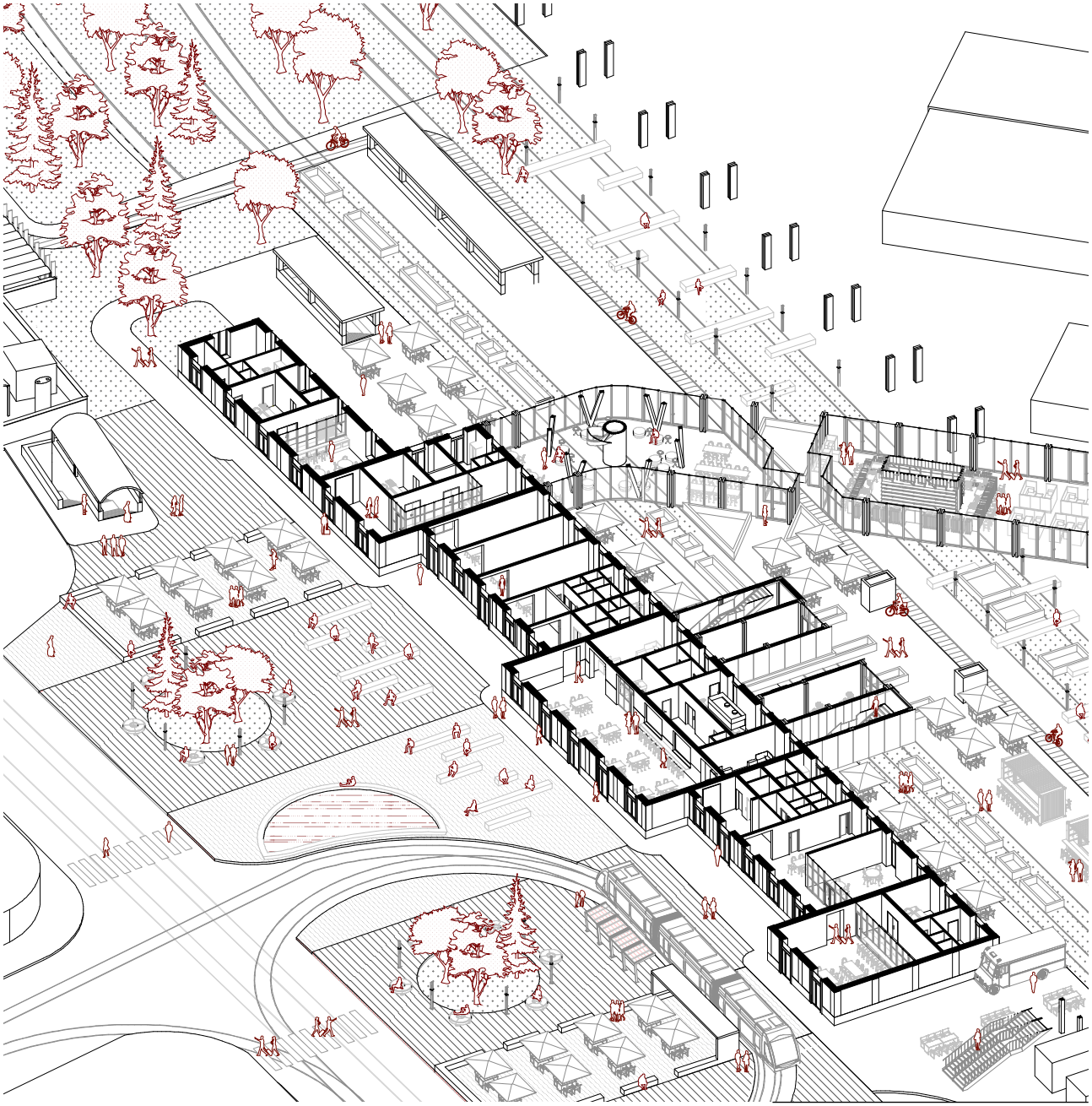
The kitchen

The detailed plan illustrates the internal layout of the main hall kitchen. The organization and the dimension of the spaces has been designed according to the current Italian regulations[1]. The normative requires:

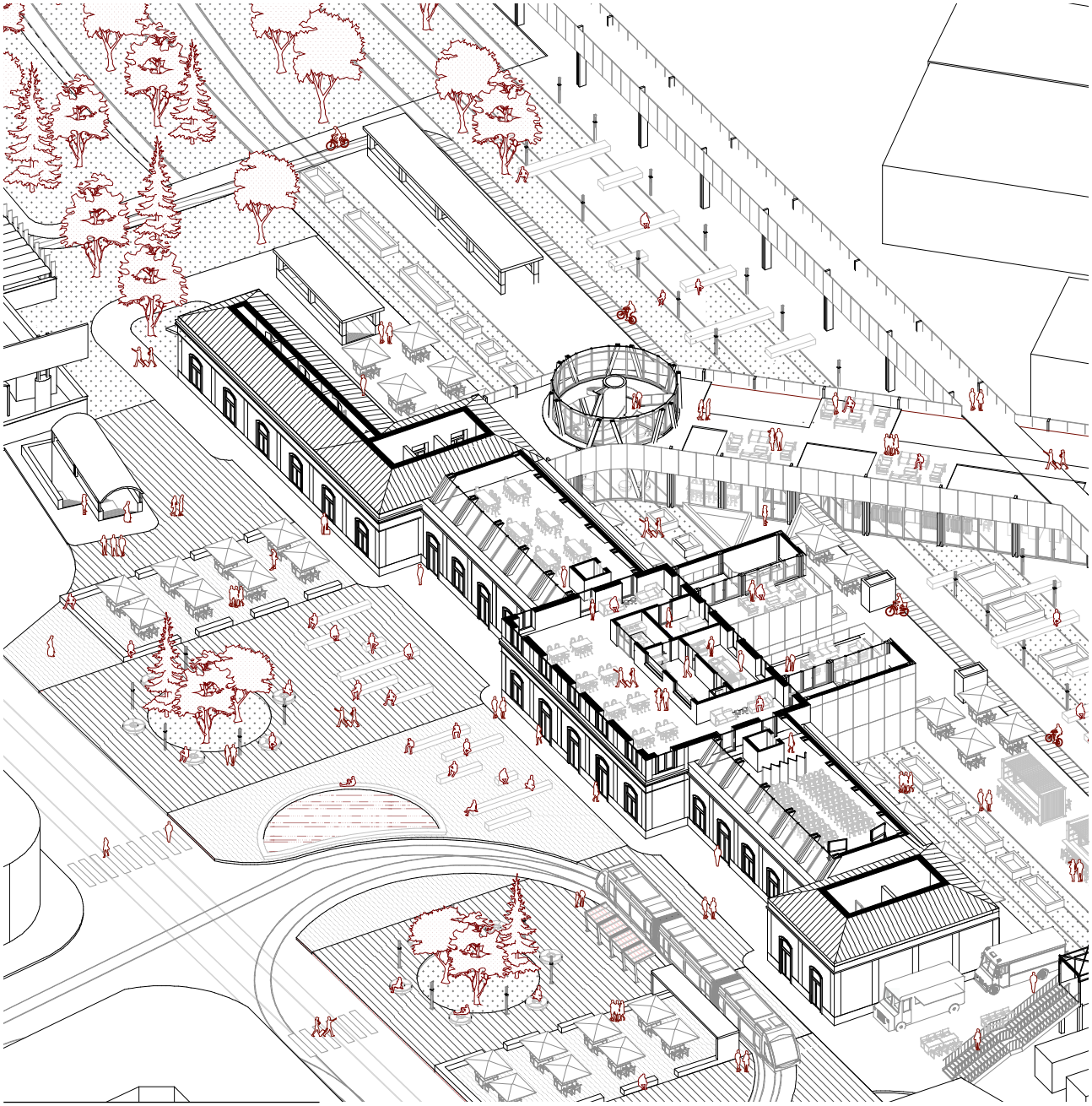
» goods storage and cold storage area;
» spaces for food preparation or processing;
» food cooking environments;
» spaces for washing dishes;
» filter spaces for organizing the service at the tables;
» spaces for the collection and removal of solid waste;
» rooms for toilets and staff changing rooms;
» an office for coordination of the activity.

According to these requirements, the food processing area is divided into four main spaces. Its disposition is designed to favour working flows, respect hygienic requirements, and improve efficiency. The kitchens are almost all glazed to allow customers to see the food preparation process, therefore implement proper ventilation systems and filters. The windows reflect an industrial style, which

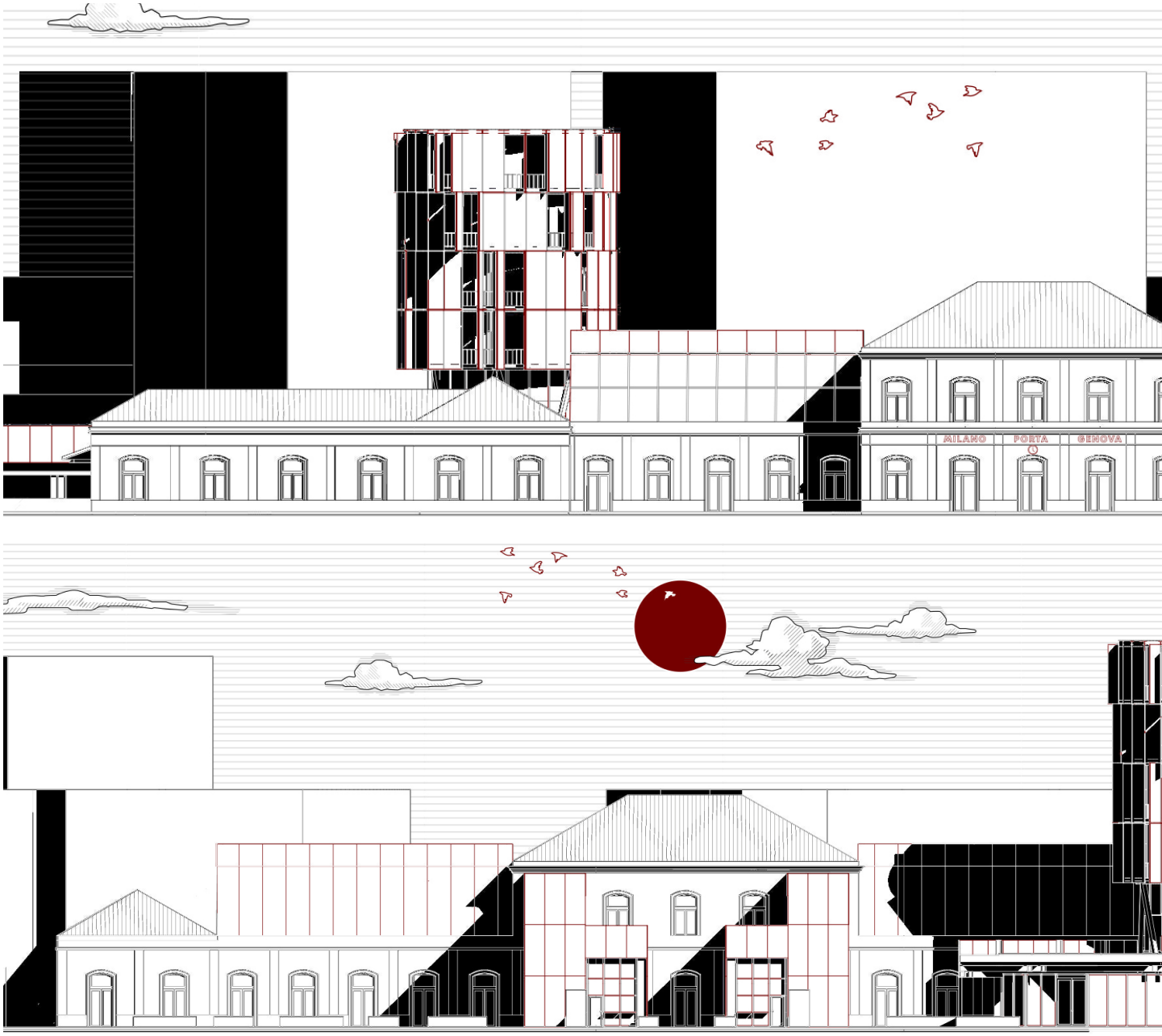
1 Legge 30 marzo 1962, n.283, DPR del 26 marzo 1980, n.327, Circolare n.8242/183 del 5 aprile 1979.



Axonometric cross section of the ground floor of the station



Axonometric cross section of the first floor of the station



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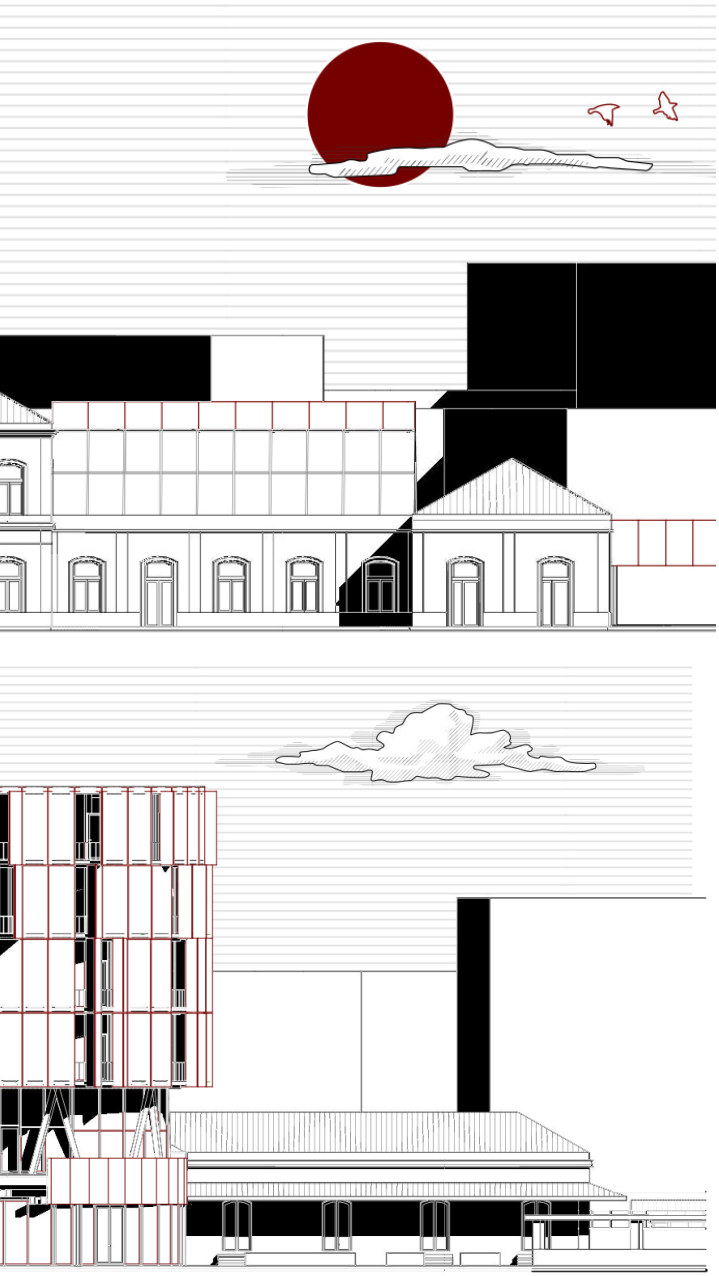


North and south elevation of the project for the station

reminds of the former function of the place.

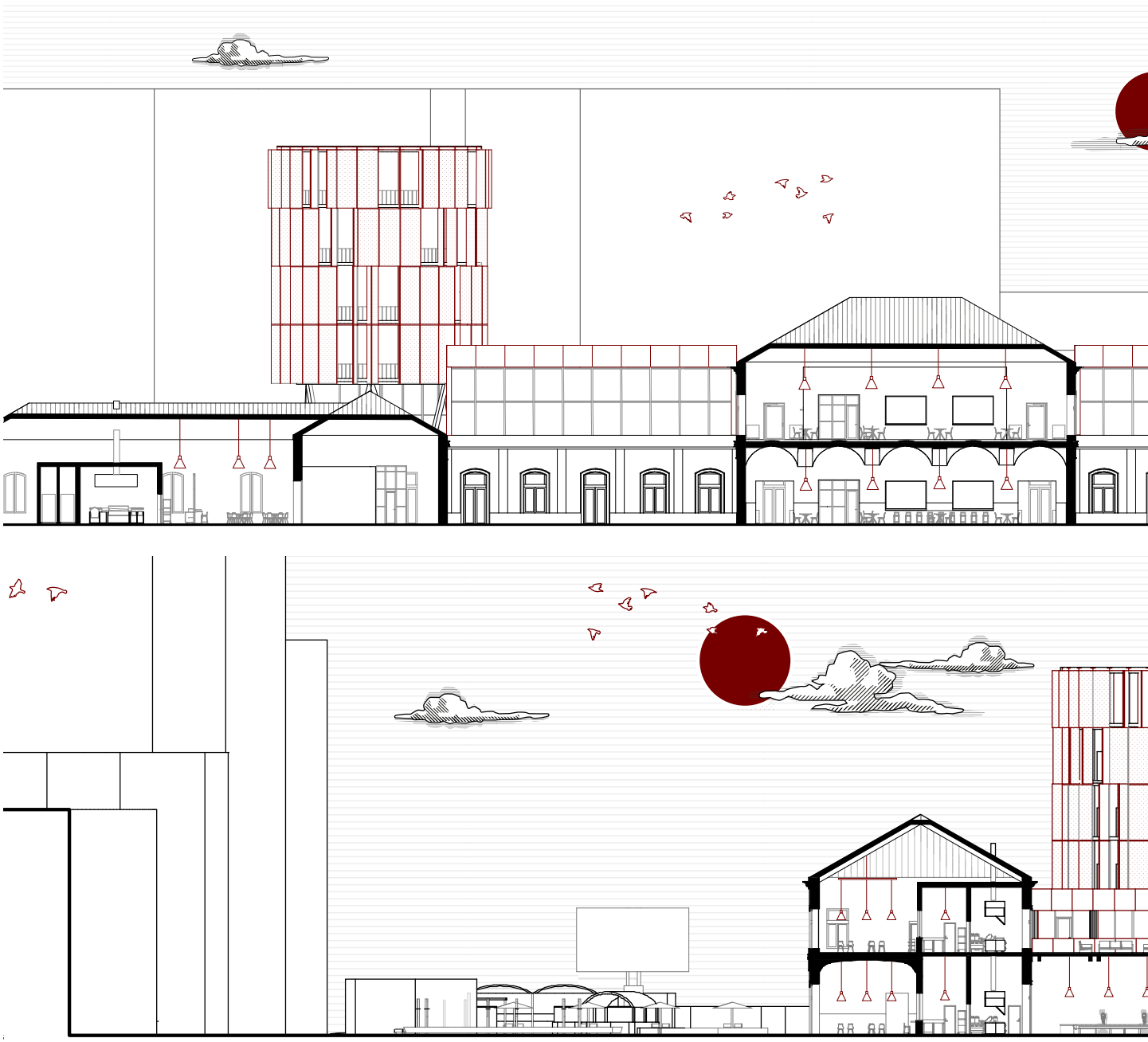
The robotic delivery system

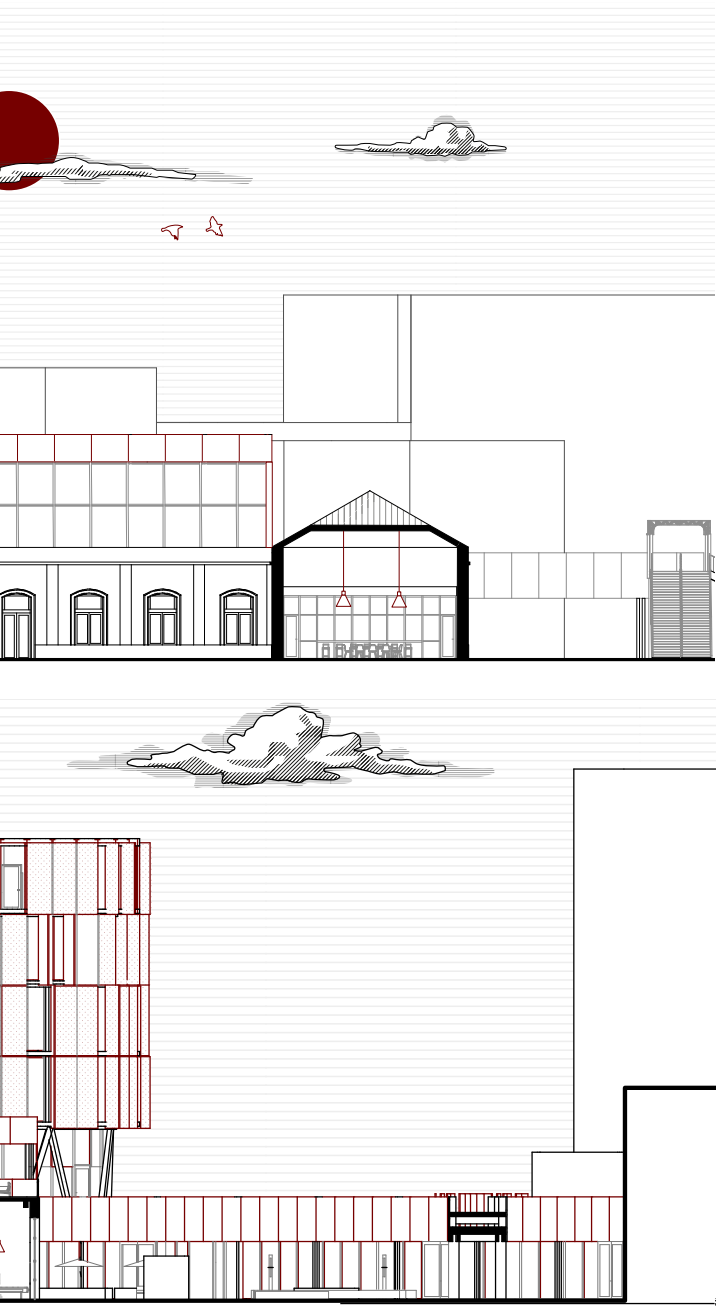
This innovative space is designed to answer to the new fast-changing food habits and the rapid diffusing home delivery service. The kitchen is directly connected to the cycle lane, from where it receives orders. The food is prepared, then sent to the robotic conveyor rollers, where it is packed and delivered to the food riders or the clients. Reinterpreting the drive-in a more sustainable way, these space transforms the station in an important node of a future food network, which might involve the other yards and increasingly the entire city of Milan.

The integration of the new buildings with the historic facade

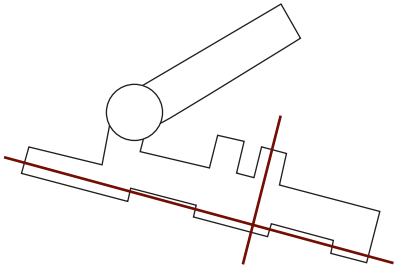
The new addition to the station are well integrated and carefully designed to respect its historic value.

The most evident and recurrent decorative element of the plastered facade is the pilaster, which gives vertical rhythm to the elevation. The new buildings replicate the same architectural language


0
20 m



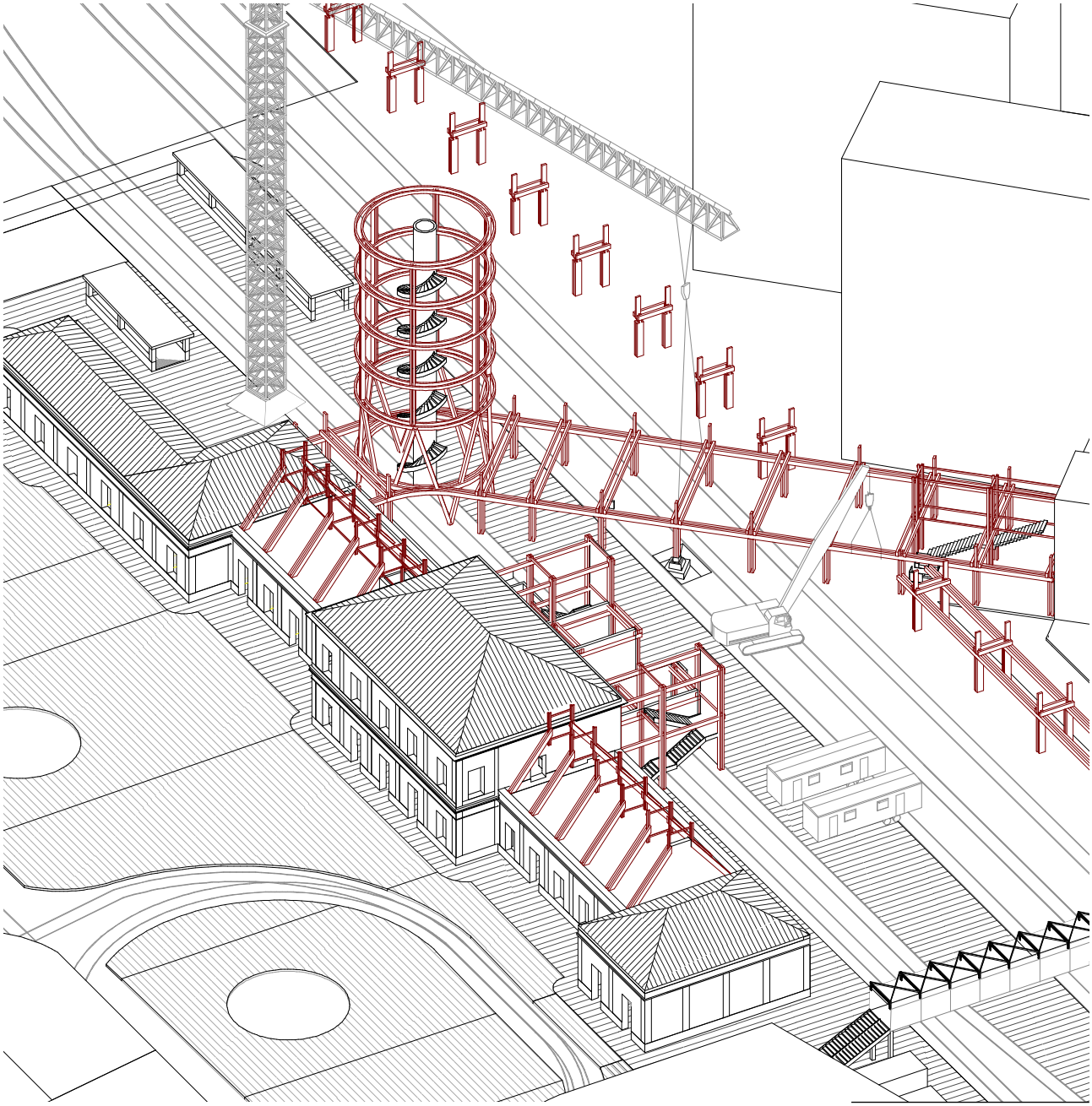
Longitudinal and transversal of the project for the station



by implementing vertical multi-layered bio-composite panels. The entire project seeks to respect sustainability and circularity, which reflects also in the implementation of bio-based or recycled materials.

The superelevations have two opposite faces. The facade towards the square is transparent to grant the view on the city and show the wooden structure below. The latter is aligned to the pilasters to give a sense of continuity and integration with the existing part. The facade towards the food court is, instead, completely covered with a grid of bio-composite panels. The blindness of the wall highlights the volumetric quality of the roof.

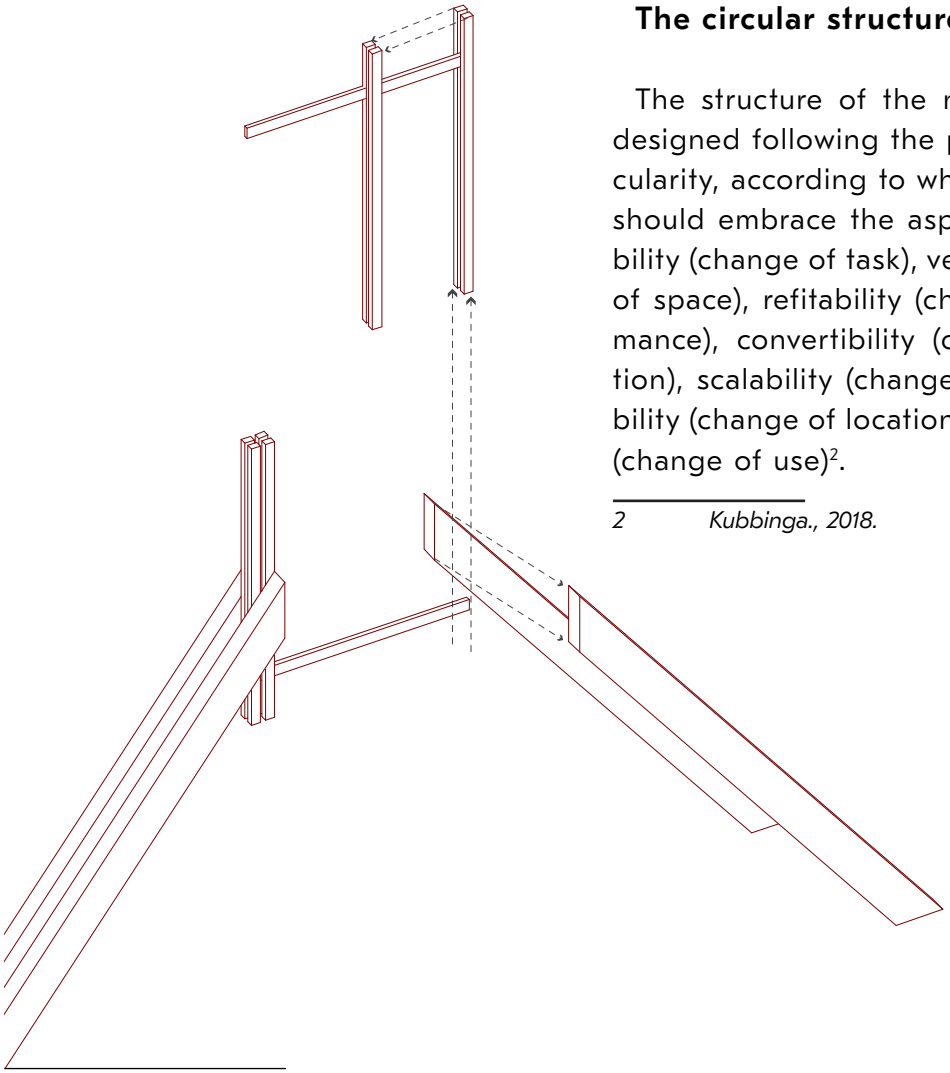
The tower implements a double facade. The internal envelope is completely transparent to make the volume disappear, while the external surface is covered with sliding and folding perforated bio-composite panels. Between the two surfaces there is a buffer space



Axonometry of the structure of the station

which allows air circulation and heat control, while also providing an open terrace for the restaurants. The basement of the tower and the southern wing are both strongly defined by the wooden structure and the glazed curtain wall.

The external walls of the back buildings are mostly blind, except for the facades towards the internal courtyard which are glazed.



Axonometric detail of the structure of the roof

The circular structure

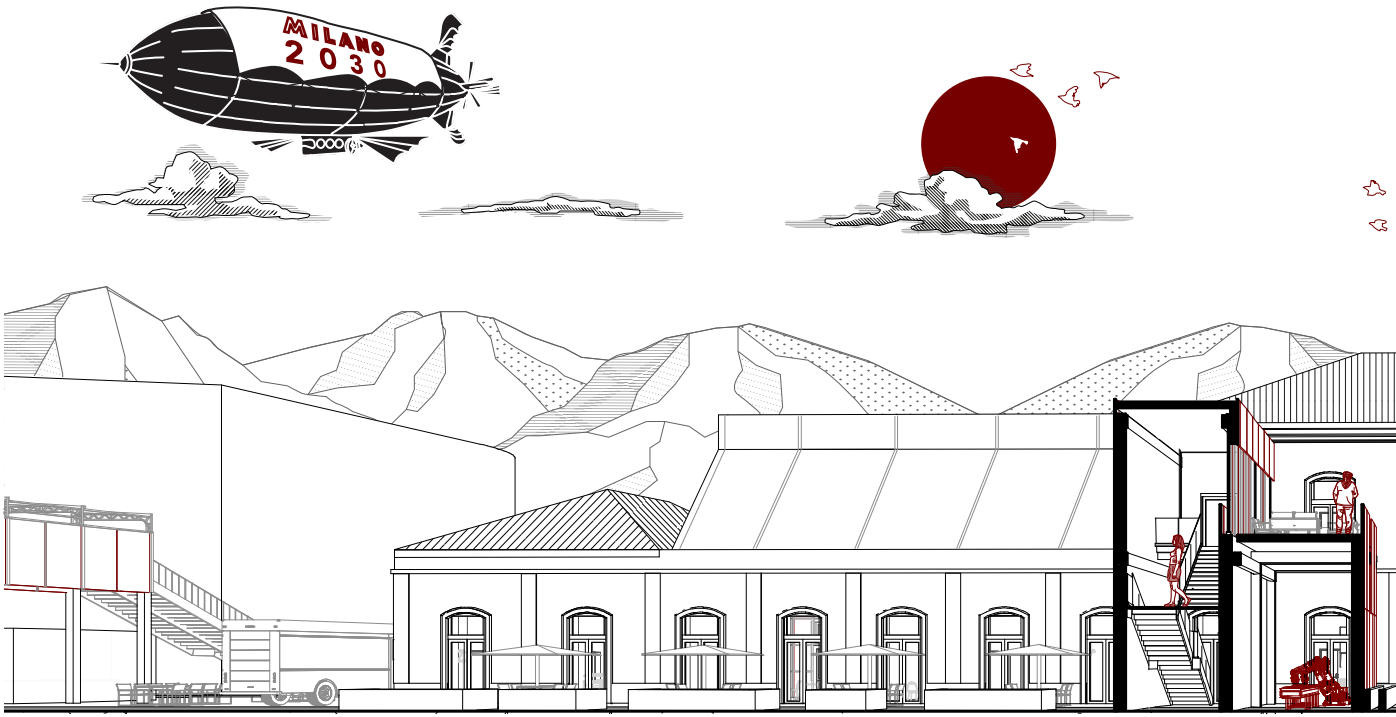
The structure of the new buildings is designed following the principles of circularity, according to which the building should embrace the aspects of adjustability (change of task), versatility (change of space), refitability (change of performance), convertibility (change of function), scalability (change of size), movability (change of location) and reusability (change of use)[2].

2 *Kubbinga., 2018.*

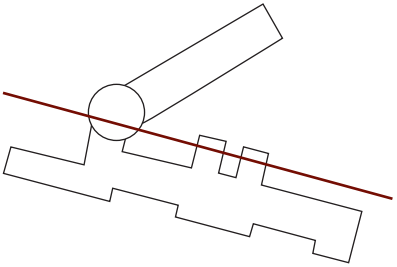
The intention was to create a fully dismountable dry system, realized with sustainable materials such as plywood. The inspiration for the interlocking connections comes from the *Archery Hall*, a sports building, located at the Kogakuin University, in Tokyo, Japan, that provides 80m² of uninterrupted, 'columnless' floor space. The roof of the sports club is composed by thin perpendicular strips of wood that brace the vertical elements (each composed of 4 parallel timbers) and slot into the resulting cross-shaped notches to resemble nocked arrows.

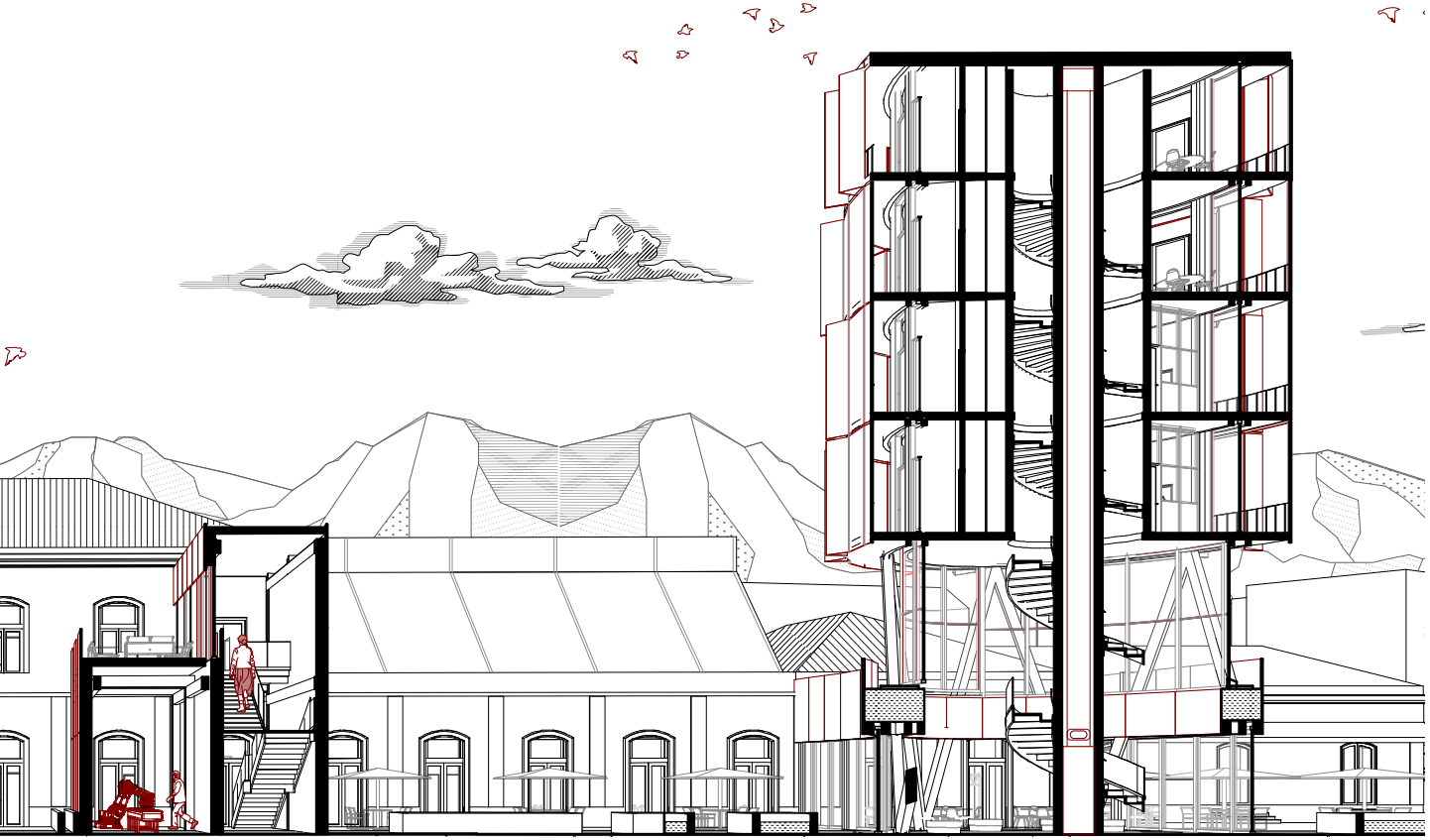
According to the website Homeli, «the roofs of the sport structures incorporate a form of recursive joinery, with repeated patterns being layered up to span the vast spaces. Seemingly frail timbers, when combined in a complex lattice work, provide the structural integrity required to support the roof»[3].

3 http://homeli.co.uk/kyudo-archery-hall-and-boxing-club-by-ft-architects/ (retrieved on 14th of January 2019).

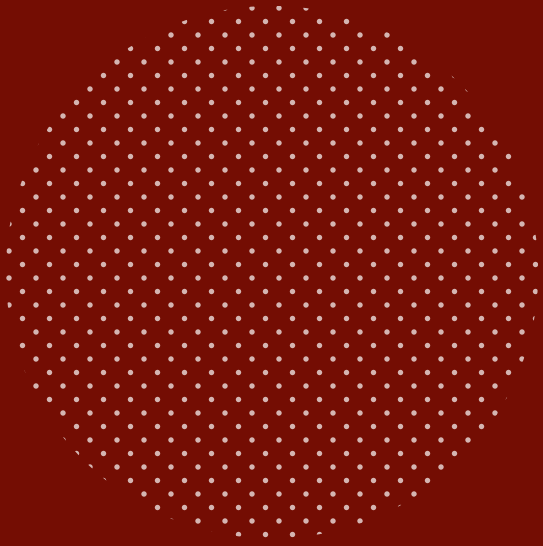


Beams and pillars are therefore designed to interlock with each other and they are connected with screws or bolts, in order to allow an easy disassembling process.

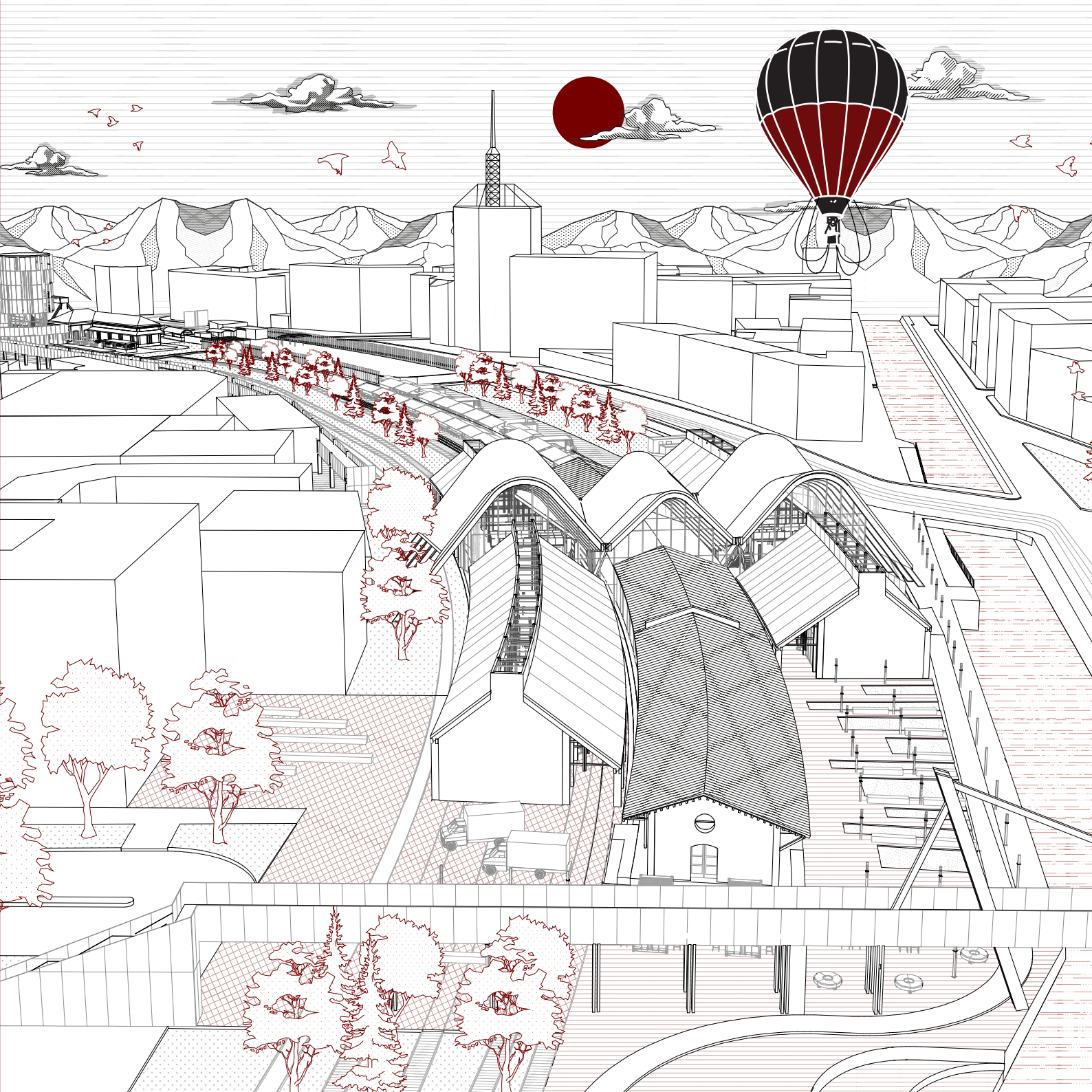




Perspective section of the station

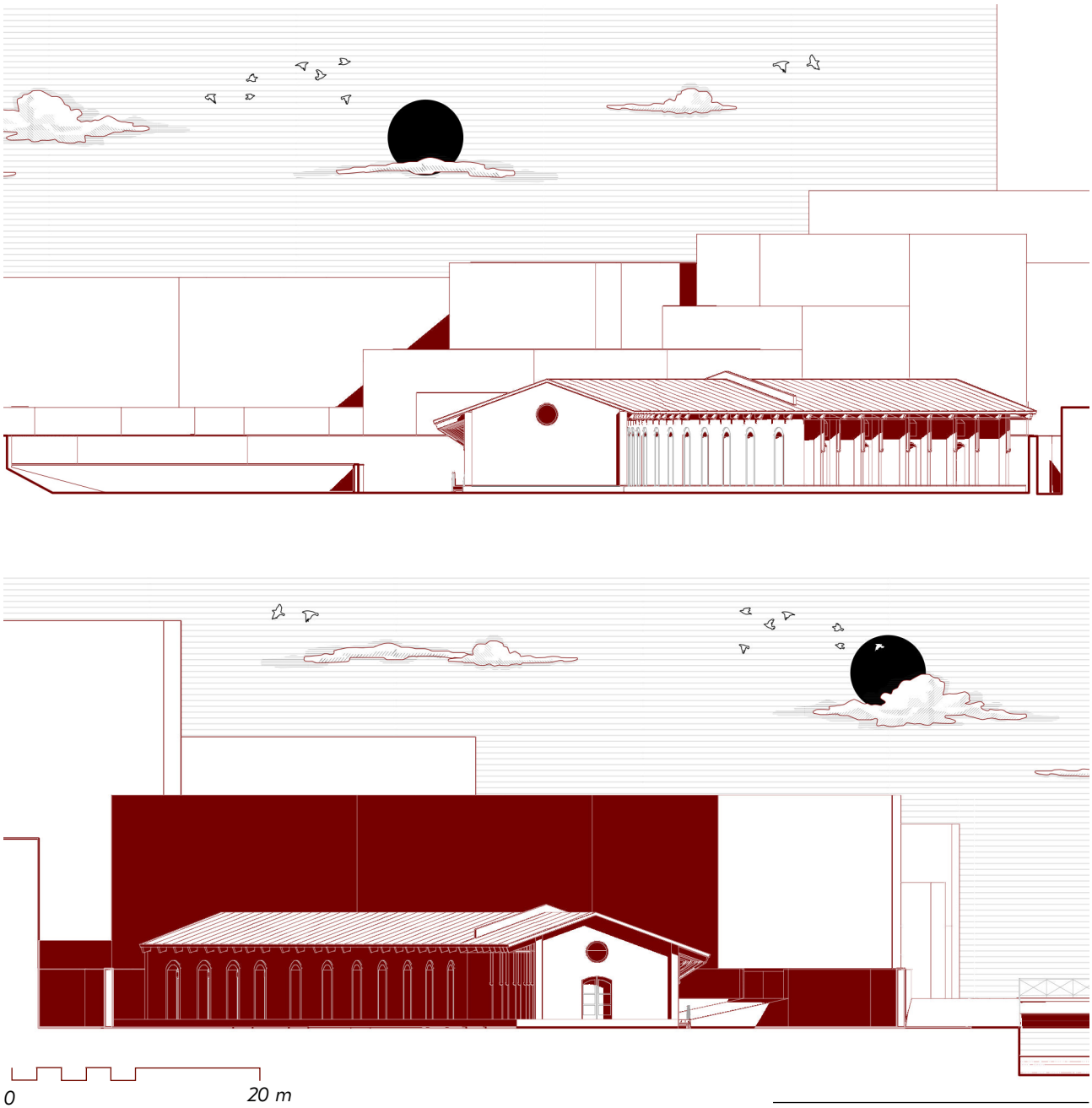


The urban market




0
20 m

Ground floor plan of the warehouse



Elevations of the warehouse

The railway warehouse

The building was one of the complementary structures to the station. It was the former warehouse where the goods were stocked.

Originally it was composed by two parts and its footprint followed the railway. The portion that still exists today is only half of the original building.

The existing internal layout and the previous function

The building is a 9 mt-wide, 125 mt-long, curved space with a single navy. The accesses are located on both sides at a regular distance.

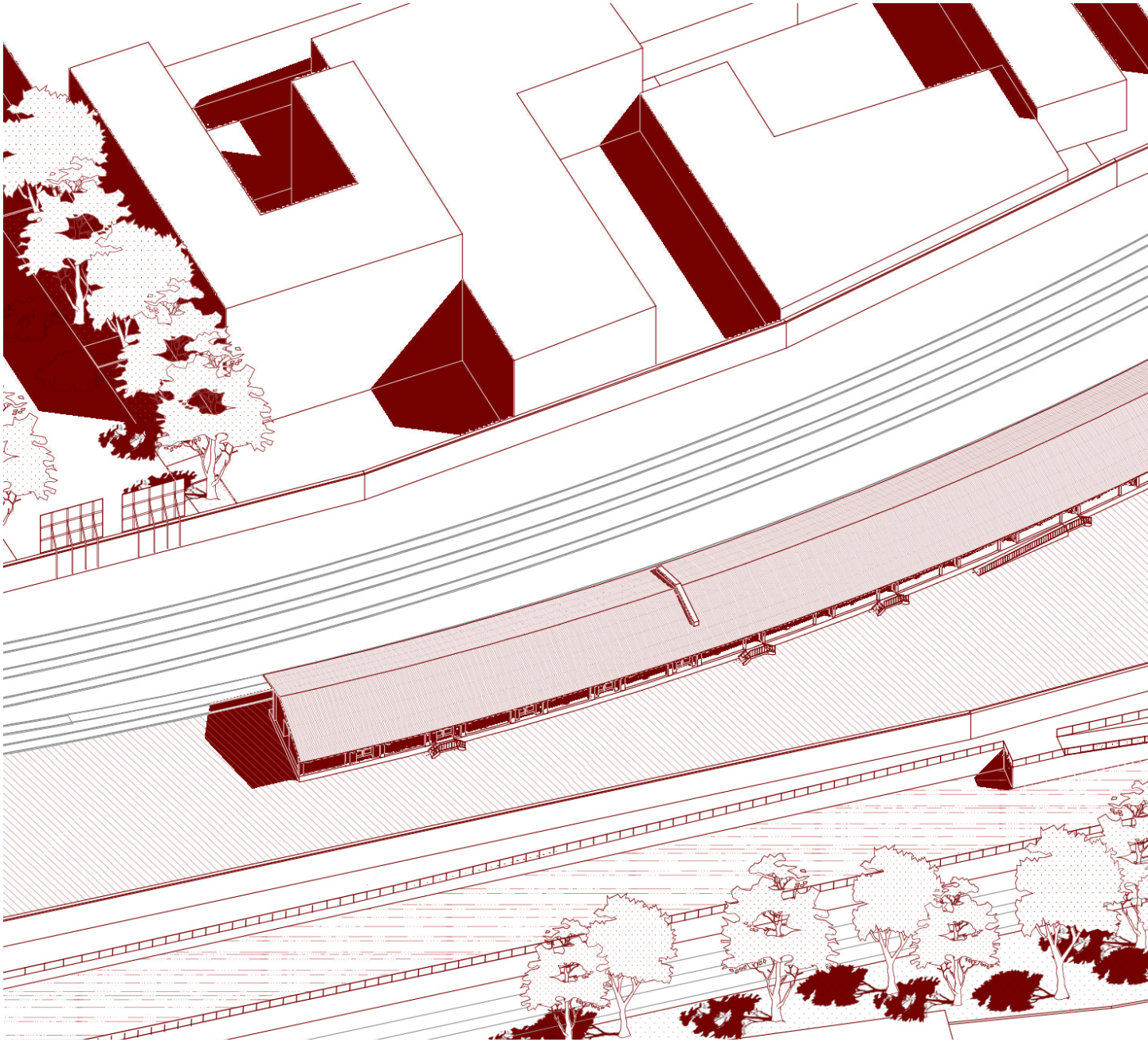
The structure is made of load-bearing masonry walls, while the roof is supported by wooden trusses.

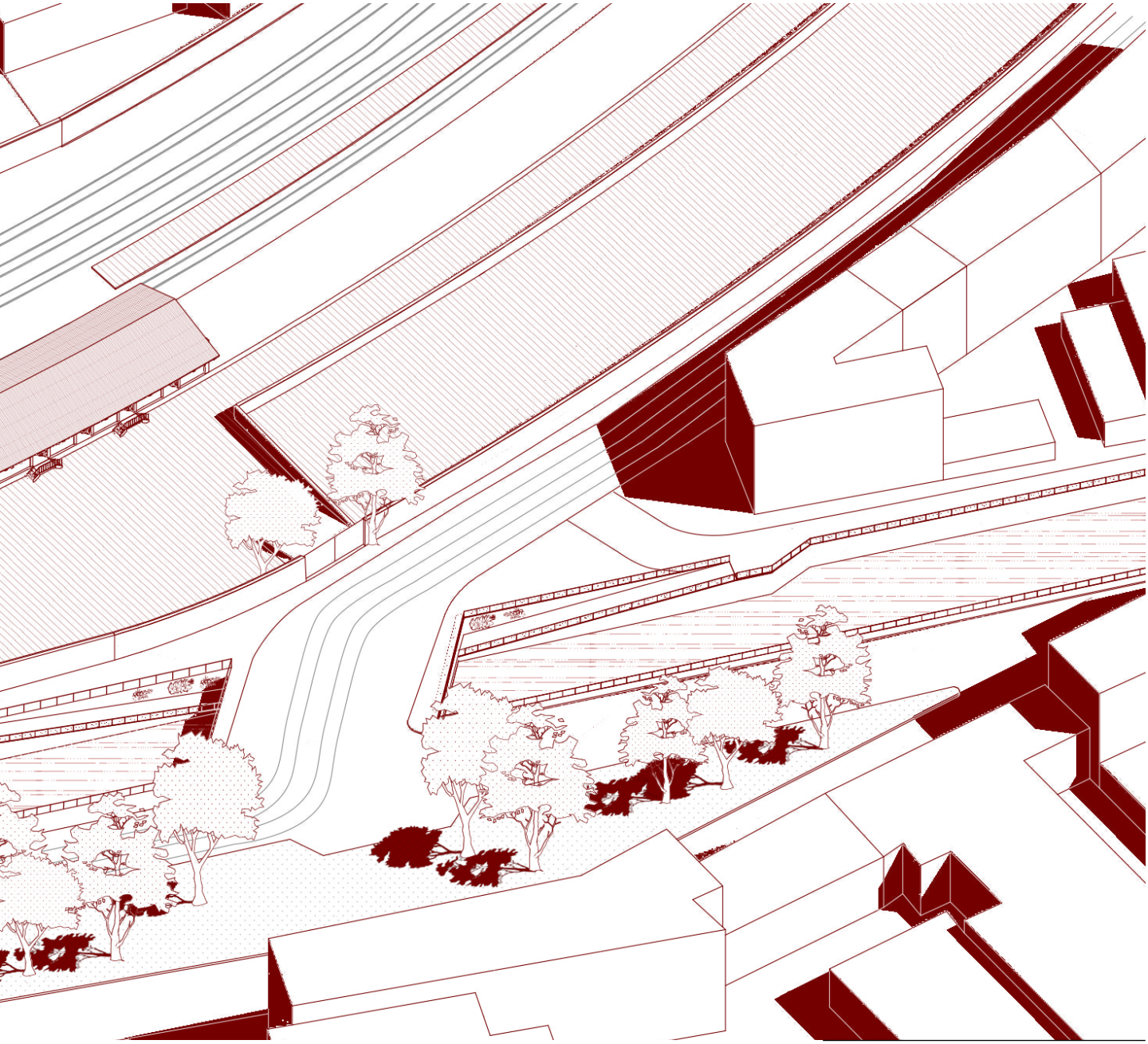
The internal space is almost completely empty, except for a toilet area and a backstage in the northern part. Because of its large square footage and its particular conformation, it has been recently used to host the *Mercato Metropolitano* activities from 2015 to 2017, with a first edition inaugurated for the 2015 EXPO. The space was equipped with temporary market stalls, street food shops and recycled urban furnitures. The large area of about 5.000 m^2 could accommodate hundreds of people.

The external areas

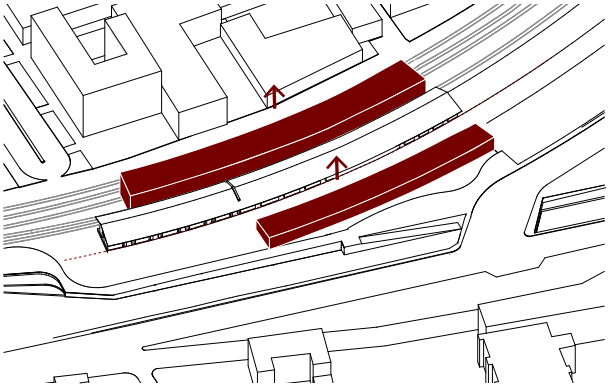
The area is accessible only from the gate on via Valenza, since it is surrounded by a masonry wall, which is still present even if the railway is not used anymore. The street is on a different elevation (+2 mt), thereby there is a ramp to connect the two levels.

The majority of the surface is a concrete slab, which can also be used as a parking space.

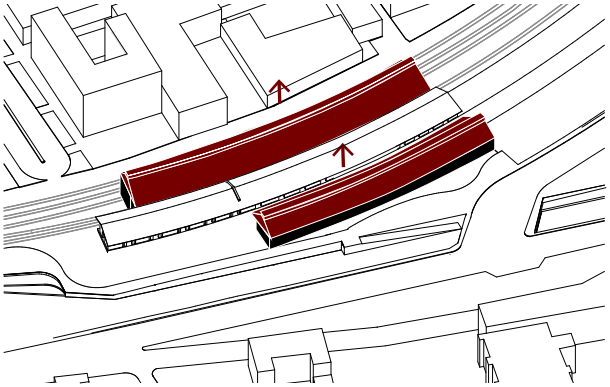




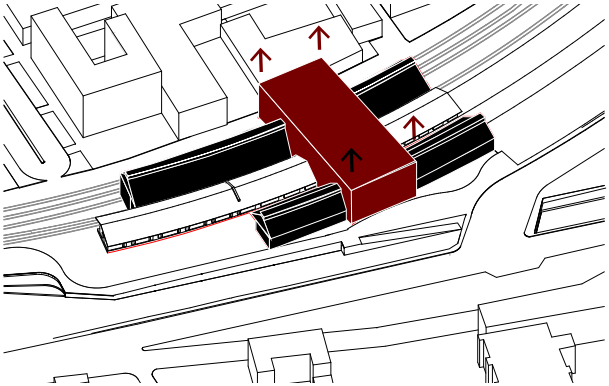
Axonometry of the existing warehouse



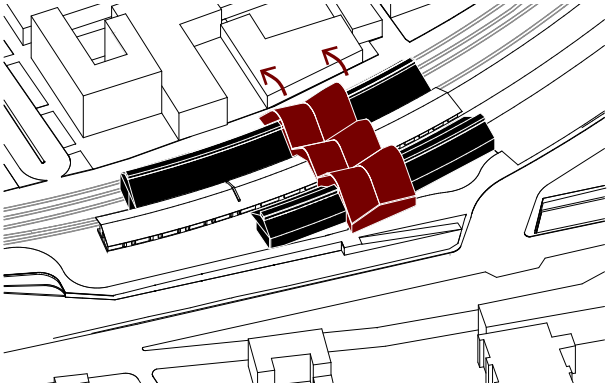
the new branches



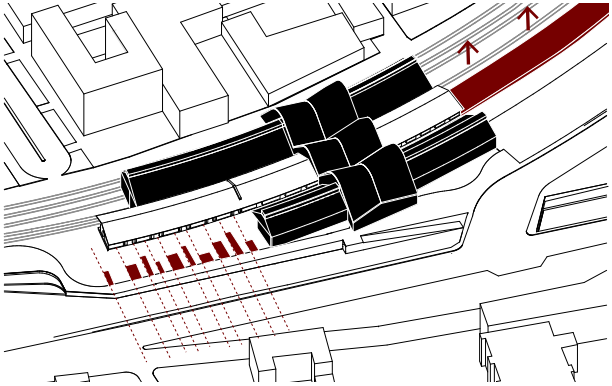
the roofs



the central court



the saddle vaulting roof



the square and the market

the functions

The design intentions

The idea for the warehouse is to take advantage of its volumetric configuration to insert a food market. The new function will configure itself as the beating heart of the system of the revitalized railway yard.

The volumetric concept

The first approach to the design of this building began with the study of its existing characteristics and its morphological relationship with the surrounding area. The warehouse appears to be strictly related to the railway, starting from its shape and volume, but at the moment it is still enclosed in a protected and separated area, thus acting like an urban island.

The design started from the recognition of the potential of the existing building. Its peculiar curve plan and the multiple lateral accesses suggested to duplicate the volumes. The first step was therefore the addition of two new buildings, which, like offsets of the historical building, enhance and highlight its strong volumetric shape.

Moreover the asymmetry of the existing sloping roof is emphasized in the shape of the new roofs. Like the superelevations of the station, their aspect is also inspired by the industrial architecture and the futuristic ideas. The light comes mainly from above through the skylight, which runs along the entire length of the buildings. The asymmetric side of the roof slightly bends to create a covered porch.

The three buildings are then connected through a third larger space. A central canopy, which acts like a covered market square lies upon the roofs. The shape of this space is a reinterpretation of the vaults of the 19th century railway stations. The entire structure is further modelled to resemble the shape of a saddle, thus enhancing the effect that the entire building is escaping from its centre through a centrifugal force. The idea of movement that defines the volumes is another take-out from the futuristic concept and also preserves the memory of the railway, where once the trains used to move.

The external areas have even a more important role in defining the connection with the rest of the city. Different spaces are created around the market. The southern area is mostly occupied by a public paved area, which also interacts with the Darsena Nova, the expansion

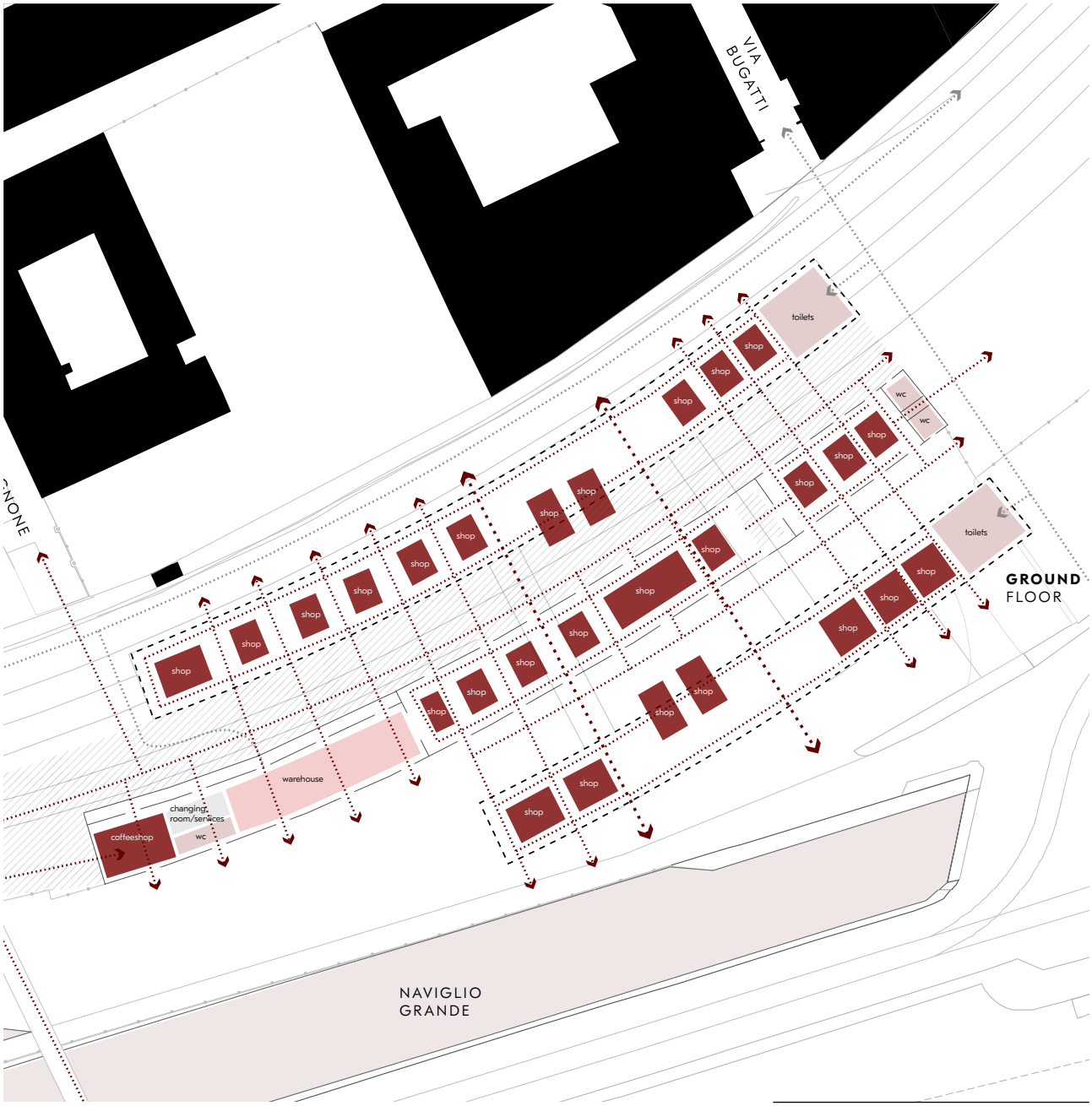


Diagram showing the metaproject of the market

of the Naviglio. The northern side is still showing the footprint of the demolished portion of the warehouse building, which is used as a basement for an open-air public market.

The new internal layout

The internal layout of the market is centred on the covered courtyard. The double height space is occupied by four main market stalls in the new buildings and two in the old part. The circulation through the area is guaranteed by the existing doors and new steps which run along the entire historical building.

The southern sleeve of the warehouse accommodates the storage area, where the market goods as well as the products ordered online by the customers can be stored, a waste management area and a cafeteria with the related services. The cafe directly interfaces with the external public square.

The northern part of the building is instead occupied by the toilets. The rest of the space hosts the stalls, which are placed in between the doors, on the opposite direction of the walls, to grant a continuous and smooth flow between the different buildings.

The new architectures are almost completely occupied by stalls, except for the northern side, where the other toilets are located.

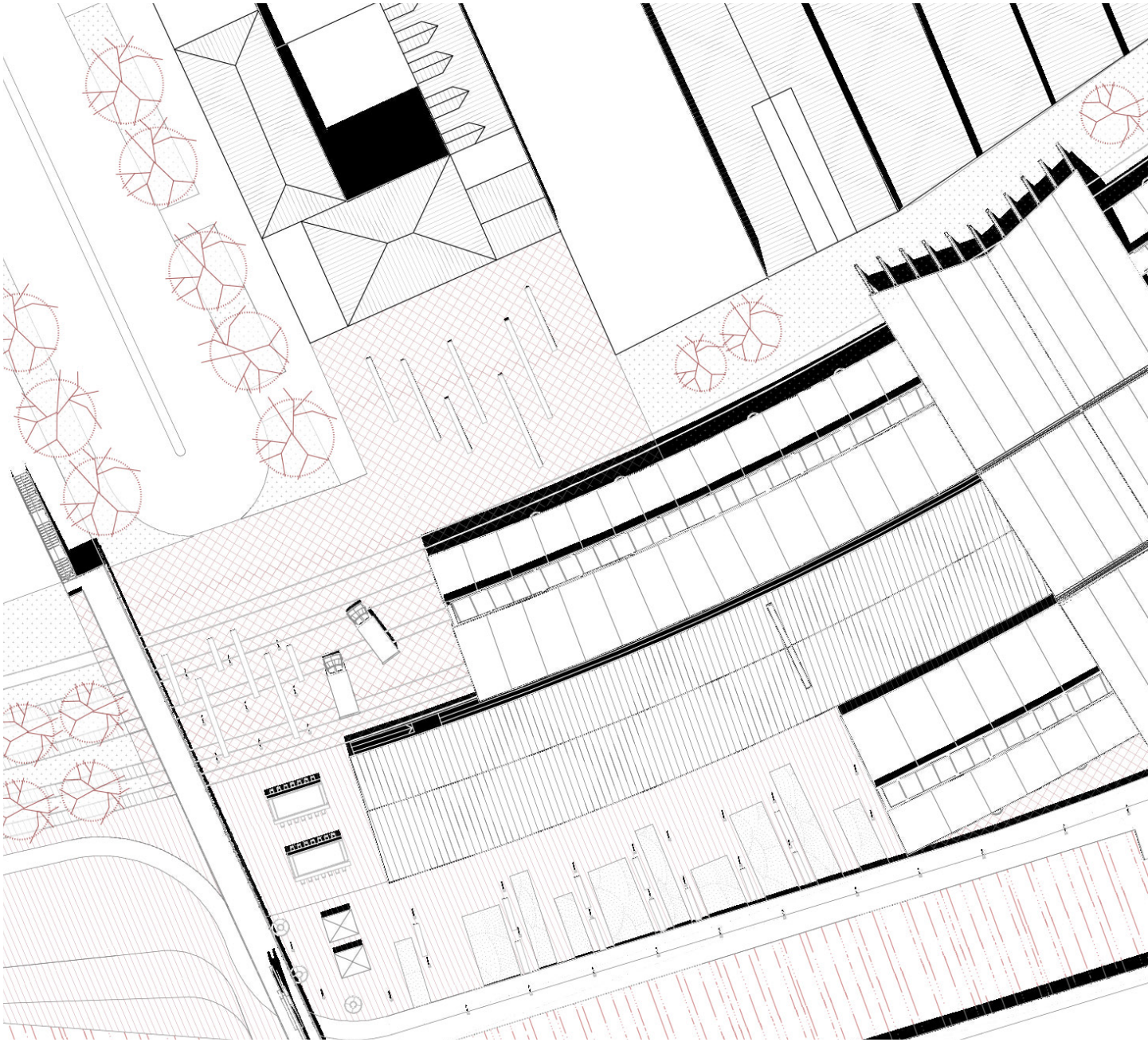
The urban connections

Since this part of the railway yard is on a different level than the rest of the street towards the Naviglio, one of the most important issue to tackle was the resewing of the urban tissue, making use of the topography.

The market is a collective public function which is able to attract many people, but it should be integrated in the urban fabric in order to function in the best way. For this reason the project establishes some main connections with the city. On the northern side, the former railway area is reconnected with via Borgognone through the creation of a public square, which functions also as goods loading and unloading area for trucks. The cul-de-sac of via Bugatti is also opened to attach to the park and to the starting point of the pedestrian bridge that leads to the station.

In the southern area the market is more connected to the Naviglio and the difference of levels is solved with a new pedestrian terrace and a ramp.

A new bridge which crosses the Navi-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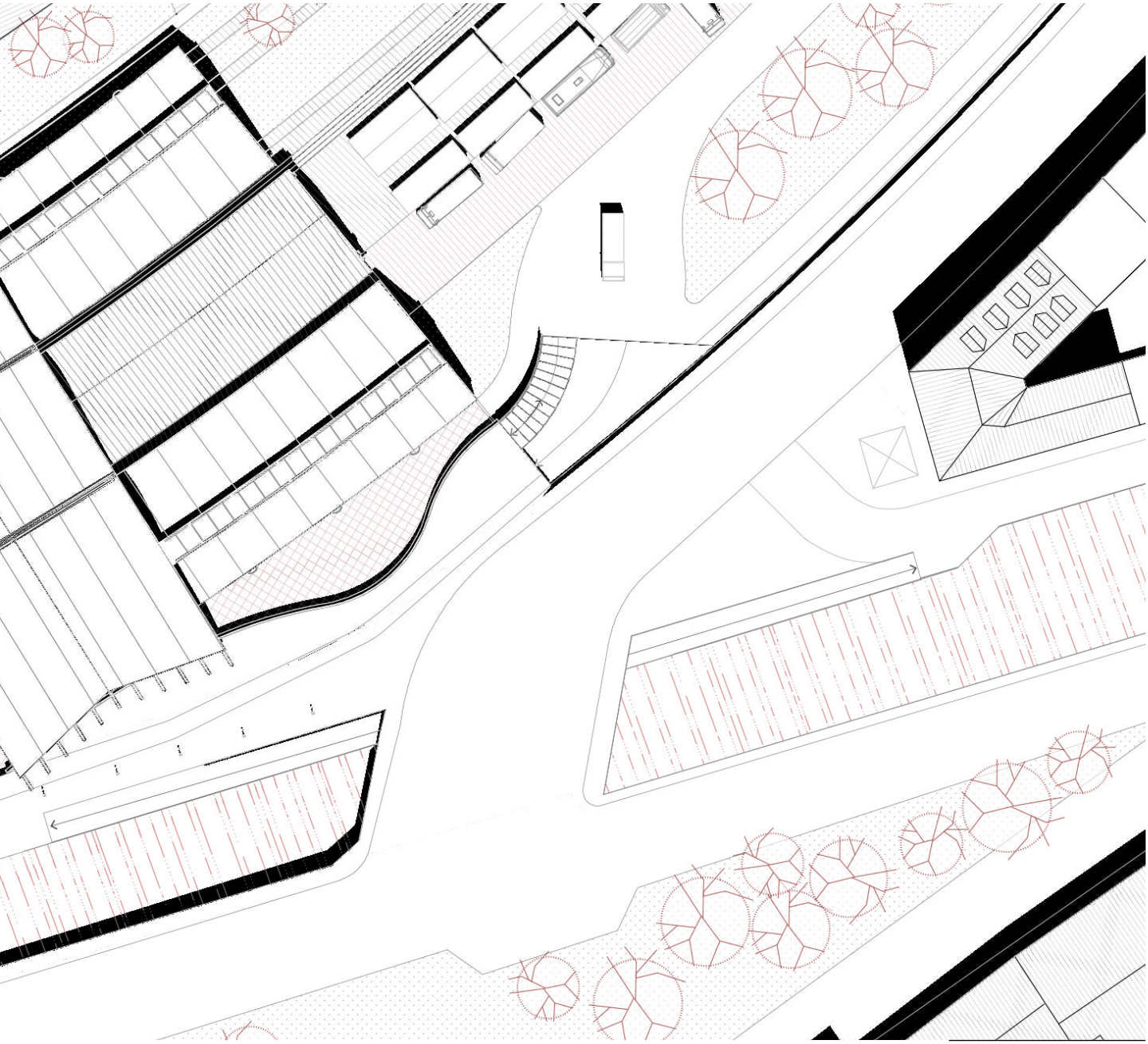
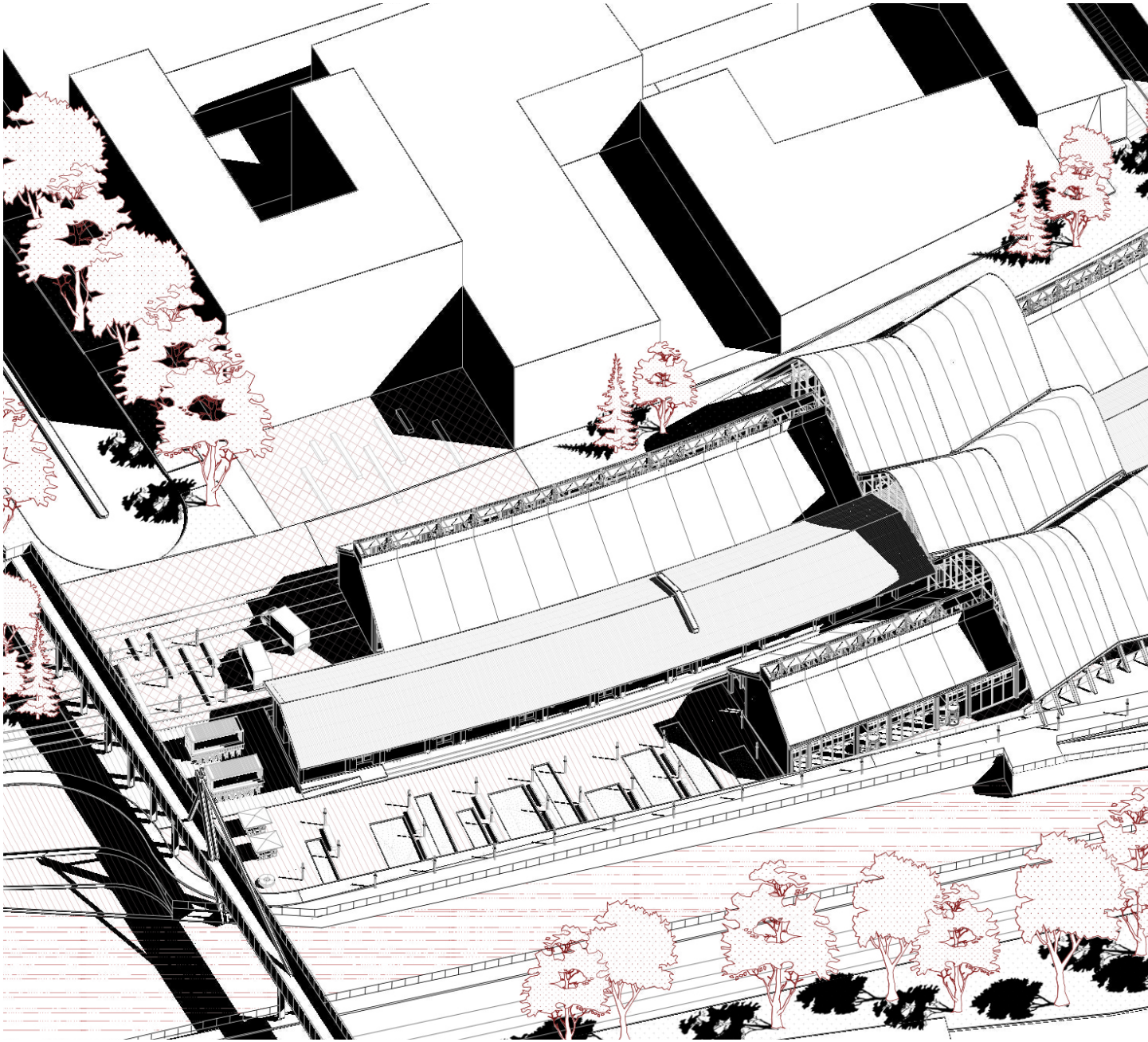
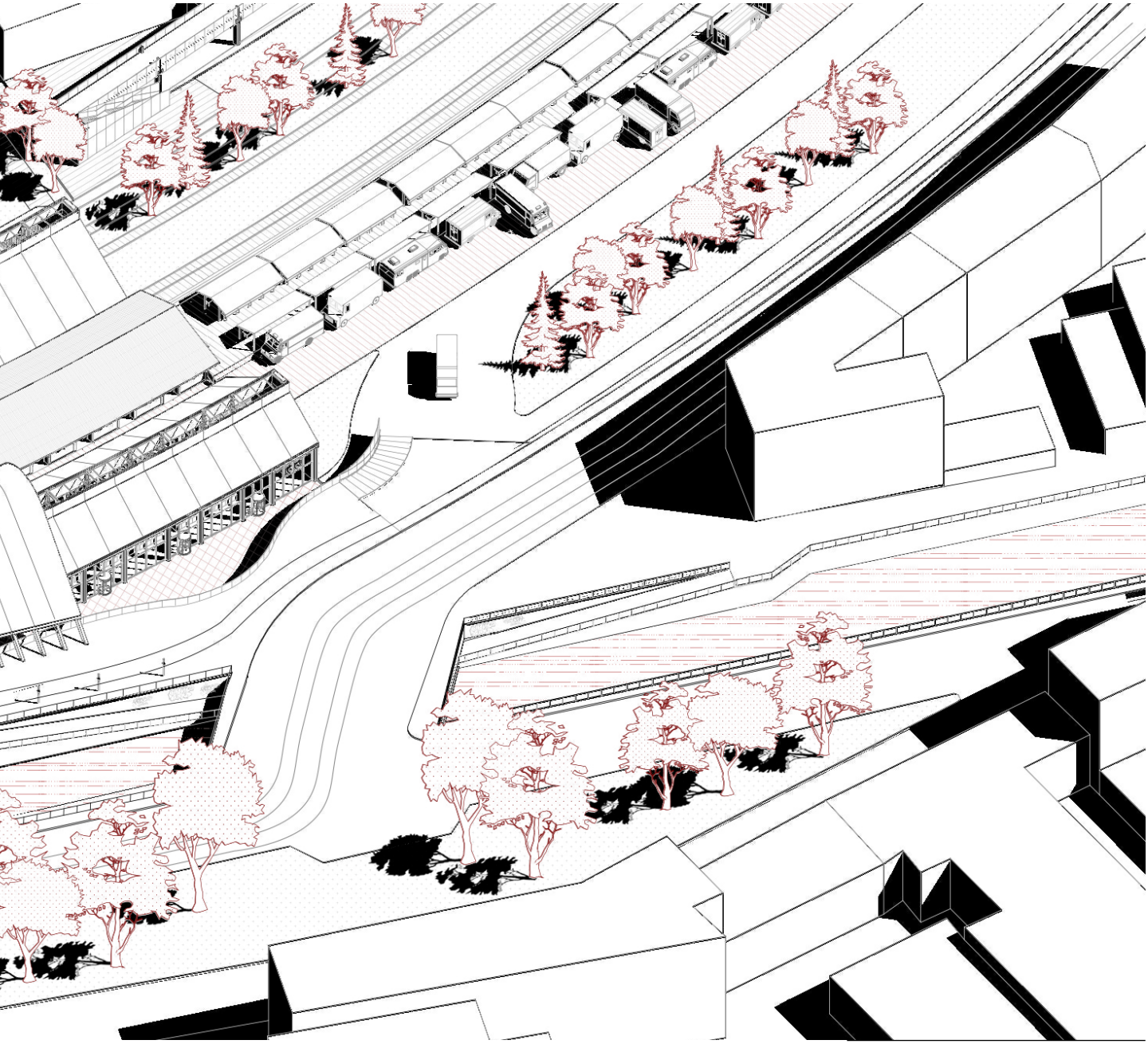
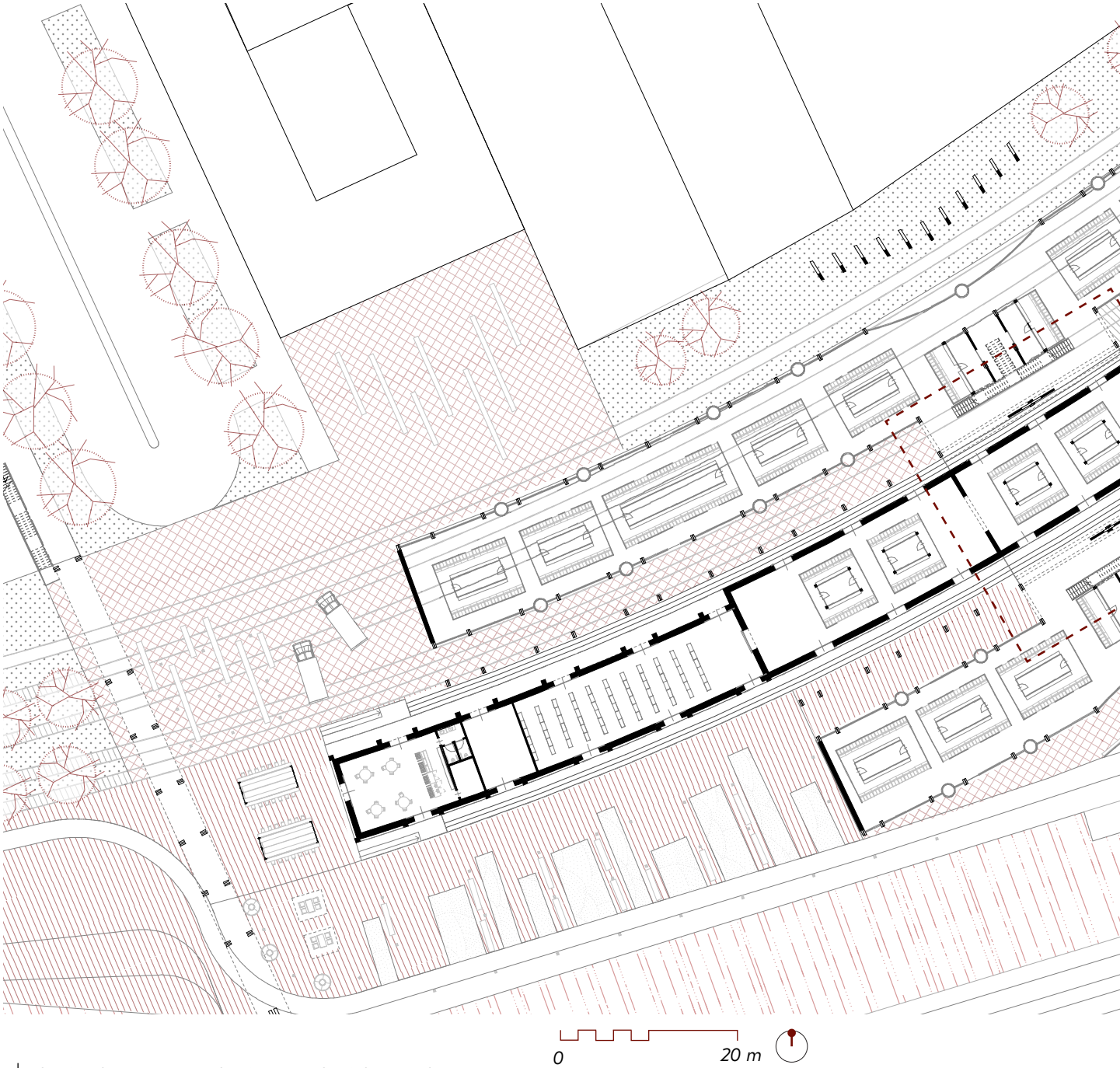


Roof plan of the market





Axonometry of the market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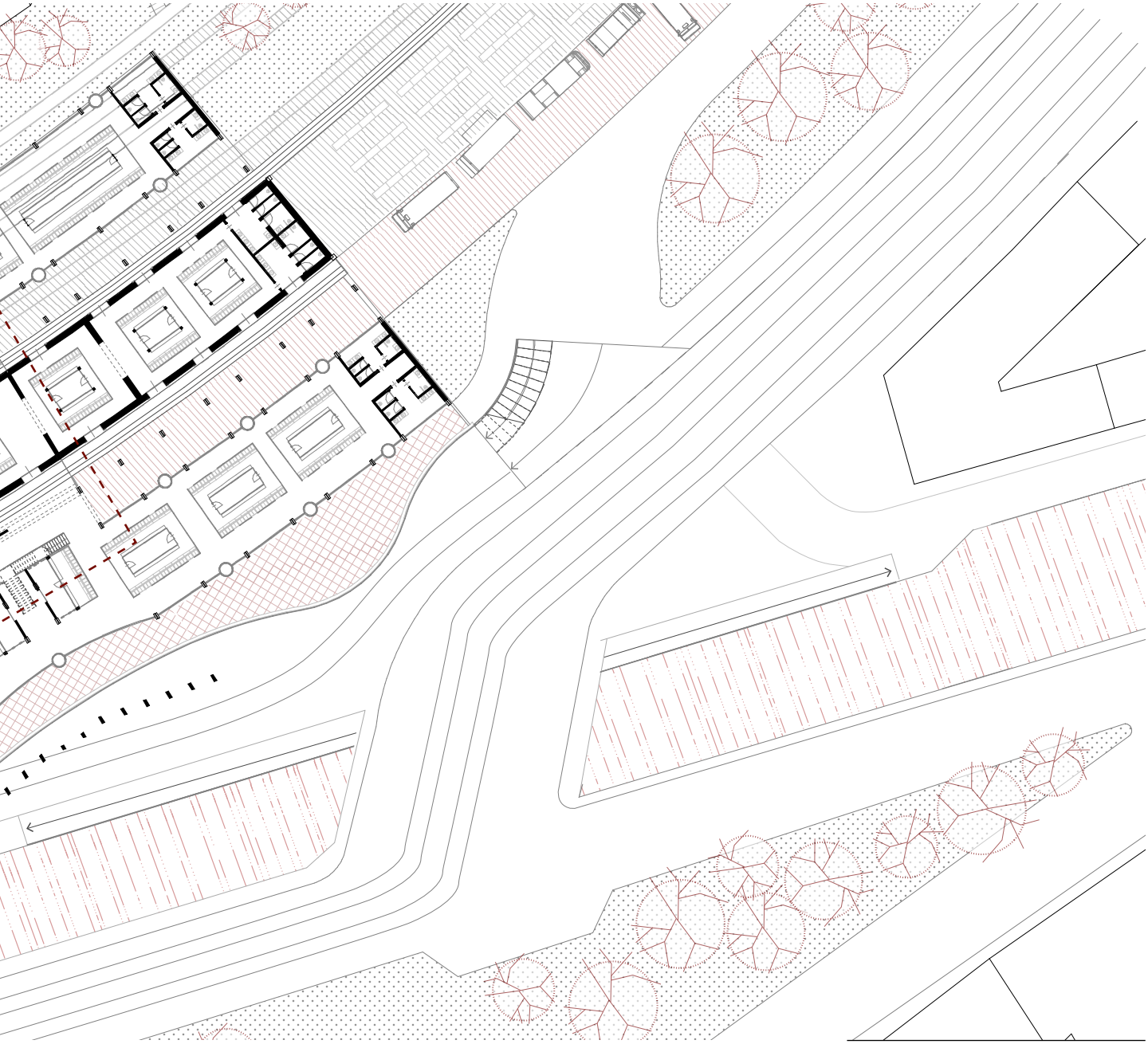
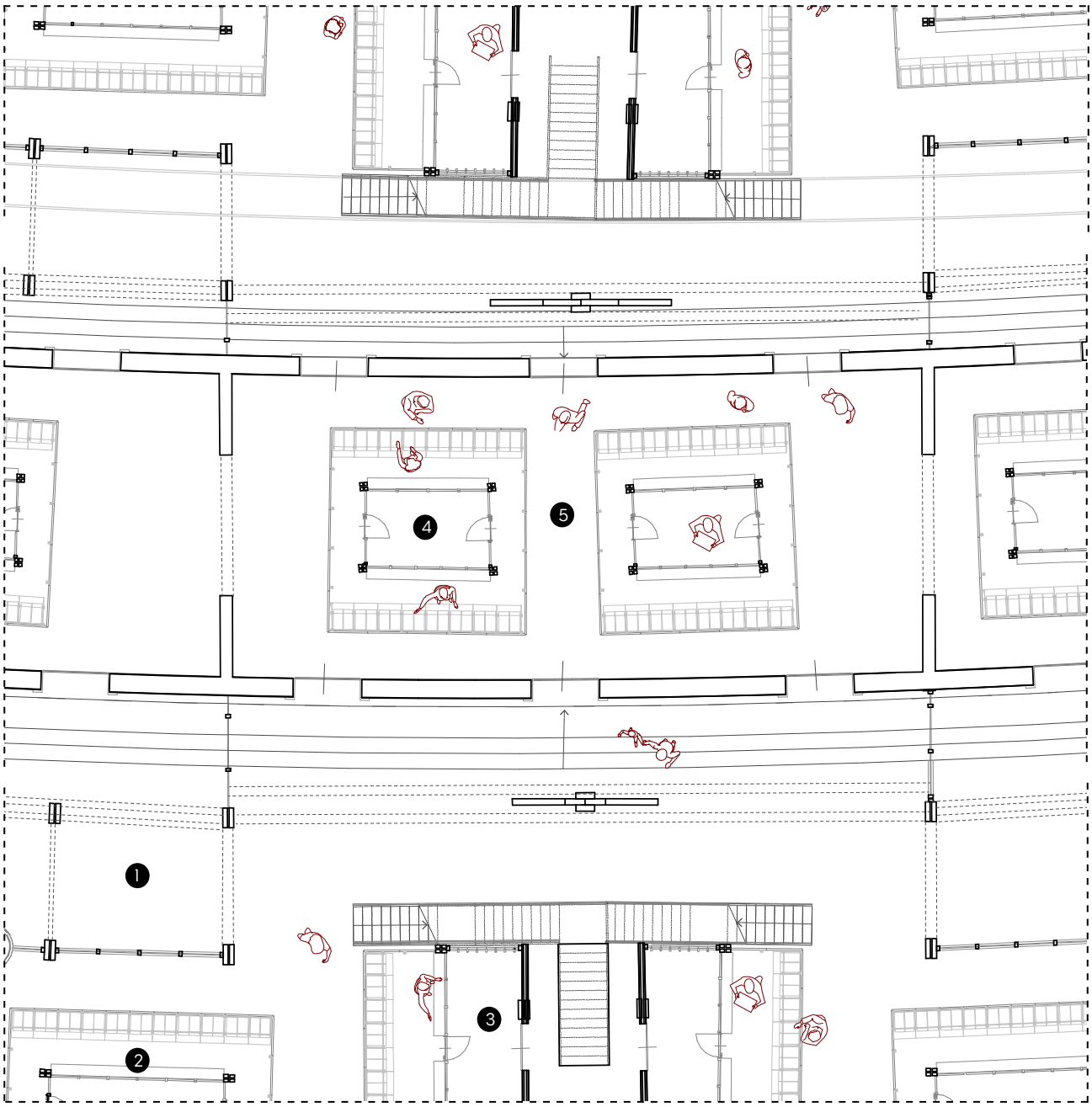


Ground floor plan of the market


1
2
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4
5
0
5
10 m

glio allows the visitors to easily reach the park, the market and the Tortona district through via Borgognone.

The open public space

As already mentioned before, the new building establishes different kind of connections with the existing urban fabric. Like the traditional markets explained by Calabi[1], also this one interacts with a discontinuity in the urban fabric, which is represented by the presence of the railway. It is again a place of limits, boundaries and margins, but it communicates with them and manages to create enjoyable public spaces.

The public square is divided into smaller areas, where specific urban furnitures are provided. The benches have the same characteristic of those of the station and can be moved along the rails in order to make the space more flexible for events or for the goods transportation.

1 *Calabi (1993).*

1. *Open porch*
2. *Stall type A*
3. *Stall type B*
4. *Stall type C*
5. *Historical part*

Detail of the ground floor of the market

The open air market is located on top of the basement of the demolished section of the warehouse to simplify the loading and unloading activities.

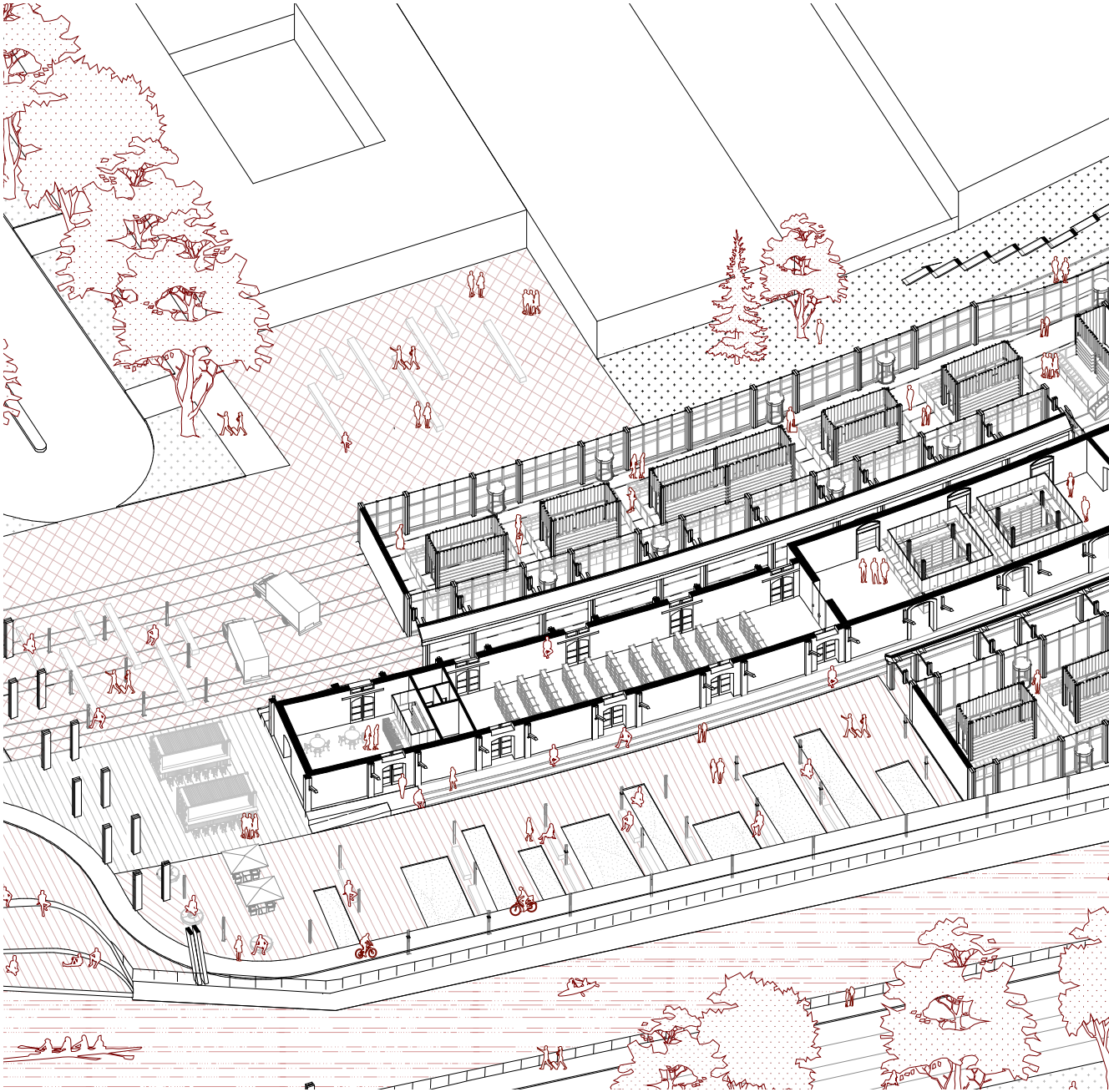
The cycle lane which arrives from the station run parallel to via Valenza, then goes up on the new terrace through the ramp and moves forward, flanking the Naviglio and then the Darsena Nova.

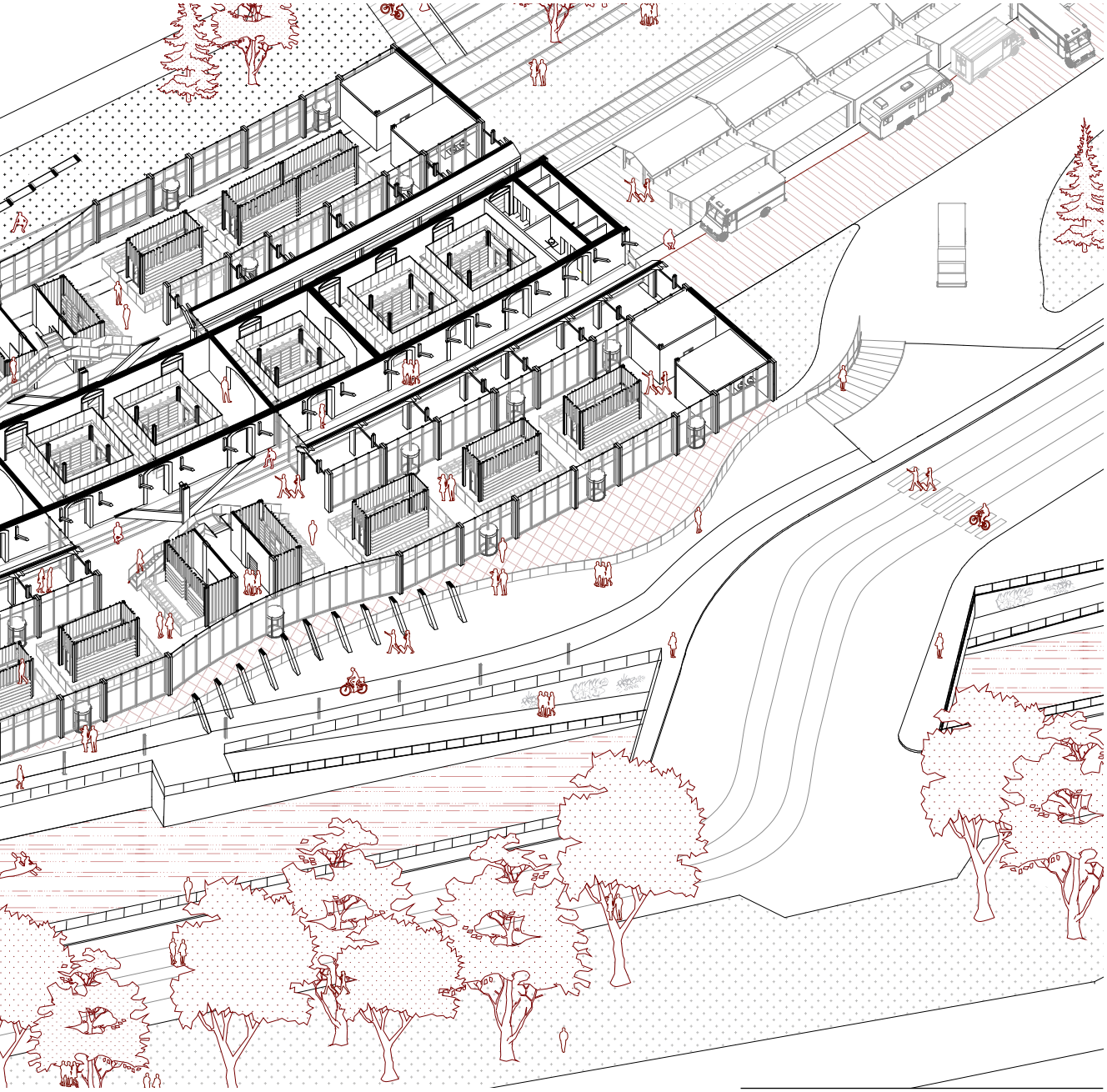
The internal distribution

The market is based on the model of traditional typologies, such as *Les Halles* in Paris or *Covent Garden* in London, and more recent European examples, such as the *Mercat Santa Caterina* in Barcelona or the innovative concept of *Mercato Metropolitano*, which has been experimented in different European cities. The space is organized around the stalls, which are designed to allow the best circulation around them.

The covered courtyard is mainly divided into three areas. The vaulted canopy becomes the roof in the new parts and goes over the wooden trusses of the historical building, which are restored and preserved. A portion of the damaged roof covering is removed in this section.

The central area is occupied by two stalls, defined as type C, which have a partially independent structure, with the





Axonometric cross section of the market

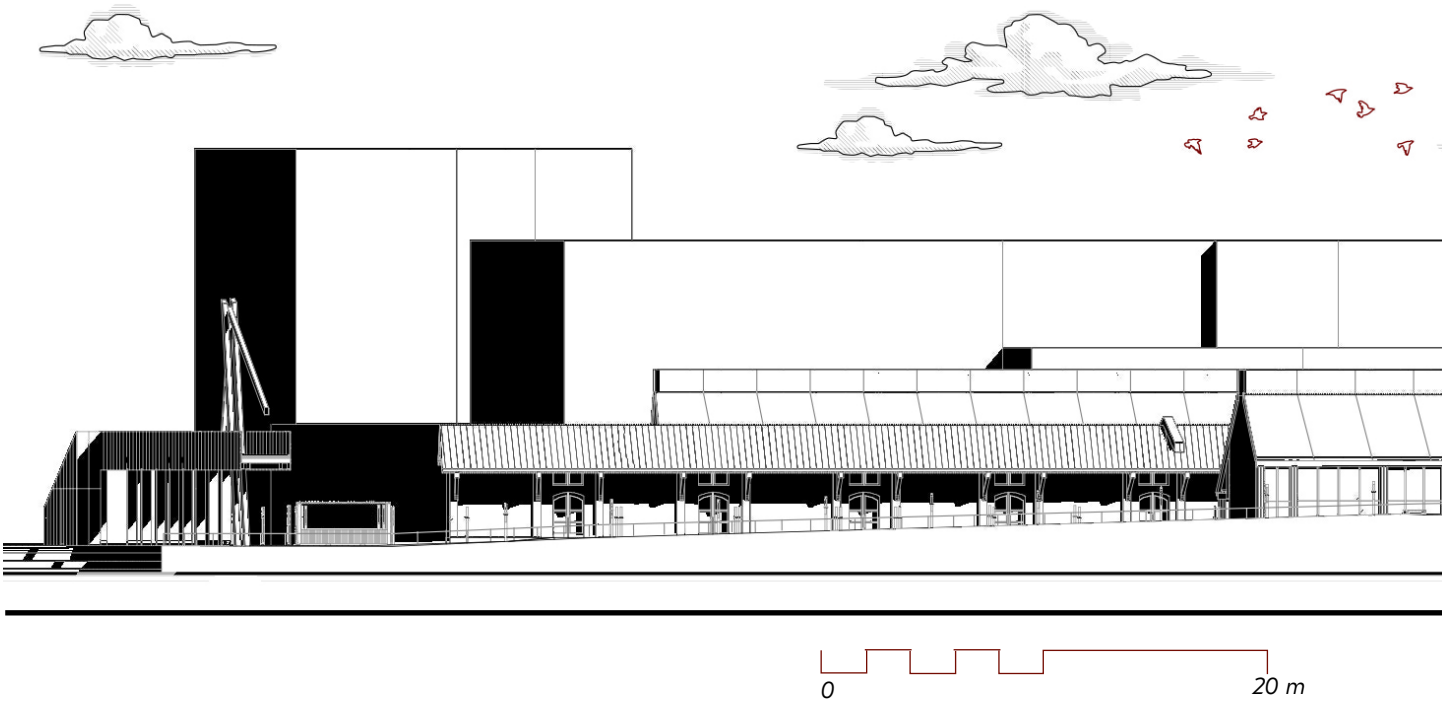
external foldable envelope hung to the trusses. The areas in the new buildings accommodate two stalls of type B, which are composed by two parts and a staircase, which leads to an upper partially cantilivered terrace. More details about the stalls are given in the following paragraph at page 272.

The trace of the rails is also preserved in the pavement, which incorporates them.

The external envelope

The treatment of the facade is similar to those of the station with the use of the same materials. The architectural language is almost the same so that the three different projects can also establish a visual, other than morphological, relationship.

Like the station, the existing building is also characterized by a vertical rhythm given by the pilasters and the trusses. The same effect is obtained in the new buildings through the wooden structure



and the glazed facade.

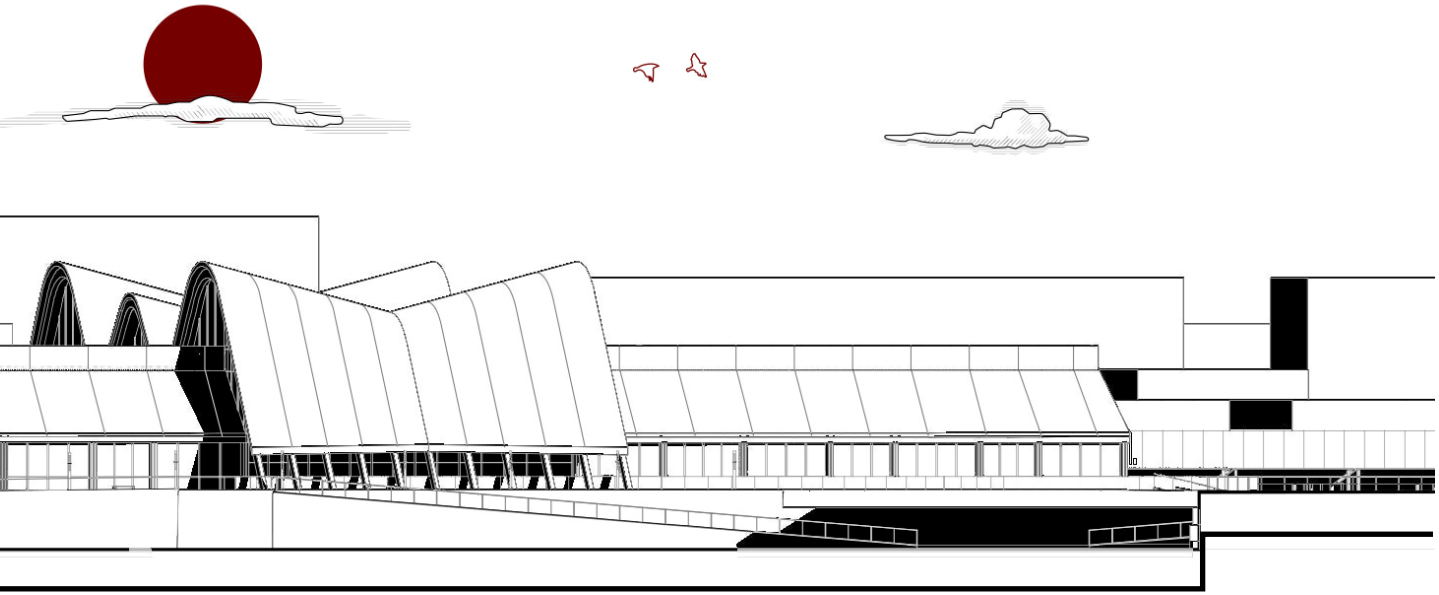
Since the roof has an important weight on the existing structure, the same happens also for the additions. The shed-like sloping roofs are covered with bio-composite panels which follow the same rhythm of the structure that supports them. In this case, the envelope emphasizes and shows on purpose the constructive system of the building.

As already said before, the central court is covered by saddle-like barrel vaults which are covered with recycled metal sheets to remind of the traditional stations' canopies. The facade towards east and west are glazed in order to let the sunlight in. To prevent internal overheating, sun shading devices can be integrated along the uprights of the curtain wall.

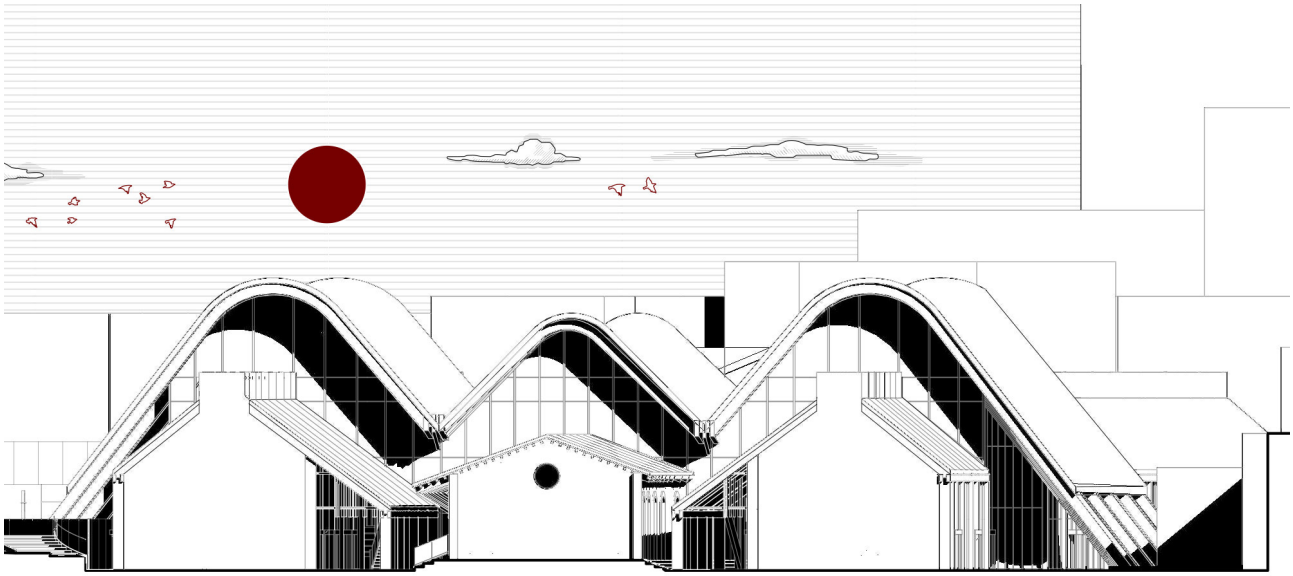
The structure

Like in the previous case, the structure of the market is designed to be easily disassembled or modified over time.

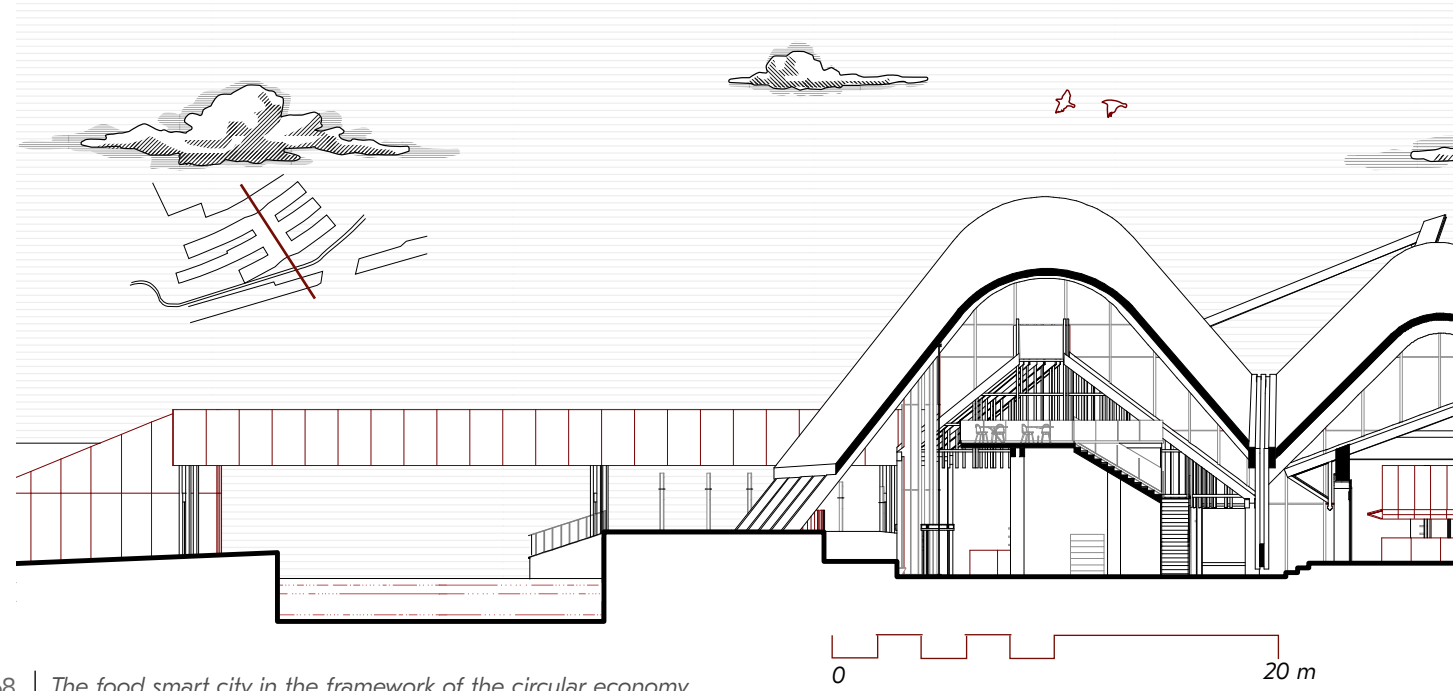
The canopy of the central courtyard is realized through a series of pointed

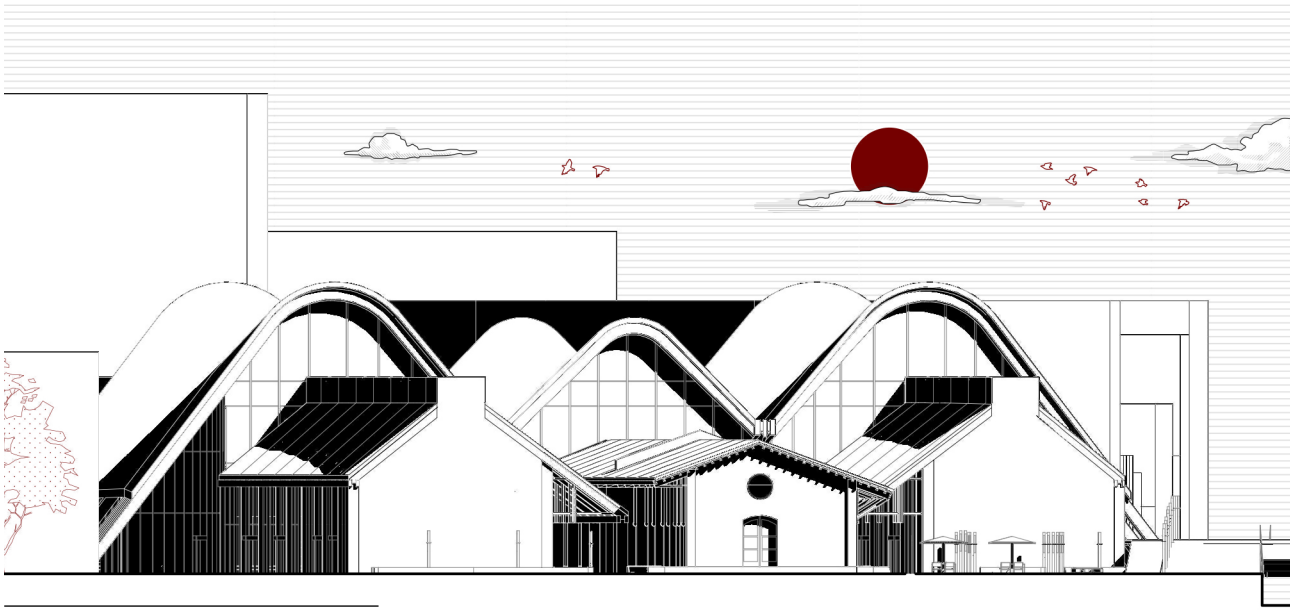


South elevation of the market

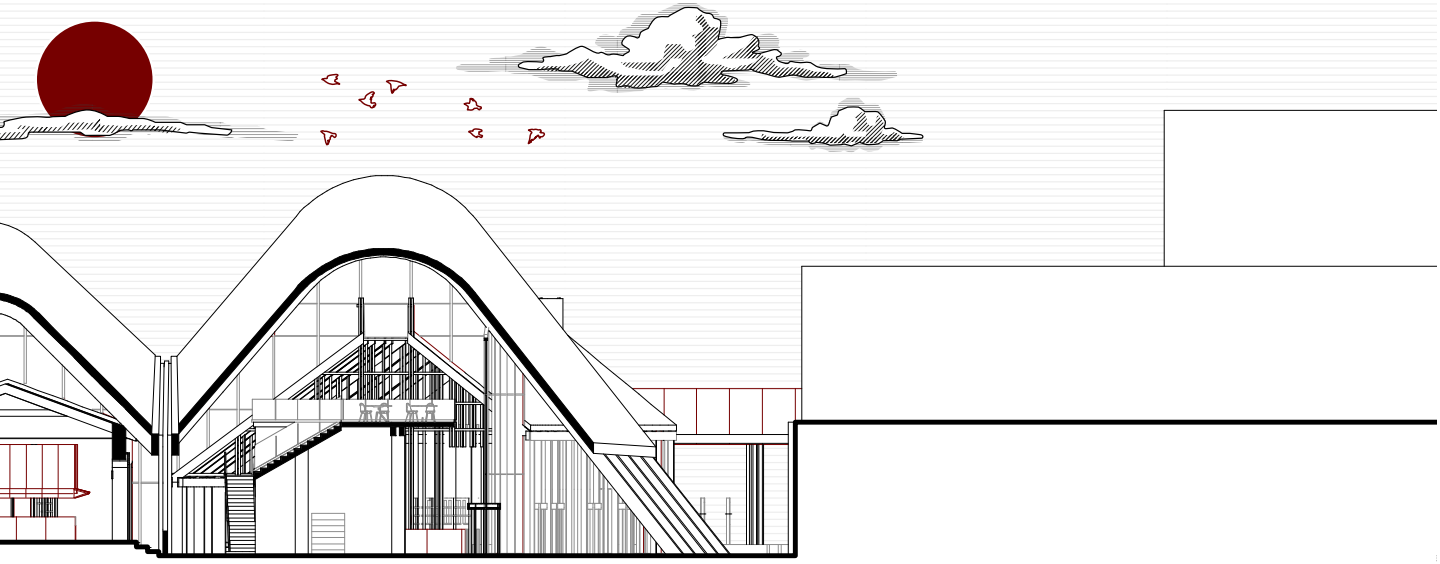


West elevation of the market

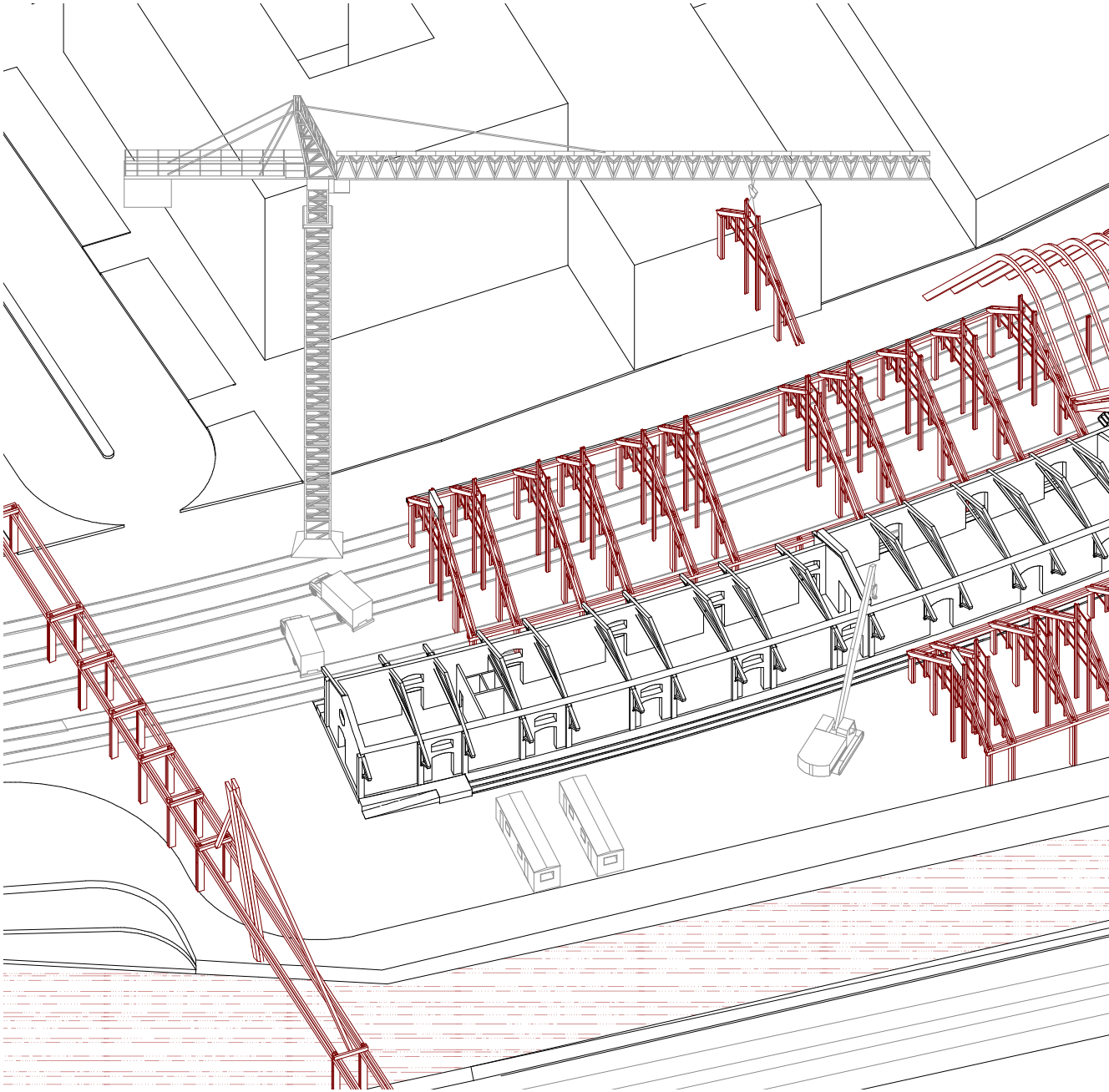


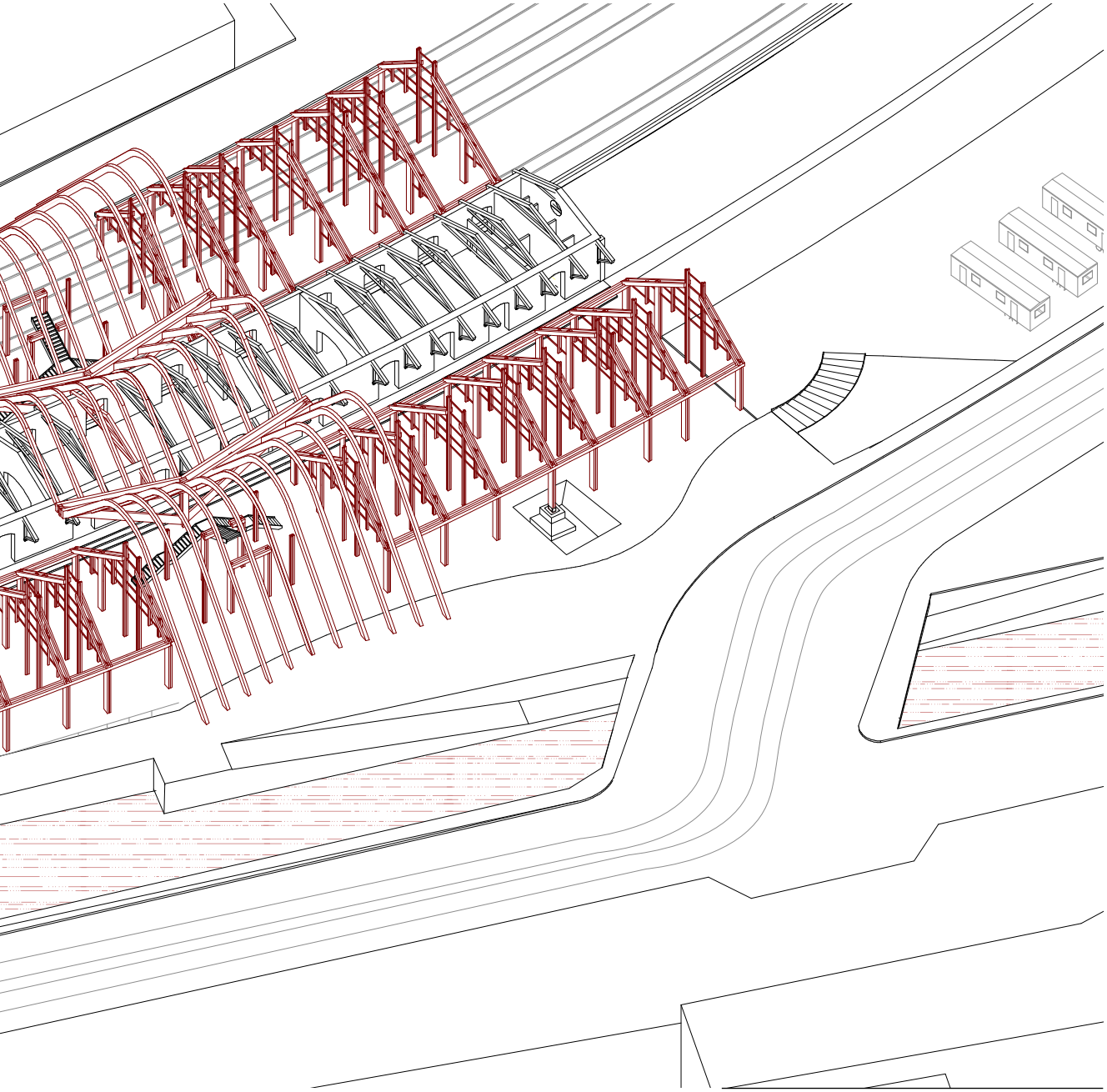


East elevation of the market

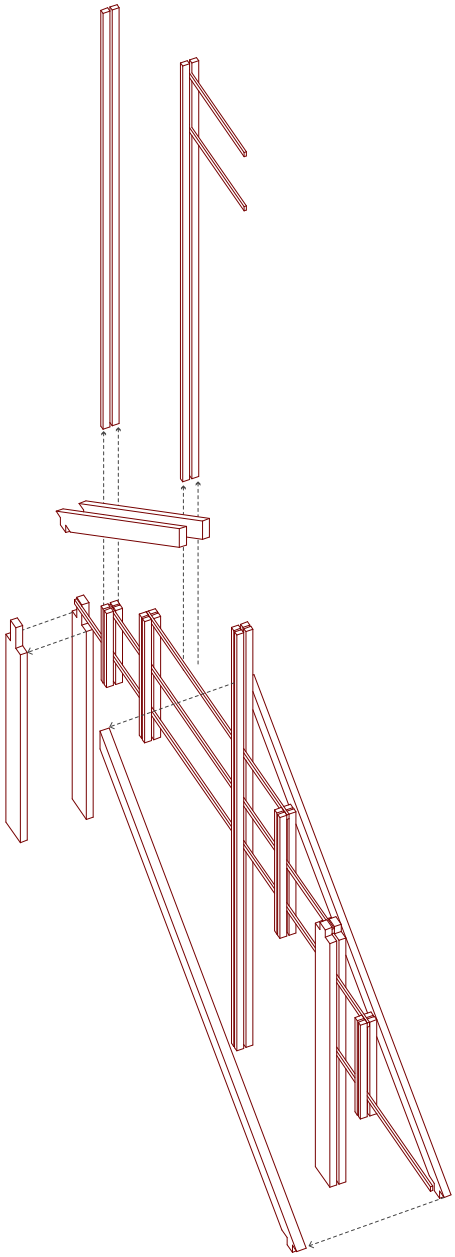


Transversal section of the market





Axonometry of the structure of the market



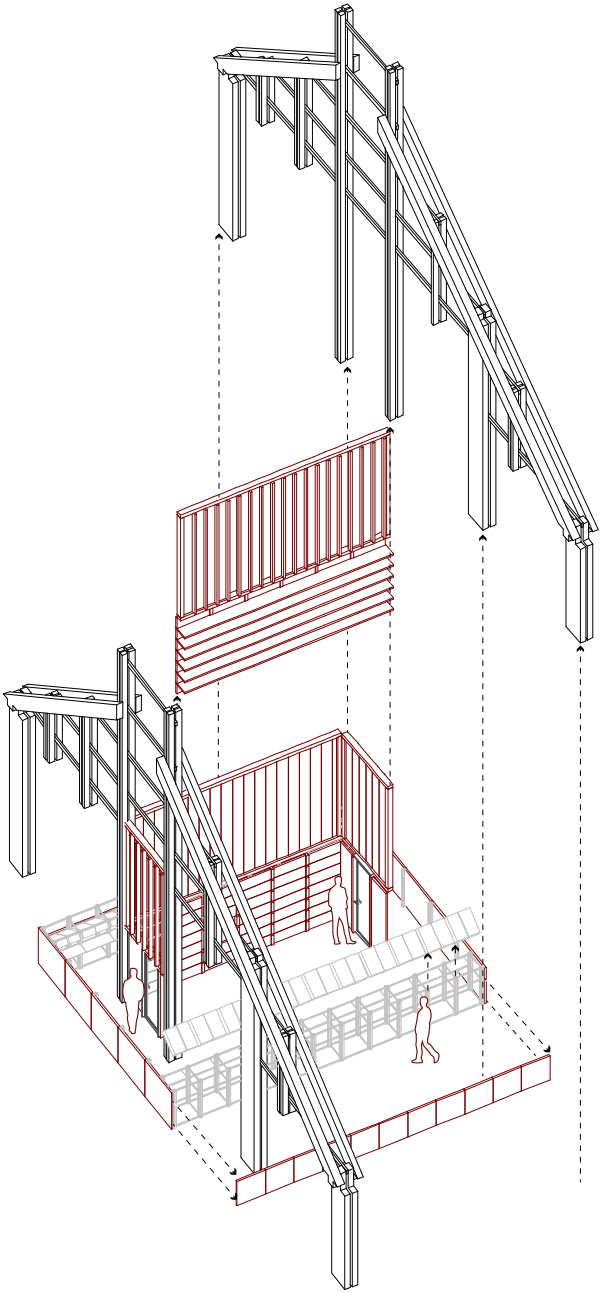
Axonometric details of the structural module

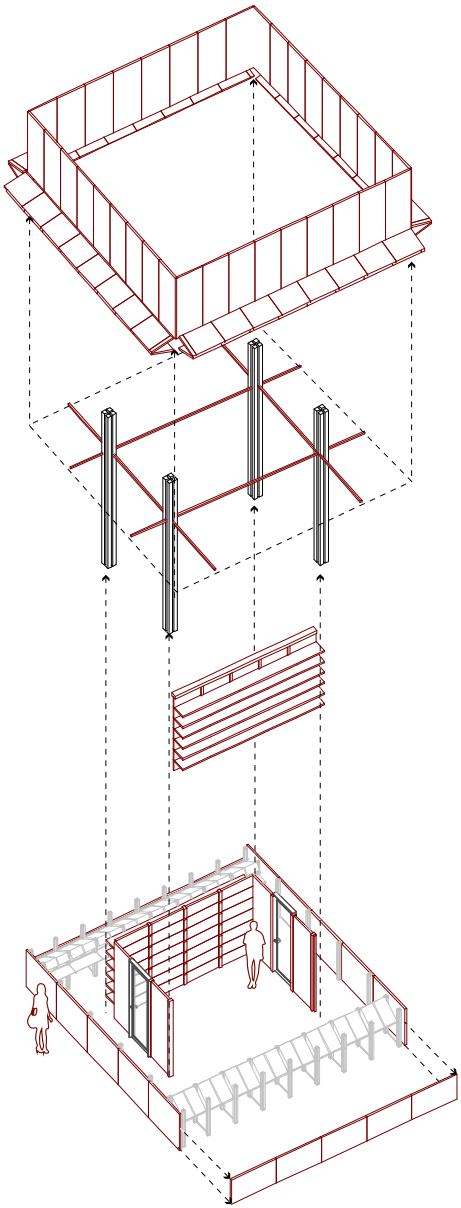
arches made of plywood. The structure which goes over the existing warehouse roof is supported by two wooden hinges.

The new buildings are supported by a serial repetition of the same precast element. This single piece is represented in the adjacent drawing. The basic module is based on twin pillars which support a double horizontal beam. The latter in turn hold the diagonal twin beams of the roof. In between the two beams there are six vertical elements, made of four different pieces each, which give stiffness and stability to the structure, while creating an interesting grid on the ceiling.

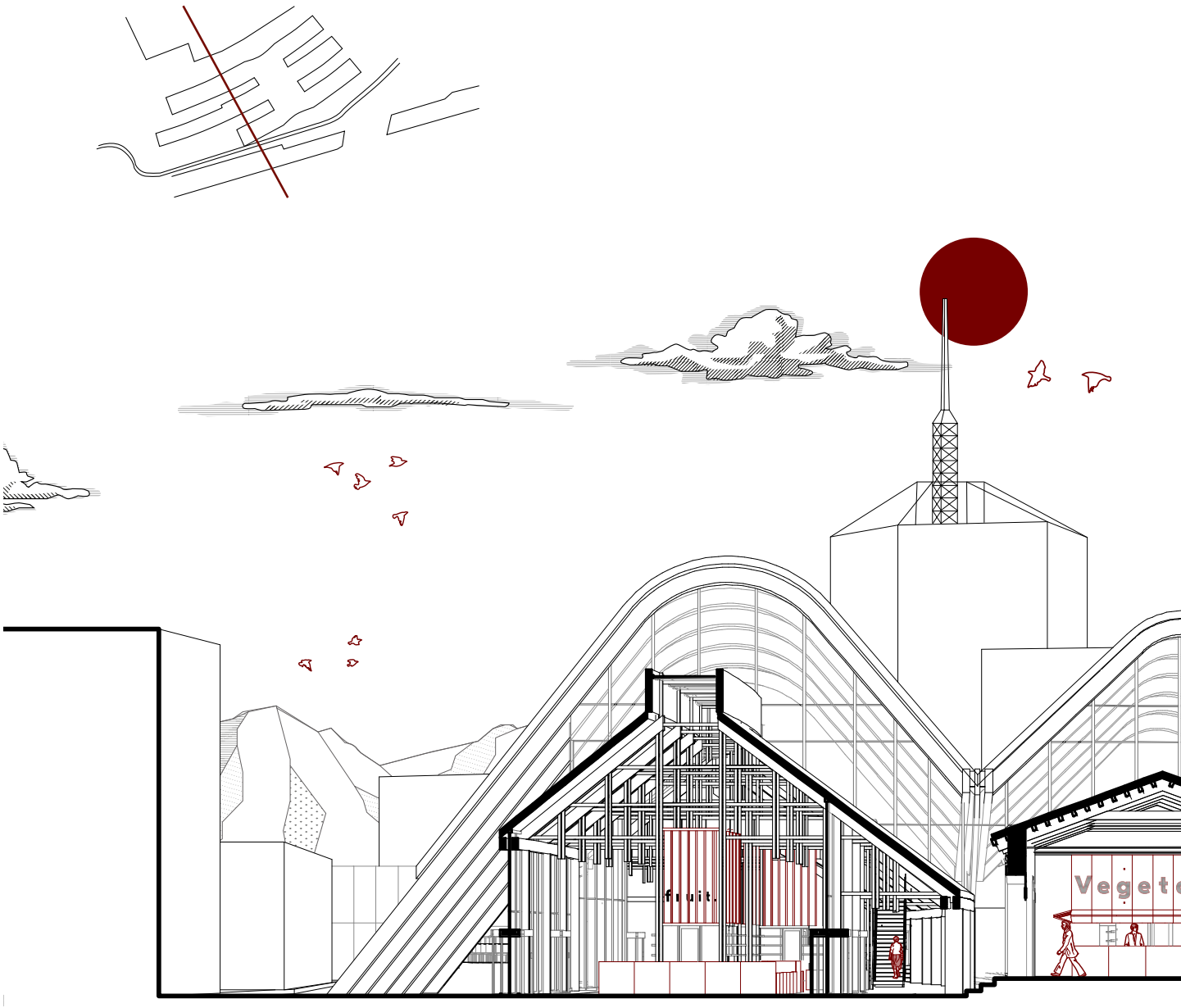
Two of these elements, the central ones, are extended till the floor. They become the main structural elements that support the market stalls type A. A metal facade wrapped around them encloses a small storage space. Around it there is a smaller-scale structure to place boxes or glazed showcases for the products.

The stall type C is similar, but it has an independent structure. The metal envelope is also designed to be foldable, so that it looks like a full box when it is closed. Both types of stall can be decorated with the name of the category of products that they sell.

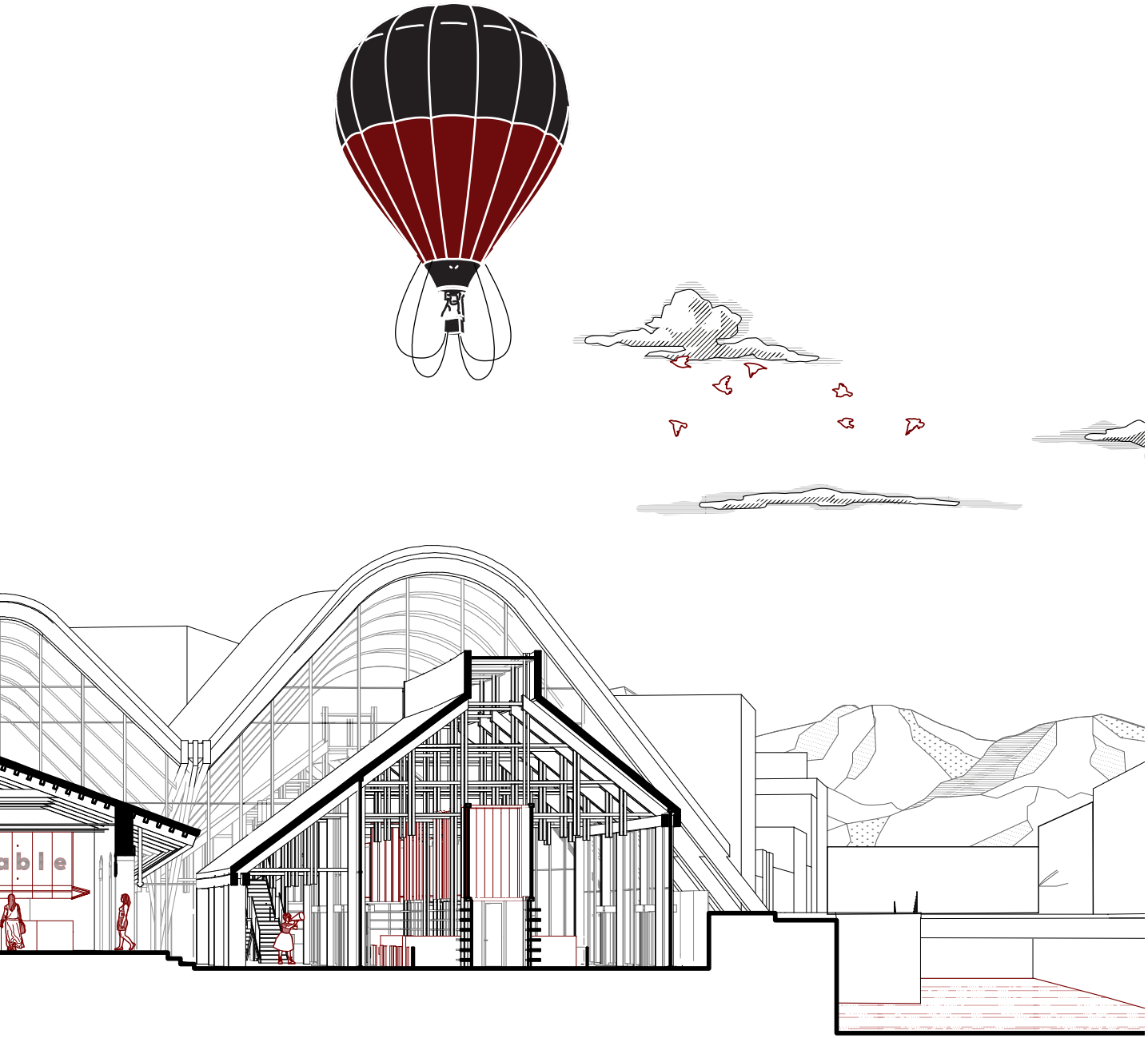


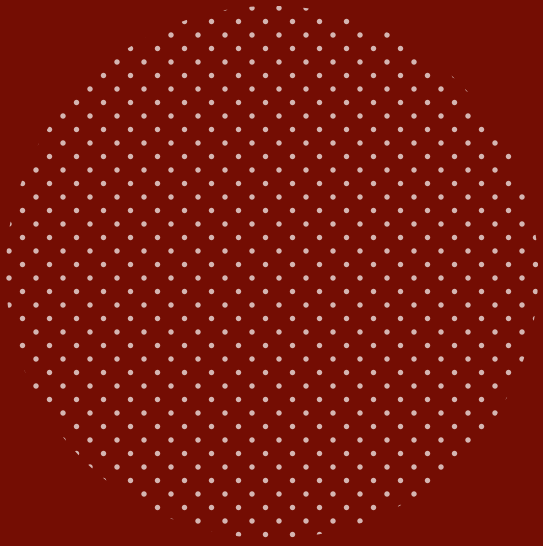


Axonometric details of the market stalls A and C

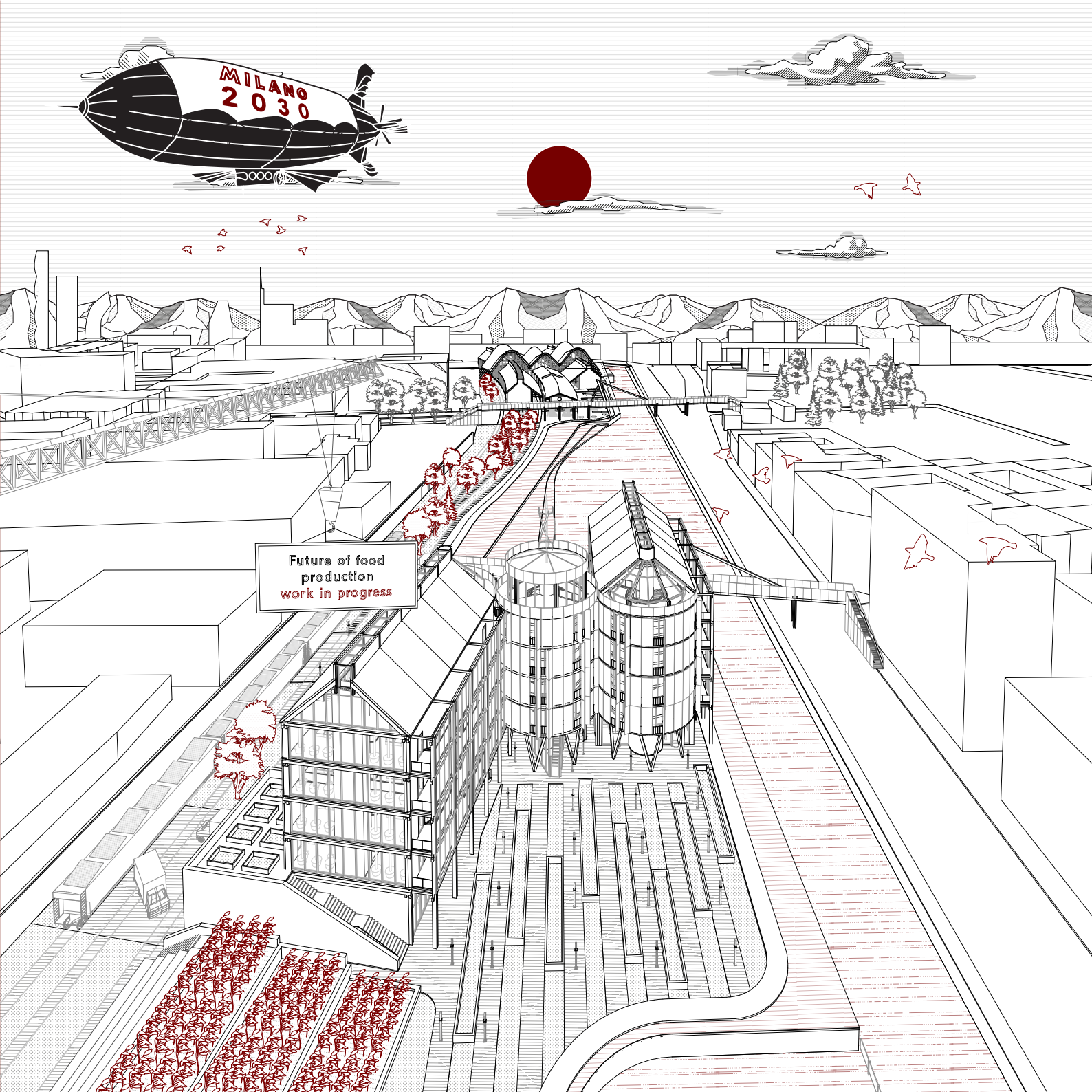


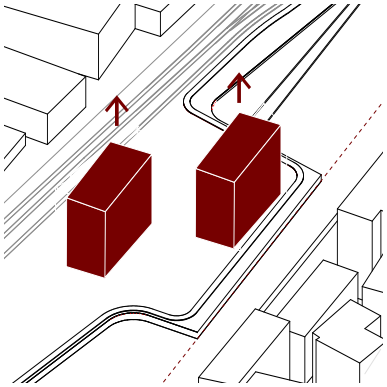
Perspective section of the market



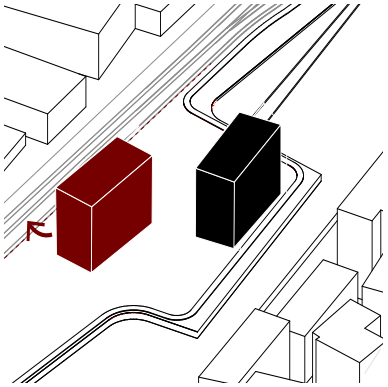


The future food hub

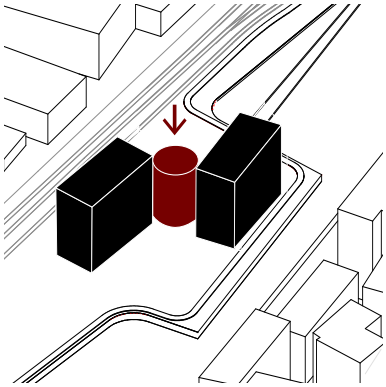

MILANO
2030
Future of food
production
work in progress



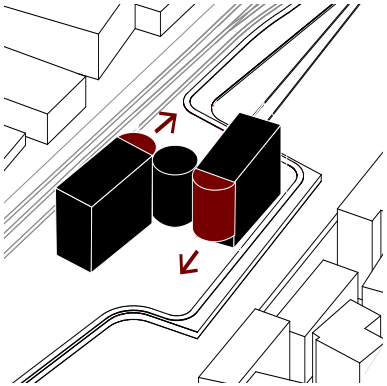
the volumes



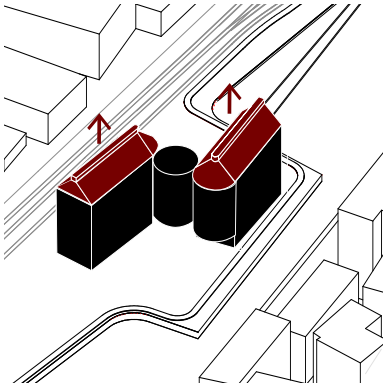
the alignment



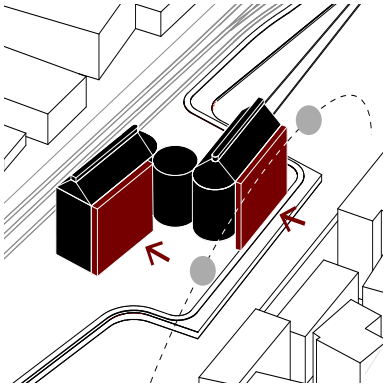
the cylinder



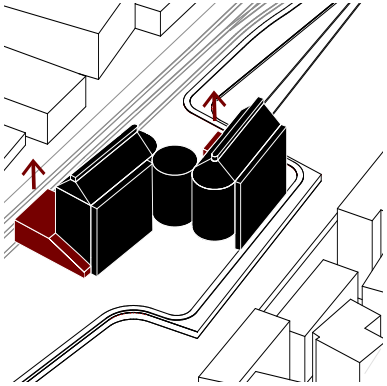
the hydroponic spirals



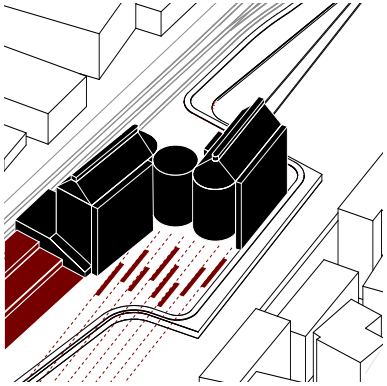
the roofs



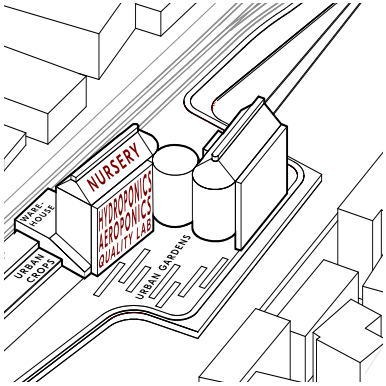
the external circulation



the warehouses



the urban crops



the new functions

The design intentions

Approaching the design of this part of the project was tougher, especially because of the innovative nature of the typology and the consequent lack of references. The project falls within the plan of the municipality to bring manufacturing and production back in the city[1], after a process that moved it to the peripheral hinterland, as shown in chapter 2.

Most of the reasoning were based on the suggestion given by Despommier in his book *The vertical farm*, on the few built examples that I found and on the technical papers about the hydroponic system that I consulted.

The design of this prototype of future food hub also integrates the concept of a vertical spiral hydroponic system that was developed together with the SAEXE[2] project funded by Alta Scuola Politecnica and the BEAVER[3] team from MIT.

The volumetric concept

The design process started from the identification of the best location for the urban farm. Unlike the previous cases, the rest of the railway yard was empty and there were no references at all to decide the position and the orientation of the new buildings. The tectonic design of the open areas, the shape water reservoir and the footprint of the existing fences helped organize the space and establish a more precise area of intervention.

The first step was to define the volumes, trying to understand which could be the best ratio of width, length and height to host the food production activities. Following Despommier[4]'s suggestion, the design reasons around multiple connected buildings from three to five floors, which is the most optimized volume to organize all the systems and spaces required. The final shape of the building eventually results into two twin volumes.

In order to respond to the morphology of the place, these simple narrow-end long volumes are north-south oriented and aligned to the Naviglio Grande and the railway. The two twin buildings are connected through a third cylindrical volume, which hosts the spiral hydroponic system. This piece acts like a hinge between the two main buildings, while also providing a connection.

1 Progetto Manifattura Milano.
2 It stands for Space Architecture for Extra-Planetary Exploration.
3 It stands for Biosphere Engineered Architecture for Viable Extraterrestrial Residence.
4 Despommier (2011).

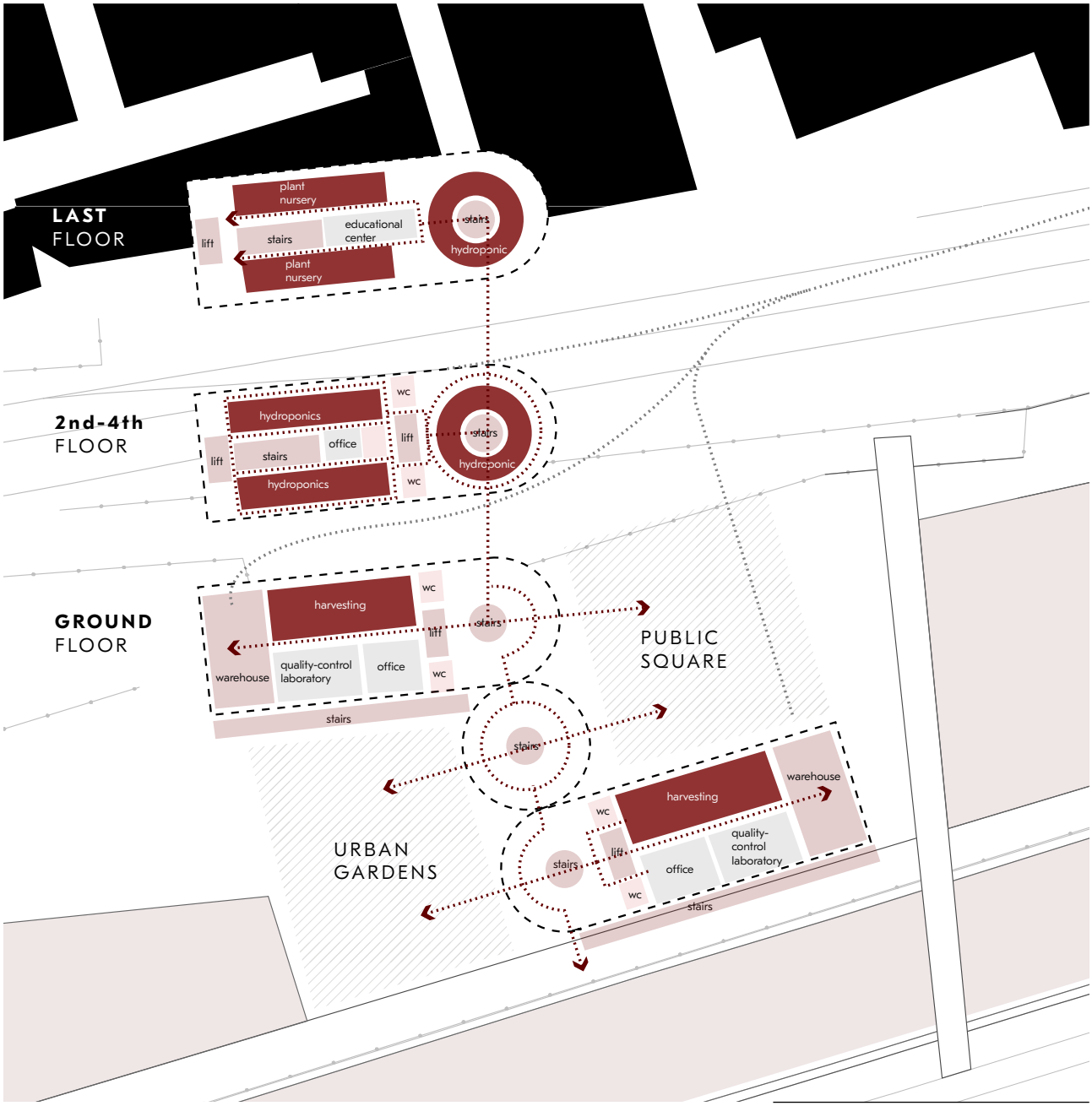


Diagram showing the metaproject of the food hub

The same system is extended to the main longitudinal buildings with the addition of semicircular apses.

The roof of the two buildings are also shaped like the rest of the new constructions which I have already described before. The inspiration for the final shapeof the module is coming from the industrial and agricultural silos.

Four additional volumes are implemented in the structure: two are added to the southern facade to provide external circulation and surface for photovoltaic panels; the others are connected to the ground floor to accommodate the warehouses.

The public spaces around the food hub are related to the rural theme of the place, thus providing extensive crop areas and urban gardens for the citizens. Given the design of the water reservoirs, the food hub becomes a sort of urban island.

The internal layout organization

The prototype is organized vertically to optimize the food production process and improve the flow of water through the crops. The floors are connected through a double system of large lifts which are used to move both farmers and plants throughout the compound.

The top floor, just below the sloping roof, is therefore dedicated to the nursery and the related activities such as seeding, pollination, pruning and germination. The floor accommodates also the tourist education centre which is opened to the public.

The three main floors hosts the horizontal and vertical hydroponic crops, as well as the aeroponic trays. The distribution revolves around a central staircase. The office to control the machines, the changing room for the workers and the toilets are also connected to this system.

Each floor is divided into three main areas. The central part is mostly occupied by the horizontal tanks for the hydroponic crops and three rows of aeroponic trays, piled up over the hydroponic system. One side hosts the vertical hydroponic crops, while the other is occupied by the vertical spiral hydroponic system, which is directly connected to the top floor nursery area and the harvesting space.

In between these three areas there are two elevators which are used to move trays up and down.

The ground floor is still organized around the main staircase. It is divided into two areas: a public one with the entrance and the visitors reception; a more private one, reserved for the workers,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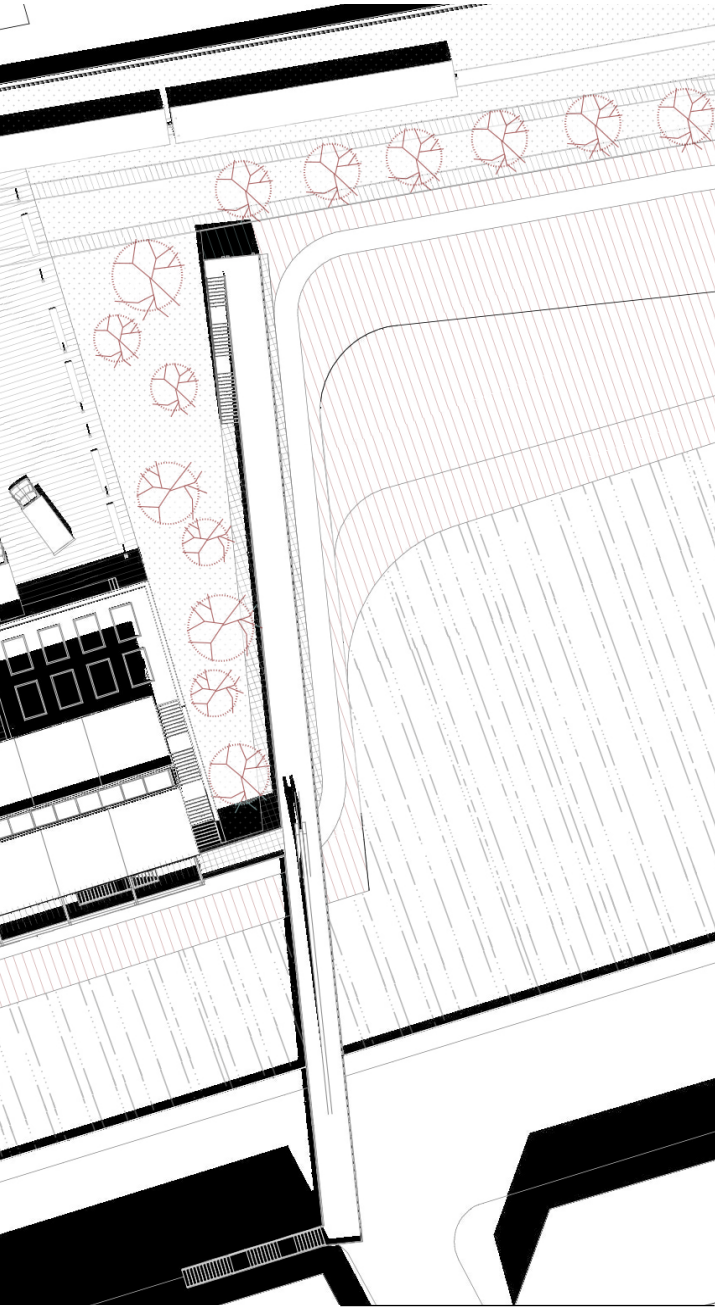
20 m



Roof plan of the food hub

with the control and management office, the quality control laboratory, the harvesting space and the food warehouse.

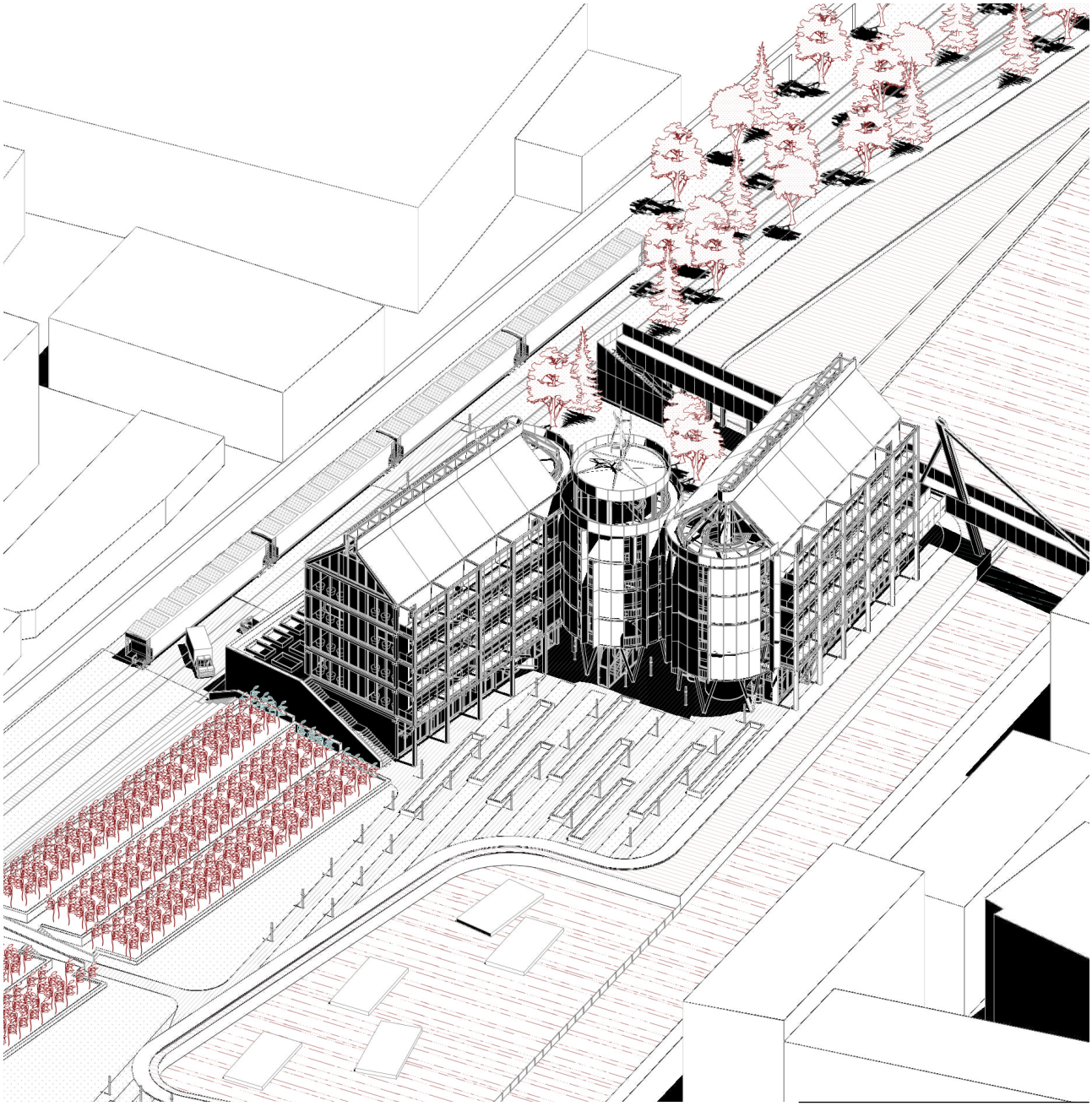
The open public spaces are organized in a different way on the two sides of the food hub. On the Naviglio side, a public square interfaces more with the water and accommodates some agricultural functions. On the back side, on the railway, there is a more flexible area which, like in the case of the market, is used both as a loading and unloading area and a gathering space.

The urban connections

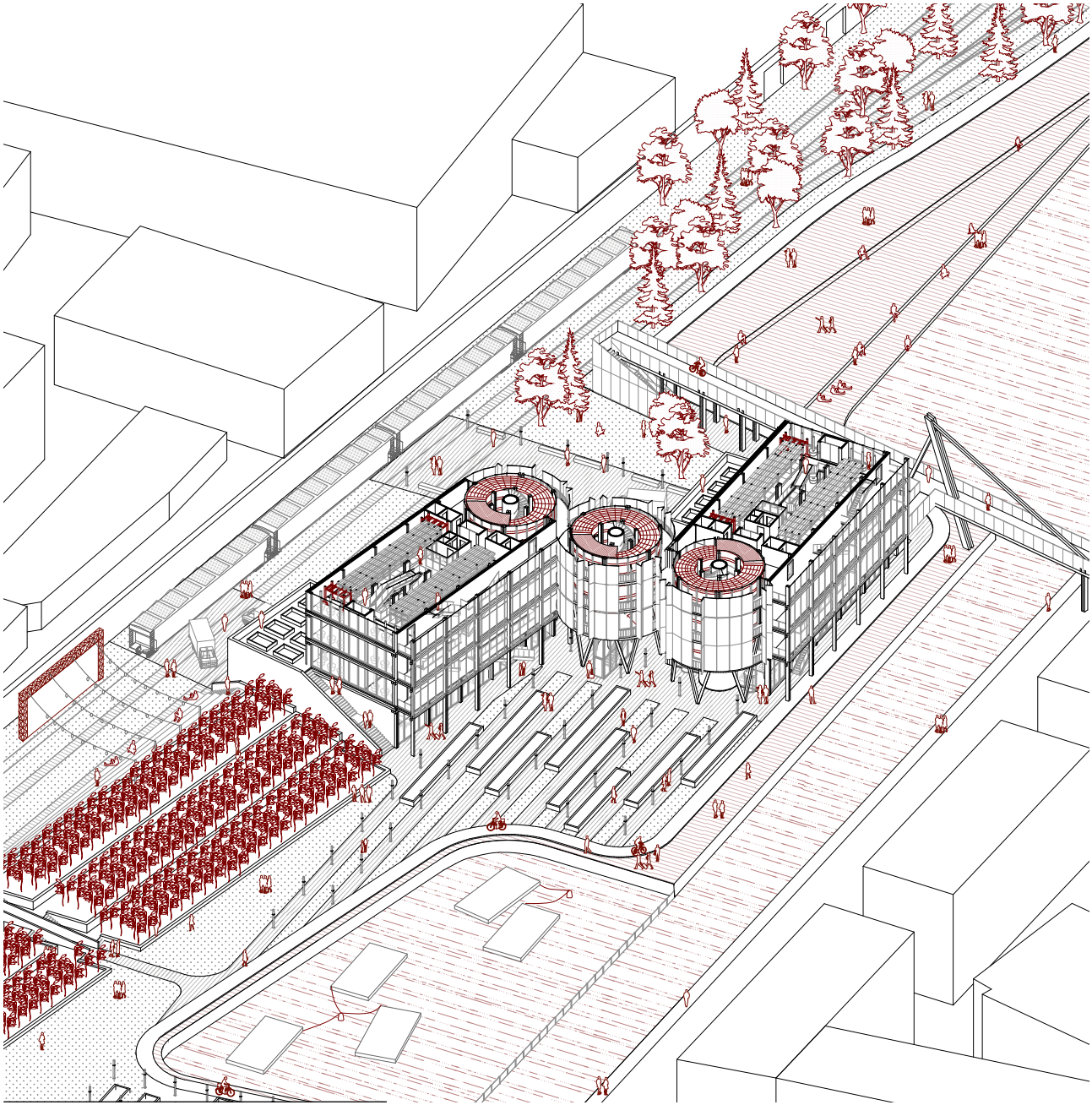
The food hub prototype seeks connection with the surrounding urban morphology. A new pedestrian bridge, twin to the market one, crosses the Naviglio, separating the Darsena Nova from the urban farm, to which it provides also direct access. The park connects the hub with the market and the station.

The open public spaces

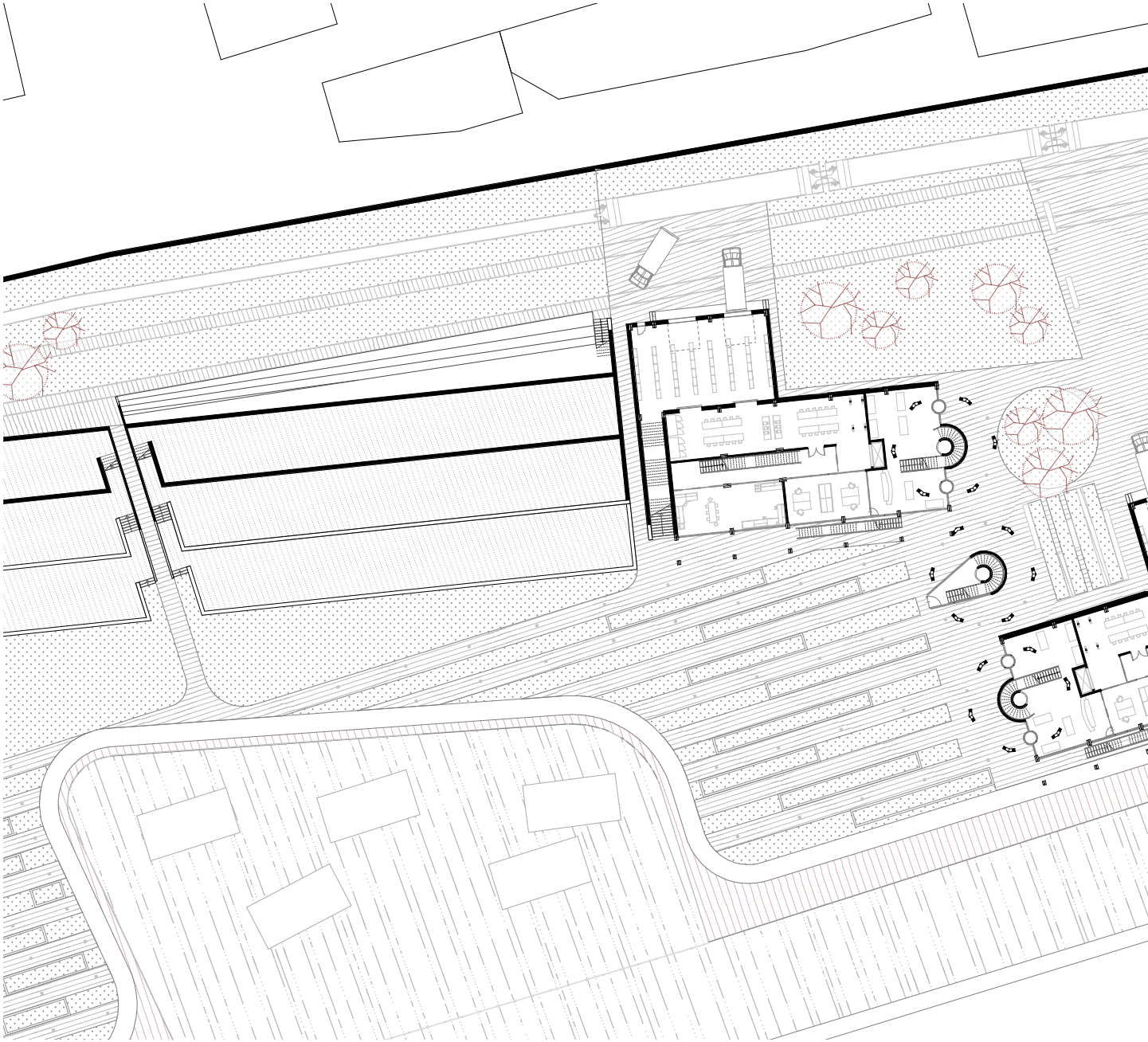
The northern part of the external areas are directly connected with the public park. A flexible square with a circular hood provides also access to the automatic solar-powered train which carries the goods from the food hubs to the



Axonometry of the food hub



Axonometric cross section of the food hub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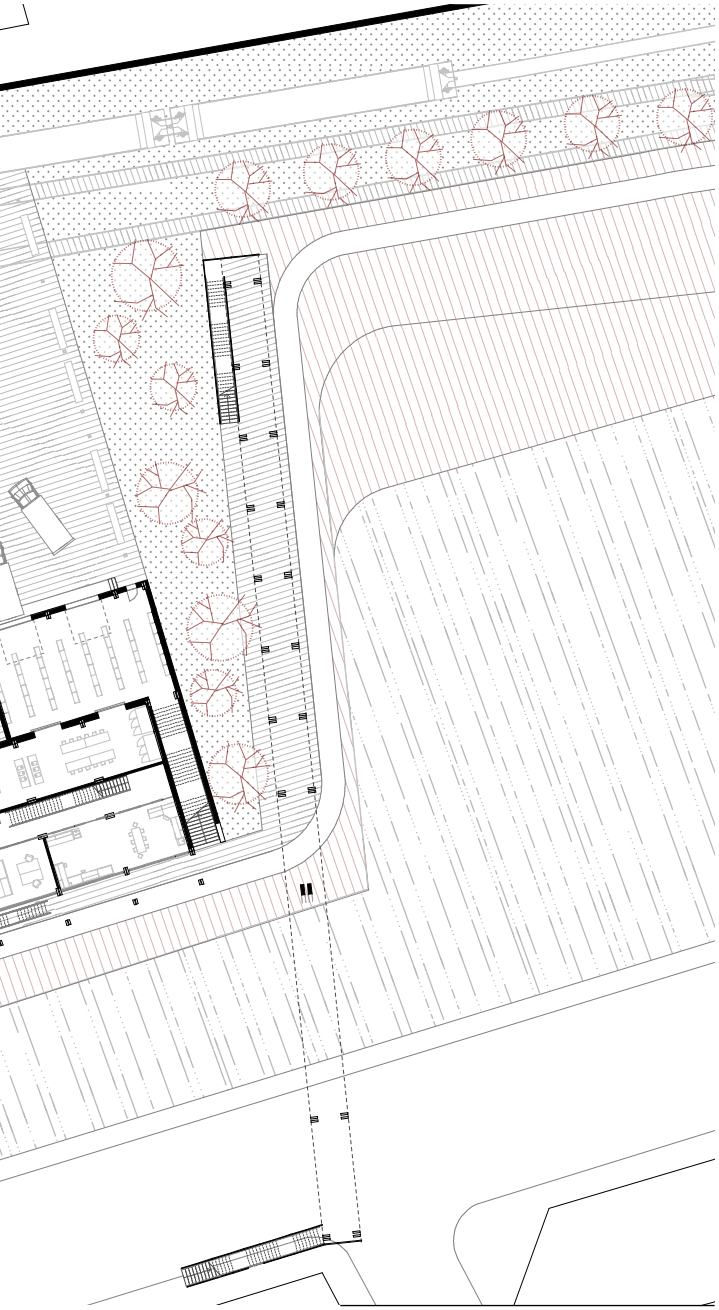


Ground floor plan of the food hub

station, through the market, using the existing railway. The train only moves during the night, when the loading and unloading activities are held.

The southern area is defined by a precise texture of green stripes, which run parallel to the Naviglio, reminding of the rails. Some tanks are provided here to grow urban gardens. A second extension of the Naviglio Grande creates a fish basin which is also used for crops on the model of the *Floating Fields* in Shenzen by Thomas Chung.

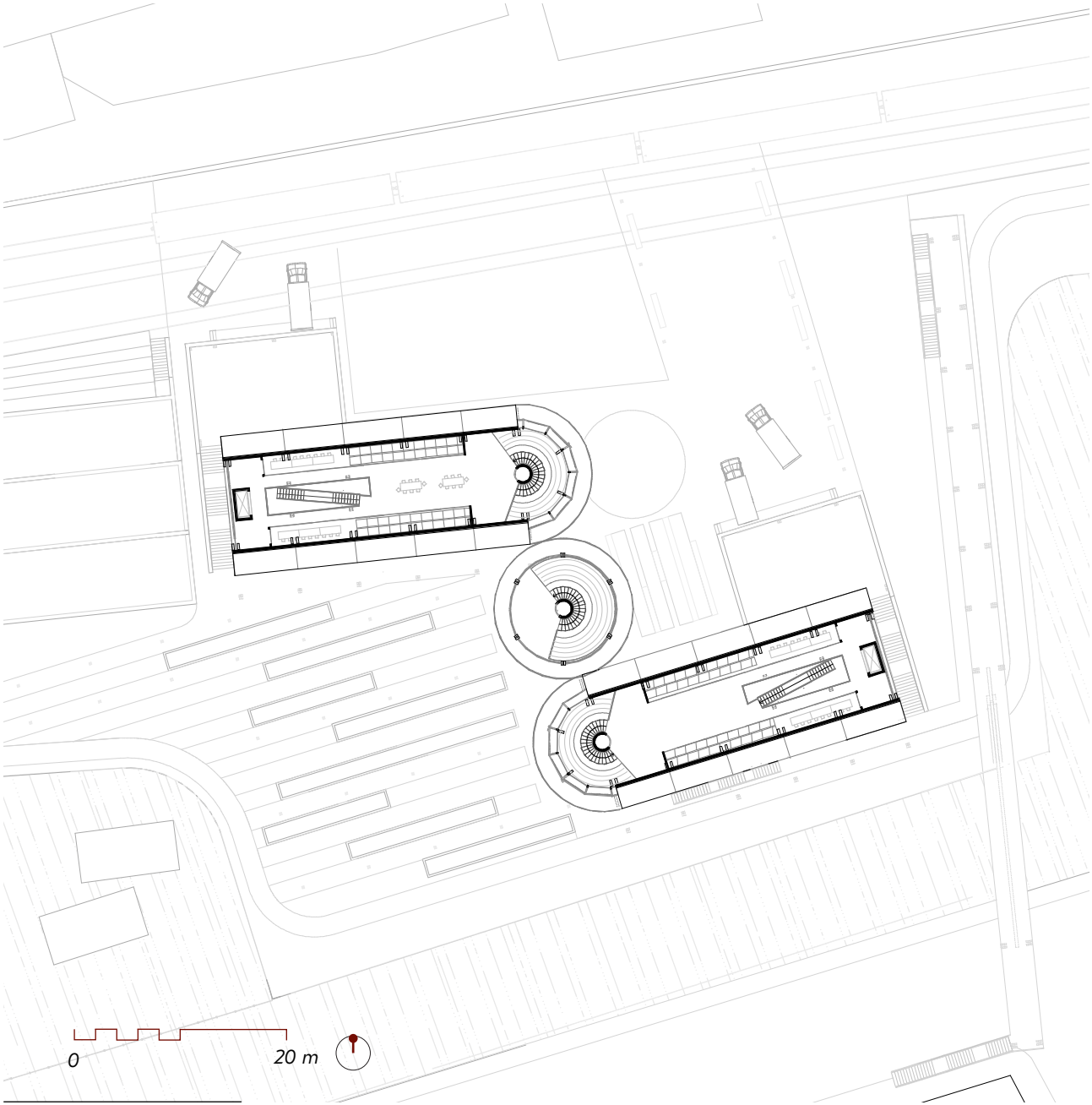
The cycle lane skirts the Darsena Nova, then flanks the Naviglio and the fish basin to eventually connect with the existing line. The reservoir is also separated from the Naviglio by a net in order to allow aquaponic cultivations.

The earth derived from the excavation of the water basin is tectonically reused to create a series of terraces with agricultural crops. The back of those terraces is equipped with steps to create a flexible public space which can be used as open-air theatre for events.

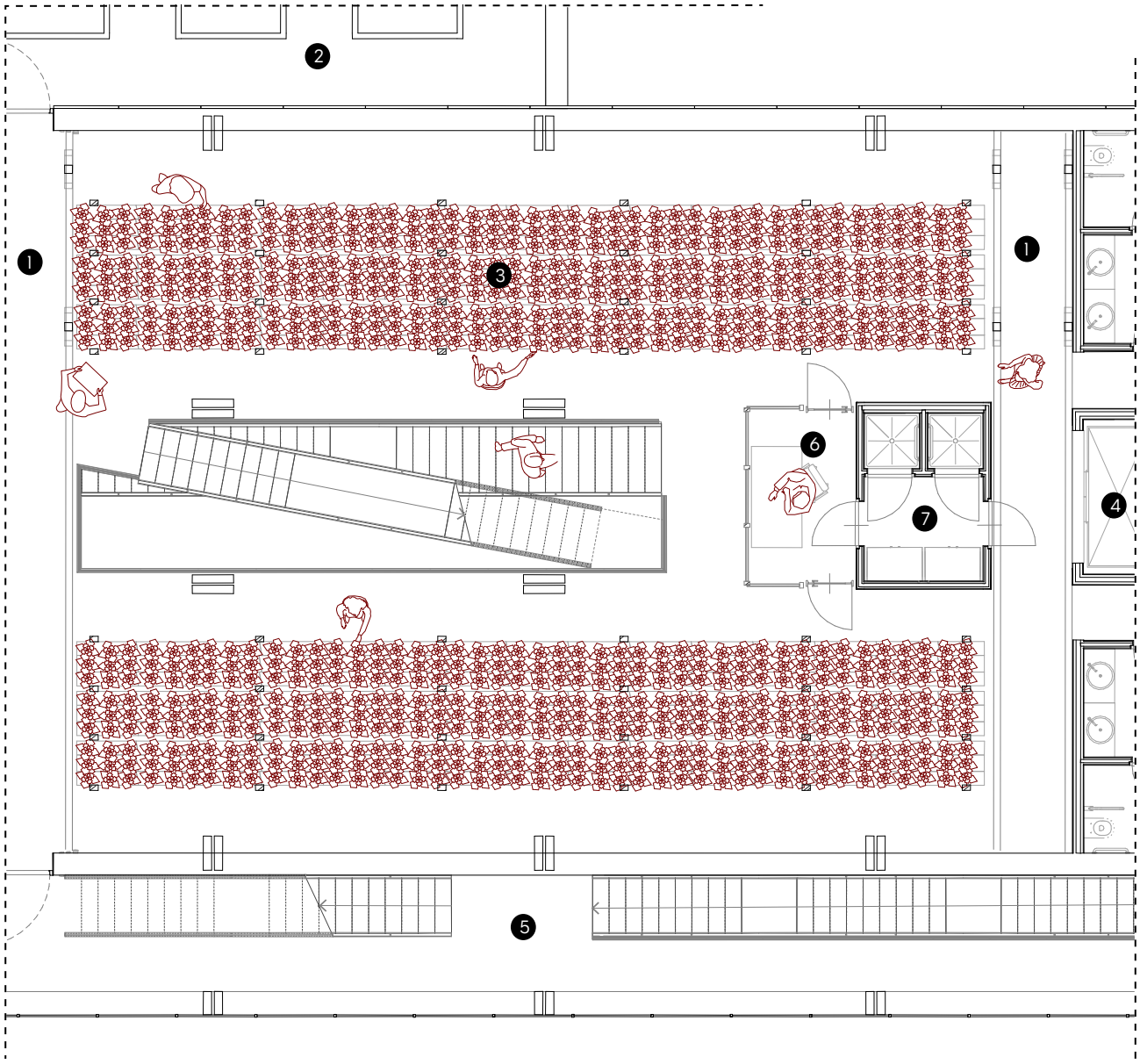
The ground floor

The two buildings which compose the complex of the food hub are organized in a similar way, thereby I will explain the

First floor plan of the food hub



Top floor of the food hub



0 5 m

layout of one of them.

As already mentioned before while talking about the internal distribution, the ground floor is organized into two main public and private areas. The main entrances are located at the base of the cylindrical volumes, where there are also the spiral stairs and the elevator for the nursery. The reception hall is occupied by a resting and welcoming space with sofas and tables.

Behind the reception counter there are the management office and the laboratory for the quality control and the research on food. The other spaces are the harvesting area, where the fully grown plants are prepared for selling and the warehouse, where the products are stored. In this area, the trays are also disinfected, cleaned and sent back upstairs to the nursery.

1 *Automatic crane*
2 *Urban roof gardens*
3 *Hydroponic crop*
4 *Plants lift*
5 *External emergency staircase*
7 *Control office*
8 *Changing rooms*

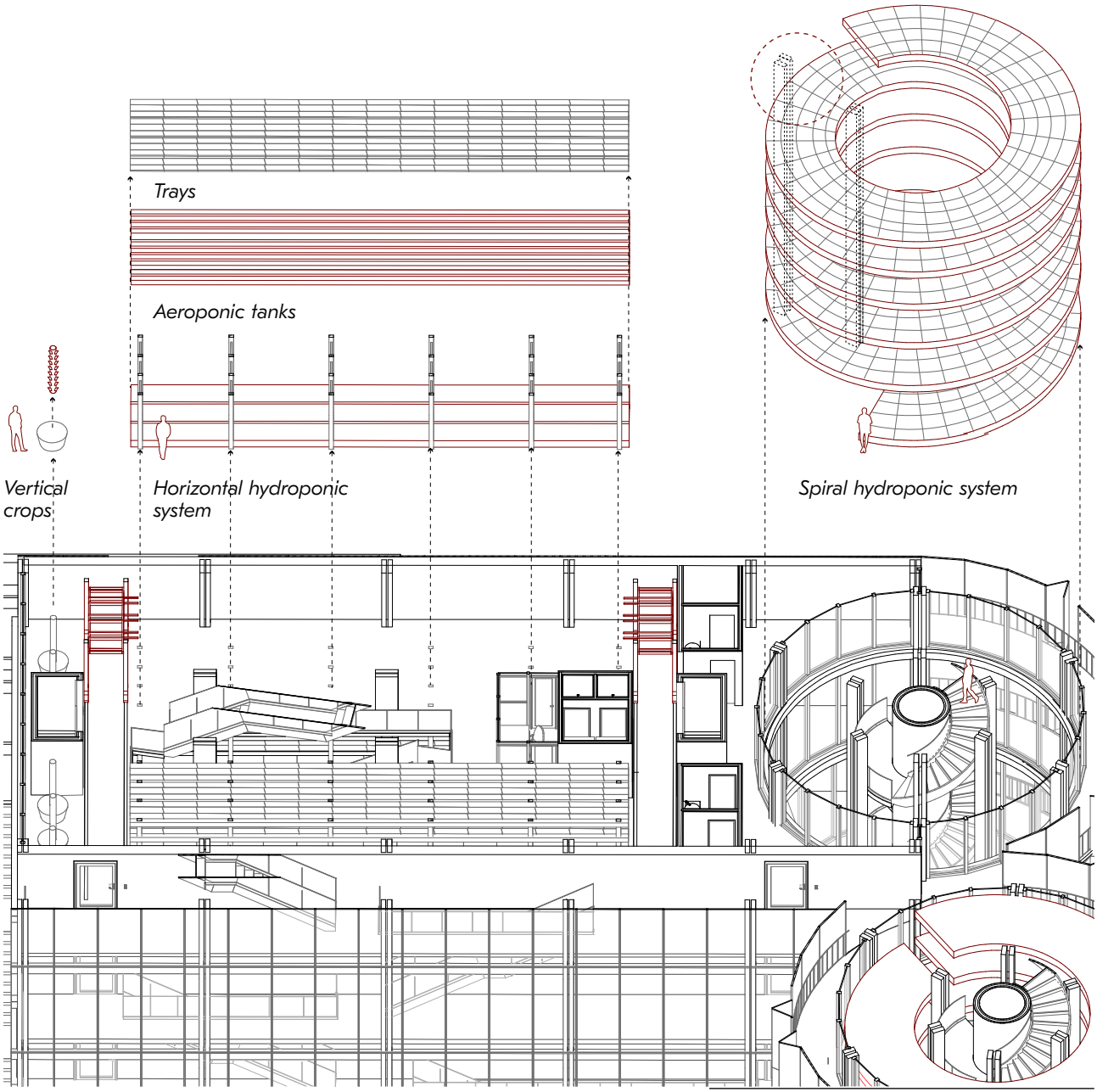
Detail of the first floor of the food hub

The central floors and the horizontal hydroponic system

The main floors of the food hub are occupied by different types of hydroponic crops. Like in a proper assembly line, the entire system of food production is automated and controlled by a small office in the central area of the floor. Temperature, atmospheric conditions and lights are also precisely monitored. Changing rooms and toilets for the workers are also arranged around the office.

The space is marked by the two large lifts. After germination in the dark rooms, the former brings the transplanted trays from the nursery to the hydroponic crops, where an automatic crane moves and positions them. The latter carries the grown plants, hooked to a second crane, to the harvesting area or the quality-control lab at ground floor. The cranes are designed to move over rails simultaneously, so that when one removes the grown plants, the other one can fill in the void with new planted trays.

The bottom part of the aeroponic tracks is embedded with a full-range, colour-tunable LED system that replicates the colour rendering index (CRI) of natural light.



Axonometry of the hydroponic systems

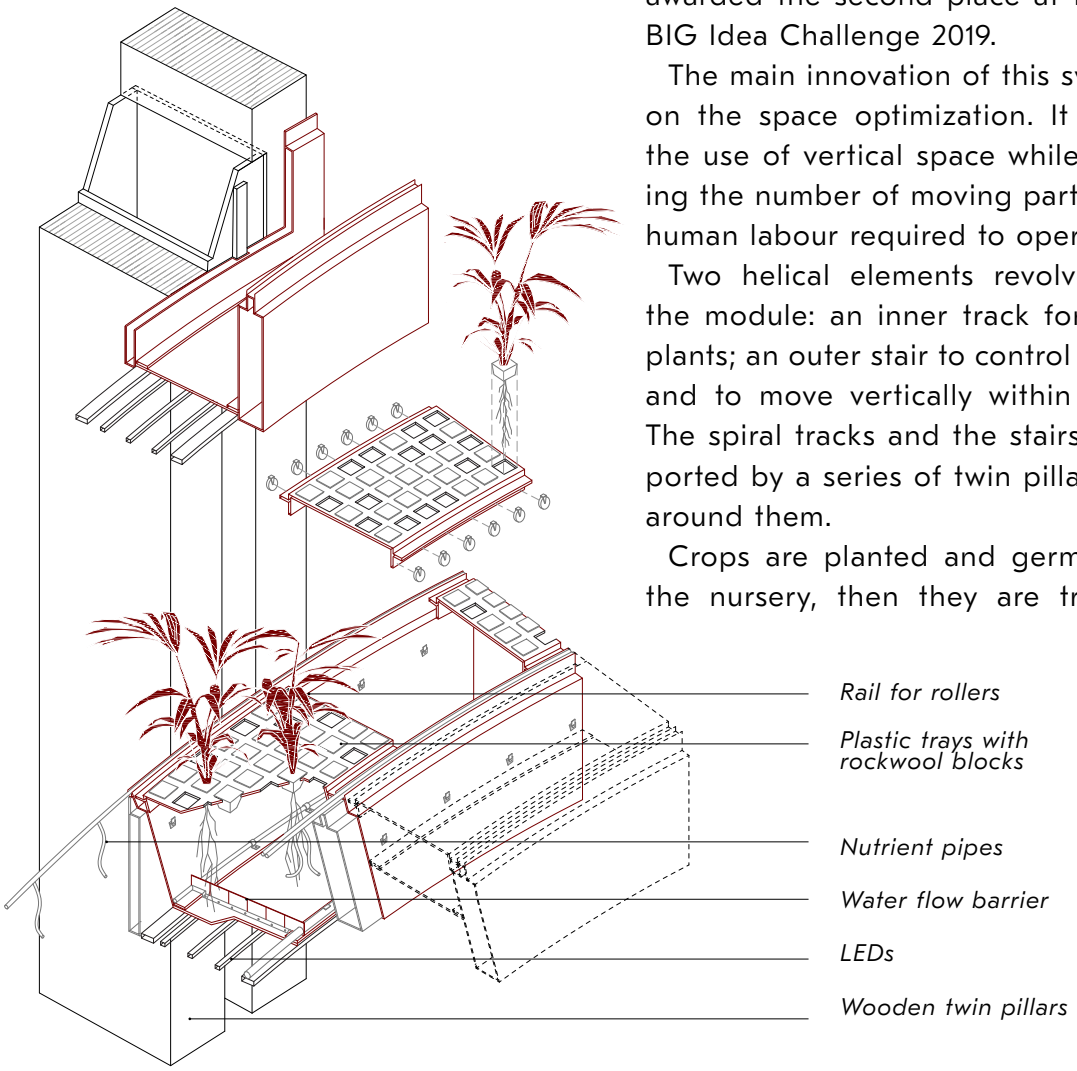
The vertical helical hydroponic system

This innovative spiral system was developed together with the Alta Scuola Politecnica and a group of students from MIT. The concept was implemented in a greenhouse module to integrate an habitat developed by NASA for the Mars exploration. The project has also been awarded the second place at the NASA BIG Idea Challenge 2019.

The main innovation of this system lies on the space optimization. It improves the use of vertical space while minimizing the number of moving parts and the human labour required to operate it.

Two helical elements revolve around the module: an inner track for growing plants; an outer stair to control the crops and to move vertically within the hub. The spiral tracks and the stairs are supported by a series of twin pillars placed around them.

Crops are planted and germinated in the nursery, then they are transplant-



Axonometric detail of the hydroponic spiral system

ed and placed on the track. They slowly move down to the bottom via gravity and rollers, reaching the ground floor when plants are ready for harvesting. In order to optimize this solution, the distance between successive rounds of the spiral trays decreases with height: at the top when the plants are young and short, the spirals are close together vertically, while at the bottom when the plants are mature and tall, the spirals are farther apart.

Six of eight archetypes of plants will be grown in the main spiral. The others will be grown with the other hydroponic systems. Each of the six spiral archetypes has a dedicated track in the spiral that they flow down during their growing lifecycle.

Each tray is made of durable polyethylene plastic and holds several plants in place. In this way, it is lightweight and easy to be manually removed if necessary. Trays are a maximum of 30 cm deep

West elevation of the food hub

to support traditional hydroponics and provide room for stem and root growth.

The bottom of the tracks implements LEDs as well to grant a sufficient quantity of light to the plants.

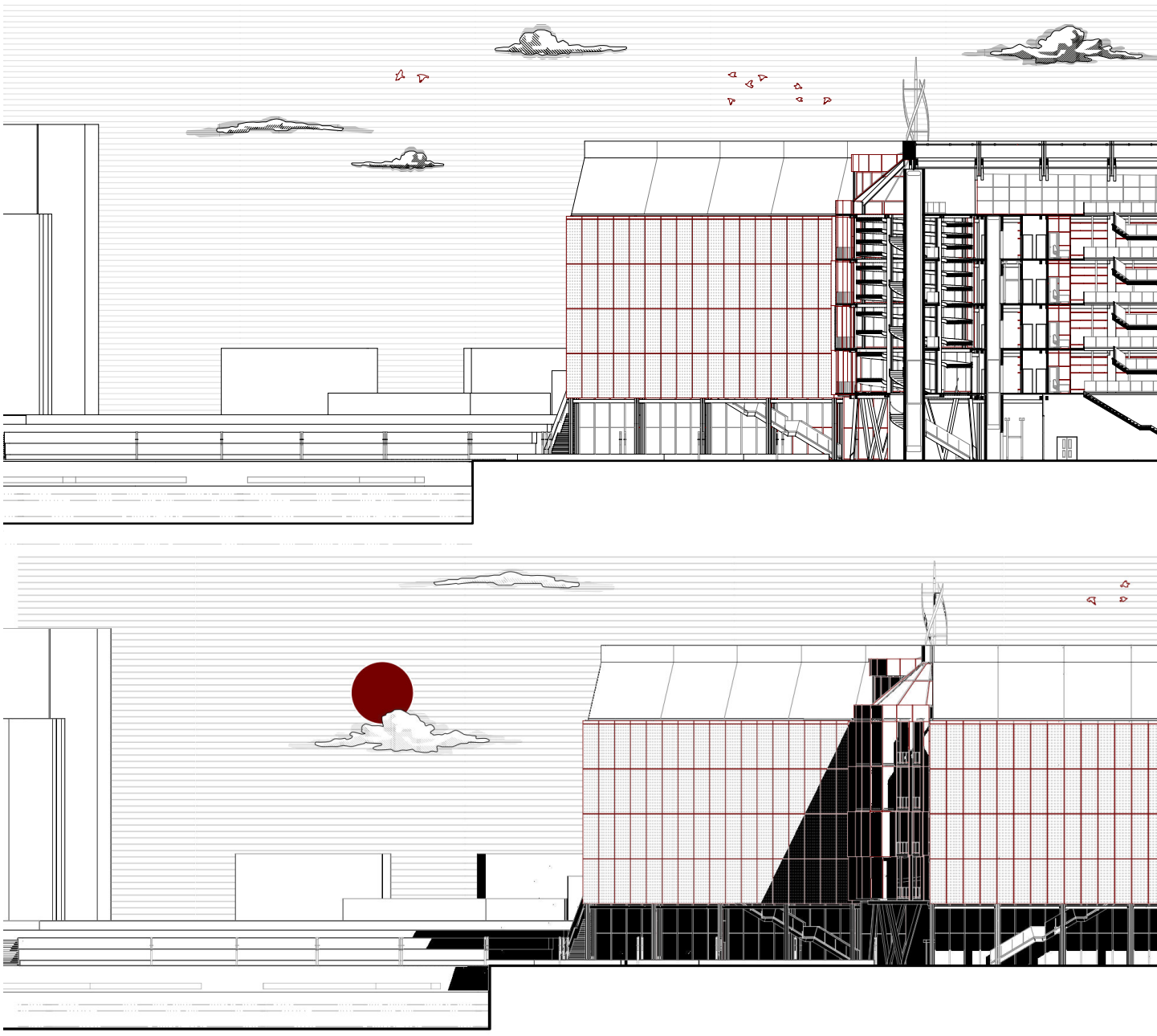
The energy production system

The food hub prototype will be also a completely self-sufficient structure from the energetic point of view. The electricity needed to run the machines, the water pumps and the lights will be provided by the photovoltaic panels installed on the southern facade and by the wind turbine implemented on top of the central cylinder. This element will also become a landmark for the food hub.

The water recycling system

As it is shown by the diagram on page 162, the water is first taken from the Naviglio, then filtered and pumped up

East elevation of the food hub



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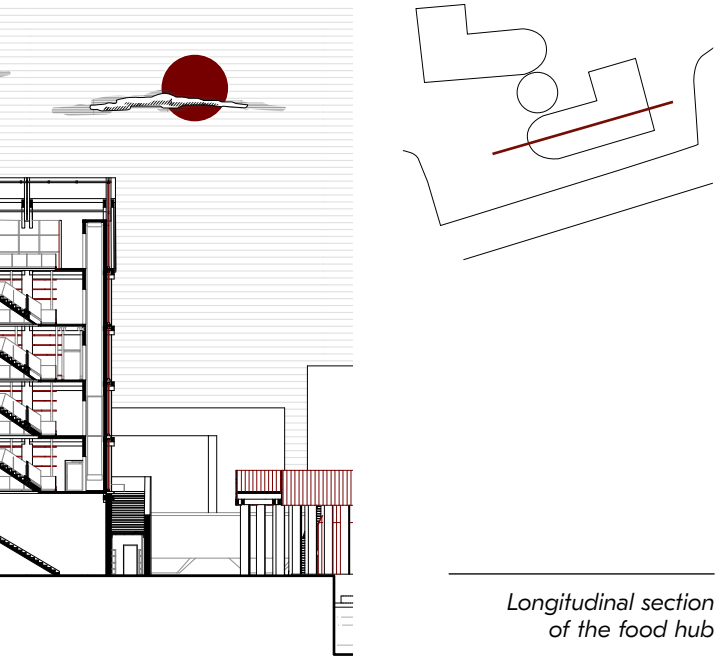
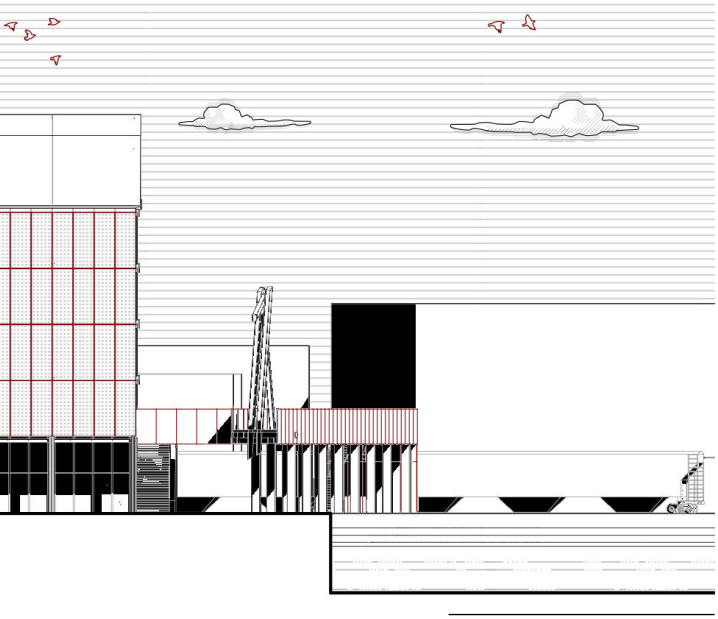


Longitudinal section of the food hub



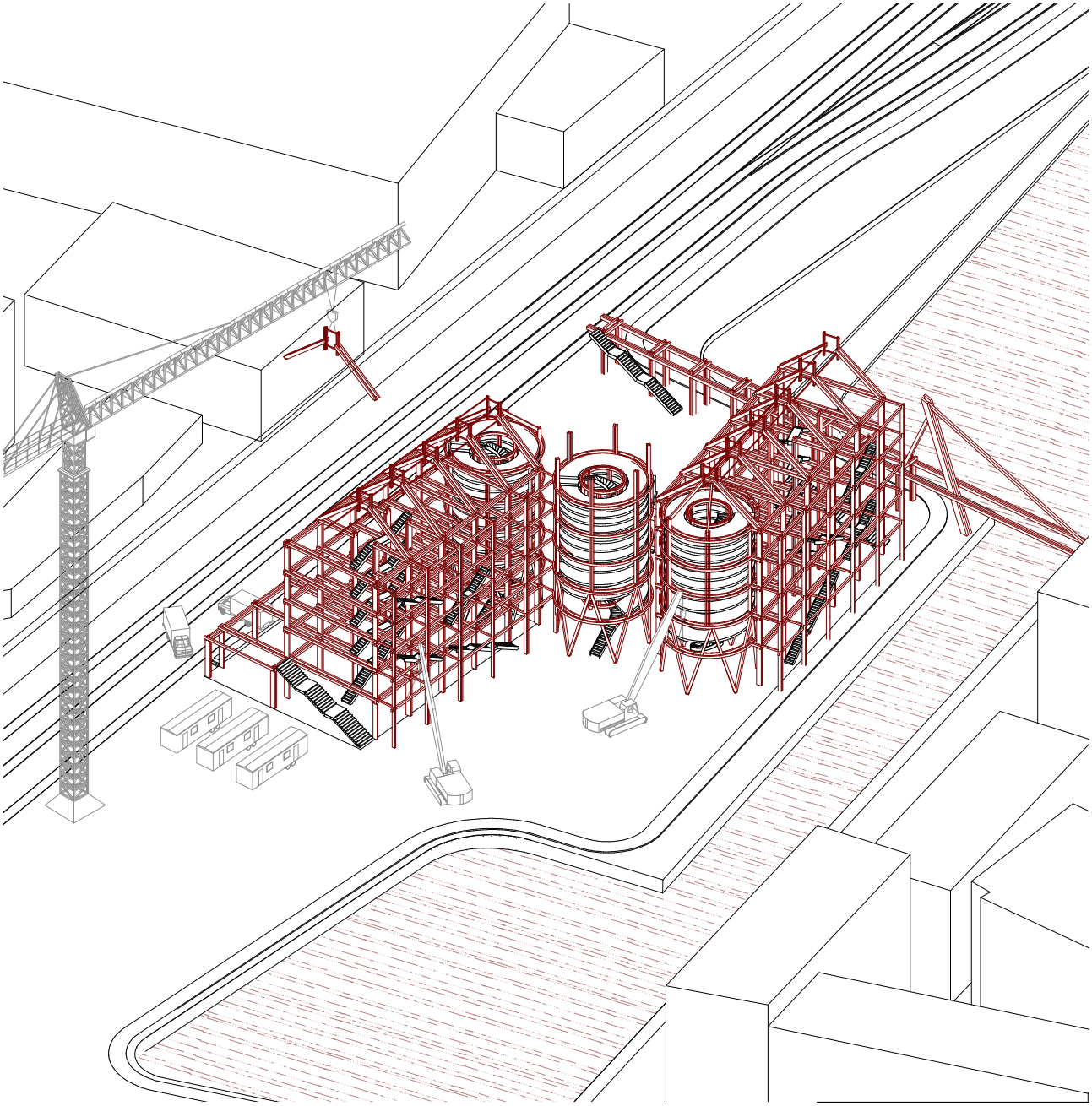
South elevation of the food hub

to the nursery where nutrients are added. The water starts to flow down and through a series of pipes reaches the aeroponic trays, where it is vaporized among the roots. The water is then collected through the vertical supporting elements of the trays and sent to the hydroponic tanks at the base. After passing through a second filter, the water is either pumped back to the top floor or sent back to the source, where it is used to feed the aquaponic crops.

The nursery

The top floor area is dedicated to germination activities and early care processes. The zone provides the precise conditions needed for seeding, while allowing easy access during this high-care time. The dark rooms can be accessed by the specific personnel, but citizens can be involved in early preparation in the education/tourist centre.

Once the plants are mature, they are transplanted into different types of trays, according to their destination. Then they are either placed on the spiral track or sent down to the other hydroponics.



Axonometry of the structure of the food hub

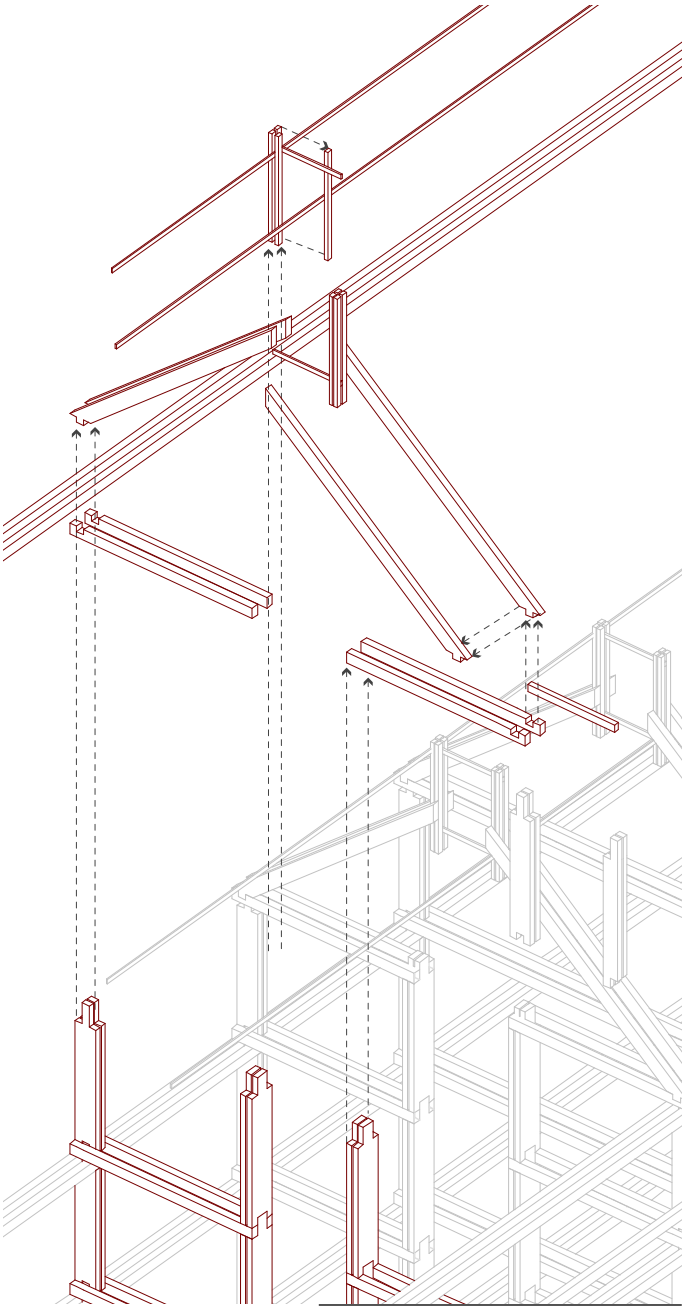
The external envelope

Most of the external walls of the food hub are blind and implement the same type of bio-composite panels of the market and the station. The southern facades have a double layer to both get the benefits of a buffer space and provide an emergency external staircase. The outer layer is made of transparent photovoltaic panels, supported by a grid of wooden beams. The cylinders have a double facade too, with an external gallery which connects the three buildings.

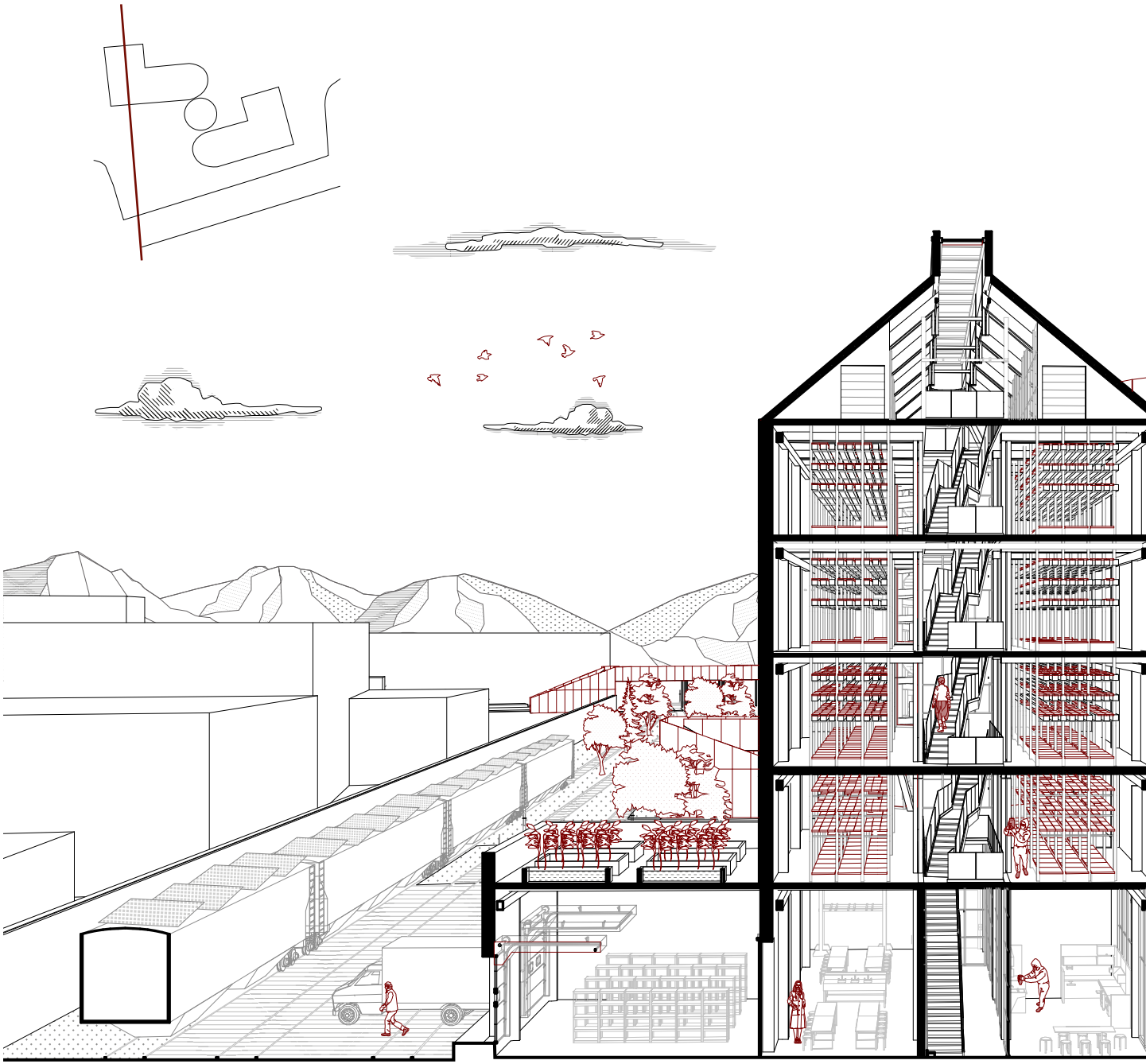
The circular structure

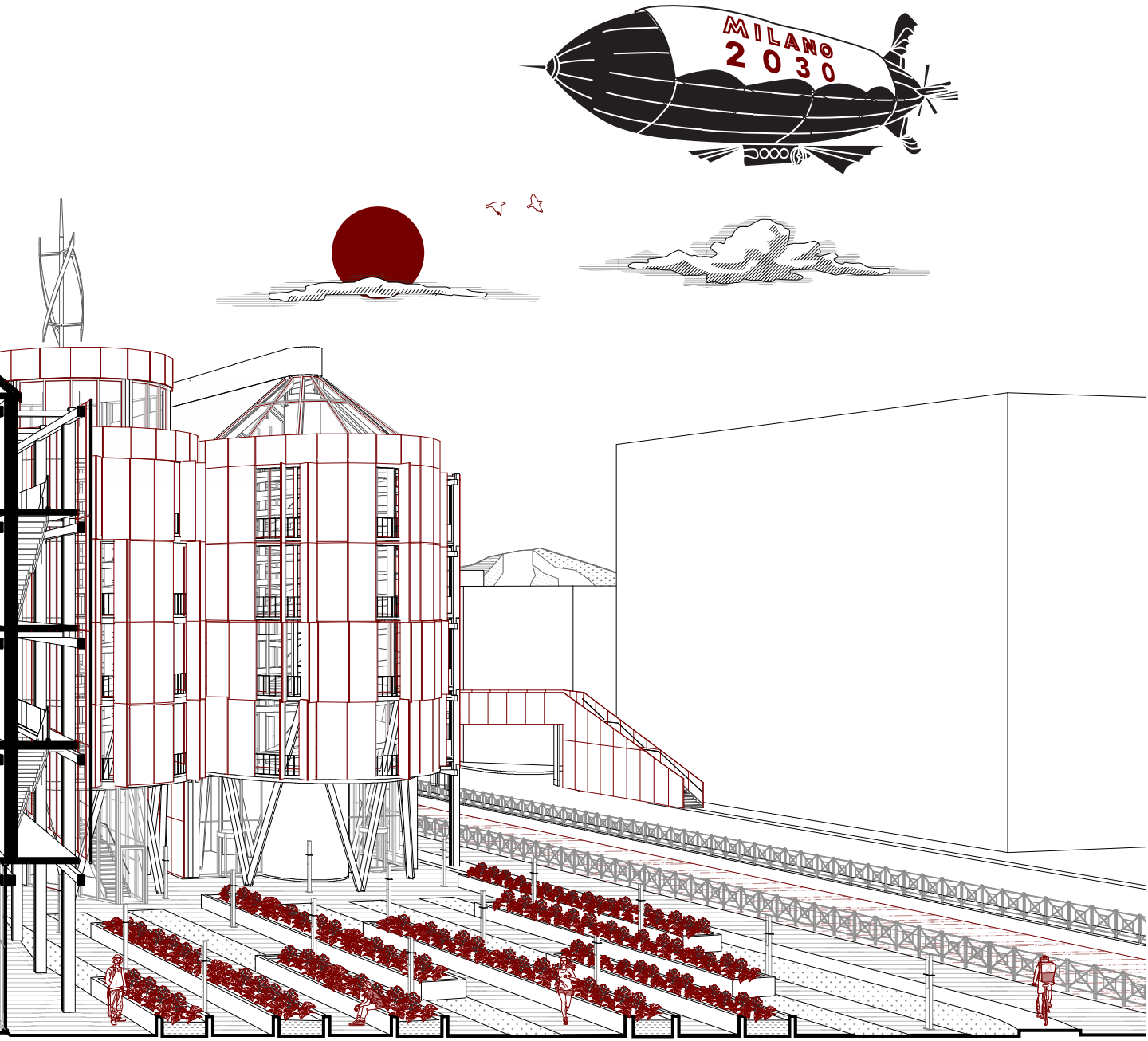
Like the other projects, a wooden interlocking system is designed to be easily disassembled or transformed, according to the principles of circularity.

The system is slightly modified here to allow multiple floors. The twin pillars are shaped to interlock with the longitudinal and transversal beams. On top floor, where there is the sloping roof, the transversal beams are replaced by diagonal ones. As illustrated by the drawings, the skylight is supported by the same system used for the station and the new buildings of the market. Smaller vertical elements are grouped in four and joint with two thinner transversal beams.

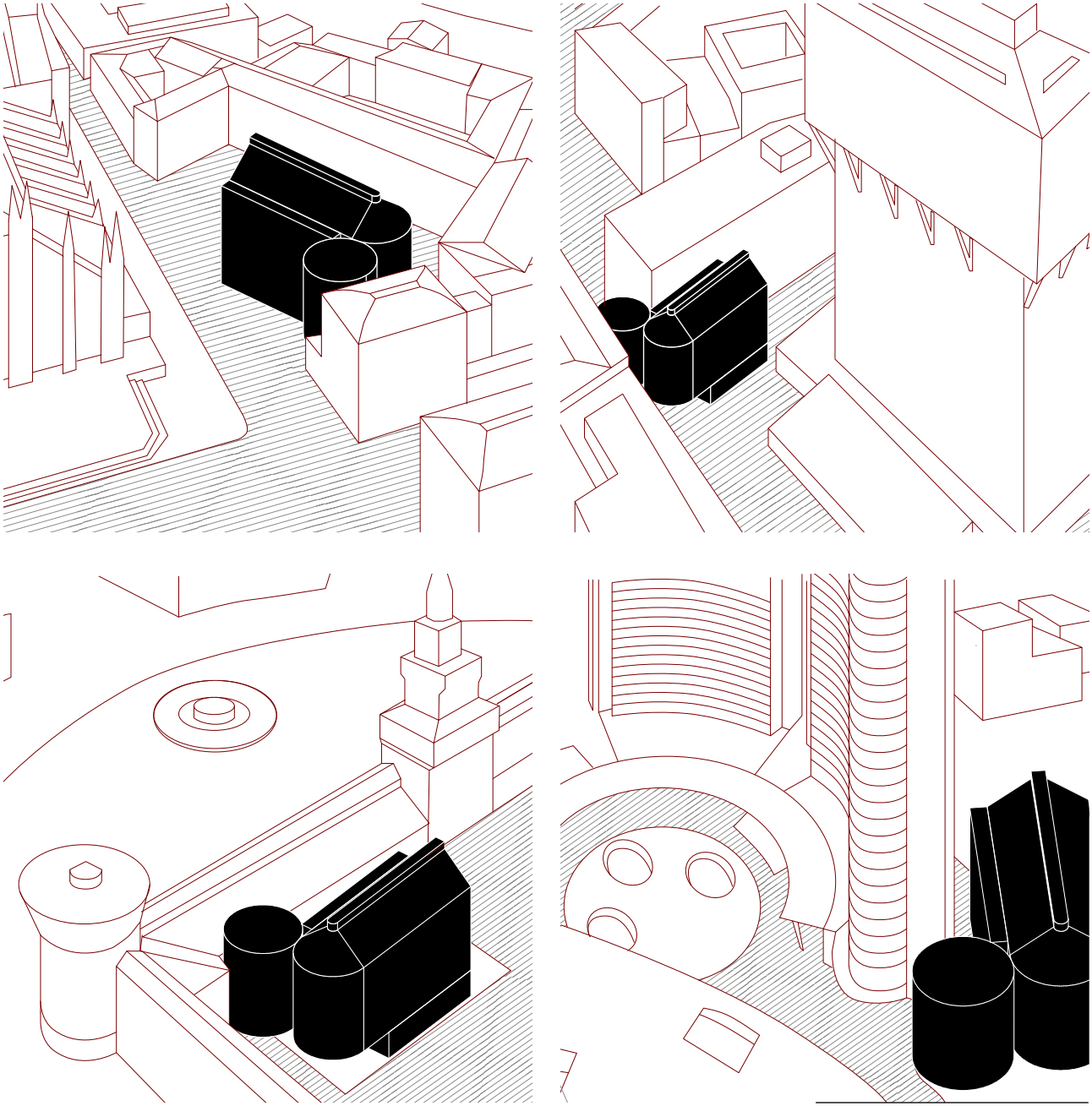


Axonometric detail of the structure





Perspective sectionof the food hub

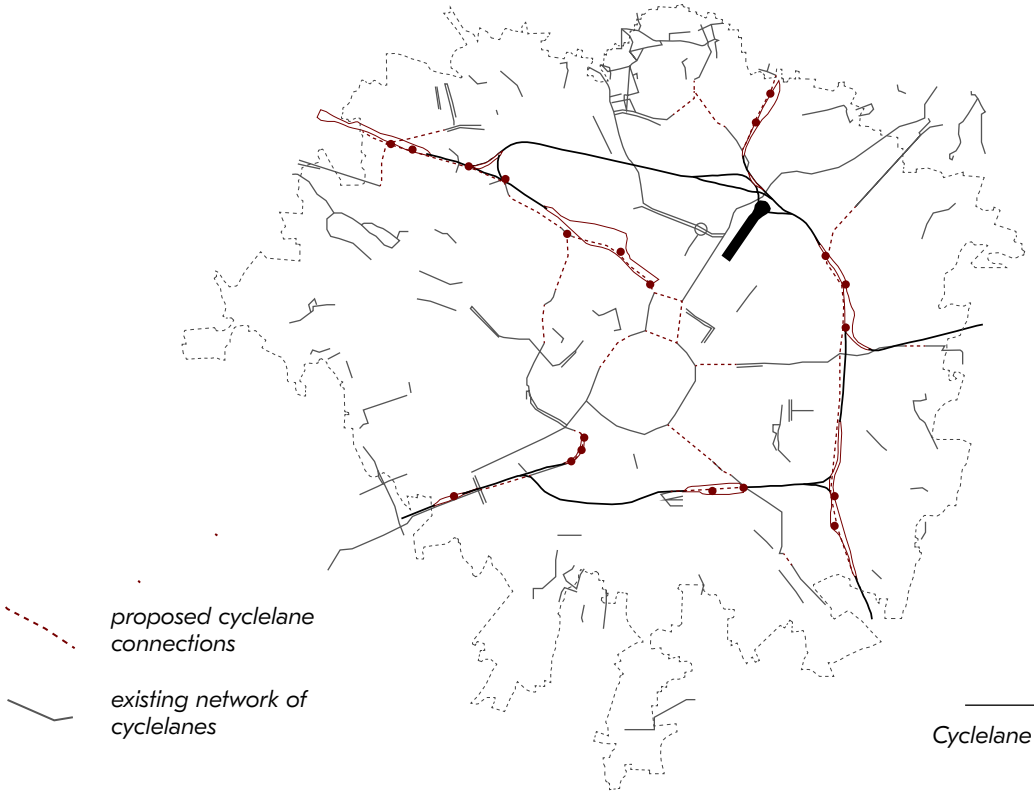


Provocative relocation of the food hub

The food hub prototype as a tool to revitalise urban areas

In a provocative way, with these four images I would like to suggest a possible future development for this prototype. Showing the food hub connected to the symbols of the historical and contemporary Milan, is a way to demonstrate that is possible to implement this module in different context to foster urban revitalization. The basic module of the food hub of Porta Genova is made of a narrow five-storey building and a cylindrical tower. The latter can be used as a hinge to connect this plug-in to existing architectures. The hub might be implemented in abandoned areas or degraded urban tissue to foster a renovation and attract new investments and jobs.

The intervention designed for Porta Genova might become the pilot project for the rest of the railway yards network and the centre of an innovative system of urban food production and delivery, which innervates the entire city.

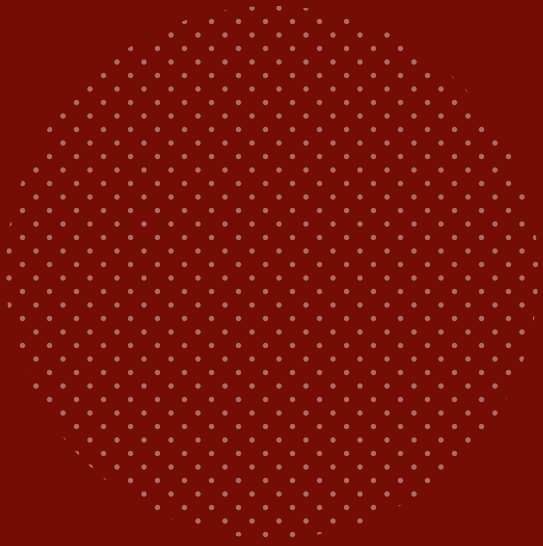


Cyclelane network and integration with the railway yards

The house is a machine for living in.

(Le Corbusier).

Design evaluation



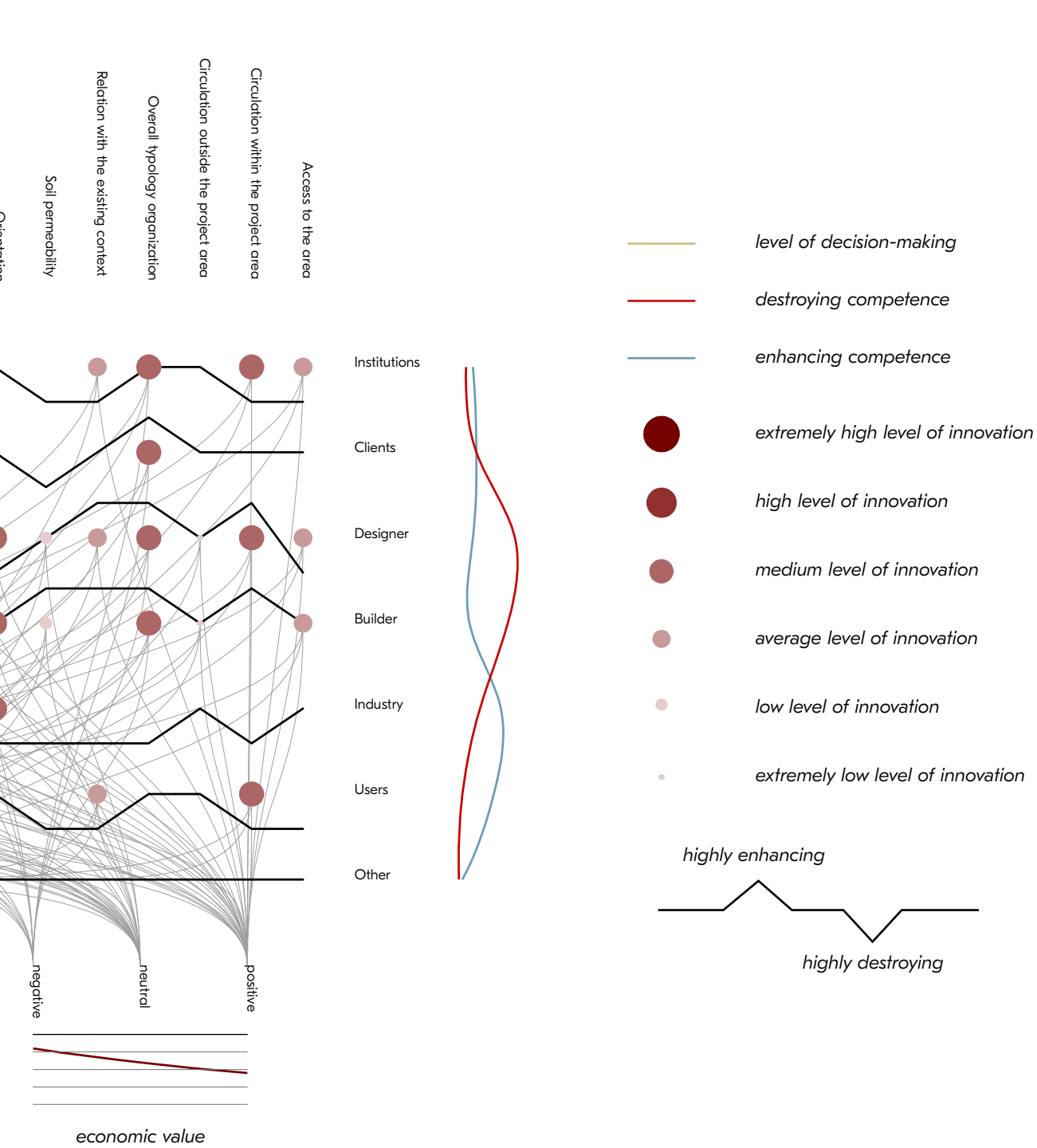
Project assessment

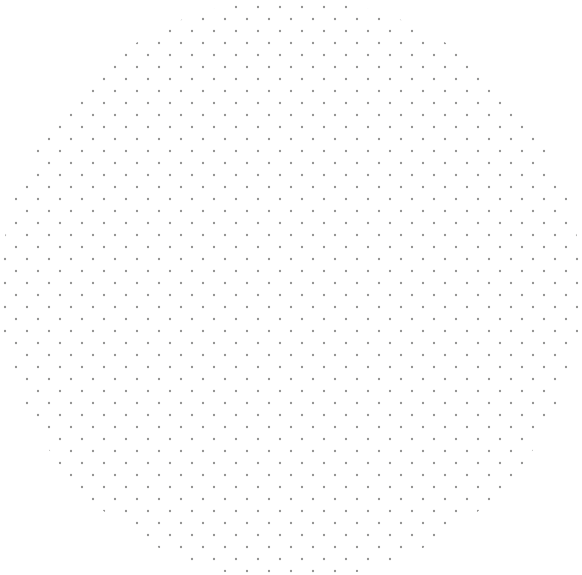
At the end of the design phase, I proceeded with a self evaluation through an assessment graphic. A grasshopper model was implemented to analyse the results of the project in terms of environmental, social and economic value. It also evaluates the role and weight of the decision-makers and their request in terms of competence.

As it appears from the graph in the following page, the designer and the builder have the bigger impact on the decision-making of the project, as well as the most destroying impact on their competences. The complexity and innovative nature of the project, especially from the typological point of view, seriously affect the resources and time required by the designer and the builder to acquire the necessary competences.

The overall balance of the project is good, since all the three curves at the bottom show a positive trend. The initial expectations about the environmental sustainability are not completely respected and this could be an aspect to develop more in detail in further iterations of the project.

Heating system
Lighting system
Ventilation system
Water system
Doors and windows
Horizontal partitions
Vertical partitions
Roof
Envelope
Circulation within the building
Building access
Floor height and number
Symmetry
Volume shape
Layout geometry
Typology
Dimension
Institutions
Clients
Designer
Builder
Industry
Users
Other
negative
neutral
positive
negative
neutral
positive
environmental value
social value


Access to the area
Circulation within the project area
Circulation outside the project area
Overall typology organization
Relation with the existing context
Soil permeability
Institutions
Clients
Designer
Builder
Industry
Users
Other
negative
neutral
positive
economic value
level of decision-making
destroying competence
enhancing competence
extremely high level of innovation
high level of innovation
medium level of innovation
average level of innovation
low level of innovation
extremely low level of innovation
highly enhancing
highly destroying



Conclusions

«Food shapes cities and through them it moulds us».

The short quote from Carolyn Steel that I propose again here summarizes the initial question that I tried to answer to with this work. Is it possible to recognize to the food a physical role in the urban morphological transformation? To give this answer, the discussion of the thesis addressed four main issues, which I will quickly recap below.

First, the fast growth of the global urban population is seriously threatening the availability of resources, thus raising serious questions on how cities could feed themselves in the future.

Second, since ancient times, food has always shaped the urban morphology, by establishing paths and creating exchange hubs. This work tried to reason about smart cities and the possibility of using food as a device to foster revitalization in disused or abandoned areas.

The third issue is related to the choice of Milan as a case study, giving its leader position in the food policy discussion. The opportunity to reflect on the effects of food on urban refurbishment was found in the current debate about the future of the railway yards of the city.

The fourth and last issue reflects on how the circular economic approach and its recent application in the construction industry might represent a feasible and sustainable new way of designing cities and buildings.

The thesis proposes therefore a vision for the former railway yard of Porta Genova for the year 2030, the same time horizon given by the municipality for the latest territorial government plan. In the framework of this work, Porta Genova has been used as a laboratory to understand the relationship between food and the city, working at different scales, from the territorial management of the green spaces and the water system of the Navigli to the metropolitan network of the yards and the industrial production, as well as from the micro-urban plan for a public agricultural park to the architectural and design level.

The morphological approach that I followed helped describe the behaviour of this isolated part of the city, where boundaries and connections play a crucial role in the definition of the quality of the urban space. These two elements are the most interesting results of the project, since it appears clearly how the relationship between the existing established district and the new typologies are redefined by intertwined action of multiple flows of people, workers and goods.

The thesis still leaves an open question. Is it possible to talk about food smart city and on what terms? The reasoning that I reported in this work supports the idea that food-related issues might represent a concrete tool to design the city of the future. The functions that the project proposes, such as food administration, retail and production establish specific connection with the existing urban environment and have effects on the way people use those spaces. The restaurant activities, the market and agricultural production have an important gathering effect, which will attract people, while making them more aware of the environmental global threats.

The choice of these functions is only one of the possible solutions to refurbish the former yards of Milan, but it proved itself valid since it created a network of spaces, people and events that might be enlarged to the metropolitan and even regional scale.

Hence, if with *smart* we define a city which is equipped with an integrated multidisciplinary approach to rethink the role of the urban agriculture as a revitalizing tool, then we can consider the term *food smart city* not as a mere concept, but a real instrument for the redefinition of the morphology of the city, the renovation of degraded areas, the diffusion of an environmental awareness and the solution to the lack of resources.

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Bibliography

Food and city

1. *Donatella Calabi (1993), Il mercato e la città. Piazze, strade, architetture d'Europa in età moderna, Marsilio;*

2. *Heike Mayer, Paul L. Knox (2006), «Slow cities: sustainable places in a fast world», in Journal of Urban Affairs, vol. 28, no. 4;*

3. *Carolyn Steel (2008), Hungry City: How Food Shapes Our Lives, Random UK;*

4. *Jacques Trienekens, Peter Zuurbier (2008), «Quality and safety standards in the food industry, developments and challenges», in Int. J. Production Economics, No. 113, pp. 107–122;*

5. *Kevin Morgan (2009), «Feeding the City: The Challenge of Urban Food Planning», in International Planning Studies, No. 14, pp. 341-348 (DOI: 10.1080/13563471003642852);*

6. *Barbara Buchner, Claude Fischler, Ellen Gustafson, John Reilly, Gabriele Riccardi, Camillo Ricordi, Umberto Veronesi (2012), Eating in 2030: trends and perspectives, Barilla centre for food and nutrition;*

7. *Barbara Melis, Graziella Roccella (2015), «Territori del cibo e dell'energia. Gestione efficiente delle risorse nella smart city: nuovi temi di progetto», in FAmagazine (www.festivalarchitettura.it);*

8. *Ipsos (2016), Il futuro vien mangiando. Tradizioni e rivoluzioni dalla spesa alla tavola, report per Tutto food, Milano world food exhibition;*

9. *Matthew Reed, Daniel Keech (2017), «Making the city smart from the grassroots up: The sustainable food networks of Bristol», in City, Culture and Society (http://dx.doi.org/10.1016/j.ccs.2017.07.001);*

10. *Food Smart Cities for Development. Recommendations and Good Practices;*

11. *www.archdaily.com/881525/baltic-station-market-koko-architects (retrieved on April 2019);*

12. *www.architetti.san.beniculturali.it/web/architetti/progetti/scheda-proget-ti?p_p_id=56_INSTANCE_hIz4&articleId=22051&p_p_lifecycle=1&p_p_state=normal&groupId=10304&viewMode=normal (retrieved on April 2019);*

Urban food policy

13. *Andrea Magarini et al. (2016), «Elementi di scenario per la costruzione di un Consiglio Metropolitano del Cibo di Milano, Milan Food Council», in Economia e Sostenibilità;*

14. *Damian Maye (2017), «'Smart food city': Conceptual relations between smart city planning, urban food systems and innovation theory», in City, Culture and Society (https://doi.org/10.1016/j.ccs.2017.12.001);*

15. *Lorenza Sganzetta, Luca Tricarico (2018), «Luoghi — spazi e strumenti per l'accesso al cibo», in Dendena, B. (a cura di), Cibo di cittadinanza Dalla Carta di Milano al cibo del futuro, Fondazione Giangiacomo Feltrinelli: Milano, pp. 61-84;*

16. *www.milanurbanfoodpolicypact.org (retrieved on March 2019);*

Vertical urban farming

17. *Dickson Despommier (2011), The vertical farm: Feeding the World in the 21st Century, Picador USA;*

18. *Kheir Al-Kodmany (2018), «The Vertical Farm: A Review of Developments and Implications for the Vertical City», in Buildings, No. 24;*

19. *www.barbarafalcone.wordpress.com/tag/agricoltura-urbana/https://montreal.lufa.com/en/about (retrieved on April 2019);*

20. *www.enea.it/it/vertical-farm (retrieved on April 2019);*

21. *www.grimshaw.global/projects/the-eden-project-the-biomes/ (retrieved on April 2019);*

22. *www.precht.at/the-farmhouse/(retrieved on April 2019);*

Circular economy

23. *William McDonough, Michael Braungart (2002), Cradle to cradle: remaking the way we make things, New York: North Point Press;*

24. *Fabio Iraldo, Irene Bruschi (2015), «Economia circolare: principi guida e casi studio», in Osservatorio sulla green economy, IEFE Bocconi;*

25. *Amy Frearson, (2015), «Encore Heureux uses recycled materials to build Circular Pavilion in Paris». (https://www.dezeen.com/2015/12/18/circular-pavilion-encore-heureux-paris-france-recycled-materials-doors/, retrieved on January 2019);*

26. *Ellen Macarthur Foundation (2016), Circularity in the built environment: case studies a compilation of case studies from the ce10;*

27. *Maria di Palma et al. (2017), «Circular city and the cultural heritage interplay», in Bollettino del Centro Calza Bini, Vol. 17, No. 1;*

28. *Ben Kubbinga et al. (2018), A Framework for Circular Buildings;*

29. *Linda Høibye, Henrik Sand (2018), Circular economy in the nordic construction sector. Identification and assessment of potential policy instruments that can accelerate a transition toward a circular economy, Nordic Council of Ministers;*

30. *www.homeli.co.uk/kyudo-archery-hall-and-boxing-club-by-ft-architects/ (retrieved on January 2019);*

Urban studies

31. *Kevin Lynch, Paolo Ceccarelli (a cura di) (1964), L'immagine della città, Venezia: Marsilio;*

32. *Giorgio Grassi (1988), «Architettura lingua morta», in Quaderni di Lotus, Milano: Electa;*

33. *Marco Romano (1993), L'estetica della città europea, Einaudi;*

34. *Aldo Rossi (2009, ed. originale 1981), Autobiografia scientifica, Milano: il Saggiatore;*

35. *Matteo Robiglio, Donald K. Carter (2017), RE-USA. 20 American Stories of Adaptive Reuse: A Toolkit for Post-Industrial Cities, Jovis;*

Milan urban and industrial development

36. *Andrea Villani (1977), Piani urbanistici per una città metropolitana: l'esperienza di Milano, Milano: Vita e pensiero;*

37. *Giuseppe Campos Venuti (1986), Un secolo di urbanistica a Milano, Milano: Clup;*

38. *Gianni Calzà, Andrea Savio (a cura di) Eugenio Gentili Tedeschi (1988), Milano, i segni della storia, Milano: Alinea;*

39. *Maurizio Boriani, Augusto Rossari (a cura di) (1992), La Milano del Piano Beruto (1884-1889). Società, urbanistica e architettura nella seconda metà dell'Ottocento, vol. 2, Milano: Guerini;*

40. *De Finetti Giuseppe, Cislaghi Giovanni, De Benedetti Mara, Marabelli Piergiorgio (a cura di) (2002), Milano, costruzione di una città, Milano: Hoepli;*

41. *Maria Vittoria Capitanucci (2012), Milano: le nuove architetture, Milano: Skira;*

42. *Serena Pesenti (2018), Milano post-bellica. La "Racchetta" e i monumenti. Questioni di tutela*

monumentale e archeologica nella ricostruzione urbanistica e architettonica del centro storico, Milano: Altralinea;

43. *www.piste-ciclabili.com/comune-milano (retrieved on June 2019);*

44. *www.muoversi.milano.it/web/portale-mobilita/geomobilita?selectFeatures=l_piste_cicl,l_aree_pedo (retrieved on April 2019);*

45. *www.cittaconquistatrice.it/la-citta-di-milano-e-il-suo-nuovo-piano-di-ampliamento-1925/(retrieved on April 2019);*

46. *www.inftub.com/architettura/MILANO-E-I-SUOI-PIANI-REGOLATO82454.php (retrieved on April 2019);*

47. *www.pim.mi.it/milano2030/(retrieved on May 2019);*

48. *www.informazionesenzafiltro.it/da-fabbriche-di-produzione-fabbriche-della-cultura-viaggio-nella-milano-industriale/(retrieved on May 2019);*

49. *www.pgt.comune.milano.it/ (retrieved on May 2019);*

Milan railway yards

50. *Rosaria Battarra (2010), «Le aree ferroviarie dismesse di Milano e Firenze», in TeMA, Vol. 3, No. 4, pp. 17-26;*

51. *Elena Mussinelli, Cristina Marchegiani (2012), «La valorizzazione degli scali ferroviari dismessi. Il caso di Milano», in TECHNE, Vol. 3, pp. 196-206;*

52. *Laura Montedoro (2013), Una scelta per Milano. Scali ferroviari e trasformazione della città, Milano: Quodlibet;*

53. *FS Sistemi Urbani (2016), Workshop Report, il processo, la sintesi dei risultati, le voci dei protagonisti;*

54. *Ferservizi, Ferrovie italiane dello Stato (2017), Manifestazione di interesse per la locazione temporanea di immobili situati nell'ex scalo di Milano Porta Genova;*

55. *Direzione Centrale Comunicazione Esterna e Media, Stazioni ferroviarie: come rigenerare un patrimonio (http://www.rfi.it/cms-file/allegati/rfi/Ricerca_stazioni_impresenziate.pdf);*

56. *www.abitare.it/it/habitat/urban-design/2017/05/21/milano-scali-ferroviari-architetti/(retrieved on March 2019);*

57. *www.storiadimilano.it/citta/milanotecnica/ferrovie/ferrovia.htm (retrieved on March 2019);*

58. *www.scalimilano.vision/ (retrieved on April 2019);*

Porta Genova

59. *Giancarlo Motta, Antonia Pizzigoni (1981), I frammenti della città e gli elementi semplici dell'architettura, Milano: CLUP;*

60. *Ornella Selvafolta e Aldo Castellano (a cura di) (1984), Rete e infrastrutture territoriali, Electa;*

61. *Triennale di Milano (1987), Nove progetti per nove città: un viaggio in Italia (catalogo della mostra "Le città immaginate", XVII Triennale di Milano, Palazzo dell'Arte, 7 febbraio - 17 maggio), Milano: Electa;*

62. *Giancarlo Motta, Antonia Pizzigoni (1991), La casa e la città. Saggi di analisi urbana e studi applicati alla periferia, Milano: CLUP;*

63. *www.geoportale.comune.milano.it/sit/open-data/(retrieved on June 2019);*

64. *www.modalitademode.com/places/la-nuova-vita-delle-stazioni/(retrieved on April 2019);*

65. *www.museolab6.com/A02.shtml (retrieved on April 2019);*

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Impressive data show that cities all over the world are devouring 75% of Earth's resources. At the current rate, the urban population is predicted to be double by 2050, meaning the 70% of the total global population, thus raising serious questions about how cities could feed themselves in the future. This thesis was moved by the urgency of addressing this topic and the reasoning about how food could foster the revitalization of the disused or abandoned areas. Two main themes were discussed to tackle these issues.