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Sustainability Challenges in Redevelopments. Insights from the re-use of seven rail yards in Milan

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Highlights

- Urban Regeneration in Milan and reuse of abandoned rail yards
- Infrastructure redesign and re-establishment of green connectivity
- A long process with multiple actors
- The competition procedure and results

Abstract

In a time of climate change emergency, contemporary urban planning pursues the enhancement of natural elements combined with local and wide area green networks as an answer to ecological and environmental issues. Regenerating abandoned urban land follows a multifunctional and multiscale approach to the integration of open and green spaces with soft mobility networks and blue infrastructure in order to improve citizen wellbeing.
In this perspective, the City of Milan has implemented regeneration policies based on the extension of parks and green connectivity since the first Urban Plan, PGT (Urban Plan) approved in 2012, and continued in the recently approved PGT 2030. As a crucial part of public policies the reuse of seven Milan rail yards suggests the possibility of matching urban redevelopment with a potential widespread regeneration of surrounding urban parts. International competitions for the rail yards have shown different aspects of regeneration aiming to stress the environmental priorities.
The crucial question of this re-urbanisation process regards two aspects. The first is related to the ability of such transformations to regenerate urban settlements at the city and metropolitan scale. The second issue tries to investigate to what extent a public –driven approach can effectively achieve public interest.

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1. Contemporary planning for sustainability

The importance of a new model of urban development that considers ecological and environmental emergencies is largely acknowledged. The heavy impacts caused in recent years by anthropic pressures on natural resources and on the soil have impoverished the production of ecosystem functions (food supply, air quality, water management and biodiversity conservation). Awareness of such impacts sets the stage to adopt new strategies to ensure ecological, environmental and landscape performance of the territory in order to achieve long-term duration of natural resources, acceptable climatic conditions and, more generally, well-being (Moccia, 2011). A comprehensive strategy becomes increasingly necessary for radical regeneration of territories through an increase in biodiversity, the strengthening of soil permeability and finally an expansion in ecosystem functions to allow the earth to 'breathe'. It is not of secondary interest to consider the pandemic contingency as an opportunity to ensure a general improvement of urban comfort in the open air, with the full exploitation of natural elements and local and wide area green networks.

Several recent studies endorse the integration of ecosystem services into spatial plans for the achievement of environmental targets (Arcidiacono, Pogliani, & Ronchi, 2020; Nin, Soutullo, Rodríguez-Gallego, & Di Minin, 2016; Woodruff & BenDor, 2016). Urban green space availability is considered an important aspect of planning because of the well-known relevance of green spaces, including parks, urban forests, residential gardens and other open spaces, for the wellbeing of residents and finally for human health (Barton, 2005; Sandifer, Sutton-Grier, & Ward, 2015). Human wellbeing and health in fact depend on maintaining a natural biodiversity (Brown & Grant, 2005) that sustains ecosystem services, also known as 'natural capital' (Haines-Young, Potschin, & Kienast, 2012).

Sustainability challenges in urban planning do not require only the provision of multifunctional and multiscale interventions, but also a transdisciplinary approach able to support the multiple spatial, territorial, environmental, social and economic dimensions that frame urban strategies (Gasparrini, 2014; Secchi, 2011). In this sense, the notion of urban welfare recalls the production of goods and services that contribute to improve the quality of life, adopting public and collective action that are keys to urban and environmental regeneration (Galuzzi, 2014). To achieve this goal and to comply with more general international climate change regulations and measures, the design and regulation of open spaces and green areas constitute the founding and structural elements for regeneration projects extended to the reuse of abandoned land and integration with existing urban fabrics also in synergy with private or third sector subjects (Giaimo, 2020; Stanghellini, 2017).

The case study investigates and discusses the reuse of seven rail yards in Milan (Fig.1) as an opportunity to re-urbanise abandoned areas that are no longer suitable for the purposes for which they were originally intended, providing an extension of green areas and green and blue infrastructures city wide.

2. Milan urban changes and the Redevelopment process in the Rail Yards

Since 2000 the City of Milan has undergone a major change in urban planning, mostly focused on agreements for the re-use and re-development of large strategic areas (Pasqui, 2018; Pogliani, 2006). This phase corresponds to a substantial transition from the old manufacturing city (and traditional services) to an advanced services city (and new manufacturing) (Armondi & Di Vita, 2017) even though the standards in infrastructure and urban welfare have been neglected for a long time (Arcidiacono & Pogliani, 2011). Over the previous 30 years (1970s to 2000s), while Milan lost almost 25% of its population, dropping from 1.7 to 1.3 million, its metropolitan area had been increasing to more than 4 million people gravitating towards the city, but living outside the municipal area. The reason for this shift was recognized in the more affordable housing costs in the metropolitan area that attracted young families and medium to low-income households. However, Milan suffered serious consequences, including worsening living conditions caused by excessive increases in the cost of housing and services and reducing environmental quality due to pollution and intensive urbanization of the surrounding agricultural land that heavily affected land cover (Balducci & Checchi, 2009).

The City Plan conceived in the mid-2000s was intended to reverse the decline and to support a process of growth in the city through the liberalisation of building permits and change in land use based on a negotiating approach that played a decisive role in a few major private transformations (Palermo, 2011). The real estate market started booming in those years until the market crisis put an end to it for a while.

Among the many projects concerning the urban change that were produced in that decade, the re-development of the rail yards and re-design of the rail belt were considered the most important long-term schemes. Since the 1990s, the rail yards (covering an area of approximately 1.1 million sqm) have been progressively decommissioned, following the technological updating of the infrastructure system and of logistics which required the construction of new decentralized hubs. At that stage, the Ferrovie dello Stato (Italian State Railways), the owner of the sites along with other private parties for very minor shares) entered a full phase of land development policies. In parallel, the City considered this emerging opportunity of transforming seven dismissed rail yards, still well interconnected by the railway structure, as crucial for the future of the city and for its metropolitan area. As a result, the Municipality, Lombardy Region and Italian State Railways entered an Agreement for redevelopment in 2006 that remained at the draft stage because the new local government (after the elections in 2011) declared the intention to repeal the Urban Plan and the former urban policy.

After approval in 2012, the new City Plan intro-

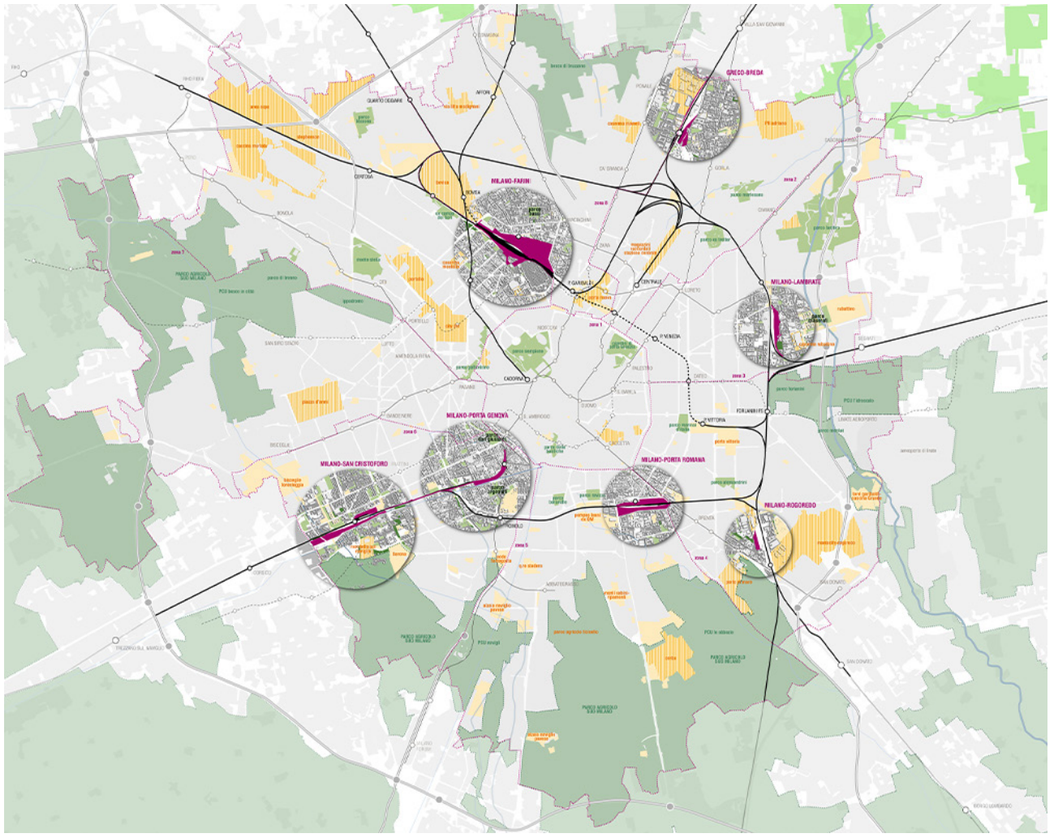

Figure 1: The seven Rail yards . *Source: Politecnico Dastu working group (2014).*

duced criteria and principles to respond to new urban planning strategies, aiming to obtain benefits for the city and local communities by sharing the value capture with the owners of the sites. Benefits included a substantial increase in green areas and parks and services at local community and city scales. In addition, a contribution was asked for land remediation and completion of the railway Circle Line, with a new set of stations and the upgrading of some of the existing ones. The project estimates an increment in passengers as well as improvement of the level of accessibility to the city centre and other metropolitan poles.
A lively debate about the public interest of the project, both in terms of areas and money contributions, was pursued in multiple public hearings that involved associations and citizens and were coordinated by a group of researchers from the Politecnico di Milano (Comune di Milano & Dastu, 2014). The public meetings were organized in five thematic lines concerning the connections of the site with the surrounding areas, the nature and vocations of the open spaces, the content of the public local services to be provided and lastly the functions and the temporary uses for an initial recovery of the areas (Fig.2).
To answer to these points, the Italian State Railways planned a three-day open workshop in which five international teams with renowned architects (S.Boeri, C.Zucchi, Miralles Tagliabue, MAD Architects and Mecanoo) presented to the city five strategic scenarios for the reuse of the rail yards, with a special focus on the greenery and the interconnections with the context (http://www.scalimilano.vision/#home).
These topics nurture the strategies declared in the

Figure 2: Farini Rail yard: the prerequisites for transformation. *Source: Politecnico Dastu working group (2017).*

five proposals aiming to increase the green and public space and implement a new ecological and social infrastructure. It explicitly refers to: i) planting greenery in the city with extensive, consistent and connected green areas; ii) compensating the environment with green in support of environmental services; iii) identity, quality beauty, naturalness: green as the heart of public life; iv) enjoyable, rich and comfortable green; v) the human scale with centrality of the road and the ground floor; vi) vitality, accessibility and safety: the commercial and service offer.
The narrative emphasis suggests a turning point in the approach to the redevelopment of the yards, mostly focussed on the relevance of ecological matters and goals, rather than on accessibility, as the improvement of the rail connections inside the city and towards the metropolitan area is left in the background.
After a long political debate, the Planning Agreement (ADP) was finally approved in 2017 (Comune di Milano, 2017a). It fixes a maximum quantity of new buildings, equal to 674,000 sqm of GFA, a third of which is for non-residential uses in order to allow a functional mix. From the viewpoint of social inclusion, 30% of the total residential building capacity is guaranteed for social housing with moderate and price-controlled rents, but also housing for sale at an agreed price. An interesting point of the Agreement makes it possible to concentrate density in the railway areas of greater accessibility, such as Farini or Porta Romana. Consequently, one of the yards (San Cristoforo, by the Naviglio Grande canal) is assigned to become only a large park and a natural oasis embedded between the urbanised areas and Parco Agricolo Sud.

Figure 3: Porta Romana Rail yard. *Source: own photo.*

As a counterbalance of building rights to private developers, the city mandates a minimum of 676,000 sqm for green areas and facilities, 10 km of new cycle paths and more financial contributions, expressly earmarked for upgrading the regional and local railway system, along with recovery of the existing four stations and the construction of three new stations.
From a broader perspective, a multipurpose action underpins the regeneration of the rail yards as an effort to restore and extend green areas for public use and enhance green infrastructure city wide in a multifunctional and multiscale sense (European Commission, 2013).
Firstly, the provision of green spaces responds to extensive public demand and the very size of the yards grants an effective distribution of permeable surfaces without consuming new soil, but re-naturalising large areas as the project features new parks for more than 5% of the total existing public green surface. These open areas are required to provide new ecological, environmental and landscape performances of the territory in order to respond to climate change challenges and to return to the community the sense of the central role of open space in the creation of the contemporary city.
As a second point, the goal of open spaces is intended to reduce air pollution and increase biodiversity. A scientific study, attached to the Agreement, recognizes that the varieties of vegetable species along the railway belt around the city number as many as 368 (equal to 81% of the total in the city) and more than 60 species and sub-species of invertebrates, especially insects and birds.
Both these goals – the extension of green permeable areas and the preservation of biodiversity - are of paramount importance in a dense city like Milan, currently characterised by an extensive urbanization. More than 80% of the municipal area (totalling 18,100 hectares) is covered with buildings and infrastructures with an average density of 71 inhabitants/hectare (ha) which reaches as much as 150-200 inhabitants/ha in the first inner-city ring which developed during the 19th and 20th centuries all around the historical city centre. The city's main environmental resources are watercourses and parks. The first resource consists of an extraordinary network of natural and artificial waterways which had been flowing through the city for centuries (branching out from the Seveso, Lambro and Olona rivers into a network of numerous irrigation ditches in the southern agricultural land, still used for farming, reaching the Milan's artificial shipping canals (the Naviglio Grande, Pavese and Martesana). Today, the evidence of these waterways is mainly hidden underground and only a few places still recall the historical image of Milan as "a city on the water" (Lucchini & Pugliese, 2009).
The second resource - Milan's public parks – originates from the first Town Plan (1884/89), and continued in two subsequent town plans, implemented since WW2, attributing an important role to parks, gardens, tree-lined avenues and public facilities (Morandi, 2007). The few successful experiences of inter-municipality planning in the 1970s have reinforced the environmental layout of the city by creation of the Parco Nord - a green haven covering more than 600 hectares in the four most densely populated northern municipalities (Milan, Bresso, Cinisello Balsamo and Sesto San Giovanni) - and the Parco Agricolo Sud Milano (extending over more than 40,000 hectares crossing 70 different municipalities), the goal of which was to create a green belt strongly characterized by farming activities around Milan and its metropolitan area. Regarding the redesign of the rail yards, the public strategy in both the Milan Urban Plan 2012 and its renewal in 2019 promotes the achievement of a continuous ecological corridor to support the enforcement of the ecosystems, the survival of the species and the introduction of a new landscape inside the existing city.
Last but not least, the role of the open spaces acquired by regeneration of the decommissioned yards consists of reconnecting urban districts that have been historically separated by the railway, an infrastructure which represented de facto a caesura in the urban frame and an interruption of relations between one neighbourhood and another (Protasoni, 2012). The Agreement expressly calls for projects "(…) aimed at overcoming the fracturing effect generated by the presence of the rail yards within the urban context" (art. n. 6), ideally integrating parts of the existing urban fabrics from a structural, morphological, functional and social point of view (Fig.3).
As a last point, the final Agreement envisages meta-design guidelines provided in the annexed Document of Strategic Vision (DVS) (Comune di Milano, 2017b). The DVS focuses on the necessary relationships with the physical, spatial, social context and the attention to spaces and connections (Pogliani, 2017). Accordingly, the DVS insists that "the continuity of roads, of cycle tracks, pedestrian connections and the public space system in general must be the foundation of future projects for these areas, not only to accomplish the design of mobility networks, but also to repair the interrupted urban and social relationships". For this reason, it suggests a mix of uses, especially on the ground floors, and the arrangement of the public space for a plurality of inhabitants and city users with a strong emphasis on pedestrian movements and the design of a cycle-pedestrian network.

3. The competitions

The Agreement mandates open competitions in the major yards (such as Scalo Farini, San Cristoforo, Porta Romana and Porta Genova) to implement the DVS Guidelines and recommends this procedure for the others. The two-stage competition concerns the presentation of Masterplans, paid for by the property owners, containing design solutions that explicitly aim at the description of a regeneration strategy and the identification of elements of continuity (Infussi, Montedoro, & Pasqui, 2019). The Agreement calls for substantial coherence between the Masterplans, being the outcome of the competitions, and the spatial and territorial relations outlined in the DVS. It also implies the need to govern and monitor this process under public direction for an appropriate time to meet multiple and varying needs at different scales and to enforce an adaptation to wider environmental issues (Terracciano, 2017).
International competitions have been held for five rail yards to meet sustainable goals under different perspectives. Scalo Greco and Scalo Lambrate participated in the C-40 Reinventing Cities scheme and Scalo Porta Romana is joining the process for the Winter Olympic Games Milan – Cortina 2026.
The private competition that started in 2019 for the Farini and San Cristoforo sites is relevant because it interweaves multi-faceted aspects dealing with a fair balance in building capacity and provision of green areas, a clear commitment to environmental design and sustainability issues and a strong focus in soft mobility solutions. The two owners, namely FS Sistemi Urbani and Coima, an

Figure 4: Farini winning project_ Limpidarium. *Source: image courtesy of OMA and Laboratorio Permanente.*

asset management company of private Investment Funds, launched the competition following the Agreement requirements of a joint project for the two sites. The reason for the joint project lies in the integrating role shared by Scalo Farini, the largest area (468,000 sqm, not considering the remaining railway corridor) with the far higher provision of GFA, and San Cristoforo (140,000 sqm), a designated park with no building capacity, in order to assure ecological continuity in the southern part of the city and close to the Parco Agricolo Sud Milano. However, given the different sizes and stakeholders, the Agreement admits a variation of timeframes and procedures.

Ecological and environmental issues play an important role in determining the Competition Brief and in the results of the competition. Three main aspects are involved. The first concerns the reduction of polluted land, through multiple tools, including innovative forms of reclamation (bioremediation), an increased degree of naturalness of open spaces, the design of green and humid areas and reforestation. A second aspect reflects an explicit public demand for a substantial supply of urban greenery covering at least half of the total surfaces. An integration with surrounding gardens and enhancement of recreational and sports activities are intended to promote a large use of green areas by different populations. The third aspect implies the distribution of cycle paths, car free zones and ecological connections that focus mainly on reconnecting the two parts of the city divided by the rail with a green flyover.

The Competition Brief sets some objectives in relation to general issues of mobility, sustainable energy and historic building protection and provides guidelines with special regard to: (1) the general morphological structure and the enhancement of surrounding pre-existing structures and projects; (2) the relationship with the context, the public space system and the relationship with the vast area; (3) the system of public spaces, the services of the green areas and the general ecology of the areas; (4) the system of connections and accessibility, integrated with public and buildable spaces, environmentally and economically sustainable; (5) the function structure, also in relation to the public and general interest services; (6) flexibility in construction, the implementation of urbanization in relation to the new districts and the feasibility of each phase, also considering the possibility of autonomous urbanization implementation of subunits; (8) the economic sustainability of the scheme.

According to the Brief, the total amount of GFA allowed in Scalo Farini is 402,460 sqm, with almost 128,000 sqm reserved for non-residential functions and a minimum of 30,213 sqm intended for ordinary subsidised housing. The total building capacity combined with an extended surface for parks results in a high density of the building sites and entails type-morphological solutions (such as heights of orientation and distribution of the building sites, relations with the road system, ground floor facilities) and high-value function distribution that have a heavy impact on urban landscape moving progressively away from the traditional Milanese urban structure. It also results in a neo-centralisation of attractive volumes and functions in semi-central areas of Milan city, advantaged by its metropolitan accessibility.

A high number of teams participated in the first stage of the Competition, and five were selected for the second stage, that closed in 2019 (http://www.fssistemiurbani.it/content/fssistemiurbani/it/scali-milano/concorso-farini/team-finalisti---finalist-teams.html). The five finalist leader teams were Arup, Baukuh, Grimshaw, Kengo Kuma Associates, and OMA – Laboratorio Permanente. Each team presented an integration of competencies in architecture, landscape design, mobility, and economic skills with a mix of experts in different fields.

Assuming the environmental issues as the priority question, a comparison of the proposals in terms of design approach to the green structure shows a growing common interest in using green infrastructure (including reservoirs, rain gardens, green roofs) to improve water quality and quantity, and to provide localized cooling for psychological and physical health benefits.

'Climatic Agents' is the motto of the OMA – Laboratorio Permanente winning proposal and expresses the objective of filtering the toxicity produced by the urban settlement with the construction of two parks (in Farini and San Cristoforo), designed as ecological filters (called Limpidarium) capable of purifying the ecosystem (Fig.4). During the final public presentation that took place in April 2019, OMA determined that "In Farini an urban grid of equipped greenery and public spaces establishes relations of continuity with the surrounding context and makes it resilient to the economic development of the city by borrowing its settlement principles. San Cristoforo becomes a common ground on the metropolitan scale for the human

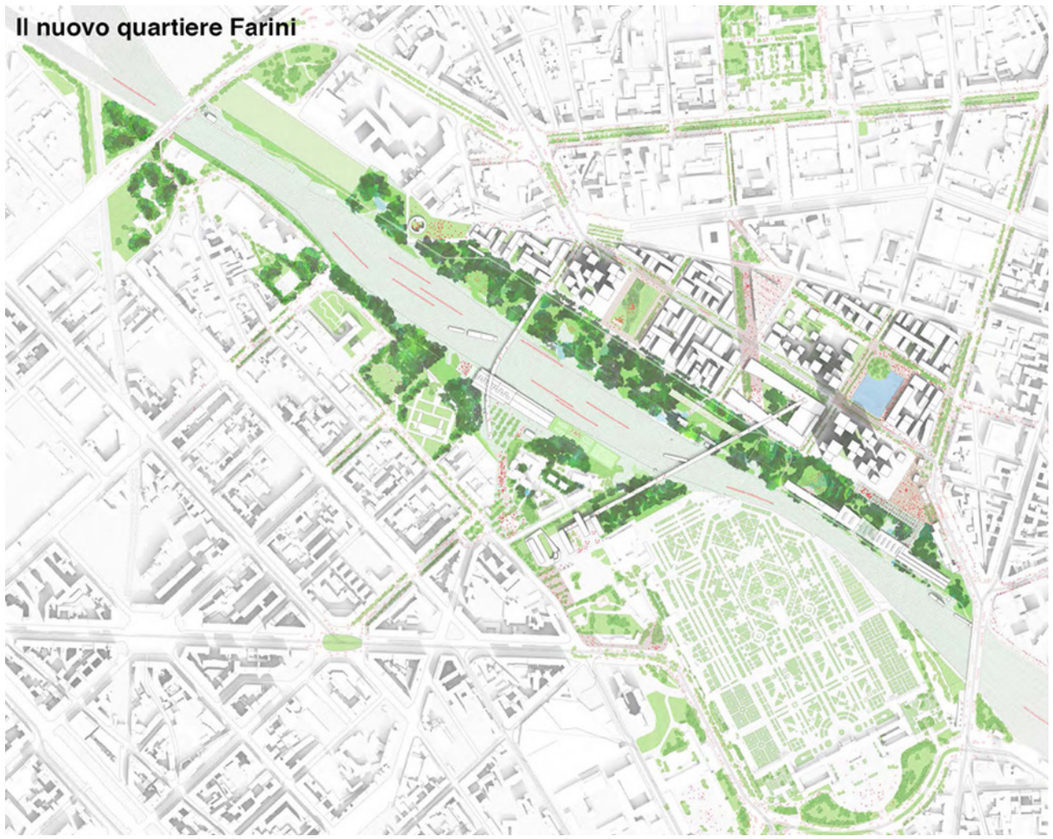

Figure 5: Farini winning project_ green public spaces. *Source: image courtesy of OMA and Laboratorio Permanente.*

and non-human community". The urban and environmental atmospheres are investigated in detail and seem to test the potential of urban greening to make the new districts more environmentally friendly and sustainable. It encompasses efficient energy use, sustainable construction, low-carbon transport and living, planting trees and green and blue infrastructure creation. Small parks and green spaces offer opportunities for physical activity, trees which give a perception of a more dominant environment and water systems become part of community space. Public green areas total more than 270,000 sqm (Fig.5).

The flexible adaptation of the winning proposal to potentially various real estate scenarios is a feature worthy of mention by the jury. However, it causes paramount issues to recede into the background, such as the impact of the (high) volumes on the surrounding city and the low qualification of specific uses and functions in the different parts of the site, in relation to accessibility, which clearly emerge from the competition proposals. More specifically, the winning project had not initially addressed various expectations of the neighbourhoods enough regarding public and local services, the role of public transport and the connecting railway pedestrian overpasses; in the following months, the Municipality organized a number of public hearings to collect suggestions from objections and complaints that required several adjustments to the initial private proposal.

It thus became evident that the schematic opposition between green space and built volumes had to be complemented by a broader consideration of urban needs and social local expectations (Fig.6).

4. Discussion and Conclusion

Observation of the development process raises some crucial questions concerning the compatibility and sustainability of the transformation with the city needs at the local, urban, and metropolitan scales. It also reflects the need for public government to assume a new role in drafting, orientating, and monitoring the change. Finally, it addresses the crucial role of the University in the production of appropriate and useful knowledge to support local governments facing multiple contemporary challenges (Orsini & Pogliani, 2021).
As a matter of fact, what emerges are the strengths and limits of the Agreement and the following competition in interpreting city goals over an extended period.
At first, the decision-making process that resulted in the Agreement was not straightforward due to the lengthy time frame, the crisis in the urban market and the different controversies that took place. When discussing the terms of the Agreement, the Italian State Railways always aimed for the valorisation of semi-central and highly accessible areas. The Municipality manifested more complex goals, covering a variety of matters ranging from the promotion of urban development without further consumption of land, the reinforcement of social capital in infrastructures for regional transport and services, a new green network, and the mending of parts of the city which the railway had separated. Despite this, some criticisms (Targetti, 2017) note the neo-centralisation policies combined with lesser attention to a fair metropolitan development.
Secondly, the Farini competition suggests further reflections on the role of the project to communicate to a wider audience and to introduce elements of radical innovation in environmental and ecological fields. On one hand, the winning project proposes an incremental process of regenerating dismissed relevant parts of the city through both a composition of big volumes that respond to developers' expectations and a green attitude that fully addresses contemporary urban needs.
On the other hand, the Municipality is responsible for the partial recapture of the development value and for reinvesting it in social infrastructures. This process relies on the ability of city government to reduce, select, evaluate, and finally monitor all the private actions to match environmental and social issues and finally to assure public interest for the entire duration of the changeover, adapting it to the social and market variations.
To conclude, a strong public leadership and monitoring cannot retract from leading the urban transition in our challenging uncertain times.

Figure 6: Farini winning project_ bird's eye view. *Source: image courtesy of OMA and Laboratorio Permanente.*

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