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Strategies for the Sustainable Reindustrialization of Brownfields

E Canevaro[1], R Ingaramo[2], I M Lami[3], M Morena[3], M Robiglio[2], S Saponaro[4], and E Sezenna[4,*]

[1] Comune di Settimo Torinese, Servizio Urbanistica e del Servizio Edilizia Privata, P.zza della Libertà 4, Settimo Torinese, Italy
[2] Politecnico di Torino – Dipartimento di Architettura e Design, Viale Pier Andrea Mattioli 39, 10125 Torino, Italy
[3] Politecnico di Torino - Dipartimento Interateneo di Scienze, Progetto e Politiche del Territorio, Viale Pier Andrea Mattioli 39, 10125 Torino, Italy
[4] Politecnico di Milano - Dipartimento di Architettura, Ingegneria delle Costruzioni e Ambiente Costruito, P.za Leonardo da Vinci, 20133 Milano, Italy
[5] Politecnico di Milano - Dipartimento di Ingegneria Civile e Ambientale, P.za Leonardo da Vinci, 20133 Milano, Italy

*elena.sezenna@polimi.it

Abstract. The rapid de-industrialization of Western economies has left an enormous impact on the urban landscape in Europe, leaving behind vacant warehouses and production facilities. Industrial sites reuse is a crucial issue for sustainable land and urban development. This work is concerned with the fundamental aspects of industrial heritage and the ways to incorporate brownfields back into the urban fabric as a value-adding element. Adaptive reuse represents the most sustainable form of reuse, as it is based on maximal conservation of built assets, minimizing time, materials, embodied energy waste, and preserving site identity. For industrial areas redevelopment and reuse often site remediation is required. This activity is usually designed, carried out and assessed before and independently from urban design, planning and real estate strategies. This independence leads to higher remediation costs and often implies demolition of built industrial infrastructures, preventing any potential adaptive reuse. The former industrial site of Acciaierie Lucchini in Settimo Torinese, just outside of Turin, offered the chance to test a holistic approach, based on the multidisciplinary integration of knowledge and skills during the whole design process in order to define real policy proposals trying to improve the technical framework for more sustainable reuse procedures. In the 93.000 m^2 area, abandoned and left to degenerate since 2000, trading in ferrous materials and then steel manufacturing were carried out for over fifty years, leaving a legacy in the form of heavy metal contaminated backfill material and underneath soil. Isolation from the city centre, poor accessibility for pedestrians and the location within an industrial zone make this site inadequate for any form of residential development. Whereas re-industrialization of this brownfield can bring new value to the site, transforming the abandoned spaces into an innovative industrial hub able to combine logistic, production, leisure and temporary living, experimenting with mixed-use programs the new relation between innovative production and the city.

Key Words: adaptive reuse, industrial heritage, Industry 4.0 campus, innovation, industrial productivity

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1. Introduction

The process of industrial change has resulted in the creation of so-called 'brownfields' across Europe, particularly in urban areas, in the industrial sections of cities. Despite the term is not univocally defined, according to the common understanding of the term as declared by previous EU multi-stakeholder networks, such as CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), brownfields are sites that "have been affected by the former uses of the site and surrounding land, are derelict and underused, may have real or perceived contamination problems, are mainly in developed urban areas, and require intervention to bring them back to beneficial use" [1].

This definition clarifies the complex issues that are raised by brownfield regeneration. Even the environmental contamination issue is often emphasized as the main bottleneck to redevelopment, actually, this aspect alone does not explain the complexities of brownfields redevelopment. As the main reason for the emergence of derelict land is economic structural change and the decline of traditional industries, the phenomenon is also often coupled with a decline of the neighborhoods around brownfields with social, urban and inevitable economic repercussions. The poor aesthetic quality of sites left to decay for long periods, causes the surrounding area to be an undesirable place to live and work, maybe attracting illegal dumping, vandalism and other crimes in an unvirtuous circle.

Nowadays brownfield redevelopment is widely acknowledged as one of the major tools to achieve future urban sustainable development. However, despite understanding the need for such action and the clear benefits, this is still not current practice in many industrialized countries. Building from scratch is easier and cheaper: fewer constraints to the masterplan design, no demolition and reclamation are required, as otherwise cannot be avoided when the places of traditional industry become places of urban and territorial transformation. Furthermore, the positive externalities of brownfields redevelopment are not necessarily signaled to project developers, as their revenues/profits will not reflect them [2].

Before the financial crisis, it was possible to find examples of metropolitan brownfields whose land increase value after real estate development was sufficient to overcome the difficulties and higher costs. Nowadays, as the number of brownfields or unused areas is continuously increasing, their regeneration gets more challenging in many urban areas.

In this context, it is required a different strategy in which disciplines of urban planning and design, economic policy and environmental remediation and restoration, should all be involved together in the urban process integrating responsibilities, tools and knowledge [3]. Traditionally they depend heavily on each other but work in sectors. All the interacting factors underlying the potential success or failure of brownfield projects should on the contrary be managed and coordinated within the overall process with the common goal of the 'rebirth of a wasteland', through the understanding of the significance of the existing, and explorations to identify opportunities for socio-economic benefits and ways to solve the technical challenges of the site. The starting point should always be the needs and requests of the local context and the market, taking also into account the spatial and temporal dimensions of the challenge, in a forward-looking perspective to prevent risks of too short-lived benefits [4].

This project is concerned with the fundamental aspects of industrial heritage and how to incorporate brownfields back into the urban fabric as a value-adding element. An abandoned steel mill in Settimo Torinese, just outside of Turin, offered the chance of testing a holistic approach, based on the multidisciplinary integration of knowledge and skills during the whole design process, with the aim to define real policy proposals trying to improve the technical framework for more sustainable reuse procedures. Located in the Piedmont region in northwestern Italy, Turin is known for its industrious past. As the center of Italian automobile manufacturing, Turin experienced a similar fate as Detroit in the United States in the late 20th century, when FIAT, the main factory, had to let go of almost 75% of its workforce and Turin lost almost 30% of its population. With the crisis of the automotive industry, also the decline of all heavy manufacturing, including steel production, came. The abandoned steel mill in Settimo Torinese thus presents the classic features of an industrial brownfield of the second half of the 20th century. Founded in the 1960s and indefinitely closed in 2000s, the site with its two large manufacturing halls is located in an industrial area, just outside the city.

Due to industrial practices and lax environmental standards of the time, pollution by heavy metals affects the soil and the industrial buildings are overgrown by weeds and prone to collapse.

These considerations bring up the question of what to do with the site and how to design its requalification. Isolation from the city center, poor accessibility for pedestrians and its location within an industrial zone make this site inadequate for any form of residential development, as the municipality has already excluded. Re-establishing the productive environment of the site is therefore one of the core elements of this project and adaptive reuse represents the best strategy to accomplish this by preserving and enhancing at the same time, the industrial heritage and retaining the site character to avoid wiping out our industrial past and integral part of the history of most of our cities.

Based on this case study, it is argued that the re-industrialization reintegration of these brownfields can lead to more benefits than affordable living space in undesirable areas in the outskirts of urban agglomerations and reinvigorate a stagnant economy, create jobs and allow manufacturing to return to our cities.

2. Strategy and methods

The general strategy to approach brownfield requalification projects, such as the Lucchini case study, was based on i) productivity, ii) innovation, and iii) industrial heritage, the three key elements that in-depth analysis of other case studies throughout Europe identified as common and recurring themes.

i. Productivity, according to the European Productivity Council definition, is an "attitude of mind. It is a mentality of progress of the constant improvement of that which exists. It is certainty of being able to do better than yesterday and continuously. It is constant adoption of economic and social life to changing conditions. It is continual effort to apply new techniques and methods" [5]. Productivity loosely means to produce something, to create value and to generate a multiplier effect for all of society, in this, despite the recent structural changes, it is a central element to the economic sustainability of metropolitan areas.

ii. Innovation, as the ultimate ability of humankind to reinvent itself and adapt to changing circumstances, can be considered a driver to productivity, as it generates new ideas to improve business and environmental performances, to re-orientate workforce and capital investment, to develop new products and new markets. From architecture and urban planning perspective, innovation may be considered as a design which gives a site more flexibility to adapt to any change in society and economy and define durable and environmentally friendly structures as it is concerned also with the future.

iii. Industrial heritage defines a place where "sites, structures, complexes, areas and landscapes as well as the related machinery, objects or documents, provide evidence of past or ongoing industrial processes of production" [6]. Its importance does not only lay in the tangible elements associated with industrial technology and processes, engineering, architecture and town-planning but includes also many intangible dimensions embodied in the skills, memories, oral testimonies, documents, items, machines and social life of workers and their communities, the tangible elements help to perpetuate [7].

The combination of these three factors required the project execution to include several phases, whose key elements are summarized in figure 1. Site survey and territorial analysis and context assessment were the starting points to reach an understanding of the current situation of the case study site and its neighborhood and the Settimo Torinese urban context, and to begin developing a sense of stakeholders' particular needs and interests. The first step of the analysis focused both on the internal dimension of the site, its industrial heritage, site history, the pre-existing building assets and their condition, site soil contamination, and the urban context, by considering the location, accessibility, and the social factors. This let identifying the main constraints. The market analysis, on the other hand, was essential to develop an understanding of what potential investors might be attracted to.

While these initial steps were entirely descriptional, exploration of the potentialities for different functions and combinations thereof in the new space, as well as of opportunities for the adaptive reuse of the site and the strategies to manage the soil contamination, required to make assumptions and select the input variables of the process. A multi-disciplinary team sharing different knowledge was a value-adding element to the quality and the extensiveness of the analysis, as the different perspectives and individual interpretation of the situation helped to uncover important details and resulted in diversified possible assumptions and scenarios. This kind of exploration required a profound rethinking of the design process, to foster an effective communication between all the involved disciplines, in order to define a strategy for the site which defines, at the same time, what is to be done at the site and also how to do it, in a flexible streamlined timeframe given various competing priorities, budget constraints and limited resources. National regulation on the reclamation of polluted sites, the environmental aspects of adaptive reuse procedures, including the analysis of the contamination and the possible approaches to remediation for the site, as well as the existing relationship, within regeneration process, between environmental engineering and architecture have been carefully analysed. The designed strategy was finally tested with the design a proposal masterplan for the site and a sustainable business model that would add value to the area. The feasibility of the entire project was demonstrated by conducting a Discounted Cash Flow valuation, considering fixed investment costs related to requalification and construction as well as recurring costs to run the operation.

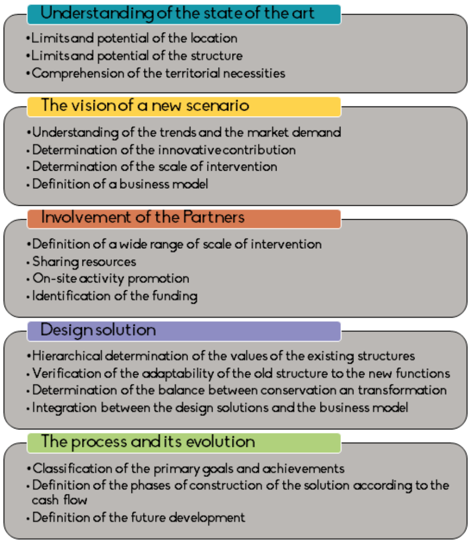

Figure 1. Strategy elements to be considered in the project development.

3. The ex-Lucchini site

3.1. Location and industrial history

The site is located in the municipality of Settimo Torinese, about 11 km northeast of Turin, between the Po River to the south and the Turin-Milan highway (Figure 2a). Within the town itself, the site is located in the "Cebrosa" industrial area, about 1 km northwest of the city center and separated from the residential parts by the aforementioned highway (Figure 2b).

a) b)

Figure 2. Map of Turin metropolitan area, and a zoom-in on the Settimo Torinese city and the site.

The ex-steel mill of Settimo Torinese was founded in 1955 by ferrous materials traders Maggio and Baldi. The area, after going through a liquidation procedure, was purchased in 1966 by Lucchini S.p.A. one of Italy's great industrialists with factories producing high-quality laminated steel. The company started producing steel rods for reinforced concrete and expanded the complex to the actual size, employing up to 200 people. Although updated with new technologies, in 36 years of activity, the industrial process, collection and melting of ferrous scraps with the classic procedures of electric arc furnace steelmaking and hot rolling, remained substantially unchanged, as well as the materials and produced waste and residues. Impurities such as phosphorus, silicon, sulphur, nitrogen, and excess carbon were removed from raw iron and alloying elements (such as chromium, manganese, vanadium, and nickel) were added to produce different grades of steel.
In 2001 the operation was closed, ending the brief stint of the steel industry in Settimo Torinese. Machinery and furnaces were dismantled for resale, elsewhere reuse or scrapping, leaving the abandoned factory and its surroundings to decay.

The owner had previously put forward a masterplan for the redevelopment of the area that was signed by the municipality, who has veto power on the development of large scale projects, like this one, and subsequently put on the market in search for investors. However, the financial crisis and lack of interest from investors put the plans on hold.

3.2. Architectural analysis and building conditions

The property is 95.000 m^2 complex (Figure 3), with two main former industrial buildings (A and B in figure 3), placed perpendicular to each other and connected through a square with a space-characterizing 30-meter-tall steel chimney (1 in Figure 3). Other interesting small elements are present, consisting on small steel constructions, a large water tank (2 in Figure 3) and minor buildings, once used as offices, services and control stations, placed along the boundary of the property (3, 4 in Figure 3). The remaining area is overall paved with concrete and includes several tanks of different sizes, which are distributed throughout and around the plants. Access to the area, confined with fences and tall concrete walls, can take place through three potential points, the main entrance in the southwest, one in the northwest and one back entrance in the northeast.

Building A, the former steel melting shop (Figure 4, a and b), about 13700 m^2, is a huge reinforced concrete structure divided into four naves, each one closed by a characteristic steel vaulted roof covered by a suggestive and unusual brick finishing. Here tons of ferrous scrap arrived from all parts of the region to be transformed into large ingots and billets, which were then subsequently rolled in Building B, the old steel mill (Figure 4, c and d). Building B, oriented perpendicularly to Building A, is a 20.000 m^2 mixed structure made of reinforced concrete and steel, emptied in February 2002 and now completely overgrown by vegetation. The roof is 20 m high and previously covered in asbestos, which has been removed, leaving the bare steel trusses under the sunlight.

Both buildings host specific indoor spaces, characterized by their former productive function: the vaulted building hosts massive concrete blocks inside, defining the previous locations of arc furnace and heavy machines; the old steel mill presents large tanks at the level of the pavement, demarking the footprint of the mill and currently occupied by a dense wild vegetation and water. In general, all the buildings at the site are in poor conditions due to natural weathering without any maintenance following the site closure and clearance, vandalism and malicious mischief. The collapsed structures, the infesting vegetation, the presence of putrid and stinking pools, the old waste and the garbage catch the visitors. Lacunas characterize the buildings, with missing metallic element of roofs or fallen down glass panels, holes in the bricks pattern, the absence of some parts of drain pipes and the lack of finishing. All over the site, stains of ascending humidity and biological patinas, signs of vandalism (as graffiti or broken glass panels) and leakage traces mark the walls. Rust is evident in the steel truss roof, as well as the metallic sheets roof and the tower.

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a) b)

Figure 3. a) top and b) isometric views of the site with access points and main industrial structures.

3.3. Environmental situation

Environmental investigations were carried out in 2002, consisting in 30 boreholes distributed throughout the site with the collection and chemical analysis of about 90 soil and subsoil samples and drilling of 6 groundwater monitoring wells. The results showed the shallower layer of soil, from ground surface down to a depth of 0.5 m at the west side and to 4.5 m in the east side of the site, is made up of historic fill material, a heterogeneous conglomeration of soil and residuals, such as ashes and slags as well as construction and demolition waste, related to industrial production and activities. This material is characterized by high concentrations of heavy metals, such as chromium, zinc, lead and cadmium, beyond the Italian regulatory screening level for industrial or commercial sites (D.Lgs. 152/06, Tab. 1/B in Annex 5 to the V Section).

Underneath the fill material, a 5-7 m thick natural alluvial coarse soil (gravel and sand with cobbles) and silty-clayey lenses is present. This layer host perched groundwater, whose quality is not affected by soil pollution, as all groundwater samples revealed metal concentrations in compliance with the regulatory limits. Beyond 10 m below ground surface the presence of a continuous clay aquitard, throughout the site, separate the first confined aquifer.

The fill material probably dates back to the early industrial period of the site as, according to available information, at least since the 1980s, waste and residues of the process were temporarily stored at site and landfilled or elsewhere reused in industrial process (mill scale) or for reclamation in excavated areas, road making, and landscaping (the slags). Owing to their high crystallinity, in fact, slags from electric arc furnace typically show a limited risk of metals release or leaching, whereas their recycling in industrial production is difficult.

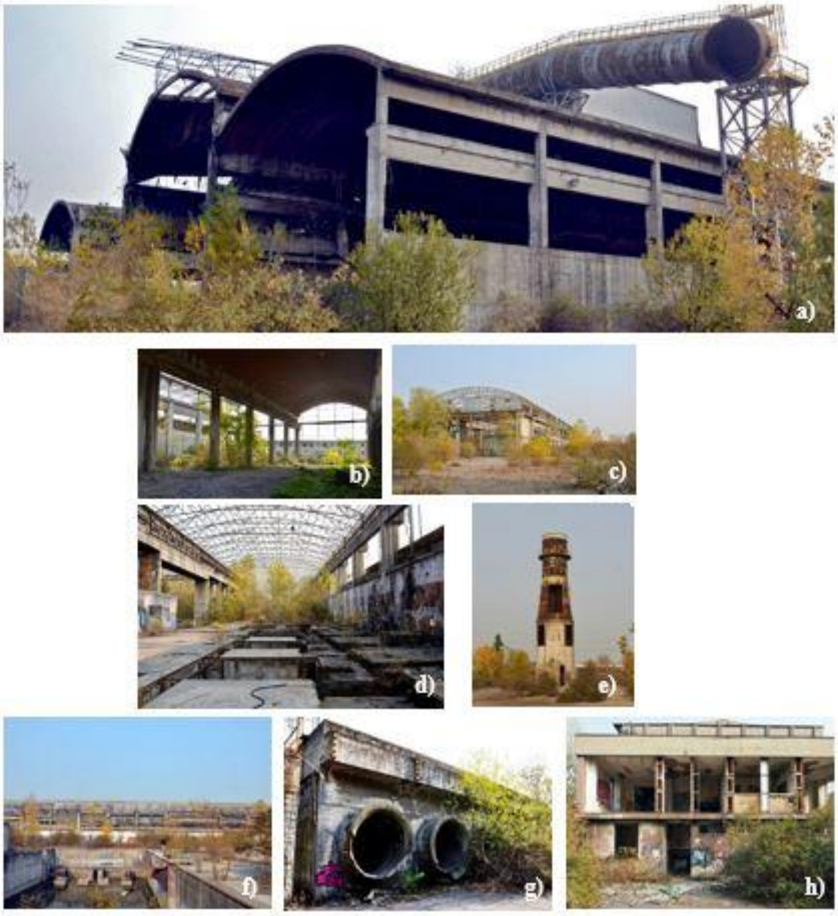

Figure 4. a) exterior and b) interior building A; c) exterior and d) interior building B, e) steel chimney; f) exterior water tanks, g) large concrete pipes, h) office building

4. Results

4.1. Territorial and market analysis

Figure 5 summarizes the main conclusions from the urban context analysis of the Lucchini site in the form of a SWOT Analysis, juxtaposing the strengths and weaknesses of the site with the possible threats and opportunities of the site redevelopment.

Excellent connection and accessibility of the site, particular by road, and its location within an industrial cluster are the major strengths of the site, suggesting logistics and manufacturing as redevelopment opportunities, to be assessed in more detail by means of a market and functional analysis.

The logistical function is rooted in the current market conditions and the excellent accessibility of the site is also underlined by an existing logistics cluster in the area [8][9]. The analysis of the manufacturing sector revealed also complex trends that pointed towards the use of advanced manufacturing, which is the foundation for Industry 4.0. Advanced manufacturing is based on innovative technologies such as 3D printing and robotics, interconnected through the cloud and supported by big data analytics. This transition into high-tech manufacturing, which is focused on low volume and high variety, requires a highly skilled workforce, as well as a functioning eco-system and support infrastructure for innovative small businesses [10][11]. Both these aspects are already present in the Turin area, with examples of successful start-ups and actions for the modernization of the industrial base, which currently make the area to rank very highly among Europe's most innovative cities [12][13].

4.2. Environmental analysis

Site-specific human health and environmental risk assessment helped to identify the needs and targets of soil remediation and to define the best approaches to limit remediation costs as well as restrictions on the future development of the site.

In this case, the contamination did not prove to be determinant in the decision-making for the design of the masterplan. The limited release of metals from slags and the peculiar hydrogeological structure of the site, with the presence of layers of fine silty and clayey soil protecting the aquifer, has prevented the quality of groundwater to be negatively affected by contamination. Moreover, the results of risk assessment showed none of the pollutants, excepting lead, presents unacceptable human health risks for the potentially active exposure routes associated with an industrial or commercial redevelopment of the site. Even for lead affected areas, it would be sufficient to either excavate the surface layer of the contaminated fill and backfill with certified clean soil or to cover the contaminate fill with a capping/buffer clean soil layer to avoid any risk of direct contact with contaminated soil and wind erosion. In the areas where soil excavations are planned for new structures, correct management of the contaminated fill is required. The different approaches to deal with site contamination allowed to select the most appropriate solution for each sub-area of the site. However as a general rule, to improve the cost-effectiveness of the project, minimization of the total volume of soil to be excavated, as well as solutions to safely reuse it on site as filling material, were sought.

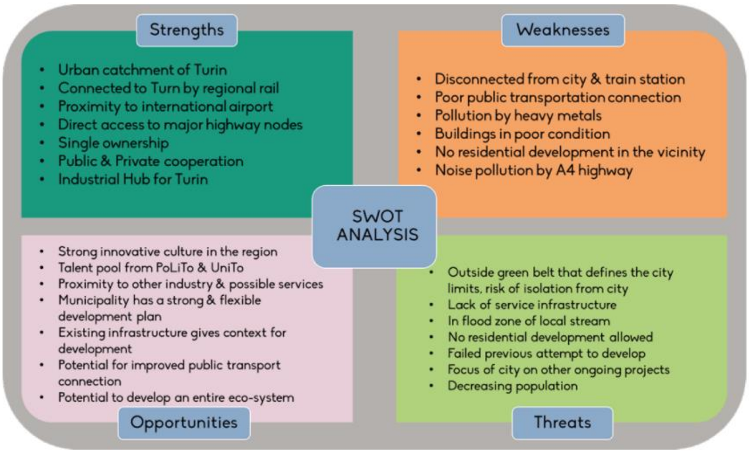

Figure 5. SWOT analysis.

4.3. The proposed solution for the site

The concept that aims to combine the three core elements productivity, innovation and industrial heritage for the Lucchini site is called "Industry 4.0 Campus". The innovative eco-system of the Turin city is the driver for the masterplan and building block for a sustainable business model. Thus, concepts of productivity and innovation, characterizing elements also of the new Industry 4.0, at the site are applied to manufacturing and logistics. On the other hand, adaptive reuse is the innovative way to deal with industrial heritage.

4.3.1. Business Solution. The idea of the manufacturing campus is to create synergies between researchers, experts and learners, by bringing them together in the same space to create a local and virtual community to enable exchanges of knowledge and expertise, while developing innovative products on-site. Collaboration along the value chain, from research over prototyping to production and service, creates a beneficial culture of open innovation and is the driver for innovation.

Researchers investigate current trends related to Industry 4.0 from a technological and economic perspective, and with makers, work on their individual prototypes in state-of-the-art shared labs. In addition to R&D labs, within the same building, a production floor, with individual production units available for rent, will provide SMEs with space to set-up and test small production lines using the latest I4.0 enabled technologies.

A third section of the campus in a separate, customizable facility will host up to two medium-large enterprises, which can use the facilities and support functions to set up their entire manufacturing process in the long-term. A modern fully automated distribution center, leased to an external logistics provider, will also be integrated into the campus. All functions are connected through an IT infrastructure and a cloud-based system, allowing its users to benefit from advanced data analytics. Although the last two functions are somewhat private, they are fully integrated into the community, and the common spaces are also open to the public, with regular cultural events intended to attract interest to the site and its activities. The value proposition in the Industry 4.0 Campus business model consists in easy and affordable access to state-of-the-art resources. In fact, by bringing together all kinds of stakeholders in the learning and production process and providing the necessary resources, it offers chances to overcome the main reasons (such as lack of resources, knowledge and experience, support or scale) why companies do not implement Industry 4.0.

Short-term leasing and subscription plans allow customers to avoid the large upfront investment of buying their own machines. However, the main selling point of this business model is the integrated knowledge-sharing platform that flourishes due to exchange and assistance from experts as well as cooperation and collaborations of all the actors that may arise in this kind of environment. The business is focused on four key activities, namely research, consulting, technical assistance and space leasing. The key resources necessary to run these activities are the facility itself, the machinery and the highly skilled human resources. Running costs are mainly derived from the investment, upkeep and salary of the key resources, while the revenues are generated from various activities. The revenue streams are diversified, stemming from consulting services, space leasing and subscription plans for short-to-medium-term users. However, in addition to the costs of running the business, it is important to consider the significant costs of requalification and construction of manufacturing campus. In order to avoid upfront exposure, both from a cash flow and risk perspective, as well as from architectural and construction point of view, the project is assumed to be carried out over in distinct phases, to allow some sections of the site to become operational and generate revenues while construction works are still continuing.

4.3.2. The masterplan. The masterplan (Figure 6) complements the business model in providing the right spaces for interactions and active communication between people and facilitates and encourages the synergies and cooperation the Industry 4.0 Campus advocates.

Based on the principles of adaptive reuse, the final layout juxtaposes the old and the new and is designed to allow each singular building to work efficiently with the others and to allow an internal evolution and adaptation to a dynamic industry, in order prevent history repeats as with the decline of mass manufacturing.

As the project aims to make the site a livable place, only pre-existence buildings and structures that may have a future use remain, and new buildings are inserted due to the specific requirements of new site functions and poor conditions of existing buildings that in most cases prevent any chance of reuse.

The three main new building on the site, in fact, respond to the three main functions of the project: a distribution center for logistics, a building for medium-scale production for a big enterprise, and the core of the Industry 4.0 Campus, with shared laboratories and offices.

The former steel melting shop is partly demolished, to leave space to the logistics building, and only the front arches towards 'Via Leini' will be preserved to serve as the contrasting access-gate to the new logistics area. The new warehouse is a solid rectangular building, with a strict perimeter outside and a wide open floor plan inside, for the sorting and storage of goods. A large service road for trucks circles it to allow easy movement and parking optimization.

The building for the big enterprise (8000 m^2 footprint) consists of a two-story building, located between the logistics warehouse and the shared cathedral space, working like a hinge between the two dimensions of the project (one more private, and one more public). This building is designed to be easily reached by the logistic services and, on the other hand, to be connected to the experimental laboratories and the other spaces of the campus. The last building, the core of the campus, consists of a large mixed-use facility with offices, spaces for production, prototyping and experimental research.

The allocation of these buildings creates spaces in between where people can gather, goods can be transported, and machines can move. This allows the maximum permeability of the site, given specific restrictions due to the different functions.

A conservatory intervention, otherwise, is carried out on the larger former industrial building, the former mill, to make again the structure safe and self-standing, and create an 'industrial cathedral', a large open space, delimited by its concrete columns and steel trusses, once carrying the roof. The space the structure describes may then host community functions and services, immersed in an urban green space meant to foster communication. The design plays with the contrast of open and closed spaces, which represents the difference between traditional and modern manufacturing: the former, noisy and polluting, hidden away in the industrial belts around the city versus the latter, clean, green, quiet and inviting. The technological solution adopted relies on modularity and expandability to ensure the flexibility of the space, while the selection of materials reflects the elements that defined the old site, like steel and iron, yet interspersed with modern elements of glass and timber. The former industrial cathedral is further valorized as the doorway to access the new functions and the new center of the whole system; in fact, except for the private access to the logistics area, the new multiple public access points to the area, that should contribute making the site a new central hub for the industrial district, all convey to this park where transition between past and present is most evident.

4.3.3. Feasibility and implications. Preliminary screening discounted cash flow analysis shows promising results, with an estimate for the total net present value of approximately 10 million € with an internal rate of return of 5.65%, not accounting for other benefits such as super-depreciation and -amortization.

Based on such results, the proposed solution has potential far-reaching benefits and could represent investment opportunity for large investors and developers, who are interested in stepping out of their comfort zone and approach innovative solutions to industrial redevelopment.

Overall, eight years are a minimum reasonable estimate for the construction timeframe, at the end of which the entire campus will be operational, generating revenues for the management company. The phases and their temporal sequence have been hypothesized to be as independent as possible, so as to allow the developer to interrupt or resume work at the end of each phase, without precluding, as far as possible, the functionality of what has been achieved until so far. The construction of logistics and the manufacturing building are the first steps, as these new facilities are attractive even without the whole campus infrastructure and should allow the site to become operational and generate the first revenues; the truly innovative Industry 4.0 Campus is realized in the latter phases, when cash flows have stabilized. The rehabilitation of the former mill into the 'industrial cathedral' accompanies the whole re-habilitation process at the site, initially with structural strengthening and rehabilitation that create new spaces to be progressively filled in with different services as the project goes on, and marks the transition from the brownfield into the new vital site.

Figure 6. The proposed masterplan [14]

5. Conclusions

The proposed project for the ex Lucchini site in Settimo Torinese, beyond the constraints of the case study, offers an example of the development a general strategy for the sustainable reindustrialization of abandoned brownfields by sustainable reintegration of a mixed-use facility in these sites, based on the core elements of productivity, innovation and industrial heritage, as well as the process to go through.

Reindustrialization is the term that best describes the process, since brownfields, as the Lucchini site, already possess an industrial heritage the masterplan should emphasize and the new designated uses are meant to make the sites again productive from a modern and innovative industrial standpoint, with solutions that are more effective, efficient and longer-lasting, hence sustainable. However, rather than developing a basic blueprint to be blindly applied, the strategy should present the planner with the right tools to consider all relevant factors for each individual project. Despite the common elements, such as the aims to preserve the industrial heritage and reclaim land for new productive uses, each site has its own story and external conditions that cannot be generalized. Moreover, even for a specific site, the final design is merely one of the possible outcomes of the strategy, as its outputs depend on the perspective and priorities, external circumstances, thought processes, assumptions and input variables. Accordingly, the proposed masterplan for this particular case study does not purport to provide “the solution” for the site, but suggests that the overall strategy can lead to desirable results, promising significant financial returns and a measurable positive social impact on the area.

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