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Technological Innovation, Design and Inclusiveness for the Manufacturing Landscapes

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Abstract
During the 20th century, several uncontrolled processes compromise the dynamics and trends of technological transitions that for centuries, had been characterizing the built environment and the manufacturing processes. In the agenda drawn by the Sustainable Transition Network, referring to manufacturing landscapes, the transition is a long process, deeply rooted to cultural and settlement specificities, to the skills of the workforce, to the opening of new markets, to the community needs. In a circular perspective for development, returning congruence to productive cycles, by linking them to the settlements vocations and communities' skills, is the design commitment. Taking into account the systemic vision for the built and performance approach, a design strategy is experienced during three years, for the Vesuvius foodscape. It consists of three main phases: *outlining the relationships between places and manufacturing, in terms of processes, products and wastes, *mapping the technological transition processes occurring at the architectural and urban scales, *defining compatibility ranges for shortening the loops and promoting inclusive technological innovations. The project outlines a regeneration strategy informed to the following visions: 1. The productive landscape is a common good, a complex system resulting from the encounter between resources and technological thinking. 2. Strengthening the community skills is an indispensable condition for promoting regeneration. 3. The third sector, social, economic and cultural reality of a private nature but tended to produce public or collective goods and services can be a privileged actor of sustainability.

Key Words: Manufactures, landscape, design, innovation, technology, reuse, reduce

1. Thesis Statement

Settlement processes are the result of a balanced and original mix between technical awareness and practical ability, tradition and creative intuition. Within complex dynamics, the built environment is a consistent expression of the wealth of communities. It is the result of aware transition processes, that involve the living and manufacturing cultures. In the Italian experience, the agri-food productions profoundly characterize urban landscapes. In areas of rural vocation, the material culture for centuries, draws settlements, activating interactions and reciprocities between the constructive and productive processes (Magnaghi, 2010).
Today the vulnerability of manufacturing landscapes increases due to the distortion and impoverishment of our material culture. Fault processes are accelerated for the loss of past commitments to building and managing local resources. The distortion of contemporary approaches towards material culture, determines technological transitions that deeply alter the functional and spatial, structural and environmental conceptions of urban and building environments as well as its productive potentialities (Becattini, 2015).
An awareness-building path over cultural heritage and its productive potentialities is

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launched by a research team from the DiARC, Federico II, (Progetto Prin 2010 – 11) to promote new perspectives towards technological transitions, based on identity and inclusiveness. The basis of the approach is that the collective re-appropriation of knowledge and memories can contribute to activating a gradual process of individual and collective empowerment (Bérard, Marchenay, 2006).
The design perspective fits into a cultural framework marked by the European Landscape Convention (Council of Europe, 2000). It sets out a vision of enlargement for landscapes management with respect to the assumptions proposed by the Charter of Gubbio that at the beginning of the '60s in the evaluation of the aesthetic and cultural heritage hitherto, introduced the physical component cultivated by art historians. Linking the definition of sites management to people's behaviour, as *the result of the action and interaction of natural and/or human factors*, the scientific community at the beginning of the third millennium, highlights the need of developing specific measures to foster the involvement of populations in transformation and conservation processes for the built environment (Brunori, Rossi, 2000).

1.1 State of art

Researches and practical experiences in ancient settlements, converge today in identifying built environment regeneration as complex knowledge-based processes, aimed at driving with synergies past and future transitions. Protecting identity and answering to users' needs, regeneration requires long-term vision, multiple domains, a broad stakeholder engagement, supporting changes in culture, structure and practices (Viola , 2012).
In recent years, more and more studies have been focusing on the power of transitions, for built environment enhancement (Grin et al., 2010). When referred to sustainability, transitions have been assumed as processes of change involving culture, structure and practices. Moving the disciplinary focus on to transition processes management, can contribute to heal the gaps often evident among instances of protection - documents, values, resources- and users' requirements.
First, cultural references to the proposal are in the historic Urban Landscape vision introduced by Unesco. According to the 2011 Recommendation, the manufacturing landscape is a complex adaptive system, resulting, over time, by the encounter of natural resources and technological thinking, built over time and shared within a community (Unesco 2011).
The research focuses on transition dynamics that deeply shape, over time, the manufacturing landscape, with the ability to accommodate technological innovations, to open new markets (Geels, Schot, 2007), to meet community needs. In the sense of state passages, transitions return the complexity of the settled material culture, assuming the value of a diffused construct as direct expression of the community engagement to activate creative synergies between knowledge of resources and ability to act on them (Ciribini, 1979). Understanding the transition processes that inform the material culture of a place requires an analysis of the technological knowledge in relation to places and companies; the conservative an or innovative approaches. Transitions are characterized for centuries in our country by a very close link between communities, places and economies, which is explicit in the presence of residential functions alongside productive

and commercial ones. In particular, in the agri-food sector, up to the last century, attention to the intrinsic qualities of food is a major aspect of productive efforts. For a long time, the competitiveness of productions is not only in the skills and tools put in place, but also in the roots between places, resources and processes.
The assumption of the proposal to return a community's ability to choose transitions is the Faro Convention (Council of Europe, 2005), which recognizes individual and collective responsibility towards the built landscape. In its framework, the idea of giving congruence to the production and consumption cycles by combining them with the physical and economic dimensions of landscape and with communities is condition for a regeneration, attentive to the potentialities and challenges of the third millennium.
On the cultural point of view, the research links the regeneration challenges to the circular economy. The circular economy model has its roots in concepts dating back to the 1970s, including the Club of Rome's Limits to Growth theory, Braungart and McDonough's cradle to cradle concept, recently gaining attention thanks to the Ellen MacArthur Foundation visions. Strategically, the research engagement aligns with action plan for the circular economy to 'close the loop' by complementing the measures contained in the legislative proposals and to contribute to meeting the United Nations Sustainable Development Goals (SDG) adopted in 2015[1].
The operational framework is marked by a commitment to promote progressive technological processes that can reduce the impact of perturbative pressures on the environment; enhance the security of supply of raw materials; increase the competitiveness; innovation; growth and jobs. Regeneration poses challenges such as financing; key economic enablers; skills; consumer behaviour and business models; and multi-level governance (Pagani, 2015).This also helps to reduce the negative social, environmental and economic impacts of the built environment – including emissions, air pollution, waste and associated costs. As for nature , regeneration can support cities to retain, refit, refurbish, reuse and recycle its resources. Return to technology the potential to draw proactively the relations between society and landscapes is supposed to promote an awareness of the integrability limits for technologies within the built. Encouraging inclusiveness through technologies means taking into account issues related with reducing negative externalities, consumption of primary resources and waste. The rebalancing of the decomposed pressures can bring to a new productive infrastructure. In this perspective, the built landscape itself becomes the driving force behind the strategy of regeneration, the physical medium through which a set of actions designed to qualify a new presence on the market can be developed. Diverting waste from landfill, using materials and products more efficiently, and improving air quality can enhance communities, companies and factories, making manufacturing landscapes cleaner, more attractive and more liveable.

2. Methodology

Enabling compatible transitions is the aim of the approach, linking past processes with present vulnerabilities, taking into account environmental and

[1]The teamwork focuses on Goal 11: Make cities inclusive, safe, resilient and sustainable

technological behaviours. The regeneration methodology here proposed, focuses on the relations between technological regimes and spaces, taking into account the following steps and activities:

Phase 1. Analysing the latent residual potentials in the manufacturing landscape studied, despite the impact of slow pressures and unexpected shocks on the built; quantitative data (statistics, historical data) and qualitative information (about values, stakeholders, interrelations, routines, power and empowerment) support the description of events under a long-term perspective.

Phase 2. Creating a unified foundation for compatible and sustainable regeneration approaches to manufacturing sites. Outlining the compatible scenarios to mitigate vulnerabilities due to processes of misalignment, both in architectural and manufacturing with uncontrolled decay of the performance levels that affect the built, triggering fault conditions of the technological units, changing the whole life cycles. The research returns the solution compatibility thresholds in relation to the values expressed by the site, with the aim of shortening the loops and making congruent economics of places with the settlement identity.

Aim of the first phase of the study is to draw an integrated framework of knowledge based on the integration between the physical, social, economic and cultural data. An anagraphic registry of the built is adopted to collect and organize data on buildings and roads; the cards for each environmental unit and technical element are defined with the aim to compare past performances with occurring pressures and shocks. According to the UNI 10838: 1999, the *functional-spatial concept* is assumed as the structured set of spaces defined by their functions, sizes, morphologies, positions also related with the external areas. The *structural concept* refers to the general principle that regulates buildings' attitude to withstand stresses of multiple nature and intensity, always being accessible to users. It concerns the constructive logic, in relation to dimensions, materials, technical solutions for elements. Similarly, the *environmental concept* is the general principle that regulates the interaction between heat, sound and light flows, investing and permeating the built.

A social and economic survey supports the study, focusing on the consistency of the built. Demographic structure, economic inequality, education, human capital and civic engagement are the criteria with which the case study are observed. The low liveliness of the real estate market is compared to the economy of the business system, taking into account the attitudes of the business system to promote models of productive organization that can determine effects of urban regeneration.

Reinventing a manufacturing site, appropriate to the third millennium, working both on the built environment and the local economy is the goal of the second phase of the study. This starts from the acknowledgment of the environments' vulnerabilities, tracing them back to slow and often unconscious processes of de-contextualization and hybridization of the construction and production solutions (Casini, 2016). Nonlinear obsolescence connote their intensification. Past synergies between spaces and design, technology and society, are denied by the name of an economic growth.

Contrasting the contemporary vulnerability to the impact of destabilizing external forces is a goal pursued through a process of governance for the coming transitions that involve not only the means and tools, but values, knowledge, and processes (Ciribini, 1984). By

focusing on the cultural and creative dimension of manufacturing landscape, the research identifies in the food production, the theoretical core from which to start experimenting for a case study in the Vesuvius area of Torre Annunziata.

3. Case Study: The Manufacturing Landscape of Torre Annunziata (Naples)

Since ancient times, Campania is a fertile region, at the top for its agri – food production. In the second half of the sixteenth century, the Vesuvius area undergoes impressive architectural transformations, aimed at specializing ancient built environments for agro-industrial manufacturing. Constructions and settlements are re - designed and transformed with the special aim to optimize landscape's productive attitudes.

An indissoluble link between local morphology and climatic agents affects productions and spaces organization. The microclimatic conditions on the slopes of the Vesuvius, deeply impact in defining buildings' qualities, in a site where the sun, the fresh breezes from the sea, the waters, are put to the service of the ability of artisans. In addition to these aspects, other features such as the attitude of local entrepreneurs to accumulate capital, their spirit of enterprise, a relationship with politics and government, at both central and peripheral, a technical basis, a viable market, the growth of local entrepreneurship, influence the architectural and urban solutions (Beguinot, 1963).

Significant among all the Vesuvius settlements is the case of Torre Annunziata (Di Martino, Russo, 1983). In the last decade of the sixteenth century, the Count Muzio Tuttavilla decides to equip the coast with settlements devoted to the production of dry pasta food. The project starts off with a reorganization plan on the morphology: in 1592, the Count instructs Domenico Fontana in the construction of an artificial channel which, from the springs of the Sarno to Episcopio, runs through the plain of Poggiomarino and flows to the sea. The opportunity to build in an area next to the sea, mills and pasta factories, marks deeply local economies. The industrial densification determines a significant impact on the built that is transformed with massive dislocations of people, homes, industries networking infrastructure and services. Small-scale productions affect this site, not only with respect to the evolution of the social and economic texture, but above all with respect to its physical structure (Gargiulo, Quintavalle, 1983).

Despite the continuous additions, subtractions and modifications, the settlement is structured over centuries with homogeneity and congruence, on the basis of structural and environmental conception, morphological and dimensional solutions, and constructive material. The community's design finds expression in the architectural and urban planning choices, maturing the ability to predict and control technological solutions with respect to the productive and housing purpose. Much before the mechanization of production processes, the attention of the business class to the site comes to the design and implementation of constructive and environmental control solutions that can improve the performance levels guaranteed by the mechanical equipments for wheat milling, dough and the drying of the product (Giannola, 2015). The longitudinal nave distributive articulation, the degrading terraces facing the gardens, the courtyards, the open stairs, the wide sidewalks on the outside, are the connective texture that specifies the quality of the food product. Material, dimensional,

morphological characterizations contribute to the technological processes, marking the finished product and differentiating it from others on the markets for consistency, grain and color (Figure 1).

Figure 1. Case study. Torre Annunziata, manufacturing landscape.

The manufacturing system is slowly affirmed on the market of the Kingdom of Naples for a product with unique quality attributes, whose peculiarity is in the clever process control, also through the organization of internal and external spaces. The whole economy spins on the synergies between places and resources: exposure, size, constructive characters of the settlement, are the factors enabling the production, increased by the presence of the port for the import of the best quality grains from Russia, and the pasta food export.

Over the course of four centuries, the market cycles with an alternation between growth and crisis mark the transitions of material culture, resulting in revisions of the production process and spatial and functional modification for physical settlement. Over time, production is conveyed as a direct and explicit result of well-established techniques in respect of which the community puts in place a set of continuous adjustments to the increasing perturbative pressures. Emblematic is in this perspective, the revision of the manufacturing process following the adoption of steam engines in mills, kneading machines, weights and mechanical presses. The direct consequence of technological innovation is, at the production level, the reduction in working time and the number of workers, while at the settlement level, the shifting of the loading and drying steps of the pasta from sidewalks, courtyards androofs, with the creation of ventilated rooms.

From the early 1900s, several transformations mark the relationships between nature and

built causing modifications in the natural environment, with implications for hydraulic functionality and the hydrogeological equilibrium of the Sarno channel, and the distortionof the settlement structure, in terms of typological, material, chromatic characters. The urban texture undergoes a slow saturation of green areas (Viola, Pinto, Cecere, 2014). The set of craftsmen-merchant residences is the subject of a change of destination for use on the ground floor, with additions and superfets to the last levels. Since the Second World War, the settlements balance is compromised by uncontrolled processes: transformative dynamics are marked by expansion into agricultural land areas, abusive expansion of the built, abandonment and lack of terraces and courtyards (Figure 2).

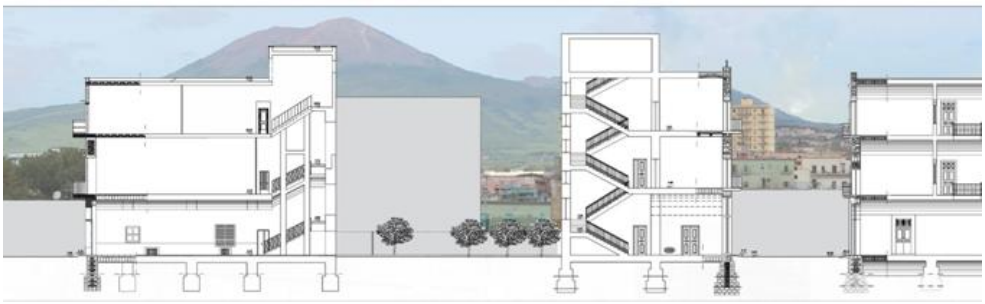

Figure 2. Case study. The relation between natural and built environments.

Technological distortions affect the whole chain of manufacturing processes From a production that earns value in terms of urban quality and workers ability to interact with natural resources, the patenting of remote-controlled machines, moves production into indoor controlled environments. Pasta can be produced everywhere: technological innovation allows remote testing of dough hardness, elimination of steps and stops in processing, reduction of waste with an exponential increase in daily quantities. The production disposal exposes the settlement system to unpredictable vulnerabilities. A long process of knowledge dispersion invests the material culture, with immediate consequences on the strategies for built maintenance and management.

On the functional-spatial perspective, two processes of opposite nature expose, today, the settlement to uncontrolled transformations: the connection between adjacent vaulted spaces, with the elimination of some structures by inserting arcs; then later, the next, splitting some rooms. The first transformation is due to the demands of technological innovation and to the introduction of new machineries within the production sites. The environmental units dilate, varying the proportional relationships between the technical elements that compose them. The production site of Torre Annunziata replaces an economy based on wheat and water with one based on coal and iron. Physical consequence is that within the built the characteristic succession of areas designed to accommodate the productive function is denied through transformations: the laboratories that hosted activities of kneading dough of durum wheat with warm water, drafting of the pastry, cut the dough, the spaces of sale, the spaces of accumulation for semolina and wheat, the outdoor spaces for the drying of the pasta, the spaces of the packaging and wrapping.

Similarly, the human capital survey returns the transitions occurred in terms of demographic structure, socio-economic inequality, education, entrepreneurship. The analysis related to our days describes a site characterized by a significant civic engagement in younger generations. Voluntary associations and social cooperatives operate dynamically in a context marked by a shortage of job opportunities. They pursue civic, solidarity and social purposes by fostering and realizing activities of general interest through free forms of action. In some of them the commitment to cooperation and aggregation is complemented by the protection of the built environment and the promotion of local resources.

4. Results and Implications

Resuming the content of the Faro Convention, an awareness-building path over the cultural heritage whose productive landscape is witnessing is being launched to promote a design that is based on technological innovation, transitions and inclusiveness. The basis of the approach is that the collective re-appropriation of knowledge and memories can contribute to activating in a highly complex context, a gradual process of individual and collective empowerment. In this perspective, the research team involves students in Architecture, PhDs, Residents, Entrepreneurs, to continuously re-balance the processes of transition for built landscapes. The foundation of the design commitment is the recognition of the urban dimension as the only level capable of ensuring at the same time the possibility to mitigate vulnerabilities, to protect resources, to open new markets, and to reduce management costs.

The emergence of new needs, the variety and variability of demand, the flexibility and multiplicity of uses, require a profound rethinking of the design perspectives. An imbalance between growing demand for innovation and available solutions, marks the scenario in which Torre Annunziata, today opens to meet the sustainability issues, through concrete actions, aimed at a conscious use of local resources. The two forces that decimated the manufacturing industry - globalization and technological progress – are supposed, today, to drive the expansion of new jobs in the field of innovation. As for the past, creativity can redesign local economies with the help of tools and procedures deduced from an advanced manufacturing.

According to McKinsey Global Institute (McKinsey, 2012) and Arup's studies (Arup, 2015), the research recognizes that manufacturing is mature today to return to cities. In the fourth industrial age, productions are cleaner, greener, quieter and no longer demand large-scale spaces. Key issue for the future of productive landscapes is the realignment of existing spaces and processes put in place. Technology, not part of an environmentally-aware knowledge framework, has caused irreparable damage to production sites; the possibility of a new future for old settlements, is in the foreshadowing of rebalancing solutions for urban metabolism. The future of an ancient city, is related to the ability to reinvent spaces and devices, with the re-design of technologies, able to fit within a built system with high prior degrees of stiffness, imagining working procedures, operators, food supply chains (Marsden, Banks, Bristow, 2000). This approach brings into play an idea of the settlement as an interconnected productive system (Marsh, 2014). In traditional manufacturing landscapes, the location is a factor due to physical

characteristics of the settlement, as the presence of a port or of natural resources. The post-industrial economy, based on knowledge and innovation, shows today an inherent capacity to take advantages of these potentialities.
Overall, the search results return the following visions:
1. The manufacturing landscape is a common good, a complex system resulting from the encounter between resources and technological thinking. The study of latent residual potentials in the manufacturing landscape returns the degree of technological transition that the built environment can face in terms of greening capacity, more sustainable manufacturing models, cleaner and high-tech processes. The consequence of this vision is that innovative manufacturing, with the support of technologies can be brought back to ancient cities (Figure 3).
2. The ancient city can accommodate the widespread factory. Manufacturing can begins to contribute to the vitality of the built environment, providing job opportunities with a high multiplier effect. Flexible and adaptable, the agri-food manufactures show high degree of integration between buildings and processes; they are resilient to economic and environmental shifts.
3. Strengthening community skills is an indispensable condition. The analysis confirm that in Torre Annunziata, the third sector, social, economic and cultural reality of a private nature but tended to the production of public or collective goods and services is a privileged actor of regeneration. The idea behind the research is that despite the globalization ofmarkets and the crisis of local economies, it is possible to leverage knowledge sharing and synergy between research and practice, believing that the short-circuit of the design-realization chain can result the most significant push for a regeneration.
In the new economy of innovation, the success of enterprises exceeds the proximities and depends on relations. The potential of nature that in the past had been the connotative aspect of the manufacturing landscape, is back in the vision of the third millennium to acquire a fundamental role. The positive balance of the built - nature relationship can be regenerated through a transition vision. Recognizing a predominant role in the cumulative impact of minor improvements, a tailored technological approach supports the design. To emphasize the processional dimension of change means to consider complementarity between space and contiguous elements. Focusing on the need to counteract the progressive saturation of green areas, the technological solutions proposed are synthesized in succession as: retain, refit, refurbish, reuse, recycle.

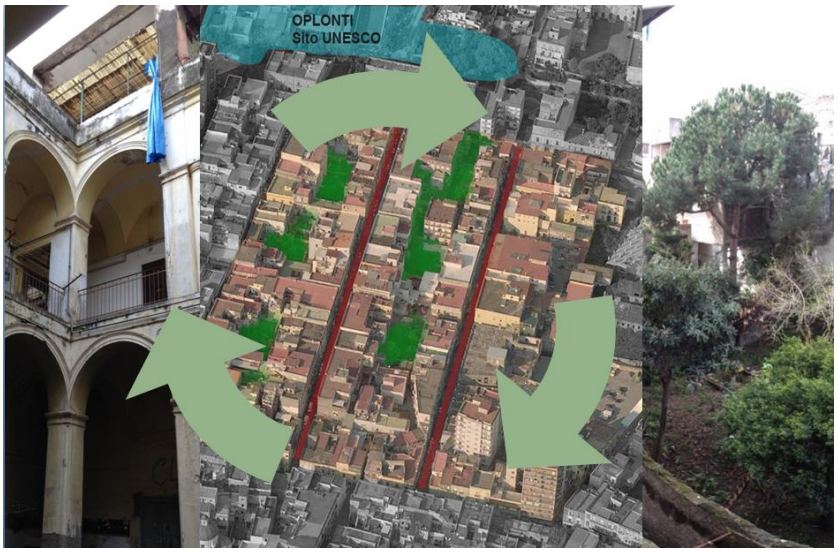

Figure 3. Design scenarios.

The prefigured approach answers to the idea that nature, people and built form a unique continuous. The theoretical hypothesis of reasoning about technological transitions is that only nature has the power to reconstruct in a harmonious unity, the fundamental disorder of reality, making it capable, so, to reveal an ultimate meaning beyond itsown chaos. The preponderance of nature can contrast real and imaginary barriers with the help of design, holding communities together (Figure 4).
Under these perspective, a mix of technological solutions that show new complementarity between nature and built, is taken into account:

- Green walls able to improve air quality and acoustics while protecting buildings form thermal fluctuations and extreme weather. With high maintenance costs, green walls, to the latitude of Torre Annunziata require the careful selection of plant species.
- Combined green roofs and solar technologies that can create vital synergies in dense urban areas.
- Permeable paving and soft landscape areas able to improve water absorption and slow rainwater run-off, installable in interstitial spaces between buildings.
- Temporary shading sails, or structures supporting climbing plants, that can help mitigate summer heat waves and make public space accessible during the hottest hours of the day.
- Fountains, mist, brooks and waterfalls that can be used to create playgrounds and recreational spaces.
- Recreational green areas with permeable surfaces that can be used as buffer zones for temporary floodings.

Figure 4. Timeline for the technological transitions.

Through the the cross fertilization of coordinated micro-actions, the proposal outlines a design strategy for the *circular city*. According to a vision that relates value chains, niche products, built environments, the research traces adaptive regenerative scenarios based on successive transitions.

5. Conclusions

Promoting an awareness of the reasons for identity can foster the growth of manufacturing attitudes of sites, by prefiguring appropriate sustainability ranges that ensure new social cohesion. Cultural changes in the production system and a renewed consumer awareness are the two nucleus for inclusive processes of appropriate technological transition based on new synergies between identities and economies.
Focusing on the re-acquisition of material culture, the settlement, for long epicenter of the processes of resource dissipation and degradation, becomes a place to review the logic of dialogue between preeminence and advent, by understanding unexpressed vocations, restoring valences satisfying new users' instances.
In the awareness of the scarcity of resources, manufactures in the third millennium are called upon to overcome every consumer concept based on the assumption that the waste product of each production process is a waste to be released into the surrounding environment. As in nature the rejection is reworked to give birth to a new life, the city is also called to put in place processes devoted to the conversion of its past waste products. The community is asked to rethink technological processes so that the scrap-waste combination can acquire a positive balance. The commitment is in line with the profound cultural evolution that marks the technological approach in built environment management through the prefiguration of synergies between urban, rural and natural areas, for circularization, reproposing what always happened in natural ecosystems.

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