CLUST-ER BUILD
EDILIZIA E COSTRUZIONI

White Paper 2024

Clust-ER Build
Building and Construction

Represents a crucial step in the journey of Clust-ER Build towards innovation in the construction, architecture, and civil engineering sectors

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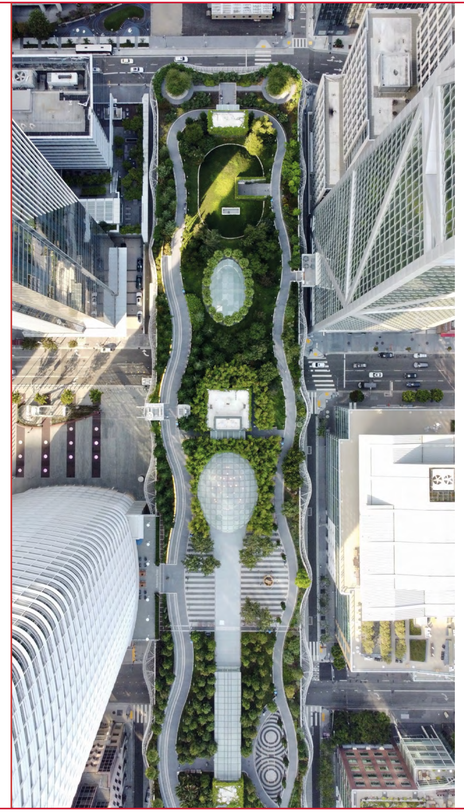


VINCENZO COLLA
Councillor for Economic Development and Green Economy, Employment, and Training

Facing the biggest challenge in the coming years: sustainability.
The new European Directive on "green homes," which came into effect at the end of May this year, will require EU countries to decisively pursue the path of redeveloping the building stock and improving energy efficiency, with the goal of total decarbonization set for 2050. This means, for our country, quite a challenging commitment if we consider, for example, that the 110% Superbonus works have only affected 5.5% of the entire Italian building stock, almost 8% in our region. The data recently released by the regional ANCE confirm an aging building stock even in Emilia-Romagna: only 1 in 4 houses was built after the introduction of seismic and energy efficiency standards, and 1 in 4 was built even before 1945. It is not surprising, therefore, that intervening in the construction sector is crucial for reducing CO2 emissions (today, the sector contributes 45%).
But sustainability, in addition to being a challenge, must also be an opportunity: generating beauty, ensuring safety, and fostering inclusion and social cohesion. Let's look at the decisions made by Europe to address urban regeneration as both an environmental and social turning point. Starting with the recovery of abandoned and contaminated areas, as well as the repurposing of unused buildings. It is clear that the European trajectory is pushing toward a new model of eco-building, for which we also need new design ideas based on research into "green materials": from technology to the use of data and Artificial Intelligence to prevent any issues related to construction.
For this reason, we must never forget, in the current and future scenario, the importance of training new skills, essential to manage this change. You cannot create a building without the right minds, especially in a time of epochal transformation, with technology evolving at an incredible speed. Emilia-Romagna is at the forefront of supporting this transition, starting with knowledge and expertise. With the Pact for Work, Climate, and the Regional Energy Plan, we have chosen to focus on the new "green" development within the construction sector and are investing to qualify the entire supply chain, from which a lot of jobs depend.

MAY 4, 2023 – CERVIA (RA)
CLUST-ER BUILD EVENT TITLED "INNOVATION AND SUSTAINABILITY FOR THE INCLUSIVE REGENERATION OF THE ROMAGNA COAST"

The event held on May 4, 2023, in Cervia, organized by Clust-ER Build with the support of ANCE Emilia-Romagna, laid the foundations for a snapshot of the current needs and opportunities in the region regarding strategic skills for the Romagna territory. Through a process of "scale-up," this could become an example of a skillset and strategies repository.

From this event, numerous discussions, interviews, and analyses emerged, contributing to the creation of this dynamic document, which is open to continuous updates and future additions.

"Driving innovation in construction and urban regeneration, creating synergies between advanced technologies, sustainability and skills, and transforming cities into places that are more resilient and liveable".

SILVIA ROSSI
Manager del Clust-ER Build

"Every human activity, past, present, and future, whether physical or virtual, takes place inside a building or through an infrastructure specifically created by human ingenuity."

ENZO CASTELLANETA
Advisor and Chair of the Innovation Representation Table, Clust-ER Build

"Together for a Social, Inclusive, and Sustainable Urban Regeneration. We are a collective determined to shape the future of our communities through urban regeneration that embraces the values of sociality, inclusion, and sustainability. As members of the Clust-ER Build Association, we firmly believe that the urban fabric must be a place of meeting, growth, and well-being for all its inhabitants, without any kind of discrimination."

LENA FERRARI
Advisor, Clust-ER Build

Strategic Objectives

- Innovation in Engineering and Architecture
- Highlight new technologies, IoT applications, and smart solutions in Engineering
- Resource and Project Management
- Discuss the impact of innovative approaches on resource lifecycle, cost efficiency, and project outcomes
- Urban Development
- Explore how technical solutions in design and materials contribute to sustainable, functional, and aesthetic urban landscapes
- Case Studies or Practical Applications
- Demonstrate the practical application and benefits of these technologies and approaches

Sommario

WHITE PAPER 2024 CLUST-ER BUILD

1. Introduction

In a rapidly evolving world, where technology and innovation drive change in every sector, architecture, civil engineering, and construction face unprecedented challenges and opportunities.

This White Paper, aimed at professionals, companies, and enthusiasts in the field, seeks to explore the latest trends, innovative solutions, and successful strategies in the field of civil engineering and construction. Through a detailed analysis of emerging technologies, such as innovative materials, integrated design, the Internet of Things (IoT), and digital solutions, it also looks at their impact on the urban landscape and resource management.
This document aims to outline a path toward efficiency, sustainability, and aesthetics in the built environment—whether urban, suburban, or infrastructural.

Our goal is to provide insights, stimulate debate, and propose concrete solutions to address today's challenges, positioning Clust-ER Build and its Partners as pioneers and leaders in the sector.
We activate innovation processes starting from people's needs. We create ecosystems where individuals and communities build relationships of trust and collaboration to combine economic goals and generate social impact.

REGIONAL MAPPING OF THE CONSTRUCTION SECTOR

Through Clust-ER Build, it is possible to provide a detailed analysis of the construction sector in the Emilia-Romagna Region.
This mapping aims to identify the main companies, specific skills, technological innovations, and market trends.

The Emilia-Romagna region is one of Italy's most industrialized areas, with a diversified economy that includes sectors such as food and agriculture, automotive, mechanical engineering, chemicals, and textiles. Its strategic geographical location in the center of the country, along with the presence of important transportation infrastructures and a solid research and innovation network, contribute to its economic prosperity.
The regional construction sector includes both large companies and small and medium-sized enterprises (SMEs), and in recent years, it has experienced sustained growth, fueled by public and private investments in new construction and renovations.

Tourism, particularly in art cities like Bologna, Ravenna, and Ferrara, has contributed to the demand for new hospitality structures and tourism-related infrastructures.
The focus on this information will guide the strategic development of the sector, improve collaboration among companies, and stimulate innovation and regional economic growth.

For more details, visit Clust-ER Build: website **build.clust-er.it**

2. Innovative Technologies

Advanced technologies are revolutionizing the field of civil engineering and construction, enabling us to witness the evolution of construction techniques on a daily basis.

Recent innovations, such as the Internet of Things (IoT), augmented reality, and smart resource management systems, are redefining the foundations of engineering thought, influencing the way buildings and infrastructure are conceived, designed, built, and managed.

For millennia, from the early Sumerian cities like Uruk in Mesopotamia (3,500 B.C.), to the city-states of Magna Grecia (700 B.C.) and the grandiose infrastructures of the Roman Empire (100 B.C.), humanity has built based on tangible and measurable experiences. However, the ongoing technological revolution today allows us to model, test, and collect data in fractions of a second, surpassing the limits of the tangible and pushing us toward previously unimaginable realities.

New technologies are having significant impacts on urban planning, improving energy efficiency, reducing environmental impact, and increasing safety and comfort for users. Despite this advancement, it is essential to preserve cultural and historical heritage, integrating the construction of new structures with the management of existing infrastructures to ensure a harmonious transition to new technologies.
Through examples of innovative projects and case studies, it is demonstrated how these technologies not only improve urban aesthetics but also help solve complex problems such as traffic congestion and pollution.

Asset Integrity, Predictive Maintenance, and the updating of models are examples of how the correct use of advanced sensors and computational capabilities can transform the approach to design and construction.

In conclusion, the importance of a multidisciplinary approach to design is emphasized—one that integrates engineering, architectural, technological, and environmental skills to develop more sustainable, efficient, and livable cities.

2.1 Evolution of Construction Techniques and Impact of New Technologies

Traditional construction techniques are evolving thanks to the introduction of innovative technologies, ranging from materials to design techniques, from IoT to augmented reality, and intelligent resource management systems.
A historical overview of the evolution of construction techniques, highlighting the shift from traditional practices to modern ones, with a particular focus on technological innovations.

THE IMPACT OF NEW TECHNOLOGIES

The impact of new technologies on the construction sector is a topic of significant interest, particularly regarding the integration of advanced solutions such as the Internet of Things (IoT) and augmented reality. These technologies are radically transforming the industry, bringing significant improvements in operational efficiency, environmental sustainability, and safety at construction sites.

OPERATIONAL EFFICIENCY

The integration of IoT in the construction sector has improved the efficiency of processes. Connected sensors and devices are now capable of collecting real-time data directly from construction sites. This continuous flow of information allows project managers to monitor the progress of work, machine usage, and resource management with unprecedented precision. The ability to analyze data in real-time also enables the optimization of operations, reducing downtime and anticipating potential problems, thus minimizing delays and unnecessary costs.
The ability to better understand and manage the built assets does not depend on how much technology exists, but rather on whether it is adaptable to the existing built heritage. A large percentage of our buildings are old, some are historical, and few are newly constructed. Therefore, it is essential to work with systems that can adapt to the needs: renovation or new construction.

SUSTAINABIITY

On the sustainability front, new technologies offer powerful tools to reduce the environmental impact of construction. IoT, for example, can help monitor resource consumption, such as water and energy, and manage waste more effectively. Moreover, augmented reality supports the creation of digital simulations during the design phase, allowing for the optimization of the design to minimize material and energy waste.
These tools not only help meet the strictest environmental regulations but also contribute to building a positive reputation among clients who are increasingly concerned with ecological issues.

SECURITY

Perhaps one of the most critical aspects where new technologies are making a difference is workplace safety. Through the use of wearable devices connected to the IoT, it is possible to monitor workers' health conditions in real-time, detecting signs of fatigue or stress.
Augmented reality, on the other hand, allows workers to familiarize themselves with the work environment through simulations before physically entering the construction site, reducing the risk of accidents.
These technological tools, therefore, not only improve the individual safety of workers but also help reduce costs associated with injuries and absenteeism.

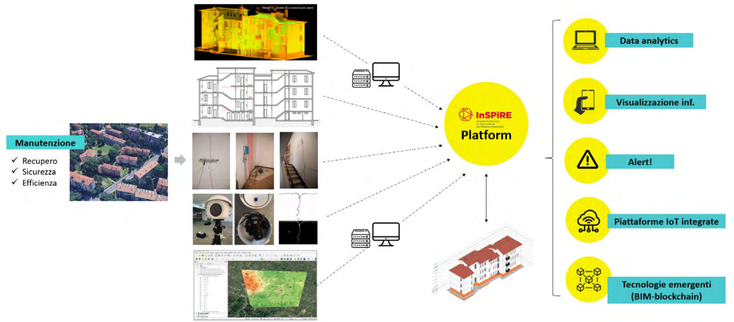
The adoption of IoT and augmented reality in the construction sector is not just a trend but a revolution that is defining the future of the industry. Companies that know how to integrate these technologies into their processes can expect significant competitive advantages, making their projects more efficient, eco-friendly, and safe. For companies in the sector, this represents a unique opportunity to position themselves as providers of cutting-edge solutions in a rapidly evolving global market.

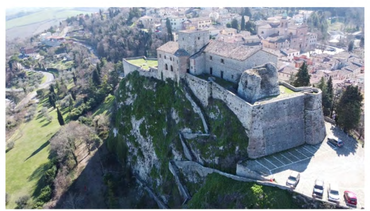
EMERGING TECHNOLOGIES AND URBAN REGENERATION

Emerging technologies are playing an increasingly central role in architectural design and urban regeneration processes, significantly contributing to the renewal and improvement of urban landscapes.
These technologies, including augmented reality, advanced sensors, Big Data, and Artificial Intelligence, offer new opportunities to transform cities into more livable, sustainable, and interconnected environments.

The ability to use Artificial Intelligence in architecture and urban planning helps bridge the gap between "conceptual form" and "built form," enabling a pragmatic approach to the real needs of the city. This approach allows virtual simulations of issues related to climate change, evaluating possible solutions and their impacts, and then, in the real world, developing procedures and initiatives that can make our buildings and cities more resilient.

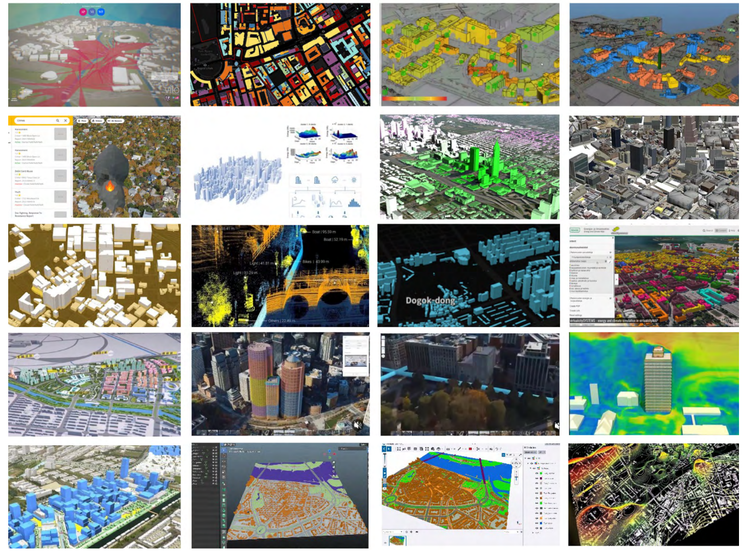
In particular, Artificial Intelligence will make a significant contribution—it could even be the driving force behind a paradigm shift in traditional urban planning thinking. For example, in civil protection plans, risk management, and prevention plans, the use of Digital Twins will be a revolutionary aspect.





Clust-ER Build, which has been working on this aspect for some time, particularly through projects funded by PR FESR funds for both the 2014-2020 and 2021-2027 periods, aims to define a protocol for the application of enabling technologies dedicated to the built environment at various scales. From BIM (Building Information Modeling) to CIM (City Information Modeling), these technologies are integrated with the development of Digital Twin applications at the urban scale.
The integration of diverse informational sources (satellite, GIS, point clouds, integrated sensors, monitoring, BIM) enables the modeling and representation of outcome scenarios and the development of collaborative platforms, as well as their training through Artificial Intelligence protocols and machine learning (INCITE project).

"Urban regeneration can represent the ground for a true paradigm shift. Today, there is a need to evaluate interventions in light of a series of parameters, including sustainability, the effects of climate change, and social inclusion. In the face of this increased complexity, Artificial Intelligence can offer a fundamental contribution by acquiring and utilizing a range of data that cannot be managed using traditional techniques, to monitor interventions that have a longer-term duration," said Michele Talia, President of the National Institute of Urban Planning, during the Roundtable "Integration Between Urban Regeneration Processes and GeoAI" on May 22, 2024.



REALIZATION OF INNOVATIVE URBAN PROJECTS

One of the most evident examples of how emerging technologies can positively influence urban regeneration is the use of augmented reality in the planning and visualization of urban spaces.
This technology allows designers and citizens to visualize changes and additions to urban spaces before they are actually implemented, fostering a participatory approach to urban planning.
A concrete example is the "Dubai Smart City" project, which will impact sectors such as the economy, transportation, and energy resources, extending from the construction sector to urban planning. The project aims to transform Dubai into one of the smartest and most interconnected cities in the world, using advanced technologies to optimize urban services and improve the quality of life for residents.

SENSORS AND INFRASTRUCTURE MANAGEMENT

The use of IoT sensors in urban areas represents another fundamental pillar of urban regeneration.
These devices enable the continuous collection of data related to various aspects of urban life, **such as traffic, air quality, and energy consumption**.

By analyzing this data, cities can optimize their infrastructure and services.
The city of Amsterdam, for example, has implemented an extensive IoT sensor network to monitor and manage traffic in real-time, reducing pollution and improving transportation efficiency.

ARTIFICIAL INTELLIGENCE AND BIG DATA

Artificial Intelligence and Big Data play a crucial role in analyzing vast volumes of urban data, providing insights that can guide planning decisions and public policies.
Projects such as Singapore's, which uses AI to integrate data from urban sensors and create simulations to improve public services and infrastructure, demonstrate how these technologies can be used to promote intelligent, data-driven urban regeneration.
Thanks to "Virtual Singapore," which is based on digital twin technology, it was possible to verify, before starting the project, the impact of the entire urban regeneration design in the new Bishan district.
Emerging technologies are transforming the fabric of modern cities, making urban regeneration a more inclusive, sustainable, and efficient process.
For industry leaders and pioneers, exploring and implementing these technologies in urban contexts not only addresses immediate needs but also prepares the ground for a future in which cities will be completely transformed by technological innovation.

CHALLENGES AND FUTURE OPPORTUNITIES

New technologies, while driving innovation in the construction and civil engineering sectors, also bring significant challenges that must be addressed to fully exploit their potential.
At the same time, they offer extraordinary opportunities to transform the future of construction techniques, improving the effectiveness and sustainability of projects.

One of the main challenges is the resistance to cultural and technological change within the sector. Many traditional construction companies may be reluctant to adopt new technologies, often due to a lack of digital skills or fear of high initial investments.
Moreover, the effective management and analysis of the large volumes of data generated by new technologies require significant IT infrastructure and specific skills, which are often lacking in the traditional construction

Another significant challenge is cybersecurity. With increased connectivity, construction systems become vulnerable to cybersecurity risks, which can lead to significant disruptions in projects and the loss of sensitive data.

On the other hand, the opportunities offered by new technologies in the construction sector are immense.
Automation and robotics, for example, can significantly increase efficiency and precision in construction, reducing construction time and labor costs, while minimizing the risk of human errors and enhancing workplace safety.
Digitalization, through tools such as Building Information Modeling (BIM), offers the possibility to manage projects in a more integrated and collaborative way, improving communication between various stakeholders and optimizing the management of the lifecycle of construction projects.

Finally, sustainable technologies and innovative materials have the potential to revolutionize the construction industry, making it more eco-friendly.
The use of recycled materials, more energy-efficient construction techniques and design oriented towards sustainability can significantly contribute to reducing the ecological footprint of the sector.

In conclusion, new technologies in the construction sector present both challenges and opportunities.
Addressing these challenges requires a joint commitment in terms of training, investment, and the development of new skills, while the opportunities promise to take the industry to new levels of efficiency and sustainability.
For companies at the forefront of providing SaaS solutions to civil engineering, these trends are not only relevant but represent fertile ground for innovation and growth in the global context.

2.2 Improvement of Energy Efficiency and Reduction of Environmental Impact

New technologies contribute to designing buildings that are more efficient from an energy and environmental perspective.

PRINCIPLES OF ENERGY EFFICIENCY

Reflection on how technological innovations have improved energy efficiency in construction, reducing energy consumption and minimizing the ecological footprint.

Improving energy efficiency and reducing environmental impact are, today, fundamental goals for conscious and sustainable development. New technologies allow for the design and renovation of buildings in a more energy-efficient way, while simultaneously reducing resource consumption and CO2 emissions. Solutions such as automation systems, solar panels, LED lighting, advanced insulation, and smart sensors enable the optimization of energy consumption, while improving the comfort of indoor environments. Furthermore, the use of eco-friendly materials and water recovery technologies helps reduce the overall environmental impact, promoting more sustainable and resilient cities.

SUSTAINABLE MATERIALS AND TECHNOLOGIES

Analysis of sustainable building materials and technologies that help reduce environmental impact, such as advanced thermal insulation or efficient heating and cooling systems.

Clust-ER Build members focus on various initiatives to raise awareness of industry technologies, improving energy efficiency and promoting the use of sustainable materials in the construction sector. Through the “Green2Build” Value Chain, they work to develop energy-efficient, resilient, and sustainable buildings.

Activities include research and implementation of innovative technologies on real-world projects, including existing structures, the adoption of low-environmental-impact materials, and the promotion of construction practices that reduce CO2 emissions. Additionally, they collaborate with government entities and academic institutions to promote the dissemination of sustainable solutions and the updating of regulations in the construction sector.

2.3 Safety and Comfort in the Urban Environment

Examination of Technologies that Enhance Building Safety and Improve User Comfort, Including Solutions such as Smart Sensors and Automated Control Systems

INNOVATIONS FOR BUILDING SAFETY

Technologies that enhance safety and comfort in urban environments often leverage the integration of **smart sensors** that monitor various parameters, such as air quality, temperature, and humidity.
These sensors can automatically adjust the heating, ventilation, and air conditioning systems (HVAC) to maintain optimal conditions inside the building, ensuring a comfortable and healthy environment for occupants.

Smart lighting systems adapt to the available natural light and the presence of people in rooms. These systems improve comfort by providing appropriate lighting based on real-time needs while reducing energy consumption by ensuring lighting is used only when necessary.

In terms of **structural safety**, advanced technologies include systems that analyze, understand the effects of external forces, and apply seismic-resistant measures. These technologies can significantly reduce the risk of damage during seismic events, particularly for older buildings and infrastructures, which represent **97% of the existing building stock.**

Seismic applications and **earthquake-resistant technologies** can monitor the structural integrity of buildings in real time, offering early warnings to occupants and emergency responders. This is especially important for older structures that were not originally designed to withstand modern seismic forces.

In conclusion, the integration of **smart sensors** and **automated control systems** not only increases comfort and efficiency but also plays a vital role in improving safety, particularly in earthquake-prone areas, ensuring the long-term resilience of buildings.

These systems, such as **base isolation** in buildings, allow structures to better withstand the forces of an earthquake, protecting both human lives and the integrity of the buildings.

At the same time, the use of **innovative construction materials**, such as **carbon fiber-reinforced concrete** or **shatterproof glass**, contributes to improving the resistance and durability of buildings against various types of stresses and threats.
The adoption of these technologies not only makes buildings safer and more resilient but also enhances the **quality of life** for the users.

The **smart integration** of sensors and automated systems paves the way for buildings that are not only constructed to resist but also provide pleasant and sustainable environments that dynamically respond to the needs of the people who inhabit them.
This convergence of **safety and comfort** is essential for the evolution of modern cities and represents an area where **innovative companies** can truly make a difference, leading progress in the construction industry.

RESIDENTIAL COMFORT AND AIR QUALITY

Discussion on the importance of residential comfort, with a focus on improving indoor air quality and advanced ventilation and filtration systems.

By using smart sensors and distributed monitoring networks, real-time data on air quality in various urban areas can be collected. These sensors can measure a range of air pollutants, such as PM2.5, PM10, nitrogen oxides (NOx), and nitrogen dioxide (NO2).
The collected data can be integrated into a management system based on BIM (Building Information Modeling), allowing urban planners and policymakers to visualize and analyze air quality data alongside other urban data, such as population density, traffic distribution, and industrial locations.

Through advanced data analysis and Artificial Intelligence, patterns and trends in air quality can be identified, as well as correlations with environmental and anthropogenic factors. This information can be used to develop strategies to mitigate air pollution and optimize urban planning, for example, by positioning green areas and parks in the most polluted areas or implementing traffic control measures.

SMART TECHNOLOGIES FOR URBAN WELL-BEING

Exploration of how Smart Technologies, such as smart lighting and automated climate control systems, contribute to creating a more comfortable and healthy urban environment.

Technological innovation can enhance the efficiency and sustainability of water treatment systems, reducing environmental impact and ensuring water security for urban communities.
By using BIM and smart systems, water treatment plants can be designed and optimized to reduce energy consumption, minimize waste, and maximize resource recovery.
For example, BIM models can be used to simulate water flow within treatment plants and identify points of congestion or inefficiency. The integration of smart sensors in water treatment systems enables continuous monitoring of plant performance and the timely detection of anomalies or malfunctions.
Furthermore, the adoption of innovative technologies, such as advanced disinfection and wastewater treatment for potable reuse, can help ensure sustainable water resource management and reduce dependency on traditional systems.
In conclusion, the use of technological innovation and smart systems, including BIM, can significantly improve air quality monitoring and water treatment in cities, thus promoting sustainable urban development, protecting the environment, and safeguarding community health, in line with the UN Sustainable Development Goals.

INTEGRATION OF GREEN SPACES AND RECREATIONAL AREAS

Reflection on the importance of green spaces and recreational areas to improve urban quality of life, providing relaxation and well-being areas for citizens.

The integration of green spaces and recreational areas within urban areas is crucial for improving the quality of life for residents. These spaces not only provide places for relaxation and socialization but also contribute to the physical and mental well-being of the population by reducing stress and promoting a more active lifestyle. Green spaces such as parks, gardens, and green roofs improve air quality, lower urban temperatures, and promote biodiversity, acting as the city's lungs. Furthermore, well-designed recreational areas can encourage social cohesion and provide safe spaces for play.

PHYSICAL ACTIVITY AND CREATING A MORE LIVABLE, INCLUSIVE, AND SUSTAINABLE URBAN ENVIRONMENT

The integration of green spaces and recreational areas is key to promoting physical activity, creating a more livable, inclusive, and sustainable urban environment.
The RIGENERA Value Chain of Clust-ER Build recognizes the importance of integrating green spaces and recreational areas into the urban context. Its primary goal is to improve urban regeneration processes, addressing city transformations in a multidimensional and multidisciplinary way. In line with the Regional Urban Planning Law 24/2017, RIGENERA promotes interventions that encourage the regeneration of urbanized land and the improvement of urban and architectural quality, with particular attention to the livability of urban spaces and neighborhoods.
This approach highlights the importance of creating more sustainable and inclusive urban environments, where green spaces and recreational areas play a central role in community well-being.

The RIGENERA Value Chain of Clust-ER Build promotes an innovative approach to urban regeneration, integrating nature-based solutions (NBS) to enhance the livability of urban spaces and reduce environmental impact. These solutions include the creation of green spaces, green roofs, urban parks, and the renaturalization of abandoned areas, which not only improve air quality but also increase the climate resilience of cities.

A fundamental element in this strategy is the adoption of Sustainable Urban Drainage Systems (SUDS), which help manage rainwater more efficiently, reducing the risk of flooding and improving the quality of wastewater. SUDS solutions, such as retention basins, bioretention cells, and permeable pavements, promote water infiltration into the soil and help prevent erosion and land sealing.
The integration of these solutions contributes to creating more sustainable urban environments, while simultaneously promoting biodiversity and enhancing the well-being of citizens through recreational and natural spaces that offer physical and psychological benefits.

2.4 Solution to Complex Urban Problems

In-depth analysis of how technological innovations address urban challenges such as traffic congestion and pollution, with concrete examples of practical applications.

TRAFFIC MANAGEMENT AND SUSTAINABLE MOBILITY

An analysis of how technological innovations are tackling traffic congestion through intelligent traffic management systems and sustainable mobility solutions.

Technological innovations are revolutionizing traffic management and promoting sustainable mobility in cities. Intelligent traffic management systems, based on Big Data and Artificial Intelligence, monitor and analyze traffic flows in real-time, optimizing traffic light synchronization and providing updated information to drivers to reduce congestion. At the same time, sustainable mobility solutions such as electric vehicles, car-sharing, and infrastructure for bicycles and pedestrians are becoming increasingly widespread. These innovations not only reduce the environmental impact of urban transport but also improve the quality of life by reducing air and noise pollution and promoting more efficient and healthier mobility within cities.

Modern cities face significant challenges related to traffic congestion, which negatively impacts quality of life, economic productivity, and the environment. To address these issues, intelligent traffic management systems (ITS - Intelligent Transportation Systems) and sustainable mobility solutions have been developed.

Intelligent traffic management systems use a combination of sensors, cameras, Big Data, and Artificial Intelligence to monitor, analyze, and optimize traffic flows in real-time. Here are some of the main components and functionalities:

- Sensors and Cameras: These detect traffic volume, vehicle speed, and road conditions, providing essential data for analysis.
- *Big Data* Analysis: The collected data is analyzed to identify congestion patterns and predict traffic flows.
- Artificial Intelligence: AI algorithms optimize traffic light synchronization, reducing waiting times and improving traffic flow.
- Driver Information Systems: Real-time applications and informational panels provide drivers with traffic updates, suggesting alternative routes to avoid congestion.
- Incident Management: Systems can detect accidents or obstacles on the road and coordinate rapid responses, reducing the time it takes to restore normal traffic flow.

Alongside traffic management, sustainable mobility solutions are gaining ground as ways to reduce dependence on private vehicles and improve urban transport efficiency. Some of the main innovations include:

- Electric Vehicles (EV): The spread of electric cars, buses, and bicycles reduces carbon emissions and fossil fuel consumption.
- Car Sharing and Ride Sharing: Services like car sharing and ride sharing (e.g., Uber, Lyft) reduce the number of vehicles on the roads, decreasing congestion and pollution.
- Infrastructure for Bicycles and Pedestrians: The creation of safe bike lanes and pedestrian paths promotes healthier and more sustainable alternative transportation.
- Intelligent Public Transport: The integration of advanced technologies into public transport systems (e.g., intelligent buses and trains) improves the efficiency and attractiveness of public services, encouraging the use of collective transport.
- Mobility as a Service (MaaS): Platforms that integrate various modes of transport into a single service, allowing users to plan and pay for their trips through a single application.

CASE STUDY: THE "FAENZA SMART LAST MILE TERRITORIAL LABORATORY" PROJECT

Creation of Proximity Logistic Spaces (SLP) Regional Funding Emilia-Romagna – "Territorial laboratory projects for innovation and sustainability of businesses in Emilia-Romagna" – Deliberation No. 317 of 03/07/2022.

The Municipality of Faenza proposes, within its PUMS (Sustainable Urban Mobility Plan), a gradual expansion of the ZTL (Limited Traffic Zone) and the development of access rules to the ZTL for commercial vehicles, while promoting the gradual incentivization of electric mobility.

For more informations visit https://build.clust-er.it/realizzazione-di-spazi-logistici-di-prossimita-slp/

INNOVATIONS FOR SOCIAL AND CULTURAL INCLUSION

Reflections on the use of technology to promote social and cultural inclusion in urban environments, through the creation of inclusive and accessible public spaces.

The use of technological innovation and intelligent systems, including Building Information Modeling (BIM), can play a crucial role in creating air quality monitoring systems and water treatment, in line with the principles outlined by the UN Agenda for Sustainable Development.

The themes of taxonomy, environmental, social, and governance sustainability (ESG), and climate change have become central in the construction and civil engineering sectors, reflecting growing awareness of the environmental impact of human activities and the need for sustainable development practices.

TAXONOMY AND ESG REGULATIONS

The EU taxonomy for sustainable activities is a classification system that helps businesses and investors identify which activities can be considered ecologically sustainable.
This helps guide investments toward projects that support environmental objectives, such as climate change mitigation and biodiversity protection.
For the civil engineering sector, this means that projects must adhere to strict criteria to be classified as sustainable, influencing funding decisions and corporate governance policies.

ESG IN THE CONSTRUCTION CONTEXT

The adoption of ESG principles in the construction sector results in a greater emphasis on ethical practices, social responsibility, and environmental impact.
Companies that adopt and promote high standards in terms of ESG can not only mitigate risks but also improve their reputation and attract investment.
For example, construction practices that minimize material waste, optimize energy use, and reduce carbon emissions are essential for meeting the expectations of both customers and investors.

Integrating ESG (Environmental, Social, and Governance) criteria in the construction sector represents a fundamental step toward sustainable and responsible development.
On the environmental front, eco-friendly practices such as the use of recycled materials, energy efficiency, and carbon emission reduction are promoted. On the social front, emphasis is placed on worker safety, creating accessible and inclusive buildings, and engaging local communities in projects. Finally, governance involves transparent management of construction companies' ethics, with particular attention to regulatory compliance and corporate responsibility.

IMPACT OF CLIMATE CHANGE

Climate change represents a significant challenge for civil engineering, requiring the adaptation of construction techniques to withstand extreme and variable weather conditions.
Innovation in building materials, climate-resilient design, and the integration of green infrastructure are all crucial elements for increasing urban resilience. Furthermore, these measures can contribute to reducing the overall environmental impact of construction, aligning with global goals for reducing greenhouse gas emissions.
ESG principles and climate change strategies are not just responses to regulatory requirements or external pressures but also represent powerful drivers for innovation and continuous improvement in the civil engineering sector.

2.5 Multidisciplinary Approach in Urban Design

Global urbanization continues to push the limits of our cities, making the adoption of a multidisciplinary approach to urban design essential. This approach not only addresses the complex urban challenges of today but also prepares cities for future sustainable needs.
The integration of engineering, architectural, environmental, and technological expertise enables the creation of innovative solutions that address various aspects of urban life.
Civil engineers and technologists provide the necessary skills to build robust and sustainable infrastructures, while architects offer a spatial and creative vision that enhances the functionality and aesthetics of urban spaces.
Environmental experts, on the other hand, ensure that projects meet sustainability criteria and minimize ecological impact. Finally, technological input, such as the use of IoT and Artificial Intelligence, helps make cities smarter through integrated management systems and automation.

INTEGRATION OF DIFFERENT DISCIPLINES

The Clust-ER Build is a place for research and transdisciplinary exploration, where a wide range of skills and experiences can thrive.
In the urban regeneration process, it is essential to actively engage a variety of stakeholders.

Professionals from different disciplines collaborate to tackle complex challenges and create effective and sustainable urban interventions. These different professional roles can work together in various ways to contribute to the success of urban regeneration projects.

The collaboration between these diverse professionals is facilitated by the use of integrated tools, such as Building Information Modeling (BIM), which provides a common platform for sharing and managing information.
BIM allows professionals to work collaboratively on a single shared digital model, facilitating communication and knowledge sharing across various expertise areas.

The involvement and collaboration of various professionals are crucial for the success of urban regeneration projects. The diversity of skills and perspectives helps ensure that projects are sensitive to the needs of the community and sustainable in the long term. By using integrated tools and effective collaboration practices, these professionals can work together to create more livable, inclusive, and resilient cities.

CASE STUDIES AND EFFECTIVE IMPLEMENTATIONS

Examples of such integration can be found in urban regeneration projects like the one in Medellín, Colombia, where a multidisciplinary approach transformed the city by introducing sustainable mobility solutions, such as urban elevators and metro-cables, and improving accessibility and quality of life in the most disadvantaged neighborhoods.

Another example is the smart city project in Singapore, which uses advanced technological solutions to optimize urban services such as traffic, waste management, and public safety, all integrated with urban design that promotes livability and social interaction.

In conclusion, the multidisciplinary approach to urban design is not just a necessity but a strategy that brings tangible benefits. Cities that adopt this philosophy not only better respond to the current needs of their citizens but also prepare to be resilient and adaptable to future changes.

COLLABORATION BETWEEN STAKEHOLDERS

Collaboration between designers, local authorities, businesses, and communities is essential for creating effective and inclusive urban projects.

This participatory approach ensures that the needs and expectations of all stakeholders are considered, creating solutions that reflect the diverse perspectives of the people they serve.

Real needs of the territory. Designers can provide technical and creative expertise, local authorities can facilitate regulatory processes and provide institutional support, businesses can contribute financial and innovative resources, while communities can offer valuable local context knowledge and ensure that the projects are accepted and supported by the population. Close collaboration between all these actors fosters the creation of sustainable, functional, and inclusive urban spaces, improving quality of life and promoting harmonious city development.

INNOVATION THROUGH DIVERSITY OF THOUGHT

Reflection on the contribution of different perspectives and expertise to stimulate innovation and find creative solutions to urban problems.

Innovation through diversity of thought is crucial for addressing urban challenges with creative and effective solutions. Involving individuals with diverse perspectives, backgrounds, and expertise allows for the exploration of a wide range of ideas and approaches, stimulating out-of-the-box thinking. This variety of viewpoints enables the identification of innovative solutions that might not emerge in homogeneous contexts, improving the ability to respond to complex problems in urban areas. Moreover, diversity of thought fosters a collaborative and inclusive environment.
Where every contribution is valued and integrated, leading to urban projects that are more resilient, sustainable, and able to meet the real needs of the population.

TRAINING AND PROFESSIONAL DEVELOPMENT

Emphasis on the need for continuous and interdisciplinary training for professionals involved in urban design, in order to keep up with technological advancements and social needs.

Continuous training and professional development are essential for professionals involved in urban design, so they can stay up to date with technological advancements and social needs.
Cluster-ER BUILD is a virtuous example in this area, promoting interdisciplinary training pathways that integrate advanced technical skills with a deep understanding of social and environmental dynamics.
This approach enables designers to develop innovative and sustainable solutions, quickly adapting to industry changes and effectively responding to new urban challenges. Investing in continuous training allows professionals to refine their skills, explore new technologies and methodologies, collaborate more effectively with different stakeholders, and thus contribute to the creation of more resilient and livable cities.

3. Impact on Urban Development

The effect of innovative technologies and advanced engineering practices on the development of modern cities.

These innovations are contributing to the creation of more efficient, sustainable, and livable urban landscapes, with a specific focus on urban regeneration projects, sustainable building, and smart infrastructure.
It is also necessary to analyze the impact of these innovations on the daily lives of citizens, emphasizing how the choices made influence not only the urban aesthetic but also the functionality, accessibility, and quality of life in urban areas.

3.1 The Role of Engineering and Architecture in Shaping the Urban Landscape

Architecture and construction are key factors in defining the appearance and functionality of modern cities.

The contribution of engineering in the creation of sustainable, efficient, and aesthetically pleasing infrastructure has an impact on the quality of urban life.

This influences urban planning, traffic, public spaces, and residential areas, highlighting the importance of an integrated approach that takes into account both technical and social and environmental needs.

This implies not only the creation of buildings and infrastructure but also the design of public spaces and traffic planning. Through the application of sustainable principles, innovative technologies, and design solutions, there is the power to transform urban areas into livable and attractive environments.

By exploring the interaction between structures, infrastructure, and the social fabric of cities, it becomes clear how engineering affects the daily experience of citizens.

For this reason, a **holistic approach** is necessary, one that considers technical, environmental, and social aspects to create a balance between functionality and sustainability.

3.2. Sustainability and Urban Design

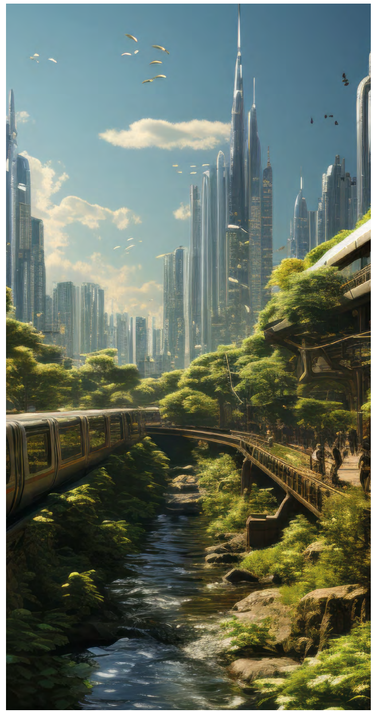
Sustainability and design influence the planning and construction of modern cities.

In an era where environmental issues and the quality of urban life are increasingly central, architecture and urban engineering must face the challenge of creating spaces that are not only functional and efficient but also sustainable and harmonious.

The role of urban design in integrating green spaces and public areas, promoting sustainable mobility, and improving the quality of life for citizens is central.

It is necessary to balance aesthetics with practicality and sustainability, considering the long-term impact of design choices on the well-being of communities and the environment.

This holistic approach to “Urban Design” aims to create cities that are not only efficient and functional but also beautiful and livable, contributing to a more sustainable and inclusive future.



4. The Future of the Construction Industry

Emerging trends such as automation, Artificial Intelligence, and augmented reality have a potential impact on construction practices.
The growing role of sustainability and green building will shape future construction standards.
There is a need for deep reflection on the importance of adaptability and continuous innovation in the sector, highlighting how construction companies can prepare to stay competitive and relevant in a rapidly changing world.

4.1 Emerging Trends and Future Predictions

It is necessary to evaluate the evolution of the construction sector, focusing on technological innovations and emerging trends.

The impact of Artificial Intelligence, robotics, and augmented reality is discussed, predicting how these technologies will transform construction methods.
The growing trends toward sustainability and green building are also explored, considering how these will influence future standards.
The paragraph concludes by reflecting on the importance of adaptability and innovation in the sector, in order to face future challenges.

4.2 The Role of Technology and Innovation in the Future of the Sector

SHAPING THE FUTURE OF THE SECTOR

It is crucial to reference technological innovations in the construction sector, exploring how new technologies, data analysis, Artificial Intelligence, and 3D printing are revolutionizing construction processes from design to realization.
The impact of these technologies on cost reduction, operational efficiency, and sustainability is fundamental.

5. Conclusions

This White Paper aims to demonstrate how **Urban Regeneration and Sustainable Development** represent an extraordinary opportunity to improve the quality of life in our cities. Through the adoption of innovative technologies, the integration of green spaces, and nature-based solutions such as Sustainable Urban Drainage Systems (SUDS), we can effectively address the challenges related to climate change, environmental sustainability, and urban resilience. The experiences gathered within Clust-ER Build highlight the potential of synergies between public entities, businesses, and communities in promoting a positive and sustainable evolution of the territory.

It is time to act together to shape a more sustainable and inclusive future for our cities. We invite all **Partners**—ranging from **Institutions** to **Businesses**, from **Professionals** to **Citizens**—to collaborate in implementing innovative solutions that transform our urban spaces. Supporting urban regeneration initiatives, adopting cutting-edge technologies, and investing in the development of new skills is essential to ensure that the cities of tomorrow, designed by today's companies, academics, and professionals, will be more livable, resilient, and in harmony with the environment. Let us unite to build a future in which sustainability is not only a goal but a shared reality.

Paper Clust-ER Build Association

We are a collective determined to shape the future of our communities through Urban Regeneration that embraces the values of Sociality, Inclusion, and Sustainability. As members of the Clust-ER Build Association, we firmly believe that the urban fabric should be a place for meeting, growth, and well-being for all its inhabitants, without any form of discrimination.

1. Sociality as a Foundation

We recognize that cities are centers of human interaction, culture, and connection. We promote the creation of welcoming, safe, and inclusive public spaces that foster interaction and exchange among people of different ages, backgrounds, and cultural origins. We support the organization of events, activities, and initiatives that encourage active participation from citizens in community life, thereby fostering a sense of belonging and shared responsibility toward the urban environment.

2. Inclusion as a Guiding Principle

We are committed to creating urban environments that are accessible and adaptable to the diverse abilities and needs of all citizens, including the elderly, people with disabilities, migrants, and other marginalized communities. We work to promote social equity and universal access to services, culture, and opportunities, ensuring that no one is left behind in the urban regeneration process.

3. Sustainability as an Imperative

We strive for urban regeneration that respects and preserves the natural environment by reducing the environmental impact of our actions and promoting sustainable practices, such as energy efficiency, low-emission mobility, and responsible resource management. We support the adoption of innovative and resilient solutions to address environmental and climate challenges, contributing to the creation of greener, more livable cities that are better suited for future generations.

4. Collaboration as the Key to Success

We recognize that urban regeneration is a complex process that requires the involvement and collaboration of all relevant stakeholders: citizens, institutions, businesses, civil society organizations, and more. We encourage the creation of inclusive and transparent partnerships based on mutual trust and active listening, in order to develop shared and sustainable solutions that address the needs and aspirations of our community.

5. Concrete Action and Long-Term Vision

We are committed to translating our ideas into concrete and tangible actions through pilot projects, urban interventions, and innovative policies that can inspire and guide the transition toward a more equitable, vibrant, and sustainable city. We maintain a long-term vision, thinking not only of immediate needs but also of the future for the next generations, working with determination to build an urban legacy we can be proud of.
We unite our strengths and passions to build a better city for all. We share this manifesto as a promise of commitment and action, with the hope that it will inspire and mobilize others to join us on our journey toward a social, inclusive, and sustainable urban regeneration.

TOPIC

CIRCULAR ECONOMY

DIGITAL REVOLUTION

SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL SAFEGUARDING

URBAN REGENERATION AND TOURISM

COMPREHENSIVE AND "TOTAL" REDEVELOPMENT

HOW DO THEY APPLY?

- Knowledge of the Territory and History
- Engagement of Citizens and Institutions
- Analysis of Socioeconomic Impacts
- Multidisciplinarity Integrated with BIM Technology

“INCITE – Inspiring City InformaTion modEling for urban resilience”

Scientific Responsible
Dr. Fabiana Raco

Strategic Industrial Research Project
PR FESR 21-27
CUP: D47G22000330003

The goal of the project is the implementation of an open-standard digital platform to support the management and informational enrichment of integrated digital models of the urban environment and interventions on the existing built heritage, from a strategic planning perspective. The project aims to define a protocol for the application of key enabling technologies and **CIM (City Information Modeling)** integrated in the direction of developing **Digital Twins** applied at the urban scale. The integration of various information sources (satellite, GIS, point clouds, integrated sensors, monitoring, BIM) allows for the modeling and representation of outcome scenarios and the development of collaborative platforms, as well as their training through **Artificial Intelligence** and **machine learning** protocols.

Partner

CICCREI – Interdepartmental Research Center for the Conservation, Construction, and Regeneration of Buildings and Infrastructures – University of Parma

UNIFE – TekneHub Laboratory – University of Ferrara

UNIBO – CIRI EC Interdepartmental Center for Industrial Research in Building and Construction – Alma Mater Studiorum – University of Bologna

CRICT – Interdepartmental Research Center and Services for the Construction and Territory Sector

University of Modena and e Reggio-Emilia

Certimac Scarl – Certification of Building Materials

Companies participating in the project

CON.AMI – Consortium of Intermunicipal Multi-Services Company

Confabitare – Association of Property Owners

ICIE – Cooperative Institute for Innovation, Soc. Coop.

BUILTI S.r.l.

PERFORMA – Architecture + Urban Planning

ALLODI srl

Officina Meme Architetti

Raise>Up srl

Areas of Innovation

The INCITE project implements innovative solutions in the following areas:

- Acquisition of geometric and morphological data from rapid surveying protocols (SLAM technologies, photogrammetry, etc.) and satellite-based methods (satellite radar techniques based on interferometric methods for structural/infrastructural monitoring and mapping of ground deformation phenomena, and optical remote sensing data for characterizing the connective fabric, such as green areas, materials, and coatings of systems);
- Informational implementation for specific purposes (structural safety, seismic risk, energy behavior, characterization of the urban connective fabric, development of innovative services such as sustainable mobility, etc.);
- Interoperability of parametric modeling protocols and informational implementation in open standard environments (BIM and GIS integrations, IFC, CityGML, etc.).

URBAN REGENERATION AND LEGISLATION

Clust-ER Build Administrative Lawyer
Stakeholder: Lucia Maggiolo

- Just as the reduction of land consumption, urban regeneration has become a widely discussed concept, frequently addressed by the legislator (both national and regional), urban planning, doctrine, and case law (as well as, of course, first and foremost, by urban architects and planners).
- Certainly, urban regeneration aspires to be much more than a mere program of recovery or redevelopment of specific urban areas; it is far more than simple building renewal. In its broadest sense, urban regeneration also aims to address territorial and social cohesion. In the definitions proposed by recent legislative initiatives, urban regeneration is often described as "a coordinated set of interventions—both public and private—spanning urban, building, socio-economic, technological, environmental, and cultural initiatives, with a strategic aim against new land consumption."
- It is therefore clear that the normative concept of urban regeneration differs from that of building and urban recovery, as it includes complex actions for the environmental, urban, and social renewal of degraded urban areas.
- The issue of urban regeneration, albeit in brief, has been present in legislation for decades. In fact, going further back in time, if we want to briefly historicize the subject, one of the first examples of urban regeneration was the sanitary plans outlined by Law No. 2892 of January 15, 1885 (known as the "Naples Law").
- Moreover, there have been many recent legislative interventions, including Article 1, paragraph 431, of Law No. 190 of December 23, 2014 (Stability Law 2015), and Article 1, paragraph 974, of Law No. 208 of December 28, 2015 (Stability Law 2016), which established, for 2016, the Extraordinary Program of Intervention for the Urban Renewal and Safety of the Peripheries of Metropolitan Cities and Provincial Capital Municipalities.
- Also, the so-called "Sblocca-Italia" Decree-Law No. 133 of 2014, converted into Law No. 164 of November 11, 2014, introduced, with Article 17, Simplifications and other measures in construction matters, with the declared "aim to simplify building procedures, reduce the burdens on citizens and businesses, and ensure sustainable development processes, particularly with regard to the recovery of existing building heritage and the reduction of land consumption."
- Another national legislative provision is contained in Decree-Law No. 32 of 2019, known as "Sblocca-cantieri," converted into Law No. 55 of June 4, 2019.
- Urban regeneration thus embodies the idea of an economic, social, and cultural renaissance, which leads to the rebalancing and civil progress of compromised and degraded areas, ensuring social cohesion in the process.
- Under the pressure of climate change, a design revolution is emerging in the planning of urban development and a profound reconsideration of the traditional model of "homeowning democracy" as the foundation of urban living.

Behind this approach lies the growing awareness that the decay and bleakness of the places we inhabit reflect, both as cause and effect, in a vicious spiral, the social decay and bleakness of society itself. For this reason, without economic and social redemption, there is no space for lasting and sustainable urban regeneration.

In essence, a primarily **sociological idea of urban regeneration** is taking hold—seen as a heterogeneous set of measures and actions that, across various levels and areas of intervention, converge toward improving living conditions, especially the urban environment, for populations (usually economically disadvantaged) living in compromised and degraded peripheral urban areas.

Italian Regions have already enacted significant legislation on the matter, including noteworthy initiatives. Among the most relevant are regional laws from Lazio (July 18, 2017, no. 7), Puglia (August 1, 2008, no. 21), Piedmont (July 14, 2009, no. 20), Tuscany (August 5, 2011, no. 40), Umbria (June 21, 2013, no. 12), and Emilia-Romagna (no. 24/2017).

The **European Union** has also played a key role in this field (Art. 174 of the Treaty, now Art. 191 of the TFEU – Treaty on the Functioning of the European Union), offering some of the most refined technical and methodological frameworks, albeit in the domain of soft law, meaning non-binding recommendations, technical guidelines, and best practices.

All essential substantive issues are addressed within this framework and can be summarized by the following **key concepts**:

- **Soil protection**, intended as sustainable use, involving actions to optimize rather than merely reduce land consumption;
- A concept of "**land consumption**" with an environmental emphasis, focusing more on impermeabilization (Soil Sealing or Land Cover) rather than just physical land occupation (Land Take or Land Use);
- **Prevention** of degradation processes, preservation, recovery, and restoration of soil functionality;
- **Graduated policies and actions** to limit, mitigate, and compensate for soil sealing;
- The **precautionary principle** in evaluating the soil impacts of territorial planning decisions;
- Integration of **environmental and land protection policies** with other sectoral policies and sustainable urban development, through the involvement of all levels of territorial governance (local, national, and the EU itself).

A final remark: As reported by Dr. **Paolo Carpentieri**, Councilor of State, in his essay titled *"Land Consumption and Its Limitations"* (November 2019)—from which this is an abstract—"**in this context, administrative justice can play a crucial, perhaps decisive, role** through the incisive use of substantive legitimacy control over the location and implementation decisions of interventions."

Failures such as:

- not adequately evaluating alternative locations;
- failing to identify reusable abandoned areas;
- insufficient investigation;
- inadequate reasoning;
- manifestly illogical decisions;
- violations of the **principle of reuse priority**;
- disproportional and unreasonable new land consumption;
- procedural flaws, such as lack of genuine public participation—

all of these may constitute **grounds of illegitimacy**, violations of the law, or **abuse of power**, and can result in the **annulment of administrative acts and decisions** that contradict the principles of minimizing land consumption and prioritizing reuse for urban regeneration.
A wise and courageous use of these powers by the **Administrative Judge** could effectively correct poor administrative decisions and compel public decision-makers to realign with these principles, while respecting participatory standards.

Glossario

A	
AI	Artificial Intelligence
ANCE	Italian National Association of Building Contractors
Asset Integrity	Processes aimed at improving design and construction approaches by integrating technical skills
B	
Big Data	A large volume of data collection that is fast and complex to process
BIM – Building Information Modelling	Management of information throughout the life cycle of a building or structure
C	
Car Sharing	Shared mobility via temporarily rented vehicles
CIM – City Information Modelling	A model using data gathered from BIM to enhance urban and territorial resilience
CityGML	A geospatial 3D model representing a city, preserving geometry and topology—not just built structures, but also vegetation, water infrastructure, urban furniture, and multiple levelsof detail
Climate Change	Climate Change
Corporate Governance	Tools, rules, and mechanisms aimed at optimizing corporate strategy implementation within a controlled system
Cybersecurity	Protection of networks, data, systems, and IT devices (hardware and software) from digital attacks
D	
Data-Driven	Data-based approach: the ability to analyze and make decisions based on objective facts
Design Revolution	A design-driven transformation of urban planning
Digital Twin	A virtual model of a project using real-time data to monitor its operational life cycle
E	
ESG –Environmental, Social, and Governance	Environmental, Social, and Transparent Governance—three key criteria for assessing sustainability and ethics in construction
EV – Electric Vehicle	Electric Vehicle
G	
GIS – Geographic Information System	Technology used to create, manage, analyze, and map all types of data linked to maps, integrating geographic location with descriptive information
Green2Build	A value chain promoting the construction of energy-efficient, resilient, and environmentally, socially, and economically sustainable buildings

H

Home-owning Democracy	Industry Foundation Classes
HVAC – Heating, Ventilation, Air Conditioning	Heating, Ventilation, and Air Conditioning systems

I

IFC – Industry Foundation Classes	A data collection model within infrastructure for facilitating BIM usage. Defines physical components of buildings, prefabricated products, mechanical and electrical systems, and models for structural and energy analysis
INCITE – Inspiring City Information Modeling for Urban Resilience	A digital platform for implementing information in integrated digital models of urban environments. Enhances data management and application protocols
IT Infrastructure	Information Technology Infrastructure—hardware or virtual environments used in increasingly sophisticated systems, including senson-equipped agents installed on each client
Insights	Internal insights: using data from within a context to plan decisions or projects with a clear view of feasibility
IoT – Internet of Things	A new technology (smart objects) that brings everyday physical objects into the digital world
ITS – Intelligent Transportation Systems	Advanced systems applied to the transport sector for intelligent monitoring, evaluation, and management (sensors, cameras, wireless communications)

L

Land Cover	Biophysical cover of the Earth's surface
Land Take	Area occupied by artificial infrastructures or natural covers
Land Use	Human use of land; specifically, the relationship between humans and how land is covered or used

M

MaaS – Mobility as a Service	Digital and intermodal public transport. Enables users to organize, book, and pay for travel via an app, choosing different public transport modes, including regional transfers
Machine learning	A branch of Artificial Intelligence that enables systems to learn from data and experiences, making them increasingly autonomous
Maintenance Predittiva	A process that analyzes data, performance, and wear of machines in real time. This allows early failure prediction and optimized plant efficiency through proactive management
Metro-Cable	A type of cable car with stop stations, developed in Medellin (Colombia)

N

NBS – Nature-Based Solutions	Nature-inspired solutions to mitigate global warming and its impact on the environment and people

O

UN – United Nations	International organization promoting global cooperation

P

PR – FESR – Regional Programme – European Regional Development Fund	EU co-funded regional development programme
PUMS – Sustainable Urban Mobility Plan	Strategic plans based on existing urban planning tools aiming to meet urban mobility needs and improve city quality of life

R

AR – Augmented Reality	Technology that overlays digital content onto the real world, enhancing both the quantity and quality of usable information in specific contexts
Ride Sharing	Sharing a ride, where a private individual offers transportation to a passenger for a fee

S

SaaS – Software as a Service	Software application service delivered via the cloud or web
SLAM – Simultaneous Localization and Mapping	Technique for mapping and navigating in an indoor environment without GPS
SLP – Mobility Logistics Spaces	Spaces designed to optimize logistics and transportation efficiency
Smart Last Mile	Intelligent management of the final segment of delivery in urban logistics
Smart Technologies	Intelligent technology that adapts and optimizes functions through data and connectivity
Soil Sealing	Sealing of soil due to urbanization, making it impermeable to water
Stakeholder	Any individual or entity with an interest in or influence over a business or project
SUDS – Sustainable Urban Drainage Systems	Urban systems for managing rainwater in a sustainable and eco-friendly way
Pilot Scale	A scalable and replicable model tested through a pilot project, involving all stakeholders in the value chain

V

Value Chain	A set of activities and processes necessary to create a product or service

W

White Paper	A document outlining the concept, goal, or solution to a specific issue or topic

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