Transforming Urban Spaces Through Sustainable Agriculture: An Integrated Analysis and Design Perspective

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Abstract. The increasing urbanization projected to reach 60% of the global population by 2030 needs innovative approaches to urban sustainability challenges. This study investigates the potential of vertical farming as a nature-based solution for urban regeneration in underutilized spaces, with a specific focus on the Magazzini Raccordati of Milano Centrale railway station. The research employs a multi-method qualitative approach integrating three complementary analytical frameworks: SWOT analysis to evaluate internal and external factors affecting implementation feasibility, stakeholder analysis utilizing a Power-Interest Matrix to identify key stakeholders and their relationships, and Ecosystem Services Evaluation to assess environmental and social benefits. Following a systematic assessment of four potential locations in Milan, the Magazzini Raccordati site was selected for its strategic position, accessibility, and potential for social and environmental impact. Three development scenarios were formulated and evaluated: (1) local production with educational programs focusing on community engagement and food security; (2) restaurant-based culinary education emphasizing gastronomic awareness and circular food systems; and (3) research and innovation hub advancing urban farming technologies through academic partnerships. Results demonstrate distinct trade-offs among scenarios: scenario 1 maximizes provisioning and cultural services, scenario 2 enhances cultural services while maintaining strong provisioning benefits, and scenario 3 optimizes supporting and regulating services. The study concludes that an integrated approach combining elements from all scenarios would best leverage the site's potential while addressing urban regeneration needs. Future research would benefit from quantitative assessment methods such as Multi-Criteria Analysis or Cost-Benefit Analysis to further validate these findings.

Keywords: Urban Farming · Ecosystem Services Evaluation · Nature-Based Solutions

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1 Introduction

By 2030, almost 60% of the global population will live in cities [1], causing severe implications for food security, social cohesion and environmental sustainability [2]. This demographic shift will transform traditional food systems into long and complex supply chains vulnerable to climate change and economic disruptions [3]. The United Nations' Sustainable Development Goal 2 (SDG 2) highlights the urgent need to address urban food security by promoting sustainable agriculture and ensuring equitable access to nutritious food [4]. Achieving this goal requires a systemic transformation of urban food systems, integrating sustainability from production to consumption while fostering social cohesion and civic engagement [5].

Even if urban agriculture initiatives have been implemented globally, existing literature lacks methodological frameworks that integrate multi-dimensional analysis for developing urban farming models. Current approaches often focus on either social, environmental, or economic aspects separately instead of adopting a combination of analytical tools. This research aims to develop and apply an integrated methodological framework combining SWOT Analysis, Stakeholder Analysis, and Ecosystem Services (ES) Evaluation to assess the viability of vertical farming projects. This step is followed by the evaluation of three different scenarios for the area of interest Magazzini Raccordati, establishing a replicable model for urban regeneration through agriculture that balances social inclusion, economic sustainability, and environmental benefits.

The present work explores the potential of the FARMER project, which seeks to enhance food security in Milan by repurposing abandoned spaces for agricultural purposes and developing a sustainable urban farm network. The innovation of the proposed approach lies in three key aspects: (1) the integration of multidisciplinary analytical tools as both assessment and design instruments; (2) a comparative analysis that enables strategic scenario development and evaluation; and (3) a specific focus on the integration of vertical farming within dense urban environments as a catalyst for urban regeneration, aligning with the most recent and current paradigm of the New European Bauhaus initiative [6], which promotes an integrated approach to implement the sustainable development pillars in urban transformations.

The FARMER project, developed within the Alta Scuola Politecnica program, held by Politecnico di Milano and Politecnico di Torino, aligns with broader research initiatives like STRutture Agricole MEtropolitane (STRAME), which aims to redefine urban farming concepts [7]. The project's contribution extends this work by creating a urban agriculture model that simultaneously revitalizes abandoned urban areas, empowers communities, and promotes environmental sustainability [8].

The paper is structured as follows: Sect. 2 analyzes best practices related to urban farming, Sect. 3 outlines the methodology used (SWOT, stakeholder and ES analyses), Sect. 4 applies this framework to the Magazzini Raccordati area of Milano Centrale station and Sect. 5 concludes with key findings, limitations, and future perspectives.

2 Urban Farming Best Practice Analysis

Among the innovative practices that have emerged in recent years, community gardens and vertical farming stand out as effective Nature-Based Solution (NBS) that offer multiple benefits for social revitalization, community engagement and sustainable food production [8]. These models, representing different approaches to urban agriculture, serve as reference points for defining the project objectives and implementation strategies [9].

2.1 Community Gardens

Community gardens have proliferated globally due to their proven ability to foster social cohesion, revitalize abandoned areas, and promote environmental awareness through local food production. These initiatives typically reflect their local socio-economic contexts and cultural traditions, resulting in diverse implementation models across different regions and communities.

A comprehensive review of exemplary cases reveals several notable initiatives:

- LUNGS [10] in New York City established a network of over 50 green spaces through strategic coordination and advocacy;
- Allmende-Kontor [11] in Berlin transformed a former Nazi airport runway into a 6,000 m^2 community space;
- The Homeless Garden Project [12] in Santa Cruz provides transitional employment through sustainable agriculture;
- Detroit Black Community Food Security Network (DBCFSN) [13] addresses food justice and racial equity through urban farming;
- Power Plant Farm and Newmarket Farm at Boston Medical Center [14] integrate agriculture with healthcare services.

LUNGS [10] particularly exemplifies effective network governance in urban agriculture. Formed in 2011, this initiative united numerous volunteer organizations across multiple neighborhoods while preserving each garden's autonomy and unique character. Through coordinated advocacy and educational programming, LUNGS promotes intergenerational knowledge transfer and community support systems that enhance neighborhood resilience.

Similarly, Allmende-Kontor [11], established in 2010 by activist researchers, demonstrates how urban agriculture can reclaim historically significant spaces and transform them into centers for social innovation. Beyond food production, the project hosts educational workshops on beekeeping, gardening, and sustainable practices, creating a multifunctional community space that connects environmental awareness with social engagement [11].

These case studies illustrate how community gardens function as more than food production sites—they serve as platforms for addressing complex urban challenges, from social isolation to environmental degradation, while building community capacity and resilience. The success factors identified across these initiatives—inclusive governance, multifunctionality, educational programming, and community ownership—provide valuable insights for the project design.

2.2 Vertical Farming Projects

Vertical farming represents an advanced and innovative approach to urban agriculture to optimize space use and resource needs. Thanks to controlled environment technology, this method allows continuous production, independent of climate conditions and season, making it particularly suitable for dense urban environments.

The performed analysis of leading vertical farming initiatives includes: Nature Urbaine (NU) [15] in Paris, which produces 200 kg of fresh produce daily on a rooftop farm while hosting educational events; Vertical Harvest [16] in Jackson, USA, which uses hydroponic farming to prioritize employment opportunities for individuals with disabilities; Sky Greens [17] in Singapore, focused on using rotating cultivation systems to maximize sunlight exposure and minimize energy use; and Plenty [18], a technology-driven initiative that uses LED lighting to achieve high indoor production.

Nature Urbaine (NU) [15], established in 2020, aims to produce food in a responsible way, establishing circular economy to local agriculture. Combining innovation and sustainability, NU Paris reuses what the city offers to agriculture, such as vacant spaces, organic waste, waste heat, turning them into valuable resources for food production. Its diversified economic model includes rental cultivation spaces, educational programming and event hosting, demonstrating how vertical farming can integrate multiple revenue streams to achieve financial sustainability [19].

Vertical Harvest [16], founded in 2016, illustrates the social impact of urban agriculture through inclusive employment models. The farm provides customized job roles to foster professional development, personal discovery and community impact, prioritizing both social impact and profitability. It engages the community through educational programs, public events, and partnerships that support food security and social inclusion [20].

From the analysis of these case studies, several key findings emerge. First, successful projects integrate multiple functions beyond food production, including education, research, and community engagement, as described for LUNGS and Allmende-Kontor. Circular economy approaches, similar to Nature Urbaine (NU) model, enhance sustainability and reduce operational costs; while partnerships with different stakeholders strengthen project resilience. Lastly, technological innovation must be balanced with social inclusion to maximize community benefits, as the Vertical Harvest project shows.

These findings directly serve as a basis for the project's scenario development for the Magazzini Raccordati site, particularly in how each scenario integrates technological solutions with social objectives to create multifunctional urban spaces.

3 Methodology for Scenarios Implementation

A qualitative multi-method approach has been proposed and adopted [21] to assess, design, and evaluate different scenarios for urban regeneration. This app-

roach integrates complementary analytical frameworks that examine the intervention from different perspectives, ensuring comprehensive consideration of socio-economic, environmental, and governance factors.

The methodological framework builds upon the work of Bottero and colleagues [5], which emphasizes the value of integrating qualitative approaches to understand complex urban systems.

This research proposes an integrated multimethod approach based on the integration of SWOT Analysis, Stakeholders Analysis and ES Analysis. Their combination is effective according to their complementarity and ability in addressing different dimensions of urban agriculture implementation and to create multidimensional framework stand out for understanding both the current conditions and potential futures of the site.

The project's methodology was implemented in three phases: (1) preliminary assessment of four potential locations in Milan, including site visits, mapping, interviews, and initial analyses; (2) detailed analysis of the selected site (Magazzini Raccordati) using the core analytical tools; and (3) scenario development and evaluation based on the analytical findings.

3.1 SWOT Analysis

The SWOT analysis [22] is a planning tool that helps to assess both internal and external factors influencing a project by identifying the strengths (S), the weaknesses (W), the opportunities (O) and the threats (T). Organized as a four-quadrant matrix, this method facilitates classification of factors into two categories: endogenous factors (strengths and weaknesses) and possible exogenous factors that could occur in the future (opportunities and threats) [5].

Unlike conventional SWOT analyses that often remain descriptive, the proposed approach links identified factors to decision-making by evaluating how certain interventions can leverage strengths and opportunities while mitigating weaknesses and threats. This approach transforms SWOT from a purely analytical tool into an instrument that actively informs design choices and strategic priorities [23].

In the present study, SWOT analysis was applied to assess the feasibility of urban farming in the Magazzini Raccordati site, identifying potential collaboration with local stakeholders, highlighting the constraints and delving into the opportunities linked to urban regeneration. The results of this analysis validate the selection of scenarios that empower the strengths of the project while mitigating weaknesses and threats.

3.2 Stakeholder Analysis

Stakeholder Analysis [24] plays a useful role in urban transformation and planning, first by identifying all the actors involved and interested in the process under analysis and, consequently, by highlighting their capacity to affect the diffusion or inhibition of strategies. To develop this strategy, the initial step is

related to the identification of each actor and its characteristics, such as the level of intervention, their corresponding roles, needs and expectations [5].

This study takes into consideration the Power-Interest Matrix method, which graphically represents the power and interest of each stakeholder in the specific project. This helps distinguish between different types of stakeholders and clearly identify the needs that should be prioritized and the expectations that should be considered first. It allows drawing a structured approach to stakeholder engagement, improving the process of decision-making and the relative effectiveness [5,23,25].

In the proposed project, the Stakeholder Analysis reinforced the decision to focus on the Magazzini Raccordati area, as it better aligned with the interests and influence of key stakeholders. Furthermore, it also gives further details and information for the scenario-building process, ensuring that the design and interventions of the project are aligned with stakeholders' priorities and needs [26].

3.3 ES Analysis

ES Analysis provides a framework for evaluating how urban interventions affect the benefits that natural systems, as green spaces, water bodies and cultivated land, provide to human beings. These services can be classified into four main categories [27]:

1. provisioning services, that include material products extracted directly from nature, such as food and raw materials;
2. regulating services, involving key natural processes that moderate natural phenomena, such as flood control, carbon storage and air purification;
3. cultural services, providing non-material benefits related to education and well-being;
4. supporting services, including fundamental processes that sustain life on Earth, such as nutrient cycling and soil formation.

Urban agriculture represents a NBS that can enhance multiple ES simultaneously. For instance, local food production through urban gardens reduces transportation emissions while improving nutritional access [28]. Urban vegetation improves air quality by filtering pollutants, with studies showing filtration rates of up to 85% in parks and 70% along tree-lined streets [28]. Green spaces strengthen cultural ES by providing spaces for education and community building. Case studies like the LUNGS gardens [10] and Nature Urbaine in Paris [15] show how these projects offer all these benefits to the urban community.

In the context of this project, the assessment of ES serves as an fundamental tool to evaluate the social benefits of the urban farming initiative. For each scenario, the evaluation was carried out through a qualitative assessment, which categorizes the ecological functions and benefits into three levels (low, medium and high), depending on the impact and contribution provided by the intervention on that service. This comparison revealed trade-offs between different intervention types and defined a more balanced approach that maximizes multiple ES.

4 Application

4.1 Case Study

The main objective of the project is to use urban agriculture as a strategy to regenerate degraded or underutilized urban areas, with dutiful and realistic attention to dimensions related to social, environmental and economic sustainability.

Four areas were initially identified for the study, each representing a significant urban void within the fabric of Milan, yet holding considerable social potential. The areas initially identified for the study were four, all representing important urban voids in Milan fabric but with high social potential: Magazzini Raccordati of Milano Centrale, Via Cogne, East Beltway, and Via Medici del Vascello. These areas, characterized by different sizes and locations, share the need for regeneration and strengthening of the weak and fragmented social network. Each site was systematically evaluated through site visits, stakeholder interviews, and preliminary analyses to understand their physical characteristics, socio-economic contexts, and regeneration potential. For the current phase of the project, one of these four areas, The Magazzini Raccordati of Milano Centrale was selected as the pilot site based on the outcomes of the subsequent analytical process. The long-term objective is to progressively expand the project's scope and management strategies, thereby embracing a broader urban perspective in future implementation stages.

The Magazzini Raccordati of Milano Centrale (Fig. 2a) represents a strategic node within Milan's urban fabric due to its central location, transportation connectivity, and historical significance. This area, consisting of underutilized warehouse spaces, suffers from fragmentation and disconnection between surrounding urban functions despite its high accessibility.

Via Cogne (Fig. 2d) ion the other hand, is in a residential neighborhood characterized by high housing density in which it is possible to find small shops, such as bakeries, fruit sellers and mini-markets and just a few bigger supermarkets.

The East Beltway site (Fig. 2c) represents an infrastructure area that currently serves as a physical barrier between different parts of the city. In particular, the affected area appears to be a series of now unusable underground parking lots that could provide an interesting area for indoor agriculture.

Via Medici del Vascello (Fig. 2b) is characterized by the presence of a preexisting community garden, which foster green activity involvement from the community. Its proximity to extensive green areas enhances exposure to nature among residents, promoting individual health and local biodiversity (Fig. 1).

4.2 Preliminary Analysis

To guarantee the FARMER project's success, several preliminary analyses were conducted to understand the particulars of the four regions that were proposed and to ascertain the opportunities and difficulties associated with the implementation of urban agriculture in those areas. A socioeconomic analysis, a general SWOT analysis for every site, and an evaluation of ES were all part of this phase.

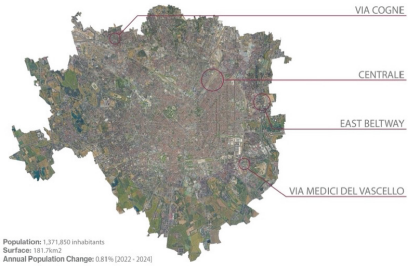

Fig. 1. Areas Overview and Urban context. Data source: https://www.citypopulation.de/



(a) Milano Centrale



(b) Via Medici del Vascello



(c) East Beltway



(d) Via Cogne

Fig. 2. Orthophoto and location of the four case studies

Socioeconomic analysis revealed significant demographic and economic variations between sites. Milano Centrale is distinguished by a multicultural populace that includes commuters, tourists and local residents across socioeconomic strata, though the area suffers from inadequate green infrastructure and limited public space accessibility. Demographic data indicates that the population in this district has a higher proportion of foreign-born residents (23.4%) compared to the city average (19.2%), reflecting its role as a transportation hub and transition zone [29].

On the other hand, most of the residents of Via Cogne are middle-class or lower-class, and they have a strong need for communal spaces for social interaction and education.

The East Beltway area's proximity to educational institutions and recreational facilities attracts diverse user groups. However, infrastructure barriers and perceived safety issues currently limit full utilization of this space.

Via Medici del Vascello benefits from existing green infrastructure and community networks but faces significant challenges from railway barriers that fragment the area physically and socially.

One of the main focuses of the analyses was to reach a better understanding of the urban farming current development in Milan urban fabric to consider the power of each area to integrate in the network. The existence of Urban farming initiatives and farms active in the city of Milan, which can serve as strategic partners for project implementation, is highlighted on the map of active local realities (Fig. 3).

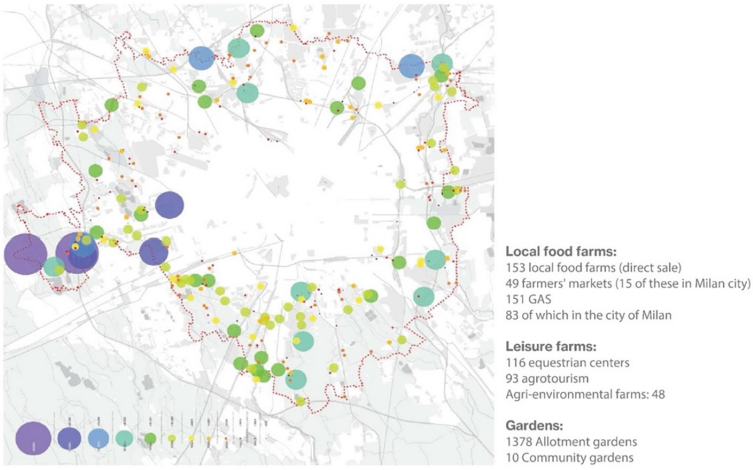

Fig. 3. Urban Agriculture Types [27]

4.3 Identification of Project Area: Magazzini Raccordati of Milano Centrale

Based on the comprehensive preliminary assessment, the Magazzini Raccordati at Milano Centrale station was selected as the primary intervention site due to several strategic advantages. The choice emerged from systematic evaluation of each site's transformation potential, stakeholder dynamics, accessibility, and alignment with project objectives.

The context of the warehouses offers the opportunity to collaborate with a diverse and at the same time problematic social reality by restoring space for sociality and sharing. With approximately 40,000 square meters of covered space across 100 warehouse units, the site provides sufficient scale for meaningful intervention while allowing phased implementation [30]. The modular structure enables diverse programming that can evolve over time in response to community needs and operational feedback.

The site's strategic position within Milan's urban fabric represents a significant advantage. Located between Milano Centrale station and the Martesana canal, the area functions as a potential connector between major urban nodes that are currently disconnected. This position enables the project to serve both local residents and visitors, maximizing its reach and potential impact on urban connectivity.

The area's demographic complexity presents both challenges and opportunities for social intervention. While the district experiences social issues typical of transit hubs, including transient populations and safety concerns, it also hosts numerous community organizations and cultural initiatives that could serve as implementation partners. The proximity to the Sammartini Centre, which provides social services to marginalized populations, offers particular potential for workforce development and social inclusion programming through the agricultural initiative.

Transportation accessibility represents another key advantage, with the site directly connected to Milan's subway system, regional trains, and bicycle infrastructure. This connectivity facilitates stakeholder engagement, product distribution, and visitor access—essential factors for operational viability and community integration.

Despite these advantages, the site presents implementation challenges that require strategic approaches. The private ownership by RFI (Italian Railway Network) necessitates complex partnership arrangements, while the aging infrastructure requires substantial renovation to meet modern operational standards. Safety concerns and negative perceptions of the area must also be addressed through integrated design that enhances visibility, activity, and community presence.

The selection of Magazzini Raccordati represents a strategic choice to maximize project impact by positioning urban agriculture as a catalyst for broader urban regeneration. This site enables the project to simultaneously address food security, social inclusion, and urban connectivity while leveraging existing infrastructure and institutional networks.

Spatial SWOT Analysis. The SWOT analysis of the Milano Centrale area provides a structured assessment of factors affecting implementation viability (Fig. 4). This analysis explicitly connects site characteristics to strategic decisions, informing scenario development and implementation approaches.

Among the advantages, the site's strategic position stands out: it is in a reachable urban area and well connected to the public transport system. Furthermore, the area is important for Milan's urban system since it directly connects Milano Centrale, one of the city's most vital infrastructure nodes, with the Martesana canal, a very interesting destination for young people and communities. This spatial configuration has the potential to develop a sustainable mobility system that promotes urban continuity and environmental sustainability, encouraging the use of bicycle and pedestrian paths and reducing dependence on motorized traffic.



Fig. 4. Graphical SWOT analysis of Magazzini Raccordati of Milano Centrale Area

Covered areas of the old warehouses provide perfect conditions for activities needing microclimatic control and access management. Furthermore, the surrounding environment produces an optimal ecosystem because of the closeness of schools, social care centers and green areas, all of which may encourage projects

of educational and social inclusion. Particularly, the closeness to the Sammartini Centre, which provides social and health services to those in marginal circumstances, offers a chance to support training and social reintegration initiatives by assisting with urban agriculture projects and educational seminars. The area also has several active associations that could be strategic partners for territorial regeneration projects including those connected to the "Cassina de' Pomm" Community Garden and urban renewal efforts.

The social balance of the area could be compromised by the danger connected to gentrification and the high expenses connected to upgrading, therefore reducing the access of the new functions to the most vulnerable population group. Ultimately, the use of space may be discouraged by the sense of insecurity and urban decay, which call for an integrated approach comprising security measures, social inclusion, and community involvement to guarantee sustainable and resilient regeneration.

Stakeholders Analysis. According to the above-mentioned objectives, different stakeholders have been for the area of Milan Central Station. In this context, the Power-Interest Matrix, a tool used to categorize stakeholders based on two key dimensions, power and interest, was applied to map the stakeholders.

Power is defined as the stakeholder's ability to accomplish desired results using their influence. On the other hand, interest characterizes the worries regarding the problem to be addressed and the issue that needs to be solved. This matrix allows for the identification of key players, keep informed, and strategic positioning, as illustrated in (Fig. 5).

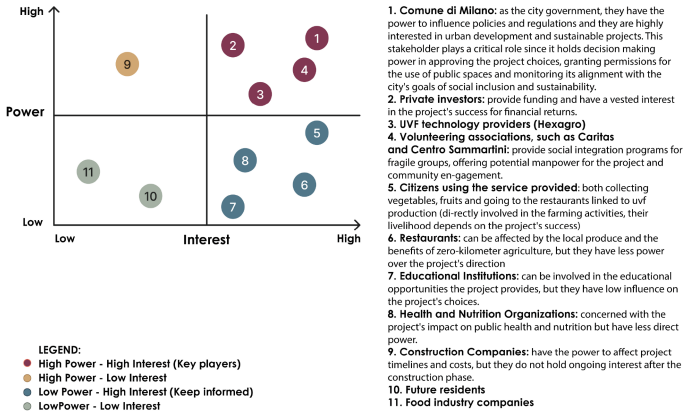

Fig. 5. Power interest matrix for the stakeholders involved

Among the high power and high interest stakeholders (key-player), the Milano municipality has been identified, since, as the city government, they have the power to influence policies and regulations and are highly interested in urban

development and sustainability projects. On the same quadrant of the matrix, it is essential to cite the UVF technology providers, in this case the HEXAGRO start-up: they have a high interest in its successful implementation and a high power to drive decisions during the project development.

In the High interest - Low power quadrant, the stakeholders involved are the main clients and customers of the project, such as private citizens and families, interested in local food security and in the community aspects, and restaurants, interested in local and fresh produce sales. Similarly, the educational institutions and health and nutrition organizations have comparable levels of power and interest, due to their limited direct influence on the project and their significant engagement with educational opportunities and health impact.

4.4 Strategic Scenarios Design

Based on the preliminary analyses, several development scenarios have been found that each tackle particular urban issues and optimise the possibilities of urban vertical farming, market integration, and educational and research centres. These scenarios seek to create a sustainable and multifunctional urban ecosystem supporting social reintegration, economic viability, and environmental resilience.

The formulation of the three strategic scenarios was guided by the results of preliminary site analyses, including site visits, stakeholder interviews, and spatial assessments. Criteria used for scenario differentiation included: (1) level of community engagement required, (2) spatial adaptability for indoor agriculture, (3) potential for economic sustainability, and (4) alignment with stakeholder interests and institutional partnerships. These criteria were evaluated through a SWOT analysis and ecosystem service potential, allowing the design team to explore diverse yet context-sensitive alternatives. The scenarios were then constructed to emphasize different strategic priorities: social reintegration (Scenario 1), circular economy and food culture (Scenario 2), and research and innovation (Scenario 3).

Scenario 1: UVF Production, Market, and Educational Labs. In the present context, warehouses in the Milano Centrale district will be transformed into Urban Vertical Farms (UVFs) that will be operated by personnel from the nearby support facilities. The program will enhance social reintegration through the provision of basic competencies in hydroponic and aeroponic cultivation. This framework not only backs social empowerment but also helps add to local food security via the provision of fresh, zero-kilometer, organic products. The cultivation process will emphasize efficiency in resource utilization, namely in optimizing water and energy utilization, and minimizing land dependence and environmental impact.

A committed urban market will be created to manage the distribution of the produce grown. The market will serve the local population and restaurants that prefer sustainable sourcing. By promoting direct exchange between producers and consumers, this activity champions short supply chains, economic

resilience, and lowered carbon emissions that typically accompany traditional food distribution channels. Moreover, the market should act as a hub of community activity, thereby strengthening neighborhood identity and facilitating environmentally friendly consumption habits.

A further dimension of this scenario involves the integration of educational laboratories that will function as centers for skill development and community outreach. These spaces will provide structured training programs, particularly for marginalized individuals, in the principles of urban farming. In collaboration with local schools such as Scuola Primaria Galvani and Istituto Comprensivo Statale "Teodoro Ciresola", the labs will also offer educational workshops aimed at fostering environmental awareness among younger generations. Through hands-on learning experiences, students will gain insight into sustainable agricultural practices, nutritional awareness, and urban ecology.

Scenario 2: Urban Vertical Farming, Restaurant, and Culinary Workshops. This scenario expands upon the previous model by integrating a restaurant and culinary laboratory within the intervention area, thereby establishing a circular food system where fresh produce is cultivated, prepared, and consumed within the same urban setting. The direct linkage between UVF production and food services ensures the highest quality of ingredients and minimizes waste and energy use.

The restaurant will function as both a dining venue and an experimental kitchen, where chefs and researchers collaborate to explore innovative plant-based cuisine and food sustainability solutions. This setting also provides a training ground for individuals undergoing professional reintegration, equipping them with culinary and hospitality skills that can enhance their employment prospects. The culinary workshops will serve as an extension of this initiative, engaging the wider public in interactive cooking sessions focused on sustainable gastronomy.

In addition to fostering economic sustainability, this scenario incorporates a specialized food market offering prepared meals and artisanal products derived from UVF ingredients. The project expands its economic reach, ensuring financial viability while reinforcing the principles of local and sustainable food systems. The combined effect of these interventions is the creation of a dynamic urban space where social inclusion, economic regeneration, and environmental sustainability converge in a cohesive and replicable model.

Scenario 3: Research and Innovation Hub for Sustainable Urban Farming. A third possible development focuses on transforming the area into a research and innovation hub dedicated to agronomy studies, food engineering and related academic activity. This scenario investigates scientific exploration, aiming to optimize urban agricultural practices through empirical research and technological innovation.

The research hub, developed in collaboration with Politecnico di Milano, will investigate crop optimization, examining the suitability of various plant species

for controlled indoor environments. Researchers will assess sustainable technologies such as precision irrigation systems, energy-efficient lighting solutions, and automated climate control mechanisms to enhance the ecological footprint of vertical farming operations.

The hub will also serve as a knowledge-sharing platform, facilitating collaborations with universities, policymakers, and private sector stakeholders. By promoting interdisciplinary research and technological advancements, this scenario contributes to the broader discourse on urban food security and climate adaptation strategies.

ES Evaluation of Strategic Scenarios. The evaluation of ES provides a key framework to compare the three proposed strategic scenarios for the Milano Centrale site. By analyzing the impact of each scenario on provisioning, regulating, cultural, and supporting services, this assessment highlights which interventions generate the most significant environmental and social benefits.

The integration of agriculture in an urban context presents multiple advantages to enhance sustainability and promote community well-being. However, these benefits vary depending on how the intervention is designed and implemented. Below, each scenario is assessed through the ES.

The first scenario enhances provisioning services, as it promotes the local food production and sales through the related market that offers fresh produce to the community of the area. Secondly, the educational labs integration strengthens cultural services, fostering community engagement and awareness, focusing on activities for children and teenagers of the neighborhood. However, its regulating and supporting services are limited.

The second scenario stands out for the cultural services, focusing more on promoting food awareness through culinary workshops and through the presence of gastronomy and restaurants with local fresh products. At the same time, provisioning services are also addressed, however, it lacks on providing regulation and supporting benefits, as indoor farming and food preparation have a minimal effect on these aspects.

Lastly, the third option is the most effective in supporting and regulating services, as it emphasizes technological advancements, sustainable research and university collaborations. The research of innovative farming techniques can contribute to the improvement and development of new urban sustainable solutions. However, this scenario has less direct impact on fostering community engagement and social inclusion, that represent two of the main objectives of the FARMER project (Table 1).

Table 1. ES Scenario Evaluation. ∗: Low. ∗∗: Medium. ∗ ∗ ∗: High.

ES	Scenario 1	Scenario 2	Scenario 3
Provisioning services	∗ ∗ ∗	∗ ∗ ∗	∗∗
Regulating services	∗	∗	∗∗
Cultural services	∗ ∗ ∗	∗∗	∗
Supporting services	∗∗	∗	∗ ∗ ∗

5 Conclusion

This research aims at reflecting on how a multidisciplinary approach can address the complex challenges of urban regeneration and networking, with specific reference to urban farming. The use of complementary analysis tools, SWOT, Stakeholder and ES Evaluation, has allowed for valuable qualitative insights into the dynamics of the context, guiding both the strategic selection of Milano Centrale as the intervention area and the development of potential scenarios.

While the proposed analysis highlights the opportunity to combine several elements from different scenarios, it is important to acknowledge the significant limitations of the predominantly qualitative methodology. The qualitative nature of the evaluation represents one of the main constraints due to the lack of precision, which is instead a value of quantitative methodologies. The absence of quantitative metrics and measurable outcomes restricts the ability to make precise comparisons between scenarios or predict their specific impacts with confidence.

Future studies will allow to progress in the analysis by integrating systematic evaluation techniques closer to the concept proposed in Multi-Criteria Analysis (MCA), Cost-Benefit Analysis (CBA), or Community Impact Evaluation (CIE). These approaches would lead to a more precise and quantitative definition of the project's impacts and enhance the ability to assess economic, social and environmental benefits across different scenarios.

The transition from a qualitative to a quantitative analysis represents an important evolution of this research, allowing a precise definition of impacts and supporting the development of more effective urban farming models [31–34].

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