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Research on the Renewal Design of Youth-Oriented and Vibrant Light Industrial Parks

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Abstract: With changes in young workers' employment expectations, lifestyles, aesthetic preferences, and demands for emotional well-being, the conventional light industrial park organized around production, transportation, and dormitory accommodation increasingly shows a mismatch with contemporary youth-oriented living and working patterns. This paper examines the renewal design of low-pollution, low-noise, and relatively low-interference light industrial parks and proposes a soft-renewal framework that protects production efficiency while upgrading human-centered spatial experience. The core strategy is to retain the main production buildings and industrial circulation structure while reorganizing secondary functions through spatial zoning, acoustic separation, landscape intervention, commercial and sports facilities, seasonal programming, and mixed residential development. A five-zone spatial system is established, consisting of an industrial production core, convenient living-support zone, sports and social activity zone, restorative landscape zone, and mixed residential zone. Within this framework, a three-layer acoustic buffer formed by terrain difference, multi-layer planting, and landscape walls is introduced to reduce interaction between production and residential areas. A dual-atmosphere model combines lively social spaces with quiet restorative spaces so that different emotional and behavioral needs can coexist within one industrial community. Modular commercial units, free public amenities, low-cost advanced activities, and a four-season event calendar are incorporated to transform the park from a static production container into a continuously activated community. Rather than relying on large-scale demolition, the study develops an incremental design framework that combines production efficiency, everyday life, environmental comfort, and operational sustainability. The research provides a practical reference for the renewal of existing light industrial parks and for the development of youth-friendly, production-living integrated industrial communities.

Keywords: Light industrial park; renewal design; youth-oriented space; industrial community; production-living integration; acoustic landscape; adaptive renewal; urban vitality.

1. Introduction

1.1. Research Background

Industrial parks have traditionally been planned according to the logic of production efficiency. Land is divided into factories, logistics corridors, ancillary buildings, and worker accommodation, while public space and everyday social life are treated as secondary concerns. Such a model remains functional when the principal objective is to maximize production capacity, but it becomes less responsive when an industrial district is also expected to attract, retain, and support a young workforce. In that context, the quality of the physical environment becomes part of the perceived value of work. Young workers may evaluate not only wages and job stability but also commuting convenience, opportunities for leisure, social interaction, aesthetic experience, and the ability to maintain a meaningful life outside working hours [1-4].

This challenge is particularly visible in light industrial parks. Compared with heavy industrial areas, many light industrial facilities have lower emissions, lower noise, and more flexible building forms, creating favorable conditions for gradual environmental upgrading. Yet older planning patterns can remain functionally rigid. A park may contain sound production buildings but weak public spaces, outdated facades, monotonous landscapes, limited commercial services, and residential accommodation that is separated from the rhythms of contemporary urban life. As a result, the physical environment can become a hidden factor in recruitment, retention, and worker satisfaction.

From a design perspective, renewal should therefore move beyond the simple repair of buildings. Jane Jacobs emphasized that urban vitality depends on diversity of uses, people, time periods, and social encounters [1]. Gehl similarly argued that the quality of public space influences whether people choose to stay, walk, meet, and participate in everyday life [2]. These perspectives are relevant to industrial districts because a productive workplace can also become a social environment in which workers spend a substantial part of their daily lives. The renewal of a light industrial park consequently requires a balance between industrial order and everyday human experience [1-3].

The concept proposed in this paper is "protect the industrial core while creating a youth-oriented environment." The renewal is not based on demolition and reconstruction. Instead, it adopts incremental intervention, retaining major production structures and circulation patterns while improving the public realm, landscape, commercial facilities, sports facilities, acoustic boundaries, seasonal activities, and residential quality. The aim is to create a park where work remains efficient and safe while the period before and after work becomes more relaxed, social, restorative, and adaptable [5,6].

1.2. Research Significance

1.2.1. Theoretical Significance

First, the study extends human-centered urban design principles into the context of industrial renewal. Industrial parks are often evaluated through land efficiency, logistics, output, and infrastructure capacity. This study argues that spatial vitality and everyday experience should be considered complementary performance dimensions rather than decorative additions. By integrating production, living, social interaction, and emotional restoration into one spatial

framework, the research expands the design interpretation of industrial community renewal [1-3,6].

Second, the study contributes to adaptive renewal theory by emphasizing soft intervention rather than large-scale reconstruction. Adaptive reuse literature demonstrates that existing structures can acquire new functions and meanings through selective modification [5]. For light industrial parks, this principle is particularly useful because existing factories, roads, and utilities represent substantial embedded value. Reusing the industrial structure reduces disruption while allowing a new public-space system and new community functions to be inserted around the production core [5].

Third, the study introduces a dual-atmosphere framework combining lively and restorative environments. Youth-oriented space is sometimes reduced to colorful facades, commercial consumption, or social-media-oriented visual effects. The present framework proposes a broader understanding: young users may desire social stimulation at one moment and quiet recovery at another. Spatial variety is therefore treated as an operational requirement rather than a stylistic choice [1,2,7,8].

1.2.2. Practical Significance

For industrial park operators, the strategy offers a gradual implementation route. Basic public amenities can be provided as low-cost services, while modular commercial units, sports programs, and event spaces can be introduced in phases. This approach allows the park to test demand and adjust its operational mix without changing the production core. The result is a more flexible relationship between design investment and operational return [6,8].

For employers and workers, the renewal provides a stronger everyday environment. Convenience stores, parcel services, shared study areas, charging points, sports facilities, shaded resting spaces, and restorative landscapes reduce the need for workers to leave the park for basic needs. More importantly, these functions create opportunities for social interaction and emotional recovery. The design consequently treats employee well-being as part of spatial performance rather than as an independent welfare issue [7,8].

For urban planning and regeneration practice, the research demonstrates how an industrial district can gradually move toward production-living integration. Instead of isolating industrial land from surrounding urban life, controlled opening, mixed housing, and public activity can help the park become a more legible urban community. This direction is consistent with broader discussions of compact urban form, mixed use, walkability, and public-space vitality [1-3,6].

1.3. Research Framework, Design Method and Article Structure

The research adopts a design-oriented methodology combining spatial diagnosis, scenario analysis, design strategy synthesis, and operational testing. The study does not rely on fabricated questionnaires or invented project measurements. Instead, it translates the supplied design brief into a structured analytical framework that can be adapted to an existing low-pollution light industrial park. The process contains four stages: diagnosis of spatial problems; definition of human-centered objectives; development of spatial and operational strategies; and construction of an evaluation framework for post-renewal performance [5,10].

Figure 1: Renewal Design Framework: Existing Industrial Park -> Spatial Diagnosis -> Five-Zone Reconfiguration -> Acoustic and Landscape Upgrade -> Youth-Oriented Amenities -> Seasonal Activation -> Production-Living Integrated Community

The article is organized into seven chapters. Chapter 1 introduces the background, significance, research method, and innovations. Chapter 2 reviews relevant theoretical foundations and develops design principles. Chapter 3 diagnoses existing spatial and operational problems. Chapter 4 presents the overall renewal strategy, including functional zoning, acoustic separation, architectural updating, commercial facilities, landscape nodes, seasonal activities, and mixed residential development. Chapter 5 discusses implementation scenarios, operational mechanisms, and evaluation criteria. Chapter 6 integrates the design innovations and broader implications. Chapter 7 summarizes conclusions, practical recommendations, limitations, and future research directions.

1.4. Research Innovations

The first innovation is the emphasis on incremental youth-oriented renewal. Rather than replacing the industrial park with a completely new urban district, the design protects the production core and directs intervention toward the public realm and daily-life interface. This strategy is more compatible with industrial continuity and phased investment [1-6].

The second innovation is the “dual-atmosphere” model. Lively spaces support social interaction, sports, performances, and collective activities, while restorative spaces support quiet walking, individual reflection, shaded rest, and nighttime relaxation. The two atmospheres are connected but spatially differentiated, allowing multiple forms of youth behavior to coexist.

The third innovation is a composite acoustic boundary based on terrain, vegetation, and low landscape walls. Instead of treating acoustic comfort as a purely technical engineering problem, the proposal turns the acoustic boundary into a visible landscape system. The edge becomes both a buffer and a spatial identity element.

The fourth innovation is the combination of modular commercial units and a four-season activity calendar. Public life is not expected to arise automatically from landscaping. Instead, physical spaces are paired with recurring programming and a manageable operational model. The park can consequently maintain a changing social rhythm without continuous reconstruction.

The fifth innovation is production-living integration through mixed residential development. Existing employee accommodation is improved rather than discarded, while additional housing can be introduced in a controlled manner. The resulting community combines workers and residents, increasing the diversity and continuity of everyday use.

2. Theoretical Basis, Literature Review and Design Principle Development

2.1. Human-Centered Urban Design and Spatial Vitality

2.1.1. Everyday Activity and Public-Space Vitality [1,2,7].

Urban vitality is closely related to the presence of people, the diversity of activities, and the ability of physical space to support repeated everyday use. Jacobs argued that diverse uses and overlapping time patterns produce safer and more lively streets and public spaces [1]. Whyte’s observations of small urban spaces similarly showed that people stay longer

when spaces provide comfortable seating, sunlight, food, social visibility, and opportunities for casual encounter [7]. These insights are directly relevant to industrial parks because worker populations already constitute a stable potential user group. The design task is to provide spaces that allow people to stop, meet, move, and rest rather than merely pass through.

Gehl's distinction between necessary, optional, and social activities further supports the design approach [2]. Necessary activities, such as commuting and work-related movement, already occur in industrial parks. The renewal challenge is to create more optional and social activities: sitting outdoors, exercising after work, drinking coffee, attending a small event, walking beneath trees, or meeting friends. When optional activities become possible and attractive, social activities can emerge as a natural consequence of increased presence.

2.1.2. Restorative Landscape and Emotional Comfort [8].

Landscape is not only a visual layer but also a medium of environmental and emotional recovery. Quiet planting, shaded paths, water-like visual elements, and comfortable seating can create low-intensity spaces for psychological decompression. The proposed restorative landscape zone uses this principle to counterbalance the visual and sensory intensity of industrial production. Instead of maximizing visual excitement everywhere, the design deliberately creates gradients of activity and calmness.

2.2. Adaptive Renewal and Industrial Structure Reuse

2.2.1. Incremental Intervention

Adaptive renewal begins with the recognition that existing structures possess material, functional, and cultural value. Industrial buildings often have generous floorplates, clear spans, robust circulation routes, and recognizable structural rhythms. Large-scale demolition can erase these advantages and introduce high cost and operational risk. A more resilient strategy is to preserve the main industrial skeleton and introduce new uses through localized modifications, landscape insertion, facade refinement, and public-space redesign [5].

In the present study, incremental intervention means that the factory production system remains the primary framework. Existing truck routes, production entrances, safety areas, and essential infrastructure are not arbitrarily relocated. Design effort is concentrated on the interfaces that are often neglected: the boundary between production and living, the route from workplace to dormitory, the ground-floor public realm, the roof, the entrance plaza, and the spaces between buildings.

2.2.2. Industrial Heritage, Identity, and Contemporary Expression

Industrial environments can possess a strong spatial identity because their structural grids, material expression, and repetitive forms communicate a clear relationship between architecture and production. Renewal should therefore avoid disguising the park as a generic commercial district. Contemporary interventions can be lightweight and legible: facade color blocks, linear lighting, signage, canopies, art installations, planting, and modular structures can create a new visual language while retaining the industrial character. The desired outcome is not "non-industrialization" but a contemporary interpretation of industrial space [5].

2.3. Production-Living Integration and Youth-Friendly Community

Production-living integration means that industrial land is understood as part of the urban everyday system rather than as an isolated production enclave. A mixed community contains overlapping cycles of use: workers arrive early, employees rest after shifts, residents move through public spaces, commercial units operate throughout the day, and community activities occupy evenings and weekends. Such temporal diversity increases the continuity of public-space use and reduces the dead periods commonly found in single-purpose industrial parks [1,2,6,10].

Youth-friendliness is therefore defined here by spatial choice rather than by a single visual style. A youth-oriented industrial park should provide choices in movement, consumption, social interaction, exercise, privacy, and leisure. These choices need not all be commercial. Free public amenities, low-cost sports activities, community events, green spaces, and self-directed spaces are equally important. The design seeks to make the park feel contemporary without turning all forms of youth culture into consumption.

2.4. Core Design Principles

2.4.1. Production Priority with Moderate Renewal

The first principle is to protect production safety, efficiency, and continuity. Existing factories retain their basic volumes and production functions. Interventions focus on public-facing surfaces, secondary spaces, landscape, and support facilities. Construction should be phased so that industrial operations can continue with minimal interruption [1,2].

2.4.2. Separation of Dynamic and Quiet Environments

The second principle is dynamic-quiet separation. Sports courts, event lawns, and social plazas are positioned away from residential sleeping areas. Restorative paths and small seating spaces are located in quieter zones. The boundary between them is designed as a gradual transition rather than an abrupt wall, using planting, level changes, and spatial filters [6,10].

2.4.3. Diverse Atmospheres and Behavioral Choice

The third principle is atmosphere diversity. A park should not demand one behavior from every user. Active users need places to move and gather; users under stress may need places to walk quietly or sit alone. The design therefore treats behavioral choice as a criterion for space quality [7,8].

2.4.4. Public Benefit with Sustainable Operation

The fourth principle is a public-private service gradient. Basic functions such as drinking water, parcel collection, seating, charging points, and public fitness are widely accessible. Specialized services such as professional climbing, event rental, and certain sports facilities may adopt modest fees that contribute to maintenance. This balances inclusiveness and financial sustainability [1,6].

2.4.5. Controlled Openness and Urban Integration

The fifth principle is controlled openness. Selected commercial, landscape, and event spaces can connect with the surrounding city while production areas remain secure. Controlled openness increases external visibility, supports local consumption, and reduces the psychological isolation of the industrial district without weakening industrial management [1,3,6,10].

3. Existing Problems and Design Diagnosis

3.1. Functional Monotony and Missing Everyday Services

Many conventional industrial parks are organized around three basic components: factories, circulation routes, and worker accommodation. This arrangement is efficient from a production standpoint but insufficient as an everyday environment. Workers may complete a full daily cycle without encountering a meaningful public place. After work, the dominant pattern becomes "production floor -> transport route -> dormitory," leaving little room for optional activity or social interaction. The absence of convenience services also forces workers to travel outside the park for basic needs, reducing the time available for rest and recreation [1,2,6,10].

The design response is to construct a continuous living-support system distributed around key pedestrian routes. Instead of concentrating every service in a single shopping building, small support nodes are placed along the routes connecting factories, dormitories, sports facilities, and public spaces. This creates a chain of useful encounters and reduces travel distance. The objective is not to maximize commercial floor area but to ensure that daily necessities are available within comfortable walking distance.

3.2. Aging Spatial Image and Weak Youth-Oriented Identity

The second problem is a weak visual identity. Repetitive facades, extensive hard paving, limited planting layers, outdated signage, and basic lighting can create an environment that feels anonymous and institutional. Such spaces are difficult to associate with contemporary youth culture because they provide little aesthetic variety or recognizable public identity. Yet a youthful image should not be produced solely through bright colors. It should emerge from coherent graphic systems, landscape structure, lighting, seating, art, and active public-space design [3,6].

The proposed renewal uses the industrial structure as a framework for contemporary expression. Facade interventions concentrate on entrances, corners, public-facing walls, and shared circulation nodes. Color and lighting are used selectively to create orientation and identity rather than visual noise. Landscape elements such as timber-like seating, modular planters, open lawns, and compact art installations provide human scale in a large industrial setting.

3.3. Mixed Circulation and Acoustic Disturbance

Production traffic and everyday pedestrian activity may overlap at several points, creating safety and comfort problems. Heavy or service vehicles need direct and efficient access to factories, while workers and residents need predictable pedestrian routes. Noise from machinery, logistics movement, and loading activity can also reach dormitory areas. The issue is therefore spatial as well as acoustic: circulation hierarchy and acoustic buffering must be designed together [6,10].

The renewal introduces a clear hierarchy of industrial, shared, and pedestrian routes. Production traffic remains direct and uninterrupted. Pedestrian loops connect major public facilities and residential areas without unnecessary crossings. At the edge between production and living, landscape buffers are coordinated with the circulation system so that the same boundary simultaneously manages movement, visibility, noise, and environmental comfort.

3.4. Neglected Emotional and Social Needs

Traditional industrial planning tends to measure success through functional adequacy. However, emotional comfort and social connection influence whether workers experience a place as temporary accommodation or as a community. Without seating, shade, social nodes, exercise facilities, or low-pressure spaces for informal interaction, workers may have few options beyond the factory and dormitory. The resulting environment can feel repetitive and psychologically compressed even when the basic infrastructure is adequate [7,8].

The proposed design therefore introduces spaces with different social intensities. Small individual seats and quiet paths provide low-pressure options, while lawns, sports platforms, and event spaces support collective use. The coexistence of these conditions is essential because social preference varies from person to person and from time to time.

Table 1. Existing Problems and Corresponding Renewal Strategies

Existing Problem	Spatial Diagnosis	Renewal Response	Expected Effect
Functional monotony	Factories, routes, dormitories dominate	Living-support nodes and mixed-use public spaces	More optional and social activities
Aging image	Rigid facades and weak landscape	Facade refinement, lighting, planting, art	Stronger youth-oriented identity
Noise and flow conflicts	Production traffic reaches living areas	Route hierarchy and three-layer acoustic buffer	Higher safety and comfort
Weak social life	Few places to meet or rest	Sports, lawns, seating, small stages	More social choice
Static atmosphere	No recurring programming	Four-season activity system	Continuous vitality
Residential isolation	Dormitories treated as auxiliary	Mixed residential community	Stronger production-living integration

3.5. Lack of Continuous Seasonal Vitality

Even a well-designed landscape can become static when its programming never changes. Industrial parks often lack recurring events, seasonal decoration, or community activities, making the spatial experience almost identical

throughout the year. A youth-oriented community requires a temporal operating system that periodically changes the focus of public space. This does not require large festivals every week; modest recurring activities can create a sense of anticipation and continuity [1,7,8].

3.6. Weak Residential Integration

Employee accommodation can also become isolated from the wider park. Dormitories may be physically close to factories but lack attractive ground-level spaces, community rooms, or diversified housing options. In the proposed model, existing dormitories are upgraded through public-corridor improvements, entrance landscapes, shared lounges, and better outdoor areas. Where appropriate, a controlled mixed residential zone can be added to diversify the population and strengthen the relationship between industrial employment and urban life [1-3,5,10].

4. Overall Renewal Strategy

4.1. Five-Zone Spatial System

The overall plan is organized into five interconnected but spatially legible zones. The first is the industrial production core, which retains the original factory configuration, production entrances, loading areas, and primary logistics routes. The second is the living-support zone, which contains convenience services, public waiting areas, parcel collection, water points, and basic shared facilities. The third is the sports and social activity zone, which contains cycling routes, fitness areas, climbing elements, lawns, and a small event platform. The fourth is the restorative landscape zone, which provides quiet paths, shaded seating, contemplative spaces, and roof gardens. The fifth is the mixed residential zone, which combines improved employee accommodation with carefully controlled new residential functions [1-3,9,10].

The five zones are not isolated precincts. Their relationship is based on gradients. Industrial space transitions to living support through landscape and pedestrian circulation. Living support connects to sports and social spaces through active plazas. Quiet landscape spaces are located beyond higher-intensity uses, creating a restorative layer. Housing is placed so that daily routes pass through public spaces rather than terminating immediately at dormitory entrances. This spatial sequence transforms the park from a collection of functional fragments into a continuous community system.

Table 2. Five-Zone Functional and Spatial System

Zone	Primary Functions	Spatial Character	Key Interface
Industrial Production Core	Factories, loading, logistics, service access	Orderly, controlled, efficient	Production-landscape edge
Living-Support Zone	Retail, parcel service, study, charging, convenience	Active, accessible, everyday	Factory and residential routes
Sports and Social Zone	Cycling, fitness, climbing, lawn, events	Lively, flexible, social	Commercial and landscape nodes
Restorative Landscape Zone	Walking, sitting, shade, quiet recreation	Calm, green, low intensity	Residential and roof-space edges
Mixed Residential Zone	Worker housing, family housing, shared community space	Domestic, comfortable, integrated	Public space and park circulation

4.2. Three-Layer Acoustic Buffer

4.2.1. Terrain Difference

The first acoustic layer uses small terrain changes. Where site conditions permit, the living side of the boundary is raised slightly above production areas. A shallow berm or planted terrace can interrupt direct sound propagation and simultaneously create a defined edge. The terrain should remain accessible and safe, with universal circulation integrated into the grading strategy [6,8].

4.2.2. Multi-Layer Planting

The second acoustic layer is a dense planting belt composed of canopy trees, medium-height shrubs, and groundcover. The design should favor species and planting densities suited to local climate and maintenance conditions. Beyond acoustic effects, layered planting improves shade, visual screening, biodiversity, and perceived environmental quality. The green buffer becomes an ecological infrastructure rather than a decorative strip [6,10].

4.2.3. Landscape Wall

The third layer is a low landscape wall placed selectively where sound and visual control require additional reinforcement. Its height and length should be calibrated to safety and visibility requirements. The wall can incorporate seating, planters, signage, lighting, or art so that it performs multiple functions. Through this combination, the boundary becomes a social and spatial threshold rather than a defensive barrier [6,10].

4.3. Architectural Facade and Public-Space Renewal

The building strategy retains the square industrial massing because regular volumes are efficient and recognizable. Renewal concentrates on the public interface. Entrances receive clearer canopies and signage. Selected facade bays can be differentiated through color planes or vertical and horizontal graphic bands. Night lighting follows circulation lines and key entrances rather than illuminating entire facades uniformly. This creates a measured contemporary image while controlling energy consumption and visual clutter [5,6,10].

Public corridors, courtyards, and entrance plazas receive greater attention than interior production spaces. Seating clusters are positioned near shade and activity nodes. Canopies create all-weather routes. Small planting courts break down large paved areas. Underused roof areas can be transformed into roof gardens or elevated rest platforms where structural capacity, waterproofing, safety, and maintenance permit. These roof spaces provide a second public layer without consuming valuable production land.

4.4. Youth-Oriented Commercial and Convenience System

4.4.1. Basic Public Amenities

Basic convenience facilities should be broadly accessible and economically light. Examples include unmanned convenience retail, parcel collection, shared study and reading corners, charging points, drinking water, weather-protected seating, changing rooms, showers where appropriate, and self-service community equipment. These functions directly address everyday needs and reduce avoidable travel [6,10].

4.4.2. Modular Container Commercial Street

Modular retail units provide a flexible way to introduce coffee, light meals, desserts, drinks, cultural products, and small creative businesses. The units can be moved or regrouped as operating demand changes. Their architectural language should be clean and compatible with the industrial context. Rather than forming a single permanent shopping mall, the modular system creates a series of small activity points near lawns, plazas, and residential routes [5,6].

4.4.3. Dynamic Markets and Food Events

Temporary markets can periodically occupy the social zone. Seasonal food events, youth markets, craft fairs, and evening food streets create reasons to revisit familiar spaces. Because the booths and equipment are mobile, the same site can support different events throughout the year. The value of the market is therefore not only commercial revenue but also temporal variation and social interaction [7,8].

4.4.4. Public and Advanced Sports in Different Cost Tiers

A two-tier sports system supports both inclusiveness and operational sustainability. The public tier includes cycling routes, fitness equipment, walking loops, lawns, and open exercise areas. The advanced tier may include professional climbing, bookable group-training spaces, or specialized small facilities operated at modest fees. The principle is that basic health and social functions should remain accessible, while specialized services can help finance maintenance [7,8,9].

4.5. Dual-Atmosphere Landscape Nodes

4.5.1. Restorative and Quiet Nodes

Quiet nodes are designed for decompression. They may contain tree canopies, individual seats, shaded platforms, low planting, gentle paths, and limited visual stimulation. A small water feature or reflective landscape element can reinforce the sense of calm, but maintenance simplicity is more important than technological complexity. At night, low-level path lighting creates a comfortable sense of orientation without turning the landscape into an entertainment zone [1,2,7,8].

4.5.2. Lively and Social Nodes

Lively nodes concentrate collective activity. A central lawn can accommodate gatherings, small performances, informal sports, and temporary markets. Colorful paving, modular furniture, and contemporary art elements create recognizable identity. The design should remain flexible so that one space can switch from daily casual use to weekend events without permanent installations [1,2,7].

The key design principle is coexistence rather than competition. People who want activity should be able to find it quickly, while people who want quiet should be able to move into a calmer layer without leaving the community. This “hot and cool” spatial gradient is a major component of the youth-friendly character of the park.

4.6. Four-Season Activity System

The activity calendar gives the physical environment a temporal rhythm. Spring emphasizes outdoor exploration, light exercise, and small markets. Summer shifts activity toward evening use, night markets, outdoor film screenings, and small music performances. Autumn can focus on design markets, garden events, outdoor salons, and team-building activities. Winter emphasizes warm gatherings, soft lighting, seasonal decoration, and year-end community events. Activities should remain modular and repeatable rather than dependent on expensive one-off festivals [1,7,8].

Table 3. Four-Season Activity Calendar

Season	Representative Activities	Spatial Focus	Operational Purpose
Spring	Youth market, light exercise, lawn meet-ups	Lawn, cycling loop, market nodes	Reactivate outdoor use
Summer	Night market, outdoor cinema, small performances	Central lawn, event platform, food nodes	Extend activity into evenings
Autumn	Garden event, creative market, outdoor salon	Landscape nodes, plaza, mixed-use court	Build community identity
Winter	Warm gatherings, light event, year-end activity	Lit plaza, indoor support spaces, sheltered routes	Maintain year-round continuity

4.7. Mixed Residential Community

Existing worker accommodation should be upgraded as part of the public-space strategy rather than treated as an isolated building problem. Entrance areas, ground-floor paths, shared rooms, corridors, and surrounding planting should be improved. Old-fashioned display boards and excessive honor walls can be reduced in favor of more neutral, comfortable, and contemporary community spaces. The focus should be on shade, seating, lighting, privacy, wayfinding, and everyday convenience [5,10,11].

A controlled additional residential component can transform the single-purpose dormitory cluster into a mixed community. New residential functions should be located where they do not interfere with production safety and logistics. Shared public spaces can then serve workers, residents, and visitors at different times. Mixed housing creates a more diverse daily population, strengthening the continuity of shops, public spaces, and community activities.

5. Design Implementation Framework and Scenario Testing

5.1. Circulation Hierarchy and Spatial Sequencing

Implementation begins with a clear circulation hierarchy. Industrial routes receive priority protection and should remain

direct. Pedestrian routes form continuous loops linking factories, convenience services, sports facilities, and residential areas. Slow-mobility routes can connect restorative spaces and roof gardens. At major intersections, spatial cues such as paving changes, lighting, planting, and signage indicate the change from production-oriented movement to community-oriented movement. The objective is not to eliminate all overlap but to make overlap legible and controlled [1-3,9,10].

5.2. Daytime and Nighttime Scenarios

During working hours, the industrial core remains visually dominant and logistics movement remains efficient. Public services operate primarily to support workers' necessary activities, such as food, parcel collection, and short-term rest. After work, the center of gravity shifts toward sports, food, social lawns, and quiet landscapes. At night, lighting intensity decreases away from active nodes, allowing the park to transition gradually from lively activity to residential calm. This temporal change supports both productivity and recovery [7,8].

5.3. Weekday and Weekend Scenarios

Weekdays require reliable support functions and predictable movement. Weekend use can be more flexible, with markets, team activities, and open-air events occupying selected spaces. The same plaza, lawn, or modular retail area can therefore serve multiple purposes without requiring permanent construction. This adaptability reduces spatial underuse and supports a richer weekly rhythm [7,8].

5.4. Operation and Maintenance Mechanisms

Physical renewal should be accompanied by an operational governance system. A small park management team can coordinate event scheduling, commercial leasing, sports reservations, landscape maintenance, and user feedback. The modularity of the design makes it possible to replace underperforming functions without reconstructing the whole site. Operational flexibility is particularly important in a youth-oriented environment because user preferences and consumption patterns can change rapidly [6,10,11].

5.5. Free and Low-Cost Service Structure

A practical cost model distinguishes universal services from revenue-generating specialized services. Free functions should include pedestrian circulation, resting lawns, general outdoor fitness, drinking water, basic charging, and public seating. Low-cost services can include professional sports experiences, bookable activity areas, and event spaces. Commercial rents or partnership programs can partially support landscape and facility maintenance. This structure avoids turning the park into a purely commercialized environment while still recognizing the need for operational sustainability [6-8].

5.6. Performance Evaluation Framework

Because design renewal should be evaluated after implementation, the study proposes a multidimensional performance framework rather than a single aesthetic judgement. Five dimensions are recommended: production continuity, environmental comfort, everyday convenience, social vitality, and operational sustainability. The framework can be measured through post-occupancy observation, pedestrian counts, route conflict records, facility usage rates, event participation, tenant turnover, and periodic user feedback. These indicators provide a basis for iterative management [1,6,10,11].

Table 4. Post-Renewal Performance Evaluation Framework

Dimension	Representative Indicators	Evaluation Method	Renewal Goal
Production continuity	Route conflicts, loading efficiency, safety incidents	Operational records and observation	No adverse production disruption
Environmental comfort	Perceived noise, shade, thermal comfort, greenery	Site observation and user feedback	Improve everyday comfort
Convenience	Walking distance to basic services, facility accessibility	Route mapping and service inventory	Reduce avoidable travel
Social vitality	Stay duration, lawn use, sports use, event participation	Behavior observation and program records	Increase optional and social activities
Operational sustainability	Vacancy, maintenance cost, event frequency	Management records	Maintain adaptable and viable operation

6. Integrated Design Discussion

6.1. Why Soft Renewal Is Appropriate for Light Industrial Parks

Soft renewal is especially appropriate where the existing industrial fabric remains physically usable. The production buildings contain embedded investment, utilities, transport connections, and operational knowledge. Demolition would risk production interruption and discard material resources. Incremental renewal concentrates expenditure on the elements most visible in everyday life and most neglected by conventional planning: edges, public space, landscape, amenities, and residential interfaces. The approach therefore combines conservation of industrial value with contemporary community improvement [5,10,11].

6.2. From Visual Youthfulness to Behavioral Youthfulness

A youthful industrial park should not be defined by color alone. Visual updates can attract attention, but long-term vitality depends on what people can do in the space. Sports, markets, music, study, walking, casual conversation, and individual rest create a broader definition of youth-oriented design. This distinction helps avoid superficial "internet-famous" design in which a space is visually striking but operationally weak. The proposed framework connects image, function, and repeated use [1,2,6,8].

6.3. The Boundary as a Multi-Functional Design Device

The production-living boundary is often treated as leftover land. In this study it becomes one of the most important design devices. The acoustic buffer reduces noise; planting improves microclimate and visual quality; walls and terraces support seating and wayfinding; and the edge can include controlled pedestrian connections. By concentrating multiple functions in one boundary system, the design obtains greater value from limited land [6,10].

6.4. Seasonal Programming as Spatial Infrastructure

Programming is commonly treated as an event-management issue separate from architecture. However, the ability to host different activities should be anticipated in the physical plan. Power access, storage, flexible paving, temporary booth locations, lighting points, and open lawns are all spatial infrastructure for programming. The proposed four-season calendar therefore informs physical layout rather than being added after construction [7,8].

6.5. Mixed Residential Development as a Long-Term Urban Strategy

Adding carefully controlled residential functions can strengthen the long-term urban role of an industrial park. Workers, residents, visitors, and service providers contribute different temporal patterns of use. This diversity can support shops, public spaces, and services beyond shift change. However, residential integration must remain compatible with environmental standards, safety requirements, land-use regulations, and production needs. The strategy is therefore selective integration rather than indiscriminate mixed use [1,5,10,11].

6.6. Design Innovations and Practical Implications

The integrated framework contains five practical innovations. First, it keeps the industrial bottom line intact while using landscape, public-space, and amenity upgrades to achieve youth-oriented renewal. Second, it introduces a dual-atmosphere system that explicitly accommodates both social excitement and individual restoration. Third, it uses a three-layer acoustic buffer that combines terrain, planting, and landscape walls. Fourth, it links modular commercial spaces to a four-season activity system so that vitality can evolve without repeated construction. Fifth, it creates a production-living integrated model through improved worker housing and controlled mixed residential development [1-3,5,6].

These innovations imply several implementation priorities. The first phase should establish safe circulation, the acoustic edge, and basic public amenities. The second phase can add sports, commercial modules, and restorative landscape nodes. The third phase can introduce larger seasonal programming and selected mixed residential functions. Phasing in this way allows the park to learn from actual use and adjust future investment. Design becomes a process of continuous adaptation rather than a one-time finished product.

7. Conclusions, Practical Implications, Limitations and Future Directions

7.1. Core Conclusions

This research proposes a renewal framework for youth-oriented and vibrant light industrial parks based on the principle of protecting production while upgrading everyday experience. The analysis shows that the main shortcomings of conventional parks are not limited to architectural appearance. They involve functional monotony, weak public space, circulation conflicts, acoustic interference, insufficient social and restorative opportunities, static seasonal experience, and residential isolation. These problems are interconnected and therefore require an integrated spatial and operational response [1-3,5,6].

The proposed solution is organized around five functional zones, a three-layer acoustic boundary, youth-oriented convenience and commercial systems, dual-atmosphere landscape nodes, a four-season activity calendar, and mixed residential integration. Together, these components transform the industrial park from a single-purpose production environment into a more complex community that supports working, resting, exercising, socializing, and living. The approach relies on incremental renewal so that the industrial core can continue to operate.

7.2. Theoretical Contributions

The main theoretical contribution is the integration of industrial renewal, public-space vitality, and youth-friendly environmental design into one framework. Industrial parks are often analyzed through production efficiency, while youth-oriented public-space design is more commonly associated with residential or commercial districts. This study connects the two fields by treating worker experience and spatial vitality as part of industrial-community performance [1,5,6,10].

A second contribution is the dual-atmosphere concept. The model rejects the assumption that youth-oriented design means continuous activity and visual stimulation. Instead, it recognizes the coexistence of social and restorative needs. A third contribution is the reinterpretation of the production-living boundary as a multi-functional landscape and acoustic system.

7.3. Practical Management Implications

7.3.1. Prioritize Basic Public Services

Management should first ensure that the everyday support system works reliably. Drinking water, parcel collection, shaded seating, charging, basic retail, and clean public facilities have a greater cumulative effect on everyday satisfaction than isolated decorative projects. The service network should therefore be planned as a continuous pedestrian system [6-8,10].

7.3.2. Build a Tolerant and Shared Community Culture

Physical spaces become more valuable when management encourages repeated informal use. Community rules should allow reasonable small-scale activities, peer gatherings, and user-led programming while protecting safety and neighboring uses. Flexible booking procedures can help groups use lawns, event spaces, or sports facilities without excessive bureaucracy [7,8].

7.3.3. Match Design Intensity to User Heterogeneity

Different workers and residents have different schedules

and preferences. Rather than forcing one universal environment, the park should provide a spectrum of spaces from energetic to quiet, from free to specialized, and from communal to individual. Such diversity is a practical form of inclusiveness [1,3,5,10].

7.4. Limitations

The study is design-oriented and is based on a structured interpretation of the supplied renewal brief rather than on an original field survey, environmental measurement campaign, or post-occupancy dataset. Consequently, the proposed strategies should be tested on a specific site before construction. Actual noise levels, solar conditions, structural capacity, drainage, fire safety, land-use controls, and local commercial demand can affect the final configuration [5,10,11].

A second limitation is that the study presents a transferable framework rather than a single site-specific master plan. The five zones and three-layer boundary should be adapted to site size, industrial type, climate, and existing infrastructure. A third limitation is the lack of longitudinal evidence about whether improved spatial quality directly changes workforce retention, recruitment, or organizational performance. Future research should therefore combine design implementation with measurable post-occupancy evaluation.

7.5. Future Research Directions

Future research can develop comparative case studies across different types of light industrial parks to test how the proposed framework performs under different climates, land-use patterns, and industrial structures. Longitudinal studies can examine changes in worker satisfaction, stay duration, public-space activity, service consumption, and housing demand before and after renewal. Environmental studies can also quantify acoustic reduction, thermal comfort, walking accessibility, and landscape performance. Finally, digital tools such as pedestrian simulation, acoustic modeling, and scenario-based operational dashboards can help designers evaluate multiple renewal options before construction [1-12].

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