

Article

The Productive Palimpsest: Quasi-Industrial Zoning and Industrial Recomposition in Seongsu-dong, Seoul

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Abstract

Quasi-industrial zoning is often described either as a mechanism for protecting manufacturing or as a flexible platform for mixed-use redevelopment. Seongsu-dong, Seoul, suggests that the two functions can coexist while also pulling in different directions. This study combines a historical and institutional reconstruction with establishment and workplace-employment statistics for 2015–2024, building use-approval data for 2016–2025, and a limited secondary analysis of IRB-approved interviews collected in 2024 for ground-level validation. Because the national establishment survey changed its enumeration framework in 2020, business trends are read through two internally comparable intervals. Manufacturing contracted in both intervals, while information, communications, professional services, design, research, and other knowledge-intensive activities expanded. Knowledge industry centers (KICs) remained a major industrial development type during the same period, and several expanding knowledge-intensive sectors fall within their statutory eligibility categories. These parallel patterns are institutionally compatible, but the business statistics do not identify actual KIC tenants and therefore do not show that sectoral growth occurred within KICs. New-construction approvals also shifted sharply toward office and consumer-oriented development in 2021–2025; this development-flow evidence is interpreted separately from existing building stock and triangulated with recent registry-based research on Seongsu's physical transformation. A selective re-analysis of four previously collected interviews provides mechanism-level evidence of short lease horizons, relocation pressure, productive-space requirements, KIC operational mismatch, and thinning supplier networks, without treating these cases as representative of the district. Seongsu is therefore better understood neither as a post-industrial district nor as a straightforward case of reindustrialization, but as a productive palimpsest in which successive forms of industry and urban use are layered unevenly. The case suggests that retaining diverse productive capacity within high-value metropolitan districts is one dimension of urban sustainability. Quasi-industrial zoning provides regulatory flexibility that can accommodate successive forms of production, but flexibility alone does not determine which activities remain under redevelopment pressure. Its strategic planning value therefore depends on how redevelopment incentives, productive-space performance, affordability, and long-term monitoring steer industrial recomposition over time.

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1. Introduction

Mixed-use planning has returned to the center of urban policy, especially through compact-city and 15 min-city agendas that seek to place housing, employment, services, and leisure within shorter distances [1]. Material production is less often part of that picture. Repair, storage, waste handling, fabrication, and goods distribution are still commonly treated as activities that can move outward as central districts become more residential, office-based, and consumption-oriented. The productive-city literature has challenged this assumption by showing that urban industry contributes not only jobs, but also supplier networks, maintenance capacity, innovation, and forms of metropolitan resilience that are difficult to replace once displaced [2–6].

Why this matters is not exhausted by environmental performance. Recent research on urban manufacturing links central production to potential carbon, resource, and space efficiencies through proximity and urban synergies, while also warning that these benefits remain context-dependent and empirically uneven [7]. Recent Korean research on urban high-tech industrial parks likewise shows that inner-urban brownfield models can support compact employment, job-housing proximity, and reuse of industrial land more effectively than peripheral greenfield development [8]. In this article, productive urban sustainability refers more narrowly to the long-term capacity of a metropolis to retain a diverse repertoire of making, repair, prototyping, logistics, and knowledge-based production through successive rounds of economic and spatial change. It does not assume that manufacturing located within the city is inherently low-carbon or circular.

That definition turns the transformation of industrial land into a strategic planning problem. Balsas and Piracha describe strategic planning as a process of identifying priorities and desirable courses of action under conditions of scarcity, market timing, and competing urban objectives [9]. In high-value industrial districts, the relevant question is therefore not only which uses are legally permitted at a given moment, but which productive capacities planning seeks to keep available through redevelopment. Flexible land-use categories can be advantageous because they preserve multiple future trajectories; regulatory openness, however, is a capacity for adaptation rather than a strategy in itself.

Seongsu-dong, on the eastern side of central Seoul, makes this tension unusually visible. Over the last decade it has become known for fashion and entertainment headquarters, design and content companies, cafes, flagship stores, pop-ups, and the reuse of red-brick industrial buildings. Seen from the street, the story can look like a familiar sequence of deindustrialization followed by cultural and commercial reinvention. That reading is incomplete. Manufacturing, repair, logistics, and other productive activities remain substantial, and the district's recent economy has grown through planning and building categories that still belong to an industrial regulatory lineage.

Footwear workshops and material suppliers continue to operate alongside printing and packaging firms, apparel and food producers, metal and machinery businesses, automobile repair, transport and storage, and public facilities for urban manufacturers [10–17]. At the same time, knowledge industry centers (KICs), reused factories, corporate offices, housing, retail, and cultural venues have multiplied. The important point is not simply that these uses coexist. Manufacturing has been shrinking while software, research, design, advertising, content, and professional services have grown rapidly. Many of the growing sectors fall within the broad statutory range of activities permitted in KICs [18].

This overlap complicates any simple account of industrial survival. A KIC can contain fabrication, prototyping, laboratories, design, software, and ordinary office work within the same legal category. Its presence indicates that an industrial development mechanism remains available, but it does not tell us which productive functions are actually retained. The same is true of quasi-industrial zoning more broadly: permissive

regulation can absorb new kinds of work without necessarily protecting firms that depend on low rents, loading space, noisy processes, or large amounts of floor area.

We use the term productive palimpsest to describe this condition. The metaphor is useful only if erasure is taken as seriously as accumulation. Seongsu contains traces of large factories, small workshops, housing, apartment factories, KICs, adaptive reuse, new makers, headquarters, and consumer spaces, but these layers do not occupy equal positions in the land market. Their coexistence is temporal and spatial, yet also distributive. The flexibility of the zoning regime allows successive reinterpretations of industry; it can also make lower-margin forms of production the easiest layer to overwrite.

1.1. Industrial Land, Productive Urban Sustainability, and the Palimpsest

The loss of urban industry is often narrated as a consequence of economic restructuring, yet planning research shows how strongly the process is mediated by land policy and property markets. Industrial districts provide adaptable premises, supplier proximity, entry points for small firms, and spaces for activities that do not compete well in highest-and-best-use calculations [3,19,20]. The problem is not solved by choosing between a protected mono-functional enclave and unrestricted mixed use. Contemporary production frequently combines fabrication, research, design, logistics, retail, and customer interaction. Recent work on mixed making spaces argues for flexible and granular zoning frameworks capable of accommodating these combinations [21], while research on large German cities shows that legal compatibility alone does not resolve operational conflict or industrial gentrification [22]. Rigid separation can obstruct hybrid production, but permissive mixed use can remove the affordable and operational spaces on which it depends [4,5]. The Brussels case is instructive because formally mixed zoning has not prevented industrial gentrification where production faces stronger bidders for land [23].

Work on new industrial urbanism and vertical factories likewise suggests that dense cities need not choose between industry and urbanity [24–27]. Production, prototyping, research, management, and public-facing functions can be stacked or combined when buildings provide the less visible infrastructure that material work requires: goods lifts, floor loading, power, ventilation, waste handling, servicing, and access for freight. Balsas extends this argument from the building to the district, treating centrally located industrial territories as inherited infrastructure that can be retrofitted rather than cleared for a supposedly more advanced use [28]. Korea's KIC sits directly within this debate. Architecturally it can operate as a vertical industrial building; institutionally its eligible tenant range also includes knowledge and information-communications industries, venture firms, and supporting uses [18]. The category is useful precisely because it is hybrid, but the permit itself cannot stand in for evidence of material production.

For this study, productive diversity means more than a mixture of land uses. It refers to the co-presence of capacities to make, repair, prototype, store, distribute, design, coordinate, sell, and maintain goods, together with a range of firm sizes, rent levels, and building types. A district of housing, offices, cafes, and cultural venues may be highly mixed while depending on distant production and logistics. Conversely, an industrial district may contain considerable productive diversity even if conventional land-use categories describe it rather simply. Productive urban sustainability depends on whether this repertoire can remain available through successive rounds of redevelopment, rather than on the preservation of any one historical industrial composition. The productive palimpsest adds time and unevenness to this idea. Earlier capacities may remain active, survive only as spatial potential, or disappear as new layers arrive. Table 1 specifies five dimensions used to connect the concept to the empirical analysis: temporal accumulation, functional composition, spatial capacity, distributional power, and environmental relevance. The

fifth dimension is deliberately bounded: the study identifies functions with potential environmental relevance but does not measure their environmental performance.

Table 1. Analytical dimensions of the productive palimpsest.

Dimension	Question	Evidence Used Here	Interpretive Use
Temporal accumulation	Which earlier industrial and urban layers remain operational?	Historical reconstruction; building regimes; use approvals	Distinguish persistence from replacement across successive development phases
Functional composition	Which material, knowledge, circulation, consumer, and residential functions coexist?	Establishments and workplace employment by industry	Distinguish productive diversity from generic service-sector variety
Spatial capacity	Which premises can still accommodate material work?	Factory and KIC approvals; prior building studies; selected interviews on production-space requirements	Read legal industrial floor area against loading, power, ventilation, goods access, and adaptability
Distributional power	Which activities are most able to remain as land values rise?	Sector decline/growth; office-led development shift; selected interviews on tenure and relocation; policy incentives	Treat flexibility as unevenly accessible rather than socially neutral
Environmental relevance	Which retained functions could plausibly support repair, reuse, shorter logistical circuits, or resource recirculation?	Manufacturing, repair, and transport/storage trends; spatial-capacity evidence; environmental literature	Identify potential sustainability relevance without claiming measured carbon, material-flow, or life-cycle effects

The environmental implications are treated with the same caution. A recent systematic review finds substantial arguments linking urban manufacturing to carbon, resource, and space efficiency, but also emphasizes that empirical validation remains uneven across contexts [7]. Circular-economy research similarly emphasizes repair, reuse, remanufacture, and the retention of material value [29], but the presence of urban factories is not evidence of circular material flows. Such claims require environmental and transaction data that are not available here [30]. The more limited point is spatial: repair, small-batch production, resource recovery, iterative prototyping, and urban logistics need premises that can accept materials, machinery, freight, and storage. Once those capacities leave a high-value central district, rebuilding them is difficult. Research on Melbourne shows the centrifugal displacement of circular-economy employment [31], while work on Paris links logistics sprawl to longer delivery movements [32]. These studies do not establish Seongsu's environmental performance; they indicate why retaining productive capacity in central locations can form one dimension of metropolitan sustainability.

1.2. Seoul's Quasi-Industrial Areas and Seongsu's Metropolitan Position

Seoul's quasi-industrial areas are legacies of the city's rapid postwar industrialization. Unlike peripheral industrial estates organized around strict functional separation, many were absorbed into the expanding urban fabric and became interwoven with housing, commerce, and infrastructure. As large-scale manufacturing decentralized from the 1980s onward and metropolitan land values rose, these areas became increasingly exposed to residential, office, and commercial redevelopment. Their contemporary significance lies in this inherited institutional position: they remain industrial use regions under the planning system while occupying locations that are now embedded in a dense, service-oriented metropolis [10,17,33,34]. Recent Seoul-wide research also shows that commercial gentrification interacts with residential and non-residential land prices in spatially

differentiated ways, underscoring the importance of reading land-use change together with property-market dynamics [35].

Commercial redevelopment in Seongsu has also mobilized the visual identity of the industrial landscape. Shin and Pae's study of the Red Brick Landscape Preservation Project shows how post-industrial imagery can be selectively used as a place-branding resource even when its relationship to site-specific industrial histories is ambiguous [36]. This distinction between the persistence of industrial image and the persistence of productive function is central to the present argument. Commercial and cultural valorization can proceed without the formal disappearance of industrial zoning, allowing the landscape of production to remain legible while the economic capacity for production changes underneath it.

Seongsu represents a particularly concentrated version of this condition. Located east of central Seoul between the Han River and Jungnangcheon, the district is closely connected to major employment and consumer markets on both sides of the river. Its combination of former large-factory parcels, fine-grained workshop blocks, transport access, and a continuing quasi-industrial designation has made it attractive not only to manufacturers but also to firms combining design, research, management, distribution, and retail [10–17]. This metropolitan position helps explain why Seongsu's transformation differs from simple peripheral deindustrialization. Recent Seoul-wide and Seongsu-specific research indicates that the same centrally located land has become increasingly valuable for office, commercial, and higher-density redevelopment [35,36], but the present study does not estimate the effect of land prices or rents on individual manufacturers. For international comparison, Seongsu is therefore most useful as a case where legal industrial continuity, commercial valorization, and economic restructuring proceed simultaneously.

1.3. Quasi-Industrial Zoning and Knowledge Industry Centers

Korea's statutory planning system divides urban land into residential, commercial, industrial, and green use regions, with subcategories that regulate permissible uses and development intensity [33]. The statutory Korean term 준공업지역 is translated as 'quasi-industrial area' in the official English planning framework; 'semi-industrial area' is also common in Korean planning scholarship, including studies of Seongsu [10]. This article uses 'quasi-industrial' when referring to the legal zoning category. The quasi-industrial zone belongs to the industrial family but accepts a wider combination of non-industrial uses than exclusive or general industrial zones. In Seoul this has allowed light industry, housing, commerce, and later office-like productive functions to occupy the same regulatory territory [34]. Seongsu received its quasi-industrial designation in 1964 and developed through the Ttukdo land-readjustment project [10,17]. The category was not conceived as contemporary lifestyle mixed use. Its starting point was an industrial district in which supporting urban uses were also possible. That historical direction matters: production was constitutive of the zone, even though later development repeatedly broadened what counted as an acceptable industrial future.

Apartment factories, later renamed knowledge industry centers, became the most visible vertical reinterpretation of this framework. Under the Industrial Cluster Development and Factory Establishment Act and its Enforcement Decree, KICs may house manufacturing as well as designated knowledge industries, information–communications industries, venture firms, and supporting facilities [18]. This breadth enables firms that combine making, software, research, design, and management to remain at an industrial address. It also creates room for office-like occupancy within an industrial development category. The analytical consequence is straightforward: KIC floor area is evidence that an industrial building regime remains active, but it is not a direct measure of material

manufacturing. Actual tenant functions, ownership structure, management rules, loading and goods access, and building performance matter more than the label alone.

Research on the Seoul metropolitan area provides an important institutional precedent for this interpretation. Lee and Jung found that land-use planning variables, including semi-industrial zoning and regulatory changes that enabled KIC development, significantly influenced the growth and location of knowledge-intensive services [37]. That finding provides a metropolitan institutional context in which knowledge-intensive services can locate within semi-industrial areas, but it does not identify the tenancy of Seongsu firms in KICs. At the same time, KICs participate directly in metropolitan property markets. A 2024 study of 435 sales transactions across 23 Seongsu KICs treats the building type as a differentiated real-estate asset whose price responds to locational and building characteristics [38]. This does not establish displacement, but it reinforces the need to understand KICs as both industrial-policy infrastructure and property-market instruments.

Recent policy makes this reinterpretation explicit. In January 2026, Seongdong-gu approved the expanded Seongsu IT-Culture-Content Industrial and Distribution Development Promotion District plan, identifying 80 recommended industries across IT, R&D, and cultural-content sectors and including measures for both new and existing industries [39]. On 3 September 2026, Seoul formally gazetted the Seongsu quasi-industrial district-unit plan after the July Urban-Architecture Joint Committee approval [40]. Together, these measures show the strategic potential of a flexible industrial use region: new forms of production and employment can be accommodated without repeated wholesale rezoning. Yet adaptability should not be confused with strategy. The same regulatory openness can expose printers, repair shops, footwear subcontractors, warehouses, and metal workshops to higher-value substitution even while they remain legally permitted. Strategic planning therefore begins where regulatory flexibility ends: with decisions about how additional development value, productive-space performance, and affordability are related to the productive capacities that the city intends to retain.

The analysis asks three related questions: (1) how quasi-industrial zoning has accommodated successive forms of production and urban use through Seongsu's industrial history; (2) what recent business, building-development, published spatial, and selected qualitative evidence reveal about the retention and erosion of different productive capacities; and (3) what these patterns imply for the strategic planning of productive urban sustainability in high-value metropolitan industrial districts. Seongsu is treated as a critical single case rather than a representative sample. Its value lies in making a mechanism visible: an industrial designation can remain formally intact while the economic and spatial content of production is being recomposed.

The paper makes three related contributions. Empirically, it provides a longitudinal reading that examines business change alongside the statutory reach of KICs and the changing composition of completed development, while keeping sectoral growth, KIC development, and actual tenancy analytically separate and triangulating these forms of evidence with published parcel- and building-based studies and a limited re-analysis of IRB-approved interviews. Conceptually, it uses the productive palimpsest less as an image of attractive hybridity than as a way of asking which productive capacities persist, which are replaced, and under what conditions. For planning, it distinguishes regulatory flexibility from strategic direction: flexible zoning preserves a range of possible productive futures, while strategic planning concerns how redevelopment rights, incentives, spatial standards, and affordability are used to steer those possibilities toward a durable productive repertoire. The argument remains narrower than a causal estimate of zoning effects, but it offers a mechanism and an evaluation framework that can be tested in other high-value industrial districts.

2. Materials and Methods

2.1. Case Design and Study Boundary

The research uses a critical single-case design. Seongsu is not presented as statistically representative of industrial districts in Seoul or elsewhere. It is selected because several mechanisms that are often studied separately are visible in the same place: a long-running quasi-industrial designation, repeated building and policy reinterpretations, persistent manufacturing, rapid growth in knowledge-intensive employment, KIC development, adaptive reuse, and recent office intensification. The case therefore supports analytical rather than statistical generalization.

For statistical consistency, the study aggregates four administrative dongs: Seongsu 1-ga 1-dong, Seongsu 1-ga 2-dong, Seongsu 2-ga 1-dong, and Seongsu 2-ga 3-dong. Their official gross areas are 1.98, 0.89, 1.18, and 1.03 km², respectively, for a combined 5.08 km² [41]. The 2026 industrial-promotion boundary covering the Seongsu quasi-industrial territory is 2,051,234 m² [39]. On a gross-area basis, the quasi-industrial territory corresponds to approximately 40.4% of the four-dong administrative study area. When non-buildable land, principally Seoul Forest, other green/open-space areas, and river-related non-buildable land, is excluded from the denominator, the quasi-industrial territory accounts for approximately 53.8% of Seongsu's buildable land. The difference between the two figures reflects the denominator used rather than a discrepancy in the zoning boundary. The business statistics nevertheless describe the economy of the wider four-dong Seongsu area, not a parcel census of the quasi-industrial zone. Residential and other non-industrial buildable areas remain included in the aggregate, so the analysis does not estimate a causal effect of zoning. Figure 1 visualizes the spatial mismatch, while the two overlap measures distinguish the gross administrative boundary from the buildable-land context.

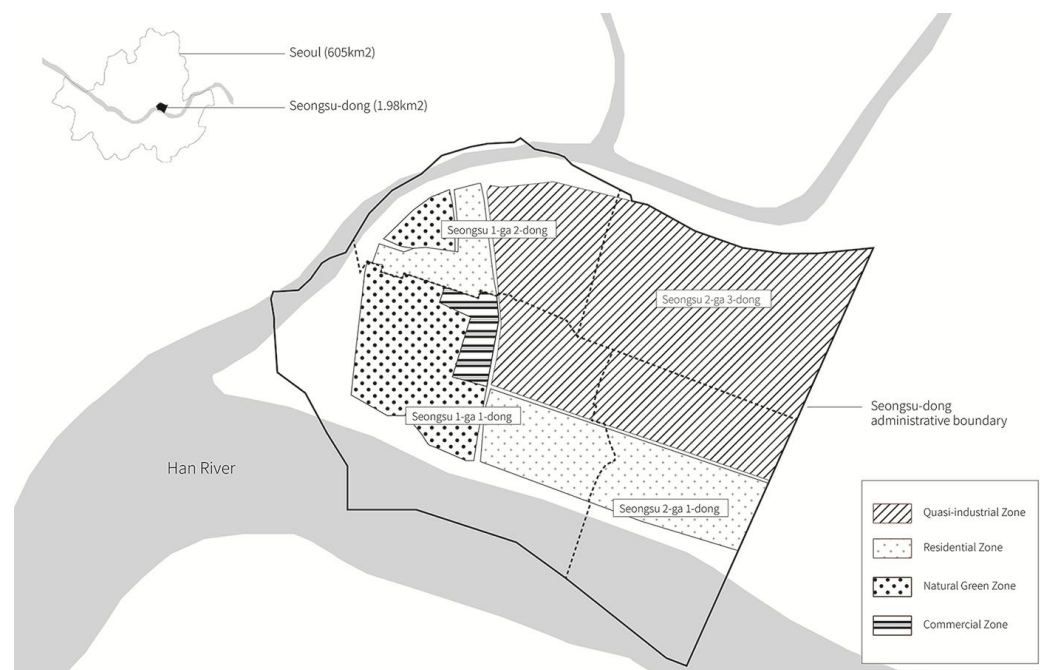


Figure 1. Study area and zoning structure of Seongsu-dong. The map shows the mismatch between the administrative boundaries used for statistical aggregation and the quasi-industrial zoning boundary, including residential and green areas within the study area. The quasi-industrial territory represents approximately 40.4% of the gross four-dong administrative area and 53.8% of buildable land. Source: Authors' drawing based on land-use zoning information from the Ministry of Land, Infrastructure and Transport and administrative-boundary data from the Seoul Metropolitan Government. Figure 1 was prepared using Adobe Illustrator (version 30.8).

2.2. Business Data Processing and Analytical Indicators

Annual Seongdong-gu business reports provide published establishment and workplace-employment tabulations for reference years 2015–2024 [42]. The source workbooks were downloaded from the district’s official statistical archive. For 2015, the detailed sheet titled ‘산업 세세분류, 동별’ was used; for 2016–2024, the corresponding sheet titled ‘2. 산업세세분류별 동별 현황’ was used. In each annual file, only the four administrative dong listed in Section 2.1 were retained. Counts were then summed across the four dong by exact Korean Standard Industrial Classification (KSIC) code. Because the source is already an aggregated administrative table rather than establishment-level microdata, no individual firms were merged or deduplicated. Original Korean codes and labels are retained in the Supplementary Materials; English labels were harmonized for readability. No missing values were imputed. Data cleaning, aggregation, tabulation, and descriptive calculations were performed using Microsoft Excel for Microsoft 365.

The series contains an important break. From reference year 2020, the national Census on Establishments moved to a registration-based population that expanded coverage to businesses without a separate physical workplace, including some home-based online businesses and one-person activities [43]. Pre-2020 and post-2020 levels are therefore not treated as one continuous series. We compare 2015–2019 and 2020–2024 as separate internally comparable intervals and use the ten-year sequence only to show broad direction. The same caution is applied to employment. Manufacturing subdivisions are harmonized at the two-digit level and change is reported separately for the two intervals; the Supplementary Materials records these decisions.

Three calculations are used repeatedly. Percentage change is calculated as $((X_{t1} - X_{t0})/X_{t0}) \times 100$ within each comparable interval. Employment share is sector workplace employment divided by total workplace employment in the four-dong study area for the same reference year, multiplied by 100. For the recent five-digit analysis, absolute employment change is $E_{2024} - E_{2020}$. Industries are ranked by positive absolute employment change only among five-digit codes present in both endpoint files; unmatched endpoint codes are excluded from this ranking rather than treated as zero. The full set of matched codes is retained in the Supplementary Data. The functional crosswalk groups manufacturing, water/waste/material recovery, and transport/storage as material production and distribution; information/communications and professional/scientific/technical services as knowledge/content activities; and wholesale/retail, accommodation/food, and arts/recreation as consumer-facing activities. Other divisions are reported but remain analytically unassigned.

The five-digit comparison is used to examine recent industrial recomposition rather than to construct a new sector taxonomy. Growth industries are compared with the statutory scope of KIC eligibility [18]. This is an institutional comparison, not a tenant-location analysis. Without establishment-level addresses, the analysis cannot claim that every software, advertising, research, or design firm counted in Seongsu occupies a KIC. It can show only whether the sectors growing in the district fall within or broadly correspond to statutory KIC eligibility categories; it cannot show whether KICs are their actual locations, whether firms entered Seongsu through KIC development, or whether KIC supply caused their growth. The classification rules, endpoint matches, excluded unmatched codes, and source-file provenance are reported in Supplementary Data S1 and Tables S1–S3.

2.3. Building Use-Approval Data: Processing, Classification, and Indicators

The built-form analysis uses monthly Seongdong-gu use-approval registers compiled by the authors [44]. Records were included when the site address was in Seongsu-dong 1-ga or Seongsu-dong 2-ga and the use-approval date fell between 1 January 2016

and 31 December 2025. Construction type was normalized into new construction, extension, major repair, and change in use. Some monthly source extracts overlap in date coverage; repeated observations were identified by matching approval date, site address, normalized construction type, main use, and reported area fields, and one canonical record was retained while source multiplicity was recorded. Nineteen repeated rows were removed in the master compilation before restricting the analysis to the 2016–2025 study window. The processed file retains source filename, source table title, and source row so that classifications can be traced back to the administrative record.

The main development-flow analysis uses only records normalized as completed new construction. This avoids treating the full gross floor area of a building appearing in an extension, major-repair, or change-of-use approval as newly supplied floor area. New construction is classified into six analytical groups: KIC, general office, housing, commercial/neighborhood facility, culture/education/welfare, and other. A record is classified as KIC only when ‘knowledge industry center’ (지식산업센터) is explicitly stated in the accessory-use field; other legally classified factories are not automatically counted as KICs. The ‘other’ category retains residual factory, automobile-related, warehouse/logistics, and other uses not assigned to the five named groups. Category share is calculated as category new-construction gross floor area divided by total new-construction gross floor area in the relevant period, multiplied by 100. The two comparison periods are 2016–2020 and 2021–2025.

2.4. Historical, Spatial, and External Validation

The quantitative material is read against a sixty-year historical and institutional reconstruction based on planning law, research on the Ttukdo land-readjustment area, studies of Seongsu’s industrial networks and morphology, adaptive-reuse research, public industrial-promotion records, KIC registers, and the authors’ earlier published work [10–18,33,34,39,40,45–47]. These sources are used to identify temporal and spatial transformation pathways rather than to create a parcel-complete historical inventory. The international literature frames mechanisms and planning questions; it is not treated as evidence of direct equivalence between Seongsu and other cities.

Two independent Seongsu-specific studies are used as external validation rather than merged into the authors’ administrative datasets. Choi, Lee, and Lee analyze property ownership, land use, building permits, and building registers to trace physical transformation and ownership-led redevelopment in Seongsu [48]. Kim and Kim use semi-structured surveys and field investigation to document migration patterns and local change among Leather Street shopkeepers under commercial gentrification [49]. These sources provide stock-based and localized checks on the direction of interpretation, while remaining analytically separate from the authors’ administrative datasets.

2.5. Interview-Based Qualitative Triangulation

To provide ground-level validation of mechanisms suggested by the longitudinal business and development data, the study selectively re-analyzes interview material collected between July and September 2024 under a research project approved by the Institutional Review Board of Seoul National University (IRB No. 2308/001-023). The broader project, led by H.Y.C., interviewed adult business operators in Seongsu, and all participants provided informed consent for academic research and publication. An earlier publication based on the broader interview corpus used twenty in-depth interviews to develop a typology of cultural manufacturers and their adaptive strategies [15].

The present article does not reproduce that typology or any interview quotations published in the earlier chapter. Instead, four interviews from the approved corpus are selectively re-examined for a distinct set of validation questions that emerged from the

quantitative analysis: (1) short lease horizons, rent escalation, and relocation pressure; (2) physical requirements of material production, including water, drainage, ventilation, dust or slurry handling, and goods movement; (3) the operational suitability of KICs for material work; and (4) the persistence or thinning of local supplier networks. The four cases comprise a small-scale brewery, a material-design workshop, a cosmetics and soap producer, and a letterpress studio. Evidence is reported as anonymized paraphrase rather than reused quotation and is used only for mechanism-level triangulation, not to estimate prevalence or represent Seongsu's manufacturing population. Table 2 summarizes the principal evidence sources, processing decisions, analytical uses, and interpretive limitations of the study.

Table 2. Evidence, processing decisions, analytical use, and interpretive limits.

Evidence	Inclusion and Processing	Derived Measures/Analytical Use	Principal Interpretive Limit
Business survey reports	2015–2024; retain four dong; aggregate published tabulations by exact KSIC code; no firm-level deduplication; split analysis at 2020 survey break	Establishments, workplace employment, shares, interval-specific change	Four-dong boundary includes residential and non-buildable land; quasi-industrial territory equals 40.4% of gross area and 53.8% of buildable land; 2020 enumeration break
Five-digit industries	Match 2020 and 2024 by five-digit code and label; exclude unmatched endpoints from ranked comparison; no imputation	Absolute employment change and institutional alignment with KIC eligibility	Does not identify actual KIC tenancy or firm address
Building use approvals	2016–2025 Seongsu 1-ga/2-ga; normalize construction type; remove repeated source observations; use new construction only for development-flow analysis	New-construction gross floor area and period composition	Flow, not current stock; no demolition, vacancy, rent, ownership, or tenancy
Planning/historical sources	Planning law, official plans, historical and morphological studies; triangulated by development phase	Institutional change and spatial transformation pathways	Coverage, boundaries, and classifications vary by source
External validation	Published property/building-registration analysis and Leather Street survey/fieldwork; not merged with primary datasets	Checks physical transformation, redevelopment, and localized relocation mechanisms	Different samples/periods; cannot validate all firms or sectors
Selected 2024 interviews	IRB-approved prior corpus (SNU IRB No. 2308/001-023); four cases selectively re-analyzed; anonymized paraphrase; previously published quotations and producer typology not reproduced	Mechanism-level triangulation of tenure pressure, productive-space requirements, KIC suitability, and supplier-network thinning	Purposive subset; not representative; cannot estimate prevalence or causal effects

3. Results

3.1. Industrial Formation and Fragmentation, 1960s–1990s

From 1964 through the late 1970s, Seongsu's industrialization followed Seoul's eastward expansion. The quasi-industrial designation and Ttukdo land-readjustment project created a framework able to receive large factories while also generating smaller parcels and workshops [10,17]. Monami, Samick Musical Instruments, Esquire, and Sindoricoh established or expanded facilities in the area, while footwear, printing, apparel,

machinery, and automobile-related businesses accumulated around them [11,12,17]. This was never a fully isolated industrial estate. Factories, worker housing, neighborhood commerce, workshops, and transport functions were interwoven from the outset.

During the 1980s and 1990s, metropolitan decentralization and industrial restructuring pushed many large plants outward. Their sites became available for apartments, schools, neighborhood facilities, and smaller firms. The change did not erase production uniformly. Fine-grained manufacturing persisted in subdivided lots and buildings. Footwear, for example, operated through specialized steps such as pattern making, cutting, sewing, soles, finishing, materials, and wholesale; printing and packaging relied on similarly fragmented subcontracting [11,12]. Residential insertion and micro-production thus developed together, leaving a fabric in which former large-factory land and small productive premises followed different trajectories.

3.2. Vertical Industrialization and Hybridization, 1990s–2010s

From the 1990s into the 2010s, apartment factories and later KICs introduced a vertical development regime. Small ownership units, goods lifts, shared management, and loading facilities made it possible to concentrate manufacturers and, increasingly, research, software, design, and professional firms in multi-story buildings. The Seongsu IT Industrial Development Promotion District formalized this direction in 2010, and Seoul's 2013 program explicitly linked advanced industries with footwear, printing, and automobile repair [46]. Calling this phase 'industrial upgrading' is only partly accurate. The same building type can support prototyping and material production or, depending on unit design, management, and tenancy, drift toward office use. KICs are better read as infrastructure for recomposition than as a simple substitute for the factory [47].

From the 2010s onward, commercialization worked through a building stock already marked by these earlier industrial and residential layers. Studies of adaptive reuse document both complete commercial conversions and production-showroom hybrids [13,14]. Industrial form acquired exchange value as an image—large spans, exposed structure, loading doors, brick—but some of the same physical qualities continued to support sampling, making, display, and events.

New small-batch manufacturers, consumer brands, design-led makers, food producers, and cultural manufacturers also found reasons to enter Seongsu: industrial permissions, supplier knowledge, adaptable premises, logistics access, and proximity to customers [15,16,50–52]. Their presence should not be used to cancel the measured decline of legacy manufacturing. It shows instead that inherited industrial capacity continued to have value for new combinations of production and market testing.

3.3. Office-Led Intensification and Spatial Overwriting in the 2020s

The most recent layer is more capital-intensive. Headquarters and large office buildings in fashion, entertainment, technology, and consumer industries have added employment in design, content, management, and professional services, along with demand for packaging, media, events, and delivery. Their arrival coincides with parcel consolidation and a development environment in which low-rise productive premises face stronger redevelopment alternatives; the present dataset does not itself estimate the resulting rent or land-price effects. This office-led intensification overlaps with, rather than simply replaces, the commercial valorization of Seongsu's post-industrial image described in recent redevelopment research [36]. By the mid-2020s, Seongsu had not moved cleanly from an industrial to a service economy; material production, knowledge work, corporate investment, and urban consumption were competing within the same regulatory territory.

Across the historical and spatial evidence, five recurring transformation pathways operationalize the 'palimpsest' as an empirical typology rather than a metaphor alone: (1)

large factory parcels converted to housing, schools, and neighborhood facilities after industrial decentralization; (2) fine-grained workshops retained or subdivided for footwear, printing, repair, and other micro-production; (3) industrial parcels intensified vertically through apartment factories and KICs; (4) industrial buildings converted to commercial or cultural use, sometimes retaining production–showroom hybrids; and (5) low-rise productive parcels redeveloped toward office and consumer-facing uses. These pathways coexist geographically and temporally, so layering refers to the simultaneous survival of some inherited capacities and the replacement of others, not to uninterrupted accumulation.

A current parcel-level example makes the fifth pathway concrete. In June 2026, Seoul conditionally approved the redevelopment of Seongsu-dong 2-ga 277-10, a 4348.8 m² site occupied by a three-story aging automobile-repair factory, into a 15-story office-led complex with neighborhood facilities and an incentive-supported floor-area ratio of about 560% [53]. The project is a planning approval rather than a completed building and is therefore not included in the 2016–2025 completion-flow statistics. It is used here only as a documented example of how a productive parcel can be overwritten by an office-oriented layer while remaining inside the quasi-industrial planning framework.

3.4. Industrial Contraction and Selective Manufacturing Change

The workplace economy of the four-dong study area grew considerably over the period. It contained 11,100 establishments and 86,663 employees in 2015, 13,000 establishments and 103,871 employees in 2019, and 18,225 establishments and 122,504 employees in 2024. The jump between 2019 and 2020 cannot be read as sudden firm creation because the enumeration framework changed. The within-period movements are more informative.

Manufacturing moved downward in both comparable intervals. Establishments declined from 3182 to 2873 between 2015 and 2019 (−9.7%) and from 3704 to 2542 between 2020 and 2024 (−31.4%). Workplace employment fell from 22,986 to 21,391 in the first interval (−6.9%) and from 20,938 to 18,983 in the second (−9.3%). The break in method prevents a single decade-long rate from being calculated, but it does not change the direction of the finding.

Manufacturing also became a smaller part of Seongsu’s employment base: 26.5% of workplace employment in 2015, 20.6% in 2019, 17.8% in 2020, and 15.5% in 2024. The district still has a large manufacturing workforce, but manufacturing no longer structures the local economy to the degree that it did at the start of the series. Table 3 summarizes the changing composition of workplace employment across selected industry divisions over the two comparable survey intervals.

Table 3. Workplace employment by selected industry division. The 2020 survey-basis break prevents direct level comparison across 2019–2020. Source: authors’ aggregation of annual Seongdong-gu business reports [42].

Industry Division	2015 Employees	2019 Employees	2020 Employees	2024 Employees	2024 Share
Manufacturing	22,986	21,391	20,938	18,983	15.5%
Wholesale & retail	16,942	18,844	22,861	22,315	18.2%
Transport & storage	3355	3668	4196	3599	2.9%
Accommodation & food	3634	4899	4766	6824	5.6%
Information & communications	7166	10,942	15,602	19,656	16.0%
Professional, scientific & technical	7403	13,463	15,870	18,549	15.1%

The contraction was not uniform. Leather, bags, and footwear employment declined from 3089 to 2531 in 2015–2019 (−18.1%) and from 2368 to 1523 in 2020–2024 (−35.7%).

Fabricated metal fell from 1619 to 1152 (−28.8%) and from 1192 to 799 (−33.0%); machinery and equipment from 1394 to 1265 (−9.3%) and from 1398 to 987 (−29.4%); and textiles from 1217 to 887 (−27.1%) and from 1063 to 806 (−24.2%). Printing moved differently across the two intervals, increasing from 3830 to 4127 (+7.8%) before the survey break but declining from 3783 to 3098 (−18.1%) afterward. These branches have historically depended on affordable premises, loading, subcontracting, skilled manual work, or equipment that is costly to relocate. Figure 2 shows the employment trajectories of selected industry divisions from 2015 to 2024.

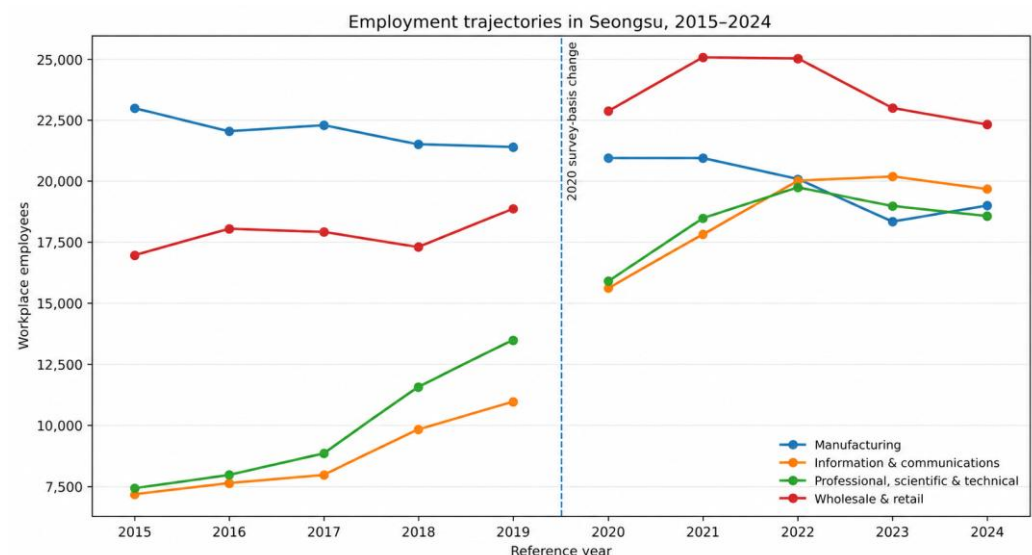


Figure 2. Employment trajectories in selected sectors, 2015–2024. Lines are intentionally broken between 2019 and 2020 because the survey enumeration basis changed in 2020. Source: Authors’ aggregation [42].

Several manufacturing branches expanded within both comparable intervals. Apparel and accessories increased by 15.0% in 2015–2019 and 30.8% in 2020–2024; chemicals by 55.4% and 22.5%; pharmaceuticals by 117.3% and 109.6%; and medical and precision instruments by 13.7% and 8.4%. Food employment was nearly flat in the first interval (−2.4%) but rose by 57.4% in the second. The result is recomposition rather than recovery. Growth in these branches did not offset the decline in manufacturing as a whole, and the available data do not establish local supplier relationships among them. Table 4 summarizes employment changes in selected manufacturing subsectors across the two comparable survey intervals.

The manufacturing pattern is compatible with differential exposure to redevelopment pressure, but it does not by itself demonstrate a rent-driven causal mechanism. The business dataset contains no lease levels, land prices, firm survival histories, or relocation records. The spatial requirements of the contracting branches nevertheless differ in ways that matter for redevelopment: footwear subcontracting, fabricated metal, machinery, and printing often depend on inexpensive space, loading, noise tolerance, or equipment that is costly to move, whereas some growing sectors can combine research, design, marketing, and customer-facing functions within more compact premises. The limited qualitative triangulation in Section 3.7 documents short lease horizons, repeated rent increases, active relocation searches, and production-space contraction among selected producers. Published fieldwork on Seongsu’s Leather Street independently documents shopkeeper migration and local change associated with commercial gentrification [49], while recent ownership research identifies a growing role for corporate and absentee owners in large, high-density development [48]. Together these sources strengthen the plausibility of a

property-market mechanism in specific parts of Seongsu, but neither the interview subset nor the published studies establish a sector-wide causal effect.

Table 4. Selected manufacturing-subsector employment within the two comparable survey intervals. Percentage changes are calculated separately for 2015–2019 and 2020–2024 because the establishment survey changed its enumeration basis in 2020. Source: Authors’ aggregation [42].

Manufacturing Subdivision	2015	2019	2015–2019 Change	2020	2024	2020–2024 Change
Leather, bags & footwear	3089	2531	−18.1%	2368	1523	−35.7%
Fabricated metal	1619	1152	−28.8%	1192	799	−33.0%
Printing & recorded media	3830	4127	+7.8%	3783	3098	−18.1%
Machinery & equipment	1394	1265	−9.3%	1398	987	−29.4%
Textiles	1217	887	−27.1%	1063	806	−24.2%
Apparel & accessories	2736	3147	+15.0%	3056	3998	+30.8%
Food	675	659	−2.4%	969	1525	+57.4%
Chemicals	368	572	+55.4%	716	877	+22.5%
Pharmaceuticals	202	439	+117.3%	282	591	+109.6%
Medical & precision instruments	844	960	+13.7%	964	1045	+8.4%

Figure 3 compares interval-specific employment changes across selected manufacturing subsectors, keeping the 2015–2019 and 2020–2024 periods analytically separate.

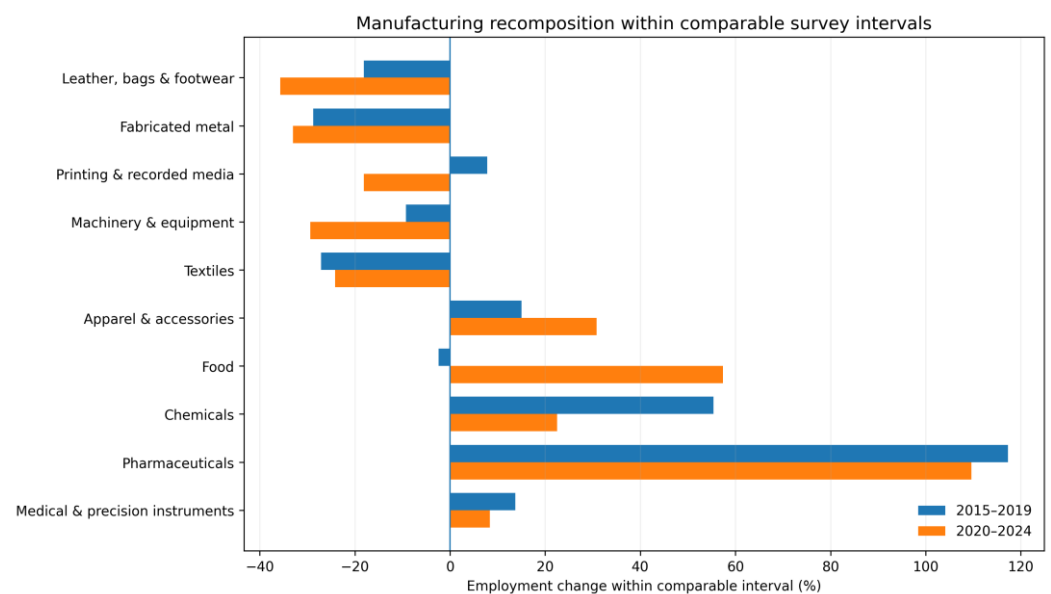


Figure 3. Interval-specific employment change in selected manufacturing subsectors. Changes are calculated separately for 2015–2019 and 2020–2024 to avoid treating the 2020 survey-basis break as a continuous series. Source: Authors’ aggregation [42].

3.5. Growth of Knowledge, Content, and Circulation Activities

The clearest counter-movement is the rise in knowledge and content work. Information and communications employment increased from 7166 in 2015 to 10,942 in 2019 and from 15,602 in 2020 to 19,656 in 2024. Professional, scientific, and technical services rose from 7403 to 13,463 in the first interval and from 15,870 to 18,549 in the second. In 2024 the two divisions together employed 38,205 people, roughly twice the manufacturing workforce.

The five-digit comparison gives this shift a more concrete form. Between 2020 and 2024, applied software added 2252 employees, e-commerce retail 1156, advertising agencies 1127, systems software 876, talent management 630, coffee shops 626, architectural services 412, and medical and pharmaceutical R&D 347. Software, R&D, architecture and engineering, and several knowledge-service activities fall within or broadly correspond to statutory categories eligible for KIC occupancy; coffee shops and restaurants are better understood as support and consumer-interface activities, while e-commerce requires more cautious classification. This comparison concerns statutory eligibility only and does not identify the buildings in which the counted establishments are located.

This correspondence supports an institutional, not locational or causal, inference. The business data show that several sectors expanding in Seongsu overlap with activities permitted under the KIC regime. They do not show that those firms occupy KICs, entered Seongsu through KIC development, or grew because of KIC supply. Establishment-level address and tenant data would be required to test those relationships directly. Table 5 summarizes selected recent growth industries and their broad correspondence with statutory KIC eligibility categories, without implying actual KIC tenancy or a causal relationship between KIC development and employment growth.

Table 5. Selected recent growth industries and broad correspondence with statutory KIC eligibility categories. The final column is a classification comparison only: it does not report establishment location or actual KIC tenancy, and the observed employment growth cannot be attributed to KIC occupancy or KIC development. Source: Authors' aggregation [18,42].

Industry (KSIC Five-Digit)	2020 Employees	2024 Employees	Change	Broad Statutory Correspondence (Classification Only; Not Tenancy)
Applied software development and supply	3637	5889	+2252	Knowledge/ICT activity
E-commerce retail	3001	4157	+1156	Conditional; not a core industrial activity in every case
Advertising agencies	1522	2649	+1127	
Systems software development and supply	4500	5376	+876	Knowledge/ICT activity
Talent and artist management	511	1141	+630	Culture/content-related; eligibility depends on classification
Coffee shops	895	1521	+626	Support/consumer activity
Architectural services	1947	2359	+412	Knowledge/professional–technical activity
Medical and pharmaceutical R&D	292	639	+347	R&D/knowledge activity

Transport and storage add another layer to the picture. Establishments increased from 890 to 907 between 2015 and 2019 and from 1196 to 1313 between 2020 and 2024, while employment moved from 3355 to 3668 and then from 4196 to 3599. The combination of more establishments and flat or declining employment points toward smaller average firm size rather than a clear expansion of large logistics facilities.

Individual freight-vehicle operators account for part of that change, rising from 548 establishments and 559 employees in 2020 to 849 establishments and 864 employees in 2024. The district still contains a circulation economy, but these figures cannot establish whether warehouses, parcel terminals, or loading infrastructure have been retained. Facility-level classification would be required for that claim. Here transport and storage are treated as an urban-supporting function whose organizational form appears to be changing.

3.6. Development Flows and the Changing Built Environment

Completed new construction between 2016 and 2025 totaled 1,586,878 m². KICs accounted for 712,271 m² (44.9%), general offices for 313,091 m² (19.7%), housing for 236,540 m² (14.9%), commercial and neighborhood facilities for 100,948 m² (6.4%), and culture, education, and welfare for 32,528 m² (2.1%). The KIC share is large enough to show that an industrial development vehicle remained central to Seongsu's recent build-out. Because KICs accommodate a wide range of eligible activities, however, this floor area cannot be read as factory growth.

The period comparison is more revealing than the total. In 2016–2020, KICs represented 49.3% of new-construction floor area, housing 20.9%, offices 10.0%, and commercial/neighborhood facilities 3.2%. In 2021–2025, offices rose to 43.5% and commercial/neighborhood uses to 14.0%, while KICs fell to 34.5% and housing to 0.5%. The center of gravity shifted from vertical industrial/knowledge buildings and residential insertion toward headquarters, offices, and consumer-facing development.

The period shift is central to the interpretation of development flow, but it is not evidence of net stock replacement. Seongsu has not undergone a simple rezoning from industry to another use; several development categories continue to coexist within the quasi-industrial territory. What the approvals show is that the composition of completed new construction became much more office- and consumer-oriented after 2020. Whether this flow produced a one-for-one loss of material-production stock cannot be determined from approvals alone.

Because Table 6 reports development flow, we use an independent registry-based study as a partial stock check rather than converting approvals into a stock estimate. Choi, Lee, and Lee's analysis of Seongsu reports 930 registered buildings in 2023 and 358,876 m² of factory, warehouse, and automobile-service gross floor area still present, while noting that this category's share declined as KIC, office, and neighborhood-commercial floor area increased [48]. Their longitudinal ownership analysis also reports that KIC gross floor area held by corporate owners increased from 18,371.0 m² in 2017 to 205,464.1 m² in 2020, while corporate and absentee owners were disproportionately associated with larger and higher-density developments [48]. The study boundary, classification system, and observation period differ from ours, so these values are not merged with Table 6. They nevertheless provide stock-based triangulation for the directional interpretation that industrial continuity and office/commercial intensification are occurring together.

Table 6. Completed new-construction floor-area composition, 2016–2025. Exact values are retained in the table because they support reproducibility; these data measure development flow rather than current building stock. Source: Authors' compilation [44].

Use Category	2016–2025 New Construction	Share	2016–2020 Share	2021–2025 Share
Knowledge industry center	712,271 m ²	44.89%	49.30%	34.53%
Office	313,091 m ²	19.73%	10.01%	43.49%
Housing	236,540 m ²	14.91%	20.90%	0.47%
Commercial/neighborhood	100,948 m ²	6.36%	3.23%	14.00%
Culture/education/welfare	32,528 m ²	2.05%	2.17%	1.76%
Other	191,500 m ²	12.06%	14.39%	5.75%
Total	1,586,878 m ²	100.00%	100.00%	100.00%

3.7. Ground-Level Validation of Productive-Space Pressures

The selected interviews are not used to infer frequencies across Seongsu. Their role is narrower: to test whether mechanisms suggested by aggregate employment and

development data appear in concrete producer experiences. The four cases reveal distinct but related pressures on tenure, operational compatibility, and local production networks.

Tenure pressure is most explicit in the small-scale brewery case. The producer, which entered Seongsu in 2022, reported one-year lease renewals and rent increases of approximately 5% at each renewal. After the first increase, the firm began searching within Seongdong-gu for a manufacturing unit of comparable scale and price but reported finding no suitable alternative, eventually widening the search beyond the district. The interviewee also reported that two of the seven or eight small producers in an earlier local group had already moved their production outside Seongdong-gu. This single case does not establish a district-wide rent trend; it does show how short lease horizons and affordability can become concrete relocation mechanisms for small producers.

Operational fit emerges separately from legal eligibility. A material-design workshop working with concrete and mixed materials described production requirements that include water, drainage, sludge handling, dust management, ventilation, and surfaces that can tolerate dirty fabrication. The interviewee had considered KIC units but regarded typical office-oriented layouts, mechanical-ventilation constraints, and restoration obligations as poorly matched to this process. The case supports the distinction between a building's legal capacity to host manufacturing and its practical capacity to accommodate particular forms of material work.

Building-level redevelopment can also contract productive capacity without formal rezoning. A cosmetics and soap producer described having expanded its production space over several years before the commercial repositioning and renovation of its former building led the owner to request that the firm leave. The producer eventually reduced its production footprint and reconfigured another space to meet manufacturing-permit requirements, including separated rooms, ventilation, electrical capacity, and water services. The case illustrates how spatial overwriting can occur through property-level repositioning even when manufacturing remains legally permissible in the wider district.

The letterpress case adds a network dimension. The studio was located in Seongsu partly because specialized services such as cutting-die fabrication, plate making, and paper cutting remained nearby. At the same time, the interviewee contrasted this network with the denser printing ecosystem of Euljiro, noting that many Seongsu suppliers had disappeared and that the remaining services were more dispersed, sometimes requiring truck-based rather than short-distance circulation. Productive infrastructure therefore persists, but in a thinner and more spatially fragmented form.

Taken together, these cases give ground-level content to the analytical dimensions in Table 1. Spatial capacity is function-specific rather than captured by industrial floor area alone; distributional power includes lease duration, affordability, and the ability to secure replacement premises; and productive networks can survive in attenuated form even as supplier density falls. Because the four cases are a purposive secondary-analysis subset, they validate mechanisms rather than their prevalence and do not establish a causal relationship between redevelopment and district-wide manufacturing decline.

4. Discussion

4.1. *Unequal Industrial Recomposition and Productive Urban Sustainability*

Taken together, the evidence does not support either a simple post-industrial reading or a narrative of secure manufacturing-led regeneration. Almost 19,000 manufacturing jobs remained in 2024, several manufacturing branches were growing, and industrial development vehicles continued to account for a large share of new floor area. Yet manufacturing declined in both comparable intervals, its employment share fell, long-established branches contracted sharply, and recent development became increasingly office-led.

Industrial recomposition describes this combination more accurately than either survival or disappearance. What is changing is not only the number of factories, but the sectoral content of work, the building types through which firms enter, and the relation between production and land value. Software, R&D, advertising, content, and corporate management add employment and may create demand for prototypes, packaging, media, and events. They do not reproduce the same skills, loading requirements, rent structures, or subcontracting networks as footwear, metalworking, machinery, and printing. Growth in one productive layer is not an equivalent replacement for loss in another.

The palimpsest is useful here because it makes room for unequal persistence. Seongsu's large factories, micro-workshops, housing, KICs, reused buildings, makers, headquarters, and cultural uses have accumulated over time, but new layers also remove or weaken earlier ones. The district remains heterogeneous because enough of the older fabric still survives to support different kinds of activity. The recent office-led flow suggests that this repertoire is not guaranteed to remain as broad as it is today.

The findings can be mapped directly back to the five analytical dimensions in Table 1. Sections 3.1–3.3 demonstrate temporal accumulation through the coexistence of retained workshops, vertical industrialization, adaptive reuse, and office-led overwriting. Sections 3.4 and 3.5 show functional recomposition: material manufacturing contracts unevenly while knowledge and content activities expand. KIC ambiguity, development-flow evidence, and the material-workshop interview address spatial capacity because legal industrial floor area does not reveal whether premises support drainage, ventilation, freight, waste handling, or other production-specific requirements. The uneven contraction of space-intensive branches, published evidence of localized relocation and ownership-led redevelopment [48,49], and the limited interview evidence on lease renewal and relocation give the transformation a distributional dimension. Section 3.7 also shows that inherited supplier networks can persist in a thinner, more fragmented form. Environmental relevance remains the most limited dimension: the continued presence of repair, manufacturing, transport, and storage identifies capacities that could matter for reuse or shorter logistical circuits, but no carbon, resource-flow, or life-cycle performance is measured here.

Read through the lens of urban sustainability, the relevant issue is not whether Seongsu preserves an earlier industrial composition unchanged. Industrial transformation can add new productive capacities, and knowledge-intensive activities can strengthen employment and innovation. The narrower sustainability claim tested here is whether successive rounds of redevelopment leave the metropolis with a sufficiently broad repertoire of material, knowledge, repair, logistical, and supporting functions. Recent Korean evidence that inner-urban industrial development can support brownfield reuse, employment density, and job-housing proximity reinforces the value of keeping industrial capacity within the city [8]. Seongsu adds a distributional test to that argument: which forms of production remain spatially and economically accessible after intensification? Environmental performance is not inferred from this evidence.

Quasi-industrial zoning should therefore be understood as a capacity for adaptation rather than a guarantee of productive diversity. It can accommodate new forms of work without requiring wholesale conversion to residential or commercial zoning, a role consistent with the Seoul metropolitan evidence on knowledge-intensive services [37]. It does not decide which firms receive investment, which can afford the resulting land values, or whether an industrial building remains operationally suited to material work. Seongsu makes the difference between spatial permission and economic survival especially clear.

4.2. From Regulatory Flexibility to Strategic Planning

Seongsu suggests a distinction between regulatory flexibility and strategic planning. Quasi-industrial zoning creates an institutional capacity to accommodate economic change because it does not prescribe one fixed relation among manufacturing, knowledge work, logistics, commerce, and other urban uses. This resembles recent calls for more flexible and granular planning frameworks for mixed making [21]. Strategic planning, however, concerns the prioritization and steering of trajectories under conditions of scarcity and competing claims on urban land [9]. In Seongsu, the zoning category leaves several productive futures open; it does not determine which of them should persist.

KICs are central to this distinction. Treating them as ordinary offices disguised as factories would miss their capacity to support genuinely hybrid firms, prototyping, laboratories, shared services, and vertically organized production. Their statutory and spatial capacity to host hybrid productive activities is real, but the present datasets do not show how much of Seongsu's observed knowledge-intensive employment is actually located in KICs. KIC development therefore should not be credited with absorbing the measured sectoral growth without tenant-level evidence.

At the same time, KIC supply is not a sufficient measure of productive retention. A software company, design office, food producer, printer, laboratory, and prototype workshop may all occupy the same statutory category while making very different demands on the building. Only some require goods lifts, heavy floor loading, ventilation, waste handling, loading, or extended operating hours. If tenant functions and spatial performance are not monitored, office-oriented firms can gradually dominate a building that continues to count as industrial floor area.

The interview material adds operational specificity to this distinction. The material-design workshop did not reject vertical industrial space in principle; rather, its concerns centered on drainage, ventilation, dust and slurry management, and the practical consequences of working in an environment predominantly organized around cleaner office-like occupancy. This suggests that productive-space performance should be evaluated by the requirements of actual processes rather than inferred from statutory building type alone.

The implication is not to restore a narrow twentieth-century definition of manufacturing. Contemporary production is hybrid, and the breadth of KIC eligibility is part of what allows it to evolve. What is missing is a way to distinguish forms of occupancy and to ask whether the physical conditions for material work are actually retained.

Table 7 does not introduce a separate set of empirical findings; it synthesizes planning implications derived from the evidence above. Material capacity follows from the decline of space-intensive manufacturing, the ambiguity of KIC floor area, and the production-space requirements documented in Section 3.7. Access and tenure are included because the aggregate datasets contain no district-wide rent series, while the selected interviews and published Seongsu research document short lease horizons, relocation searches, property-market pressure, and localized migration [48,49]. Tenant function follows from the broad legal eligibility of KICs and, separately, from the district-wide growth of knowledge-intensive sectors; because the two datasets are not linked at the establishment level, this juxtaposition is a monitoring rationale rather than evidence of actual KIC tenancy. Inherited building stock is grounded in the historical and adaptive-reuse pathways in Sections 3.1–3.3. Urban-supporting functions follow from the continued but changing repair, transport, storage, and supplier-service economy, and long-term trajectory follows from the split-period employment trends and the shift in new-construction composition. Table 7 should therefore be read as a strategic monitoring framework for steering regulatory flexibility, not as a claim that all listed indicators were measured systematically across the district.

Table 7. Productive-performance dimensions for hybrid industrial districts.

Evaluation Dimension	What Should Be Observed	Why It Matters	Possible Planning Response
Material capacity	Loading, goods lifts, floor load, water and drainage, power, ventilation, dust/slurry/waste handling, operating compatibility	Nominal industrial floor area may function as ordinary office space	Link incentives and approvals to productive-space performance where appropriate
Access and tenure	Rent, lease duration and renewal terms, unit size, relocation search, small-firm survival	Flexible zoning does not protect low-margin firms from land-value pressure	Use development incentives to secure affordable and appropriately sized productive space
Tenant function	Shares of material production/prototyping, R&D/design, ICT, general office, and support uses	KIC designation does not reveal what happens inside the building	Introduce periodic tenant-function reporting or representative monitoring
Inherited building stock	Condition, retrofit potential, subdivision, servicing, fire and accessibility upgrades	Robust industrial buildings may remain useful even when their current use changes	Support productive retrofit where retention is preferable to demolition
Urban-supporting functions	Repair, logistics, storage, specialized supplier services, resource-handling capacity, and service radius	These activities can be displaced even when they remain legally permitted	Coordinate operational sites and access at district or metropolitan scale
Long-term trajectory	Manufacturing employment, subsector survival, KIC tenancy, office approvals, affordable productive floor area	A mixed-use snapshot can conceal directional loss of productive capability	Monitor change longitudinally rather than relying on land-use mix at one date

The flexibility paradox is therefore a strategic planning problem. The same openness that allows new productive sectors to enter also permits economically weaker productive activities to disappear. The planning task is not to eliminate this openness or freeze the district in a twentieth-century industrial composition, but to connect redevelopment rights and incentives to productive-space performance, affordability, tenant-function visibility, retrofit, and metropolitan support functions. Balsas's retrofit strategy for centrally located industrial land is complementary to this position [28]: Seongsu shows that productive displacement can occur even without formal rezoning, through the internal flexibility of an industrial category itself. Evidence from German planning likewise suggests that enabling mixed productive environments does not by itself resolve industrial gentrification [22].

4.3. Transferability, Asian Metropolitan Context, and Limits of the Single Case

Seongsu is not offered as a universal model. Several conditions are case-specific: the Korean KIC legal regime, Seoul's quasi-industrial zoning system, the district's 1964 designation and land-readjustment history, its exceptionally high metropolitan accessibility, and the 2026 incentive framework. The transferable contribution is narrower and mechanism-based. It concerns the possibility that (a) formal industrial designation can remain while productive content changes; (b) flexible zoning can legally accommodate knowledge-intensive activities without wholesale rezoning, although actual building-level tenancy must be established independently; (c) higher-value redevelopment can co-exist with continued but declining material production; and (d) industrial retention therefore needs to be evaluated through productive performance and long-term trajectory rather than land-use labels alone. These propositions require testing, not direct transplantation, in other cities.

Recent Asian research on industrial land transformation often evaluates redevelopment through land-use efficiency, brownfield reuse, innovation, and industrial structure upgrading. In South Korea, inner-urban high-tech industrial parks have been associated with more compact brownfield development and higher employment density than peripheral greenfield models [8]. In China, a recent panel study of 284 cities finds that land redevelopment can promote industrial structure upgrading through innovation agglomeration and consumption expansion [54]. These are important outcomes, but Seongsu suggests an additional sustainability criterion: which productive capacities remain available to the metropolis after upgrading has occurred? A district can become more innovative, employment-dense, and economically valuable while simultaneously losing material functions that are difficult to re-establish once displaced.

Three questions follow from the case. First, hybrid industrial districts need to be read longitudinally; a current land-use map cannot show whether diversity came from accumulation or replacement. Second, legal industrial designation needs to be separated from productive performance, particularly in vertical factories, innovation districts, maker districts, and mixed employment zones. Third, diversity has a distributional dimension: new high-value firms can increase employment and functional variety while displacing lower-margin activities that remain important to the wider city.

These propositions can be tested in other central industrial territories, including Brussels' mixed productive areas, London's industrial land, Melbourne's cultural-manufacturing districts, and North American innovation districts [3,6,23]. The comparison with Bal-sas's U.S. Sunbelt case is particularly useful because it identifies the conversion of centrally located industrial land as a strategic planning problem [28]. Seongsu reveals a related but institutionally distinct process: productive displacement can occur while industrial zoning remains formally intact. Comparative work could therefore ask not only whether industrial land is retained, but whether flexible zoning produces a durable repertoire of productive spaces or a temporary passage toward office homogenization.

The evidence sets clear limits on what can be claimed. The four-dong statistical boundary is substantially larger than the quasi-industrial territory. The latter represents approximately 40.4% of the gross administrative study area but approximately 53.8% of buildable land once non-buildable green/open-space and river-related land is excluded. The aggregate business trends still include residential and other non-industrial buildable areas, so they should not be read as a parcel-level census of the quasi-industrial zone. The 2020 change in the business census prevents a single continuous decade-long establishment series. Industry classifications establish co-location, not firm-to-firm transactions or material flows. Building approvals measure completed development flow rather than current stock, demolition, rents, vacancy, or tenant composition. The independent building-registry study used for triangulation has different boundaries and classifications and is not merged with the authors' dataset. The four interview cases are a purposive subset of a previously collected IRB-approved corpus and are used only to validate specific mechanisms; they cannot estimate how common those experiences are across Seongsu. Most importantly, the current data do not identify which growing firms occupy KICs. The KIC analysis is therefore limited to statutory eligibility, KIC development-flow evidence, and selected operational observations; it does not establish a relationship between district-wide sectoral growth and actual KIC tenancy.

The combined validation strategy strengthens the interpretation without eliminating these limitations. Published property/building-registry analysis provides a stock-based check on physical redevelopment [48], published Leather Street fieldwork documents localized migration under commercial gentrification [49], and the selected interviews provide mechanism-level evidence on tenure, productive-space requirements, KIC suitability, and supplier-network thinning. The interview material was originally collected for an

earlier study of cultural-manufacturer resilience [15]; the present article re-analyzes different dimensions, does not reproduce that study's producer typology, and does not reuse its published interview quotations. Future work should combine parcel-level zoning and building-stock data with representative KIC tenant sampling, longitudinal rent and vacancy series, firm-survival and relocation records, and a purpose-designed longitudinal interview panel. Those additions would allow the causal and distributional mechanisms to be tested more directly.

5. Conclusions

Seongsu-dong is best understood as a productive palimpsest rather than as a district that has simply deindustrialized or successfully reindustrialized. Six decades of quasi-industrial zoning have accommodated large factories, small workshops, repair and circulation, housing, vertical industrial buildings, adaptive reuse, new makers, knowledge and content firms, headquarters, and consumer activity within the same changing territory. The persistence of this variety is significant, but it is not neutral.

The longitudinal evidence shows where the pressure is concentrated. Manufacturing employment declined in both comparable intervals, and footwear, metalworking, machinery, textiles, and printing lost substantial ground. At the same time, apparel, food, chemicals, pharmaceuticals, and precision instruments expanded selectively, while information, software, research, advertising, architecture, and other professional activities grew much faster. KICs accounted for a substantial share of completed new-construction floor area during the study period, while several rapidly growing knowledge-intensive sectors fall within or broadly correspond to statutory KIC eligibility categories. These are parallel findings from separate datasets: the business statistics do not identify actual KIC tenants, so sectoral growth cannot be used as evidence of KIC occupancy, and KIC expansion cannot by itself be treated as proof of manufacturing retention.

The qualitative triangulation adds a limited ground-level check on these aggregate patterns. Selected producers reported short lease horizons and relocation searches, production processes whose drainage, ventilation, and material-handling requirements fit poorly with office-oriented KIC environments, contraction of production space during commercial building repositioning, and supplier networks that persist in increasingly fragmented form. These cases do not establish prevalence, but they show how the statistical and spatial mechanisms can be experienced at the level of individual producers.

Retaining diverse productive capacity should therefore be understood as one dimension of urban sustainability. The claim is not that every urban factory is environmentally sustainable, nor that an earlier industrial composition should be preserved unchanged. It is that a metropolis depends on spatial capacity to make, repair, prototype, store, distribute, and maintain as well as to design, research, manage, and consume. When lower-margin material functions are lost from high-value central locations, re-establishing comparable spatial capacity can be difficult and costly; this study does not quantify the environmental consequences of that loss.

The flexibility paradox follows from this requirement. Quasi-industrial zoning has genuine adaptive value because it can absorb changing forms of work without a wholesale shift to residential or commercial zoning. Yet flexibility does not set a strategic direction. A low-margin workshop and a high-value office can both be legally compatible while facing very different prospects of remaining in place. Strategic planning must therefore connect regulatory openness to decisions about productive-space standards, affordable and appropriately sized premises, KIC tenant-function visibility, industrial retrofit, repair and logistics capacity, and the long-term monitoring of development trajectories. Seongsu's value as a case lies in showing that zoning can preserve the possibility of production without guaranteeing its distributional survival.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/land15101835/s1>, Data S1: Annual establishment and workplace-employment aggregation for the four-dong study area, 2015–2024; Table S1: Crosswalk between official industrial classifications and the three functional groups used in the manuscript; Table S2: Annual two-digit manufacturing-subsector establishment and workplace-employment series, 2015–2024; Table S3: Top 30 five-digit industries by absolute workplace-employment increase from 2020 to 2024 among codes present in both years. Additional data include the complete common five-digit-code comparison for 2020 and 2024.

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