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Manufacturing in the Metropolis: What Does Istanbul Produce and Where

Metropolde Üretim: İstanbul'un Üretim Alanları ve Ürünleri

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Abstract

The relationship between global city formation and manufacturing persistence challenges deindustrialisation assumptions in emerging global centres. This study examines Istanbul's industrial landscape through a data-driven spatial case study, incorporating 2021 firm-level data from the Istanbul Chamber of Industry (ISO) and GIS-based spatial analysis. Moving away from longitudinal tracking, the research employs a cohort-based approach to analyse the spatial distribution of 14,704 manufacturing establishments by their founding dates. The findings reveal a nuanced transformation characterized by spatial reorganization and technological specialisation rather than wholesale decline. Istanbul demonstrates a hybrid economic model where manufacturing not only persists but has largely emerged during the city's period of global integration, with over 80% of firms established after 2000. The analysis identifies intricate spatial clustering patterns along the D-100 and TEM transportation corridors, forming specialized production zones that complement global city functions. These findings necessitate a revisiting of linear transformation narratives in global city theory, demonstrating that manufacturing functions as a structural complement to the service economy in globalising metropolises rather than its casualty.

Keywords: Istanbul, Manufacturing, Global City, Spatial Analysis, Cohort Analysis, Industrial Persistence

Öz

Küresel kent oluşumu ile imalat sanayinin sürekliliği arasındaki ilişki, gelişmekte olan küresel merkezlerdeki sanayisizleşme varsayımlarına meydan okumaktadır. Bu çalışma, İstanbul'un özgün sanayi peyzajını, İstanbul Sanayi Odası'nın (İSO) 2021 yılı firma düzeyindeki verilerini ve CBS tabanlı mekânsal analiz yöntemlerini kullanarak veri odaklı bir vaka analizi çerçevesinde incelemektedir. Araştırma, 14.704 imalat işletmesinin mekânsal dağılımını, kuşak temelli (cohort-based) bir yaklaşımla kuruluş tarihlerine göre analiz etmektedir. Bulgular, imalat faaliyetlerinin topyekûn bir yok oluştan ziyade, mekânsal yeniden yapılanma ve teknolojik uzmanlaşma ile karakterize edilen nüanslı bir dönüşüm geçirdiğini ortaya koymaktadır. İstanbul, imalatın sadece devam etmekle kalmadığı, aynı zamanda işletmelerin %80'inden fazlasının 2000 yılından sonra olmasıyla, imalatın küresel entegrasyon sürecinde yeniden üretildiği hibrit bir ekonomik model sergilemektedir. Analizler, D-100 ve TEM ulaşım koridorları boyunca küresel kent işlevlerini tamamlayan uzmanlaşmış üretim kümelerinin varlığını ortaya koymaktadır. Bu bulgular, küresel kent teorisindeki doğrusal dönüşüm anlatılarının yeniden ele alınmasını zorunlu kılmakta; imalatın küreselleşen metropollerde hizmet ekonomisini tamamlayan yapısal bir unsur olarak işlev gördüğünü somut biçimde ortaya koymaktadır.

Anahtar Kelimeler: İstanbul, İmalat Sanayi, Küresel Kent, Mekânsal Analiz, Kuşak (Kohort) Analizi, Endüstriyel Süreklilik.

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INTRODUCTION

The relationship between the emergence of global cities and the spatial distribution of manufacturing activities is a topic of ongoing debate in global urban studies for over three decades. While early theoretical frameworks, largely shaped around the seminal works of Sassen (1991), Friedmann (1986), and Taylor (2004), associated global city formation with a dramatic shift toward advanced service sectors and the erasure of industrial activities from the metropolitan landscape, contemporary empirical evidence suggests more diverse and non-linear pathways of urban development (Parnreiter, 2019; Indraprahasta et al., 2018; Kleibert, 2017; Krijnen et al., 2017; Zhang and Peck, 2016). This is particularly evident in cities outside the North Atlantic area, where deindustrialization and industrial persistence often occur simultaneously, challenging the assumption of a uniform process of economic transformation (Hill and Kim, 2000; Ma and Timberlake, 2013; Olds and Yeung, 2004; Zhang, 2014; Timberlake et al., 2014).

Istanbul, as a primary economic gateway representing approximately one-third of Turkey's GDP and a quarter of its industrial output, offers a significant case for examining these spatial dynamics. Despite its integration into global networks as a regional headquarters and logistics hub, the city has not experienced a terminal manufacturing decline. Instead, Istanbul presents a hybrid development pattern (Yetişkul and Demirel, 2018) characterised by the spatial reorganization of manufacturing activities rather than their wholesale displacement (Sayın et al., 2022).

Moving from this perspective, the objective of this study is to provide an empirical understanding of the contemporary spatial and structural patterns of Istanbul's manufacturing industry using a 2021 firm-level dataset. To achieve this, we employ a data-driven spatial case study design, utilizing Geographic Information Systems (GIS) to analyse 14,704 unique manufacturing establishments registered with the Istanbul Chamber of Industry (ISO). By focusing on sectoral dynamics and firm age cohorts, the research investigates how the city's manufacturing base has adapted to a rapidly changing metropolitan landscape.

The findings reveal complex patterns of industrial reorganization, showing that manufacturing activities not only persist within the inner peripheries but also expand along major transportation corridors toward the city's rural edges. This research contributes to scholarly conversations on industrial resilience in emerging global cities by providing empirically grounded evidence of manufacturing persistence. Istanbul's experience underscores the need to reconsider the coexistence of production and service functions in contemporary urban contexts, moving beyond traditional deindustrialization narratives.

The paper is structured into four main parts. Following this introduction, the historical evolution of Istanbul's manufacturing industry is summarized to provide context for its current state. The methodology section details the geocoding and cohort-based spatial analysis processes. The empirical section presents the spatial distribution and sectoral compositions of manufacturing activities in 2021. Finally, the study concludes by synthesizing the empirical evidence of Istanbul's hybrid industrial model to refine contemporary urban theories and providing targeted directions for future research on manufacturing resilience in emerging global cities.

THE HISTORICAL EVOLUTION OF ISTANBUL'S MANUFACTURING INDUSTRY

The evolution of Istanbul's manufacturing sector resists the conventional paradigms of deindustrialisation typically observed in Global North metropolises (Pike, 2022; Yetişkul and Demirel, 2018; Schindler et al., 2020). Instead, it is better characterized as a "simultaneous and complex process of decentralization and recentralization" (Scott et al., 2001: 18), where industrial activities relocate within the city-region rather than disappearing. Moving away from universal linear models, Istanbul's trajectory suggests a hybrid transformation where manufacturing adapts to global city functions through spatial reorganisation. This development reflects what contemporary urban studies define as variegated pathways of global city formation, particularly prevalent in emerging economies where industrial persistence remains a structural feature of metropolitan growth. Therefore, it is imperative to take into account the local experience of Istanbul together with the more general political and economic

changes taking place at the national level as well as the city's growing integration into international economic networks in order to reach a more accurate knowledge.

Imperial Heritage and Mid-Century Industrialisation

Unlike many other late-industrialised cities, Istanbul began its industrialisation process during the late Ottoman period, resembling 19th-century European industrialisation in many ways, albeit on a different scale and at a different pace. The city's initial industrial geography was shaped by three primary factors: waterfront access, proximity to rail infrastructure, and availability of non-Muslim entrepreneurial networks. During the nineteenth century, the city functioned as the Ottoman Empire's primary interface with the global economy, hosting more than half of the empire's industrial output (Quataert, 1992). Early industrial Istanbul was structured spatially in three main zones. The main industrial corridor with shipyards, foundries, and manufacturing workshops turned out to be the Golden Horn district. Like other port cities during the era, this concentration followed a classic waterfront industrialisation trend. Developed along the Marmara Sea coast, especially in Zeytinburnu and Bakırköy where textile mills and chemical plants predominated, the second industrial zone evolved. Around the Oriental Railway's end in Yedikule, the third zone emerged where rail access helped the food processing and machinery sectors to flourish (Tekeli, 2013).

The founding of the Turkish Republic in 1923 started a notable change in the industrial scene of Istanbul. Three linked events helped to shape this change: political driven industrial decentralisation, the rise of state-run manufacturing facilities, and the conversion of abandoned industrial sites. Aiming to modernise the economy, the new republican government's strategy of state-led industrialisation mostly favoured the development of Ankara and surrounding cities rather than Istanbul (Evsile, 2018; Eskidemir et al., 2019). Particularly affected by this policy change was the Golden Horn industrial corridor, where between 1923 and 1940 almost 40% of major manufacturing companies closed or moved (Tekeli, 2013). Istanbul's industrial capacity suffered greatly during this time when industrial buildings closed, particularly those owned by non-Muslim Ottoman citizens and foreigners.

New industrial sites and companies did, however, also start to arise during this time. While established businesses including textiles, shipbuilding, and leather manufacture continued in the Golden Horn area, new state-owned manufacturers for food processing, tobacco, and consumer goods started running in Beşiktaş and Beyoğlu (Doğan, 2013). Along the Marmara coast, new state-sponsored industrial districts arose, most famously the Bakırköy Textile Factory built in 1937, which developed an integrated industrial complex including worker accommodation and social facilities (Akgöz, 2023). Along the Sirkeci-Halkalı railway line, a new industrial axis evolved with an emphasis on food processing and light manufacturing, which would later become vital in the western industrial growth of the city. The Prost Plan in 1937 formalised this spatial reorganisation by designating particular areas for manufacturing activities and representing the first deliberate attempt at industrial planning by design, although implementation remained limited.

The period between 1950 and 1980 represents two distinct phases in Istanbul's industrial development. The 1950s marked the transition to a multi-party democratic system and liberal economic policies, while the 1960-1980 period was characterised by state-led import substitution industrialisation (ISI) (Pamuk, 2024). This dual character fundamentally shaped both the scale and spatial organisation of Istanbul's manufacturing sector.

In the 1950s, liberal economic policies promoting private sector involvement and foreign investment led to initial industrial growth, shifting industrial investments to Istanbul, in contrast to the early republican statist economic policies that sought to relocate industrial production to Anatolian cities (Yıldız, 2020). This strategic shift has significantly enhanced the city's manufacturing capability, with new firms forming, particularly in private sector investments in the automotive, equipment, chemical, and consumer products sectors (Güvenç, 1993; Erbaş, 2018). To express this shift quantitatively, while a mere 20% of Turkey's manufacturing facilities were situated in Istanbul in 1950, this figure climbed to 46% by the late 1970s (Uğur et al., 2019).

Planned industrial development and the application of ISI policies in the 1960s hastened industrialisation. Although the Anatolian side has witnessed a comparatively higher degree of planning, areas such as Ümraniye, Maltepe and Kartal, on the Anatolian side, and Bayrampaşa, Gaziosmanpaşa and Kâğıthane, on the European side, which are characterised by extensive public lands and a pronounced rural settlement character, have undergone a transformation into major industrial zones (Akın, 2012; Şahin, 2015). Workers' quarters, primarily informal and unplanned (refer to Gecekondu), emerged around the new industrial zones, leading to the transformation of these industrial areas into new peripheral districts through their integration with residential neighbourhoods. Meanwhile, a significant number of traditional industrial facilities in the Golden Horn, Topkapı and Bomonti relocated to emerging peripheries, mostly due to rising housing costs and deteriorating infrastructure and the lower costs of new industrial zones (Doğan, 2013).

The establishment of five large industrial zones in the initial quarter of the period had a significant impact on the spatial development of industry, as well as shaping the production pattern and sectoral clusters (Yüzer and Giritlioğlu, 2003). Significant changes in industrial organisation were witnessed, with the average size of manufacturing firms increasing from 45 workers in 1950 to 125 in 1980. This phenomenon can be attributed to the predominance of large-scale, vertically integrated production units, a characteristic that was particularly prominent during the ISI period (Pamuk, 2024). Concurrently, sectoral clustering trends initially manifested in various metropolitan areas from the early stages of the period. Textile and clothing manufacturers were concentrated in inner-city areas such as Zeytinburnu, Merter and Güngören, while the automotive and machinery sectors had a notable presence along the E-5 corridor, particularly in Kartal, Maltepe and Gebze. The distribution of food processing plants exhibited a notable concentration in the Topkapı and Bayrampaşa regions, while chemical industries demonstrated a predominant presence in the Anatolian region, particularly in the districts of Tuzla and Gebze (Doğan, 2013).

Early Global Integration and Industrial Restructuring (1980-2000)

The 1980-2000 period marked a fundamental transformation in Istanbul's industrial geography, characterised by simultaneous processes of core area deindustrialisation and peripheral industrialisation. This spatial and structural reorganisation was intimately linked to Türkiye's transition from an import substitution strategy to global integration, accompanied by the lifting of import restrictions, an increase in foreign investment, and the establishment of a focus on export-oriented industries. Istanbul, the country's economic hub, was the primary driver of this transformation, resulting in a notable shift in the industrial landscape (Berköz and Eyuboğlu, 2007).

The transformation of traditional industrial zones was the most prominent in the two areas. The Golden Horn district experienced what might be termed "selective deindustrialisation", with more than 600 industrial establishments relocating in the post-1980 period (Bezmez, 2008). While large-scale facilities in shipbuilding, cement production, and heavy manufacturing moved, smaller manufacturers in metalworking and furniture production demonstrated greater adaptability and modified their operations to meet new environmental regulations. The Maslak-Büyükdere axis underwent an even more complete transformation, evolving from an industrial corridor into Istanbul's premier central business district through a systematic process of industrial relocation (1980-1985), infrastructure development (1985-1990), and service sector expansion (1990-2000) (Özdemir, 2002).

As the city centre underwent deindustrialisation, new industrial zones emerged along the TEM highway corridor, creating a second industrial ring (Tekeli, 2013). This peripheral industrialisation was anchored by three major planned industrial zones: the İkitelli Organised Industrial Zone (1980, 700 hectares), specialising in metalworking and machinery; the Dudullu Organised Industrial Zone (1983, 300 hectares), focusing on electronics and automotive components; and the Tuzla Organised Industrial Zone (1985, 500 hectares), dominated by chemical and pharmaceutical industries. This planned development was complemented by spontaneous industrial clusters, notably the Bağcılar-Güngören textile district (Hagemann, 2015) and Ümraniye electronics manufacturing zone (Temurçin and Aldırmaz, 2014).

The organisational structure of manufacturing underwent significant transformation during this period in a way that partly reflects the broader patterns of industrial reorganisation in globalising cities (Sayın, 2022). Large-scale integrated facilities characteristic of the import substitution era gave way to networks of smaller, specialised producers oriented toward export markets and global supply chains. This transformation was particularly evident in the emergence of industrial districts characterised by dense networks of small and medium-sized enterprises engaged in flexible production and subcontracting relationships. The new industrial organisation was arguably supported by the development of specialised infrastructure, including technical training centres, research facilities, and logistics complexes, particularly in peripheral industrial zones (Yüzer and Giritlioğlu, 2003).

This spatial and organisational restructuring created what might be termed "hybrid industrial spaces" where manufacturing activities coexisted with other urban functions. In inner-city districts such as Şişli and Beyoğlu, this took the form of mixed-use industrial buildings and combined production-retail spaces, whereas peripheral zones such as Beylikdüzü and Tuzla developed integrated industrial-residential complexes and manufacturing-logistics parks (Ayık and Avcı, 2018). This complex reorganisation laid the groundwork for Istanbul's contemporary industrial landscape, establishing enduring patterns of spatial distribution and production organisation that continue to shape the city's economic geography.

21st century globalisation – Rising Istanbul as a global city

Istanbul's post-2000 development presents an intriguing case of what might be identified as a form of hybrid globalisation (Sayın et al., 2022), in which global city functions coexist with sustained industrial activity. During this period, Istanbul solidified its position as Turkey's gateway to the global economy while emerging as a secondary global city, focusing on three primary functions: serving as regional headquarters for global corporations, functioning as a major transport and logistics hub, and developing financial service capabilities (Sayın, 2020). This development led to substantial economic growth, with the total economic output of the city increasing significantly over the years, except during the 2008 crisis. From 2004 to 2022, the city's total economic output rose from 150.57 billion TRY to 4.5 trillion TRY. The services sector experienced the most notable growth, claiming a dominant 38.7% share by 2022, as shown in Figure 1. However, the contribution of advanced services, such as IT, finance, and professional services, is still relatively modest, contrasting sharply with established global cities.

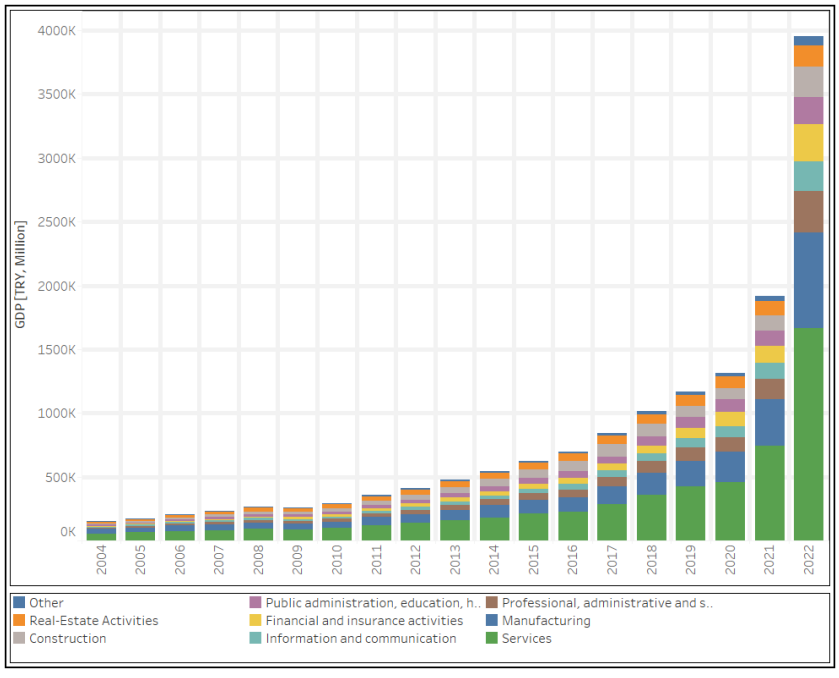

Figure 1 : GDP of Istanbul by Sectors (2004-2022) (TurkStat, 2023)

Throughout the 2000s, significant spatial and sectoral reorganisation occurred across metropolitan areas. Whereas the central business district along the Maslak-Büyükdere axis on the European side appeared to be a prominent hub, new business districts have emerged on the Anatolian side. The Bosphorus corridor and coastal areas have seen a transition toward tourism, entertainment, and real estate development, accompanied by the closure of traditional industrial facilities. However, growth in the service sector is largely driven by retail and wholesale trade activities, as illustrated in Figure 2.

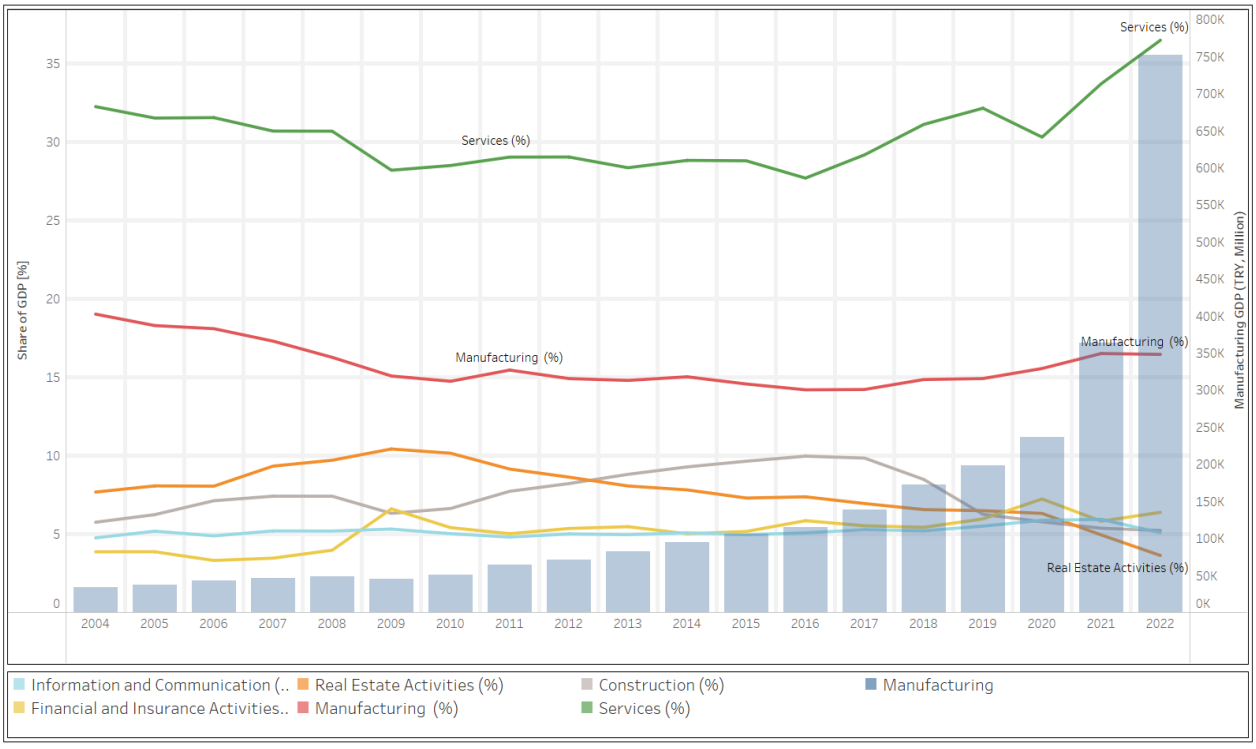

Figure 2: Manufacturing and Service Sector Growth (2004-2021) (TurkStat, 2023)

Despite this growth in the service sector, manufacturing has shown a remarkable resilience. Manufacturing production grew from 33 billion TRY in 2004 to 750 billion TRY in 2022, with particularly rapid growth in 2021-2022 reflecting post-pandemic recovery and reconfiguration of global supply chains. The sector has also undergone significant structural transformation, characterised by the emergence of small and medium-sized enterprises, increased production flexibility, and strong export orientation.

The contemporary industrial geography of Istanbul exhibits a layered pattern, in which different generations of manufacturing activities coexist. Traditional industrial districts have adapted through modernisation and specialisation, while new industrial districts have emerged along major transportation corridors, particularly the D-100 and TEM highways. These new industrial spaces are characterised by flexible production networks and strong export orientation, often integrating manufacturing activities with logistics centres, design studios, and trading operations.

This spatial reconfiguration has contributed to a polycentric urban structure, blurring the traditional distinctions between the city and the periphery. Current trends, particularly strong manufacturing growth in 2021-2022, suggest that Istanbul's hybrid economic character represents a stable development pattern rather than a transitional phase, necessitating policy frameworks that can accommodate both global city functions and modern manufacturing activities.

To summarise, while the traditional centre of the city underwent deindustrialisation processes during the 1960s and the 1970s due to rapid urbanisation, deepening through the 1980s and the 2000s with global integration, the overall manufacturing sector has not declined but rather experienced growth. The manufacturing industry is still crucial to the city's economy, maintaining Istanbul's position as the country's main industrial hub. While the service sectors have shown remarkable growth, this has been primarily driven by retail and wholesale trade activities rather than advanced service providers. Contrary to typical global city narratives, finance, insurance, and information and communications activities remain relatively insignificant in a city's economy.

METHODOLOGY

Research Design and Case Selection

This study employs a data-driven spatial case study design that integrates quantitative firm-level data with Geographic Information Systems (GIS) to examine the contemporary manufacturing landscape of Istanbul. By focusing on the 2021 industrial structure, the study provides a spatial cross-section of manufacturing persistence in a globalising city. Our methodological approach aligns with recent studies on urban manufacturing in global cities (Doussard et al., 2018; Zhang and Peck, 2016) while adapting their frameworks to Istanbul's specific context. Istanbul offers a fruitful ground to examine manufacturing persistence in globalising cities for several reasons. First, the city represents a significant share of Türkiye's economic output, contributing approximately one-third of the national GDP and one-quarter of the manufacturing production (TurkStat, 2023). Second, Istanbul's manufacturing sector has a strong export orientation and global integration, with the city's manufacturers generating 106 billion dollars in exports by 2021, representing 55% of Turkey's total manufacturing exports. Third, the timing of Istanbul's global city emergence – primarily post-2000 – offers an opportunity to examine manufacturing transformation during active global integration, rather than studying it retrospectively as with established global cities.

Data Sources and Collection

The empirical analysis draws on three primary data sources that together provide a comprehensive picture of Istanbul's manufacturing landscape. The core dataset consists of detailed, firm-level information from the 2021 records of ISO, which maintains the official registry of manufacturing establishments within the metropolitan area. The initial database contained information on 17,192 manufacturing firms; however, a rigorous data cleaning and validation process was conducted to ensure locational and operational accuracy. This process resulted in a final dataset of 14,704 unique manufacturing establishments. The reduction in the number of records primarily stemmed from the exclusion of duplicate entries, firms with incomplete or incorrect address data that prevented reliable geocoding, and entities whose primary activities were identified as non-manufacturing. This refined database provides granular information on firm characteristics, including age, size, ownership structure, industrial classification (NACE Rev.2), and technology intensity levels.

To complement the firm-level data, current and historical industrial land-use information was obtained from the Urban Planning Department of Istanbul Metropolitan Municipality (ŞPDB). These spatial data provide the necessary context for understanding the evolution of industrial zones and changes in manufacturing locations across the metropolitan area. Additionally, the study incorporates broader economic indicators from the Turkish Statistical Institute (TurkStat) and the Ministry of Industry and Technology, including sectoral GDP contributions, employment statistics, and export figures for the year 2021. While the reliance on official ISO and TurkStat data ensures a high degree of formal reliability, it is important to acknowledge that these sources focus on registered manufacturers. Consequently, the analysis reflects the formal industrial structure of the city and may not fully capture informal economic operations, which are particularly prevalent in sectors such as textiles.

Analytical Framework and Methods

The spatial analysis was structured into a series of interconnected stages designed to systematically uncover the contemporary dimensions of Istanbul's industrial geography with statistical rigor. The process initiated with the geocoding of the 2021 ISO dataset in ArcGIS, transforming textual address records into precise geographic coordinates to establish a high degree of positional reliability. Following this spatialization, Kernel Density Estimation (KDE) was employed as a non-parametric statistical technique to identify general industrial clustering patterns across the metropolitan area. This stage provided a foundational visualization of concentration and dispersion without imposing underlying distributional assumptions.

Building upon the general density patterns, the analysis incorporated a dual-layered approach for sectoral and technological differentiation. Firms were first classified by sector using NACE Rev.2 codes and subsequently categorized by technological intensity levels—high, medium-high, medium-low, and low—following the OECD classification guidelines. This differentiation allowed for a more comprehensive understanding of the spatial organization of technological specialization and the formation of specialized production zones within the urban fabric, rather than assuming the existence of innovative hubs based solely on technological grouping.

Finally, to address the historical layer of Istanbul's industrial landscape, a cohort-based spatial analysis was integrated to examine the distribution of firms by their founding dates. Rather than tracking individual firm migrations over time—which would require a longitudinal dataset—this study analyses the present-day spatial structure by categorizing firms into three age cohorts: those established before 1980, between 1980 and 2000, and after 2000. By applying Optimized Hot Spot Analysis (Getis-Ord Gi* statistic) in ArcGIS, statistically significant hot and cold spots were identified. This method reveals the historical traces of industrial persistence and recent peripheral expansion, providing a spatial cross-section of the city's evolving industrial morphology.

Methodological Limitations

Our methodological approach has several limitations that should be considered when interpreting the findings. Firstly, the data collected at the firm level only accounts for officially registered manufacturers, which leads to an underrepresentation of the overall manufacturing activity, particularly in sectors with a substantial presence of informal economic operations such as textiles. While this reliance on formal records ensures statistical rigor, the findings primarily reflect the structured industrial landscape of the city. Secondly, as the spatial analysis is based on a 2021 cross-sectional dataset, it does not track the individual migrations or year-by-year positions of firms over a historical time series. Consequently, while the cohort-based approach identifies spatial patterns of persistence and expansion by firm age, it cannot reveal the specific "decline" or "disappearance" of individual firms that occurred prior to the study period. Finally, although the spatial analysis effectively captures and visualizes locational patterns, it identifies the "where" rather than the "why" of industrial clustering. The causal factors and decision-making processes driving these spatial choices require further investigation, as the scope of this study remains focused on macro-spatial and structural patterns rather than qualitative behavioral analysis.

SPATIAL AND STRUCTURAL PATTERNS OF ISTANBUL'S MANUFACTURING INDUSTRY

The empirical findings of this study challenge the classical deindustrialization narratives often associated with global city formation by revealing the persistent and adaptive nature of manufacturing in Istanbul. While established global city theories suggest a linear transition from a production-based to an advanced service-dominated economy, the spatial and structural patterns identified in this research point toward a 'hybrid' model of urban development. This hybridity is evidenced by the continued concentration of diverse manufacturing activities along strategic transportation corridors and the emergence of new industrial cohorts even as the city integrates more deeply into global networks. The persistence of these industrial

patterns suggests that manufacturing is not a transitional remnant but a structural component of Istanbul's global functions, characterized by spatial reorganization and technological specialization rather than wholesale displacement.

Manufacturing Characteristics in a Globalising City

Istanbul presents a distinctive case of manufacturing persistence in a globalising city, challenging conventional assumptions about industrial decline in emerging global centres:

"Typical to large metropolitan areas, Istanbul tends to have a more diversified economic basis, with a higher share of services in its sectoral mix (about two-thirds), with an expansion of advanced services in the central city. But contrary to many OECD metro-regions, Istanbul maintains a sizeable manufacturing sector, specialised in relatively labour-intensive, low-technology activities, i.e., mainly textiles and supply chain. This sector represents 37% of the total labour force and 26% of GDP and around 80% of total exports. (OECD, 2008: 14)"

Our 2021 analysis confirms that the sectoral importance of manufacturing, underscored in the OECD report, remains robust. Manufacturing enterprises represent approximately 20% of the city's business landscape, ranking second only to wholesale and retail trade. In contrast, the high-order service sectors—finance, insurance, and information communications—collectively account for less than 10% of the total enterprises (İKA, 2022). Despite this structural significance, the 2021 profile reveals an industry that is predominantly small-scaled and relatively young. Approximately 90% of the 14,704 manufacturing establishments analysed are micro – and small-sized enterprises employing 50 or fewer workers, while large-scale heavy industries (250+ employees) constitute no more than 2% of the total (Ministry of Industry and Technology, Istanbul Provincial Directorate, 2021). Furthermore, a substantial majority of manufacturers in Istanbul are first – or second-generation family-owned enterprises. Our cohort analysis (Figure 3) shows that over 80% of these operating enterprises were established within the last two decades. This structural characteristic underscores that Istanbul's manufacturing sector is not a stagnant remnant of the pre-globalization era but has actively emerged and adapted alongside the city's rise as a global hub.

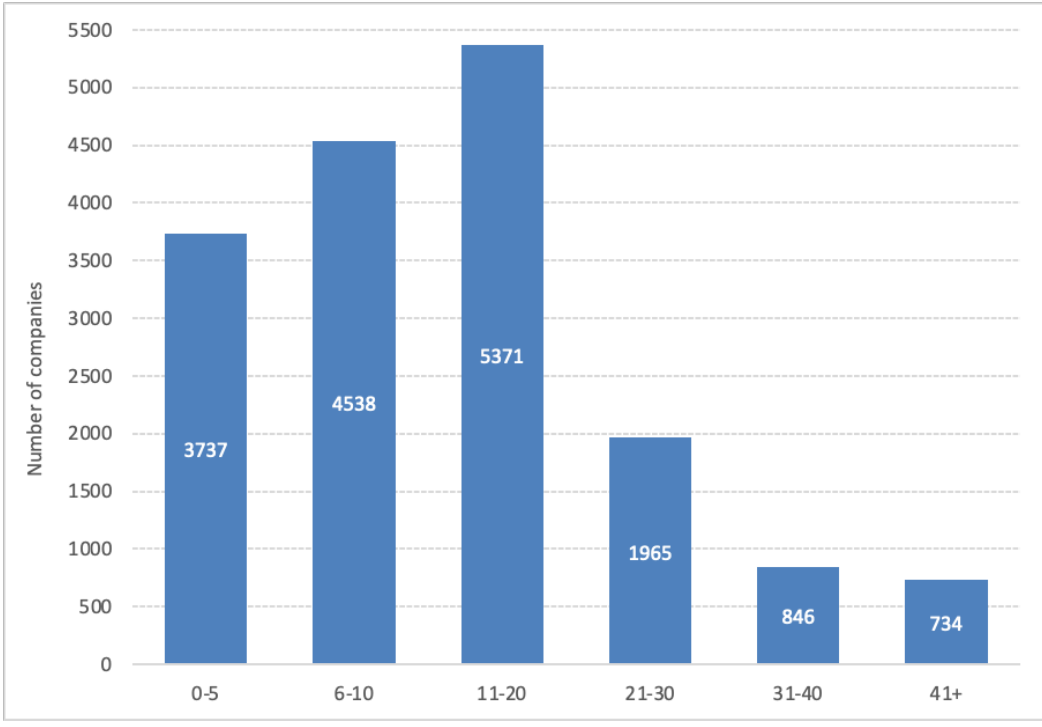

Figure 3: Istanbul's Manufacturers by Age Group 2021 (ISO, 2021)

The employment profile of Istanbul's manufacturing sector reflects, in general, similar patterns to those observed in globalising metropolises in emerging economies (Schindler et al., 2020). More than 70% of total manufacturing employment is concentrated on two primary light industries: textiles, and the production of basic metals, along with several tools and machinery. In the sector, only one-third of the total number of registered workers have obtained a university degree or higher qualification, while approximately half have only received primary or secondary education (İBB, 2020). A significant proportion of the workforce, estimated at almost 80%, are engaged in blue-collar occupations, with the majority of these workers receiving compensation that is either at the minimum wage or below (Ministry of Industry and Technology, Istanbul Provincial Directorate [MoIT-Istanbul], 2022). Furthermore, the sector's importance is likely understated in official statistics due to the prevalence of informal employment, with unregistered workers constituting 20.6% of male and 36.1% of female total employment, particularly concentrated in the textile manufacturing sector (BETAM, 2022). Recent increases in migrant labour have suggested even higher actual industrial employment levels (Pinedo Caro, 2020).

The technological classification of Istanbul's manufacturers reflects the company and labour profiles of the sector (Figure 4). An analysis of firms by technological intensity shows that only 2.35% (346 firms) utilise high-technology processes, while 20.16% (2,964 firms) employ medium-high technology. Firms with medium-low levels of technological production capability account for 22.68% (3335) of the total number of enterprises. The majority operate at lower technological levels, with 51.22% (7352) in the low-technology category. This distribution largely confirms the views that Istanbul's manufacturing industry is more focused on production activities and less on research, development and design, however, the presence of a significant medium-technology segment (42.84% combined medium-high and medium-low) also suggests that there is a potential for technological advancement, particularly in sectors integrated with global production networks.

Technology Usage	Sectors	Number of Companies
Low Technology	Beverages	45
	Food products	876
	Furniture	502
	Leather and related products	470
	Other manufacturing	600
	Paper and paper products	409
	Printing and reproduction of recorded media	379
	Textiles	1.295
	Tobacco products	5
	Wearing apparel	2.828
	Wood and of products of wood and cork, except furniture; articles of straw and plaiting ...	123
Medium-Low Technology	Basic metals	409
	Coke and refined petroleum products	31
	Fabricated metal products, except machinery and equipment	1.456
	Other non-metallic mineral products	391
	Repair and installation of machinery and equipment	96
	Rubber and plastic products	952
Medium-High Technology	Chemicals and chemical products	543
	Electrical equipment	730
	Machineryand equipment n.e.c.	1.188
	Motor vehicles, trailers and semi-trailers	410
	Other transport equipment	93
High Technology	Basic pharmaceutical products and pharmaceutical preparations	85
	Computer, electronic and optical products	261

Figure 4: Number of Companies by Technological Classification 2021 (ISO, 2021)

Istanbul's export profile by technological intensity further confirms this pattern, with low – and medium-technology products dominating the city's international trade (Figure 5), which in turn is reflected in the city's competitive positioning in international markets. The city's export specialisation in five key sectors – basic metals, clothing, motor vehicles, electrical equipment, and chemical products – shows how manufacturing has adapted to global market demands while building on historical industrial strengths (İPA, 2021). Rather than competing directly with low-cost Asian producers, Istanbul's manufacturers have carved out specific niches, particularly in medium-technology sectors and flexible production systems mostly serving to European markets (MoIT-Istanbul, 2022).

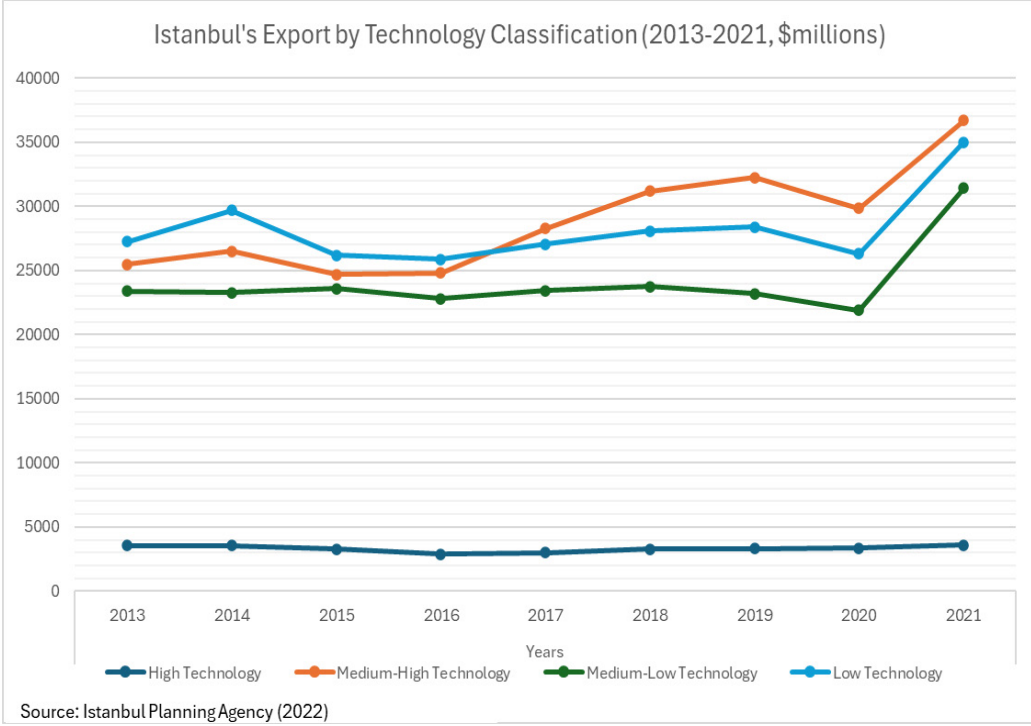

Figure 5: Istanbul's Export by Technological Classification 2021 (IPA, 2021)

The persistence and adaptation of Istanbul's manufacturing sector reflect what might be termed 'strategic industrialisation' in a globalised context. While maintaining traditional labour-intensive industries, particularly textiles and basic metals, the sector has simultaneously developed new capabilities in automotive components, electrical equipment, and chemical products. This dual character – combining labour-intensive production with growing medium-technology capabilities–has enabled Istanbul to maintain its manufacturing base while gradually moving up the value chain in select sectors. These facts underscore Istanbul's continuing role as a production centre with an export-oriented manufacturing pattern, rather than representing a transitional phase toward an advanced service-dominated economy. The predominance of small and medium-sized enterprises, strong export orientation, and gradual technological upgrading in specific sectors indicate an adaptive industrial ecosystem that complements rather than contradicts the city's global functions.

Spatial Distribution of Manufacturing Activities

The spatial organisation of Istanbul's manufacturing sector demonstrates how industrial activities can persist and adapt within a globalising metropolis. Contrary to theories of simple displacement, the current land-use patterns reveal that manufacturing maintains a significant presence within the metropolitan area, specifically by expanding alongside the city's peripheral growth (Üçoğlu, 2019). This distribution is characterised by a complex process of spatial reorganization, where firms show distinct

clustering patterns along the East-West axis, primarily following the D-100 (E-5) and TEM (Trans-European Motorway) highways (Figure 6). These two major transportation corridors have acted as the primary backbone of industrial geography since the 1980s, facilitating both logistics and labour access. Currently, the European side remains the industrial heart of the city, hosting 78% of manufacturing firms, compared to 22% on the Anatolian side (MoIT-Istanbul, 2022). As visualised in Figure 6, the historical core has transitioned toward high-order services, trade, and tourism, while manufacturing has consolidated its dominance in newer peripheral districts, such as Bağcılar, Sancaktepe, and İkitelli (see also, Akgün and Akgün, 2017).

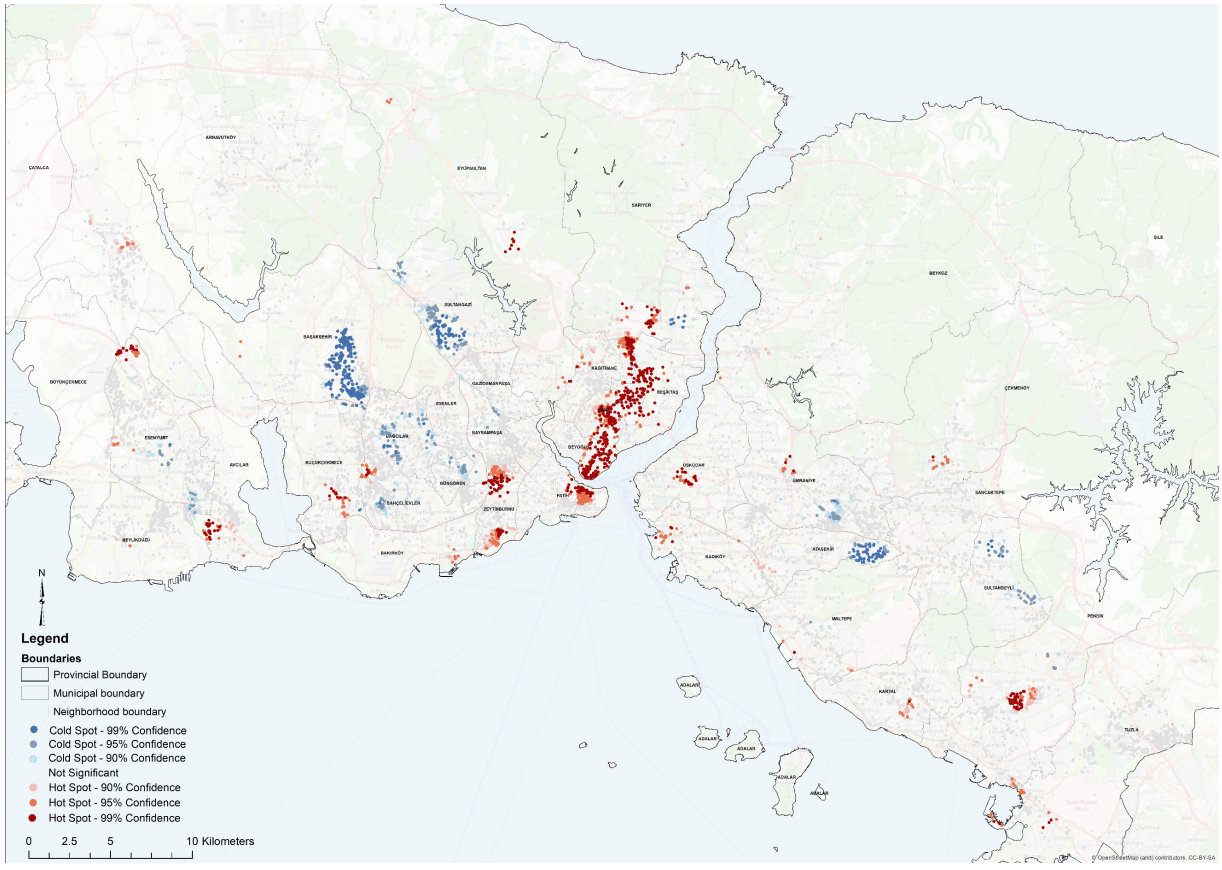

Figure 6: Location Patterns of manufacturing firms, 2021

Analysis of the firm age distribution (Figure 7: 2021) reveals a sequential spatial-temporal pattern of development. The first periphery, including districts like Bayrampaşa and Zeytinburnu, is characterized by a high concentration of older establishments (pre-1980), representing the city's industrial legacy. In contrast, a "second periphery" has emerged in districts such as Esenyurt and Beylikdüzü on the European side, and Sancaktepe and Sultanbeyli on the Anatolian side, which are dominated by newer firms (post-2000). On the European side, this expansion exhibits a south-to-north movement toward the rural edges, whereas the Anatolian development is strictly linear along the East-West highway axes.

This spatial persistence challenges policy initiatives—such as the 2009 Environmental Development Plan—that aimed to decentralize industry away from the metropolitan center. Despite these formal planning objectives, the 2021 mapping shows that manufacturing activities have adapted to higher land costs and regulatory pressures by forming specialized peripheral clusters rather than exiting the city entirely. This behavior has significantly contributed to Istanbul's polycentric urban structure, where manufacturing centers act as vital economic anchors for newer residential settlements in the periphery.

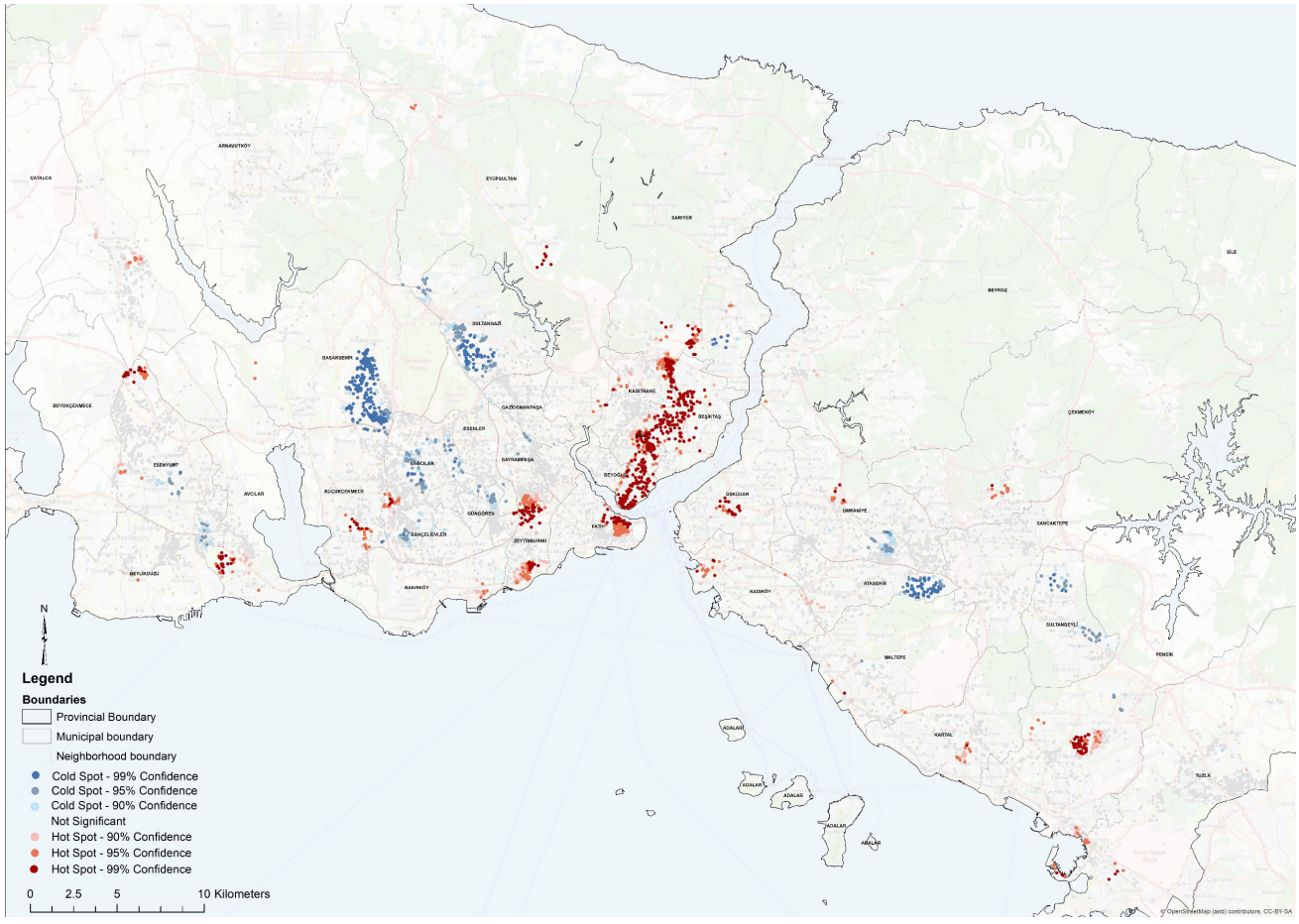

Figure 7: Hot Spot Analysis of Firm Age Distribution, 2021

Hot-spot analysis of the firm age distribution provides further insight into this spatial evolution. The oldest firms cluster around traditional industrial districts – Fatih, Beyoğlu, Beşiktaş, Şişli and Kağıthane on the European side, and Üsküdar, Kadıköy, Ümraniye, Pendik and Tuzla on the Anatolian side. In contrast, younger establishments are concentrated in emerging industrial districts such as Sultangazi, Bağcılar, and Başakşehir on the European side and Ataşehir, Sancaktepe, and Sultanbeyli on the Anatolian side. This spatial pattern challenges conventional assumptions about industrial displacement in globalising cities. Despite policy initiatives aimed at decentralising the industry, particularly evident in the 2009 Environmental Development Plan, manufacturing activities have adapted rather than disappeared. While some relocation to peripheral areas has occurred, industrial activities have maintained a significant presence within the metropolitan area, contributing to Istanbul's polycentric urban pattern (Dökmeci and Berköz, 1994; Enlil, 2011). This polycentricity extends beyond settlement patterns to encompass economic activities, with manufacturing playing a crucial role in shaping a city's spatial and economic structure.

Sectoral Agglomeration Patterns

The 2021 analysis of industrial agglomeration patterns in Istanbul reveals several sectoral specialisations across the metropolitan area. Based on the NACE classification, specific manufacturing activities show clear geographical preferences, leading to the formation of specialized industrial districts within the urban fabric (Figure 8). Basic metal production, for instance, is heavily concentrated in the Başakşehir and Bayrampaşa corridors on the European side with secondary clusters on Ümraniye and

Tuzla on the Anatolian side. Chemical and pharmaceutical manufacturing has developed a prominent cluster around the Tuzla Organized Industrial Zone, benefiting from specialized maritime and logistics infrastructure. Food manufacturing maintains a presence in historical industrial districts such as Fatih and Beyoğlu while also developing new clusters in peripheral locations such as Sultanbeyli, suggesting a dual pattern of historical persistence and peripheral expansion.

The other sectors show varying degrees of spatial concentration. Furniture production has developed multiple clusters across both sides of the city, with a significant presence in Kağıthane, Başakşehir, Ümraniye, Kartal, and Sultanbeyli. The leather industry has maintained its historical connection to inner-city locations, particularly in Fatih, Güngören, and Şişli, with newer clusters emerging in Bahçelievler and Bağcılar. The automotive sector, including vehicle and transport equipment manufacturing, shows a strong concentration around Tuzla shipyards, creating an integrated maritime-industrial complex.

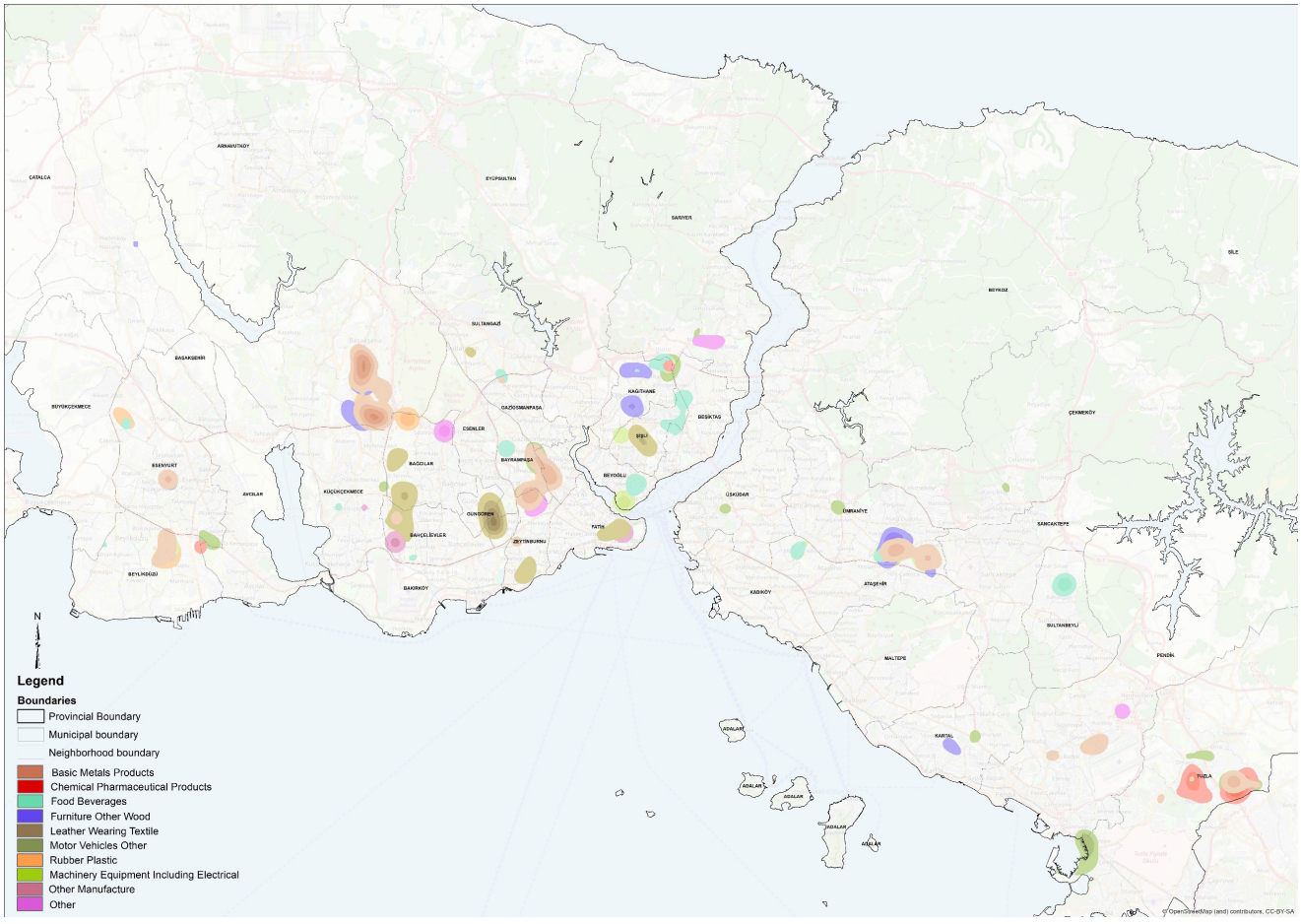

Figure 8: Sectoral Distribution of manufacturing in İstanbul, 2021

When analysed through the lens of technological intensity, the spatial distribution reveals a more fragmented pattern (Figure 9: 2021). High-technology manufacturing, though representing only 2.35% of the firms, shows a preference for the Anatolian side, specifically in the districts of Ümraniye, Tuzla, and Ataşehir. Conversely, medium-low and low-technology firms—representing nearly 74% of the industry—show more dispersed patterns but maintain strong clustering tendencies in traditional industrial districts and newer peripheral zones where land costs are lower and transportation access is high.

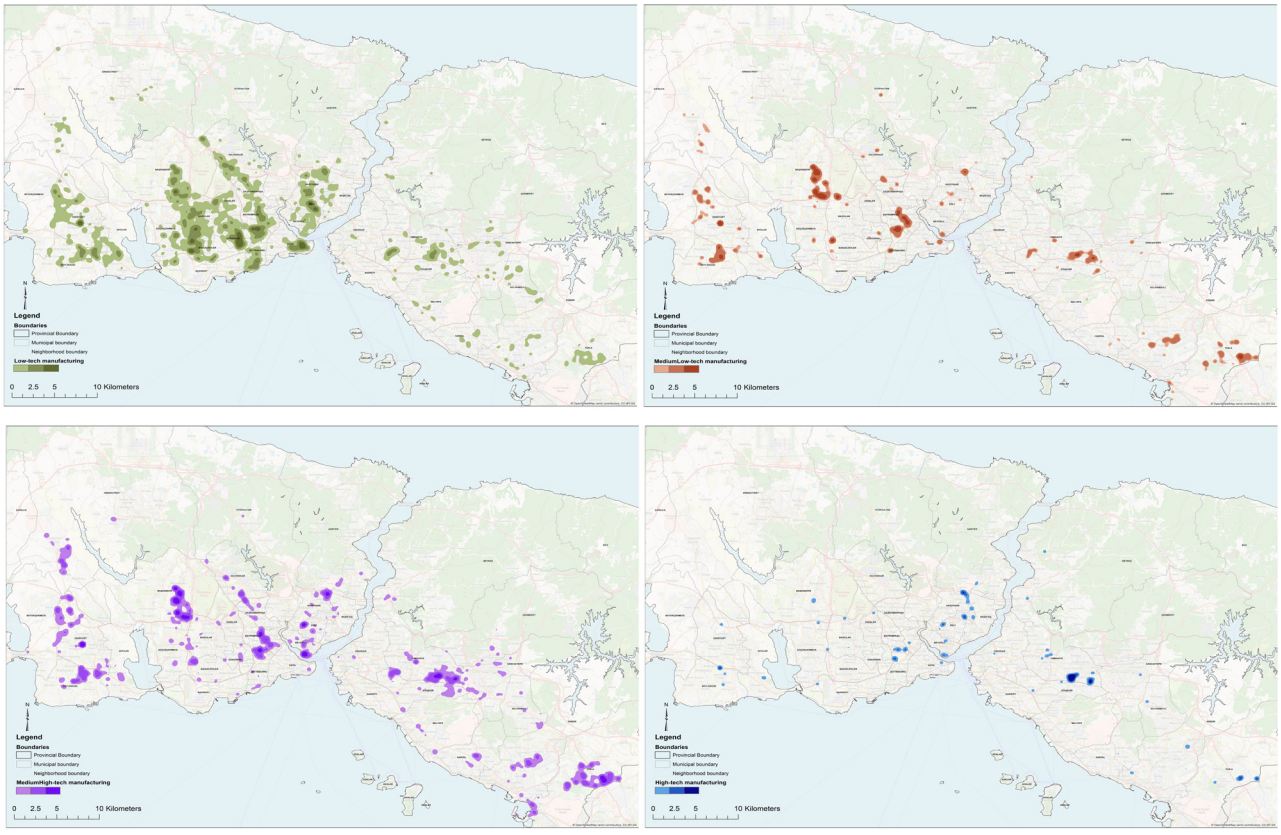

Figure 9: Agglomeration Patterns by Technology Level

Medium-high technology firms, accounting for 20.16% of the establishments, demonstrate strong clustering tendencies in specific districts. On the Anatolian side, these companies are primarily located in Tuzla, Ümraniye, and Ataşehir, alongside other clusters in Pendik and Kartal. The European side shows significant concentrations in Başakşehir, Bayrampaşa, and Beyoğlu, creating what might be termed "technology corridors" along major transportation routes.

Medium-low and low-technology firms, collectively representing nearly 74% of manufacturing establishments, show more dispersed spatial patterns, but maintain clear clustering tendencies. Medium-low technology firms (22.68%) clustered predominantly in peripheral districts on both sides of the city, particularly along the main transportation corridors. Low-technology firms, while present throughout the metropolitan area, show notable concentration in traditional industrial districts and newer peripheral zones, particularly in areas with lower land costs and good transportation access.

The 2021 mapping (Figure 8: 2021) also indicates a significant spatial overlap between different types of manufacturing activities in districts like Ümraniye and Başakşehir. While this co-location suggests the development of diversified industrial environments, it primarily signifies the emergence of specialized industrial zones rather than proven functional networks. Without a detailed analysis of supply-chain linkages, these overlapping areas are characterized here as mixed production zones that benefit from shared urban amenities and infrastructure. The concentration of diverse firms in these districts reflects a strategic spatial preference for major transportation corridors rather than strictly segregated industrial zoning, contributing to the polycentric economic structure of the city.

DISCUSSION AND CONCLUSION

This study provides a comprehensive spatial and structural examination of Istanbul's manufacturing landscape, offering evidence of how industrial activities persist and evolve within a globalizing metropolis. The 2021 industrial profile of the city suggests that the relationship between global city formation and industrial activity is not one of inevitable decline, but rather one of adaptive transformation. Our findings contribute to several key theoretical debates in urban studies and economic geography while raising important questions about the diverse pathways of urban economic development in emerging economies.

The Istanbul case demonstrates that deindustrialization is not a uniform outcome of global city integration. While seminal global city theories posited a dramatic shift from manufacturing to advanced services, Istanbul exhibits a resilient industrial structure where 80% of operating enterprises were established during the city's active period of globalization. This hybridity is characterized by a transition from large-scale, vertically integrated units toward flexible networks of smaller, specialized manufacturers that are deeply integrated into global supply chains. These findings align with recent research on other emerging economy metropolises (Roy, 2016; Zhang and Peck, 2016) yet suggest that Istanbul's experience is distinctive in several ways. Unlike Chinese cities, where state-led industrialisation remains dominant, or Indian metropolises, where informal manufacturing predominates, Istanbul has developed a more balanced model combining formal small and medium-sized enterprises with global production networks.

Our mapping of the 2021 dataset reveals a pattern of 'selective decentralization' that challenges the assumption of a complete industrial exodus from metropolitan cores. Instead of uniform displacement, the spatial organization shows sophisticated sorting along the D-100 and TEM transportation corridors, where industrial activities have consolidated into specialized peripheral clusters. These zones represent contemporary forms of industrial agglomeration where manufacturing activities of varying technological intensities coexist with logistics and design functions. Such spatial configurations indicate that specialized industrial districts serve as vital economic anchors within Istanbul's polycentric urban structure.

Furthermore, the persistence of manufacturing in Istanbul must be evaluated within its institutional and policy context. While Organized Industrial Zones (OIZs) have been instrumental in fostering industrial clusters, their effectiveness is often constrained by inconsistencies between national export-oriented strategies and local urban planning objectives. The 2021 spatial data suggest a disconnect between formal decentralization policies and the reality of industrial clustering in the metropolitan periphery. This underscores the urgent need for integrated policy frameworks that harmonize industrial retention with global city functions.

Ultimately, Istanbul's experience necessitates a reconsideration of the theoretical link between globalization and urban economic development. Rather than viewing production and services as mutually exclusive sectors, the 2021 cross-section of Istanbul illustrates how they can coexist as complementary components of a global city-region. To broaden the findings of this study, future research may focus on two interconnected areas. The first may explore the underlying drivers of Istanbul's hybrid trajectory, including political and institutional arrangements, firm – and sector-specific strategies, and the role of labour market dynamics. The second may adopt a comparative perspective to investigate whether Istanbul's experience represents a genuinely distinctive pathway or a broader pattern among emerging global cities. Such comparative research could further investigate the functional linkages between manufacturing and advanced services, offering deeper insight into how production activities persist and adapt within the broader dynamics of global city formation.

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