

Characterising the evolution of the urban form of zones that accommodate warehousing clusters in the City of Cape Town municipality

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DOI: <https://dx.doi.org/10.4314/sajg.v13i2.3>

Abstract

Modern economies are characterised by increasing globalisation, e-commerce, and a growing number of logistics facilities. Despite insightful research on the changing locational patterns of logistics facilities epitomised by logistics sprawl, there is a lack of literature analysing changes in the urban form of areas that accommodate warehousing clusters. The paper, therefore, aims to analyse changes in the urban form of zones that accommodate warehousing clusters in the City of Cape Town municipality. The study was based on three main types of secondary data: georeferenced 1:50 000 topographical maps from 1942 to 2010, current and historical spatial planning policy applicable to the City of Cape Town, and historical literature on the spatial economic characteristics of the zones that accommodate warehousing clusters. The topographical maps were loaded onto ArcGIS 3.10, after which large buildings were traced to ascertain changes in the urban form of the warehousing cluster areas over the respective decades. The study found that changes in the urban form of the contemporary warehousing cluster areas were linked to the growth of industrial zones and the transport infrastructure. However, the spatial policy for the time under consideration, although cementing the growth of industrial zones in the municipality, did not explicitly consider the placement of warehousing facilities. In light of the findings, the City of Cape Town municipality is urged to anticipate and plan for the growth of warehousing relative to the industrial zones and transport infrastructure. To ensure efficient and sustainable land utilisation, derelict industrial buildings in accessible areas could be redeveloped to accommodate warehousing facilities.

Keywords: *City of Cape Town; warehousing; logistics; industrial land use; transport infrastructure; urban form*

1. Introduction

Globalisation and e-commerce have augmented the growth of logistics processes in cities (Yuan, 2018). Logistics manages the movement and storage activities, starting with the acquisition of raw materials and moving to the final consumption points (Holl & Mariotti, 2018). Within these intricate processes, warehousing plays a central role in that it facilitates the storage of products. Significant repercussions of the growth of logistics processes, which adversely affect the sustainability of cities, include air pollution, noise pollution, and traffic congestion (Taylor et al., 2005). A multi-faceted analysis of the locational patterns of logistics facilities has accordingly drawn the attention of

researchers, who focus on, amongst others, the topic of logistics sprawl (Dablan & Browne, 2019; Kang, 2020a).

Despite certain insightful studies on the changing geographical patterns of logistics facilities from the inner-city areas to the periphery, epitomised by logistics sprawl, there is a paucity of literature analysing changes to the urban form of zones that accommodate logistics clusters. Such analysis is crucial to understanding the factors that influence logistics clusters and ensuring that the placement of logistics facilities is well considered in spatial planning policy. This is against the backdrop of the findings in the literature that logistics is largely neglected, or insufficient provision is made for it, in spatial planning policy (Kin et al., 2023; Mokhele & Fisher-Holloway, 2022).

The paper aims to analyse changes to the urban form of the zones that accommodate warehousing clusters in the City of Cape Town municipality, South Africa. The changes are considered relative to the main factors that influence the locational decisions of logistics firms, viz., industrial land use, transport infrastructure, and spatial planning policy.

The paper is structured as follows: the second section presents the literature on the factors that influence the positioning of logistics facilities and the connections between the locational patterns of logistics and manufacturing firms. The third section discusses the data collection and analytical methods employed in the study and is followed in the fourth section by a presentation of the findings of the study. The fifth section goes on to discuss the findings, while the sixth section concludes the paper.

2. Literature Review

2.1. Factors that Influence the Locational Choice of Logistics Firms

Identifying locational factors for the development of logistics facilities can provide insights for formulating appropriate logistics-related land-use policies (Sakai, Beziat & Heitz, 2020). Factors that influence the locational-choice decisions of logistics facilities are diverse and include land availability and affordability, availability of an effective transport infrastructure, level of economic development, availability of labour, and land-use planning (Yang et al., 2022).

Regarding land availability and affordability, land with the potential for development has become a critical factor in the locational choice of logistics firms. As land in the urban core is in short supply, the hotspots for developing logistics facilities have shifted from the central urban areas to the peripheral areas since the latter have ample land for development (Yang et al., 2022). Verhetsel et al. (2015) note that logistics firms can only afford lower land rentals than those paid by offices and retail projects. Relatedly, Jakubicek and Woudsma (2011) found that factors that negatively influence the ability of an area to attract logistics firms are the cost of the land and the tax rates. Therefore, peripheral zones near airports, for instance, typically attract space-intensive activities, such as warehousing (Fernández, Caralt & Valcarce, 2023).

The literature has shown that accessibility to transportation services and facilities plays a vital role in influencing the location of logistics firms (Sivitanidou, 1996; Bowen, 2008; Verhetsel et al., 2015; Tchang, 2016; Heitz et al., 2017; Holl & Mariotti, 2018; Onstein et al., 2018; Gingerich & Maoh, 2019; Kang, 2020b; Xiao et al., 2021). A good transport infrastructure is crucial for, among others, extending the market for logistics establishments and improving the overall efficiency of logistics companies. Owing to their strong dependence on a large-scale transportation infrastructure, logistics firms tend to locate near railway stations, seaports, and airports. This tendency shows that locational choices increasingly favour zones with better access to transportation infrastructure (Tchang, 2016; Solis-Trapero et al., 2019). In the City of Cape Town municipality, Mokhele and Mokhele (2023) found that the potential airfreight catchment of Cape Town International Airport extended to approximately a 20km radius.

As noted by Jakubicek and Woudsma (2011), access to customers and suppliers is one of the factors that attract logistics firms to a particular location and keeps them there. To provide logistics services in a timely and efficient manner, logistics firms often tend to be positioned geographically close to their customers, which could include manufacturing firms (Yan et al., 2022). Historically, logistics facilities have primarily been associated with manufacturing because the demand came mainly from manufacturing firms that need to store their inputs and products (Solis-Trapero et al., 2019).

Another essential factor that should be considered in the locational choice of logistics facilities is the availability and quality of the labour force (Jakubicek & Woudsma, 2011; Simchi-Levi, Chen & Bramel, 2014). Because logistics establishments typically require many workers to maintain their operations, the availability of a labour force in the surrounding areas could be a crucial factor in the decision-making processes around the choice of a suitable location (Yang et al., 2022). In this regard, in their study on the locational behaviour of foreign logistics firms in China, Hong and Chin (2007) found that high labour costs acted as a deterrent to foreign investment.

Policies and plans formulated by the government are also fundamental factors in decision-making around the choice as to where to locate a logistics firm. For instance, governments can encourage the establishment of logistics clusters in specific areas by increasing the supply of land devoted to logistics facilities or by formulating preferential development policies for logistics firms (Yang et al., 2022). Furthermore, Sakai, Beziat and Heitz (2020) highlighted the significance of land-use zoning on the placement of logistics firms. This presentation shows that the spatial distribution of logistics firms is not only subject to the locational-choice behaviours of firms but could also be influenced by land-use planning policies and guidelines (Li et al., 2020). It should, however, be noted that in some instances, the planning authorities attempt to regulate the operations of logistics establishments without understanding their operational needs (Jakubicek & Woudsma, 2011). In the Cape functional region in South Africa, Fisher-Holloway and Mokhele (2022) found that the spatial development frameworks did not sufficiently provide guidelines and strategies for the placement of warehousing.

2.2. Relationship between Logistics and Manufacturing

The connections between the logistics industry and the economy have attracted the attention of several researchers, who argue that the advancement of logistics is essential to augmenting economic development (Karayun et al., 2012; Lang & Yang, 2017; Gao et al., 2018; Li & Chen, 2021). Logistics processes are therefore involved in the activities of different sectors of the economy such as agriculture, industry, business services, and transport (Li et al., 2017). Considering the proclaimed interconnections, it is essential to empirically analyse the relationship between the logistics industry and non-logistical enterprises (Yan et al., 2022; Lan & Yang, 2017; Gao et al., 2018). For instance, in Pizhou, China, Gao et al. (2018) found that the extent of the relevance of connections between the logistics and other sectors decreased from highest to lowest in the following order: the primary sector, the tertiary sector, and the secondary sector.

Yan et al. (2022) noted a close relationship between the logistics sector and manufacturing. Such an analysis is in fact essential for improving the efficiency of both sectors. Effective logistics management can lead to a reduction in costs, increased profitability, optimised flows, reduced time intervals, and concomitantly address transportation costs in the context of globalisation and enterprise management (Grischuk & Gunicheva, 2017). Therefore, it is paramount to understand the linkages between the logistics and manufacturing industries (Zheng et al., 2022).

A range of empirical literature documents the connections between logistics and manufacturing. For instance, Zheng et al. (2022) identified the spatial distribution pattern of logistics and the manufacturing industry in the Yangtze River Delta, China. Of direct relevance to the focus of this paper are some studies that analysed the connections between warehousing (as a component of logistics) and the establishments operational in other economic sectors. In an examination of the concentration of warehousing and distribution centres in Southern California, the United States of America, Jaller et al. (2017) found that the number of warehousing and distribution centres (W&DCs) in a zip code could be explained in terms of the number of establishments in the manufacturing and the transportation sectors. In this regard, those zip codes with a significant presence of manufacturing establishments (and transportation services) were more likely to accommodate W&DCs. This finding is aligned with the understanding that the proximity to the manufacturing facilities underlines the importance of being positioned close to the customers and the requisite distribution network. Chhetri et al. (2014) add that logistics facilities emerge and evolve in response to the concentration of manufacturing firms and the need to distribute their outputs to diverse areas, both locally and globally. The efficient delivery of products from the manufacturing plants to the warehousing facilities and then to the retailers is crucial; hence the optimal warehousing placement has become an important strategic decision for organisations linked to the manufacturing sector (Singh et al., 2018). Sheffi (2010), therefore, notes that positioning logistics facilities, such as warehousing, in industrial areas promotes resource sharing.

3. Research Methods

3.1. Study Area

The paper is based on the study area of the City of Cape Town municipality in the Western Cape province, South Africa (Figure 1). Although the municipal area is in a geographically isolated area at the southernmost tip of South Africa and the African continent, it is well endowed with sea, land and air-based transport infrastructure. This endowment makes the City of Cape Town an ideal location for logistics companies and an appropriate study area for analysing changes to the urban form of areas that accommodate warehousing clusters.

Figure 1 depicts the warehousing cluster zones in the City of Cape Town, which, as discussed further in Section 3.2, formed the foundation for the analysis presented in this paper. As detailed in Fisher-Holloway and Mokhele (2023), the cluster zones were identified by applying optimised hotspot cluster analysis in ArcGIS, using the 2021 GIS point data obtained from AfriGIS. ArcGIS cluster analysis grouped the entries on the basis of their geographical proximity (Qualtrics, n.d.).

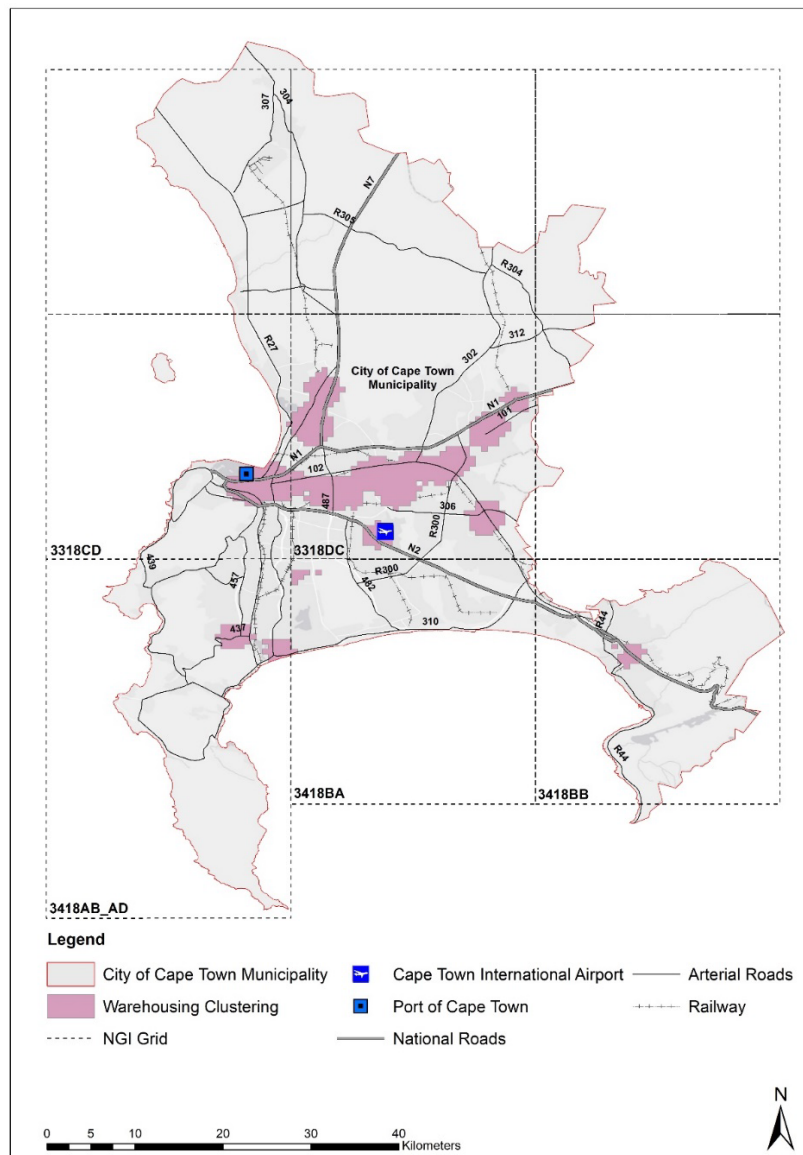


Figure 1. Study area

3.2. Data Sources

Three main types of secondary data were sourced to address the aim of the study. Firstly, to analyse the urban form over time, the georeferenced electronic versions of the 1: 50 000 topographical maps were obtained from the National Geo-spatial Information (NGI). Arranged according to the grid blocks and six-digit identifiers reflected in Figure 1, the earliest recorded map dated back to 1942, and the most recent to 2010. Each map covered an area of 15' of latitude by 15' of longitude (SA Mapsheet Referencing, n.d.). Secondly, the spatial development framework document for the City of Cape Town was obtained from the municipality's website. Historical spatial planning policies applicable to the City of Cape Town were acquired from the Western Cape provincial government and libraries in Cape Town. Thirdly, the historical literature was sourced on the spatial economic characteristics of the areas that accommodate warehousing clusters. This literature was triangulated to describe the urban form patterns and trends identified from the topographical maps.

3.3. Data Analysis

The georeferenced topographical maps applicable to the zones that accommodate the warehousing clusters were loaded on ArcGIS 3.10 and trimmed to exclude areas beyond the cluster areas. Informed by the availability of the maps for the respective decades, the analysis focused on the following periods: 1940 – 1949; 1950 – 1969; 1970 – 1989; 1990 – 1999; 2000 – 2009; and 2010 – 2021. Although the latest map was from 2010 (Section 3.2 above), the warehousing locational data used by Fisher-Holloway and Mokhele (2023) to identify the cluster areas in the City of Cape Town were from 2021.

Following Mokhele (2017), a footprint analysis approach was applied to the relevant topographical maps to ascertain the historical urban form of the warehousing cluster areas. The analysis, which focused on two-dimensional building outlines (Chamberlain et al., 2024), entailed manually tracing the outlines of large buildings in ArcGIS. On the topographical maps, large buildings represent non-residential buildings, with community facilities indicated with symbols such as 'P' (for post office), 'PS' (for police station) and 'S' (for school). Thus, large buildings with no symbols were understood to accommodate industrial or warehousing-like facilities.

In congruence with the footprint analysis and the historical literature review, the applicable spatial planning policies were interrogated over the respective decades to ascertain the policy direction in locating industrial or warehousing facilities in the City of Cape Town municipality.

4. Findings

This section presents the study's findings, organised around the following timeframes: 1940 – 1949, 1950 – 1969, 1970 – 1989, 1990 – 1999, 2000 – 2009, and 2010 – 2021. As discussed in Section 3.3, some of the periods analysed covered two decades because NGI did not have topographical maps for certain decades.

4.1. The Urban Form of the City of Cape Town: 1940 – 1949

Little signs of industrial or warehousing-like urban form could be observed in the City of Cape Town in the 1940s (Figure 2), indicating limited development in the areas where the contemporary warehousing clusters are positioned. Areas near the Cape Town central business district (CBD), namely Woodstock, Salt River, Observatory and Maitland, showed initial signs of industrial development. The literature supports this observation by noting that at the turn of the 20th century, industrial activity clustered around the Cape Town CBD and in Woodstock and Salt River (City of Cape Town municipality, 2002). Major transport infrastructure near these early industrial zones included the national roads (the N1 and N2), the Port of Cape Town and the rail infrastructure. The railway system in the City of Cape Town dates from 1862, when the first line was laid between the Cape Town CBD and Eersterivier, to the east (Speed, 1981).

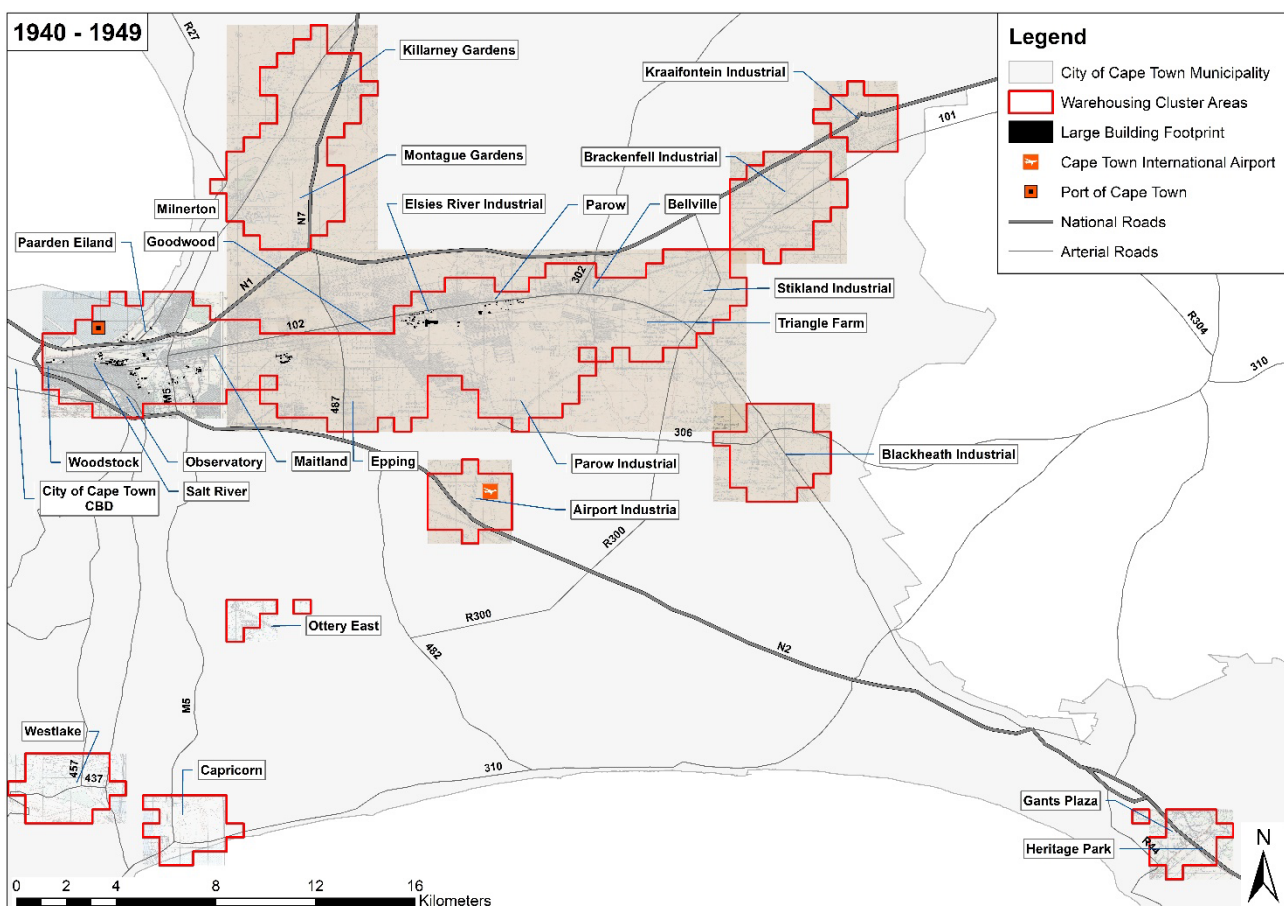


Figure 2. Large building footprints: 1940 – 1949

On the periphery of the CBD, the urban form of Milnerton, Montague Gardens, and Killarney Gardens did not portray a concentration of large buildings typical of industrial facilities. As most of the land in Ottery East was vacant, the area also displayed a similar trend. Furthermore, Goodwood, Parow, Bellville, Epping, Parow Industrial, Elsies River Industrial, Beaconvale Triangle Farm, and Stikland did not accommodate many large buildings typical of industrial development.

Areas near the edge of the municipal area, including Kraaifontein, Blackheath, Brackenfell, Westlake, Capricorn, Gants Plaza, and Heritage Park, were characterised by expanses of vacant land.

Figure 2 and the associated narrative above show that the areas accommodating warehousing clusters in the City of Cape Town had not developed significantly in the 1940s.

4.2. The Urban Form of the City of Cape Town: 1950 – 1969

Figure 3 illustrates the urban form of the zones that accommodate the warehousing clusters in the City of Cape Town for the period 1950 – 1960. Areas adjacent to the CBD, namely Woodstock, Salt River, Observatory, Ndabeni, Maitland, Goodwood, and Paarden Eiland, portrayed the emergence of new buildings typical of industrial development. The literature supports this observation by noting that with the increasing scale of manufacturing in Cape Town in the mid-20th century, a search for more extensive, cheaper land led to the establishment of industrial areas in Maitland, Paarden Eiland, then Epping, and subsequently in Brackenfell and Blackheath, on the eastern edge of the city (City of Cape Town municipality, 2002). The mapping undertaken by Schuman (1975) confirms that Paarden Eiland and some parts of Epping were already developed in 1963. In 1968, Epping was one of the two zones in the municipality (with the Cape Town CBD's environs) with the highest employment intensity (Schuman, 1975).

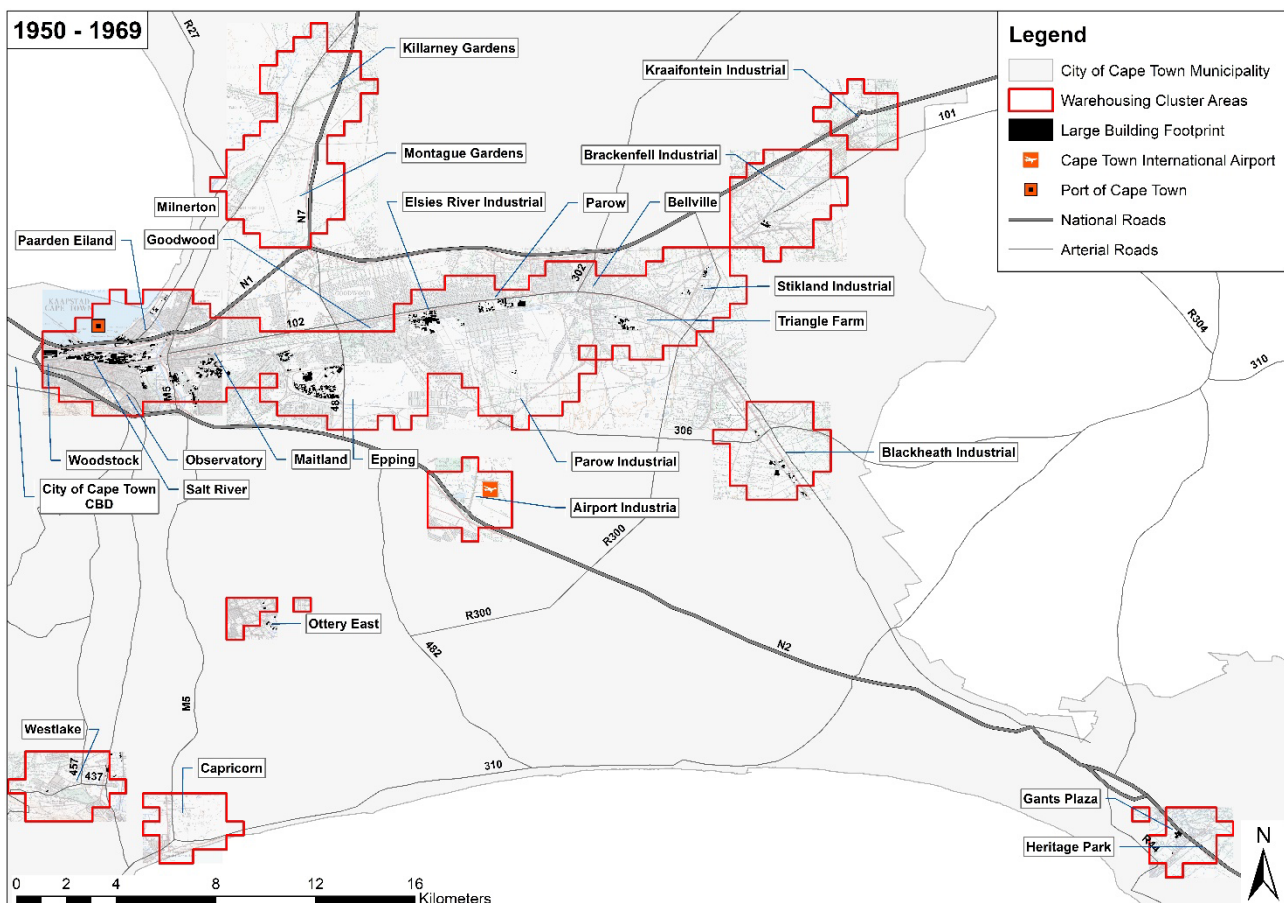


Figure 3. Large building footprints: 1950 – 1969

The development of large buildings emerged in Elsies River and Triangle Farm with some sections of Elsies River developed mainly in 1963 (Schuman, 1975). Brackenfell Industrial, Blackheath Industrial, Gants Plaza, and Heritage Park reflected minor changes in their urban form during the 1950s and 1960s.

The urban form of Milnerton, Montague Gardens, and Killarney Gardens showed no significant development in the areas where the contemporary warehousing clusters are positioned. Furthermore, Ottery East remained vacant between 1950 and 1969. Regarding significant transport infrastructure development in the municipality, Cape Town International Airport was opened in 1954 in an accessible area, bounded by the N2 national road. Nevertheless, the area near the airport was still undeveloped in 1966 (Mokhele, 2017). Kraaifontein Industrial, Westlake, and Capricorn also remained undeveloped.

4.3. The Urban Form of the City of Cape Town: 1970 – 1989

Figure 4 illustrates the form of the contemporary warehousing cluster areas in the 1970s and 1980s. During this period, there was an observable concentration of manufacturing facilities on the development axis extending along Voortrekker Road (102) from the Cape Town CBD to Bellville (van Zyl, 1981). Woodstock, Salt River, Observatory, and Maitland showed minimal expansion in terms of large buildings; however, the urban form of Ndabeni showed change as a result of its significant industrial expansion. Large land tracts in Paarden Eiland also showed development.

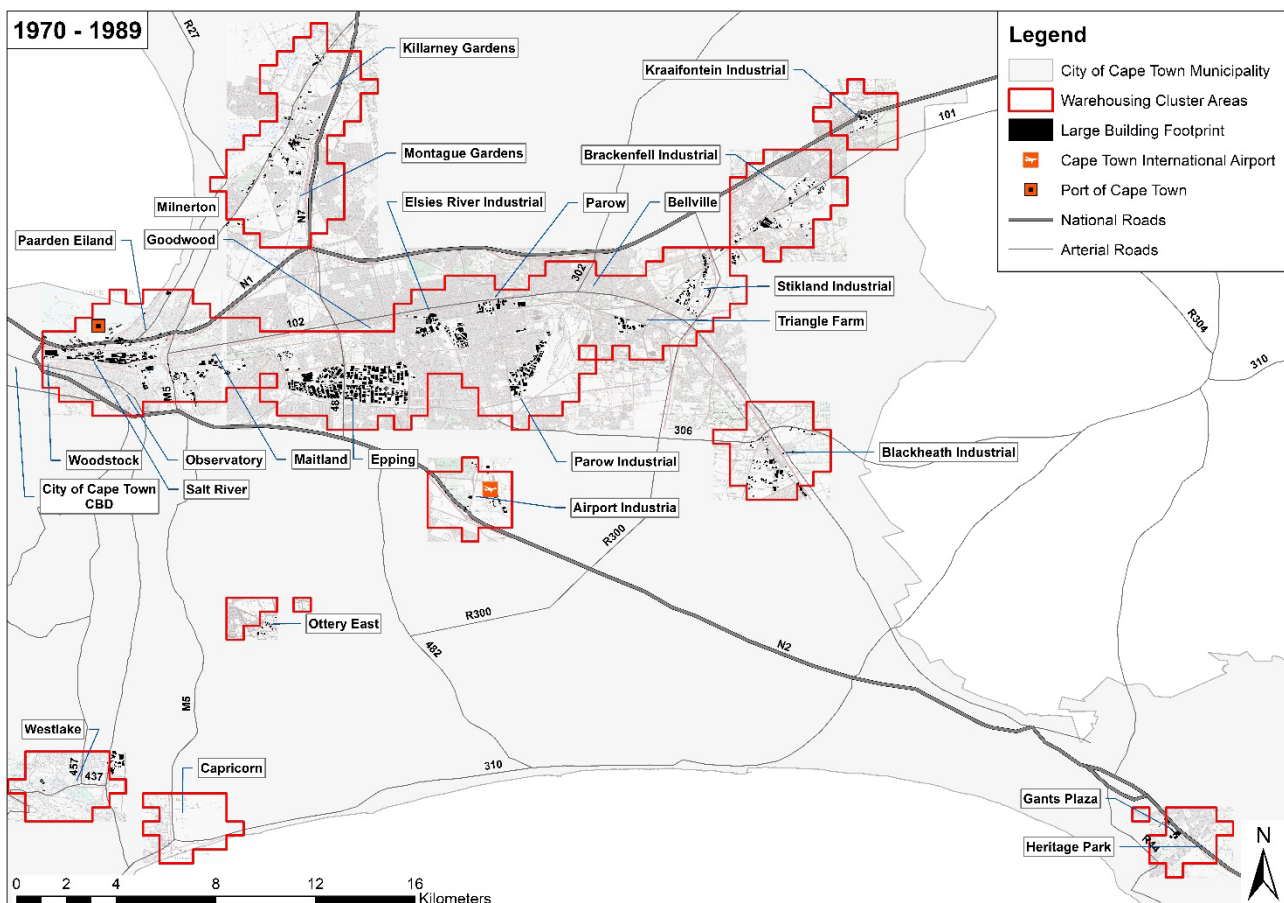


Figure 4. Large building footprints: 1970 – 1989

On the edge of the CBD, Milnerton and Montague Gardens showed a change and an exponential growth in their urban form. At this stage, Montague Gardens, largely vacant during the 1950s and 1960s, had developed into an industrial area, and from 1985, it became the fastest-growing industrial

zone in the City of Cape Town (Mokhele, 2017). In 1981, there was around 143 ha of vacant industrial land in the neighbouring Milnerton (Guide Plan Committee for the Cape Metropolitan Area, 1984).

Goodwood, Parow, Bellville, Epping, Parow Industrial, Elsie's River, Beaconvale Triangle Farm, and Stikland Industrial demonstrated significant urban form changes. The eastern portion of Epping showed an increased concentration of large buildings, which concurred with the mapping by Schuman (1975), indicating that some sections of Epping and Elsie's River were already developed in 1973. In 1979, Parow, Goodwood, and Maitland were characterised by the industrial structures dedicated to the production of textiles, clothing, footwear and leather products. By then, the Cape Town CBD, Epping, and Bellville were already established as important centres for food processing, fabricated metal and machinery production. Apart from the textiles, leather products and footwear that dominated the production lines, the basic iron and steel industry, particularly in Blackheath and Epping, had also made its mark (Guide Plan Committee for the Cape Metropolitan Area, 1984).

During the same period, some industrial facilities were concentrated in proximity to Cape Town International Airport. In fact, the government vehemently tried at this stage to promote industrial development in the airport's environs. In 1981, about 130 ha of land in this area was zoned for industrial purposes, albeit most of the land was not occupied (Mokhele, 2017).

Observations indicated that the road infrastructure layout of Kraaifontein Industrial had been developed and that there was moderate growth in large new buildings. Around 1979, the manufacturing sector in Kraaifontein was dominated by fabricated metal production (Guide Plan Committee for the Cape Metropolitan Area, 1984). Although 236 ha of land in Brackenfell had been zoned for industrial purposes in 1981, most of the area at this stage was still being used for agricultural purposes (Guide Plan Committee for the Cape Metropolitan Area, 1984). Gants Plaza and Heritage Park reflected the emergence of a few large industrial buildings typical of the manufacturing sector.

Significant change occurred during the period 1970 – 1989 in the urban form of Blackheath, with large buildings being constructed. In 1979, the area was characterised by an industrial structure dominated by the production of non-metallic minerals and fabricated metal products. However, 81 ha of the zoned industrial land in Blackheath was still vacant in 1981 (Guide Plan Committee for the Cape Metropolitan Area, 1984).

The first Cape Town Metropolitan Guide Plan/ Structural Plan came into effect in 1988. The vision focused on, among others, the concentration of industrial facilities near certain residential areas and industrial development in the environs of Cape Town International Airport. Other areas designated for industrial development in the guide plan included Epping, Bellville South, Parow, and Ndabeni (Department of Development Planning, 1988), all of which supported the locational patterns of industrial activity that prevailed at the time.

4.4. The Urban Form of the City of Cape Town: 1990 – 1999

Figure 5 illustrates the prevailing urban form during the 1990s when the Cape Town Metropolitan Guide Plan was in force. The urban form of the areas adjacent to the CBD, namely Woodstock, Salt

River and Observatory, did not vary much from that of the previous decade. Ndabeni and Paarden Eiland displayed an increasing number of large buildings. Moreover, in Paarden Eiland, there was a shift from heavy industry to light industry. In 1996, the area had a prime industrial rental rate that was three percent higher than the municipal average (City of Cape Town municipality, 2002). Maitland, Goodwood, Parow, Bellville, Epping, Parow Industrial, Parow East, Elsies River Industrial, Beaconvale Triangle Farm, and Stikland Industrial demonstrated an increased concentration of large buildings.

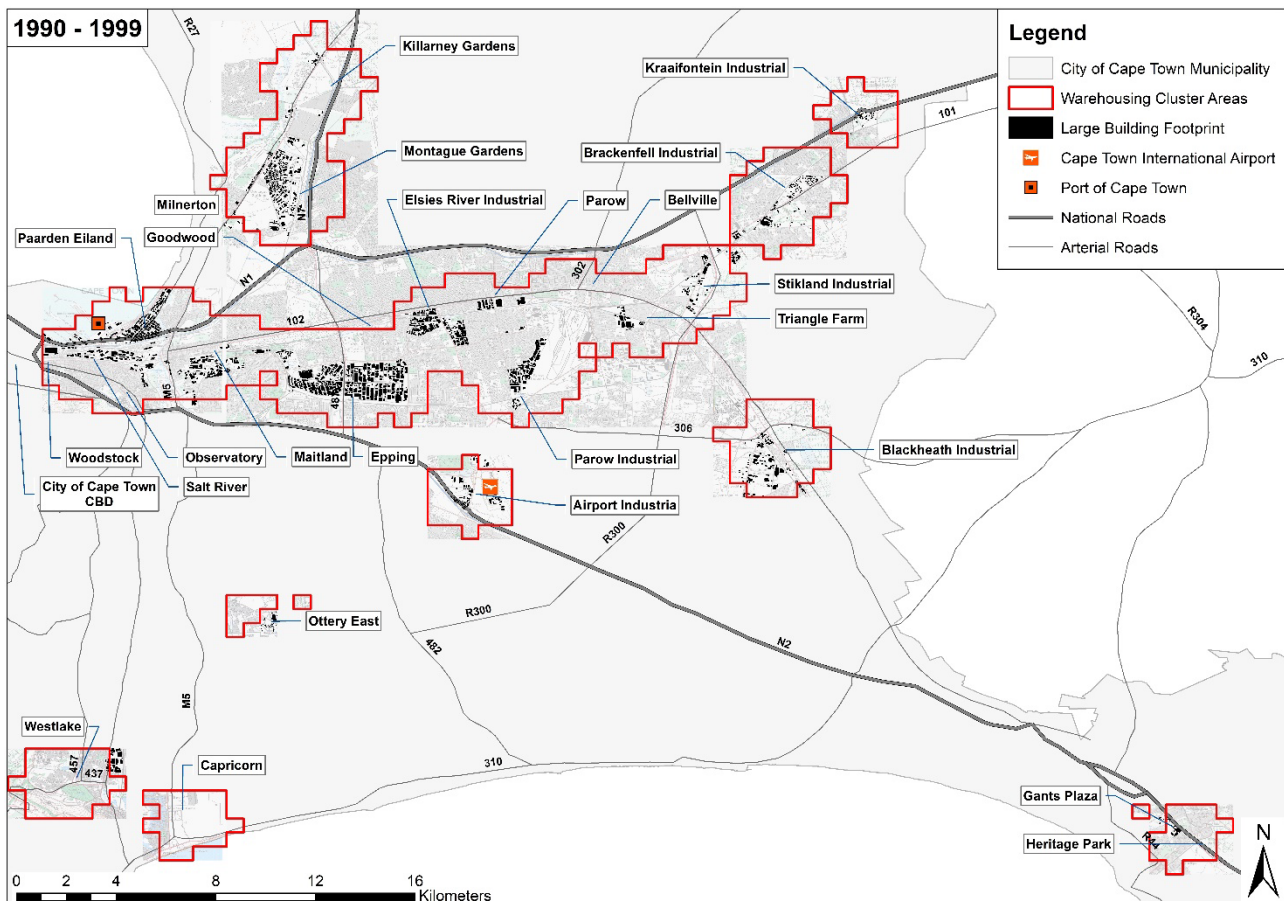


Figure 5. Large building footprints: 1990 – 1999

Milnerton and Killarney Gardens showed minimal change from 1970 onwards. A new growing trend in warehousing and storage facilities near Cape Town International Airport could be identified in 1993 (City of Cape Town municipality, 2002). It should be noted that this was the first time the reviewed literature explicitly mentioned warehousing. Ottery East had started to experience a change in its urban form with the development of large industrial buildings, while growth continued in the older peripheral industrial zones, including Epping, Blackheath, and Brackenfell – mainly near Voortrekker Road (102). Montague Gardens also experienced significant increase in new businesses, where land use at this stage was becoming more intensive (City of Cape Town municipality, 2002).

4.5. The Urban Form of the City of Cape Town: 2000 – 2009

Figure 6 illustrates the urban form of areas accommodating contemporary warehousing clusters during the first decade of the 21st century. The pattern of industrial activity over this period reflected

a consolidated concentration of large buildings extending from the CBD, through Woodstock and Salt River along the northern railway line through Epping, Parow, Bellville, Brackenfell, and Blackheath. The airport environs, Killarney Gardens, and Montague Gardens were the industrial areas close to this anchor development band. Attracted by good access to the N1 freeway and the Cape Town CBD, Montague Gardens offered a wide diversity of economic activities. During this period, Montague Gardens and Killarney Gardens attracted significant investment (City of Cape Town municipality, 2002), and Montague Gardens was regarded as the fastest-growing industrial area in the City of Cape Town since 1985 (Mokhele, 2017).

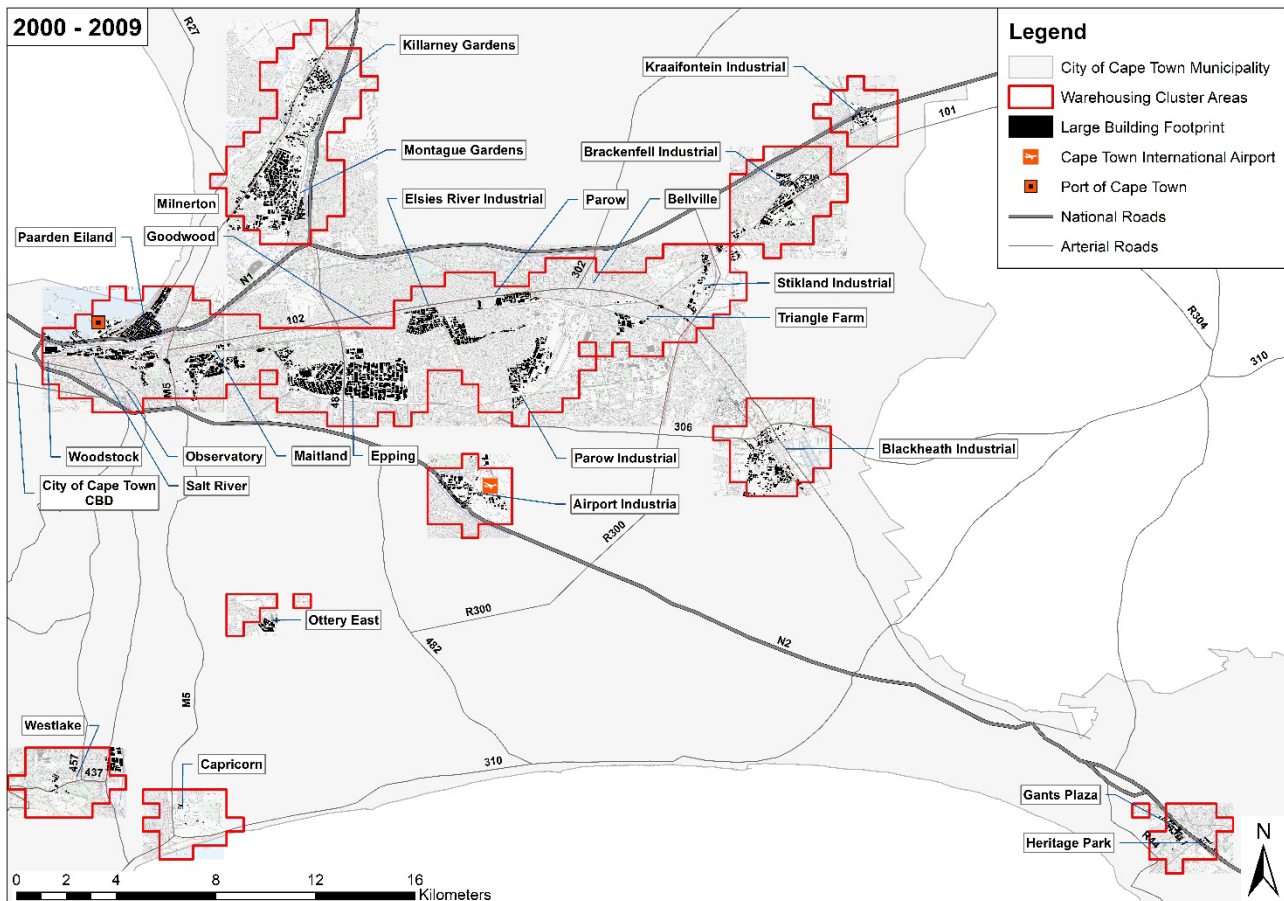


Figure 6. Large building footprints: 2000 – 2009

Woodstock, Salt River, Observatory, Ndabeni, Brooklyn, and Paarden Eiland; and Maitland, Goodwood, Parow, Parow East, Bellville, Epping, Elsies River Industrial, Beaconvale Triangle Farm, and Stikland followed the same trend as that of the previous decade where a concentration of large buildings could be observed in these areas.

At this stage, the concentration of large industrial buildings had increased in the environs of Cape Town International Airport, and a significant portion of Airport Industria’s land area was developed in 2000 (Mokhele, 2017). Ottery East continued the trend from the previous decade with the erection of large buildings. Brackenfell, Kraaifontein, and Blackheath followed the same trend as that of the previous decade, with a moderate increase in the number of large buildings. Westlake, Capricorn,

Gants Plaza, and Heritage Park observed the most noticeable development in terms of the number of large industrial buildings developed.

4.6. The Urban Form of the City of Cape Town: 2010 – 2021

The City of Cape Town’s Spatial Development Framework (SDF), first drafted in 2012, succeeded the Cape Peninsula Guide Plan. The SDF essentially reinforces the historical patterns of industrial development within the municipal area and encourages industrial development on the city's periphery (City of Cape Town municipality, 2018). As shown in Figure 7, the period 2010 – 2021 showed the continuation of industrial development along major transport routes, with increased growth in the industrial areas on the edge of the municipal area, in areas such as Blackheath, Brackenfell, Kraaifontein, Gants Plaza, and Heritage Park.

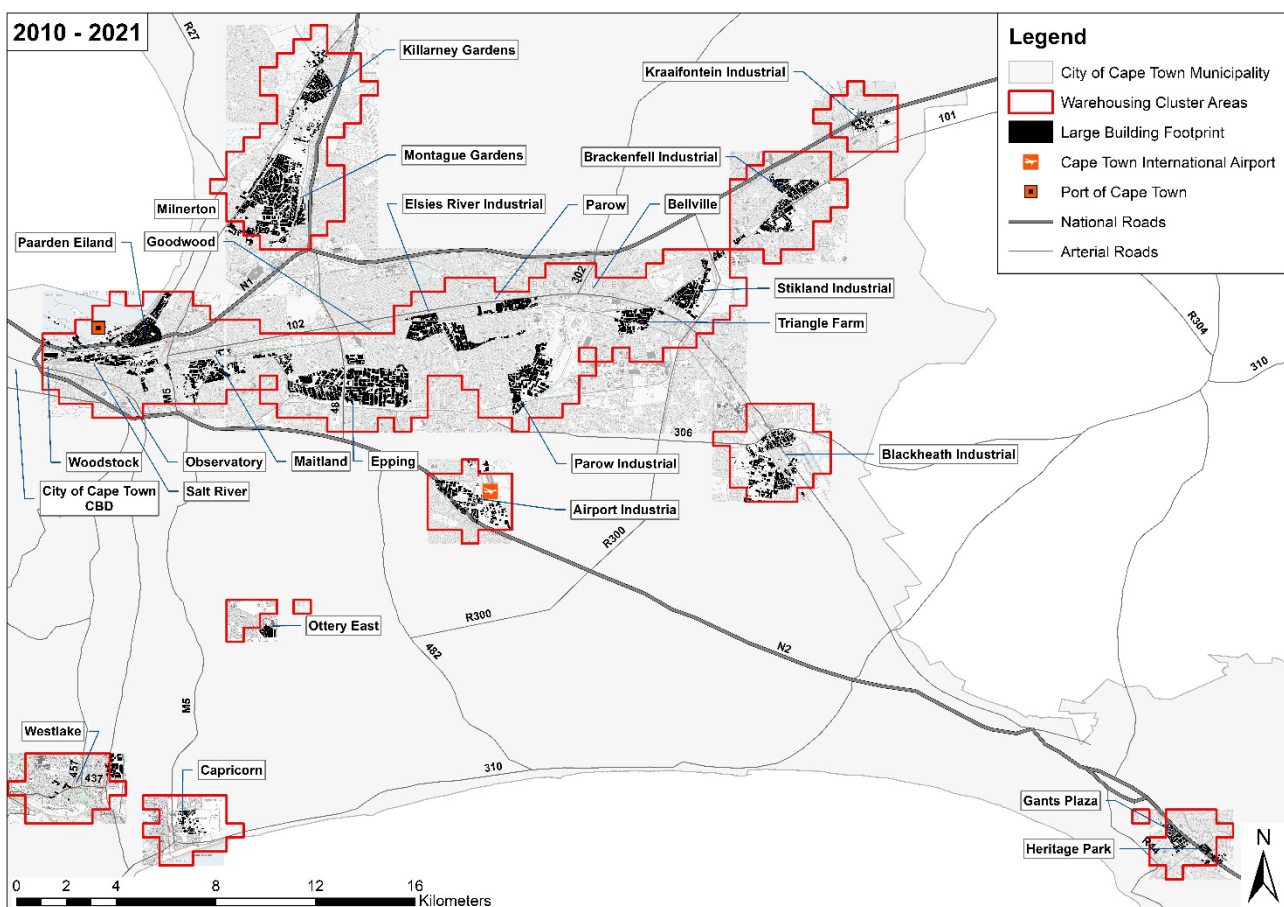


Figure 7. Large building footprints: 2010 – 2021

Woodstock, Salt River, Observatory, Ndabeni, Brooklyn, and Paarden Eiland showed minimal change, as large-footprint buildings had saturated the CBD and its environs. The noticeable difference was the development on the south-western portion of Paarden Eiland and a few large buildings that were erected within the already compact industrial zones.

Milnerton showed a slight change in its urban form, while Montague Gardens grew in the south-west and Killarney Gardens in the north. Maitland, Goodwood, Parow, Bellville, Epping, Elsies River, Beaconvale Triangle Farm, and Stikland reflected a similar trend as in the previous two

decades, with the construction of large buildings increasing. The concentration of industrial and logistics developments at and around Cape Town International Airport intensified.

Brackenfell and Kraaifontein followed a similar trend of moderate growth as for the previous decades, with Brackenfell eventually attaining a high density of industrial buildings. Blackheath showed the most significant change in urban form as the concentration of industrial land use amplified. Westlake followed the trend of minimal change in urban form with a few new moderately sized buildings. Gants Plaza and Heritage Park demonstrated the continuation of the development trend experienced in the previous decade, with an increased concentration of moderate to large buildings.

5. Discussion

The warehousing clusters in the City of Cape Town are predominantly positioned within industrial areas, whose urban form and land-use composition evolved during the period 1942 – 2021. At the turn of the 20th century, industrial activities tended to be clustered around the Cape Town CBD and the neighbouring Woodstock and Salt River. With the increasing scale of manufacturing by the mid-century, a need for more extensive and cheaper facilities led to the establishment of industrial areas in Maitland, Paarden Eiland, then in Epping, and later in Brackenfell and Blackheath (City of Cape Town municipality, 2002). The spatial planning policy, including the Cape Metropolitan Guide Plan and the City of Cape Town Spatial Development Framework, has supported the locational patterns and trends of industrial development. Despite the explicit guidelines for locating industrial activities within the municipal area, Mokhele and Fisher-Holloway (2022) found that the City of Cape Town's spatial planning policies had not adequately taken cognisance of the placement of warehousing facilities. This lack in appreciating such a fundamental consideration demonstrates a poor alignment between the placement of logistics facilities and spatial planning policy in the City of Cape Town.

The analysis herein noted that with the advent of the service economy and the transition in certain areas (such as Paarden Eiland in the 1990s) from heavy to light manufacturing, the zones that predominantly accommodated industrial activities since the turn of the 20th century have become home to the warehousing clusters. It is also important to note that the areas that were historically significant industrial zones, such as Paarden Eiland and Montague Gardens, currently accommodate the most intense clustering of warehousing facilities. This transition from the dominance of industrial activities to the incorporation of significant warehousing facilities occurred despite the spatial plans and frameworks being silent on the placement of logistics facilities or warehousing specifically. The organic transformation of the urban form is indicative of a close relationship between manufacturing and logistics. Sheffi (2010) argues that placing logistics facilities (such as warehousing) in industrial areas promotes resource sharing. However, it should be acknowledged that in the era of e-commerce, logistics facilities or warehousing specifically do not exclusively service the manufacturing firms.

A relationship was also observed between the transport infrastructure and the concentration of industrial development in the zones that accommodate warehousing clusters. Observations from evaluating each warehousing cluster demonstrated a significant concentration of industrial land use where significant access routes, such as the N1, N2, N7, and Voortrekker Road (102), were present. The presence of a railway infrastructure was also evident within most warehousing cluster areas in the City of Cape Town. The only cluster areas that did not have access to the railway infrastructure were the airport environs, Westlake, Capricorn, and Ottery East. The railway system in the City of Cape Town dates back to 1862, when the first line was constructed between the Cape Town CBD and Eersterivier, to the east (Speed, 1981). The use of rail for freight purposes is, however, not optimal; hence it can be inferred that the railway system does not play a prominent role in facilitating the placement of industrial and warehousing facilities.

Major infrastructure nodes such as the Port of Cape Town and Cape Town International Airport also attracted industrial development, particularly warehousing development from the 1990s. All in all, high levels of accessibility have arguably shaped the positioning of industrial facilities and warehousing clusters in the City of Cape Town.

6. Conclusion

The paper analysed changes to the urban form of areas that accommodate warehousing clusters in the City of Cape Town municipality relative to the industrial land use, transport infrastructure and spatial planning policy. It was determined that changes to the urban form of the contemporary warehousing clusters have been linked to the growth of industrial zones and the positioning of the major transport infrastructure. Although spatial planning policy has been explicit in directing the placement of industrial activities in the municipality, it has paid no attention to the positioning of warehousing and other logistics facilities.

Given the growing globalisation and e-commerce activities, the City of Cape Town municipality is urged to anticipate and plan for the growth of warehousing facilities. The planning policy and guidelines should be considered in tandem with the existing industrial zones and respective forms of transport infrastructure. It should, however, be acknowledged that contemporary warehousing facilities may not exclusively cater for manufacturing or industrial firms. To benefit from agglomeration economies in and around the warehousing cluster areas, a concerted effort could be put into repurposing well-positioned old or derelict industrial buildings to accommodate warehousing, which could be linked to, amongst others, e-commerce processes. As warehousing is the most space-intensive logistics and supply chain component, this brownfield-oriented approach would ensure efficient and sustainable land utilisation in the long run.

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