

## Logistics And Territory: A Reciprocal Interaction Serving the Urban Dynamics of the Port City Of Lomé.

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### Abstract

The internationalization of the production process, driven by technological advances, has strengthened the role of port and airport cities in the global logistics chain. As a spatial support for logistics activities, cities provide the land resources necessary for the establishment of logistics facilities. These facilities generate economic externalities by facilitating the storage and movement of goods, but their location has a significant impact on the spatial growth of these cities. This article aims to analyze the impact of logistics facilities on the spatial dynamics of the city of Lomé through a mixed methodological approach combining quantitative and qualitative data. The results reveal that the central and immediate municipalities of the port area, notably Golfe 1 and Golfe 4, account for 43% of logistics facilities, compared to 57% for the remaining 11 municipalities. However, although located on the outskirts, the municipality of Agoè-nyivé 6, which is home to the industrial platform, also attracts several minor logistics facilities that contribute to the spatial sprawl of the city of Lomé. Proximity to major logistics facilities and the road network, as well as land accessibility, are the main criteria for the location of warehouses and stores in Greater Lomé (DAGL).

**Keywords:** *Urban Logistics, Logistics Facilities, Urban Expansion, Urban Planning.*

### Introduction

As the first place of stay for goods in transit and the destination for those intended for consumption, port cities are shaped by multiple economic, social, and cultural dynamics. Their competitiveness depends mainly on their ability to ensure the sustainability of flows of people and goods. This performance requirement highlights the need for effective coordination between urban planners and those involved in the planning of logistics facilities in order to ensure the coherent integration of infrastructure within the urban space. Understanding the relationship between logistics and the territory is based on an analysis of the interactions between transport, storage, and production, which are considered to be the fundamental components of the production system. In this regard, [1] defines logistics as “the operation that aims to optimize flows in the production system, both for industry and distribution.” However, in urban areas, the distribution of goods is a matter of urban logistics, the objective of which is to optimize the management of goods and people flows while limiting environmental pollution and traffic congestion [2]. It also incorporates a spatial dimension, taking into account production functions, the location of storage facilities, and key transport infrastructure in urban areas [3].

According to [4], thinking about urban freight must incorporate, “*the triptych of urban planning, transportation, and infrastructure*”. In this sense, logistics services must effectively meet the functional needs of the territory [5, 6]. However, in cities in developing countries, rapid urban growth has not been accompanied by adequate infrastructure planning. This compromises the efficiency of logistics chains, particularly the last mile [7]. Yet the speed of goods and people flows is an indicator of the city's economic performance. It depends on the development of transport infrastructure and the

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establishment of high-quality logistics facilities [4, 5, 8, 9, 10, 11, 12]. As the physical support for the flow of goods, logistics facilities structure urban space by facilitating the supply of goods to households. A distinction is made between large and small logistics facilities.

As gateways for goods entering urban areas, large-scale facilities such as ports, airports, and logistics platforms attract small-scale storage and distribution facilities to their immediate surroundings due to their agglomeration effects. Although the spatial impact of the latter remains relatively less significant than that of large facilities, their integration into the urban space remains a challenge for urban stakeholders. It is becoming necessary to effectively define the criteria for locating these facilities according to the present and future needs of city dwellers in order to limit their effect on urban sprawl [13]. Large logistics infrastructures are preferably located on the outskirts, where land is more readily available [14]. Conversely, smaller facilities, such as urban warehouses and distribution stores, tend to be concentrated in central urban areas, despite greater land constraints [15]. Regardless of their size and location, logistics facilities have a significant impact on urban development through the flows they generate and the resulting agglomeration externalities [16]. In West Africa, the distribution of goods at the urban level involves urban facilities such as markets, supermarkets, retail stores, and neighborhood shops. These commercial spaces are supplied by goods stored in warehouses located in port and industrial areas, as well as in large markets.

### **Research Questions**

What is the spatial organization of logistics facilities in the Greater Lomé Autonomous District (DAGL)?

How does the spatial dimension of urban logistics impact the urban dynamics of the DAGL?

While the economic and environmental dimensions of urban logistics have been sufficiently explored by researchers, it is clear that there is less research in the literature on the spatial aspect, or rather on the interaction between logistics facilities and urban planning. This article aims to fill this gap by analyzing the reciprocal interaction between logistics and territory in the spatial dynamics of the DAGL.

## **Literature Review**

### **Typology Of Urban Logistics Facilities**

Logistics facilities refer to “specific buildings and warehouses that house all activities related to logistics and freight transport”. [17]. They comprise a range of infrastructure of varying sizes and functions that constitute the logistics offering of the territories that host them. Large-scale facilities such as ports, airports, and multimodal platforms are entry points for goods, while urban warehouses, stores, and distribution centers are involved in their storage and distribution.

The literature reveals several types of urban logistics facilities according to their size and function [17, 18, 19]. In their study of the Paris region [17], the authors distinguish between two categories of urban logistics facilities according to their function: terminals or platforms, intended for transshipment operations, and warehouses, specialized in storage. However, the authors point out that some logistics facilities perform both functions simultaneously. The physical dimensions of these facilities are also a classification criterion. [18] classify warehouses according to their surface area. The smallest cover an area of 200m<sup>2</sup> and are designated as XXS warehouses, while the largest (XXL warehouses) have a surface area of 40,000m<sup>2</sup>. [19] propose a unified taxonomy based on the characteristics, functions, and specificities of these infrastructures, which they refer to as “*urban logistics spaces*”. Two main categories emerge: on the one hand, generalist spaces, including urban logistics zones, distribution centers, and urban consolidation centers; on the other hand, specialized spaces, such as good storage centers, logistics management centers, vehicle reception points, and logistics units. These urban logistics spaces act as an interface between supply chains and urban space, facilitating the organization of goods flows within cities [19].

### **Logistics Real Estate and Its Location: A Response to Logistics Demand with Multiple Externalities on Urban Space**

The infrastructural dimension of logistics is closely linked to regional organization and development [16]. The increase in demand for logistics facilities, particularly in port cities, has led to the emergence of a specific type of real estate market known as “logistics real estate” [20]. These facilities are now establishing themselves as key drivers of urbanization [6], mobilizing both local authorities and players

in the real estate sector. The location of urban logistics facilities is determined by criteria such as geographical proximity, availability of land and labor, accessibility, and transportation costs [20]. Two main factors are highlighted by [21] in the case of the city of Tokyo: accessibility to transport networks and land use policies. The latter impose restrictions on the location of logistics infrastructure by defining two types of zones: urban development promotion zones, which can accommodate logistics infrastructure, and controlled urbanization zones. They conclude that although urban zoning is beneficial for Japanese cities, it can also contribute to spatial imbalances in logistics infrastructure. In line with this reasoning, [5] emphasizes the importance of developing appropriate public policies that take into account the specific characteristics of each city in order to avoid unbalanced land use planning.

The location of logistics facilities has a significant impact on urban dynamics. [22] identifies two types of influence that logistics facilities have on urbanization, depending on their location. The first model, known as “integrated logistics,” allows logistics facilities to coexist with economic and urban activities. He goes on to show that this model is a source of conflict due to noise pollution and traffic. The second model allows warehouses and logistics platforms to be located in areas reserved exclusively for logistics activities, generally on the outskirts. According to the author, this second model consumes a lot of space. It also contributes to logistical sprawl, which is defined by [15] as the growing concentration of warehouses on the urban periphery, where land is accessible and inexpensive. It contributes to the increase in distances traveled by freight vehicles when supplying downtown stores [2,12]. Referring to the agglomeration effect of logistics facilities, [23] asserts that the concentration of warehouses and logistics platforms constitutes a particular form of urbanization that attracts economic and logistics activities.

### **Urban Logistics Facilities: A Difficult Spatial Integration**

The establishment and development of logistics and transport infrastructure in urban areas is fundamentally what differentiates urban logistics from traditional logistics [24]. Another distinctive feature of urban logistics is the importance of the actors involved in its organization [25]. Although urban logistics is a recent field of research, its organization dates back to ancient times, such as in ancient Rome, where regulatory measures already provided for the establishment of warehouses on the outskirts in order to limit the negative externalities of urban freight [25, 26]. It was in the 1990s that projects and programs on urban freight began to emerge in Europe [7, 20]. These various projects, aimed at minimizing the negative impacts of urban freight while maintaining its operational efficiency, have developed in different forms depending on the countries concerned: urban distribution centers in France, logistics centers in the Netherlands, and “city logistics” in Germany and Switzerland. In France, the process of optimizing urban freight has taken place in several phases. A phase of awareness-raising, a phase of experimentation, and a phase of developing the decision-making tools necessary to define policies for improving the flow of goods in cities [27]. According to the authors, the national urban freight program, launched in 1993, aims to better integrate the flow of goods into urban development. The use of regulatory measures in German cities to the detriment of operational measures can be explained by the failure of the “City Logistics” initiative, which involved the development of urban distribution centers in 1992 in German and Swiss cities [25].

These various initiatives, led by public authorities, logistics operators, and researchers, aim to promote the sustainable integration of urban freight in cities in northern countries. However, similar approaches are virtually non-existent in cities in southern countries, particularly in West Africa. However, the rapid population growth that characterizes West African cities is leading to an increase in demand for goods and therefore for logistics services. It is becoming necessary to integrate an urban logistics planning scheme into their development plans in order to better organize the dozens of categories of logistics chains that supply them [7].

### **Materials and Methods**

The methodological approach adopted in writing this article combines quantitative and qualitative methods.

It begins with a literature review based on the analysis of scientific articles, dissertations, and doctoral theses on topics similar to the one addressed in this article. This review provided a brief overview of the literature on the term in question.

## **Field Data Collection and Interviews**

### **Field Data Collection.**

In order to understand the logic behind the concentration of urban logistics facilities, data was collected on the location of warehouses and stores in the 13 municipalities that make up the DAGL. Only stores and warehouses covering an area of 300m<sup>2</sup> or more were taken into account. The data collectors, working in pairs and equipped with GPS devices, spent five days geolocating stores and warehouses in the municipalities. A total of 606 warehouses and stores were recorded.

Given the difficulties of taking measurements in the field, a sample warehouse built on half a lot of land (i.e., 300m<sup>2</sup>) was presented to the collection agents during training before they were deployed in the field.

The decision to limit the survey of warehouses and stores with a surface area greater than or equal to 300 m<sup>2</sup> is justified by the lack of standardization in the size of logistics facilities in the study area. However, the basic unit of measurement for urban land in the study area is the "lot." 1 lot = 600 m<sup>2</sup>. The initial assumption is that goods stored in a warehouse built on half a lot (300 m<sup>2</sup>) of land can generate a flow of several light commercial vehicles for distribution.

The data collected was processed in Excel and visualized in QGIS and ArcGIS mapping software.

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### **Interviews**

The interviews took place in three municipalities (Golfe 1, Golf 4, and Agoènyivé 6) and aimed to understand the logic behind land price changes and the spatial transformations underway in these municipalities. A total of 30 stakeholders from the real estate, transport, and logistics sectors were interviewed. Some homeowners with properties for sale and neighborhood leaders were also interviewed.

These three municipalities were chosen for the survey because of the presence of large logistics facilities such as the Port, the Grand Market of Lomé, Place Bonke, and the Adétikopé industrial platform.

### **Analysis of the Road Network**

The analysis of the road network in Greater Lomé is based on the use of vector data and GIS tools to assess the density of transport infrastructure. First, basic data was collected in the field using a Qfield questionnaire and cadastral databases. This data was cleaned and corrected to eliminate any topological errors and harmonize the classification of roads into primary and secondary roads. Tertiary roads are not included in the analysis.

Once the data had been processed, a road density analysis was carried out by applying a spatial grid to estimate the total length of roads per unit area (the surface area of the municipalities).

To facilitate the interpretation of the results, the densities calculated for each municipality were classified into four groups according to their importance: Low density; Medium density; High density; Very high density.

Mapping was carried out using QGIS software, employing spatial interpolation and symbology techniques to visually represent variations in the road density across the DAGL territory. This approach makes it possible to identify the most accessible areas of the Greater Lomé territory in terms of road network coverage.

### **Analysis of Land Use in the Municipality of Agoè-Nyivé 6 (Adéticopé)**

The evolution of land use in Greater Lomé, particularly in the municipality of Adéticopé, from 2010 to 2024 was analyzed using satellite images (Landsat 5, Landsat 8, Sentinel-2A), according to a diachronic approach. After pre-processing (radiometric and atmospheric corrections and georeferencing), supervised classification was performed using the Random Forest algorithm, identifying the following classes: built-up areas, dense vegetation, sparse vegetation, and water bodies. Accuracy was assessed using a confusion matrix and the Kappa index. The results were integrated into ArcGIS geographic information systems to map spatial dynamics, revealing a continuous expansion of

the urbanized area at the expense of natural and agricultural spaces around the Adéticopé industrial platform.

**Presentation and Analysis of Results**

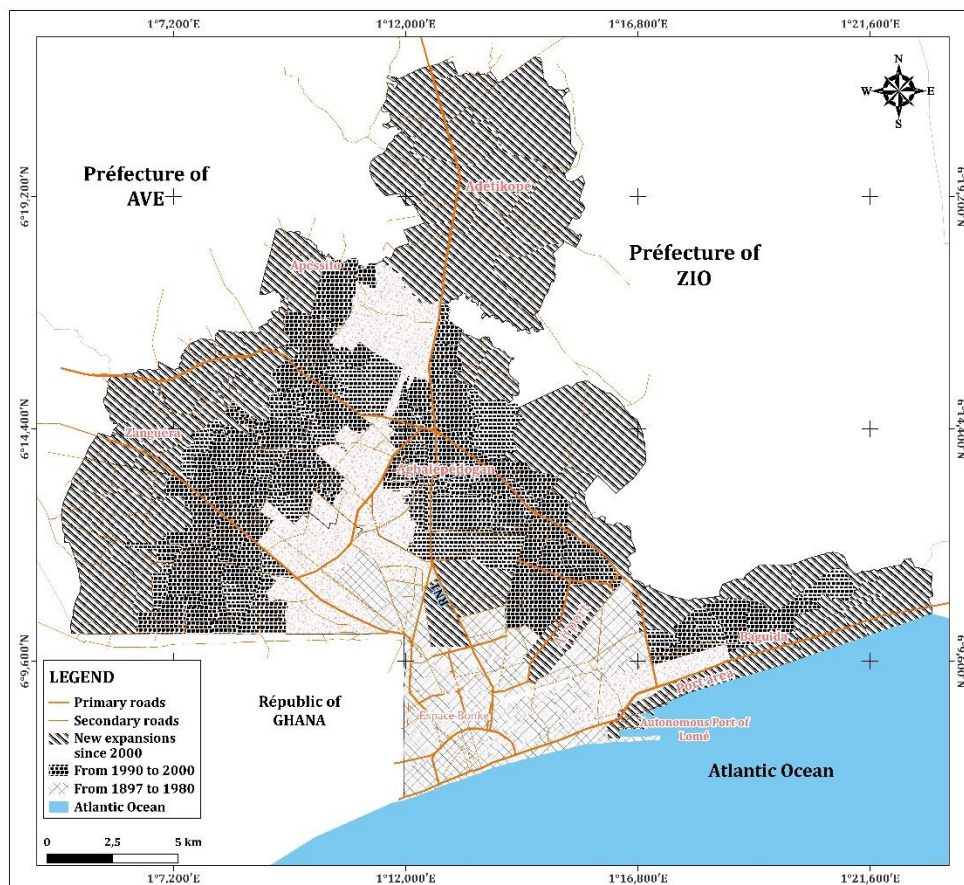
**Lomé, A Rapidly Expanding West African Capital**

**From The Municipality of Lomé to the Autonomous District of Greater Lomé (DAGL)**

Lomé became the capital of Togo in 1897 and experienced rapid spatial growth marked by the absorption of surrounding cantons and rural areas. According to [28], between 1914 and 1959, the area of the city of Lomé increased 23-fold. While this growth remained moderate until the 1960s, the following decades, particularly 1960-1970 and 1970-1981, were marked by accelerated urbanization (Figure 1). This led to the emergence of new neighborhoods beyond the administrative boundaries set by the government authorities in Decree No. 71-63 of April 1, 1971.

Organized into five districts, the municipality continued to expand, encompassing the surrounding cantons: Aflao-Sagbado and Sanguéra to the west; Légbassito, Agoè-nyivé, and Togblékopé to the north; and Baguida to the east. These successive expansions gave rise to a sprawling agglomeration known as “Greater Lomé,” whose area grew from 33,300 hectares in 2010 to 425,060 hectares in 2022 (RGPH, 2022).

Lomé’s urban front now extends to the canton of Adéticopé and its surroundings to the north, and to the outskirts of the cantons of Baguida de Sanguéra and Apéssito to the southeast and northwest. This urban area forms the Autonomous District of Greater Lomé (DAGL), whose various phases of spatial development are presented in Figure 1 below.



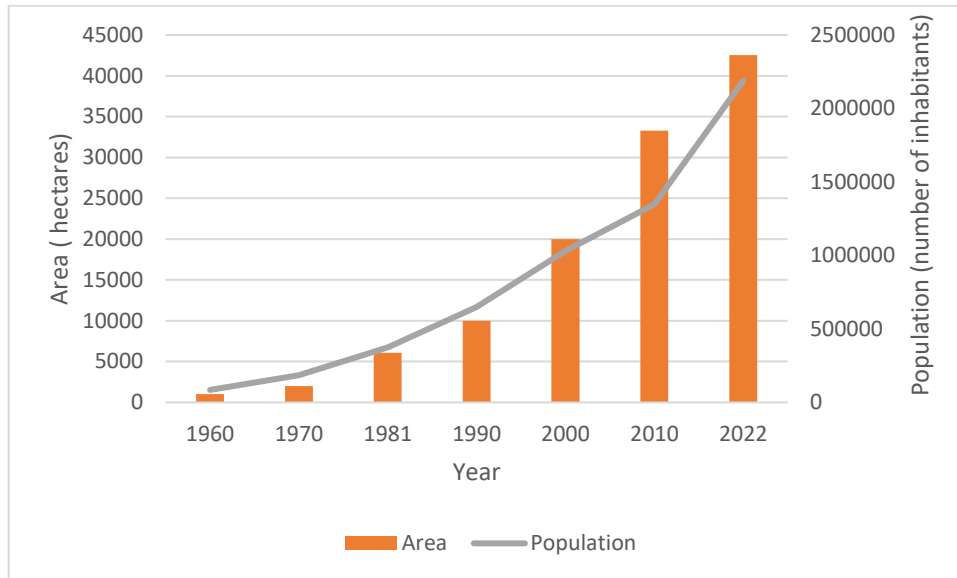
**Figure 1. Map Showing the Phases of Spatial Dynamics in the City of Lomé From 1897 to 2024**

**Source: RGPH 1970, 1981, And 2010, INSEED 2015 And 2022, And Fieldwork 2023**

**Lomé, Spatial Dynamics Driven Mainly by Population Growth.**

The spatial dynamics of Lomé are mainly the result of sustained population growth, which is driving increased residential mobility towards the urban peripheries. This process is fueled in particular by the

attractiveness of land in these areas, where the cost of land remains relatively affordable, especially for low and middle-income households. This trend toward peri-urbanization is amplified by economic and technological factors, notably the increase in household motorization, which facilitates access to peripheral areas and contributes to their gradual integration into the DAGL. The analysis in Figure 2 below shows rapid population growth in Lomé.



**Figure 2. Population and Land Area Trends in Lomé from 1960 to 2022**

**Source: RGPH 1970, 1981, And 2010, INSEED 2015 And 2022, Fieldwork, 2023**

The population doubled between 1960 and 1980, with particularly strong growth during the decade from 1960 to 1970, which saw an annual rate of 8% compared to an average of 5% between 1960 and 2022. This demographic growth led to considerable spatial expansion during the same period. An analysis of the evolution of Lomé's surface area from 1960 to 2010 shows two decades during which Lomé's surface area doubled. These were the decades from 1960 to 1970 and from 1990 to 2000. However, the most intense spatial growth was observed between 1970 and 1981, a period during which the city's area tripled, increasing from 2,000 ha to 6,076 ha with an annual growth rate of 11%, well above the average of 6% observed over the entire period from 1960 to 2022.

Population growth has the effect of an increase in the demand for goods and services, while spatial expansion leads to longer transport distances between the suburbs and the urban center of the DAGL, as well as increased dependence on vehicles. It is therefore necessary to emphasize the structuring role played by transport and logistics facilities in the spatial expansion process of the DAGL.

**Role of Urban Logistics and Transport Facilities in the Urban Dynamics of Lomé**

**Major Logistics Facilities and Their Implications for the Spatial Dynamics of the DAGL**

These refer to all logistics and transport facilities covering a large spatial scale, such as ports, airports, logistics platforms, and commercial spaces. They play a decisive role in the urban distribution of goods and in the structuring of urban space. They have multiple impacts on urban planning at both the municipal and metropolitan levels.

As a port city, Lomé, in addition to its deep-water port, is home to several major logistics and transport infrastructures, the main ones being the airport, Place Bonke, and the Adétikopé industrial platform. In addition to these facilities, there are commercial facilities commonly referred to as "markets", the most important of which is the internationally renowned Grand Market of Lomé. The latter functions as a multipurpose platform concentrating commercial and logistics activities. It is the main source of supply for the city's secondary markets and local shops. Goods are exchanged between the various logistics and commercial facilities via a road network covering 975,482 m, only 26% of which is in good condition, according to data from the Directorate General of Public Works (DGTP).

- **The Autonomous Port of Lomé and its industrial zone, a driving force behind the expansion of the city of Lomé**

Inaugurated in 1968, the Autonomous Port of Lomé is one of the major infrastructure projects initiated by the Togolese authorities in the 1960s. It is located on the southeastern outskirts of the city. As a result of rapid urban expansion, this logistics facility became integrated into the urban fabric of Greater Lomé in the 1990s. Covering an area of 900 hectares, the port and its industrial zone have seen their spatial footprint expand in response to constant increases in traffic (Table 1), extending their influence well beyond their initial boundaries.

**Table 1. Evolution Of Overall Traffic at the Autonomous Port of Lomé from 2012 To 2022**

Year	Imports	Exports	Transshipments	Total	Annual traffic growth rate
2012	6301254	1143932	326561	7771747	
2013	6575567	963571	1159386	8698524	12%
2014	6616763	959815	1703426	9280004	7%
2015	6308675	1002066	8102746	15413487	66%
2016	5254789	920261	7808537	13983587	-9%
2017	5910129	1127041	12279454	19316624	38%
2018	6633323	1255183	14228910	22117416	14%
2019	6569332	1288532	14832699	22690563	3%
2020	7662207	1336308	16975696	25974211	14%
2021	7963244	1445970	20061481	29470695	13%
2022	8069126	1656601	20046259	29771988	1%

**Source : PAL, 2023**

Table 1 shows an increase in overall traffic at the Port of Lomé from 7,771,747 tons handled in 2012 to 29,771,988 tons in 2022. This represents an average annual growth rate of 16%. Total traffic has therefore increased 3.8-fold in 10 years. However, 2015 saw strong growth (66%) compared to the previous year. This was due to a significant increase in transshipment traffic, which fell in 2016, leading to a 9% drop in total traffic. The overall increase in traffic has led to high demand for logistics facilities. Logistics facilities have gradually expanded beyond the immediate vicinity of the port, reaching the northern outskirts of the city in particular. It is in this context of increased traffic that a 400-hectare industrial platform was developed in 2021 in the municipality of Agoènyivé 6, with the aim of decongesting the port area of Lomé. These initiatives have led to a profound transformation of the spatial organization of the municipalities of Agoènyivé 6, Golfe 1, and Golfe 4.

The municipality of Golfe 1, home to the port and its industrial zone, is home to several commercial facilities, including 32 used car lots and retail outlets selling household appliances and office equipment. The items generally sold in these markets come from containers or vehicles imported from the West or Asia. Together with the Golfe 4 district, this district forms a business area where trade and logistics activities are highly developed. The desire for geographical proximity has led to a concentration of economic operators and real estate developers in this part of the city. There are 179 warehouses and stores larger than 300m<sup>2</sup> in this district. It should be noted that setting up in the port area is subject to the requirement to carry out an activity related to port operations and services [29]. The port area is not the only space coveted by transport and logistics operators. They are also acquiring plots of land in the surrounding municipalities in order to set up their warehouses and stores there.

The changes underway in Communes Golfes 1 and 4 are characterized by a gradual loss of residential function in favor of a strengthening of economic function. Logistically, this is manifested by the transformation of residential houses into warehouses for storing various goods from the port and its industrial zone. Indeed, the rapid increase in land values, combined with the rise in environmental nuisances (noise, insecurity) linked to port activities, is contributing to the decline in residential value of the old neighborhoods in Communes 1 and 4. This phenomenon is prompting many homeowners to sell their houses and move to the northern, northwestern, and eastern outskirts of the city. Land is less expensive in these outlying neighborhoods, which are also less noisy than the central neighborhoods.

Faced with increasing demand for storage space near the port, real estate developers, transit companies, and economic operators are investing tens of millions of CFA francs in the acquisition of

old houses, which they demolish to build warehouses and stores in their place. It should be noted that, in addition to inheritance, purchase and long-term leases are the two most common methods of land acquisition in Greater Lomé [28]. However, more than 80% of those surveyed acquired their plots through purchase.

Following an interview with a homeowner who has put his house up for sale in the municipality of Golfe 1, the latter made the following statement.

**Box 1. Excerpt From an Interview with A Homeowner Selling a Property in the Municipality of Golfe1.**

*" ... yes, I built this house in the 1940s. I bought the plot (600 m<sup>2</sup>) at the time for 150,000 CFA francs (or 250 CFA francs per m<sup>2</sup>). Today, I have put my house up for sale because of the rise in land prices and the insecurity and noise in this neighborhood. You can see for yourself the condition this house is in. I don't have the money to renovate it. However, I can sell it for more than 80,000,000 and use barely half of that money to build a bigger, more modern house in Agoè or Baguida, far from the noise of the trucks. You see that warehouse over there? It used to be a friend's house, but he sold it last year for several million to move to Agoè-Sogbossito, where he built a nice house."*

This excerpt reflects the changes underway in the communities surrounding the port, as well as the reasons why former homeowners are selling their houses to move to the outskirts. Although noise and insecurity are also cited, sales are mainly driven by rising land and property values.

- **The Adétikopé Industrial Platform (PIA): a logistical lever for the spatial restructuring of the northern outskirts of Lomé and the decongestion of the port.**

Located about 20 kilometers north of Lomé, Adétikopé was one of the 16 cantons of the Zio prefecture. In 2014, it was absorbed by the urban front and became part of the Agonyivé prefecture. It has become a destination for city dwellers and new urbanites, with a population of 110,194 (RGPH5,2022), and has undergone impressive urbanization, linked in part to the establishment of an industrial unit called the “Adétikopé Industrial Platform (PIA)”. The municipality thus combines its traditional residential function with an industrial and logistical function.

Covering a total area of nearly 130 hectares, the platform site is located east of National Road No. 1. According to [30], the platform is organized around three main functions: industrial, logistics (storage and cross-docking), and circulation. Industrial activities account for the largest share of its space (27%), followed by storage (23%) and container depots (16%). Support functions, such as internal circulation, green spaces, administrative and commercial facilities, occupy smaller portions. All of these functions aim to ensure the site's logistical efficiency.

Operational since 2021, the PIA has brought about profound changes in the municipality of Agoènyivé 6, in economic, infrastructural, social, and urban terms.

Economically, the PIA has revitalized local activity, marking the transition from an agricultural economy to one focused on trade, logistics, and industry. This is reflected in the increase in the number of storage facilities, which rose from 6 in 2000 to 32 in 2015, and in the number of small shops, which rose from 13 to 65 over the same period. [31]. In 2024, the municipality had 41 warehouses and stores larger than 300 m<sup>2</sup>, representing 7% of the minor logistics facilities in Greater Lomé (Table 2).

**Table 2. Distribution of Warehouses Measuring 300m<sup>2</sup> or More by Municipality in the DAGL**

Commune	Number of warehouses and stores larger than 300m <sup>2</sup>	Percentage
Golfe 1	179	30%
Golfe 4	78	13%
Golfe 5	56	9%
Agoe-nyive 1	51	8%

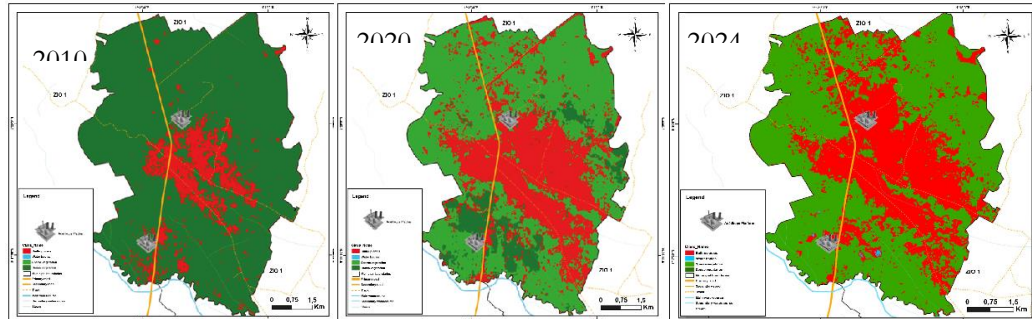
Agoe-nyive 6	41	7%
Golfe 7	37	6%
Golfe 6	34	6%
Agoe-nyive 5	29	5%
Agoe-nyive 4	27	4%
Golfe 2	25	4%
Golfe 3	20	3%
Agoe-nyive 3	15	2%
Agoe-nyive 2	14	2%
Total	606	100%

In terms of infrastructure, the municipality has 85 km of roads, including 5 km of paved primary roads. RN1, a strategic axis of the Lomé-Ouagadougou-Niger corridor, has been widened from south to north between Lomé and Davié, with traffic lights installed at the PIA to regulate the flow of trucks. Specific improvements have been made to the Djablé and Dalavé roads to improve secondary access.

On the social front, the platform is a major source of employment, with 2,000 jobs created out of the 35,000 planned. In addition, informal activities related to handling, storage, and logistics have emerged, mobilizing local labor.

The PIA has also intensified urban and land dynamics in the municipality. These are characterized by an increase in residential and logistics demand. The search for proximity to the platform and accessibility to road networks is attracting both low-income populations and logistics investors, accelerating pressure on land and transforming the built environment. This has led to a reduction in agricultural land in favor of built-up areas (Plate 1).

Plate 1 below shows the rapid expansion of built-up areas, particularly to the north and northeast of the industrial platform after it became operational in 2021. This expansion was rather slow in the decade prior to 2020.



Furthermore, pressure on land is reflected in speculation characterized by an increase in plot prices and rents. The average price of a plot (600 m<sup>2</sup>) has increased 34-fold in 20 years (2005 to 2025), rising from 500,000 to 17,000,000 CFA francs in the central part of the municipality of Adétikopé. However, in outlying neighborhoods such as Tonoukouti and Tsikplonoukondji, it rose from 300,000 to 8,000,000 CFA francs during the same period, a 26.6-fold increase.

One of the objectives of the PIA is to relieve congestion in the port area of Lomé. This has been achieved by organizing the transfer of containers destined for Sahelian countries to the PIA's dry port and heavy goods vehicle parking area. This transfer mechanism has contributed to an increase in truck traffic between the port area and Adétikopé, in particular via the Grand Contournement road and National Road No. 1.

Nevertheless, the impact of heavy goods vehicle traffic on urban mobility remains limited, as trucks are only allowed to circulate outside rush hours. Although this activity initially met with resistance from shipping companies, the main players in maritime transport, such as MSC, CMA-CGM, MAERSK, ONE, and PILS, gradually embraced the scheme and officially joined the PIA in 2024.

In addition, the platform's entry into operation has led to increasing commuters flows between other municipalities in Greater Lomé and Agoè-nyivé 6. This commuter mobility generates traffic congestion,

particularly at the entrance to the municipality during morning and evening rush hours. However, almost all of the workers employed on the platform live in Adétikopé and the surrounding area. They generally travel to the platform on foot or by bicycle.

- **Lomé Airport, a hub generating freight traffic with multiple spatial impacts**

Transferred to the northeastern outskirts of Lomé in 1944, Lomé-Tokoin Airport, following expansion and modernization work, became Gnassigbé Eyadéma International Airport in 2016. It currently covers 413 hectares and has a freight area with an annual handling capacity of 50,000 tons, compared to 15,000 before the expansion work [32]. It is located in the Gulfe 2 district, less than 5 km northwest of the Autonomous Port of Lomé.

Like the port area, the airport area is in high demand by air freight operators, who have set up small warehouses and stores there. However, the number of warehouses larger than 300m<sup>2</sup> registered in the commune is low, representing only 4% of the total registered in Greater Lomé (Table 2). This situation can be explained, on the one hand, by the small size of parcels shipped by air and, on the other hand, by the proximity between the port and the airport, which leads to the joint use of warehouses located in the port area to handle air freight. However, its spatial impact is decisive in the urbanization of the eastern outskirts of the DAGL with the development of neighborhoods such as Hédzranawoé, Enfanmé, Noukafu, etc.

In addition to the major logistics facilities mentioned above, there are medium-sized facilities, such as Place Bonke. The latter functions as a platform for consolidating and distributing goods flows, although its impact on urban land use planning is limited.

It receives trucks and containers whose contents are redistributed by light commercial vehicles such as tricycles to the various warehouses, stores, and shops in the DAGL. At the same time, this facility also allows for the consolidation of goods from several markets and the port area. They are then loaded onto trucks bound for the outskirts of Lomé and other locations in the country.

It should be noted that these major logistics facilities host minor logistics operators on their sites or in their immediate vicinity.

### **Minor Logistics Facilities and Their Spatial Organization Logic in the DAGL**

Minor logistics facilities are considered in this article to be storage warehouses and retail outlets. The latter include shops and supermarkets covering an area of at least 300m<sup>2</sup>.

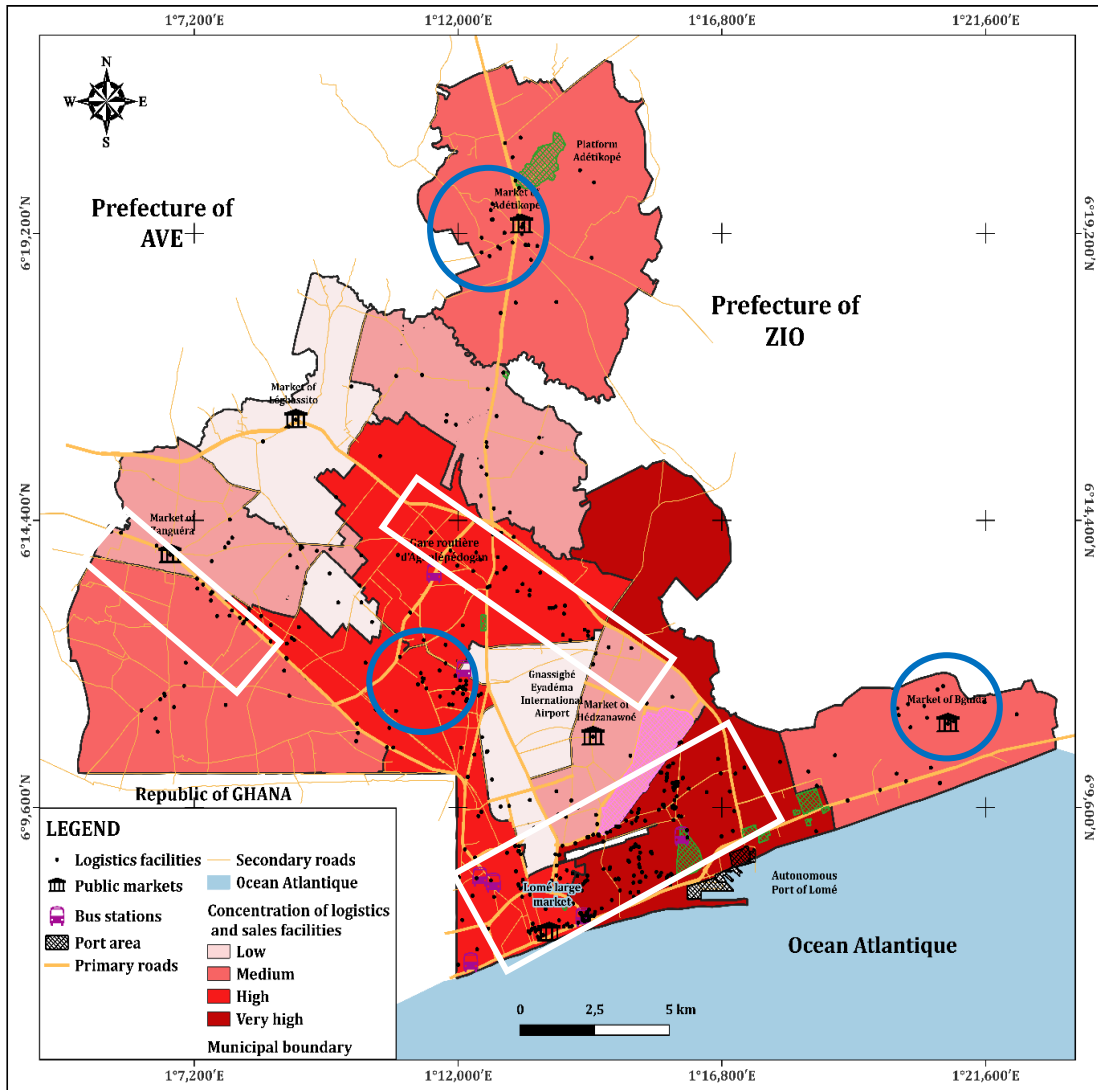
- **Factors determining the location of minor logistics facilities in the DAGL**

Proximity and accessibility are the two main factors determining the location of minor logistics facilities in the DAGL.

### **Proximity to Major Logistics Facilities and Commercial Facilities.**

Proximity is a multidisciplinary concept. According to [33], the spatial-temporal approach to proximity refers to the position of objects in space and time. The proximity referred to in this article is spatial. It is measured by distance and accessibility [34].

Proximity to major logistics and commercial infrastructure is one of the determining factors in the location of warehouses in the DAGL. Figure 4 shows the spatial distribution of warehouses and stores in Greater Lomé. There is a concentration in the port area, around the large market in Lomé, along streets and commercial facilities.



**Figure 4. Spatial distribution of warehouses and stores in Greater Lomé**

While proximity to major logistics infrastructure influences the location of warehouses in Greater Lomé, accessibility also remains a decisive factor for urban freight operators. Central municipalities, particularly Golfe 1 and Golfe 4, are the most accessible due to their dense road networks, which are very dense and dense respectively (Figure 4). They also have a high proportion of paved roads, unlike peripheral municipalities where these infrastructures are less developed, which accentuates inequalities in logistical accessibility across the metropolitan area.

**Accessibility As a Criterion for Locating Warehouses and Stores in the DAGL.**

Accessibility is the main criterion for locating logistics facilities [17]. In terms of accessibility, two factors guide decisions on the location of warehouses in the DAGL. On the one hand, the territory's ability to facilitate access to facilities based on the level of development of a high-quality road network that is well integrated into the urban fabric. On the other hand, the location of these minor logistics facilities close to major logistics facilities in order to minimize access distances.

**Box 2. Excerpt from an interview with a freight forwarder who owns warehouses in the Akodésséwa neighborhood near the port.**

*We handle goods coming from or going to the port and airport, so you understand that we can't set up our warehouse outside this area without risking increasing the distance to the port and losing customers. Sometimes, colleagues also ask us to store their customers' goods when they run out of space in their own warehouses, which means that our warehouse is never empty. If we were far from the port, we would not be able to benefit from all these advantages. We are in high demand from occasional customers. Since we are 300 meters from the paved road, we sometimes have difficulty accessing the warehouse during rainy periods. But we do not experience the same difficulties as warehouses that are still far from the road.*

DAGL, as there is a concentration around major commercial and logistics facilities and along major roads.

The municipalities of Golfe 1 and Golfe 4, which are home to the port and the large market of Lomé respectively, account for 43% of warehouses and stores larger than 300m<sup>2</sup> in the DAGL (Table 2).

The spatial distribution of warehouses and stores in the Greater Lomé Autonomous District reflects a location strategy based on proximity to major hubs generating goods flows and major road axes, with a view to optimizing logistical accessibility.

## **Discussion of Results**

This study has shown the spatial dynamics of the Greater Lomé Autonomous District and the structuring role of major logistics facilities in urban change at the municipal and metropolitan levels. As a result of the interactions between logistics and urban development, minor logistics facilities reveal two patterns of location in urban space.

The first logic is that of concentration around major logistics and commercial hubs. The second involves organization along the structuring axes of the DAGL road network. These results corroborate the work of [6] and [16], which asserts that the search for geographical proximity favor the attraction of minor logistics facilities around larger facilities. Nevertheless, [18] point out that urban warehouses and distribution centers tend to be located in the centers of urban areas, where they are used as relay points for peripheral logistics facilities in supplying downtown businesses. According to [15], both types of facilities are evolving as components of the same distribution network to meet the supply demands of city dwellers.

Using the example of the Autonomous Port of Lomé and the PIA, the study also reveals the varied territorial effects of major logistics facilities. In the Golfe1 commune, the proximity of the port is leading to increasing pressure on land, marked by a shortage of space and the conversion of garages and residential houses into storage warehouses. In contrast, the peripheral commune of Agoé-nyivé 6 has undergone rapid urbanization since 2014, which has intensified since 2021, the year marking the start of the platform's operation (plate 1). This has been accompanied by land speculation and a functional transition characterized by a decline in primary activities in favor of tertiary activities [28, 31, 34]. In line with this logic, [2] highlight the harmful effect of logistical sprawl on green spaces. According to these authors, logistical sprawl, like commercial and residential urban development, contributes to the artificialization of land while reducing the space available for agriculture.

At the metropolitan level, logistical suburbanization helps to divert heavy goods vehicle traffic away from urban centers. However, results have shown that it increases the distance between city centers and suburbs while altering the daily mobility of employees. An analysis of the effects of urban sprawl in Lomé by [35] reached the same conclusion.

Logistical sprawl reinforces the dynamics of urban sprawl, with both processes producing convergent effects on the transformation of urban space. In this context, rigorous planning of the

location of logistics infrastructure appears essential to manage the spatial growth of West African cities and limit the negative externalities associated with the mobility of people and goods.

## **Conclusion and Recommendations**

The literature review reveals a lack of research on the spatial organization of urban logistics facilities and their effects on urban planning, particularly in West African cities [4]. This research has provided insight into the logic behind the spatial organization of warehouses and stores in the DAGL urban area. The variation in their sizes and the fragmentation of their ownership complicate any classification work. Thus, only facilities of 300m<sup>2</sup> and above were taken into account in the study. The results revealed, on the one hand, that major logistics facilities often contribute to urban sprawl due to their location on the outskirts of cities where space is available and less expensive. In these areas, they promote the development of logistics and commercial activities that drive demand for logistics real estate such as stores and warehouses. Thus, the response to this ever-growing demand is leading to a special transformation characterized on the outskirts by the gradual disappearance of brownfield sites and green spaces in favor of built-up areas. Furthermore, the concentration of logistics facilities in the same geographical area and in residential areas generates negative externalities such as traffic congestion, air and noise pollution, etc.

Demonstrating the relationship between logistics and territory through the spatial organization of major and minor logistics facilities in the urban space of DAGL, this study did not address the classification of warehouses and stores according to their functions, sizes, and owners. Future research may take these aspects into account, as well as comparisons with other West African cities for the modeling of minor logistics facilities in West Africa.

Furthermore, for greater efficiency in African urban planning, urban development plans (UDPs) must:

- incorporate an urban logistics plan;
- define areas for the location of current and future logistics facilities, taking into account population trends;
- map, in the specific case of the DAGL, logistics facilities according to their capacity and plan for future expansion or relocation
- improve the accessibility of logistics facilities by developing a high-quality road network that is well integrated into the urban fabric.
- Establish regulations for the construction of warehouses in the DAGL.

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