

**The Implications of the Urban Logistics Concept for
Reducing Traffic Congestions
A case study on Al Haram Street, Giza, Egypt.**

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Abstract

This study addresses the persistent traffic congestion in Al Haram Street within the Greater Cairo Metropolitan Area (GCMA). Recognizing the detrimental effects of congestion on Egypt's economy and urban livability, this research attempts to explore the causes of traffic congestion in GCMA and to investigate the viability of implications of proper urban logistics solutions to reduce traffic congestion in the GCMA, especially on Al-Haram Street in Giza. In order to achieve this aim, considering the review of previous studies, reports, as well as governmental directions provided a deep understanding of the research problem and evaluated the preparedness for implementation. Furthermore, a comprehensive mixed-mode survey approach was adopted to identify the underlying factors contributing to traffic challenges and to investigate the viability of the urban logistics strategies. These strategies included the introduction of cargo bikes for efficient goods delivery, refining

the bus transport network, pedestrian-friendly infrastructures, and effective public parking garages (PPGs). The study emphasizes the need for reimagined urban infrastructure, aligning with the aspirations of Egypt's Vision 2030. Through these insights, the research offers a blueprint for urban areas dealing with congestion issues and pushing the boundaries of traditional urban logistics toward a sustainable future.

Keywords

Urban Logistics, Cargo Bikes, Last Mile, Egyptian Vision 2030, Traffic Congestion, Greater Cairo Metropolitan Area (GCMA).

انعكاسات مفهوم اللوجستيات الحضرية في تقليل الازدحامات المرورية.
دراسة حالة شارع الهرم، الجيزة، مصر.

الملخص

تتناول هذه الدراسة الازدحام المروري المستمر في شارع الهرم داخل منطقة مدينة القاهرة الكبرى (GCMA) إدراكاً للأثار الضارة للازدحام على الاقتصاد المصري والقدرة على العيش في المناطق الحضرية، يحاول هذا البحث استكشاف أسباب الازدحام المروري في منطقة القاهرة الكبرى والتحقيق في جدوى الآثار المترتبة على الحلول اللوجستية الحضرية المناسبة لتقليل الازدحام المروري في منطقة القاهرة الكبرى، وخاصة في منطقة الهرم. شارع بالجيزة. ومن أجل تحقيق هذا الهدف، فإن مراجعة الدراسات والتقارير السابقة وكذلك التوجيهات الحكومية قدمت فهماً عميقاً لمشكلة البحث وتقييم مدى الاستعداد للتنفيذ. علاوة على ذلك، تم اعتماد نهج مسح شامل مختلط لتحديد العوامل الأساسية التي تساهم في التحديات المرورية وللتحقق من جدوى الاستراتيجيات اللوجستية الحضرية. وتضمنت هذه الاستراتيجيات إدخال درجات الشحن لتوصيل البضائع بكفاءة، وتحسين شبكة النقل بالحافلات، والبنية

التحتية الصديقة للمشاة، ومواقف السيارات العامة الفعالة. تؤكد الدراسة على الحاجة إلى إعادة تصور البنية التحتية الحضرية، بما يتماشى مع تطلعات رؤية مصر ٢٠٣٠. ومن خلال هذه الأفكار، يقدم البحث مخططاً للمناطق الحضرية التي تتعامل مع قضايا الازدحام وتدفع حدود الخدمات اللوجستية الحضرية التقليدية نحو مستقبل مستدام.

الكلمات المفتاحية: الخدمات اللوجستية الحضرية، دراجات الشحن، الميل الأخير، الرؤية المصرية ٢٠٣٠، الازدحام المروري، منطقة القاهرة الكبرى.

1- Introduction

Nowadays, we live in a fast-paced environment where everything around us is subject to dynamic and frequent change, especially in urban cities. For instance, the Greater Cairo Metropolitan Area (GCMA) population, including three governorates: Cairo, Giza, and Qalyubia, has successively increased with a tremendous figure of about 20 million residents (Hudec, 2023). This has led to a significant increase in the number of cars and other transportation modes causing the traffic congestion problem (Sims, 2022). Moreover, traffic congestion substantially reduces transport speed and extends travel lead time, which in return costs Egypt 50 billion EGP of its gross domestic product (GDP) which makes up 4% of its GDP (Masoud, 2023). Hence, traffic congestion is regarded as one of the most serious problems affecting all pillars of sustainability in Egypt.

While previous studies suggested possible solutions to reduce traffic congestion, such as Urban Transport Strategy for Cairo: Advice and Dissent held in the 1980s, these measures were often short-sighted as they proposed a temporary relief to the problem

by introducing the Cairo Transportation Authority (CTA) busses in GCMA to ease the daily commute of the people (Abdelati & Abdelhaeez, 2023). This solution neglected the fact that increasing the number of buses will not only expand the load rate of passengers but will also intensify the traffic tremendously and have a negative impact on the environment. On the other hand, previous studies shed light on the underlying causes and dynamics contributing to the traffic problem that has arisen in GCMA and provided valuable insights into the complicated factors driving the traffic problem, thereby enriching the better understanding of its origin and more sustainable ideas for potential solutions (Hussein, 2015).

Due to the extensive geographical coverage of the GCMA, which spans three distinct governorates, this research necessitates a strategic focus in order to facilitate a comprehensive analysis of the problem. For instance, Al Haram Street is one of the main corridors in the governorate of Giza, it links urban regions like Dokki and Al Manial with the Alexandria-Desert road that also leads to the city of Sheikh Zayed and 6th of October (See **Figure 1**).



Figure 1: Route from Al Haram Street to Sheikh Zayed City

Source: (Google, n.d.)

The provided data exhibits a demographic analysis of Al Haram Street, a notably crowded artery spanning through three urban sectors in the Giza governorate: Qism Al Umarniyah, Qism Al Talbiah, and Qism Al Ahram. Observing the population figures from 2017 to 2021, there is a clear upward trend in the number of inhabitants across all districts. In Qism Al Umarniyah, the population increased by 20,778, reaching 386,844 in 2021. This area also shows the highest population density of the three, with 52,826 individuals per square kilometer in 2021, indicating a high concentration of residents in the urban fabric. Moving to Qism Al Talbiah, there was a growth of 26,023 residents, totaling 483,690 by 2021. The density here is slightly lower than in Al Umarniyah, standing at 46,509 per square kilometer, suggesting a slightly more distributed population within its urban boundaries. In Qism Al Ahram, the population rose by 37,391 individuals, with a 2021 figure of 696,696. It has the lowest density among

the three, with 38,792 individuals per square kilometer, which may imply a bit more breathing room compared to the other two districts, although it's still considerably dense. Cumulatively, the total population along Al Haram Street in these three districts witnessed an increase of 84,192 people, surging from 1,483,038 in 2017 to 1,567,230 in 2021. The collective density figure is not simply an additive result but rather a comprehensive indicator of the overall population spread over the area, marked at 144,127/km² in 2021.

Table 1: Population and Density at Al Haram Street

Name	Status	Population 2017	Population 2021	Density/Km ² 2021
Al Umarniyah	Fully Urban	366,066	386,844	52,826
Al Talbiah	Fully Urban	457,667	483,690	46,509
Al Ahram	Fully Urban	659,305	696,696	38,792
Total		1,483,038	1,567,230	144,127

Source: Citypopulation (2021)

The statistics shown in **Table 1** not only underscore a consistent population growth but also highlight the challenges associated with managing urban infrastructure, resources, and quality of life in such densely populated regions. Moreover, these statistics concludes the significant impact on the traffic on Al Haram Street. On the other hand, Al Haram Street lacks the infrastructure necessary to accommodate the substantial daily traffic volume, resulting in persistent and constant traffic congestion. Thus, there is an urgent need for effective urban planning and sustainable development initiatives to

accommodate the growing populace while maintaining and improving living standards.

It is worth mentioning that traffic congestion is becoming one of the major problems in Egypt and it is increasing every day drastically. Consequently, major contributions from local and foreign institutions, including international conferences, new governmental policies and strategies as well as academic research, were made to overcome such an issue and the problem still exists. Another major issue is that developing countries, such as Egypt, are following the same motor car-centric patterns, while developed countries are now attempting to rectify these patterns by limiting the expansion of private cars and prioritizing public and clean transportation modes (Zou & Zhao, 2023).

Thus, it is of great importance to acknowledge the fact that urban areas are significantly different in terms of road traffic congestion risk. The structure and size of urban cities, in addition to human behavior, have an excessive influence on the road traffic volume and pattern and, consequently, on the associated congestion created in these areas (Albalate & Fageda, 2019; Rahman et al., 2022)

Based on the above discussion, this research attempts to explore the causes of traffic congestion in GCMA and to investigate the viability of implications of proper urban logistics solutions to reduce traffic congestion in the GCMA, especially on Al-Haram Street in Giza. In order to achieve this aim, considering the review of previous studies as well as governmental directions

shall provide a deeper understanding of the research topic and evaluate the preparedness for implementation, thereby helping to identify both the potential opportunities and challenges of introducing the concept.

2- Urban Logistics and Traffic Congestion

With urbanization rapidly taking the wheel in global development trends, cities around the world are expanding, both demographically and infrastructurally. This expansion has brought with it a series of challenges, especially in terms of the efficient movement and distribution of goods within congested urban settings. Here, the concept of urban logistics becomes essential, serving as a tool for addressing and mitigating these urban logistical challenges (Melo & Baptista, 2017). In essence, urban logistics acts as a crucial bridge, connecting the vast networks of global supply chains to the congested streets of our urban areas, ensuring that goods and services reach their final destination in a timely and efficient manner (Fraske & Bienzeisler, 2020).

While urban logistics is a relatively new field, especially in developing countries, its significance and implications cannot be neglected. At the foundation of this concept lies the goal of optimizing the last-mile delivery, which is the final stage in the supply chain, ensuring that goods transition from local hubs right to the doorsteps of customers (Mazzarino & Rubini, 2019). Moreover, given the dense and dynamic nature of urban

environments, this last mile is often connected with challenges, making its effective management dominant (Muriel et al., 2022). The literature offers diverse interpretations of urban logistics. For instance, some definitions describe urban logistics as an integrated framework focusing on the organization, planning, and control of goods movement within urban spaces (Bosona, 2020). On the other hand, some definitions interpret urban logistics as the complicated systems and procedures that drive the management of freight transport within urban boundaries (Lagorio et al., 2016). While the main idea remains consistent across the definitions, however, the emphasis varies, as some definition gives more focus on strategic planning and organization, while others investigate operational systems and procedures. Such variances accentuate the richness of the domain, reflecting its adaptability and relevance to diverse urban setups. Moreover, urban logistics is not just about transportation but involves a layered understanding of urban ecosystems linking various sectors, from commerce and public policy to environmental sustainability.

Understanding the intricacies of urban logistics necessitates a deep dive into its defining features, distinct from traditional logistics. One of the cornerstones of urban logistics is the concept of Micro-hubs. These are small yet essential distribution centers located strategically within urban parameters to ensure reduced

transport distances, thereby minimizing congestion and environmental impact (Melo, 2017).

Another important principle is to provide multi-modal solutions, as urban logistics relies heavily on the flexibility of using various transportation modes to ensure rapid responsiveness to the entire urban areas and can significantly diminish the over-reliance on any single form of transport, leading to more balanced road use (Ji et al., 2020).

However, what truly modernizes and optimizes urban logistics in today's world is its integration with technology and digitalization. This could be shown in many ways, such as advanced tracking systems, route optimization software, and smart transportation modes (Büyüközkan & Ilıcak, 2022). Nevertheless, as cities grow more interconnected, collaborative platforms have emerged as another defining feature of the use of technology in urban logistics. Such platforms allow various stakeholders, including local businesses, governmental bodies, and even consumers, to collectively address urban freight challenges.

Finally, with cities facing escalated environmental concerns, urban logistics attempt to achieve a sustainable domain through more emphasis on the use of electric vehicles, encouragement of cycling, and minimizing packaging, all aimed at reinforcing a greener urban ecosystem (Silva et al., 2023).

The following sub-section attempts to develop a deeper insight into the pressing challenge of traffic congestion in urban cities

and how innovations in urban logistics can offer effective solutions to the problem.

2.1: Urban Logistics and Traffic Congestion: challenges and innovative solutions

Urban logistics has a profound interrelationship with traffic congestion, where the need to transport goods seamlessly is often stuck with the realities of overcrowded urban streets. Moreover, the advancements in e-commerce and the consequent rise in deliveries have intensified the pressure on urban infrastructures leading to significant escalation in the traffic as delivery vehicles fight for space with private cars, buses, and other modes of transport (Mucowska, 2021). This not only obstructs the timely delivery of goods but also increases environmental pollution due to long vehicle idling (Batarliené & Bazaras, 2023).

Furthermore, congestion affects the economic viability of urban logistics. Delayed deliveries translate to increased operational costs and reduced customer satisfaction. Moreover, congested streets can limit the accessibility to certain parts of the city, challenging the very principle of urban logistics, which aims to ensure efficient goods movement across all urban areas (Gatta et al., 2018). Thus, with optimized routing, off-peak deliveries, and the use of alternative transportation modes, urban logistics can be a significant factor in the profound of innovative solutions (Mazzarino & Rubini, 2019).

The challenges posed by traffic congestion in urban cities have stimulated numerous proven innovative solutions that require broader infrastructural and policy changes, such as:

- **Consolidation Centers:** These are hubs where goods are collected and then distributed efficiently. By centralizing the receipt and dispatch of goods, fewer vehicles are needed on the roads, thus reducing congestion.
- **Law Enforcement:** Effective regulations, such as designated delivery times or zones, can help manage the flow of delivery vehicles, ensuring they do not move in the morning or evening rush hours.
- **Public Parking Areas:** Designated loading and unloading zones can prevent delivery vehicles from obstructing traffic. Furthermore, multi-level parking systems can accommodate more vehicles, freeing up street space.
- **Pedestrianization and Crossings:** Some areas can be reserved just for pedestrians. This not only makes walking safer and more pleasant but also can make vehicle traffic smoother. Also, strategically placed crossings mean pedestrians won't disrupt the flow of vehicles.
- **Public Engagement:** Engaging the public in decision-making can lead to solutions that are holistic and reflective of the diverse needs of urban inhabitants.

- **Green Transportation:** Promoting eco-friendly transport options like cargo bikes or electric scooters can reduce the number of cars on the road.
- **Digital Platforms:** Using technology to forecast traffic and suggest optimal delivery times or routes can help in avoiding traffic hotspots.
- **Flexible Delivery Windows:** Instead of rigid delivery times, offering flexibility can ensure deliveries happen when roads are less busy.

To conclude, a thoughtful approach to transportation and delivery systems can make urban living smoother and more sustainable by driving these solutions into practice, they can greatly improve traffic issues in urban cities.

In the upcoming sections, the research attempts to address the traffic challenges faced by the GCMA while investigating how Egypt's Vision 2030 ties into the problem of transport congestion and the role of urban logistics in addressing these challenges.

3- The traffic congestion problem is GCMA:

The GCMA is an expansive urban region that includes Cairo, Giza, and a large part of the Qalyubia Governorate. Due to its position as the political and economic center of Egypt, it experiences a significant flow of road transport users, leaving it subject to severe congestion (Elsadek et al., 2022). Moreover, decades of rapid urbanization, population expansion, and inadequate public transportation systems have all contributed to the escalating of the

congestion problem, which has driven global and local institutes and academics to conduct extensive research on the subject (Ibrahim et al., 2012; El-Kadi, 2013; Moussa, 2023).

The World Bank's 2006 study on urban transport in the GCMA revealed significant issues such as traffic congestion, overcrowded public transport, high road accident rates, environmental pollution, and underfunding. Solutions proposed included major public transport projects, improved policy integration, user-centric public transport, and traffic demand management.

Furthermore, the World Bank Group investigated traffic congestion in the GCMA in 2014. The study acknowledged private vehicles as the dominant means of transportation, accounting for 55% in 2014 and expected to grow by 2030. Taxis and micro-mini buses came in second and third, with 24% and 16%, respectively. Moreover, careless driving behaviors, insufficient parking, random vehicle stops, and random pedestrian crossings, were blamed for a substantial portion of the congestion. Also, due to incidents such as vehicle breakdowns and security checks, major routes such as the May 15th Bridge and Al Haram Street were especially subject to congestion. Furthermore, the report affirmed that the primary causes of traffic congestion were classified under the following reasons: road design issues, lack of road etiquette, parking issues, law enforcement deficiencies, and unexpected accidents. In response, the report suggested methods such as improved

traffic management, increased government action, the implementation of traffic-related fines, and investment in extending public transport networks.

Another study by the World Bank conducted in 2019 started by proposing the fundamental law of road congestion which suggests that new road capacity will certainly lead to an equal increase in driving due to more cars replacing those removed by public transit measures. This law proposes that while the introduction of public transportation might initially reduce the number of cars, over time, this effect will disappear. However, the findings confirmed that this was not the case in GCMA, as new cars took the position of drivers who converted from private to public transportation. Thus investments in infrastructure and urban planning were proposed as critical steps towards the congestion problem.

In summary, a significant observation is that many main routes seem to be operating beyond their intended capacity, often resulting in peak-hour traffic congestion. A possible contributor to this issue is the lack of proper transportation infrastructure and maintenance. Moreover, advanced traffic signaling and law enforcement systems could be essential in managing traffic more efficiently. Furthermore, from a societal perspective, traffic congestion negatively impacts the residents' quality of life, primarily due to long driving times and stress.

Thus, to improve the traffic congestion in GCMA, the Egyptian government has taken several measures that reveal the

significance of the urban logistics concept. The Egyptian government has introduced new traffic laws to improve road safety in GCMA. These laws assign points to drivers, with violations resulting in license suspensions (Timmermans et al., 2022). Moreover, old cars are replaced with eco-friendly newer models, and imposed emission inspections ensure vehicles meet specific standards (Taher & Shafie, 2021).

4- Urban Logistics and Egypt's Vision 2030:

In alignment with Egypt's Vision 2030 and the Sustainable Development Strategies (SDS), this research underlines a holistic approach to reducing traffic congestion in Egypt. Egypt's 2030 vision formulates a comprehensive development plan on three key dimensions: environmental, focusing on sustainable urban development; economic, which integrates economic growth, knowledge, innovation, research, and governance; and social, addressing social justice and health. These factors merge to form a national progress blueprint (Chen, 2018; Moghaieb, 2019), with the concept of urban logistics implied in (Ali et al., 2021).

Furthermore, Egypt's Vision 2030 addressed several serious obstacles in the transport sector hindering Egypt's economic growth. Poor services within the transport networks and insufficient networks of public transport, such as:

- Insufficient safety and security procedures in all networks of transport and high rates of traffic accidents.

- Poor infrastructure capabilities to cope with traffic congestion.
- The lack of financial resources to finance investments in the transport sector, and the limited involvement of the private sector in the execution and administration of transportation initiatives is mostly attributed to inadequate financial incentives.
- The increasing of air pollution and carbon dioxide emissions.
- Lack of dependence on railways and river transport in the movement of goods, resulting in increased traffic density and frequent occurrence of unnecessary trips and accidents.
- Inadequate synchronization between sustainable transportation strategies and new city urban development plans.
- Weak institutional and administrative capabilities.

These obstacles create a heavy burden that should be put into consideration if Egypt is ever going to achieve a convenient urban environment congestion-free.

Additionally, Egypt's Vision 2030 included a set of policies and guidelines to enhance the transport sector by 2030, such as:

- Achieving a balance between the various means of transport and setting the rules regulating all of that. In addition to, paying attention to multimodal transport, especially the ports, railways, and river transport.
- To pay attention to multimodal transport to reduce the burden on roads, taking the necessary measures to do so, particularly when transporting containers.

- Activate the role of railways in terms of operation and management.
- Promoting river transport to reduce the burden on roads.
- Promoting a sufficient public transportation system to reduce the number of trips taken by private vehicles. With the current 1.9 billion passengers annually using public transport, there is an expected increase of 30% by 2020, and aiming for a 50% increase by 2030.

When considering the key objectives of Egypt's Vision 2030 and the SDS, it becomes evident that urban logistics and transportation have a significant impact on developing the nation's future direction. Egypt encounters several inherited transportation challenges, including inadequate transportation infrastructure, concerns regarding safety, excessive traffic congestion, and escalating levels of pollution. Nevertheless, the 2030 vision presents a detailed strategy to address these concerns. This highlights the necessity for an integrated urban logistics strategy, including effective public transportation systems and coordinated urban development initiatives that promote sustainable modes of transportation.

In the next section, the research will highlight Egypt's ambitious transportation projects and their alignment with SDS.

5- Egypt's Visionary Transportation Projects

The Egyptian government's investment in transformative transportation projects comes at a critical juncture, especially when considering the escalating traffic congestion issues in the GCMA. This area faces massive mobility challenges, emphasizing the need for the ambitious transportation projects anticipated in Egypt's Vision 2030 (Chen, 2018; Moghaieb, 2019). The GCMA's congestion problem is not simply an inconvenience; it carries substantial socio-economic and environmental repercussions. The hours lost in traffic translate to economic inefficiencies, increased carbon emissions, and a diminished quality of life for Cairo's residents (Fayez et al., 2021; Mohamed et al., 2022).

The strategic expansion of the rail network promises a viable solution. By offering an efficient, fast, and eco-friendly alternative to road transport, it is expected that a significant portion of the commuting public will transition to using trains. This shift not only eases road traffic but reduces the pressure on the city's road infrastructure which has historically been under pressure due to the huge volume of transportation movement (Owais et al., 2021). Moreover, infrastructure projects, such as the Rod El Farag Axis Bridge and other similar ongoing projects, provided alternative routes and reduced the dependency on a few main corridors, these projects aim to redistribute traffic, thereby optimizing vehicular flow across the GCMA (Al-Menshawry et al., 2022).

On the other hand, the development of the new administrative capital plays a dual role; firstly, by relocating key governmental functions and businesses, it reduces the daily influx of commuters into the heart of Cairo; secondly, with its state-of-the-art transportation systems, it serves as a model to all developing countries for how urban mobility can be effectively managed to prevent congestion from happening (El-Ashry, S., 2020). Additionally, the push towards green transportation in Egypt by introducing electric buses and mono-rails, given their capacity and speed, can transport a larger number of passengers compared to conventional vehicles, promising reduced traffic volumes and congestion (Mohamed et al., 2022).

In essence, Egypt's transportation projects are not only considered infrastructural upgrades; they are comprehensive solutions designed to tackle the complex challenge of congestion in the GCMA. As Egypt moves forward towards 2030, these projects offer a vision of a GCMS where mobility is efficient, sustainable, and dynamic.

After conducting a comprehensive review of the extant literature and various reports from the World Bank Organization on the causes of traffic congestion and the potential role of urban logistics in overcoming this persistent urban challenge.

This review offered a global perspective that highlighted both the macro and micro-level particulars of urban traffic dynamics and

the pressing need for innovative solutions tailored to the unique characteristics of the Egyptian mindset and culture.

Based on the rich insights gathered through the extensive literature review and detailed analysis of global and local dynamics, a deeper appreciation for the unique intricacies of Egypt's urban framework has emerged. Moreover, with an understanding of the distinctive challenges and prospects embedded within the Egyptian urban context, a tailored set of solutions has been proposed (see **Table 2**). For the scope of this study, these urban logistics solutions will be critically examined, particularly focusing on their viability and acceptance by several retail and service businesses in Al Haram Street such as mini markets, restaurants, pharmacies, etc. This approach ensures not just theoretical relevance but also practical applicability, combining global best practices with local sensibilities.

Table 2: Proposed Solutions for Urban Traffic Management in Al Haram Street

Solution	Description
Cargo-bikes for delivery	Replace trucks with cargo-bikes to reduce road congestion.
Efficient bus transport network	Reduce minibuses and establish a fixed bus station system.
Pedestrian bridges	Build more pedestrian bridges to prevent illegal road crossings.
Public parking garages	Construct multi-level public parking garages to reduce on-street parking and congestion.

Source: Author's own

6- Methodology

To gain a comprehensive understanding of urban logistics and its intricate relationship with traffic congestion, this research employed a semi-administered survey approach, commonly referred to as a mixed-mode method. This approach combines the benefits of both self-administered and interviewer-administered techniques. It typically commences with the interviewer presenting the survey to participants, offering an opportunity to explain the survey's objectives and answer preliminary inquiries, thus ensuring the subjects are well-informed and aligned with the survey's goals. Post this orientation, participants work on the survey independently, allowing them to consider the multifaceted aspects of urban logistics and traffic problems without external influence. Upon completion, the interviewer revisits certain responses to resolve any ambiguities, ensuring data integrity. The reason behind using this method is to afford participants the autonomy and discretion of self-administered surveys while retaining the depth and clarity facilitated by interviewer interactions. This method's efficacy is particularly resonant when investigating topics as layered as urban logistics, where certain sections of the survey might necessitate deeper clarification to capture its diverse implications (Gideon, 2012).

Furthermore, descriptive analysis was employed to analyze and represent data in a format that is both interpretable and

comprehensive. This approach was used to describe, illustrate, or condense data meaningfully, enabling the identification of prominent patterns or trends. Throughout the descriptive analysis of urban logistics and its implications for traffic congestion, the researcher started by assessing the frequency distribution of responses, giving a snapshot of overall opinions. This quantitative evaluation was deepened by a categorical interpretation of the qualitative reasons provided by respondents, shedding light on the nuances and differences from their perspectives. Moreover, recognizing discernible patterns across categories enabled the researcher to understand broader trends and general views regarding urban logistics and traffic congestion, ensuring the insights derived are contextually grounded and relevant to the primary objectives, which can be concluded in the following:

- To assess the current traffic situation in Al Haram Street.
- To investigate the viability of the proposed urban logistics solutions to the traffic congestion problem.

In order to meet the above-mentioned objectives, the survey was structured around five key areas of inquiry:

1- Traffic Congestion Causes on Al Haram Street:

Respondents were asked to identify the primary reasons for traffic congestion on Al Haram Street from their vantage point.

2- Cargo Bikes vs. Trucks:

The survey investigated participants about their views on the feasibility of cargo bikes as an alternative to traditional trucks for goods delivery.

3- Microbuses vs. Efficient Bus Transport:

Participants were prompted to consider the potential impacts, both positive and negative, of reducing or even eliminating microbus commutes in favor of a more organized bus transportation network with fixed stations.

4- Pedestrian Bridges vs. Illegal Road Crossings:

The survey requested opinions on the idea of introducing more pedestrian bridges as a method to restrict unauthorized road crossings.

5- Public Parking Garages vs. On-Road Parking:

Lastly, respondents were asked about their stance on implementing additional public parking structures alongside Al Haram Street to counter the prevalent issue of illegal on-street parking.

The selection of the business categories or store types on Al Haram Street was based on the diversity of businesses and how they might be impacted differently by the traffic congestion and how would they perceive the proposed urban logistics solutions. The reason behind this is that different businesses have varying logistical requirements. A restaurant might prioritize speedy deliveries, while a clothing store might be more concerned about the volume of goods transported.

Due to the difficulty in obtaining public records or any other formal documentation, direct observation was employed as the primary method for identifying and selecting the sample for this research. Thus, direct observations, by walking along Al Haram Street and noting the prominent types of businesses, informed the selection of a diverse sample from various business categories for the survey. The determination of the number of surveys for each store category was guided by the researcher's observational analysis. Specifically, the observations pinpointed eight dominant business categories on Al Haram Street. Consequently, a total of 67 surveys were administered across these categories as follows:

Table 3: Survey distributions across the dominant business categories

Store Types	Number of surveys
Clothing Stores	15
Flower Shops	5
Restaurants & Cafes	20
Toys & Home Appliances	8
Phone Accessories	14
Mini-Markets	8
Pharmacy	9
Juice Stores	3

Source: Author's own

7- Analysis and Findings:

In this section, the research took a thorough look at the collected data, highlighting a spotlight on the intricacies of urban logistics and its impact on traffic in Al Haram Street. For the purpose of this research, descriptive analysis was adopted streamlining vast

amounts of information into clear, valuable insights. This approach has been helpful in highlighting the major trends and patterns, as well as capturing the sentiments of those surveyed. Furthermore, to ensure a comprehensive understanding, the research attempted to quantify the responses by determining how often specific answers were given to able to measure common sentiments and prevailing opinions (Lawless, 2010).

Yet, to fully grasp the depth of the problem, it was vital to go beyond just numbers by delving into the detailed explanations and personal experiences shared by respondents to add a layer of richness to the findings. This combination of quantitative data and qualitative feedback provides a multi-faceted view of Al Haram Street's traffic challenges and offers a foundation for potential solutions (Duffy, 2009).

As we move forward through this section, each area of inquiry, from the causes of congestion to the feasibility of alternative transport methods, will be explored and analyzed in detail to provide a holistic understanding that is both grounded in data and reflective of the community's perspectives.

Section 1: Traffic Congestion Causes on Al Haram Street:

The traffic situation on Al Haram Street is undeniably complicated. Several factors, as highlighted by the respondents and as evident from the data, contribute to the persistent congestion problems that face this main road.

1. *Peak Hour Traffic:* Respondents often spotlighted the remarkable coincidence of employees, students, and officials moving during peak hours. This coordinated rush apparently overwhelms the urban infrastructure, inducing significant delays and congestion.
2. *Government and Private Engagements:* The respondents emphasized that frequent citizen movement toward governmental or private facilities, especially during specific hours, intensifies traffic congestion.
3. *VIP Motorcades:* According to the feedback, VIP convoys, typically extending across several vehicles, are obstacles to the regular flow of traffic causing extreme traffic jams.
4. *Unauthorized Stops:* One common observation from the respondents was the frequent and unplanned stops by minibuses and private vehicles, which disrupt the continuous flow of traffic and cause many accidents.
5. *Population Density:* Al Haram Street, being densely populated, naturally faces higher vehicular movement, making congestion almost a daily ordeal. Many respondents emphasized that the dense populace along Al Haram Street regularly magnifies vehicular movement, making congestion almost a daily challenge.
6. *Traffic Management and Infrastructure:* An evident lack of traffic signs and poor road conditions act as bottlenecks.

Most of the respondents believe that infrastructure gaps lead to severe traffic congestion, especially during rush hours.

7. *Driving Behavior*: The respondents also pointed to reckless driving as a significant factor. Such behavior not only causes congestion but can also elevate the severe risks and accidents.
8. *Private Vehicle Usage*: Respondents observed a noticeable preference toward private transportation, which increases the number of vehicles on the street causing extreme congestion, especially during peak hours.
9. *Population Migration*: The migration from rural regions and cities all over Egypt to the Giza Governorate for various reasons including, work and studying has impacted significantly the congestion problem.
10. *Peddlers and Hawkers*: The respondents flagged a significant contributor to the traffic problem which is the presence of illegal and unlicensed peddlers and hawkers.
11. *Law Enforcement*: A perceived laxity regarding traffic rule enforcement was perceived by most of the respondents, as this encourages violations leading to unplanned stops and congestion.
12. *Security Checks*: Frequent security stops can disrupt the regular flow of traffic. Although the respondents acknowledge the importance of such stops for safety and maintaining public order.

13. *Accidents and Breakdowns*: Respondents declared that the high rate of accidents and vehicle breakdowns usually leads to sudden and long stops.
14. *School Buses*: Their operation during specific hours can lead to a temporary surge in traffic volume.
15. *Road Capacity vs. Demand*: Most of the respondents emphasized the fact the minimal road capacity, doesn't digest the traffic demand, especially during peak hours.
16. *Parking Spaces*: The lack of public parking spaces/garages
The lack of public parking spaces/garages and the consequent on-road parking emerged as a significant concern in the respondents' feedback.

In summary, the congestion on Al Haram Street is a multifaceted issue. It's a mix of infrastructural limitations, behavioral patterns, and external factors like migration and population density. Addressing these concerns requires a holistic, data-driven, and respondent-inclusive approach.

Section 2: Cargo Bikes vs. Trucks:

The logistics and transportation industry has experienced notable advancements, with businesses exploring alternatives for delivering goods efficiently. Cargo bikes have emerged as a potential alternative to traditional trucks, particularly in urban areas with dense populations and traffic congestion. Thus, section 2 in the survey attempted to understand the viability of

using of cargo bikes as a replacement for trucks while considering the perceptions of various stores (See **Table 4**).

Table 4: Perceptions of Store Types on Using Cargo Bikes as an Alternative to Trucks for Deliveries

Store Type	Yes	No	Reason (YES)	Reason (NO)
Clothing Stores	3	12	<ul style="list-style-type: none"> It is suitable for easily-accessible stores on Al Haram Street. 	<ul style="list-style-type: none"> Not suitable for fixed timetables. Not suitable for the type and quantity of weekly shipments. Its maximum permissible weight doesn't suit the weight of the delivery goods. Not suitable to operate on Al Haram Street, only suitable for alleyways. Not supported and not regulated. It slow speed will cause traffic congestion. Not suitable for all type of goods. Suitable for post offices only.
Flower Shops	3	2	<ul style="list-style-type: none"> For its high speed and its small size. 	<ul style="list-style-type: none"> It causes danger to the one riding it.
Restaurants & Cafes	4	16	<ul style="list-style-type: none"> Time Saving Freight cost reduction Immediate deliveries 	<ul style="list-style-type: none"> Its slow speed will cause congestion and traffic flow instability. Slower than trucks and not safe. Slows down traffic Introduces time waste The government doesn't support bike lanes. So, it's not safe and not reliable. Suitable for small sized stores only. It needs to be regulated and operated with licensed riders.
Toys & Home Appliances	4	4	<ul style="list-style-type: none"> Cost efficient for short distance deliveries. Very responsive 	<ul style="list-style-type: none"> Not suitable for this type of stores.
Phone Accessories	0	14		<ul style="list-style-type: none"> Not suitable for main streets. Not very efficient.
Mini Markets	6	2	<ul style="list-style-type: none"> It could substitute inventories and warehousing for its frequent delivery capabilities. Always available, unlike transport companies. Very cost efficient, especially after the reduction of fuel 	<ul style="list-style-type: none"> Very slow transit time.

			<ul style="list-style-type: none"> subsidies. • Goods-friendly, in term of safety. • Very responsive. 	
Pharmacies	6	3	<ul style="list-style-type: none"> • Moving warehouse • Reduces air pollution • Reduces fuel consumption costs • Reduces time. 	<ul style="list-style-type: none"> • The handling process is very slow.
Juice Stores	3	0	<ul style="list-style-type: none"> • Very responsive • High delivery rates 	

Source: Author's own

Based on the data analyzed and shown in **Table 4**, it is obvious that there is a diversity of opinions based on the store type concerning the practicality of cargo bikes over trucks. Clothing stores predominantly lean against the use of cargo bikes. Their primary concerns revolve around the logistical challenges of using bikes for their type of shipments. These shipments might be voluminous or weighty, thereby posing challenges for bikes. Conversely, mini markets and pharmacies show a more balanced or favorable perspective towards cargo bikes. The nature of their products – often smaller, regular, and urgent – could explain this tendency.

Moreover, the table reveals several perceived advantages of cargo bikes, such as their responsiveness, cost-efficiency, environmental benefits, and time-saving potential. Flower shops and juice stores, for instance, acknowledge the speed and immediate delivery capabilities. This could be attributed to the perishable nature of their products or the urgency of customer demands. Furthermore, the ecological benefits highlighted by

pharmacies by reduced air pollution and fuel consumption, to meet global environmental concerns.

Despite the previously mentioned advantages, many respondents have some concerns. A recurrent theme across store types is the potential for traffic congestion due to the slower speeds of cargo bikes compared to trucks. Another concern is the lack of infrastructure support, such as dedicated bike lanes, which raises questions about safety and reliability. Likewise, the need for regulation, training, and licensing of riders is another area that demands attention.

In conclusion, while cargo bikes show promise as an alternative to trucks in certain situations, their widespread adoption requires addressing logistical, infrastructural, and regulatory challenges. The diverse opinions highlighted in **Table 4** highlight the importance of tailoring solutions based on specific store types and urban contexts.

Section 3: Microbuses vs. Efficient Bus Transport

The shift from traditional forms of transportation to more organized and efficient systems is a topic that garners significant attention in urban planning and development. The following section of the survey aimed to capture the perceptions of different store types on the potential transition from microbuses to a more streamlined bus transport network with designated stations. **Table 5** presents a summary of different responses, shedding light on the benefits and challenges of such a transition.

Table 5: Store Responses to Transitioning from Microbuses to a Fixed Bus Station System

Store Type	Yes	No	Reason (YES)	Reason (NO)
Clothing Stores	10	5	<ul style="list-style-type: none"> • Reduce traffic congestions • Reduce accident rates • Buses have larger payload • Buses are suitable for elders, handicapped and full-time employees. • Buses have fixed timetables, and fixed stops. • Microbus drivers' bad behavior. • Buses have a unified ticked price, unlike microbuses. • The greediness of microbus driver's in loading the vehicles inflicts threats to the lives of the commuters. 	<ul style="list-style-type: none"> • The population density is so huge, and buses only wouldn't match this huge demand. • Buses operate less frequent at night which makes it unreliable mode of transport at night.
Flower Shops	4	0	<ul style="list-style-type: none"> • Microbuses cause distortion in the flow of traffic. • Buses are more reliable. 	
Restaurants & Cafes	14	6	<ul style="list-style-type: none"> • Microbus drivers don't obey and follow traffic rules. • Buses have larger payload. • Reduce traffic volume. • Facilitate the flow of traffic. • Bus drivers usually follow traffic rules. • Buses are more urban and modern than microbuses. • Buses show a more civilized view of the country. • Buses facilitated the movement of people. • Microbuses make more frequent stops over multiple of lanes. • Buses are cleaner 	<ul style="list-style-type: none"> • Buses only don't have the capabilities to move all the inhabitants of Al Haram Street. • Bus stations don't exist nearby key locations and entities in Al Haram Street. • Few bus stations are found all over Al Haram Street, which makes buses unreliable mode of transport. • Huge population density and demand can't be covered with buses only.
Toys & Home Appliances	8	0	<ul style="list-style-type: none"> • Buses are more reliable • Buses have fixed timetables • Buses are an urban mode of transport. • Buses, if stuck to their lanes, would reduce traffic congestion. 	

Phone Accessories	13	1	<ul style="list-style-type: none"> • Microbuses show in an inappropriate way to the tourists in Al Haram Street, which surely might reduce tourism. (Visual Pollution) 	<ul style="list-style-type: none"> • Huge population density.
Mini Markets	5	3	<ul style="list-style-type: none"> • Microbus driver's drive recklessly which threatens peoples' lives. • Microbuses are not well organized and planned, which proves their deficiency • Buses are regulated by local institutions that offer weekly, monthly and annual ticket. 	<ul style="list-style-type: none"> • Fixed bus stations will force people to walk more by foot.
Pharmacies	7	2	<ul style="list-style-type: none"> • (Same as all of the above) 	<ul style="list-style-type: none"> • (Same as all of the above)
Juice Stores	0	3		<ul style="list-style-type: none"> • (Same as all of the above)

Source: Author's own

The data from **Table 5** reveals a clear trend: a majority of respondents from varied store types favor the introduction of a more organized bus transport system over the existing microbus system. However, the reasons for this preference and the concerns raised by the minority vary considerably. The most frequently mentioned advantage of transitioning to buses is the anticipated reduction in traffic congestion as microbuses tend to distort the flow of traffic, especially when making frequent stops across multiple lanes. Moreover, the prevalent opinion is that microbus drivers often disregard traffic rules due to the lack of formal training or regulatory oversight. Furthermore, the reckless driving behavior of microbus operators poses a significant threat to commuters and pedestrians alike. On the other hand, buses offer predictable timetables and fixed stops and this not only ensures reliability but also provides a sense of

security for daily commuters. Furthermore, buses operating under local institutions might benefit from standardized ticketing systems, offering passengers more transparent and possibly more affordable fare structures.

The primary concern shared by most of the respondents revolves around the logistical challenge of replacing minibuses. Given the high population density in Al Haram Street, respondents believed that buses alone would not suffice to cover the massive demand. Another concern is that minibuses could be seen discouraging tourists and affecting their view of the area negatively.

Section 4: Pedestrian Bridges vs. Illegal Road Crossings:

In urban planning and infrastructure development, the facilitation of pedestrian movement is crucial for ensuring safety and easing vehicular traffic. With the growing concern over illegal road crossings, which can pose threats to both pedestrians and drivers, the potential of pedestrian bridges has come into focus as one of the most important solutions to the congestion problem of Al Haram Street. **Table 6** shows the thoughts of various respondents from different store types towards this solution and provides reasons for their point of view.

Table 6: Responses on the Activation of Pedestrian Bridges Over Illegal Road Crossings

Store Type	Yes	No	Reason (YES)	Reason (NO)
Clothing Stores	15	0	<ul style="list-style-type: none"> • Will reduce pedestrians' accident rates. • Escalators are also needed for elders and handicapped. • Less road crossings, facilitates the flow of traffic. • Introduce traffic safety. 	
Flower Shops	5	0	<ul style="list-style-type: none"> • (Same as all of the above) 	
Restaurants & Cafes	18	2	<ul style="list-style-type: none"> • Save up road spaces, to be used to create more road lanes. • Reduce traffic volume, including pedestrians and vehicles. • Yes, more pedestrian bridges are need especially at Al Talbiah and Al Aresh stops. 	<ul style="list-style-type: none"> • Pedestrian bridges are only a waste of public money. • Pedestrian bridges in Egypt lack regular maintenance which makes it unsafe to use. • Pedestrian bridges are usually a hideout for drug dealers and thieves. The police rarely patrols them.
Toys & Home Appliances	8	0	<ul style="list-style-type: none"> • (Same as all of the above) 	
Phone Accessories	14	0	<ul style="list-style-type: none"> • (Same as all of the above) 	
Mini Markets	7	1	<ul style="list-style-type: none"> • (Same as all of the above) 	<ul style="list-style-type: none"> • Not suitable for elders and handicapped.
Pharmacies	9	0	<ul style="list-style-type: none"> • (Same as all of the above) 	
Juice Stores	3	0	<ul style="list-style-type: none"> • (Same as all of the above) 	

Source: Author's own

The survey results from **Table 6** present a comprehensive picture of the respondents' opinions regarding the activation of more pedestrian bridges in place of illegal road crossings. It is clear that the majority of stores expressed a pronounced preference for

the introduction of more pedestrian bridges for safer pedestrian crossings and to reduce potential pedestrian accident rates. This concern explains the perceived dangers of illegal crossings and underscores the urgency of addressing this issue.

A noteworthy observation is the call for escalators, especially to cater to elders and the handicapped. This indicates that while pedestrian bridges are seen as a solution, their design and accessibility features need to be taken into account to make them truly effective and inclusive.

While the majority of the respondents demonstrated favorable attitudes towards the concept, it is important to acknowledge that a minority of individuals expressed dissenting opinions regarding pedestrian bridges. These arguments expressed concerns regarding the distribution of public money claiming that infrastructure investments of this nature may be seen as unnecessary unless adequate maintenance is ensured. Moreover, it is imperative to consider the potential for illegal activities to occur at these bridges, emphasizing the necessity of developing robust monitoring protocols and performing routine patrols.

Section 5: Public Parking Garages vs. On-Road Parking:

The management of parking places is becoming increasingly crucial. The issue of increasing congestion in urban areas, such as Al Haram Street, has brought the discussion surrounding the advantages and disadvantages of public parking garages vs on-road parking to the top. The feedback provided by the

respondents clearly indicated a strong preference for public parking garages (PPG). A significant number of participants expressed their dissatisfaction with the prevailing condition of on-road parking, highlighting issues such as insufficient space, disorderly parking resulting in obstructed walkways, and the ongoing need to navigate interactions with unauthorized valet services, commonly referred to as "Al Sayes."

The perceived advantages of PPG were multifaceted. From a safety perspective, respondents felt that garages would offer better protection against theft and damages compared to on-road parking. The convenience factor was also frequently highlighted; many expressed the belief that a well-structured PPG system would save them time otherwise spent searching for a spot. On the other hand, environmental concerns were confirmed by some of the respondents, who felt that reducing the number of cars aimlessly searching for parking would lead to decreased emissions and, consequently, a more breathable city.

A particularly emotional feedback centered around the socio-economic implications of PPGs. A sizeable portion of respondents felt that public parking garages could potentially eliminate the unregulated and sometimes troublesome phenomenon of "Al Sayes." By providing a structured and official parking system, the issues arising from these informal parking setups could be mitigated.

8- Conclusions and Recommendations

In the evolving landscape of urban studies, the relationship between urban logistics and traffic congestion remains a focal point for scholars and policymakers alike. This paper attempted to address this issue in one of the most congested areas in GCMA, Al Haram Street. The main aim of this research was to understand the root causes behind the prevalent traffic congestion in the GCMA. In order to achieve this aim, the research attempted to provide a holistic view of the overarching traffic problem on Al Haram Street, and secondly, to critically evaluate the potential of proposed urban logistics solutions in addressing the widespread congestion concerns. Before exploring potential solutions, it was essential to get a comprehensive understanding of the underlying factors contributing to this urban challenge. By synthesizing both quantitative and qualitative data, this research endeavors beyond simple surface-level observations, aiming to capture the multifaceted perceptions and experiences of different respondents. The findings revealed that introducing cargo bikes as a mode for goods delivery can provide a dual solution; not only would it reduce the environmental footprint, but the compact size and maneuverability of these bikes would also mean they can navigate congested streets more efficiently, ultimately leading to reduced road occupancy and less congestion. Moreover, an efficient bus transport network, characterized by streamlined routes and fixed bus stations,

presents another avenue to alleviate the pressures of urban congestion and eliminate the commuting of minibuses. Likewise, by increasing the number of pedestrian bridges and actively discouraging illegal road crossings, vehicular flow becomes smoother, reducing unnecessary stops. Finally, the inconveniences and challenges of on-road parking, compared with the potential benefits of PPGs, make a persuasive case for reconsidering urban infrastructure planning, especially in areas like Al Haram Street.

In alignment with Egypt's Vision 2030, the nation's blueprint for a sustainable future, addressing the challenges of traffic congestion becomes even more pertinent. This study resonates with the vision's emphasis on creating sustainable urban environments, underpinned by efficient infrastructure and innovative solutions. Implementing strategies like cargo bikes and a more efficient bus transport network not only contributes to easing traffic congestion but also aligns with the broader goals of environmental sustainability and urban development set out in Egypt's Vision 2030. The proposed enhancements, such as increased pedestrian bridges and the reconsideration of on-road parking in favor of PPGs, further highlight the importance of holistic urban planning. In conclusion, the insights from this research do not just serve Al Haram Street's immediate needs; they also pave the way for aligning urban logistics and

infrastructure endeavors with Egypt's long-term developmental goals.

While this research undertakes a significant exploration into traffic congestion in the GCMA, it is important to acknowledge certain limitations:

- This research primarily focuses on understanding the root causes of traffic congestion within the GCMA. It does not purport to provide an exhaustive list of all factors impacting traffic across Egypt, nor does it offer an end-to-end solution to the overarching congestion issue.
- The analysis was constrained by the data available at the time of research. Thus, the data may not capture all nuances or recent developments related to congestion and urban logistics.
- Traffic patterns and stakeholder opinions are dynamic and may evolve over time. Our findings represent a snapshot within a specific timeframe, and future research might reveal changing perspectives or new challenges.
- The insights and findings from Al Haram Street may not directly apply to other regions or cities in Egypt or beyond. Each urban area has its unique challenges, infrastructure, and stakeholder dynamics.

Thus subsequent studies may build upon the current foundational work, addressing these limitations and providing more comprehensive solutions to Egypt's traffic congestion challenge.

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