

## **Strategic Integration of Policy and Logistics: A Case Study of Copenhagen's Model for Sustainable Urban Supply Chains**

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### **Abstract**

This study explores integrating logistics policies and practices in creating efficient and sustainable urban supply chains. The study analyzes how green transport policies, the use of digital technologies, and collaboration between government and the private sector contribute to improving logistics efficiency and reducing emissions through a qualitative approach with thematic interviews with stakeholders and a case study of Copenhagen. Copenhagen has successfully implemented low-emission zones and an intelligent traffic management system that optimizes delivery routes, thereby reducing congestion and increasing sustainability. The findings provide important insights for other cities, including Jakarta, that face similar challenges in the logistics sector. The study suggests that implementing an effective policy integration model can help address environmental and operational issues, as well as improve the quality of life for urban residents. The results of this study contribute to the literature on urban logistics and sustainability policies and offer strategic recommendations for policymakers.

Keywords: Urban Supply Chain, Policy Integration, Sustainable Logistics, Digital Technology.

### **Abstrak**

Studi ini mengeksplorasi integrasi kebijakan dan praktik logistik dalam menciptakan rantai pasokan perkotaan yang efisien dan berkelanjutan. Studi ini menganalisis bagaimana kebijakan transportasi hijau, penggunaan teknologi digital, dan kolaborasi antara pemerintah dan sektor swasta berkontribusi pada peningkatan efisiensi logistik dan pengurangan emisi melalui pendekatan kualitatif dengan wawancara tematik dengan para pemangku kepentingan dan studi kasus kota Kopenhagen. Kopenhagen telah berhasil menerapkan zona rendah emisi dan sistem manajemen lalu lintas cerdas yang mengoptimalkan rute pengiriman, sehingga mengurangi kemacetan dan meningkatkan keberlanjutan. Temuan ini memberikan wawasan penting bagi kota-kota lain, termasuk Jakarta, yang menghadapi tantangan serupa di sektor logistik. Studi ini menunjukkan bahwa penerapan model integrasi kebijakan yang efektif dapat membantu mengatasi masalah lingkungan dan operasional, serta meningkatkan kualitas hidup penduduk perkotaan. Hasil studi ini berkontribusi pada literatur tentang logistik perkotaan dan kebijakan keberlanjutan serta menawarkan rekomendasi strategis bagi para pembuat kebijakan.

Kata Kunci: Rantai Pasokan Perkotaan, Integrasi Kebijakan, Logistik Berkelanjutan, Teknologi Digital.

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## **INTRODUCTION**

Urban supply chains are playing an increasingly crucial role in the global economy as the population of large cities grows. Rapid urbanization creates a higher demand for goods and services, especially in densely populated urban areas; an effective logistics system is key to ensuring the smooth distribution of goods, from food to technology needs, with increasing demand. Urban supply chains are responsible for ensuring that the essential needs of urban communities are met in a timely and efficient manner (Rajabion et al., 2019). They also serve as the backbone of business, industry, and the urban economy as a whole, when urban logistics fail, inefficiencies such as late deliveries and increased operational costs can negatively impact economic stability, reduce competitiveness, and reduce the quality of life for people in

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Received: September 25, 2024; Revised: November 27, 2024; Accepted: November 30, 2024

cities. Sustainability and efficiency in urban supply chains are important not only for local economies but also contribute to the dynamics of the global economy (Van Engeland et al., 2020).

Urban logistics challenges are becoming increasingly complex with rapid urbanization, one of the main problems being traffic congestion that hinders the smooth distribution of goods in big cities (Mazzarino & Rubini, 2019; Qi et al., 2017). Longer travel times due to congestion lead to increased operational costs and decreased efficiency, urban logistics also contributes significantly to greenhouse gas emissions, especially from delivery vehicles that are constantly moving on congested city streets (Laguir et al., 2021). Another challenge is the need for more infrastructure to support logistics, such as narrow and limited road access and inadequate distribution facilities in city centers, which exacerbates the problem of managing the supply chain in urban areas. High distribution costs resulting from rising fuel prices and the need to meet rapid demand are additional constraints for logistics companies and the business sector in general. Rapid urbanization also exacerbates these challenges, as rapid population growth puts pressure on city transportation systems and infrastructure, creating a vicious cycle that is only possible with integrated policy interventions and innovations in logistics technology (Schaltegger & Burritt, 2014).

Rapid urbanization also creates challenges in terms of sustainability. Most large cities face space constraints for distribution centers and logistics facilities, especially in urban centers that are already densely populated with commercial and residential buildings, logistics companies often have to set up warehouses on the outskirts of cities, which extends the distance that delivery takes to consumer centers, this not only increases delivery times but also increases energy consumption and exhaust emissions from logistics vehicles (Grant et al., 2017). As the population grows in urban areas, the demand for fast delivery of goods, such as e-commerce, is expected to increase exponentially, putting additional pressure on already fragile urban logistics systems and creating new challenges for companies that must find ways to maintain fast service without sacrificing sustainability and efficiency.

Uncoordinated regulations and policies are also a major obstacle in urban logistics operations. Many cities implement transportation regulations, such as delivery time restrictions and low-emission environmental zones, without taking into account logistics needs. Although these policies aim to reduce environmental impacts, they often disrupt the smooth distribution and increase logistics companies' operational costs. The lack of dialogue between local governments and the logistics sector means that the regulations implemented are not aligned with practical needs on the ground (Issa Zadeh & Garay-Rondero, 2023). Urban supply chains will continue to struggle to achieve long-term efficiency and sustainability without supportive policies and adequate infrastructure, and better integration between policies, technologies, and logistics strategies is needed to address these challenges; some data supporting this statement is presented in the following table 1.

Sustainability is a major concern in urban logistics due to the high environmental impacts of goods distribution activities in large cities. One of the main issues is air pollution, which is largely caused by logistics vehicles that use fossil fuels, such as trucks and delivery vans. These vehicles emit greenhouse gases, such as carbon dioxide (CO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>), which not only exacerbate climate change but also compromise air quality in urban areas. The high energy consumption of these delivery vehicles further adds to the environmental burden, especially when distribution is carried out on inefficient routes due to congestion and longer distances due to inadequate infrastructure, these negative impacts make sustainability in urban supply chains a critical issue that needs to be addressed urgently (Xia et al., 2020).

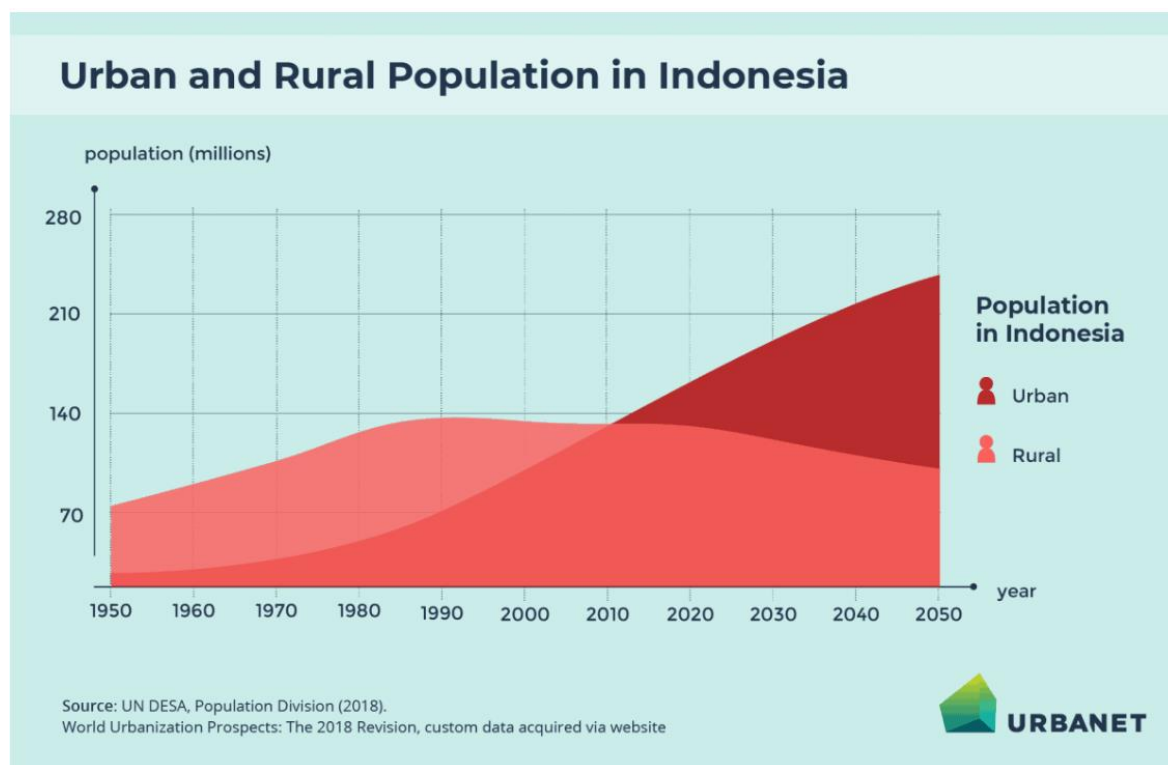
**Table 1. The Relationship between Urbanization Level and Supply Chain**

<b>Data</b>	<b>Description</b>	<b>Complete Data</b>	<b>Source</b>
<b>Global Urbanization Rate</b>	Population growth in urban areas worldwide over the last decade.	In 2023, 56.2% of the world's population lived in urban areas, with a projected increase to 68.4% by 2050.	UN Report, World Urbanization Prospects, World Bank
<b>Number of Logistics Vehicles in Urban Areas</b>	Data on the number of vehicles used for logistics distribution in major cities.	In big cities like Jakarta, it is estimated that more than 100,000 active commercial vehicles are used for logistics every day.	Department of Transportation, Indonesian Logistics Association, Statistics Institute
<b>Greenhouse Gas Emissions from Logistics</b>	Statistics on carbon emission contributions from the urban logistics sector.	The transportation sector, including logistics, contributes around 23% of global greenhouse gas emissions, of which 11% comes from logistics distribution in large cities.	Ministry of Environment
<b>Urban Logistics Costs</b>	The average cost of logistics distribution in big cities compared to small cities.	Logistics costs in big cities like Tokyo and Jakarta can be 20-30% higher compared to suburban or rural areas.	National Logistics Association, Reports from McKinsey, Deloitte.
<b>Urban Transport Policy</b>	Examples of policies related to transportation and logistics in several major cities.	London has implemented an Ultra Low Emission Zone (ULEZ) that restricts diesel vehicles from entering the city center, while Jakarta has implemented odd-even for traffic management.	Local regulations, the Ministry of Transportation, and local government reports
<b>Sustainable Supply Chain Case Studies</b>	Case studies of cities that have implemented environmentally friendly logistics policies.	Copenhagen has integrated electric vehicles into logistics distribution to reduce emissions, saving up to 25% energy compared to fossil fuel vehicles.	Academic journals, World Economic Forum, government reports
<b>E-commerce Consumer Demand</b>	Increased demand for fast delivery from urban consumers due to the growth of e-commerce.	By 2022, more than 30% of total logistics deliveries in big cities like Jakarta will come from e-commerce, with an annual increase of 10-15%.	Statista, e-commerce report from the Indonesian E-commerce Association

Source: Data proceed

The growing public awareness of the environmental crisis and the demand from the public and government to reduce carbon footprints have driven major changes in logistics practices. Urban communities are demanding that logistics companies take proactive steps to reduce pollution, such as switching to electric vehicle fleets, optimizing delivery routes, and using environmentally friendly

technologies (Mirzabeiki et al., 2023; Uzun & Ergül, 2024). The government is also increasingly strict in implementing regulations that force companies to comply with sustainability standards, such as the implementation of low-emission zones and carbon taxes. With pressure from both parties, both the government and the public, the logistics sector is not only required to improve its operational efficiency but also to adapt to a more sustainable and environmentally friendly business model. Data on the urban population in Indonesia can be seen in the following figure 1:



**Figure 1. Number of people living in urban and rural areas in Indonesia**

Source: [Urbanet](https://urbanet.net)

The fragmentation between government policies and logistics operations is often a serious obstacle to achieving efficiency and sustainability in urban supply chains. Urban governance policies that are not coordinated with logistics needs, such as strict traffic regulations or delivery time restrictions, often cause operational disruptions that result in higher costs and higher emissions. Policies that focus on reducing environmental impacts, such as the implementation of low-emission zones or the ban on diesel-powered vehicles in certain areas, are often implemented without considering the available logistics infrastructure and technology. As a result, logistics companies have to adapt suddenly and inefficiently to comply with these regulations, which in turn disrupts the entire supply chain (Mirzabeiki et al., 2023).

Strategic integration between government policies and environmentally friendly and efficient logistics practices is essential. Urban governance policies should be designed with logistics needs in mind, both in terms of infrastructure and technology, governments can work with the private sector to develop distribution centers closer to city centers or encourage the use of digital technologies to optimize delivery routes (Tasche et al., 2023). Transport and environmental policies should be combined with sustainable logistics initiatives, such as promoting the use of electric vehicles and implementing more efficient supply

chain management systems, which can create supply chain systems that not only reduce environmental impacts but also improve operational efficiency in increasingly complex urban environments with better coordination (Sehnem et al., 2019).

A major challenge in urban supply chains is the need for coordination between government policies and the logistics sector. Transport regulations, urban planning, and environmental policies are often developed separately without considering the complex operational needs of the logistics sector. This misalignment leads to a range of inefficiencies, such as traffic regulations that limit delivery hours in city centers, which in turn extend delivery times and increase operational costs. The environmental policies that are implemented, such as emission restrictions or low-pollution zones, are only sometimes accompanied by adequate infrastructure solutions to support logistics companies in achieving sustainability targets (Esan et al., 2024).

The logistics sector needs help to meet sustainability goals, such as reducing carbon emissions and optimizing energy use, this lack of integration not only slows the transition to greener logistics but also hinders operational efficiency, creating a major hurdle for companies operating in increasingly dense and regulated urban environments. Without better coordination between government policies and the needs of the logistics sector, these challenges will continue, undermining cities' ability to achieve efficiency and sustainability in the long term (Xu et al., 2019).

The integration of logistics policies in urban contexts has become a critical area of study as cities grapple with the challenges of sustainability, efficiency, and rapid urbanization. While existing research has extensively explored individual aspects of green transport policies, digital technologies, and public-private collaboration, there remains a significant gap in understanding the dynamic interplay between these factors. This study uniquely contributes to the field by investigating how these three elements can be strategically integrated to optimize urban supply chains, the research aims to provide a comprehensive framework that addresses the multifaceted nature of urban logistics, emphasizing both efficiency and sustainability by focusing on this triad.

One of the distinctive contributions of this study lies in its examination of how green transport policies, such as low-emission zones and eco-friendly vehicle incentives, interact with advancements in digital technologies, including data analytics and smart logistics platforms. The research highlights the pivotal role of public-private collaboration in bridging policy objectives with practical implementation, and this approach not only sheds light on innovative strategies but also offers actionable insights for stakeholders aiming to design resilient and adaptable urban logistics systems.

The literature review delves into previous studies on urban logistics, identifying key themes and gaps that this research addresses. The methodology section outlines the qualitative approach employed, detailing the case study of Copenhagen as a model for successful integration. The results present insights into how policy, technology, and collaboration converge to enhance urban supply chain performance. The discussion and implications highlight the broader relevance of the findings, offering recommendations for policymakers and practitioners, and this structured approach ensures that readers can easily navigate the paper and grasp its contributions to the field of sustainable urban logistics.

The purpose of this study is to explore and analyze how effective integration of policies with logistics practices can contribute to improving the operational efficiency and sustainability of urban supply chains. This study seeks to identify ways in which government policies, such as transport regulations, urban planning, and environmental policies, can be aligned with the needs of the logistics sector to create a more efficient and environmentally friendly distribution system. This study aims to provide in-depth

insights into the strategic steps that policymakers and logistics industry players can take to reduce environmental impacts, optimize energy use, and improve operational effectiveness.

## **LITERATURE REVIEW**

### **Urban Supply Chain and Logistics**

Urban supply chains and logistics are increasingly becoming an important focus in the context of rapid population growth and urbanization in many parts of the world. Logistics in urban environments face several challenges, including traffic congestion, space constraints, and the need to meet increasing consumer demand for fast delivery. Research by (Li et al., 2022) highlights how traffic congestion in large cities such as New York significantly impacts the efficiency of goods delivery, resulting in higher operational costs and adverse environmental impacts. A study by (Kumar et al., 2019) notes that high greenhouse gas emissions from the urban logistics sector are driving the need for more sustainable solutions, such as the use of electric vehicles and the optimization of delivery routes.

The growing trend in urban logistics also shows the increasing use of digital technology and data analytics to improve efficiency. Research by (Fan et al., 2023) revealed that the use of information technology can help companies manage their supply chains more effectively, enabling faster response to consumer needs and reducing carbon footprints. Thus, a better understanding of supply chain dynamics and logistics challenges in urban environments is crucial for formulating policies that can support the integration of sustainable logistics policies and practices. These studies provide a valuable framework for developing more efficient and environmentally friendly logistics strategies in an era of increasing urbanization.

### **Sustainability in the Supply Chain**

Sustainability in the supply chain has become a major focus in the logistics literature, especially in urban areas that face significant environmental challenges. Sustainability practices in logistics include the use of environmentally friendly vehicles, route optimization to reduce energy consumption, and the implementation of management systems that prioritize resource efficiency. Research by (Hu et al., 2019) shows that companies that adopt sustainability practices in their supply chains not only reduce their environmental impacts but also improve operational efficiency and competitiveness.

A study by (Vachon & Klassen, 2007) further explores the impact of implementing sustainability strategies in urban logistics, emphasizing that the integration of environmental policies and logistics practices can result in significant emission reductions in large cities. This study identifies several examples of cities that have successfully implemented sustainable initiatives, such as the use of electric vehicles for delivery and the development of distribution centers integrated with city infrastructure. A study by (Chhetri et al., 2018) highlights the importance of collaboration between the government and the private sector in encouraging the adoption of sustainability practices in logistics, especially through incentive policies and infrastructure support, this literature suggests that sustainability in the supply chain is not only important for environmental protection but also contributes to efficiency and innovation in urban logistics.

## Policy and Logistics Integration

Policy and logistics integration has become an important topic in the supply chain management literature, especially in the context of improving operational efficiency and sustainability. Many studies have shown that uncoordinated government policies can create significant obstacles to logistics operations. For example a study by (Rossi et al., 2013) emphasized that misalignment between transportation policies and urban planning can cause congestion and reduce the efficiency of goods distribution, this study notes that collaboration between policymakers and logistics practitioners is essential to create the infrastructure that supports smooth operations.

A study by (Letnik et al., 2018) investigated how environmental policies can influence logistics strategies. They found that by implementing stricter regulations on vehicle emissions, companies can adopt green technologies and improve operational efficiency; companies can not only meet regulatory demands but also reduce long-term costs through energy savings and operational efficiency with policies that support innovation. Another study by (Akinsulire et al., 2024) noted that effective policy integration can improve the relationship between the government and the logistics sector, allowing for the development of a more integrated transportation system. This study shows that with synergies between government policies and logistics practices, companies can optimize delivery routes and reduce transportation costs. Case examples from cities that have successfully implemented this strategy, such as Copenhagen, show that cross-sector collaboration can produce positive results in terms of efficiency and sustainability.

Research by (Montoya-Torres et al., 2016a) also provides insight into how integrated logistics policies can contribute to the development of efficient logistics areas, this study shows that policies that support the development of transport infrastructure and distribution facilities in urban areas can improve accessibility and reduce delivery times. The integration of policies and logistics not only improves operational efficiency but also creates added value for the community and the economy as a whole. Previous studies have confirmed that effective integration of policies and sustainable logistics practices is key to improving efficiency in urban supply chains. By identifying and addressing existing barriers and encouraging collaboration between the public and private sectors, cities can create logistics systems that are not only efficient but also environmentally friendly, the results of this study provide a strong foundation for understanding the importance of policy integration in achieving sustainability and efficiency goals at the local and global levels.

## Literature Gap

Although many studies have addressed the relationship between logistics policies and practices in the context of sustainability and efficiency, there are still gaps in the literature that require more attention. One major gap is the lack of studies exploring the specific impacts of policy integration on logistics efficiency in different urban contexts. Most studies, such as those conducted by (Montoya-Torres et al., 2016b), focus more on the challenges faced without deeply analyzing how integrated policies can be implemented to improve operational efficiency, this suggests the need for further research to formulate practical and applicable policy strategies.

Existing research often focuses on one particular policy aspect or sector, such as environmental or transport regulation, without considering broader cross-sectoral impacts. For example, (Bosona, 2020) provide insights into transport policy but do not explore how the integration of such policies can involve other sectors, such as urban planning and infrastructure development policies. This research highlights

the need for a more holistic, multidisciplinary approach to understanding the interactions between policies and logistics practices. While there are studies that highlight the importance of sustainability in supply chains, such as (Wei et al., 2024), most of them have not specifically linked sustainability practices to supportive policies in the context of urban logistics. These studies tend to separate sustainability issues from policy aspects, thus hindering a more comprehensive understanding of how policies can promote sustainable practices in logistics.

More studies need to examine the different local and regional contexts in implementing policy and logistics integration. Most of the existing studies are general and do not consider the unique characteristics of different cities. For example, the study by (Mazzarino & Rubini, 2019) emphasizes the importance of collaboration between the public and private sectors. It does not explore how local factors, such as culture and economic structure, influence the success of this integration.

This literature gap suggests the need for further research that can more comprehensively integrate logistics policy and practice perspectives. More in-depth research can provide the insights needed to formulate more effective and integrated policies and support the development of sustainable logistics systems in urban environments. Filling this gap will enable stakeholders to make more informed decisions in addressing the logistics challenges of growing megacities.

## **RESEARCH METHOD**

This study uses a qualitative approach to explore and analyze the integration of policy and logistics in improving the efficiency and sustainability of urban supply chains. A qualitative approach was chosen because this study aims to understand the perspectives, experiences, and challenges faced by various stakeholders, including policymakers, logistics industry players, and the community. The study explores deeper nuances about how logistics policies and practices interact with each other in a complex urban context (Peterson, 2019).

Data will be collected through several sources to gain a comprehensive understanding of the topic. First, case studies will be conducted on several cities that have successfully integrated policies with logistics practices, such as Copenhagen. In-depth interviews with experts in logistics, urban planning, and public policy in Jakarta are conducted to explore their perspectives on best practices and existing challenges (Salmona & Kaczynski, 2024). These interviews help to obtain rich and contextual data. Secondary data analysis sourced from research reports, policy documents, and related statistics will also be used to provide broader data support.

The analytical method that will be used in this study is thematic analysis. After data collection, interview transcripts and notes from the case study will be analyzed to identify key emerging themes. This process will involve coding the data to find relevant patterns, challenges, and solutions in policy and logistics integration. This study will be able to construct an in-depth narrative about sustainability and efficiency practices in urban supply chains, as well as provide valuable insights for policymakers and logistics industry players by using the thematic analysis approach (Lobe et al., 2020).

The methodological approach, incorporating thematic interviews with stakeholders and a case study of Copenhagen, is well-aligned with the study's objectives. The justification for employing qualitative methods is strong, particularly given the intricate nature of policy and logistics integration. The methodology section could be improved by providing a more comprehensive description of the interview process, this should include details such as the criteria used for selecting stakeholders, the rationale behind these choices, and an overview of the scope and focus of the questions posed during the interviews. Including a concise explanation of why Copenhagen was selected as the case study—such as its relevance



as a model for sustainable urban logistics or its innovative practices—would offer readers a clearer understanding of the study's context and strengthen the methodological rigour.

## RESULTS AND DISCUSSION

### Policy Integration for Urban Supply Chain Efficiency

Policies that impact urban logistics cover several key areas, such as transport regulations, environmental guidelines, and zoning laws. Transport regulations generally relate to rules governing the operation of transport vehicles, distribution routes, and access restrictions in certain areas. Many major cities, such as London and Paris, have implemented low-emission zones that restrict fossil fuel vehicles from entering downtown areas to reduce congestion and air pollution. These policies force logistics operators to adopt more environmentally friendly fleets, such as electric or hybrid vehicles.

Environmental guidelines are increasingly central to logistics operations, particularly regarding reducing carbon footprints and energy consumption. Municipalities in countries such as Sweden have introduced policies that require using renewable energy sources in logistics infrastructure. These regulations encourage investment in green technologies, including using solar panels in logistics warehouses and increasing cold chain efficiency through innovations in energy storage.

Zoning laws play a significant role in determining the location and design of logistics infrastructure. Good zoning supports more efficient distribution arrangements, focusing on placing warehouses, distribution centres, and access to major roads. Cities such as Shanghai have implemented industrial zoning specifically for logistics, facilitating distribution throughout the city without affecting traffic in the city centre. A logistics policy expert at the Indonesian Ministry of Transportation explained the challenges faced by the city of Jakarta in managing transportation regulations.

He stated, *"The current regulations are still focused on enforcing conventional transportation rules without considering sustainability impacts. We are developing more adaptive policies, but cross-sector coordination is still a major challenge"*.

A logistics manager from a Regional Shipping Company said, *"Zoning in big cities often does not take into account modern logistics needs, resulting in increased operational costs due to inefficient distribution and limited access to the city center"*.

It is clear that one of the main problems in logistics policy integration is the need for coordination between various government sectors. Transportation policies that are not aligned with environmental guidelines or zoning laws often lead to inefficiencies in logistics operations. This is also in line with the literature that emphasizes that policy fragmentation hinders the creation of sustainable supply chains. In the context of Jakarta, for example, the current transportation policy is not yet adaptive enough to the needs of the modern logistics industry, which is increasingly demanding energy efficiency and sustainability.

The interviews also showed that urban zoning that does not meet modern logistics needs can hinder distribution efficiency, highlighting the need for a more proactive and sustainable zoning approach, as implemented in cities such as Shanghai, where logistics zoning is strategically integrated to minimize traffic disruption and emissions. Collaborative governance is key to streamlining urban logistics operations through synergies between government, the private sector, and communities. Governments play a leading role in setting policies and regulations that support logistics infrastructure. The private sector, such as logistics companies and technology providers, plays a role in implementing innovative

solutions that improve operational efficiency. This collaboration is evident in several pilot projects in major cities around the world, for example, in Amsterdam, where the government is working with logistics companies to create micro-distribution hubs that utilize electric vehicles and cargo bikes to reduce emissions and congestion in the city center. This initiative is also supported by local communities who are involved in designing the urban environment to be more friendly to sustainable logistics traffic.

Communities also play a key role in supporting and adopting proposed changes in logistics governance, such as reducing private vehicle use or supporting low-emission zone policies, often involving public awareness campaigns led by local governments and civil society groups. Through this collaboration, the logistics sector can operate more efficiently and environmentally friendly, ultimately improving the quality of life for urban communities. The success of this collaboration depends on open communication, flexible policy settings, and a shared understanding of sustainability goals. Good collaborative governance can reduce conflicts of interest, create more inclusive policies, and produce logistics solutions that not only benefit industry players but also have a positive impact on the wider community (Heliantina et al., 2024; Qi et al., 2017).

Digital technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) play a vital role in enhancing the integration between policy and logistics and improving the efficiency of urban supply chains. IoT enables real-time tracking of delivery fleets, inventory, and traffic conditions, facilitating faster and more accurate decision-making by logistics players. AI is used to optimize distribution routes, reduce delivery times, and minimize fuel usage, supporting sustainability efforts. In major cities such as Singapore and Shanghai, the use of these technologies has already shown tangible results in streamlining logistics operations and reducing carbon emissions.

The application of digital technology in logistics is also starting to grow. Several local logistics companies have started using IoT-based platforms to manage fleets and goods more efficiently in Jakarta. This technology helps in addressing Jakarta's dense infrastructure challenges, such as severe traffic congestion, by predicting faster alternative routes. Local governments are starting to look at the use of AI to optimize traffic management, which can support smooth logistics operations, especially in distribution center areas.

A technology manager from a logistics startup in Jakarta said, *"We use IoT-based sensors in our vehicles to track road conditions and traffic patterns. This helps us choose more efficient routes, especially during peak hours. But the main challenge is the mismatch between government transportation policies and the ability of this technology to be fully optimized."*

An official from the Jakarta Transportation Agency added, *"We are exploring the use of AI to manage traffic on major roads, but our digital infrastructure is not yet fully ready. Collaboration with the private sector will be very helpful in accelerating the adoption of this technology."*

The results of this interview show that although IoT and AI technologies have begun to be applied in Jakarta's logistics sector, there still needs to be a gap between the potential of these technologies and the readiness of government infrastructure. The application of IoT technology in selecting logistics routes has been proven to help reduce the impact of congestion. However, regulations that only partially support the optimal use of this technology hinder maximum results. Statements from government officials highlight the need for collaboration between the public and private sectors to build digital infrastructure that supports technology-based logistics policy integration. Further analysis shows that technology can improve logistics efficiency in Jakarta but requires more flexible and integrated policy support. The government needs to accelerate the development of more sophisticated digital infrastructure, such as

smart traffic management systems, so that AI and IoT technologies can provide maximum benefits in the context of a city with infrastructure challenges like Jakarta.

### **Sustainability in Urban Supply Chains**

Sustainable logistics practices have a significant environmental impact, especially in terms of reducing greenhouse gas emissions and optimizing energy use. One of the main benefits of sustainable logistics is the reduction of carbon emissions produced by the transportation fleet. With hybrid vehicles or low-carbon fuel technology, logistics companies can minimize air pollution, which is often a major problem in dense cities like Jakarta, by adopting electric vehicles. The use of more efficient energy management systems, such as smart grid technology and AI-based route optimization, contributes to reducing excess energy consumption. These initiatives not only support sustainability efforts but also play a role in improving public health by reducing air pollution levels.

This emission reduction is very important considering the contribution of the transportation sector to global warming. According to research from the World Resources Institute, the transportation sector contributes around 15% of total global carbon emissions, with the majority of emissions coming from large, traffic-dense cities. In cities such as Copenhagen and Oslo, the implementation of low-emission transportation fleets has succeeded in reducing carbon emissions significantly, proving that sustainable logistics can make a real difference in terms of environmental impact. A logistics expert from Green Logistics Indonesia said, *"By using electric vehicles in our fleet, we have managed to reduce carbon emissions by 30% in two years. However, the less than optimal charging infrastructure in large cities like Jakarta is still a challenge that needs to be overcome."*

From this interview, it can be seen that the adoption of electric vehicles does have a significant environmental impact, but the main challenge lies in the supporting infrastructure. Big cities like Jakarta still need more electric charging stations so that electric vehicles can be operated effectively and comprehensively. Therefore, collaboration between the government and the private sector is needed to accelerate the development of environmentally friendly supporting infrastructure. Sustainable policies play an important role in supporting environmentally friendly logistics practices. One of the main initiatives taken by many cities around the world is the implementation of green transportation, which involves the use of low-emission vehicles, the development of charging infrastructure, and incentives for companies that adopt environmentally friendly technologies. The London government has introduced the Ultra Low Emission Zone (ULEZ), which restricts the access of high-polluting vehicles in the city center. This policy forces the logistics sector to update its fleet with cleaner vehicles, thereby contributing to a reduction in carbon footprint (Halldórsson & Kovács, 2010; Notteboom & Neyens, 2017).

The concept of a circular supply chain is also a policy model that supports sustainability. This model encourages the reuse of resources and waste reduction in the supply chain process, from production to distribution. In some cities, such as Amsterdam, policies that support a circular supply chain have been proven to reduce waste by up to 20% and reduce operational costs for logistics companies. Implementing this practice involves coordination between policymakers, manufacturers, and distributors to ensure that resources are used optimally without harming the environment.

An official from the Indonesian Ministry of Environment stated, *"We are in the process of designing policies that support green transportation and circular supply chains, but the main challenge is to harmonize policies across sectors and gain support from industry players."*

The interview revealed that despite the government's strong desire to adopt green transportation and circular supply chain policies, cross-sector coordination remains a major obstacle, this challenge is in line with findings in the literature that show that the success of sustainability policies depends heavily on close collaboration between the government, the private sector, and the community. Jakarta, for example, still needs a clearer and more coordinated policy framework for these initiatives to be effective and deliver maximum environmental impact.

Implementing sustainability measures in urban logistics faces several complex challenges. One of the biggest challenges is the high upfront costs. Replacing a fleet of fossil-fueled vehicles with electric vehicles, for example, requires a large investment, not to mention the development of supporting infrastructure such as charging stations. This is often a major obstacle for logistics companies, especially small to medium-sized ones, who may not have the resources to make such large investments; the lack of unified regulations and policy harmonization across sectors is also a barrier, as there is no clear guidance on how industry players can implement sustainable logistics practices effectively.

Another challenge is the reliance on legacy technology. Many logistics companies still use legacy systems and infrastructure that do not support environmentally friendly technologies, such as electric vehicles or data-driven logistics management. Public awareness is also a challenge. Despite the global push to reduce carbon footprints, some in the industry and the general public still need to fully understand the importance of transitioning to sustainable logistics or are not motivated to change because they do not see short-term benefits.

One of the most effective solutions is through government incentives to address these challenges. The government can provide subsidies or tax cuts for companies that adopt environmentally friendly technologies, such as electric vehicles or digital technology-based logistics management systems. Examples of this initiative already exist in several developed countries. In Norway, the government offers incentives in the form of tax exemptions for logistics companies that use electric vehicles so that they can save operational costs while contributing to reducing carbon emissions. This step can be adopted by other countries, including Indonesia, to accelerate the adoption of sustainable technologies in the logistics industry.

Public-private partnerships are also an important solution to address these challenges. Collaboration between governments, private companies, and communities allows for the sharing of resources, risks, and benefits in an effort to improve the efficiency of urban logistics. For example, governments can provide electric vehicle charging infrastructure, while the private sector contributes logistics technology and innovation. Such partnerships are already being implemented in cities such as Amsterdam, where the government is working with logistics companies to create an electric vehicle-based urban distribution solution that reduces emissions without sacrificing delivery efficiency. Awareness campaigns involving the wider public and the private sector can raise awareness of the importance of sustainability in urban logistics; both governments and the private sector can create a stronger social incentive to support sustainability policies by educating the public about the negative impacts of logistics vehicle emissions. Challenges in implementing sustainability measures can be addressed through a combination of financial incentives, strategic partnerships between the public and private sectors, and increased public awareness. These solutions will not only improve operational efficiency but also help create a more environmentally friendly supply chain.

## **Empirical Analysis**

Copenhagen is an example of a city that has successfully integrated policy and logistics to create an efficient and sustainable urban supply chain. The city has adopted a holistic approach to transport and supply chains that supports emission reductions, increased logistics efficiency, and environmental sustainability. Some of the key initiatives that make Copenhagen a model for policy-logistics integration are as follows:

a. Green Transportation Policy

Copenhagen has implemented a green transport policy aimed at reducing emissions from the transport sector, including logistics. One important policy is the use of low-emission zones that require logistics vehicles to meet certain emission standards. The city invests heavily in bicycle infrastructure and encourages cargo bikes to deliver logistics. This not only reduces air pollution but also reduces traffic congestion, which is often a problem in urban logistics distribution.

b. Use of Digital Technology

Copenhagen has leveraged digital technologies, such as the Internet of Things (IoT) and Artificial Intelligence (AI), to manage the city's logistics flow more efficiently. The city has implemented an intelligent traffic management system, which uses real-time data to optimize delivery routes and reduce travel time. With this technology, logistics vehicles can avoid congested areas and choose the most efficient routes, which not only saves time but also reduces fuel consumption and carbon emissions.

c. Sustainable Logistics

One of Copenhagen's main focuses is on sustainable logistics, which involves implementing a circular supply chain model. The Copenhagen government encourages the delivery of goods using electric vehicles and implements efficient waste management practices in partnership with the private sector. For example, the city has created an eco-friendly logistics hub in the city center, where goods are delivered using electric vehicles for last-mile delivery, reducing greenhouse gas emissions.

d. Public-Private Collaboration

Copenhagen's success in creating a sustainable supply chain is also supported by close collaboration between the government and the private sector. The city government provides supportive infrastructure and regulations, while local logistics companies adopt green technologies and efficient distribution practices. A concrete example of this collaboration is the Citylogistik-kph project, which works with several companies to create a centralized delivery system, reduce the number of vehicles on the road, and increase distribution efficiency.

e. Results and Impacts

Thanks to these policies and innovations, Copenhagen has achieved a significant reduction in CO<sub>2</sub> emissions from the logistics sector. The city is also known for having one of the best air quality in Europe despite its high level of urbanization. The successful integration of policies and logistics in Copenhagen makes it a model that can be adapted by other cities looking to improve the efficiency of urban supply chains sustainably. The city shows how coordinated policies and collaboration with the private sector can create environmentally friendly and efficient supply chains in cities while maintaining the quality of life of its citizens.

The integration of policies in Copenhagen has shown a significant impact on logistics efficiency and sustainability, such as low-emission zones and the use of bicycle infrastructure; the city has managed to reduce traffic congestion, which in turn speeds up the delivery of goods through the green transport policies implemented, Copenhagen can manage logistics flows in real-time by utilizing digital technology, allowing vehicles to avoid congestion and choose the most efficient routes. The result is faster delivery times and reduced operational costs.

Sustainability in Copenhagen is also heavily influenced by the integration of policies that encourage sustainable logistics practices. Policies that promote electric vehicles and green infrastructure widely help reduce greenhouse gas emissions while improving people's quality of life by reducing air pollution. Jakarta, as one of the most densely populated cities in the world, faces similar challenges in terms of congestion, pollution, and the need to improve logistics efficiency. However, these problems are exacerbated by the lack of integration between transport policies, urban planning, and logistics practices. Adopting the successful policy integration model in Copenhagen can provide Jakarta with concrete strategies to address these issues; for example, Jakarta can implement green transport policies that establish low-emission zones and encourage the use of electric vehicles for delivery, which can reduce air pollution.

The use of digital technology is also very important; by adopting advanced technology, Jakarta can improve its traffic and logistics management. Implementing a real-time data-based freight management system can help drivers avoid congestion and optimize routes, reducing travel time. Collaboration between the government and the private sector is key to improving logistics sustainability. Jakarta needs to create a collaborative platform that involves various stakeholders, including logistics companies, the government, and the community, to implement sustainable logistics solutions. The success of policy integration in Copenhagen shows that a coordinated approach can improve logistics efficiency and sustainability. Applying the same principles will go a long way in addressing the serious logistics challenges for a large city like Jakarta while improving the quality of life for its citizens and creating a cleaner and more efficient urban environment.

Based on case studies and in-depth interviews conducted, it was found that cities that successfully integrate policies with logistics practices have a comprehensive approach to urban planning and transportation. For example, Copenhagen has implemented a policy that encourages the use of electric vehicles in the distribution of goods, as well as the establishment of low-emission zones in the city center; this policy has a direct impact on reducing carbon emissions by up to 30% in the urban logistics sector.

Logistics is one of the main components of the supply chain, and it includes the movement of goods and services from producers to consumers. In the context of urban supply chains, the integration of policies, technologies, and sustainability practices directly affects the efficiency and effectiveness of the flow of goods in large cities; the results of this study can be summarized in the following points in table 2:

In a thematic analysis of expert interviews, it was found that the main challenge faced was policy fragmentation. Many other cities still face difficulties in aligning transport, environmental, and urban planning policies. A logistics expert from Indonesia emphasized that conflicting policies between the local and national levels often hinder the implementation of an efficient logistics system. The study also found that policy integration that involves not only transport regulations but also broader city infrastructure planning has a more significant impact on logistics efficiency.

The findings of this study support previous literature highlighting the importance of collaboration between the government and the logistics sector. As stated by Rodrigue et al. (2013), coordinated policies can help operational efficiency. This study confirms that cities that have successfully implemented policy and logistics integration strategies have also achieved higher efficiency in their goods distribution

operations. This aligns with the findings of Bhatnagar and Sohal (2005), who stated that integrating transport and logistics policies contributes to cost and emission reductions.

This study also identified several gaps that have yet to be widely discussed in the literature, especially related to the local context and cultural differences in each city. For example, in several cities in Southeast Asia, such as Jakarta, implementing environmentally friendly transportation policies is still hampered by inadequate infrastructure. This finding suggests that each city has unique characteristics that affect the success of policy and logistics integration, and therefore, the solutions implemented must be tailored to the local context.

**Table 2. Summary of Research Results**

Aspect	Research result
<b>Regulatory Framework</b>	Transport and environmental policies influence urban logistics, but logistics policies and practices still need to be fragmented. More integrated policy implementation is needed to achieve efficiency.
<b>Collaborative Governance</b>	Collaboration between government, private sector, and communities can streamline logistics operations. Public-private partnerships play a vital role in providing green infrastructure and technology.
<b>Technology and Innovation</b>	Digital technologies such as IoT and AI play a vital role in improving logistics efficiency and policy integration. In Jakarta, the main challenge is the infrastructure that needs to support the implementation of new technologies.
<b>Environmental Impact</b>	Implementing sustainable logistics practices, such as using electric vehicles and route optimization, reduces emissions and energy consumption and has a positive impact on the urban environment.
<b>Policy Practice</b>	Green transport policies and circular supply chains are effective approaches to reducing the carbon footprint of urban logistics but require well-coordinated cross-sector policy support.

Unlike Copenhagen which boasts advanced infrastructure with a smaller population, and a long-standing commitment to environmental policies, Jakarta presents a far more complex urban landscape. The Indonesian capital grapples with a dense population, persistent traffic congestion, and logistical systems that are still evolving, and these differences mean that replicating Copenhagen’s strategies directly in Jakarta would likely face significant challenges. Copenhagen’s extensive cycling lanes and widespread adoption of electric vehicles reflect a level of infrastructural maturity and public environmental consciousness that Jakarta has yet to achieve. Consequently, adapting such strategies would require recalibrating them to fit Jakarta’s context, and this might involve prioritizing investments in hybrid or electric public transportation systems, which can move large volumes of people efficiently, and integrating low-cost, accessible digital platforms to optimize logistics operations and traffic flow.

Policies in Jakarta must address socio-economic disparities that impact access to sustainable solutions. Initiatives like subsidies for greener transport options, partnerships with local businesses to encourage eco-friendly logistics practices, and targeted education campaigns could foster wider acceptance and adoption. A comparative analysis between Copenhagen and Jakarta—or other cities with similar logistical and environmental constraints—would yield valuable insights into how localized challenges influence the implementation of sustainability strategies, and this analysis could explore

variations in stakeholder engagement, funding mechanisms, and technological deployment, providing a blueprint for adapting strategies in diverse urban settings.

Its practical value could be enhanced by integrating specific metrics to measure the effectiveness of proposed strategies. Reductions in greenhouse gas emissions, improvements in delivery efficiency, and enhanced public-private collaboration could serve as tangible outcomes. Tracking air quality improvements or reductions in vehicle-related pollution could indicate the success of green transport policies in Jakarta's case. Measuring decreases in traffic congestion or wait times in supply chain operations could offer a clear picture of logistical efficiency gains. Metrics tied to technological integration, such as adoption rates of traffic optimization platforms or the use of real-time data by logistics companies, could further demonstrate progress. By focusing on these measurable outcomes, the study would not only provide theoretical insights but also a robust framework for evaluating the real-world impact of sustainable logistics strategies across varied urban environments.

This study emphasizes the importance of strategic policy integration for enhancing the efficiency and sustainability of urban supply chains, drawing insights from the Copenhagen case study. However, cities with differing logistical and environmental challenges, such as Jakarta, require tailored recommendations for their unique circumstances. Jakarta struggles with high population density, severe traffic congestion, and less-developed infrastructure, which complicates adopting green transport policies and digital technologies, adapting Copenhagen's strategies to such cities demands careful consideration of local challenges.

One key recommendation is the development of hybrid or electric public transportation systems that are adaptable to both urban and peri-urban areas. In contrast to Copenhagen, which has an extensive cycling infrastructure, Jakarta might focus on improving public transport options like buses and light rail, prioritizing environmentally friendly models that can handle higher passenger volumes. Investing in low-cost digital technologies for logistics optimization, such as mobile traffic management applications and real-time delivery tracking systems, could be a more feasible solution for cities with budget constraints. Another recommendation is fostering public-private partnerships focusing on infrastructure improvement, such as developing low-emission zones or creating incentive programs for businesses to adopt sustainable logistics practices. Cities facing governance or infrastructural challenges may benefit from a phased approach, where pilot projects and small-scale implementations serve as testing grounds for larger, more comprehensive policies. Capacity-building initiatives and collaborative efforts between local governments, businesses, and international organizations can also play a crucial role in overcoming governance barriers and facilitating the successful implementation of green logistics strategies.

The discussion of the results of this study underlines the importance of technology in supporting policy and logistics integration; as found in the Stockholm case study, the use of data-driven technology and route management systems has been shown to improve efficiency. This study shows that the application of modern technologies, such as big data and artificial intelligence (AI), has great potential in supporting policies that focus on sustainability and efficiency in urban logistics. This study makes an important contribution to the understanding of how policy and logistics integration can generate significant benefits in terms of efficiency and sustainability. These results provide strategic insights for stakeholders to create more integrated and adaptive policies for the evolving needs of urban logistics.

## **CONCLUSION**

The conclusion of this study reaffirms that strategic integration between government policies and logistics practices is essential for enhancing the efficiency and sustainability of urban supply chains. It was



demonstrated through the Copenhagen case study that green transport policies, digital technologies, and public-private collaboration are effective in addressing logistics challenges and mitigating environmental impacts, and these insights offer a valuable model for cities like Jakarta, where adopting similar approaches could help alleviate congestion and pollution while fostering a more sustainable logistics system, ultimately improving the quality of life for urban communities. Policymakers should prioritize the development of green transport policies tailored to local conditions, invest in cost-effective digital technologies to optimize logistics operations and foster collaborative frameworks between public and private sectors to translate these findings into actionable steps; gradual implementation alongside capacity-building programs can ensure sustainable progress for cities facing infrastructural or governance challenges. Future research could expand on this study by examining other successful case studies across diverse urban contexts, offering comparative insights and developing a framework for policy adaptation that can be applied globally.

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