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An International Analysis of Sustainable Urban Freight Transportation Planning Efforts

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Abstract

An International Analysis of Sustainable Urban Freight Transportation Planning Efforts

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Urban freight transportation includes postal deliveries, delivery of inventory or building material to commercial businesses and construction projects, delivery of food, and waste collection. Despite the extent of known negative external impacts of freight transport on air pollution, safety, and congestion, a relatively small number of cities are taking a comprehensive approach to mitigating impacts of urban freight transport through planning practices. This research acknowledges as a starting point that local freight transport should exist more harmoniously with residents in urban areas through decreasing emissions, fatalities, and congestion. I argue that public agencies should lead planning processes for sustainable urban freight transport inclusive of industry stakeholders to develop context-sensitive solutions.

As the conversation of sustainable urban mobility has become more popular in the past two decades, I investigate the extent to which sustainable urban transport has

permeated this conversation. This research evaluates if and how local public agencies plan for sustainable urban freight transportation in 12 international cities selected from the Atlas of Urban Expansion. A small sample size was used to develop a framework for gauging how prevalent sustainable urban freight transport planning is across cities in eight world regions. The findings of this report observe that of 12 cities, 1 city has an approved plan for sustainable urban freight transportation. The concept of sustainable urban passenger transport is much more pervasive across cities in the sample than sustainable urban freight transport. Urban freight appears to be often overlooked in many transportation planning processes. The report finds that non-governmental organizations, nonprofits, and researchers should make sustainable urban freight transport an added focus in applied research and reporting efforts related to sustainable urban mobility with partner cities or countries moving forward.

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INTRODUCTION

Freight transportation accounts for approximately 90% of global greenhouse gas (GHG) emissions in the logistics sector.[1] In 2016, light, medium and heavy-duty trucks made up over 40% of total GHG emissions from transport in the United States, and about 48% of emissions from on-road vehicles.[2] In urban areas, freight commonly includes postal deliveries, inventory or building material delivery to commercial businesses and construction projects, delivery of food and groceries, and waste collection. Urban freight transport facilitates many behind-the-scenes operations of cities. Delivery of urban goods ensures that stores have items on the shelves and that waste is picked up and transported away from residential neighborhoods. Last mile emissions for these trips are responsible for about 25% of emissions in the logistics supply chain.[3] This suggests that targeting urban freight transport for emissions reduction could have an outsized impact on improving air quality.

Freight transport comes in many forms: airplane, marine cargo shipping, rail, and trucks. Existing literature makes the case for rail or waterborne transport over truck freight movement as a more efficient use of energy and resources based on rate of pollution. However, trucks enable drivers to maneuver small urban spaces, resulting in trucks being the highest used mode in urban areas.[4] Truck transport has disproportionate impacts air

[1] (Punte, 2017)
[2] (Fast Facts: U.S Transportation Sector Greenhouse Gas Emissions 1990-2016, 2018)
[3] (Punte, 2017)
[4] (OECD, 2003)

quality, safety, and congestion than other modes of freight transport.[5] I argue that these negative externalities can be mitigated through planning for sustainable urban freight transport in urban areas. Unfortunately, urban freight transport is often over-looked in broader urban transportation planning and land use discussions.[6]

Urban freight transportation is defined as "The movement of freight vehicles whose primary purpose is to carry goods into, out of and within urban areas."[7] Sustainable urban freight transportation strategies facilitate the movement of goods and services in a city while limiting levels of greenhouse gas emissions. In other words, sustainable urban freight transport entails "…maximizing the economy efficiency of distribution in urban areas, while minimizing the environmental and social impacts, taking into account the complete door-to-door transport chain."[8] Successful sustainable urban freight efforts would result in reduced congestion and air pollution. Another result would be freight transport that operate at speeds that limit safety concerns for other road users. Improving the sustainability of urban freight transportation could also contribute to achieving broader identified sustainable development goals for urban areas around the world.

Rapid urbanization and population growth increases demand for urban freight transport. As more people and businesses are drawn to an urban area, passenger transport and freight transport needs compete for the same right-of-way. [9] In 2018, 55% of the

[5] (Punte, 2017)
[6] (Rodrigue, Comtois, & Slack, 2017)
[7] (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)
[8] (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)
[9] (Punte, 2017)

world's population lived in urban areas, ranging in size from over 100,000 residents to megacities of over 10 million inhabitants.[10] By 2030, 60% of the world's population is projected to live in cities of over half a million residents.[11] The concentration of population in urban areas increases the need for urban goods transport as well as the number of people that will be subject to negative externalities of urban freight transport. Diesel emissions and small particulate matter have been connected to causes of lung cancer and increases in asthma, among other respiratory and cardiovascular diseases.[12] Without efforts to mitigate negative impacts of urban freight transport, new urban residents will be exposed to known health risks caused by carbon intensive trucking. Some cities have considered strategies such as off-peak delivery times to reduce congestion and air pollution. Other sustainability initiatives have included restricting the age of vehicles allowed within the urban center as an incentive for truck owners to upgrade fleets to lower polluting vehicles with newer technologies. To reach a reduction in emissions from truck-related freight transport, the International Transport Forum (ITF) recommends policy measures that would require information collection, setting standards for externalities, or implementing fiscal measures to incentivize or disincentivize specific behavior.[13] I believe that these objectives should be achieved with urban freight stakeholders at the table during a public agency-led planning process for sustainable urban freight transport.

[10] (United Nationals Economic and Social Affairs, n.d.)
[11] (United Nationals, Department of Economic and Social Affairs, Population Division, 2018)
[12] (Clean Air Asia, 2012 p.2)
[13] (*The Carbon Footprint of Global Trade*, 2015)

Existing research on urban freight transport focuses largely on addressing specific problems such as reducing CO_2 emissions through decreasing load/unload times. Approving one-off policy measures to mitigate specific issues is reactive. In this report, I argue that facilitating a planning process inclusive of all urban freight stakeholders is a proactive approach to achieve more sustainable outcomes in urban freight transport. Identifying a clear vision of how urban freight can move through an urban area can enable public agencies to determine a comprehensive set of policy measures and programs for their city to undertake. This could also serve as a catalyst for local agency staff to confront sometimes conflicting urban mobility needs on constrained rights-of-way.

In 2015, United Nations member states adopted 17 global goals for sustainable development to guide countries around the world in planning and policy decisions.[14] This set of goals was an update to the Millennium Development Goals (MDGs) approved in 2000, and includes measures and indicators for tracking progress toward each goal. While transportation was conspicuously absent from the MDGs, the topic takes on a more prominent role in the updated set of Sustainable Development Goals (SDGs). One of the SDG indicators includes tracking both passenger and freight volumes by mode of transport. Other indicators relate to tracking particulate matter and CO_2 emissions from transport-related activities.[15] The applicability of the SDGs to cities in different contexts around the world is the primary inspiration for the international approach to this report. I focus on the issue of urban freight planning and seek to understand how prominent the concept of

[14] (United Nations, n.d.)
[15]

sustainable urban freight planning is in local municipal agencies around the world. I attempt to do this by collecting information on urban transportation in international cities and by cataloging the extent to which sustainable urban freight policies or plans are pervasive.

Through this research, I gauge the extent to which sustainable urban freight transportation planning has permeated the global conversation of sustainable urban mobility.[16] I selected a random sample of 12 cities from a database of 200 cities contained within the "Atlas of Urban Expansion." I identify if the municipality has approved a plan for sustainable urban freight transportation, and document supplemental information regarding the existence of urban transportation plans, studies conducted on urban freight problems in the city, and if a national transportation plan exists for the country. Through collecting this information, I seek to answer the following questions:

- How many of the sampled cities have a sustainable urban freight transportation plan?
- How many of the sampled cities have an approved urban mobility plan?
    - How many of these plans address issues of urban freight or urban logistics?
- Does the country of the sampled city have a national transportation plan?
    - Are urban freight issues acknowledged or addressed in the national transportation plan?

[16] Rodrigue et al identify three broad categories of urban mobility, and identify the complimentary nature of different categories as well as the competing forces for urban space, and transport infrastructure: personal transport, collective transport, and freight transport (Rodrigue et al., 2017).

Hypotheses Guiding the Research

My hypothesis is that the results of this analysis will reveal a low number of cities that have approved sustainable urban freight transportation plans. I anticipate that cities with larger populations are more likely to have approved a sustainable urban freight transportation plan or have policies related to urban freight movement in an urban transportation plan. I am unsure of the extent to which national plans will influence urban freight transportation planning processes. I expect that fewer cities in the global south will have approved urban transportation plans or sustainable urban freight plans, as opposed to cities in developed countries. I also anticipate that other attributes will impact the likelihood of a city developing policies to address urban freight transport, such as the share of national GDP produced in the city, or the presence of an active port for international trade. A city that is responsible for a large percentage of national GDP may be more likely to value developing a sustainable urban freight transportation plan or may have more national support to do so based on its economic position within the nation.

In the sections that follow, this report reviews the literature on negative external impacts of urban freight transport, and research that identifies the role of public agencies in sustainable urban freight planning. It also evaluates the role of urban freight transport in facilitating the SDGs, explains the methods used to gauge the prevalence of sustainable urban freight transport planning in local agencies, and reports on analysis of the 12-city sample.

LITERATURE REVIEW

This section includes a review of strategies developed to address three externalities of urban freight transport: air quality, congestion and safety. This is not a comprehensive list of externalities, but I believe that these three negative impacts are among the most important to be addressed in order to facilitate sustainable urban communities. The three externalities also tend to be common catalysts for urban freight studies, policies and/or plans as will be seen in the analysis to follow. Other research in this section identifies why local agencies have historically not been proactive in urban freight planning. Lastly, I examine how sustainable urban freight transport could facilitate progress toward SDGs for countries and cities that undertake sustainable urban freight transport planning.

Existing research tends to focus on identifying solutions to specific urban freight transport problems. In the following sections I provide an overview of studies related to improving air quality, decreasing congestion, and improving safety. I have grouped air quality and congestion research together because multiple research initiatives provide improvements to both areas.

Air Quality & Congestion

In 2014, about half of the global population living in urban areas was exposed to at least 2.5 times higher levels of air pollution than maximum standards set by the World Health Organization (WHO).[17] "In 2016, an estimated 4.2 million people died as a result

[17] ("Goal 11 .:. Sustainable Development Knowledge Platform," n.d.)

of high levels of ambient air pollution."[18] A Clean Air Asia reported completed in 2012 highlighted the important role that freight transport plays in CO_2 emissions. Home to 12 of the world's megacities, Asian urban areas are experiencing intense effects of negative externalities like CO_2 emissions. Air pollution contributes to more than 800,000 premature deaths each year. Road transport contributes approximately 74% of transport related CO_2 emissions. The amount of CO_2 emissions from light and heavy commercial vehicles account for over half of road transport emissions in Asia. Diesel is the primary fuel type used in most Asian countries. Across the continent, it accounts for over 60% of the CO_2 emissions caused from road transport. The report provides a data-driven foundation for Asian urban areas to undertake sustainable urban freight planning initiatives to reduce the air pollution from freight transport. [19]

A global study completed by the International Transport Forum (ITF) in 2015 identified carbon-intensive trucking as the primary cause of CO_2 emissions caused by freight transport. ITF estimated that 30% of all transport-related CO_2 emissions are a result of freight transport related to international trade.[20] Of that amount, trucking was accountable for more than 50% of all trade-related emissions.[21] Existing research supports the idea that a focused effort to reduce emissions of operating light and heavy duty vehicles is imperative to improving sustainability of urban freight transport.

[18] ("Goal 11 .:. Sustainable Development Knowledge Platform," n.d.)
[19] (Clean Air Asia, 2012)
[20] (*The Carbon Footprint of Global Trade*, 2015)
[21] (*The Carbon Footprint of Global Trade*, 2015)

Researchers in the University of Washington's Urban Freight Lab have worked to identify solutions to reduce the amount of time that trucks spend idling in loading zones, and to decrease the amount of failed first delivery attempts by goods carriers.[22] When vehicles go through multiple delivery attempts, they contribute to congestion and increased emissions from added trips. The group concentrates on identifying low-cost improvements that would have high impacts to alleviate issues of urban freight transport. Their research includes a pilot test of e-bike delivery of UPS packages, as well as a common carrier locker pilot test in an office tower to reduce delivery time. The e-bike pilot with UPS delivery is currently underway and findings are not published. The project could substantially reduce emissions and decrease vehicular congestion by delivering packages by a non-vehicular mode. The pilot for testing a common carrier locker took place over the course of two months in 2018, with UPS and the U.S. Postal Services participated in delivering packages into a locker system within the office building. One major contributor to the success of this project is that it was proposed in an area of high delivery density, which allows the locker system to functions as a small version of a distribution node in an urban area.[23] The density of delivery needs in urban areas enable solutions for efficient delivery to scale up if multiple private delivery companies are open to the change. The pilot found that delivery time in the office tower decreased by 78%, resulting in a reduction of the amount of time that trucks spent in a loading zone or used public curb space. [24] Collectively, 11 million

[22] (University of Washington, n.d.)
[23] (University of Washington, n.d.)
[24] (University of Washington, n.d.)

tons of CO_2 are emitted annual in the United States from idling truck and train engines. This includes 5,000 tons of particular matter and "200,000 tons of oxides of nitrogen."[25] Reducing idling time of light and heavy-duty vehicles can substantially reduce CO_2 emissions and localized air pollution.

Safety

In October 2018, the National Highway Traffic Safety Administration (NHTSA) reported a 9% increase of crashes involving large trucks between 2016 and 2017.[26] Additionally, fatalities in urban areas were higher than fatalities of rural areas for the second year in a row. Large truck occupant fatalities increased by 16% to the highest rate since 1989. The number of people occupying other vehicles involved in a crash with a large truck also increased over 8% between 2016 and 2017. Some factors that contribute to the safety risks of freight transportation include blind spots, larger loads, transport of hazardous material, and slower vehicle reaction times.[27] The need to increase the safety of freight movement in urban areas is highlighted by the disproportionate impact of freight vehicles on serious injuries or fatalities of other mode users.[28] Transportation officials in London noted a disproportionate number of serious or fatal injuries from goods vehicles compared to other road users during plan development for their sustainable urban freight plan.[29]

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[25] ("Truck Idling," n.d.)
[26] (National Highway Traffic Safety Administration, 2018)
[27] (UN Habitat, 2013)
[28] (UN Habitat, 2013)
[29] (Transport for London, 2007)

A strategy commonly used to reduce severity of impacts of collisions with freight vehicles is restricting vehicle weight and size on specific roadways.[30] Roadway types may include walkable streets that generate high numbers of pedestrians and cyclists, narrow roads, and weak or low bridges. Time restrictions can also be used to decrease the amount of delivery trucks entering walkable urban areas during peak times for foot traffic or areas near schools to decrease potential collisions. Increased technology is another strategy used to improve overall road safety, including movement of urban freight vehicles through urban traffic management and control systems.[31]

The Tokyo Trucking Association launched an accident awareness campaign that requires multiple member branches to designate specific prevention techniques for different neighborhood contexts. Each branch works with local government officials and neighborhood organizations to spread traffic safety promotion at intersections. They also integrate safety information into elementary school programs through worksheets and class trips. This information is later shared in member forums, including an annual traffic accident prevention meeting.[32] Programs like this can be integrated into urban freight plans and can catalyze partnerships between local public agencies and private transport companies.

[30] (Allen, Thorne, & Browne, 2008)
[31] (Allen et al., 2008)
[32] (Tokyo Trucking Association, n.d.)

The Role of The Public Sector

Making freight movement more sustainable benefits both municipalities and private companies. If trucks spend less time on congested roadways, the company pays less in fuel costs and likely vehicle maintenance over time. At the same time, the city reaps a benefit of having less polluting freight traffic on the road at peak travel times. Optimizing the efficiency of local supply chain and logistics operations can have a profound impact on the negative externalities associated with urban freight.[33] Reducing the weight of vehicles frequently using a roadway can also lead to reduced life cycles and associated roadway rehabilitation and maintenance costs. Despite the potential for multiple positive impacts, public agencies have historically perceived urban freight to be a private sector problem because much of urban freight is generated by private commercial operations.[34]On the other hand, private sector operators regard urban freight problems to be a result of lacking infrastructure or regulatory problems that should be addressed by public agencies.[35]

In 2003, an Organization of Economic Cooperation and Development (OECD) working group on Urban Freight Logistics laid out challenges for delivering goods in 21st century urban environments.[36] The report acknowledges the mismatch between work undertaken on the topic and its high level of importance. The report highlights that "[r]elatively little has been done by governments to facilitate the essential flow of goods in urban areas and to reduce the adverse impacts of urban goods transport on the communities

[33] (*The Carbon Footprint of Global Trade*, 2015)
[34] (Punte, 2017)
[35] (Punte, 2017)
[36] (OECD, 2003)

being served. This has resulted in increasing problems associated with goods delivery including competition with passenger transport for access to road infrastructure and space for parking/delivery facilities."[37] In 2003, governments were overlooking the need to plan for urban goods movement in urban areas, suggesting that the consideration of sustainability of urban freight was also not part of local agency considerations. The report highlights that the awareness of urban freight by public officials and urban residents is primarily focused on the negative impacts of urban freight transport, such as congestion in urban areas, physical barriers and noise pollution. Additionally, freight vehicles are a major cause of accidents and crashes because their size and inability to be nimble in small spaces impacts all surrounding modes.[38] The report highlights the need for integration of policies and measures across sectors, suggesting that policies be created in a way that facilitates developments and innovation in the private sector.[39]

Seven years after the OECD report, researcher Maria Lindholm found three major themes in conversations with local authorities about urban freight transport: a general lack of expertise in local authority staff on urban freight, a lack of consideration for freight movement in land use planning and data collection, and multiple impediments to implementing more sustainable freight transport practices.[40] During interviews, freight operators identified struggles between regulatory restrictions placed on the industry and how this can create friction between competing goals.[41] For example, weight restrictions

[37] (OECD, 2003)
[38] (OECD, 2003)
[39] (OECD, 2003)
[40] (Lindholm, 2010)
[41] (Lindholm, 2010)

on certain streets may result in trucks taking longer routes. While restricted access to a street may help the life cycle of a specific street, it may increase overall distance of travel and contribute to air pollution.[42] Another example includes the need to address how changes in land uses in cities will impact freight distribution patterns, as new commercial locations are added to the urban freight distribution network.[43] Consideration for how policies governing urban form and land use will impact the location of logistics centers is imperative, particularly as the landscape for freight distribution changes.[44] The rising need for more distribution facilities coupled with decreasing costs of transportation has led to the sprawl of logistics operations and distribution centers across metropolitan areas. Locating distribution centers in suburban or exurban areas has negative environmental impacts on communities close by, and overall metropolitan areas from added vehicle miles traveled to deliver goods to employment and residential centers.[45] Lindholm's interview participants also identified the need for better monitoring of residential parking violations when personal passenger vehicles block access for freight vehicles to park to make deliveries. The outcome of Lindholm's interviews support the idea that urban freight issues should be addressed through a planning process. Engaging private companies and suppliers would encourage public agencies to consider unintended consequences of potential policies. These types of insights should be considered when crafting policies and planning initiatives to improve sustainability of freight transport.

[42] (Lindholm, 2010)
[43] (Lindholm, 2010)
[44] (Dablanc & Ross, 2012)
[45] (Dablanc & Ross, 2012)

Lindholm identified a need to improve the transportation planning process, and that a lack of awareness and knowledge about urban freight transport generated low interest of local authorities to make decisions to improve sustainable outcomes of urban freight.[46] She found that work done at the level of the European Commission highlighted the need for integrated freight and urban transport planning, but that the level of importance did not transfer to the local authorities. In Swedish cities, 1% of cities had a full-time employee to work on freight transport issues.[47] She identified the following institutional needs: greater communication and cooperation within local agencies across departments, and a champion for sustainable urban freight initiatives to increase the amount of knowledge on the subject and elevate its priority with local authorities.[48]

Creating a plan for sustainable urban freight movement provides an opportunity for local governments to explicitly communicate what types of operations they desire to see within their cities. Moreover, formally documenting a process to determine existing problems, collect data to evaluate solutions and propose solutions formalizes and legitimizes sustainability goals over time and through different terms of political leadership. In some municipalities, the identification and prioritization of sustainability initiatives can impact other city departments and priorities such as land use planning initiatives. Behrends et. al identified a working definition of a Sustainable Freight Transport system, including the following as a set of proposed objectives:

[46] (Lindholm, 2010)
[47] (Lindholm, 2010)
[48] (Lindholm, 2010)

- "to ensure the accessibility offered by the transport system to all categories of freight transport;
- to reduce air pollution, greenhouse gas emissions, waste and noise to levels without negative impacts on the health of the citizens or nature;
- to improve the resource- and energy-efficiency and cost-effectiveness of the transportation of goods, taking into account the external costs and;"
- to contribute aesthetically to the built environment by avoiding accidents and minimizing occupied right-of-way without impeding mobility of passenger transport."[49]

The need for public sector intervention comes from the need for continuous balance or rebalance of social costs and benefits resulting from urban freight transportation.[50] In a 2012 Study of Urban Freight Transport, the European Commission identified multiple industry inefficiencies that contributes to rising levels of congestion and air pollution: low load factors and empty vehicles on the road, slow-moving loading and unloading at transfer points, and making multiple deliveries to an individual location in a given time period.[51] As public agencies consider taking on a more prominent role to manage impacts of urban freight movement, it is imperative to understand what planning and policy measures intersect with urban freight transport, The 2012 study includes a review of existing policies and potential policy changes for local public agencies to consider implementing. The report

[49] (Behrends, Lindholm, & Woxenius, 2008)
[50] (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)
[51] (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)

created 6 groups of improvement categories and identified specific strategies within each category. A summary of the information is below; the report should be read in more detail for additional information:

1. Regulatory measures
    a. Create time windows for deliveries in a specific geographic area.
    b. Vehicle weight and size restrictions in specifically identified geographic zones.
    c. Low Emission Zones, established in specific areas where access is limited to vehicles that do not meet designated emission standards.
2. Market-based measures
    a. Congestion charging.
    b. Mobility credit schemes.
    c. Indirect subsidies for operators of urban freight that adopt sustainable urban freight transport practices.
3. Land use planning measures
    a. Requiring parking spaces for freight in new developments and a designated loading zone area.
    b. Establish logistics zones to combine complimentary uses and limit sprawl of company location.
    c. Safeguard locations in urban areas close to rail or waterborne freight networks for future distribution capabilities.

4. Infrastructure measures
    a. Designated on-street loading and unloading bay spaces, organized throughout an urban area.
    b. Establishment of distribution parks and logistic zones that are connected to rail.
5. New technologies
    a. Implement a sophisticated and widespread Intelligent Transport System with real-time road network data.
6. Management and other measures
    a. Create Urban Logistics Plans, integrated with wider land use planning policies and passenger mobility plans.
    b. Consolidation of supply and demand centers.[52]

Local officials should consider a combination of the policy measures listed above based on the planning context for their own city and an identified vision for how urban freight should function within the broader urban environment.

'Market' stakeholders in urban freight include retail, both physical stores and e-commerce, post, construction material needs, waste collection and transport, and the food category, including hotel, restaurant and catering.[53] Any type of urban freight transportation plan must consider the needs of each of these industry sectors. The other

[52] Summaries and list of information adaption from information found in: (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)
[53] (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)

primary stakeholder categories include administrators, shippers, receivers, carriers, and residents.[54] Various stakeholders in an urban freight transportation planning process are outlined in Error! Reference source not found.. [55] The large number of stakeholders may d iscourage public agencies from taking a more prominent role in creating regulatory frameworks that govern the movement of urban freight. The stakeholders all play different and necessary roles with the supply chain, operating with different incentives. However, the determination of acceptable levels of negative externalities produced by business operations in dense areas of high concentrations of people should not be left to individual business owners.

The Smart Freight Centre (SFC) is a global nonprofit whose mission is to lead the way to a more efficient and sustainable global freight sector by working with businesses to implement initiatives for smart freight logistics.[56] In a report conducting a review of good practices in the field of sustainable urban freight planning, SFC found that coordinating regulatory and institutional coordination is imperative to successful urban freight plans.[57] The report includes detailed explanation regarding how public agencies can address the root cause of concerns for private businesses, trade-offs that must be considered by all stakeholders, and the importance of quality data collection.[58] Two of nine exemplary cities

[54] (EdX: Sustainable Urban Freight Transportation: A Global Perspective & TU Delft Learning Online, n.d.)
[55] This graphic was created and adapted from a table found on p. 27- p.28 in this report: (MDS Transmodal Limited & Centro di ricerca per il Trasporto e la Logistica (CTL), 2012)
[56] (Smart Freight Centre, n.d.)
[57] (Punte, 2017)
[58] (Punte, 2017)

referenced in this report include London and Tokyo. Policy measures included in their sustainable urban freight transportation plan are summarized below.

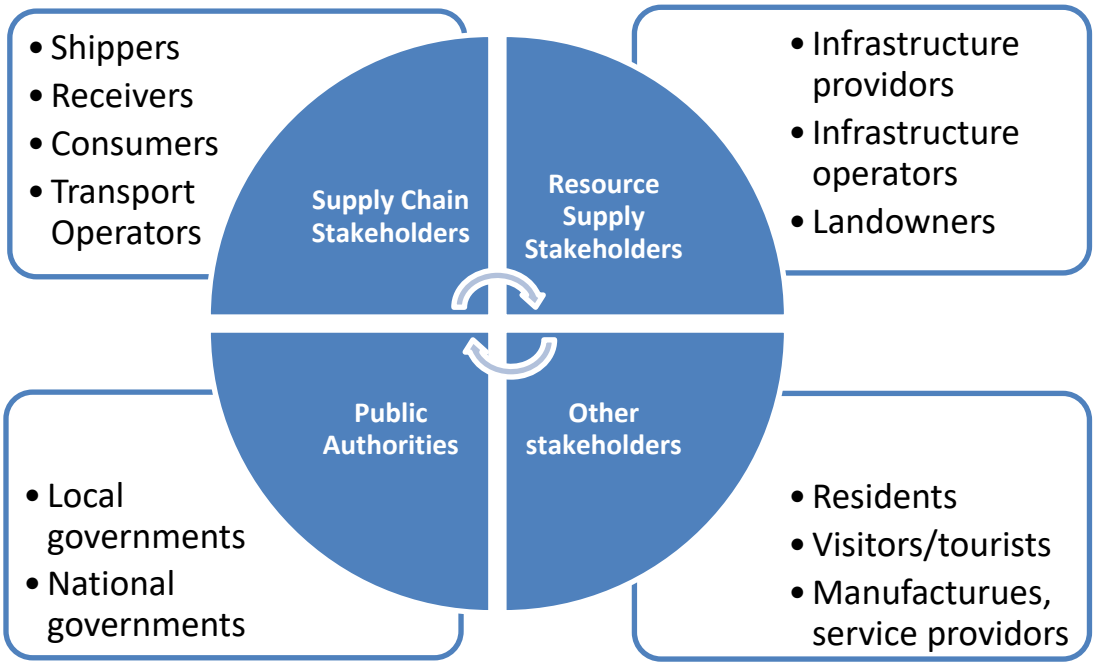

Figure 1: Stakeholders in Urban Freight Transportation Planning.

London, England

London adopted a sustainable urban freight plan in 2007, with the vision: "…the safe, reliable and efficient movement of freight and servicing trips to, from, within and, where appropriate, through London to support London's economy, in balance with the needs of other transport users, the environment and Londoners' quality of life…"[59] London's plan for sustainable urban freight identified seven major goals, categorized the

[59] (Transport for London, 2007)

three pillars of sustainability: economy, environment and society. Goals under the Economy category include supporting population and economic activity growth, improving efficiency of goods and service distribution, and balancing the needs of freight transport with the passenger transport needs and available resources. Environment goals were focused on improving air quality and CO_2 emissions caused by movement of goods and services, well as improving the quality of London's built environment by reducing noise levels caused by freight. Goals categorized under society are related to improving health and safety of residents through the reduction of collisions involving freight transport, and more broadly reducing the impact of negative externalities of freight movement on surrounding communities.[60]

The plan identified four key projects to launch the implementation of the sustainable urban freight plan, including a: Freight Operator Recognition Scheme, Delivery and Servicing Plans, Construction Logistics Plans, and developing a Freight Information Portal. The Freight Operator Recognition Scheme is a capacity-building strategy and project, requiring coordination with drivers and operators of urban freight within and across London. This project includes advocating for more sustainable practices, and establishing industry standards that can help businesses identify sustainable third party freight operators.[61] Delivery and Servicing Plans and Construction Logistics Plans would be tools used by authorities working in traffic management and planning that would lead to a reduction in carbon emissions during building construction and ongoing building

[60] (Transport for London, 2007)
[61] (Transport for London, 2007)

operations. The purpose of developing the freight information portal would enable sharing of best practices and improve efficiency by creating a one-stop-shop for freight operators and users.[62] The plan included specific identified goals, milestones, and responsible parties, and work streams that would support the identified initiatives. Medium and long-term goals were also identified to bring the plan's vision to fruition.

Tokyo, Japan

Officials in Tokyo, Japan identified impacts of changing demographics of the Tokyo Metropolitan Region on the distribution of urban freight. Access to internet, increased aging populations, and evolving dynamics favoring smaller storefronts have led to smaller and more frequent deliveries of urban freight throughout the city. Within the city, about 99% of freight is transported by road. In response to these and other problems identified with urban freight movement and distribution, Tokyo adopted a new "The New Comprehensive Program for City Logistics" in 2001. The city also established quantitative targets to collect information on urban freight to inform future decisions.[63]

Some of the prominent initiatives that resulted from this plan include promoting and using rail for residential waste collection, capacity building and knowledge exchange between the Tokyo Trucking Association and private businesses to advocate for more sustainable vehicle use and safer driving, and joint-initiatives to establish urban consolidation centers. Preparation for the 2020 Olympic games was acknowledged as a

[62] (Transport for London, 2007)
[63] (Punte, 2017)

motivating factor to improve safety and health conditions associated with urban freight movement. They worked toward this with pilot programs of moving urban freight on urban rail during off-peak commuting hours, and through policies that established limits on diesel emissions. Results of these initiatives have included a 40% decrease in accidents and 20,000 tons of CO_2 saved.[64]

Impact Of Sustainable Urban Freight Transport On SDGs

In 2015, the 2030 Agenda for Sustainable Development was adopted by UN member states. The 2030 Agenda designates 17 Sustainable Development Goals (SDGs) and 169 associated targets for countries to measure progress at the national scale.[65] **Figure 2** shows all 17 approved SDGs; the 17 SDGs call for immediate action and apply to low, middle and high-income countries around the world. Goals and indicators related to transportation are sprinkled across the 17 broader goal areas. Complementing the adopted 2030 Agenda for Sustainable Development and the SDGs, the New Urban Agenda (NUA) was adopted in 2016 at the United Nations Conference on Housing and Sustainable Urban Development.[66] The New Urban Agenda serves as a new global framework to guide city decision-makers around the world in achieving sustainable urban development. The NUA is a shared vision and a tool for sustainable urban development, in support of the belief that "If well-planned and well-managed, urbanization can be a powerful tool for sustainable development for both developing and developed countries."[67] I argue that similarly, if well-

[64] (Tokyo Trucking Association, 2010)
[65] (United Nations, n.d.)
[66] (*New urban agenda*, 2017)
[67] (*New urban agenda*, 2017)

planned and well-managed, urban freight movement can support growing local economies with minimal long-lasting impacts to residents and the environment. The delivery of goods and services facilitate the existence of walkable urban areas and cultural centers. Produce must be delivered to markets for customers to access, and goods must be delivered to stock shelves for businesses to thrive in urban areas. Residence buildings in urban areas are also drivers of urban freight needs. The increase of e-commerce has brought an unanticipated number of vehicles on the road during all times of day to deliver packages, food, and other items to individual doorsteps. The 2030 New Urban Agenda identified the need for "Urban freight planning and logistics concepts that enable efficient access to products and services, minimizing their impact on the environment and on the livability of the city and maximizing their contribution to sustained, inclusive and sustainable economic growth."[68]

Figure 2: Global sustainable development goals identified in UN 2030 Agenda for Sustainable development.

In response to the creation of the SDGs, the World Bank Group (WBG) created an initiative called Sustainable Mobility for All (SuM4ALL).[69] The SuM4All initiative is

[68] (*New urban agenda*, 2017)
[69] ("Implementing the SDGs | Sum4all," n.d.) https://www.oecd-ilibrary.org/urban-rural-and-regional-development/oecd-urban-policy-reviews_23069341

built on a foundation of four policy principles, including universal access to economic and social opportunities, increasing the efficiency and effectiveness of transport options, increasing safety of all modes, and minimizing environmental impact of traditional transportation externalities.[70] Central to the initiative is the belief that policy makers must make decisions considering these four priorities together to achieve synergistic benefits. Synergistic benefits from transportation decisions manifest in multiple ways: for example, a reduction in travel speeds of freight vehicles can lead to a reduction in crash fatalities and injuries as well as a reduction in greenhouse gas emissions. This policy decision can also improve operational efficiency for light and heavy-duty vehicles and improve overall travel conditions for all other road users like pedestrian and cyclists.[71] This approach to identifying synergistic benefits of sustainable urban transport initiatives should be emulated as cities local agencies consider strategies to make urban freight transport more sustainable.

Improving the sustainability of urban freight transport can also have synergistic benefits in making progress towards multiple SDGs. For example, decreasing the level of congestion from urban freight vehicles will reduce GHGs and particulate matter emitted from urban goods transport. This will contribute to making progress on Goal 3 (Good health and well-being) by improving air quality for local residents and vulnerable populations; 11 (Sustainable Cities and Communities) by improving air quality across the community; and 13 (Climate Action), because making urban freight transport more

[70] ("Our Ambition | Sum4all," n.d., p. 4)
[71] (Morales Sarriera & Fulton, 2017)

sustainable is a climate action step. Creating a sustainable urban freight plan will require the participation of various stakeholder groups, which contributes to Goal 17 (Partnerships for the Goals). Lasting partnerships that originate through a planning process can provide a foundation for working on future SDG related initiatives together.

The research summarized in this section provides a foundational background for the analysis completed in subsequent sections of this report. Urban freight transport studies tend to result from the desire to mitigate individual problems, limiting agencies from considering comprehensive solutions and system-wide impacts. International non-governmental organizations (NGOs) have recognized the need for planning for sustainable urban freight within broader identified goals for sustainable development. The analysis in remaining sections of this report evaluates how prevalent sustainable urban freight planning is in local public agencies using as 12-city international sample. The next section explains the methods used.

METHODS

Through collecting information about cities' sustainable urban freight planning efforts, this report aims to develop a framework for understanding how prevalent the concept of sustainable urban freight planning is for municipalities around the world. To study city urban freight planning practices, I examine 12 cities from the AUE, and look for information regarding existing urban freight policies or plans. I inventory how many cities have taken steps toward making urban freight transport more sustainable, and the number of cities that have approved transportation plans. I subsequently evaluate if urban freight is a component of those plans to understand the degree to which sustainable urban freight practices have permeated the broader conversation of sustainable urban mobility.

The population data used in this analysis is found in the Atlas of Urban Expansion, a joint initiative with the Lincoln Institute of Land Policy, UN-Habitat, and New York University. The Atlas of Urban Expansion (AUE) is a multi-year project with multiple phases, created to evaluate how urban areas have changed over time. The AUE is a stratified global sample of 200 cities with cities of 100,000 or more people. As of 2010, there were 4,231 cities in the world with a population of at least 100,000.[72] Of the 200-city sample, the 2014 mean population is 3,936,156. The median population is 1,277,281. The time-frame used for the database is from 1988 - 2014.[73] The population numbers used for this research report are population estimates from 2014. This dataset was selected and

[72] (Angel et al., 2016)
[73] (Angel et al., 2016)

preferred over other global city population estimates because of consistency in geographic extent used in database creation (all population estimates are measured at the metropolitan area level). The database also differentiates between urban extent boundaries and built up area boundaries and provides historical data for these variables. The sample of 200 cities that make up the AUE was selected at random in proportion to urban population in each region, and are categorized into 8 different global regions:

- East Asia and the Pacific
- Europe and Japan
- Land-rich developed countries
- Latin America and the Caribbean
- South and Central Asia
- Southeast Asia
- Sub-Saharan Africa
- Western Asia and North Africa

Land-rich developed countries are defined as to include the United States, Canada, Australia and New Zealand.[74] Historical data in this database exists over three time periods: 1988, 2000, and 2014.[75]

For my analysis, I took a random sample of 12 cities of the initial 200. The 12 cities have a 2014 mean population of 1,373,013 and a median population of 1,057,731. The city

[74] (Angel et al., 2016)
[75] (Angel et al., 2016)

with the smallest population is Rawang, Malaysia with 236,967 people. The city with the highest population is Mexico City with 17,765,121. The 12 cities in this sample include: Budapest, Hungary; Cirebon, Indonesia; Pokhara, Nepal; Kampala, Uganda; Kolkata, India; Mexico City, Mexico; Rawang, Malaysia; Cabimas, Venezuela; Algiers, Algeria; Rajshahi, Bangladesh; Ulaanbaatar, Mongolia; Modesto, California (USA).

I used the Google search engine to search specific queries to determine whether a city has an approved sustainable urban freight transportation plan. I collected supplementary information to determine if the city has a municipal transportation plan, or a national transportation plan. If the municipality does have an approved transportation or mobility plan, I explored the plan to determine if freight transportation was considered in this plan. If the country had a national transportation plan, I investigated the extent to which urban freight policies or strategies were outline in the report. The search queries that I used include:

- (city name) sustainable urban freight transport plan
- (city name) sustainable urban freight strategy
- (city name) urban transportation plan
- (country name) national freight transportation plan
- (country name) national transportation plan

I also attempted to locate local government websites to search for the existence of transportation departments and any department that may lead the creation of an urban freight transportation plan. I was limited in this task by language barriers of various cities

studied. The information collected about each of these cities was collected to answer the following questions:

- Does this city have a sustainable urban freight transportation plan?
    - If yes, what are the main components of this plan?
- Does this city have any urban transportation or mobility plan?
    - Is urban freight an element in this plan?
- Does the country have a transportation plan?
    - Is freight transportation recognized in this plan?
- Have studies and reports about sustainable freight mobility or urban mobility been conducted about this city?

The World Bank Sum4All Global Tracking Framework is used to provide context of national statistics regarding emissions, logistics performance, and road quality. Understanding the national context of a sample city provides supplementary context to urban freight transportation plans. For example, identifying if a relationship exists between national level road quality or logistics performance index rankings and cities with sustainable urban freight plans. Another example is having the ability to evaluate if cities with sustainable urban freight plans are more prevalent in countries with more CO_2 emissions or less. The Global Tracking Framework country level statistics are presented at the beginning of the next section.

FINDINGS

Country-level information is presented at the beginning of this section to provide context to the relative differences between countries on specific transport and freight related metrics. Metrics include a logistics performance index, road quality, percentage of $PM_{2.5}$ exposure above World Health Organization (WHO) guidelines, and other indicators related to emissions and energy consumption. Following this information, outcomes of city-level information collected on urban freight is provided. No pattern is observed at this time between cities that do and don't have approved sustainable urban freight plans because of the sample size.

Country Level Information[76]

Table 1: Countries of the 12 cities included in analysis.

Land-Rich Developed Countries	East Asia and the Pacific	Europe and Japan	South and Central Asia	Southeast Asia	Sub-Saharan Africa	Latin America and the Caribbean	Western Asia and North Africa
United States		Hungary	India	Indonesia	Uganda[77]	Mexico	Algeria
	Mongolia		Nepal			Venezuela	
			Bangladesh	Malaysia			

[76] Information in this section was downloaded from the World Bank Group SuM4All Global Tracking Framework: (World Bank Group, n.d.-b). Countries are categorized by 8 world regions identified in the Atlas of Urban Expansion.

[77] Multiple charts show a value of 0 for Uganda because information was unavailable for multiple indicators in the Global Tracking Framework. This omits Uganda from some of the observations and comparisons provided in country-level observations.

In 2013, the United States had by far the highest GHG emissions related to transport (**Figure 4**). While the US is larger in land mass than all other countries in the sample, countries with higher land mass like India are nowhere near as close in emitting transport related GHGs. I suspect that this is due to the auto-dependent nature of most American cities. **Figure 6** displays the percent of total population exposed to levels of $PM_{2.5}$ air pollution exceeding World Health Organization guideline values; all countries in this sample other than the US experience much higher levels of localized air pollution. In terms of CO_2 emissions from road transport relative to GDP, the United States tops the list, followed by Venezuela and Malaysia. The level of CO_2 generated in these cities by road transport is much higher than the value in GDP produced by that mode of transport. The US also had the highest ratio of energy consumption of transport relative to GDP in 2012, followed by Venezuela, Mexico and Algeria.

The Logistics Performance Index is an indicator created by the World Bank in the Global Tracking Framework (**Figure 7**). Each country receives a score rating in relation to all other WBG member countries on a scale of 1 to 5, 1 being the lowest and 5 being the highest. Countries in different world regions maintain the top ranking of this indicator; no clear pattern stands out for one world region to be considered stronger than another because of the sample size. Quality of Roads information is split up by world regions (**Figure 8 – Figure 10**). Road quality data is available between 2006 and 2015. Roads are ranked from 1-7, with 1 being the worst, and 7 being the best. Uganda and Mexico have for the most part improved their road quality since 2009, with Mexico beginning to decline between 2013 and 2015. Uganda maintains steady improvement. Algeria had an increase in the road

quality index between 2009 and 2010, falling steadily afterward until about 2015. Venezuela saw improving road quality between 2006 and 2010 but began declining in quality after 2010. Other countries that saw largely steady improvements in road quality include Mongolia, Nepal, India, and somewhat Indonesia and Hungary. The United States declined from 2006 to 2010 and has remained steady since 2010. The two countries that started with the best quality and remain toward the top of the list for the road quality index are Malaysia and the United States.

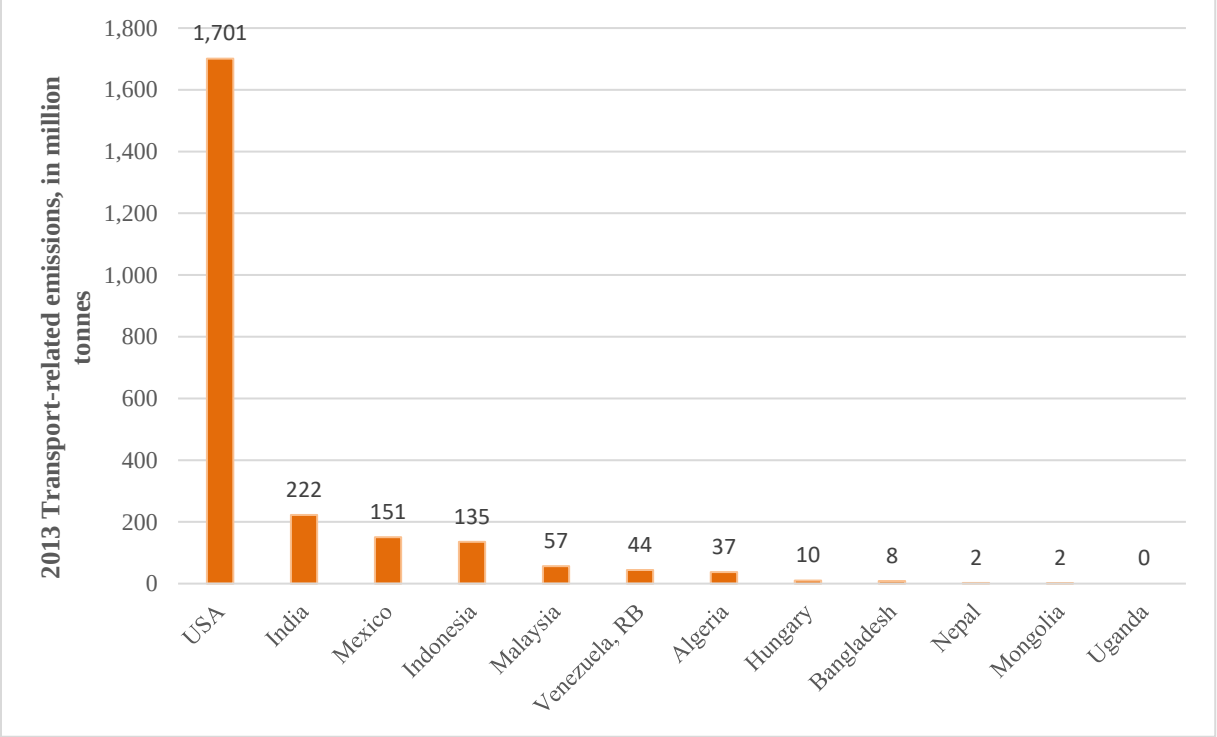

Figure 3: Total world transport-related greenhouse gas emissions, 2013.

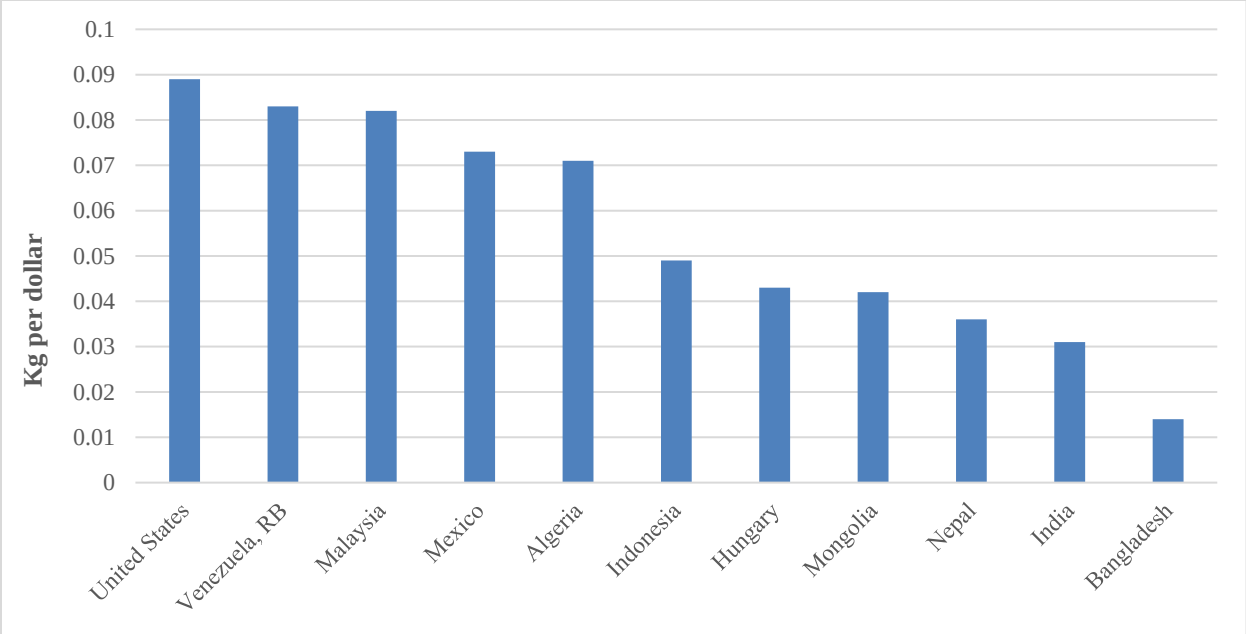

Figure 4: CO_2 emissions from road transport Per Dollar of GDP, 2013.

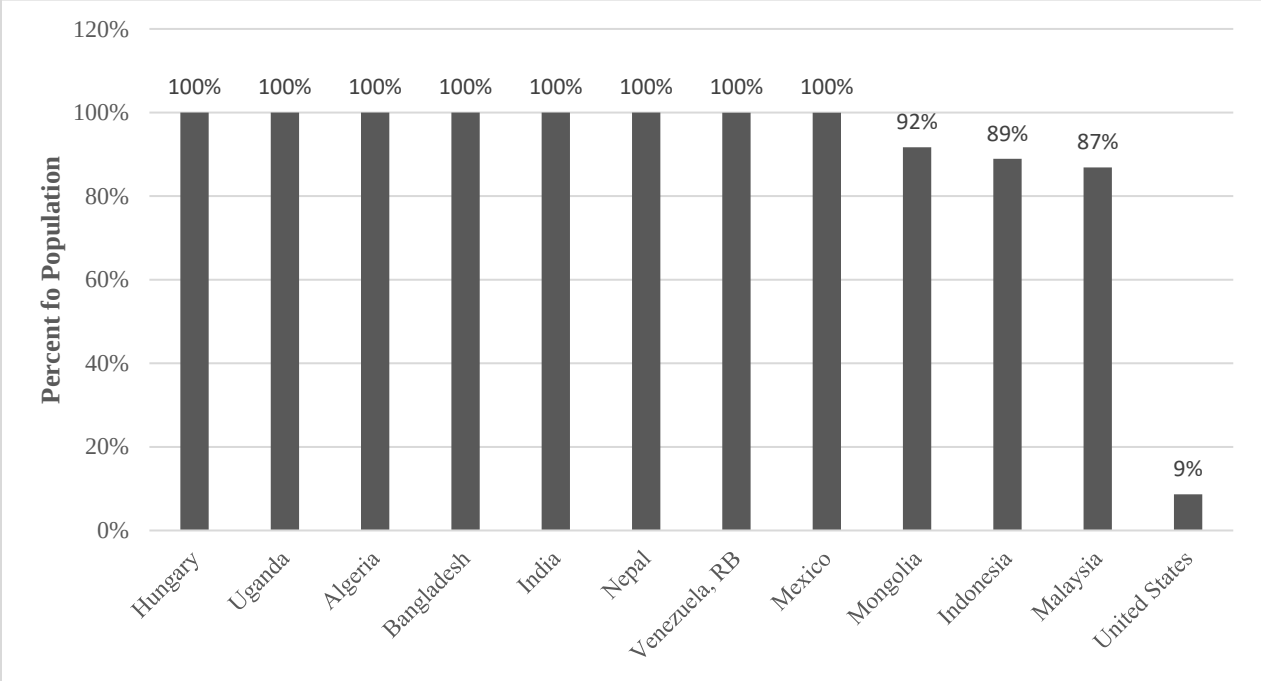

Figure 5: Percent of total national population exposed to levels of $PM_{2.5}$ exceeding World Health Organization Guidelines, 2015.

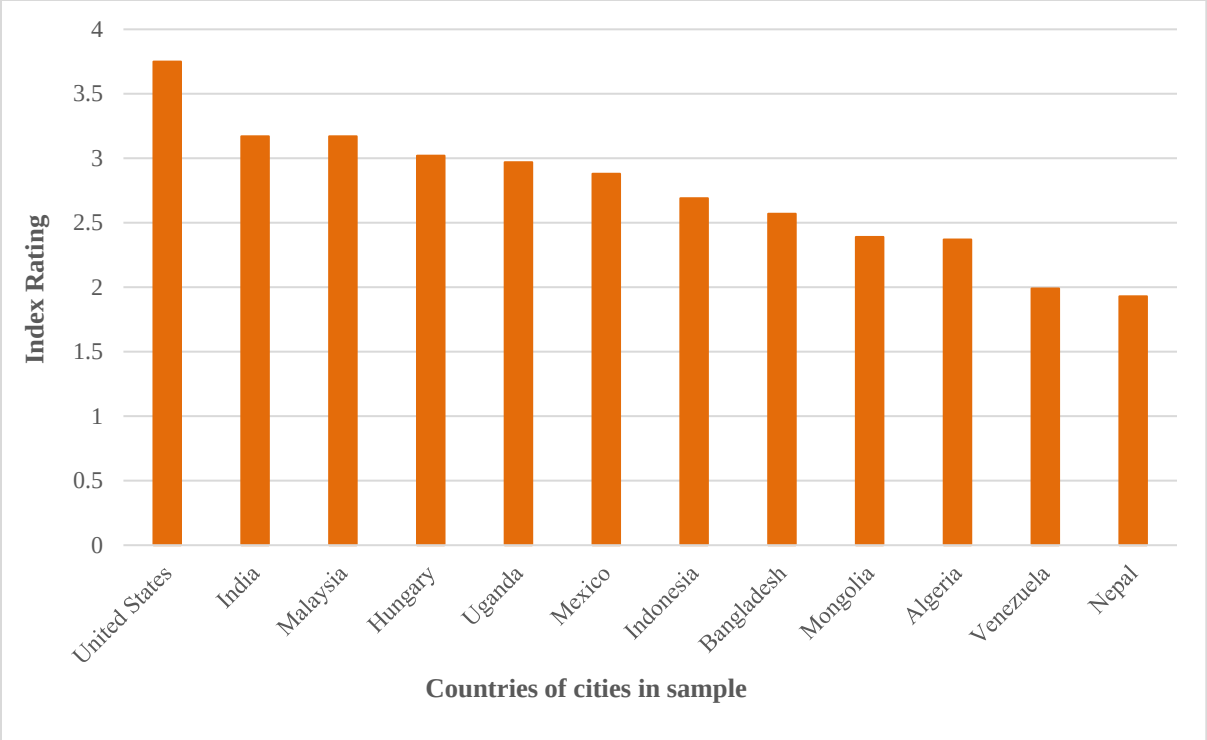

Figure 6: Logistics Performance Index, 2016

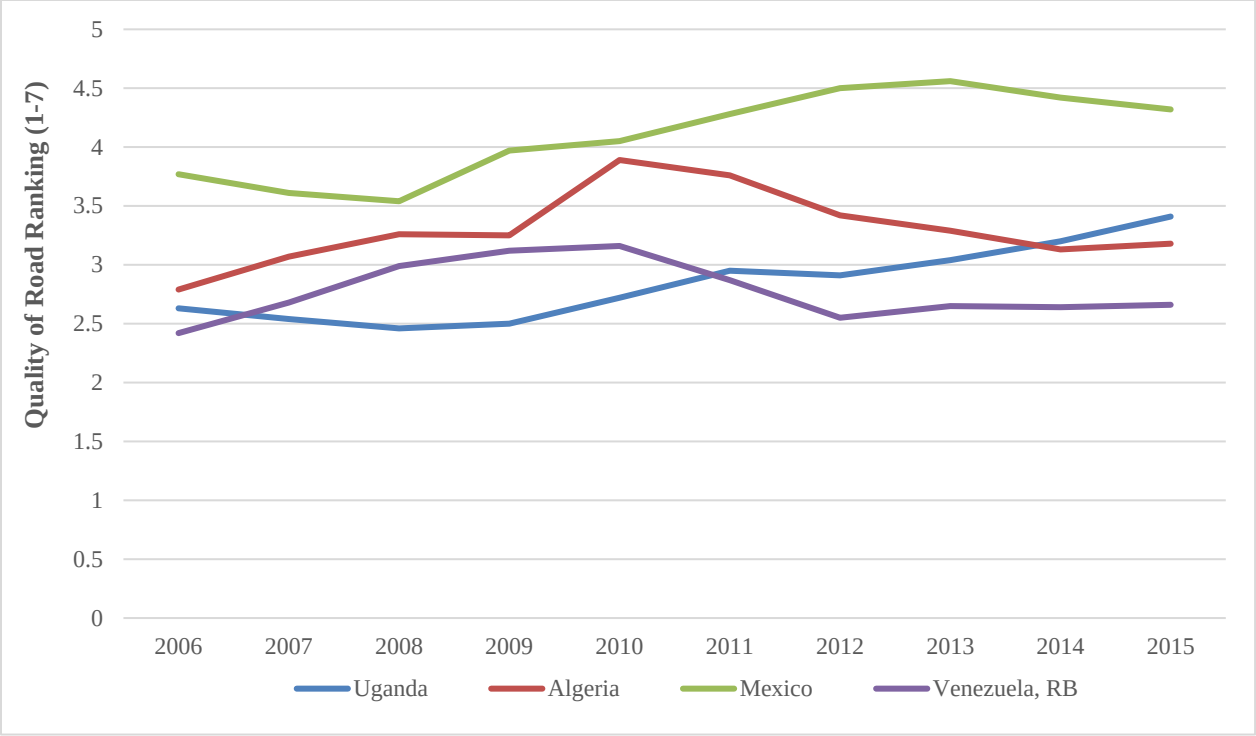

Figure 7: Quality of road data for countries of cities included in sample in the Sub-Saharan Africa, Latin America and the Caribbean, Western Asia and North Africa world regions.

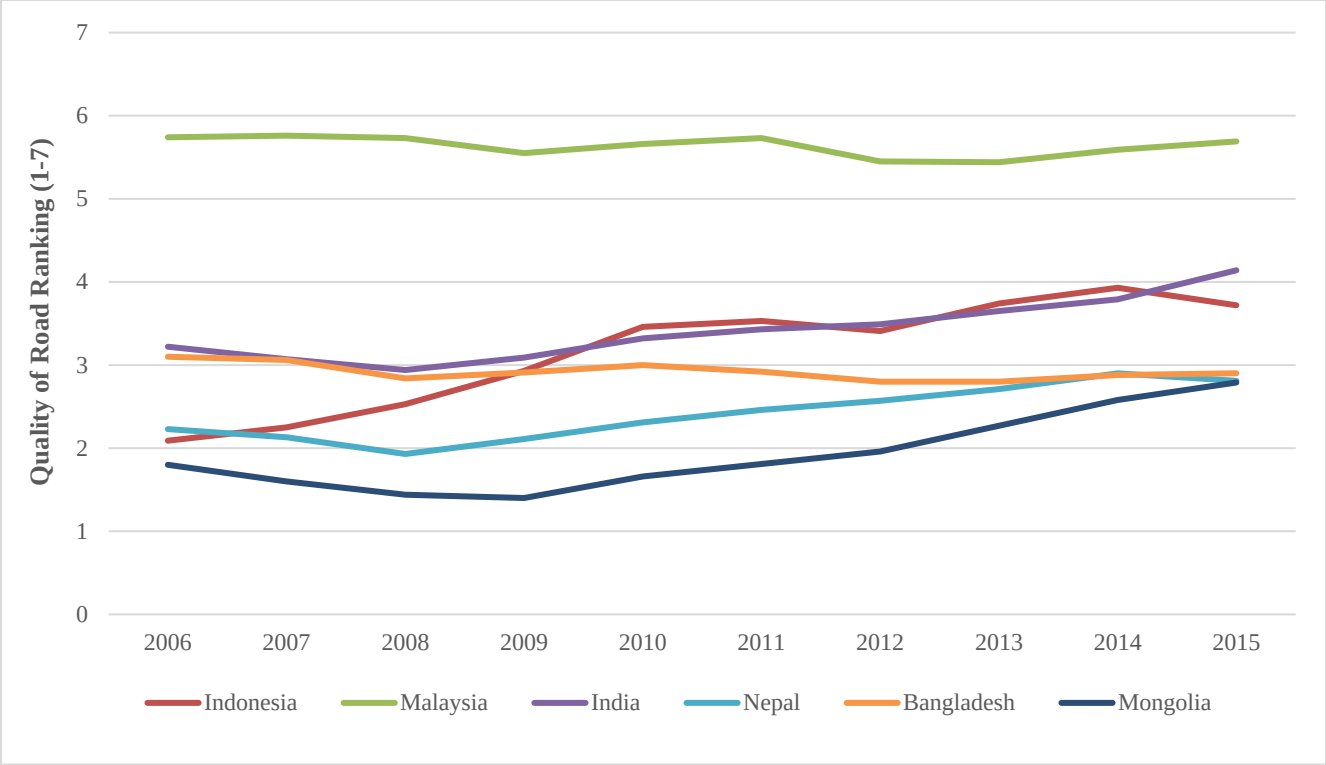

Figure 8: Quality of road data for countries in sample in Southeast Asia, South and Central Asia, and East Asia and The Pacific world regions.

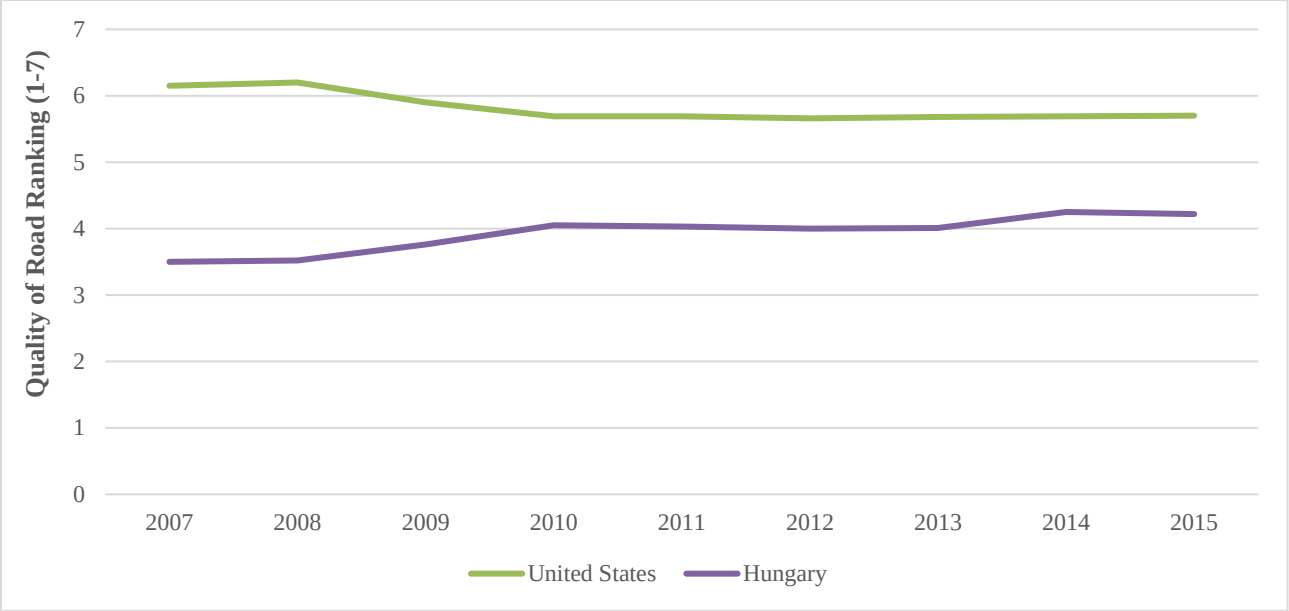

Figure 9: Quality of Road data for Europe and Japan, and Land-Rich Developed Countries world regions.

City-Level Findings

The analysis of city-level urban freight transportation plans is summarized in below. Tables that display how the information was cataloged can be found in the appendix. I investigated questions identified in the methods section to determine if an urban freight transportation plan existed, or if urban freight was addressed in local transportation or mobility plans. Out of 12 samples cities, one city has approved a specific urban freight transportation policy and plan. The only city in the sample that has done this is Budapest, Hungary, who approved an urban freight transportation plan in 2009.

Four cities have an urban transportation plan, and three of those cities have some type of urban freight component in the mobility plan. Eleven of the twelve cities have a

national transport plan, and 6 of those cities have information in the plan or policies that would affect urban freight transport. Most national plans addressed freight in terms of national economic interests and focused more on efficient intermodal freight between metropolitan areas rather than within them. The ones that did address urban freight included policies or regulations that would impact urban freight mobility or provided specific policy direction for urban areas to adhere to. I was unable to read through two plans due to a language barrier. I also recognize that government structures and jurisdictional powers likely vary across different cities and countries, and that I may not know where to seek specific information. Some type of academic research or NGO report has been completed on urban freight, sustainable mobility, or transportation at a national or local level in 10 out of 12 cities. 6 of those cities had a report or piece of research completed specifically to investigate problems and propose mobility solutions for that city.

A sample of 12 cities is not enough to observe broader trends and make decisive claims about the state of urban freight transport around the world; however, that only one of 12 cities have freight policies is indicative of the relative difference in consideration given to urban freight mobility than passenger mobility. The hypothesis that larger cities are more likely to have urban freight plans is not held up in this analysis, as Budapest is the 5th most populous city in this sample (**Figure 10**). Hungary has consistently received scores between 3 and 4.5 for the road quality index and is fourth highest ranking country in this analysis for logistics performance, implying that the country's logistics operations are not overly sophisticated. 100% of the population in Hungary is exposed to levels of particulate matters that exceed WHO guidelines, which could have served as one

motivating factor to develop a plan for sustainable urban freight transport in Hungary's capital city. However, compared to other countries in this analysis, Hungary ranks eighth place in terms of transport-related GHG emissions. It seems that the biggest motivating factor for Budapest to adopt a sustainable urban freight transportation plan because of its location in Europe.

The European Union approval of guidelines for creating a Sustainable Urban Mobility Plan (SUMP) served as a key catalyst for Budapest to pursue an urban freight transportation plan. In 2009, Budapest local government proposed a mobility planning approach. After reform of local transport governance, the municipality revised the transport strategic planning process. A SUMP was decided on based on the EU Commission recommendation.[78] The European Commission supports developments of SUMPs through providing funding for plan development and through Eltis, a platform that provides tools and resources to municipalities.[79] The recommended SUMP framework includes a section for the evaluation of urban freight and logistics, but the framework is not binding in any way. Therefore, while the concept of developing a SUMP is widespread, there is variation between plans regarding the extent to which freight and other aspects of mobility are considered. The influence of European practices like SUMPs was pervasive in literature, reports, and resources that I discovered while conducting this analysis. Summary information of other cities and their level of interaction with sustainable urban freight planning is summarized below.

[78] (Budapesti Kozlekedesi Kozpont, 2009)
[79] ("European Platform | Eltis," n.d.)

Four cities have an urban transportation plan[80]: Budapest, Hungary*; Kampala, Uganda*; Kolkata, India*; Ulaanbaatar, Mongolia.

Cities that have a national transportation plan with a component related to urban freight transport (cities highlighted in orange in **Tables 2 and 3):** Kampala, Uganda; Pokhara, Nepal; Rawang, Malaysia; Rajshahi, Bangladesh; Ulaanbaatar, Mongolia; Modesto, California.

Figure 11 and **Tables 2 and 3** provide information regarding current population, population growth rate and change in built up area from roughly 2000 - 2014.

[80] The * indicates that urban freight was a component of the urban transportation plan. This asterisk is also indicated on Tables 2 and 3.

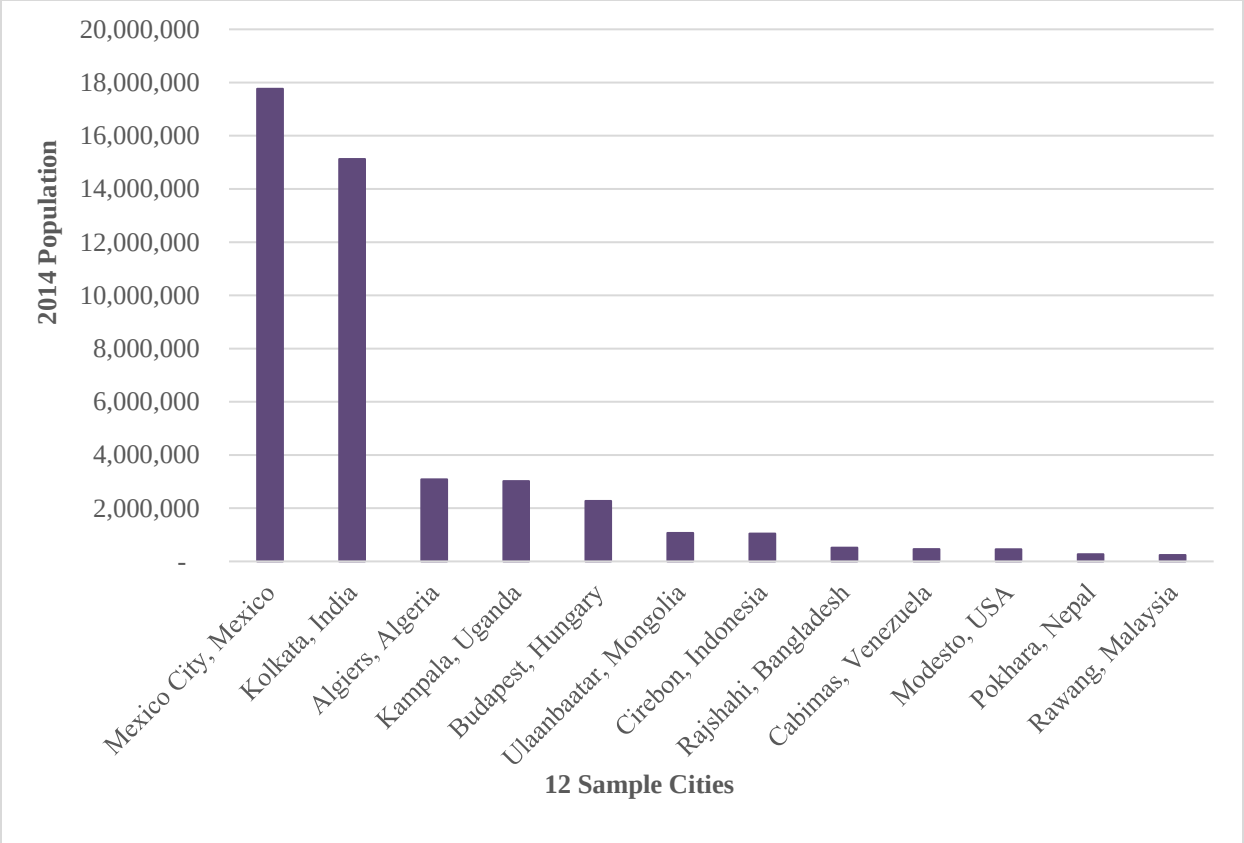

Figure 10: 2014 Population of sampled cities.

Table 2: Population growth rate in sample cities.

City Name	Country	Population Annual Growth Rate from 2000-2014[81]	Population Growth Rate from 2000 - 2014
Rawang	Malaysia	13.6%	444%
Cirebon	Indonesia	8.5%	218%
Rajshahi	Bangladesh	5.2%	62%
Pokhara	Nepal	5.1%	96%
Kampala*	Uganda	5.0%	83%
Ulaanbaatar	Mongolia	4.1%	69%
Mexico City	Mexico	2.5%	42%
Algiers	Algeria	2.5%	41%
Modesto	United States	2.2%	37%
Budapest*	Hungary	1.7%	21%
Cabimas	Venezuela	1.3%	20%
Kolkata*	India	0.9%	10%

Table 3: Built up Area (HA) growth rate in sample cities.

City Name	Country	Built Up Area (ha) Annual Growth Rate from 2000-2014	Built Up Area Growth Rate from 2000 - 2014
Rawang	Malaysia	12.9%	547%
Cirebon	Indonesia	12.5%	1082%
Rajshahi	Bangladesh	9.1%	169%
Kolkata*	India	5.6%	102%
Budapest*	Hungary	5.5%	76%
Kampala*	Uganda	4.3%	69%
Algiers	Algeria	4.1%	80%
Ulaanbaatar	Mongolia	4.0%	61%
Mexico City	Mexico	3.5%	64%
Modesto	United States	3.0%	49%
Pokhara	Nepal	2.6%	54%
Cabimas	Venezuela	1.3%	25%

[81] Not all city observations logged in AUE database were made in the same year. The range of data collection is (2000-2002) and (2013-2015). Rajshashi was the only city evaluated in 2010.

Rawang, Cirebon and Rajshahi rank the highest on annual population growth roughly between 2000-2014, and on annual growth of built up area in that same time-frame. Of the three countries that these cities are located in, Malaysia and Bangladesh have national transportation plans that address urban freight movement in some way. Indonesia is the one only with a steadily improving road quality index ranking between 2006-2015. No trend is detected between population growth rates, built up area growth rate, or country statistics in the previous section among these cities because of the sample size. This and other limitations are explored in the following section.

In terms of sustainable urban mobility, organizations supporting the SDGs such as the UN, the World Bank Group, the OECD, and the German Society for International Cooperation (GIZ) have numerous reports analyzing problems related to sustainable mobility for different cities and countries. Development banks are partnering with governmental institutions to invest in Bus Rapid Transit (BRT) to alleviate congestion and invest in collective mobility. This type of work has permeated the arena of sustainable mobility on a global scale, visible from the number of available resources I discovered during this analysis. I anticipate that reports are created for nations and cities that may not have the internal capacity to conduct the same type of research themselves. The size and geographic scope of NGOs and nonprofits have allowed for pilot efforts in different cities around the world. These initiatives catalyze incremental steps toward progress for sustainable urban mobility. However, urban freight transport is often overlooked in proposed solutions.

Moving forward, NGOs, nonprofits, research institutions, and development banks that provide resources for local governments should place a greater emphasis on the importance of developing capacity of local institutions to address urban freight issues in addition to passenger mobility. While planning for active transportation or increasing BRT will have positive impacts to social inclusion and environmental sustainability, increasing the number of people using a bike lane will have limited benefits in reducing personal exposure to particulate matters if the bike lane is next to a congested street of high polluting heavy-duty vehicles.

Interreg Central Europe is an initiative of the European Union European Regional Development Fund that is working to better understand and analyze urban logistics challenges of central European cities.[82] The initiative, called SULPITER provides resources and capacity building tools to governments in central Europe to develop sustainable urban logistics plans in functional urban areas.[83] This initiative was created following the adoption of a European Commission goal to achieve city logistics free of CO_2 by 2030.[84] This is an important step for the developed world, and is an initiative that should be expanded to other regions of the world. The United Cities and Local Governments organization "represents and defends the interest of local governments on the world stage, regardless of the size of the communities they serve."[85] They work to build capacity and provide resources to local governments of all sizes, and should be considered

[82] ("SULPiTER project," n.d.)
[83] ("SULPiTER project," n.d.)
[84] ("SULPiTER project," n.d.)
[85] ("UCLG," n.d.)

an ally and tool in moving the conversation forward about urban mobility systems inclusive of urban freight.

Through this research, I observed that vast amounts of resources exist for local public officials to tap into for strategies to implement sustainable urban mobility practices. Notably, the time-frame of approval of plans and reports regarding sustainable urban mobility and sustainable urban freight discovered in this analysis were all after 2000. This provides an optimistic perspective of how much work has been accomplished in the past two decades. Moving forward, NGOs conducting urban mobility studies in international cities and developing knowledge sharing platforms for local agencies should ensure that urban freight mobility solutions are integrated into practice and capacity-building tools.

Limitations

Some limitations of this analysis include: the queries identified may not yield the most appropriate resource results, and it is possible that the resources I seek exist in a language other than English, which increases the level of difficulty for me to find the documents and understand the contents of the documents.

One limitation and bias that I bring to this research is valuing the importance of planning processes and documents for funding and building local infrastructure projects. Local planning processes in the United States place great emphasis on planning process in order to collect and analyze data, evaluate relevant research and best practices, and provide alternatives for community members and policy makers to contemplate for decision-making. Long-range infrastructure planning practices document different infrastructure

needs prior to the availability of funding sources for the project. Once a project is imminent or a funding source is identified, the typical next step of a capital project includes a phase for preliminary engineering and design. A plan that includes needs for specific infrastructure projects can provide support for a project and indicate its alignment with broader city goals. I acknowledge that because my experience in local government infrastructure planning has been based in the United States, I am unsure if other countries or cities have the same level of requirements for approved planning documents prior to approving projects or integrating policy strategies into public sector projects. However, a progress report on the SDGs suggest that planning is valued: "The quest for sustainable and coordinated urban development starts with national policies and regional development plans. As of 2015, 142 countries had a national urban policy in place or under development. Those countries are home to 75 per cent of the world's urban population."[86] My understanding of the American government system and the role of local planning within it could lead me to be looking for freight plans and policies in inappropriate departments in other countries.

Lastly, sample size and the variation in the sample may be a limitation. While 12 cities provided enough variation to begin developing a database to gauge prevalence of sustainable urban freight planning, the sample size is too small to observe broader trends about sustainable urban freight planning. Additionally, some cities such as Budapest are capital cities. Cities of different sizes and importance within their national context will no

[86] ("Goal 11 .:. Sustainable Development Knowledge Platform," n.d., p. 11)

doubt be influenced differently than smaller cities where few governmental officials live. Alternatively, some countries are small, and are made up of nodes of urban centers where much of their population is located. Some nuance is likely lost in the attempt to conduct a global analysis on this random sample of cities.

CONCLUSIONS

This section discusses the answer to the over-arching motivating question of this research: to what extent has sustainable urban freight transportation planning permeated the global conversation of sustainable urban mobility? My thoughts on this question based on the analysis are discussed below.

It seems that the need for sustainable urban freight transportation planning has been recognized by the European Commission and in some major US cities. The European Union has provided specific guidelines and goals to achieve sustainable urban freight goals and has advocated for sustainable urban mobility planning initiatives to achieve those goals. Overall, the state of sustainable urban freight transport planning seems to be in its beginning stages and has permeated the global conversation of sustainable mobility in a limited way. Many applied research reports created by NGOs or academic institutions to analyze urban mobility needs in specific cities overlooked urban freight transport needs. As capacity building for SDG implementation continues, I anticipate that relationships between local agencies and NGOs, nonprofit and research agencies will become stronger. NGOs, nonprofit organizations, and research institutions play a vital role in moving the conversation forward for sustainable urban freight. They also work to build capacity and share information from local governments regarding best practices for sustainable urban freight planning. All of these organizations and agencies play an important in ensuring that sustainable urban freight practices are integrated into local planning efforts.

The United Cities and Local Governments started prior to the Habitat III. UCLG was an active member in the development of the SDGs and has a formal program to help

cities realize and "localize" the objectives of the SDGs. Their work manifests in advocacy and partnerships with localities for capacity building, and a resource toolkit for "action learning" of local decision-makers and planners. It addresses every aspect needed to integrate SDGs into local processes, including insights and guides on how to create strategies and plans. Core partners of this initiative include the UN Human Settlements Programme (UN-HABITAT), and the UN Development Programme (UNDP). The work of the group includes providing a toolkit for localities to understand how to create context-sensitive adaptations of SDGs in their own communities. It also is designed to help agencies determine indicators and targets for data collection and monitoring. The program includes an Urban SDG Knowledge Platform, which is a platform to share policy and planning practices between member cities. The UNSCAP is one of two facilitators of this platform. The Urban Sustainability Exchange is a similar platform of collected case studies and best practices for sustainable urban developed cities and was created by the City of Berlin. Industry stakeholders need to intentionally broaden the scope of urban mobility to include urban freight. Local governments should work to include urban freight mobility into sustainable urban mobility initiatives and conduct pilot efforts or urban freight plans to encourage this change. One way to do this could be for local agencies to designate a staff member working on urban mobility issues to develop internal resources for evaluating existing urban freight needs. NGOs, nonprofit organizations and research institutions should also place a greater emphasis on freight mobility in work related to urban mobility. Identifying the differences between personal, collective and freight urban mobility must be

further developed in local agencies so that policies can reflect all needs of the transportation system.

This report finds that the topic of sustainable urban mobility has intensified within the broader conversation of sustainable development over the past two decades; evidenced by the amount of research and reports conducted on sustainable transport for cities around the world. The degree of prominence of sustainable urban freight transportation planning within the context of urban mobility, however, is less developed. Of 12 sample cities in this study, one city has an approved sustainable urban freight plan. The SDGs highlight the need for planning of urban transport systems, and the important role that public agencies play in determining the future built environments of municipalities. I believe that NGOs that work on capacity building and disseminating information to local governments should emphasize the role that public agencies can take in planning for sustainable urban freight transportation. I hope that as progress reports of SDGs continue annually, urban freight will take a more prominent position in the conversation of urban mobility.

APPENDICES

Table 4: Database outcomes regarding sustainable urban freight transportation planning

Table 5: Supplemental mobility policy and planning information*

*“LB”: language barrier: I was not able to read the plan.

Table 4: Data outcomes regarding sustainable urban freight transportation planning.

INFORMATION PROVIDED IN ATLAS OF URBAN EXPANSION						URBAN FREIGHT TRANSPORTATION PLAN	
City	**Country**	**Region**	**Population (T3)**	**Built Up Area Density (Persons/ha)**	**Urban Extent Density (persons / ha)**	**Urban Freight Transportation Plan? (Y/N)**	**IF yes, date of approval**
Budapest	Hungary	Europe and Japan	2,272,785	44	30	Y	2009
Kampala	Uganda	Sub-Saharan Africa	3,017,000	100	59	N	NA
Cirebon	Indonesia	Southeast Asia	1,044,889	163	96	N	NA
Pokhara	Nepal	South and Central Asia	272,830	167	102	N	NA
Kolkata	India	South and Central Asia	15,123,555	251	156	N	NA
Mexico City	Mexico	Latin America and the Caribbean	17,765,121	110	85	N	NA
Rawang	Malaysia	Southeast Asia	236,967	49	26	N	NA
Cabimas	Venezuela	Latin America and the Caribbean	460,894	49	36	N	NA
Algiers	Algeria	Western Asia and North Africa	3,085,561	111	69	N	NA
Rajshahi	Banglades	South and Central Asia	517,053	160	86	N	NA
Ulaanbaatar	Mongolia	East Asia and the Pacific	1,070,573	69	53	N	NA
Modesto	United Sta	Land-Rich Developed Countries	458,146	20	14	N	NA

Table 5: supplemental mobility policy and planning information.

PROVIDED	SUPPLEMENTAL IFNORMATION											
City	Port City? (Y/N)	Approved Local Transportation Plan (Y/N)	Is Freight Addressed in Plan?	National Transport Plan (Y/N)	Policies related to Urban freight?	Date Approved	Outisde Research? (Y/N)	Type of insitution	Name of institution	Problem identification or solution creation, or both?	Scale	Date
Budapest	N	Y	Y	Y	LB	2014	Y	Academic and NGO	European Union, European	Best Practices	Local	2017
Kampala	Y	Y	Y	Y	Y	Jul-05	Y	NGO	WRI and WBG	Both	National	2/1/2018 and in 2017
Cirebon	Y	N	NA	Y	LB	NA	Y	NGO	World Bank, UN Environment, and other -	Both	National and local	7/4/2005, also varying in 2000s
Pokhara	N	N	N	Y	Y	2001/2002	Y	Academic	Tribhuvan University	Both	National	2015
Kolkata	N	Y	Y	Y	N	2006	Y	NGO	GIZ, WBG, UN	Both	National and local	2013, 2016, 2018
Mexico City	N	N	NA	N	NA	NA	Y	NGO	UN	Both	National	2013
Rawang	N	N	NA	Y	Y	2015	Y	NGO	WBG, GIZ,	Both	National	2016
Cabimas	N	N	NA	N	NA	NA	N	N/A	NA	NA	NA	NA
Algiers	Y	N	NA	Y	N	Early/Mid 2000s	Y	Academic	individual researchers and university institutions	Problem Identification	National and local	2018
Rajshahi	N	N	NA	Y	Y	2004	Y	NGO	UNESCAP, Clean Air Asia	Both	National and Local	2012 and 2015
Ulaanbaatar	N	Y	N	Y	Y	2016	Y	NGO	UNESCAP	Both	National and some local	2018 for both reports.
Modesto	N	N	NA	Y	Y	Out for public comment in 2019	N	N/A	NA	NA	NA	NA

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