CHAPTER 5: Public Transport Systems and City Logistics

Abstract

With half of the world's population living in urban areas and the developed countries rapidly urbanising, patterns of movement and consumption in cities are changing. The movement of people and goods within cities becomes a critical urban and transport planning concern to build sustainable urban economies and reduce the externalities such as congestion and pollution. City logistics ensure that freight distribution within urban areas is done efficiently and sustainably. It provides innovative responses to customer demands at a local, regional and international level. This chapter recommends widespread implementation of the green agenda in the transport and logistics sector to bring positive environmental benefits to the sector, while at the same time promoting other pillars of sustainable development in transport and logistics such as economic sustainability.

INTRODUCTION

This chapter maintains that the smooth functioning of cities without efficient transport and efficient logistics is currently impossible. It realises that transport and city logistics are key to the achievement of sustainable urban economies. The key elements of transport and city logistics as to be discussed in this chapter include the movement of people and goods within cities and the reduction of externalities such as congestion and pollution. Cities in the modern era are more crowded and, as a result, logistics activities must be adapted to the requirements of sustainable development and allow for an increase in the efficiency of the flow. Another takeaway of the subject area is that city logistics ensure that freight distribution within urban areas should be done efficiently and sustainably. This manner should also be innovative enough to cater for local, regional and international customer demands so that sustainable development can be realised.

BACKGROUND AND CONTEXT

Transport and city logistics are critical aspects of the sustainable development of cities across the world. This chapter is based on the theoretical underpinnings of sustainable development, hence it is

important to highlight that sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). The three main components of sustainable development are economic growth, social equity for meeting the needs of today's generation and environmental protection for the ability to meet today's and future generations' needs. Thus, a transport system in a sustainable society is very important and this transport system has a direct impact on human health and safety. Including issues of safety in the transport discourse, it is important to highlight that half a million people in developing countries die each year from transport-related air emissions and a similar death toll results from traffic accidents. In the developed world, there is a 75% urban population such that designing sustainable transportation systems is considered one of the most pressing issues faced by modern cities (Kennedya *et al.*, 2005). This supports the focus of this chapter and its focus on the innovative aspects of transport and city logistics.

Urban transport and logistics are complex systems in which freight is moved in the same transport system as that in which passengers travel (Russo and Comi, 2010). Thus, a sustainable transport system contributes to economic growth and social equity without systematically increasing concentrations of substances in the atmosphere and degrading the natural environment. Sustainable urban logistics and sustainable transport are important subjects of interest in the built environment. Some of the vast challenges facing city logistics are connected with the rapid growth of the urban population and its ageing. Changes in the spatial structures of trade affect the amount and type of the flow of goods in urban areas, Supplies are becoming more frequent and include small parts of goods. This, in turn, determines the effectiveness of the means of transport use and it appears likely that shortly demands on the flexibility of the supply is even greater. These urban dynamics present new challenges for transport and logistics that aim at the uninterrupted supply of cities while caring about the quality of life and striving to reduce the negative impact of transport on the environment. In light of the above, cities should try to improve or maintain the quality of life for their residents.

CONCEPTUAL FRAMEWORK

The subject of public transport systems and city logistics is important in the realisation of contemporary urban planning agendas. The main

agenda being the new urbanism or, rather the concept of smart growth that is supported by the sustainable development theory. This section finds a clear and strong relationship between transport, circulation, public transport, public transportation system and city logistics. The following are the explanations and descriptions of the components of this chapter's conceptual framework.

- *Transport:* Transport refers to the activity that facilitates the physical movement of goods and individuals from one place to another. In business, it is considered as an auxiliary to trade, supporting trade and industry in carrying raw materials to the place of production and distributing finished products for consumption.
- *Circulation:* This is how people and vehicles flow through a given area or in the transportation system. As observed by Wan *et al*. (2012), traffic circulation is defined as ways of controlling and managing accesses to proposed development and connections to the adjacent roadways. Three types of traffic conflicts and developments include the conflict between a motor vehicle and non-motorised vehicles, the conflict between motor vehicle and pedestrians and conflicts among motor vehicles.
- *Public Transport:* may be defined as any form of passenger or freight transport that is available for hire and reward. As observed by Preston (2009), in practice, it usually refers to land-based passenger transport and in particular bus and train services and variants thereof.
- *Public Transport System:* includes a variety of transit options such as buses, light rail and subways. These systems are available to the general public and may require a fare and run at scheduled times.
- *City Logistics:* The process for totally optimising the logistics and transport activities by private companies with the support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy (Taniguchi *et al.*, 2001). This definition highlights the total optimisation of logistics activities of private companies, rather than local optimisation. It also incorporates the social issues of the environment, congestion and energy savings and economic issues relating to urban freight transport within the framework of a market economy.

THEORIES UNDERPINNING THE STUDY

SUSTAINABLE DEVELOPMENT THEORY

Sustainable development has become a fundamental strategy to guide the world's social and economic transformation. As observed by the Brundtland Report, sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Goniadis (2015) argues that to fulfil human needs and to ameliorate the quality of human life, development is of vital importance. To perceive sustainability, one must take into account three main areas of influence. These are called the pillars of sustainability in the aspects of social, economic and environmental. The achievement of sustainability means that the natural resources are preserved, the environment is protected, the economy is not harmed and the quality of life of people is improved or maintained. Environmental sustainability entails that the natural environment retains its total functionality and utility for a long period. Goniadis (*bid.*) observes that actions taken should encourage a balance in our natural environment while simultaneously promoting positive growth rates. Actions that disrupt the balance of the environment should be avoided and if they occur, they should be limited. Any development envisaged in the built environment should be thought of in terms of its environmental impacts. In the context of transport and logistics, there are varieties of issues within environmental sustainability such as pollution and environmental sustainability aims to minimise such impacts to the environment.

Another dimension of a component of sustainable development is economic sustainability. This is the ability of an economy to support a defined level of economic production indefinitely. As observed by Goniadis (*ibid.*), economic sustainability refers to decisions that are made in the most prudent way possible concerning other aspects of sustainability. The last of the pillars of sustainable development is social sustainability. This relies on the decisions and projects that promote the general improvement of society. The social aspect of sustainability supports the concept of intergenerational justice, which means that future generations are entitled to the same or greater quality of life as current generations. This pillar also speaks to other socially related issues such as community development, resilience and human adaptation. This dimension is equally important to other

dimensions of sustainability and if not taken seriously, can lead to the collapse of the whole process of sustainability and the society itself.

In light of the above, sustainable transportation is the capacity to support the mobility needs of a society in a manner that least harms the environment and does not impair the mobility needs of future generations. In this chapter, it is believed that transportation is a core component supporting the interactions and the development of socio-economic systems. Rodrigue (2021) indicates that sustainable development applied to transport systems requires the promotion of linkages between environmental protection, economic efficiency and social progress. Under the environmental dimension, the objective consists of understanding the reciprocal influences of the physical environment and the practices of the industry and that environmental issues are addressed by all aspects of the transport industry. Under the economic dimension, the objective consists of orienting progress of economic efficiency. Transport must be cost-effective and capable of adapting to changing demands. Under the social dimension, the objective consists of upgrading standards of living and quality of life.

THE RATIONALE FOR STUDYING PUBLIC TRANSPORT SYSTEMS AND CITY LOGISTICS

This subject of study is critical in the built environment as indicated by a widespread freight transport contribution to deteriorating the urban environment that has been duly noted across the world. The growth of trucks in urban areas not only worsened the roads and highways and created traffic congestion, but also contributed to an overall deterioration of the urban environment. Traffic management schemes and measures restricting truck movements in urban areas such as truck ban and similar vehicular volume reduction schemes, have been implemented. Though such schemes seem to curtail truck movements, they have negative economic consequences and can become a regulatory impediment for the development of an intermodal logistics network system in urban areas. It is, therefore, imperative to formulate a holistic framework, addressing the environmental issues related to the intermodal logistics system in urban areas.

EVOLUTION OF PUBLIC TRANSPORT SYSTEMS AND CITY LOGISTICS

Since the 1820s various forms of public transportation have come and gone throughout the world, impacting general structuring of cities. Wallace (2017) provides that technological advances gave way to an

evolution of public transit systems that started with horse-drawn cars and developed into cable cars, heavy and light rail systems and eventually electric and self-driven cars. Since the 18th century, mechanisation allowed each transportation mode to experience an evolution in motive methods and vehicles. As observed by Rodrigue (2020), new engine technologies offer the ability to be used across several modes with specific adaptations. The first most meaningful innovation was the steam engine that improved the performance of the maritime and railway modes at the end of the 18th century. The bulk of a steam engine made it impractical to be applied to road transportation.

The internal combustion engine (ICE) in the late 19th century brought about the large-scale mechanisation of transportation modes, especially road transport (Rodrigue, *bid.*). It was followed by the diffusion of cars, buses and trucks supported by the construction of vast highway networks. For rail, diesel locomotives replaced steam engines, improving power and range. However, the development of high-speed rail (HSR) relied on the electric motor due to its capacity to generate a velocity that an ICE would be unable to.

For air transport, the ICE (piston engine) allowed heavier planes and the emergence of the first commercial services in the 1920s (Rodrigue, *ibid.*). Innovations in air propulsion led to jet planes that could quickly transport a large number of passengers over long distances. Then, wide-body jets (such as the B747) enabled to improve further the scale at which air transportation could carry passengers and freight. The technological evolution of maritime transportation impacted more substantially vehicles than their speed, particularly their economies of scale. Metallic hulls and fuel propulsion enabled the growth of ship size and their specialisation (oil, freight, containers). The introduction of the containership in the 1970s allowed a versatile cargo carrier that continuously benefited from economies of scale and supported the rapid development of the global economy.

In the 21st century, the automation of transport systems is unfolding, including its terminals. This improves their reliability and performance while reducing their operating costs. Self-driving vehicles and drones are starting to be introduced. Figure 1 is a diagrammatical illustration by Rodrigue (*ibid.*) outlining the evolution of the public transportation system since the 18th century.

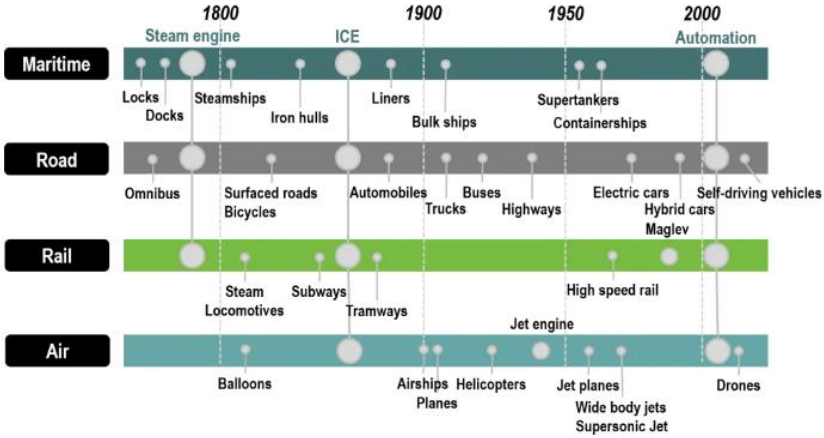

Figure 1: Evolution of Transport Technology since the 18th century.

TECHNIQUES AND APPLICATIONS IN PUBLIC TRANSPORT SYSTEMS AND CITY LOGISTICS

The understanding, analysis and implementation of transportation and city logistics are done through several techniques and processes. Some of the fundamental techniques and processes in transport systems and city logistics include scheduling, timetabling, traffic assignment, trip generation and cordoning. These techniques and processes are defined and described below.

Scheduling: refers to determining the optimal allocation of vehicles in a given transportation schedule based on the execution of all trips (Shang, 2019).

Timetabling: is the creation of a schedule for vehicles to operate the transportation service. The inputs of timetabling include the frequency of service for the given route and the expected travel times between stops on the route. The travel times can be determined either by historical experience or through estimates based on traffic conditions, vehicle acceleration and deceleration characteristics and expected dwell times.

Traffic assignment: the process of allocating a given set of trip interchanges to the specified transportation system (Tom and Rao, 2007). The fundamental aim of the traffic assignment process is to

reproduce on the transportation system, the pattern of vehicular movements which would be observed when the travel demand represented by the trip matrix, or matrices, to be assigned is satisfied.

Trip generation: a trip is usually defined in transport modelling as a single journey made by an individual between two points by a specified mode of travel and for a defined purpose. Trips are often considered as productions of a particular land-use and attracted to other specified land-uses. The number of trips that arises in unit time, usually for specified zonal land use, is called the trip generation rate. Trip generation is estimated in three ways which are by linear and multiple regression, by aggregating the trip generating capability of a household or car and aggregating the total as observed by the distribution of each selected category in the zones and by household classification method through a catalogue of the characteristic mean trip rates for specific types of households.

Cordoning: Vehicle and person surveys that provide time-series data of traffic flow across a given set of screen-lines.

SMART URBAN TRANSPORT SYSTEM

Public transportation systems include a variety of transit options such as buses, light rail and subways. These systems are available to the general public and may require a fare and run at scheduled times. Bandauko *et al*. (2016) provide that a smart urban transportation system is a transportation system that creates walkable communities, provides a range of transport choices and access to a wide range of origins and destinations. They further indicate elements of a smart urban transportation system that includes a dense, frequent public transit service; a variety of street types that provides both access and mobility and sidewalks and bicycle facilities that provide direct, safe travel routes. A smart urban transportation system should be closely related to land-uses such as residential and commercial, in a specific environment to support quality transit services and to reduce trip distances. Some of the principles of the smart urban transport system are the design of roadways which should respect the character of communities and the currently planned land-uses by transitions from one area to another, transportation projects should be planned through ongoing partnerships with local communities, considerations of the needs of pedestrians, bicyclists and transit users in designing all roadway projects and sidewalk networks that should be well connected

with opportunities for regular, safe street crossings and finding transportation solutions that can be executed in a sensible phase (New Jersey and Pennsylvania Departments of Transport, 2008).

TRANSPORTATION, GREENISM AND NEW URBANISM

Transportation is a process of moving whatever comes out of one location to the next location. As highlighted above, transportation systems evolved and have been influenced by different planning approaches or concepts coined by scholars over the last two centuries. This section of the chapter will dwell on greenism and urbanism in the context of transportation. New urbanism aims at reforming the constructed cities as it seeks to create new and complete cities (Kakhki and Shokouhi, 2017). As observed by the Victoria Transport Institute (2015), new urbanism is also called smart growth, new community design, neo-traditional design, traditional neighbourhood development, location efficient development and transit-oriented development. New urbanism is thus a set of development practices to create more attractive, efficient and liveable communities. These can significantly improve accessibility and reduce per-capita automobile travel. In terms of transportation, the design features of new urbanism include the following:

- Most dwellings are within a five-minute walk (a quarter-mile) from the centre. Streets are designed for walking and cycling, with sidewalks on both sides, bike lanes where needed, good crossings, traffic calming features used to control motor vehicle traffic speeds and other features to encourage non-motorised travel.
- Networks of highly connected roads and paths provide multiple routes between destinations, increasing accessibility and reducing problems if one route is closed. Access points into neighbourhoods may be highlighted with a gateway or signs.
- Thoroughfares are relatively narrow and shaded by rows of trees that slow traffic and create an appropriate environment for pedestrian and bicyclist.

New urbanism and transit-oriented development reflect neighbourhood and local level planning, while complete streets, streetscaping and access management apply these concepts for specific roadways, location-efficient development reflects these principles at a regional level. New urbanism increases transportation options, emphasises high-quality transit services and stations and sometimes provides

priority to walking, cycling and transit. As observed by the Victoria Transport Institute (*ibid.*), new urbanism supports the development of a more connected street network, often using a modified grid pattern. This provides multiple routes and more direct travel between destinations compared with a disconnected street network with many dead-end roads that result in more circulation routes and funnel traffic onto a few roadways. Increased street connectivity has been shown to reduce per capita vehicle travel and reduce traffic volumes on major roads.

The Victoria Transport Institute (*ibid.*) also outlines the travel impacts of the application of the new urbanism principles on transport in the design and planning of cities. They argue that new urbanism improves accessibility, improves transport choice and reduces traffic speeds which reduce per capita automobile ownership and use. NEW (2001), however, postulates that although most individual design features have modest impacts on total travel, their effects are cumulative and synergistic, resulting in significant total reductions in vehicle use. Residents in well-designed New Urbanist neighbourhoods with good walkability, mixed land-use, connected streets and local services, drive 20-35% less than residents in automobile-dependent areas. Vehicle travel reductions may be possible if New Urbanism is coordinated with other travel demand management (TDM) strategies such as Transit Improvements, Car sharing, Road Pricing, Parking Management and Commute Trip Reduction programs (CMHC, 2010).

Greenism can also be regarded as green urbanism. It is regarded as the implementation of green infrastructure attempting to ensure the incorporation of environment and urban planning. Viviers *et al*. (2017) provide that green urbanism emerged internationally as a way of understanding, how green assets and ecological systems function, as part of the infrastructural fabric that supports and sustains society and builds resilience. Viviers *et al*. (*bid*.) further argue that green urbanism theory focuses on adjusting the relationship between urban and nature and has emerged as a conceptual and theoretical basis for a new planning paradigm. This brings into context the multi-disciplinary approaches to urban planning such as sustainability plans, environments that are quiet, clean and effective, compact communities and green transport, ecosystem services, urban greening, gardens and green roofs, city farms and urban agriculture, renewable energy projects, sense of place and lifestyle. In this respect, Nilsson *et al*.

(2007) explain that urban greening embraces the planning and management of urban vegetation on streets, parks, playgrounds, local gardens and the urban periphery, also aiming to add value to the local community. In terms of transportation, green transportation or sustainable transportation, comprises those modes of transportation that do not depend on diminishing natural resources, like fossil fuels. These transportation modes rely on renewable energy sources. They also have a very low impact on the environment as these modes produce minimal or no greenhouse gas emission.

APPROACHES TO UNDERSTANDING PUBLIC TRANSPORT SYSTEMS AND CITY LOGISTICS: GLOBAL CASES IN THE STUDY

Transport and logistics are the lifeblood of societies and a strong association exists between growth in overall economic activity and growth of transport. All over the globe, the movement of people and goods creates wealth and prosperity. A look into the European transport and city logistics highlights a system of open borders and affordable transport that has given the European continent unprecedented levels of personal mobility. Goods are shipped rapidly and efficiently from factory to customer often with localisation in different countries. All these transport and logistics processes happen between a wider human settlement sphere, with cities as the most important players. As observed by the European Foundation for the Improvement of Living and Working Conditions (2008), the European Union (EU) has contributed to this dynamic by opening national markets to competition and by removing physical and technical barriers to the movement of people and goods. Transport is essential for the competitiveness of European industries and in the words of the European Commission, mobility is also an essential citizen right.

Since time immemorial, mobility has greatly improved in the world, from an African village to the megacities of the developed world. This steady increase in mobility also comes with social costs such as air pollution, noise, congestion, safety difficulties and health problems and even premature deaths as prescribed by Krzyzanowski, Kuna-Dibbert and Schneider (2005). In other dimensions, climate change poses challenges of a new dimension to modern society and the transport sector contributes substantially to the continuing growth in carbon dioxide (CO_2) emissions in the European Union. It is on this background note that the European Foundation for the Improvement of

Living and Working Conditions (2008) argues that today's transport patterns and growth rates are unsustainable.

In Europe, the transport and logistics sector encompass the transport of people and goods by rail, road, water and air, including support activities such as warehousing. Access to transport by road, railway, sea and air is crucial to the mobility of passengers and hence crucial to economic development. As observed by the European Foundation for the Improvement of Living and Working Conditions (*ibid.*), in 2003, the average EU citizen travelled 12 092 km on land, 81% of this by car. Some 44% of all goods measured in tonnes travel on road, while 90% of international freight transport is done by ship. In 2006, 13.3% of consumer expenditure went to transport. Most transport consists of road transport.

URBAN LOGISTICS SYSTEMS IN ASIA

Studies across the globe have shown the impacts of the transport system on the environment, especially in urban areas. Urban logistics or, rather, city logistics, including physical distribution and supply chains in urban areas, is a promising subject that can be looked at. Lidasan (2011) argues that measures involving transport planning and logistics in urban areas called city logistics have promised to solve many traffic and transport problems. The concept of city logistics is thus not a new one but only recently has the concept caught the attention of transport planners and experts for its potential contribution to meeting the objectives of logistics from the efficiency, economic and environmental standpoints. This section of the chapter shows how logistics initiatives in cities of the Asian communities have helped in developing a framework that contributes to alleviating the negative impacts of freight transport on the urban environment and promoting good passenger movement in their urban areas.

A study of city logistics in the Asian context done by the Japan Institute of Highway Economics for Organisation for Economic Co-operation and Development (OECD) highlights how several Asian cities considered city logistics policy objectives and initiatives. The study was done in 2003 and it remains useful in the subject of study today as it highlighted some important aspects of city logistics, like efficiency and economy, safety and environment and infrastructure and urban structure objectives. The study highlighted that there are differences in the priorities of cities concerning city logistics policy objectives. The

cities that set higher regard to safety and environmental objectives were Seoul, Tokyo and Osaka. Manila and Jakarta placed more emphasis on economic and efficiency objectives. This was favourable mainly because these cities were still in the developing stages such that their aim was at improving their economic support infrastructure and services. Bangkok and Kuala Lumpur, were considered on the verge of joining developed cities of Asia, regarded safety and environmental objectives as more important due to the gravity of air pollution problems and high accident rates.

METRO MANILA: CASE STUDY

Like any other metropolitan area in Asia, Metro Manila faces several challenges. Its logistics policies are consistent with that of the country. At the local level, Metro Manila is focused on reducing traffic congestion, alleviating environmental and social impacts and improving the economic and technical efficiency of the transport system. At the national level, the policy objectives aimed at improving an efficient intermodal transport system that serves as the backbone of the country's intermodal logistics network system, supporting economic development and regional economic cooperation in South East Asia. A closer look into these strategies in the transport and city logistics sector highlight that the policy objectives are consistent with city logistics and following this premise, Metro manila prioritised city logistics policy objectives are as follows:

- Efficiency and economy;
- Safety and environment; and
- Infrastructure and urban structure.

In light of the above Metro Manila policy objectives, the following city logistics initiatives were introduced.

a. Travel Demand Management Schemes (TDM) that consisted of a Unified Vehicular Volume Reduction Programme and Truck ban at major thoroughfares;
b. Application of Information and Communications Technology, such as Electronic Toll Collection and Customs facilitation at major ports;
c. Land-use controls;
d. Development of terminals; and
e. Development of economic and industrial zones at urban fringes.

As indicated above, the major or primary objective of Metro Manila in terms of transport and city logistics is attaining efficiency and economy. Other Asian cities have an underlying problem related to urban freight transport congestion. To address such problems and at the same time meet efficiency and economic objectives, the priority measures should include the provision of road links, development of terminals and development of information systems. The provision of road links is aimed at building the country's economic infrastructure backbone. Intermodal logistics corridors such as the Subic/Clark-Metro Manila-Batangas corridor have been improved through the upgrading of a high standard highway system. Lidasan (2011) observes that completion of the limited access highway network in the corridor will provide the vital link from southern Luzon to central Luzon, where major international ports and airports are located. The corridor will also enhance the access of production areas to the markets and improve the mobility of people in the two regions.

The truck ban scheme is meant to illustrate the implications of city logistics policies in Metro Manila. The truck ban has been in force for several years. The common issues, both positive and negative, related to the traffic ban in Metro Manila, are summarised below:

a) It is the most commonly utilised vehicle restriction in developing countries.

b) Banning trucks is perceived as a practical form of reducing traffic during peak hours;

c) Government usually enforces truck restraints so that public transit modes would not compete for limited road space;

d) Viable measure during construction periods, when road capacity is greatly reduced, ensuring better traffic movements; and

e) Truck restrictions can present problems, if not fully understood.

A truck ban is considered a powerful traffic management scheme; however, it affects urban freight transport operations. As mentioned, the truck ban has impacts on the urban transport system. The most important are economic impacts, which are summarised below:

a) Changes in truck operating characteristics
    i. Shortened delivery schedules and reduced delivery hours
    ii. Reduced quantity of products delivered during banned hours
    iii. Increased travel time

b) Reduced truck delivery frequency
    i. Decreased truck trip frequency per day

c) Reduced production/supply chain efficiency

i. Decreased rate of production due to delays in delivery schedules

d) Increased transport costs

i. Increased costs due to poor productivity are passed on to consumers.

REGIONAL CASES IN THE STUDY

City logistics property is currently scarce across much of Africa. As observed by Knight Frank (2016), there is a growing need for high-quality new development in logistics property in sub-Saharan Africa. This is driven largely by the growth of Africa's middle classes and the associated expansion of its consumer markets. There is a high demand for high-quality logistics space from retailers and consumer goods manufacturers seeking to expand their African operations and improve distribution networks and supply chains. With this need in mind, it is important to note that poor transport infrastructure is an inhibitor to the growth of many African logistics markets, with road and rail links between key economic hubs remaining patchy. Knight Frank (*ibid.*) observes that although there is a Trans-African Highway Network, first conceived by the United Nations Economic Commission for Africa in the 1970s, large parts remain unbuilt and many sections in disrepair and essentially unusable as trade routes.

The cost of moving goods in Africa is, on average, estimated to be two or three times higher than in developed countries and transport costs can represent as much as 50-75% of the retail price of goods. Most African countries have poor quality of roads and rail networks and in some cities, facilities, such as railroads, are non-functional or non-existent, this forces even logistics companies, such as DHL Express, among others, to transport the majority of its cargo by air. Some of the major challenges with the city and transport logistics in African cities include traffic congestion within major cities. This impact logistics operations. In Lagos, Nigeria, there are restrictions on lorry movements during the day, forcing deliveries to be made at night. This situation also contributes to the locational advantages of industries and commercial centres to be located well away from busy city centres. Knight Frank (2016) also indicates that congestion around seaports and competition for limited warehouse space has also led to a trend towards the development of inland dry ports.

ZAMBIA: A CASE STUDY

Zambia has been chosen to represent the regional case study on transport and city logistics because of its geographical position. It is located at the intersection of Southern, Eastern and Central Africa and this makes it one of the promising logistics locations in Sub-Saharan Africa. Lusaka, the capital of Zambia, is a key logistics hub at the crossroads of trans-African transport corridors running from north to south and from east to west. Major routes through Lusaka include roads connecting it with ports in South Africa, Mozambique, Tanzania and Namibia. Zambia is reliant on its road and rail connections with other countries, but its transport and city logistics are relatively good compared with some of its neighbours.

Lusaka is currently undergoing major road improvements, including the construction of an Inner Ring Road, the first phase of which was completed in 2014. Logistics and industrial market activity have historically been concentrated in the industrial area to the west of Lusaka, which compromises mostly older units lacking modern design features, such as cross-docking and intermodal facilities. Traffic congestion has made access to the industrial area increasingly difficult and there is little land available for new development, pushing developers to seek sites elsewhere in the city. Knight Frank (*ibid.*) indicates that the most significant current logistics development in Lusaka is York Commercial Park, located 6 km south of the CBD on Kafue Road. This project is under construction by Actis in conjunction with Improvon, a leading South African warehouse and logistics developer.

LOCAL CASES IN THE STUDY

Zimbabwe's modern transport system developed concomitantly with the colonisation of the country in the 1890s. Hence the country's external trade and transport links and the transit traffic from other countries and between cities has undergone a series of radical changes. Linkages of Zimbabwe's transport and transit system highlight a high-level political hand since the colonial period. From the 1950s, Zimbabwe then Rhodesia, developed protectionist policies against South Africa; then the international blockade during the unilateral declaration of independence (UDI) government (1965-80) forced Southern Rhodesia to foster closer links with South Africa and led to the counter-blockade of Zambia, that reduced Zambia transit traffic through Southern Rhodesia. Mozambique, being at war again in

the 1970s, closed Southern Rhodesia's access to its most important ports and the civil war in Southern Rhodesia/Zimbabwe itself, that together with the blockade, reduced the economy and started a process of decay in the transport system, especially the railways and finally independence in 1980 that led to a new expansion of the road network into the district service centres and a few towns.

The current condition of the transport and logistics network or system is not known , but it is clear that it has declined significantly since the mid-1990s. The transport networks such as the railway and road networks have declined because of a lack of funding for routine and periodic maintenance. Most of the deterioration has occurred on urban roads and the unpaved rural road network. This does not support the fact that the efficiency, reliability and safety of transport services for various kinds of freight is a key issue for the transport sector. The poor condition of a large part of the road network in Zimbabwe has had a direct and indirect impact on the transport service industry. Pedersen (2002) argues, however, that rehabilitation of the road network is not a sufficient condition for a strong and competitive road transport and logistics industry.

Some of the problems that are notorious in Zimbabwe's urban transport system are argued to have stemmed from the implementation of public transport policies and services. One such popular problem policy was the Structural Adjustment Programme (ESAP) which was blamed to have caused the deregulation of urban transport in Zimbabwe. This policy is said to have affected both the movement of people and goods. In terms of passenger transport, by the year 2000, public transport services in urban areas of Zimbabwe had been on a declining trend. The decline in these services has resulted in high transport costs and an inadequate and unreliable public transport system. Most of the public transport vehicles that were acquired following the deregulation in 1993, had reached the end of their economic life and needed to be replaced. However, the replacement programmes of private operators were adversely affected by the deterioration in economic conditions and by erratic fuel supplies. Moreover, the Zimbabwe United Passenger Company (ZUPCO) bus fleet has been depleted and its services reduced drastically. As a result, peak periods are once again characterised by long queues of passengers and excessively long waiting times. People are compelled to walk long distances and travel in all sorts of vehicles, including

lorries and pick-ups, a practice that has compromised the safety of travellers. In terms of the road freight industry, the policy had a large impact on the patterns of both trade and transport in Zimbabwe.

The problem in Zimbabwe in terms of transport and city logistics is summed up by Mbara (2015), who argues that in Harare, there are challenges which include an increase in population and the number of motor vehicles, a deteriorating transport infrastructure, severe congestion and an inefficient public transport and a high rate of accidents. All these fundamental challenges in the transport and city logistics subject indicate that like any other African cities, Zimbabwean cities have their fair share of transport and logistical issues. Mbara (*ibid.*) goes further to argue that all the shortcomings of Zimbabwe's transport sector have implications on achieving sustainable transport, hence the need to raise the question on the requirements of achieving sustainable transport for the cities.

EMERGING DEBATES IN THEORY, POLICY AND PRACTICES

The subject of transport and city logistics is a critical aspect of the fabric of cities, towns and rural areas across the world. As indicated in the preceding sections, transport and city logistics deals with the movement of people and goods from one point to the other, either in cities, across cities, countries and continents. Several important issues have been highlighted as cities are facing unprecedented challenges in moving goods and people. Most of the challenges, such as traffic congestion and environmental pollution, have been seen to be major issues in the developing world while in the developed world, issues of importance are to do mainly with the efficiency and effectiveness of the transport and logistics systems.

Some of the key issues include the relationship of cities with aspects such as freight volumes, nature of freight distribution, environmental issues, social issues and policy and regulation. In terms of freight volumes, the main challenge is on the capacity of urban freight transport systems, especially looking at congestion, lower driving speeds and frequent disruptions caused by the movement of goods in the cities and distribution sprawl that deals with the space consumption associated with freight movement in cities. The nature of freight distribution issues includes smaller volumes and time-sensitive freight and this touches on issues of frequency and repetitiveness and also the issue of e-commerce, that is home deliveries. Those aspects seem

to divert transport and logistics debates and challenges from the traditional aspects.

Environmental issues deal with the mitigation of environmental externalities such as emissions and noise, the growing demand for reverse logistic flows that is waste and recycling. Social issues must do with the mitigation of social disturbances that is safety and health and passengers/freight interference. Policy and regulation deal with the competition and conflicts of land-use, access, that, is allowable vehicles, streets and time windows and zoning, i.e. land-use, freight distribution clusters and urban consolidation clusters.

The growth of the freight circulating within urban areas has exacerbated congestion as goods movements and passengers contribute to congestion. Urban freight distribution commonly accounts for the last mile in contemporary supply chains, but this takes place in a setting where many constraints are exacerbated. The propensity of large urban areas to have high congestion levels challenges a key issue in logistics, i.e. the reliability of distribution. This is particularly the case for the disruptions and lower driving speeds that urban congestion imposes, making urban freight distribution prone to inefficiencies.

LESSONS DRAWN

The movement of people and goods is fundamental to economic and social activities in a city. Effective transport and logistics are essential to support economic development and engagement in the global economy. The difference between transport and logistics is such that logistics deals with the management of the flow of things between the point of origin and the point of consumption and transport are the mechanism by which and services get from one point to another. The relationship between transport and logistics is essential for the development and functioning of cities across the world. When cities ensure that their transport and logistics systems run efficiently and effectively, there is a guarantee of a good business environment and functioning economy and healthy and happy people.

Transport is strongly linked to cities and it is affected by planning related to their-day-to-day and future operations. Issues such as population growth and ageing, liveable cities, infrastructure resilience and changes in land-use patterns, are reshaping how people and

goods move across urban areas. In such an instance, stakeholder operations, perspectives and attitudes do matter in the future of transport and city logistics. Regardless of this increased awareness of the importance of the movement of goods and people in cities, most responsible authorities, especially at the local level, have neglected or shown less interest in city logistics solutions (Van Duin and Quak, 2007). This calls for an improved understanding of the link between urban freight and cities (Cui *et al.*, 2015).

Freight distribution is one of the principal users of urban space and is a central element in the complexity of mobility and accessibility planning. In recent decades, there has been a tremendous change in freight distribution and logistics which, in turn, has affected urban and suburban areas. The shift to containers that carry goods over long distances, globalisation of production, just-in-time production and inter-modality have all had considerable implications for transport demand (Cidell, 2011). Additionally, we have observed the fragmentation and dispersal of freight flow due to e-commerce, smaller shops and an increased logistics sprawl, whereby terminals have been located further away from city centres and there have been increases in the numbers of last-mile deliveries (Morfoulaki *et al*., 2016). Urban development and land use are being transformed by new supply chain organisations, logistics network designs and consumer-based economies through modern logistics (Goodchild and Ivanov, 2018; Hesse, 2016). Suburban areas are attractive for freight activity, specifically warehousing because of the availability of 'low-cost land' and transportation infrastructures that connect to more complex systems of regional and national flows (Dablanc *et al*., 2014; Dablanc and Rakotonarivo, 2010; Rodrigue *et al*., 2016).

The sector of transport and city logistics has also been identified to carry a large significance of stakeholder perception, attitudes and behaviour in city transport networks, the most relevant stakeholders in urban freight being authorities, carriers and receivers. Authorities are responsible for transport infrastructure systems, law and enforcement and governing policies at three levels, i.e. local, regional and national. This, in short, is the city administration. They are mostly responsible for making the city attractive for residents, visitors and businesses and minimising the negative effects of transport and logistics in the city. Carriers are mostly private stakeholders responsible for transport from distribution terminals and aim to collect and deliver goods as efficiently

as possible by optimising load capacity, co-loading and delivery routes. Receivers are the final link in the supply chain and their main task is related to commissioning and receiving deliveries.

CONCLUSION AND FUTURE DIRECTION

Urban areas throughout the world are rapidly changing and so are the patterns of movement of goods and people. In light of sustainable development, this movement is key to building sustainable urban economies with limited externalities such as congestion and pollution. The concepts of transport and logistics then speak to the efficient transportation of freight. As highlighted, this sector is facing many challenges regardless of the wishes and aspirations of the planning arms of either cities or countries of the world. Thus, it is important to find solutions that help cities and regions throughout the world to attain sustainable transport and city logistics.

The chapter exposed that most considerations in transportation focus on passengers, leaving freight issues somewhat neglected. However, it is the position of this chapter to ascertain that logistics is at the heart of the operation of modern transport systems and implies a degree of organisation and control over freight movements. This chapter realises that “greenness” is the code word for a range of environmental or sustainable concerns and is usually considered positively in the aspects of the built environment. The chapter supports the combination of greenness and transport and city logistics that suggest an environmentally friendly and efficient transport and distribution system.

This study calls for green transport and logistics that speak to practices and strategies that reduce environmental and energy footprint in the movement of people and goods while having high regard for other principles of sustainability such as economic sustainability. Governments across the world are recommended to implement the green agenda on the transport and logistics sector.