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Dynamic Effect of Rapid Urbanization on City Logistics: Literature Gleened Lessons for Developing Countries

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Abstract This paper reviews literature on the effect of urbanization on city logistics globally and highlight lessons for developing countries to consider. The literature is structured in categories that arise from the effect of urbanization in city logistics such as traffic congestion, road safety concerns, urban economy, environmental impact and energy consumption. Though the study of city logistics has been widely done in many developed Countries, very few studies have been done on city logistics in many developing countries. It is evident through literature that the expansion of the urban areas and cities to accommodate growing urban population is increasing the demand for freight transport and affect the amount of freight flows in many cities and impact negatively on the flow of goods and supplies to the cities. Cities therefore need comprehensive transport logistics plans and management that will help to maximize its positive impact to the society. The study findings help to understand the dynamic challenges of rapid urbanization to city logistics as well as propose solutions on city logistics measures and initiatives that aid to reduce the effect of rapid urbanization. Further, City Logistics have been noted to be critical as the population of cities grow, optimization and efficiency become key to future urban transport as more people demand mobility.

Keywords: *dynamic, city logistics, congestion, urbanization, transport, developing countries*

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1. Introduction

This article is a Literature Review excerpt from the principal researcher's Doctoral Thesis. The Doctoral programme was offered by the University of Zambia (UNZA) in collaboration with the Zimbabwe Open University (ZOU) and had been running since 2014 [1,2,3,4]. The study explores the dynamic effect of rapid urbanization on City Logistics worldwide to inform developing countries in the 21st century in line with the Sustainable Development Goals by 2030.

2. Literature Review

2.1. Understanding Urbanization

Urbanization is a global growing problem and it has been growing throughout the twentieth century worldwide with an estimation of 180,000 people joining global urban population every day. This is according to [5] on the study of urban sustainability in which he made contributions to new thinking about urbanization and cities through accessing, measuring and profiling urban sustainability. He further states that cities have become critical places for the survival of humanity as they provide possibilities for prosperous of humanity globally. However this can only happen if there is new rethinking on urban development. The [6] and [7] world urbanization prospects reports states that 3.9 billion people lives in urban areas today compared to 746 million in 1950. The reports further estimated that by 2050, more than 70 % of the world's population will live in urban areas compared to 55% today. [8] in his book on sustainable-urban-logistics evaluation and engineering has therefore highlighted that the expected continued increase in urban population will affect the expansion of the urban areas and cities and this will increase the demand for freight transport and affect the amount of freight flows in many cities and impact negatively on the flow of goods and supplies to the cities. Cities will therefore, need comprehensive transport logistics plans and management that will help to maximize its positive impact to the society. It is for this reason that city logistics has been realized to be a competitive way of managing business and development in the cities so as to help contribute positively to rapid urbanization and achieve sustainable economic development.

The [9] report on harnessing Africa's opportunity from rapid urbanization indicates that Africa is currently the fastest urbanizing region after Asia, and urbanization is thus a defining trend for Africa. The report further states that apart from northern Africa, urbanization in Africa has

doubled between 1995 and 2015 and this is projected to double again in 2035. In a related report by [10], it is highlighted that African urban population has been growing by 14 fold from 32 million in 1950 to over 450 million in 2014 and this is expected to double by 2030 and triple by 2050 respectively. This will be absolutely the fastest urban population in the physical footprint of African cities according to [11] report on policy makers' road map for building a resilient sustainable cities. However, economic progress in many African countries and cities have lagged behind this urban population growth for several years as quoted in the [10] report. This is because urban population growth has brought various implications for many African governments especially in their quest to finance vital urban infrastructure like transport infrastructure. [12] Study on urban environment in Africa has also stated that low and poor investment in vital urban transport infrastructure has brought many problems in many African cities and traffic congestion and road crashes is no exception.

Despite this wide implication of urbanization in many African cities, urbanization has been a major driver of development and poverty reduction throughout modern history [13]. Though urbanization has been a major driver of development and poverty reduction throughout modern history many African countries are not utilizing the full potential of urbanization due to the fact that though many cities are growing fast, they are not making them productive as highlighted in the [9] report on harnessing Africa's opportunity from rapid urbanization. According to [10] report, historic experience has shown that though urbanization and industrialization are closely related in a mutual beneficial manner in developed countries it is not so in many Africa countries. However the potential of urbanization in strengthening economic growth and development in African cities has only been grasped recently. It has now been realized that African countries must take advantage of urbanization to drive industrial development and growth so as to achieve sustainable urbanization. Realizing this opportunity of urbanization therefore, requires more concerted efforts and this should result in major investment in urban infrastructure like transport network and other services and initiatives [14]. This is because, when urban population increases, urban freight transport issues becomes important as it supports a better life for people.

According to [15] report on unleashing the potential of urban growth, urbanization has been defined as a gradual shift in residence of human population from rural areas to urban areas. Urbanization do not only cause a sharp increase in the population but also commercial activities and mobility services. In modern times rapid urbanization has taken place due to the fact that most developmental project are taking place more in cities. This has resulted in the development of more cities and it is evident that these cities will experience the challenges of traffic congestions, road crashes and many other. The cost that will be incurred as a result of freight traffic jams will be high in these cities and this requires these cities to develop comprehensive logistics system. This is because freight traffic is not only the driver of infrastructure overload but is also the victims of it and the question therefore is whether the concept of city logistics which has its history in Germany and some of its neighboring countries during mid-1990 could help to reduce this problem [16].

Based on the above highlighted reports and study findings, it is evident that though urbanization has brought economic growth and development in developed countries through increased commercial activities and mobility services, it has brought various implications for many developing African governments. This is mainly due to increase in mobility demand for the flow of people, goods and other supplies to the cities which requires huge investment to finance vital infrastructure like urban transport network.. It is for this reason that city logistics has been realized to be a competitive way of managing business and development in the cities so as to help contribute positively to rapid urbanization and achieve sustainable economic development.

2.2. Effects of Urbanization on City Logistics

The world has experienced rapid urbanization in the past 100 years as highlighted in the [17] report on world urbanization prospects. Despite urbanization creating opportunities for both migrators and city business owners, it also comes with a lot of challenges as it is affecting how consumers do the shopping, what type of product and service they need and how those goods are delivered. Companies in cities also need to understand the characteristics, preference and buying patterns of consumer that will result from urbanization. Furthermore these companies need to know how this shifting demographics will affect their business and organization footprint as they need to know where there customers live and work from.

According to [9] report on harnessing Africa's opportunity from rapid urbanization, though industrial success supports the growth of the city, many cities do have challenges to cope up with rapid urban population growth. This is because population increase through urbanization has turned transportation freight from, to and within urban areas a major challenge. Despite freight transportation being a life line for urban retail and industry, it causes traffic congestion, emission and road crashes which results in significant negative impacts on the quality of living in urban areas. As the population of the city grows, optimization and efficiency will therefore be key to future urban transport as more people will be demanding mobility. It is for this reason that city logistics has emerged as the solution to the future mobility of people and goods in the cities. [18] on the study of recent trends and innovations in modelling city logistics has defined City logistics as a process of totally optimizing the logistics and transport in urban areas by increasing the logistic operations of the city but with less vehicle movements while considering the effect on the environment, traffic congestion, safety and energy consumption within the context of a market economy. [19] on the study of how City logistics changes how we supply further defines City logistics as the process of managing and optimizing urban freight and passenger transport while taking into account the impact those movements have on the environment, society and economic activity of that particular city. City logistics is therefore an emerging field of research, with its major focus being the efficient

management and movement of goods from origins to destinations in urban areas and interest in its problems and concept is growing each year [20]. This is because cities are places of largest concentration of population and logistics is therefore very important for the cities socio-economic sustainability.

Urbanization is currently causing exceptional challenges to urban transport systems especially in developing countries. Many cities in Africa therefore requires massive public investment in road infrastructure to accommodate the ever rising population in a compact environment. According to [13] report conducted in Kenya on the state of cities, it was reviewed that cities that are rapidly growing fast have two distinct factors: they appear to have above average car ownership rates in relation to income and they also tend to have below average proportions of land space devoted for road infrastructure and this too results in high traffic congestion This current increase in urban population has increased the demand for goods and services and this demand increases goods delivery commercial trips in the city resulting into more congestion, high energy consumption, pollution and reduction in accessibility and safety. This expected increase in freight deliveries in the city as a result of increased demand for goods and services supports the importance of city logistics decisions. This is because the movement of goods is affected by transport infrastructure condition and industrial arrangement while on the other hand this results in traffic congestion, high energy consumption and pollution. The economic geography of many cities which comprises of urban, suburban, peri-urban and surrounding rural areas is a source of common pool of both labor market and demand consumption and this affect city logistics through the demand for movement of goods as well as people in search of other services. Modern cities hence requires the efficient and timely distribution of freight for them to survive, grow, flourish and be sustainable because an improvement in transport network will expand the functional space of the growing cities and generate economic momentum of the city. According to [21] study on urban growth and sprawl from remote sensing data, urban areas growth is usually dynamic and complex in nature as is influenced by many drivers and underlying factors and transport is considered as one of these factors.

Traditionally urban transportation was focused on passengers due to the fact that cities were viewed as locations of human interactions, however cities are also locations for production, distribution and consumption and this is linked to freight mobility. Though many African countries are struggling to develop adequate housing and transport infrastructure, many developed countries have invested in urban transport so as to support and sustain productivity. According to [9] report on harnessing Africa's opportunity from rapid urbanization, the fast development of many slums in many African cities are done without adequate plan for transport infrastructure and this affect city logistics The lack of adequate planned housing results in poor transport infrastructure because planned housing and urban infrastructure also include transport infrastructure. It is therefore evident from the [16] study on major challenge for logistics in global urbanization and [23] that demographic changes through urbanization will have a great impact on logistics and supply chain as it will not only affect how goods and services are bought and sold but also on how they are delivered to the consumer in the city and this trend will bring challenges to movement of freight in the city.

This dynamic development in urban areas due to rapid urbanization is therefore posing serious challenges in the provision of transport services for the growing population. However the findings from [24] study on reduction of social and environmental impacts of urban freight transport gives evidence that increased road freight is also responsible for a number of negative impacts ranging from traffic congestion, high energy consumptions, air pollution, public health, accidents and city accessibility. Furthermore, the conflicts between trucks, passenger vehicles, cars, pedestrian and cyclists usually occurs in these highly populated urban cities and this is mainly due to high vehicle volume and inadequate capacities in transport infrastructure. While urbanization brings many social and economic benefits, it also brings challenges as it puts excessive pressure on infrastructure and its mobility system of the cities. These challenges affects not only the freight distribution efficiency but also the quality of life and safety in the city. This increased urban traffic flow due to urbanization results in congestion which lengthen journey time, increase energy consumption and pollution as well as traffic accidents [24].

Throughout the history of mankind, freight traffic have developed hand-in-hand with urbanization and city development. Factors that results in rapid urbanization in cities also leads to high levels of traffic congestion as the interplay of number of vehicles against available road capacity determines the level of road traffic congestion. This is highlighted in the study on understanding congested travel in urban areas conducted by [25]. In this study, it was reviewed that rapid urbanization increases the demand for transportation and this burdens urban road infrastructure as a result of increased number of vehicles against road capacity and this results in traffic congestion. The [26] report on managing urban traffic congestion further indicates that effective urban governance requires a balance between the benefit of urbanization and the dis-benefits of excessive congestion. It is therefore prudent to look into solutions that will help manage congestion as a result of increased motorization due to rapid urbanization in the city. According to [23] study on causes of traffic congestion in urban areas in Poland, congestion is defined as the breaking down in the flow of motor vehicle traffic which results in reduction in speed due increase in vehicle volume. This ultimately results in vehicle volume exceeding road capacity. Congestion in city logistics arises when transport users compete for the available limited transport capacity and this leads to economic cost through the increase in travel time, unreliability of travel time and addition fuel consumption. The concentration of population and economic potential in the cities results in the occurrence of large transport needs and in the event that these needs are met, a phenomenon of road congestion occurs.

City logistics in many developing countries have many challenges and this is mainly due to increased urban population and increased motorization. This increased motorization due to increased population, the existing of

road transport infrastructure capacity in many of these cities have reached critical levels and is usually unable to meet the increasing demand of vehicles on the road. The [27] urban transport and city efficiency strategic review report on urban population growth reviewed that may cities have increased motor vehicle ownership and this has resulted in traffic congestion in developing countries. Though this urban transportation system have positive affect on the efficiency logistics system and customer satisfaction of the city it has negative consequences on the social economic development of the country as it brings about high level of congestion. This has also been reported by [28] study on congestion toll pricing models and methods for variable demand networks report that was done in in Florida. In order to improve city logistics therefore, we need to improve urban transport network system because congestion increases man-hours and forces business to raise prices of their products and services and this affect much needed time and place utility in supply chain. Traffic congestion also increases public transport operation cost because traffic congestion extends travelling time, delays placement of products in the market and increases delivery costs [23].

Urbanization process presents a tendency that increases urban traffic flows. This increased urban traffic flow due to urbanization results in congestion which lengthen journey time, increase energy consumption and pollution as well as traffic accidents. If no measure is taken to control traffic congestion ,not only individual journey cost and cost of trade will increase but also the entire city transportation system will be paralyzed and this will affect urban sustainable development. It is therefore necessary to balance transportation supply and demand. Though one of the practical way of matching supply and demand is by constructing more roads, constructing more roads actually attracts more transportation demand which results in traffic congestion and this calls for more demand management methods of controlling traffic in the city. This is reported in [29] study on urban road traffic congestion charging based on sustainable development conducted in China. In this study Sun Ye suggested that increase road supply is only one kind of solution to alleviate supply and demand. This is because it has been proved in various countries that constructing of more roads attracts more traffic and this results in a vicious circle of traffic congestion road building and congestion alleviations. It is for this reason that the study on city logistics will not only look at road construction as the answer to city logistics but also in other solutions of alleviating congestion in the city.

[30] on the study of the cause, effect and possible solution to traffic congestion reviewed that as the population of the country increases, the demand for road travelling also increases. This therefore causes traffic congestion where the demand for population growth has not been accompanied by the construction of new road network. This traffic congestion according to the study results in waste of time, delay movements, road accidents, inability to forecast travel time, high fuel consumption, and road rage and environmental pollution. However though this study pointed out that increase in road capacity and traffic control are the major solution to traffic congestion, there are many other city logistics solutions that the study did not highlight. [31] and [21] also in their study on measurement of traffic congestion on high dense urban corridors in Hyderabad city, urban growth and sprawl from remote sensing data respectively states that urbanization has brought an increase in the number of vehicles on the roads and this rise in traffic volume causes roads to be congested. It was reviewed in their study that urban population growth affects transport through the increased travel and goods demand pattern and this causes infrastructure pressure due to traffic congestion. Though motorization is still low in many developing countries like Zambia, road infrastructure is still underdeveloped compared to developed countries and this results in congestion. Despite developed countries having high motorization in their cities which results in road congestion than developing countries, they tend to afford also a well-developed road and rail based mass transit systems and this helps to reduce road transport congestion according to [32] study on transportation in developing countries.

According to [33] study on vehicle routing problems for city logistics there are many strategies that many countries have implemented so as to help address the challenges congestion in city logistics. These strategies ranges from infrastructure, operational, technology and policies. However, though these City logistics solutions are common worldwide, each country has its uniqueness in implementing what can work in its geographical, demographical, political, environmental, social, cultural and economic context. Some countries have concentrated on infrastructure, operational, technology while others in policy execution Though many authors and researchers have come up with their own city logistics initiatives that will reduce congestion, [34] in the study of city logistics concept selection, reviewed that city logistics solutions cannot be implemented with same policies and initiatives in all cities. This is because different demographic, geographic, economic, sociological, cultural and historical features as well as many different stakeholders in city logistics who usually have conflicting interest. Furthermore, City logistics solutions and requirements that will help reduce congestion are different from one city to another mainly due to specific local characteristics like size of the city, dimension and structure of the city, existence of specific facilities and urban road network, shops and products in the city [35].

It should therefore not come as a surprise that increasing city population is straining urban transportation system due to the increase in the movement of people and goods. However, according to the above study findings, building of road infrastructure to reduce congestion is not sustainable because it has been proved in various countries that constructing of more roads attracts more traffic and this results in a vicious circle of traffic congestion. Furthermore, building of more roads to reduce traffic congestion is not sustainable because construction of road infrastructure is very costly especially for developing countries. Managing city traffic congestion solely by developing road infrastructure is not viable because in urban areas space is limited and infrastructure expansion is enormously expensive and this signifies the importance of proper planning so as to implement other sustainable initiatives and solutions. This study, has therefore not

given comprehensive city logistics solutions that can help reduce congestion and its effects in developing countries cities like Lusaka city. This is because, though other solutions have been reviewed in other related studies, they are not a one size fits all solutions because the political, geographical, social, cultural, economic and design of each city will determine the city logistics. This study will therefore focus on the solutions of city logistics of Lusaka which will help accommodate the expected increasing rate of motor vehicle ownership but with transportation efficiency that will avoid the cost of transport delays due to congestion.

2.3. Contribution of City Logistics to Road Safety in Urbanized Cities

According to [36] report on road traffic injuries, global urban population have grown hand in hand with motorization in recent years as the number of motor vehicles worldwide has grown from 0.85 billion in the year 2000 to about 2.1 billion in 2016.This has led to an increase in traffic and posing serious challenges to road safety resulting in 1.35 million people dying each year due to road traffic crashes and more than half of these accidents occur in urban areas. This high rate of fatal accidents in urban areas is mainly due to high urban population resulting in mixed traffic and more than half of them involve pedestrian, cyclist and motor cyclist. The report further indicates that developing economies records higher rates of traffic accidents with 93% of fatalities coming from low to medium income countries. These accident do not only cause human suffering through fatalities and road traffic injuries, they also incur heavy economic burden on family and national economy. The report also highlights that there are proven measures to reduce the risks of road traffic crashes as indicated in 2020 Agenda for sustainable development targets for reduction of road traffic crashes.

[36] Further reviewed that road accident poses serious economic problems especially in low and middle income countries as the death rates in these countries due to road crashes and injuries are three times higher than in higher income countries. It is actually estimated that road traffic crashes have serious impacts on national economies as its cost is approximately 3% of their annual gross domestic product in developing countries like Zambia.

According to [37] report on good practices for reducing road safety risks caused by road users distraction, the number of road accident in cities have grown and it is mainly vulnerable people like pedestrian and cyclist who are mainly victims. [38] Report on action plan on mobility reviewed that 69% of road accidents occur in cities. This is because vulnerable road users have increased in many cities especially in developing countries like Zambia due to rapid urbanization. City logistics solution should therefore be planned so as to help protect road crashes caused by other venerable road users. [39] Study on road traffic safety in Africa countries further states that road crashes constitute a major health, economic and development problem for many African countries. It further states that though Africa has only 4% of the global motor vehicle population, it accounts for more than 10 % of world's total collisions and fatalities and increased motorization in Africa as a result of increased urbanization will result in the increase of number of road traffic crashes. [39] Further states that more than 40% of these fatalities on African roads are pedestrians.

[28] study on congestion toll pricing models and methods for variable demand networks report that was done in Florida observes that though urban transportation system positively affects the efficiency logistics system and customer satisfaction of the city, it has negative consequences on the social economic development of the country as it brings about high level of road safety challenge with an estimated of 69 % of road traffic crashes occurring in urban areas. This represents about 500,000 deaths and up to 15 million people injured in urban road accidents in developing countries each year as highlighted in the [40]. These accidents as underlined in the [41] are estimated at a direct economic cost of between 1 and 2 percent of worldwide gross domestic product. It is further estimated that the loss due to road crashes at 1 to 2 percent of worldwide global domestic product (GDP) is estimated at $65 billion and this is equal to the total annual aid and lending's the international institutions gives to these countries.

[42] study on urban growth, travel practice and evolution of road safety reviewed that the harmful effect of transport in urban planning need to be taken more into account. This is because road safety has become the priority in urban travel. However while the influence of urban planning on road safety has become a major issue, very little study has been under taken on this subject. Though road network has often been studied for its influence on road safety other urban characteristics like population, land use, housing density have not received comprehensive studies [43,44]. [45] In the study of uncovering the behavior of road accidents in urban areas reviewed that, despite the fact that road accidents being a global challenge, many researchers have not answered the question on how the number of accidents in urban areas increases with the increase in population in cities. This is because, when quantifying the different aspect of the cities, simple per capital measures are used though these only assume implicitly that urban characteristics increases linearly with population size. This assumption however is not entirely correct as it ignores the inherent nonlinear nature of the organization and dynamics of the cities with different population sizes. [46] in the study of factors influencing traffic accident frequencies on urban roads has reviewed that in order to reduce the occurrence of traffic accidents and its impact on traffic in urban areas, it is necessary to analyze the vital, factors that affect the occurrence of traffic accidents so as to put forward the corresponding accident analyzing model. This will help to provide scientific basis for optimizing traffic management as well as provide useful information in the development of traffic regulations.

According to [47] Zambian annual road traffic crash statistics report, reported that Zambia has been experiencing rapid growth in both human and motor vehicle population over the last 10 year with an average of 45,000 motor vehicle being registered each year. Further [48] report also indicates that the population has been growing at 3% per annum. However this growth in vehicle and human population in Zambia like in many African

countries has not grown at the same level with road and other transport infrastructure and this brings about safety challenges especially in urban areas. In 2019, Zambia recorded a total number of 30,648 road traffic crashes which resulting in 1,746 fatalities and more than 50 % of the road crashes occurred in urban areas. Despite many continuance road upgrading and constructions as well as road safety interventions that the Government and road transport and safety agency has introduced in Lusaka city, the rate of accident has not improved and pedestrians and cyclist are the most venerable road users [47].

Improved city logistics therefore helps reduce road crashes and this may have a positive effect on the economy of the country and the city because increase in traffic due to urbanization do not only cause congestion but also causes a high risk of accidents in the city. The study of city logistics of Lusaka city should therefore be conducted so as not to look into how city logistics can help improve road safety but also on how road safety can be improved by reducing risks caused by venerable road user's distraction. This is because characteristics and behavior of venerable road users in Lusaka city are unique to other countries and region due to social, demographic, economic and political setup of the country.

2.4. Contribution of City Logistics to Urban Economy

According to [49] transportation is a very essential logistical driver of supply chain as it contributes to economic growth in the urban areas. Effective urban transportation system affects the efficiency of logistics system and customer satisfaction of the City. This is because a lot of economic activities in urban areas depend on the movement and delivery of goods and services and these movements depends on urban freight. Despite many Cities being developed and organized with the priority on human mobility, the cities economical activities through freight transport remain vital to the success of many urban areas. It is for this reason the rapid growth of China and other Asian Countries' and urbanized city economies have been attributed to highly developed transport infrastructure and logistics system [50].

[51] Study on Logistics Inefficiencies of Urban Transportation System in Ghana further states that City logistics plays a important role in the development of the economy of the City because urban transport is a crucial driver of supply chain as it helps to facilitate socio-economic development and enables business competitiveness in the global economy. The study also highlights that cities are the engine of economic growth in most developing countries and to this effect urban transport is the oil that prevents the engine from stopping to run. It is for this reasons that deteriorating transport conditions in many developing countries are not helping in improving urban economies. Transport logistics is therefore very vital to the life of city citizens in every society because it does not only affect urbanization but it is also one of the major provider of wealth [52]. As the world economy improves and technology increases and the way we do our business should also change. City logistics can therefore help to promote innovative schemes that will reduce the total cost of economic activities, social and environmental cost of goods movement in the city [53]. According to [54] transport is the blood stream of every economy as it keeps the economy running by carrying goods, people and services. It is the blood stream because the movement of goods, people and services is one of the major activity that affect every economy and society as it connects supplier to customer and accomplishes the objective of the supply chain. Freight transport is therefore very critical to economic growth in any Country because its efficiency can strengthen the countries business competitiveness [55].

According to [56] study in the challenges of logistics performance, logistics system is negatively affected by underinvestment in transport infrastructure of the city and this has the negative effect on the social and economic activities of the city. The immediate effect of underinvestment in transport infrastructure is the ineffective transportation and this results in rising cost of logistic activities and business. Delays in the delivery of goods such as perishable goods to destination results in goods not being delivered in the same fresh condition and this reduces shelf life of the products as poses a great risk to business as products are not sold at economic price.

In many developing Countries, the pressure on urban transport systems due to urbanization is increasing. Motor vehicle ownership and use has been increasing with vehicle ownership growing at 15 to 20 percent per year in some developing countries. Though freight transport in urban areas due to increase in urban populations plays an important role in the economic and social development of our cities, its impact on the quality of life, accessibility and attractiveness of local communities has received little attention in comparison to passenger transport especially in developing countries like Zambia [26]. However it is evident that city logistics can help improve the economy of the city by optimizing transportation of goods and services so as to reduce congestion, loading and unloading operations and energy use. This is because the aim of city logistics is to minimize or reduce transportation operation cost in the city [57] (Francis & Antonio 2020). Additionally, City logistics should be part of economic policy of every country because transport is one of the basic factor determining the level of economic development social and environmental impacts. [58] Taniguchi, Thompson, 2001). According to [33] 7% of the gross domestic product (GDP) in 2009 in EU was due to transport industry with a total employment capacity of 5%.

2.5. Urbanized and Environmental Impact and Energy Consumption

Transport has a positive role to the economy, as highlighted by [51] study on Logistics inefficiencies of urban transportation system in Ghana, however despite this positive role of transport to the urban economy, the large number of freight in major cities due to urbanization often bring about externalities and cause huge challenges like high energy consumption and pollution. This is because transport is one of the major contributor of global GHG emissions as it accounts for 29% of GHG emission. It is further estimated that 60% of global oil consumption and 25% of energy consumption is due to transportation.

[50] As cities grows in population more challenges in combating GHG arises due to increase in transport. According to [59] global emission are rising and the global target of reducing 50 % of carbon emission by 2030 and net zero by 2050 will be hard to achieve. Urbanized cities therefore need comprehensive transport logistics plans through city logistics so as to help maximize its positive impact to the society. It is for this reason that City logistics has been realized to be a competitive way of managing business and development in the cities while at the same time achieving the much needed sustainable economic development urban areas.

Though urban transportation system affects the efficiency logistics system and customer satisfaction of the City it has negative consequences on the social economic development of the city as it brings about high level of environmental impact. The major environmental impact in City Logistics are fuel consumption, noise and pollution emission [60]. According to [61], freight transportation is a major contributor of climate change. [62] Study further estimates that approximately 10% of energy related emission comes from fright transport. These negative impacts of freight activities has great influence in the attractiveness of the city and its livability. Though modern cities account for 2 percent of the world's land mass, they are responsible for over 80 percent of global energy consumption and around 70 percent of worlds greenhouse gas (GHG) emissions [13]. In Europe, urban freight is responsible for 25 percent of urban transport related carbon dioxide emissions and about 30-50 percent of other transport related pollutants like nitrogen oxide. It also accounts for significant part of ambient noise and this cause a lot of discomfort to City dwellers especially at night.

As quoted from [63] City logistics is the process of totally optimizing the logistics and transport in urban areas while considering the effect on the environment and other externalities. This total optimization of transport and logistics activities will not only help to minimize the overall total costs of city logistics but also other environmental factors that are generated by transport logistics activities. City Logistics will aim at increasing the efficiency logistics process and activities of the city as well as help mitigate the negative effects of transport logistics [18]. This is because smooth functioning of cities without efficient logistics is currently impossible. City logistics activities must therefore be adapted to the requirement of sustainable development. The objective of sustainable freight transport in City logistics is to reduce energy consumption per ton-kilometer, reduce ton-kilometer of less sustainable transport modes and increase in the use of transport modes that are environmental friendly [55].

Traffic congestion in the city do lead to substantial increase in CO2 emissions for freight vehicles as there is always a relationship between emissions, distance travelled and travel speed for large truck [65]. Total energy inputs and greenhouse emissions have been estimated to be contributing 63% through tailpipe operations for on-road vehicles [66] During congestion, higher level of acceleration and baking during congestion leads to high fuel consumption on freight Since freight vehicles can produce significant amount harmful emission of sulphur oxide, nitrogen oxide and particulate matter, there is need to reduce the level of emission is harmful to the population living and working in cities. According to [67] in the study of the relationship between the features of urban freight transportation and negative impacts of urban freight transport operations, air pollutant emissions per vehicle kilometer and fossil fuel consumption per vehicle kilometer have been identified as a major influence in vehicle air pollution.

Implementing effective city logistics measure and policies could help in combating environmental damage from the increase vehicular pollution emission. It is therefore evident that logistics solutions like development of logistics network design and sustainable logistics management policies help to reduce carbon emission through determination of optimal configuration of logistics infrastructure.

2.6. City Logistics Framework in Urbanized City of Lusaka

In order develop city logistics, there is need to look into city logistics framework. There are many aspects in the designing, assessing, implementing and evaluating city logistics frameworks. They range from infrastructure, regulatory, logistical, cooperative, technical, and behavioral approaches [68]. The report further states that, City logistics framework development should be divided into design, assessment, implement and evaluate stages. The design stage involves the identification of problems its causes and setting of goals. This also involves listening to public voices so as to identify problems and its causes in city logistics. The assessment stage involves the use of a pilot project so as to help determine side effects. This helps to monitor if restricting of trucks in some city locations does not result in the increase in a high number of small trucks resulting into congestion and negative environmental impact. Implementation stage is a stage that needs collaboration between public authorities and private companies because the success of any city logistics measure depends on the mutual understanding and cooperation of stake holders in the city. Evaluation stage require multiple criteria so as to help assess policy measures as well as cost for freight carriers, environmental impact, traffic safety and energy consumption. Key performance indicators (KPI) like life quality in the city, economic development, accessibility and transport efficiency will therefore play a very important role in evaluating city logistics policy measures [68].

According to [69] a number of studies have proposed frameworks or metric for evaluating road network .While some studies have focused on the modeling and computational aspect as highlighted by [70] other research studies have developed mathematical modeling and optimization techniques to identify worst-case road network scenarios, or best responses to such scenarios [71]. However, despite the above suggested models and frameworks, many studies have emphasized on the road network vulnerability evaluation itself as highlighted by [72]. Road network vulnerability is a risk to road infrastructure disruptions in the society and the impact of this disruptions for individuals are evaluated in economic

terms. This urban transport network system consists of four main categories, namely facility networks, route network, organization network and demand network.

There are two major types of models that are used in city logistics. These are optimization model and simulation model. According to [73] Solomon (1997) optimization model is the model that makes the best use of available resources under constraints circumstance. In order to make best use of available resources during constraining circumstances so as to achieve efficient routine and scheduling, analyzing of road network vulnerability is necessary as it helps in prioritizing the planning and preparing for emergency responses. Analyzing of road vulnerability therefore helps in developing mitigating measures through maintaining of road network, prioritizing, budgeting and preparing of emergency responses in the city [74]. According to [75] road network vulnerability is defined as the susceptibility of the road network to incidences as a result of considerable reductions in road network serviceability. Road network disruptions is usually caused by a wide range of events and some of them originate from transport system like traffic accidents and traffic failures while others are external caused by nature like floods due to heavy rains which makes the road fully or partially impassable. It is therefore important to conduct road network vulnerability analysis by comparing and aggregating the various aspects of disruption impacts for under different scenarios. Evaluation of road network vulnerability is done through mathematical models and optimization techniques so as to respond scenarios. Road network performance modeling is therefore essential in transport planning as it will help develop mitigating measure in the city. This will help city planners in understanding how the road network in the city can absorb disturbances and also adapt so that the road network retains essentially the same capacity [74].

2.7. City Logistics Solutions in Urbanized Cities

Arising from [55] study, it is therefore evident that city logistics help promote urbanization as it improve the sustainable economy of the city through optimization of transport. This helps to reduce cost of doing business in the city through the reduction of cost of traffic congestion, energy consumption and time saving. According to [75] the amount and characteristic of freight transport demand is determined by logistics decisions along the supply chain. The trends of City development are exogenous and they have exacerbated the challenges of urban freight system. In an effort to respond to these challenges, city logistics planners and providers have of late been devoted to finding appropriate solutions to promote sustainability, effectiveness, safety and security.

In recent times many modeling techniques for planning and evaluating the city policy measures have been developed and Interest in the problems and conceptual solutions for city logistics is increasing each year. According to [18] there are a number of techniques and approaches to help solve city logistics problems. However some initiatives require a high infrastructure support to be launched while others try to improve the existing situations by assessing different scenarios and established solutions that aim at optimizing their efficiency [76]. [77] Also states that city logistics initiatives can also be divided into 2 groups. These are initiatives within the current urban context and initiatives with changing urban context. Initiatives of current urban context are focused on better utilization of available infrastructure like road, vehicles and warehouses. These do not require large investments and are easy to apply. They include policy initiatives like road pricing, loading and unloading zones, carrier cooperation, vehicle routine improvements and technological vehicle innovation. Initiatives with changing urban context are complex and difficult to implement and apply as they require significant financial investment like infrastructure and the involvement of different stakeholders. This includes construction of infrastructure like logistics centers, road network and underground system. However managing city logistics solely by developing road infrastructure is not viable because in urban areas space is limited and infrastructure expansion is enormously expensive and this signifies the importance of proper planning so as to implement other sustainable initiatives and solutions. Urban goods transport planning and management is therefore one of the way to achieve city logistics as it will help reduce transport costs, congestion and environmental impact of this activity City logistics initiatives can further be classified to their level of contributions to improve environmental, economic, social sustainability or transport efficiency. These are Environmental zones, time windows, vehicles restrictions by weight, length or area, load restrictions, night distribution, loading and unloading zones, segmentation to traffic and road pricing. [77].

According to [33] there are many strategies that many countries have implemented so as to help address the challenges of city logistics. These strategies ranges from infrastructure, operational, technology and policies. These City logistics solutions are common worldwide, however each country has its uniqueness in implementing what can work in its environmental, social, cultural and economic context. Some countries have concentrated on infrastructure, operational, technology while others in policy execution Though many authors and researchers have come up with their own city logistics initiatives, city logistics cannot be implemented with same policies and initiatives in all cities [34]. This is because different demographic, geographic, economic, sociological, cultural and historical features as well as many different stakeholders in city logistics who usually have conflicting interest [34]. Furthermore, City logistics needs and requirements are different from one city to another mainly due to specific local characteristics like size of the city, dimension and structure of the city, existence of specific facilities and urban road network, shops and products in the city [35]. There is therefore need to find specific solutions for city logistics of Lusaka city owing to the geographical, political cultural, demographical, and economical and design of the city.

2.8. Urban Population and Freight Trends in Zambia

In many developing counties transport challenges might be similar in the cities with a large deficit between

demand and supply, congestion, lack of unloading and loading spaces due to high density, insufficient planning and logistics sprawl leading to longer distances to the final receiver [79]. Of late many developing countries Zambia inclusive have experienced the increasing pressure on urban transport systems. Motor vehicle ownership and use has been increasing with vehicle ownership growing at 15 to 20 percent per year in some developing countries. This growth is exceeding the ability and the rate of road space and it results in major impediment to efficient working of urban economies in cities due to high levels of congestion and road safety concerns [47]. Though freight transport in urban areas plays an important role in the economic and social development of our urban areas, its impact on the quality of life, accessibility and attractiveness of local communities and cities has received little attention in comparison to passenger transport especially in developing countries like Zambia [26].

Transport and urban growth are always strongly related with a reciprocal relationship between them. On one hand transport infrastructure attracts urban population and growth while on the other hand urban population and growth attracts transport infrastructure by causing an increase travel demand and movement of goods .Studies has indicated that transport infrastructure expansion and urban growth highly correlates. This is because it is evident from the studies that population growth in urban areas increases urban trips and freight movement and this usually creates an imbalance between transport infrastructure supply and travel demand results in congestion [80]. Transport plays an important role in urban development by providing the essential mobility options for people and goods and this influences the pattern and growth of urban economy. It is therefore evident that understanding transport urban dynamics is important in increasing necessary conditions for developing urban strategies [81].

Zambia's population stands at 18, 3 million people [82]. Zambia has also been categorized as one of the most urbanized country in sub-Sahara Africa. Its urban population stands at 45.3 percent and it is growing at a rate of percent 3 percent 82]. Though urbanization in Zambia has provided massive advantages to drive socio-economic development, it has also brought challenges in the cities like Lusaka due to the increase in demand for freight and passenger transport and this has affected the amount of freight flows in the cities and impact negatively on the flow of goods and supplies. It is estimated that from the 45% of the Zambian population that live in the urban areas, most of this urban population depends on public transport for their daily transit and goods delivery [48]. However public transport service in Zambia is of relatively low quality and is more expensive compared with developed countries. As a result, the city has experienced increased usage of private motor vehicles in both freight and passenger transport leading to traffic congestion and road safety concerns [83]. Zambia's population is projected to increase from the current 18 million people to 24 million people by the year 2030. Urbanization in Zambia is also growing at a rate 4.3 % annually and the urban population is projected to reach 11 million by 2030 [84]. With the growth of urban population in Zambia, traffic flows will increase and it is for this reason that city logistics is required so as to optimize the movement of goods and people and achieve the much need sustainable urban economy.

3. Conclusion

Emergent from this study is clear evidence that demonstrates a wealth of literature on the dynamic effect of rapid urbanization on City Logistics predominantly in developed world. Despite its empirical evidence of how city logistics make the city viable by improving the economy of the city while reducing transport cost, congestion, improving safety and environmental impact the efficient urban goods transport planning and management, many developing countries have not examined how city logistics can help city be viable. Thus, cities in developing world must therefore respond to these challenges due to growth in mobility by not only expanding transportation supply through building transport network that will accommodate the increasing number of people and vehicles but also through other city logistics solutions.

4. Implications for developing Countries

Arising from the above review, it is evident that:

1. Rapid urbanization comes with high motorization related challenges in many cities because urbanization process presents a tendency that increases urban traffic flow.
2. Tailor-made studies on the effect of urbanization on city logistics should be conducted so as not only look into how urban population affect city logistics but also find the city logistics solutions that could help reduce the challenges that comes with high motorization like, traffic congestion, energy consumption, road accident and environmental pollution.
3. Equally, urbanization contributes to exceptional challenges to urban transport systems in many cities like Lusaka. Cities must therefore respond to these challenges due to growth in mobility by not only expanding transportation supply through building transport network that will accommodate the increasing number of people and vehicles but also through other city logistics solutions.

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