



Public Transportation as a Strategic Tool for Sustainable Development

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ABSTRACT

Globally, the significant growth in the number of motorized road vehicles has been evident in recent decades. This article focuses on analyzing public transportation as a public policy within the context of urban mobility for sustainable development. The research methodology employed is applied, bibliographical, and qualitative in nature. The results highlight the need to establish definitions and guidelines for the urban mobility to take place by encouraging and investing in the search for public transportation means as environmentally and socially viable alternatives as a way to contribute to mitigating global warming and achieving Goal 11.2 of the Sustainable Development Goal number 11.

KEYWORDS: Public policies. Public transportation. Sustainable transport.

1 INTRODUCTION

The topic of sustainable development has been the subject of numerous meetings over the past decades, and its promotion can be achieved by mitigating the negative effects of anthropic activities. As Abreu and Santos (2019) highlight, sustainable development is achieved by reducing traffic jams, environmental pollution, social disparities, and prioritizing private transportation.

Too and Earl (2010) show that a key element for achieving sustainability in cities is having a good public transportation system. The National Urban Mobility Policy (PNMU), established by Federal Law No. 12,587 on January 3, 2012, as an instrument of urban development policy, regulates constitutional provisions and aims to integrate different modes of transportation, improve accessibility, and enhance the mobility of people and goods throughout Brazilian territory (BRASIL, 2012). This policy aims to undo the history of exclusive incentives for individual transportation, implemented by the federal government as far back as the 1950s.

The PNMU is limited to establishing guidelines and financial support at the federal level, while its implementation as public policy falls within the jurisdiction of municipalities and states regarding metropolitan regions, as stipulated by the Constitution (BRASIL, 1988).

The difficulties identified in urban mobility stem firstly from the unplanned growth of most Brazilian municipalities and the consequent inefficient road infrastructure. Secondly, the lack of municipal urban mobility plans in most municipalities, aimed at formulating urban mobility policies at the municipal as well as metropolitan levels. Thirdly, the absence of federal public policies that incentivize greater use of public transportation as a means of accessing public services. Fourthly, the absence of federal policies encouraging the use of public vehicles with lower fossil fuel consumption.

The fiscal incentives promoted by the federal government to encourage national production of individual vehicles reflect Brazil's divergence from the Sustainable Development Goals (SDGs) established by the UN, to which Brazil is a signatory.

According to the report by the Intergovernmental Panel on Climate Change (IPCC), urban centers are the major contributors to air pollution, with traffic being one of the leading causes (IPCC, 2020).

As a signatory country, Brazil is responsible for immediately instituting public urban mobility policies related to public transportation to accelerate the reduction of global greenhouse gas emissions and to address adaptation to the negative impacts of climate change.

This commitment to mitigating greenhouse gas emissions aims to keep the global average temperature increase below 2°C or 1.5°C, thus meeting the goals set in the SDGs (UN, 2015).

In 1987, the then-chair of the World Commission on Environment and Development (CMMAD), Gro Harlem Brundtland, characterized sustainable development as a broad political concept for economic and social progress, and after years of international debate, the work "Our Common Future" was published by the WCED, where sustainable development was described as that which meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1991). Proposing, from then on, a consensus on the concept of sustainable development and a broad strategic framework for achieving it. Among the issues impacting sustainable development in cities and metropolitan areas are air pollution and noise pollution.

In this context, the means to promote urban mobility influence the pollution issue in cities. Urban mobility refers to the people moving capacity within a city's limits or even the metropolitan region, encompassing road infrastructure (avenues, streets, viaducts, bridges, walkways, and sidewalks) and transportation modes (collective, active, and individual).

2 OBJECTIVE

To analyze public transportation as public policy in the context of urban mobility for sustainable development.

3 METHODOLOGY

The research is classified as applied and qualitative in nature, with a bibliographic review based on the SciELO, Scopus, and CAPES Periodicals Portal databases.

The research is considered applied in the terms of Fleury and Werlang (2016). In applied research, previously acquired knowledge is used to collect, select, and process facts and data, thus obtaining and confirming the results.

It is a qualitative research, which, according to Andrade and Holanda (2010), allows for the recovery of the interpretative processes of social phenomena within the scope of science.

4 SUSTAINABLE TRANSPORTATION

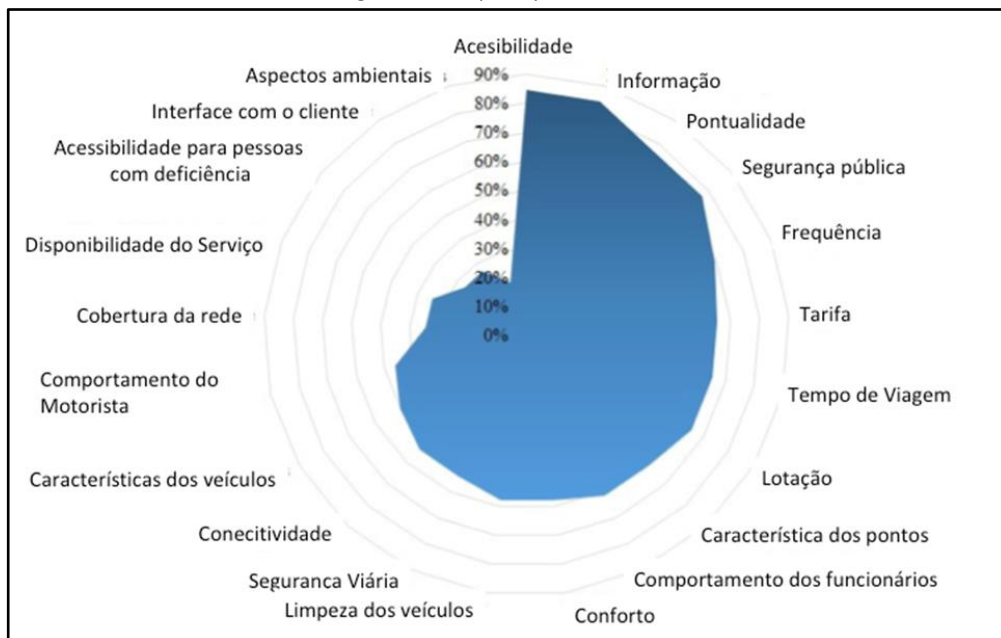
The concern with quality, efficient, and sustainable transportation systems is present worldwide, as shown for instance, by the research of Lambat, Kapse, and Sabnani (2022), Mendiola and González (2021), and Guerra et al. (2018).

According to Barczak and Duarte (2012), current urban mobility patterns, marked by increasing individual motorization, have high social, economic, and environmental costs, driven by the unplanned growth of cities. Lambat, Kapse, and Sabnani (2022) in their study of transportation systems in Indian cities found that the reasons for the preference for individual motorized transportation may be related to safety, delays, convenience, flexibility, easy availability, and economic viability offered by personalized modes, particularly two-wheel vehicles, compared to public transportation.

Regarding Latin America, the research by Mendiola and González (2021) on public transportation in the Metropolitan Region of Buenos Aires, as well as Guerra et al. (2018), who discuss the supply of transportation in Mexico's largest cities, shows that land use, population density, urban design, along with traffic and accessibility to the destination, impact the choice of transportation mode.

Oliveira, Mairinque, and Lima (2021) conducted a literature review and examined the frequency of Urban Public Transportation quality indicators in these studies (Figure 1).

Figure 1 – Frequency of indicators.



Source: Oliveira, Mairinque and Lima (2021, p. 14).

Figure 1 shows that accessibility, information, timeliness, and public safety were the most recurrent indicators in the studies reviewed.

According to Mello (2016), the quality of traffic on public roads, combined with the structural conditions of the road network and the labor market, is significantly impacted by the intensive and uncontrolled use of urban roads for individual motorized transportation. This pattern has persisted since World War II, with the automobile playing a significant role in the strategic definition of public policies and accessibility.

Globally, the growth in the number of motorized road vehicles has been significant in recent decades. According to Assunção (2012), this has led to traffic jams, reduced green spaces, increased traffic accidents, and higher levels of air and noise pollution, all of which are among the main problems facing cities related to urban mobility. Table 1 shows the production of various types of vehicles in Brazil from 1960 to 2019.

Table 1 - Vehicle production in Brazil, 1960-2019.

Year	Automobiles	Light Commercials	Trucks	Bus	Total
1960-1969	1.424.117	326.172	305.499	40.627	2.096.415
1970-1979	6.262.216	854.819	696.294	90.879	7.904.208
1980-1989	6.702.327	1.345.863	619.855	108.480	8.776.525
1990-1999	10.013.127	2.043.898	531.262	180.189	12.768.476
2000-2009	18.699.174	2.426.383	1.034.004	276.196	22.435.757
2010-2019	24.501.354	4.109.144	1.310.503	317.079	30.238.080

Source: Self-prepared based on ANFAVEA (2020).

Based on Table 1, a clear growth in vehicle production has been observed since the 1960s as a result of the road-oriented policy implemented by the Brazilian government, particularly in encouraging the production of individual vehicles.

The PNMU defines urban transportation as the set of public and private transportation modes and services used for the movement of people and goods within cities. Aimed at contributing to universal access to the city, the National Urban Mobility Policy, through the National Urban Mobility System, defines motorized urban transportation as passenger and collective transportation, accessible to the entire population (BRASIL, 2012).

Among the public transportation fare policy guidelines, besides affordability for users, the PNMU is guided by the promotion of equity in access to services, improving efficiency and effectiveness in service delivery. It is the responsibility of municipalities to promote and regulate urban transportation services, and states are responsible for providing inter-municipal urban public transportation services. The provision of public transportation services must be based on the sustainable development of cities, considering social, economic, and environmental dimensions (BRASIL, 2012).

According to Santos and Silva (2019), with the need to promote sustainable public transportation, it is necessary to encourage service improvements, along with the development of strategic programs and policies, increasing the competitiveness of public transportation by attracting more passengers and ensuring greater usage, raising user awareness is essential to enable a change in behavior linked to dependence on individual transport.

The PNMU provides several rights to users, such as the guarantee of receiving adequate service—being informed about passenger boarding and disembarking points, free and accessible information on routes, schedules, service fares, and modes of interaction with other modes; having a safe and accessible environment, and the guarantee of participating in the planning, supervision, and evaluation of services.

Public transportation in Brazil can be divided into: the bus system; rail-based systems (urban trains, subways, and monorails); and other systems applicable to specific cases, such as boat, cable car and airmobile.

The rail-based transportation system is suitable for large cities, urban agglomerations, and metropolitan regions, requiring significant investments and maintenance. Systems

applicable to specific cases, such as boat, cable car and airmobile, function only as complements to other transportation systems (BNDES, 2018).

The bus public transportation service is the primary mode of public transportation, present in 2,901 Brazilian municipalities, representing 52% of existing municipalities (BRASIL, 2021), and a large part of Brazilian cities have a collective public transport system incapable of competing with the individual mode, due to the lack of proper planning, associated with rapid urbanization rates and the absence of prioritization for public transportation modes. These factors result in various externalities related to the inefficiency of the public transportation system, such as operational difficulties with increasing travel times, pollutant emissions, loss of operational efficiency, and high transportation fares (BRASIL, 2012).

Given this reality and in response to the Sustainable Development Goals (SDGs) established by the UN, through the 2030 Agenda, SDG 11, target 11.2, provides:

by 2030, provide access to safe, affordable, sustainable, and accessible transportation systems for all, improving road safety through the expansion of public transportation, with special attention to the needs of vulnerable people, women, children, persons with disabilities, and older persons (UN, 2015, n.p.).

Brazil ranks fifth among the largest climate polluters, accounting for about 3.2% of the total from all countries, behind China, the USA, Russia, and India. Brazil's per capita emissions are also higher than the global average. In 2020, the average CO₂ emission per Brazilian was 10.2 tons, compared to the global average of 6.7 (SEEG, 2021). Additionally, according to SEEG (2021), the transportation activity is the most significant emitter of greenhouse gases resulting from fuel combustion. Machado and Piccinini (2018) highlight that in 2018, 3.5 million new vehicles were circulating in Brazilian cities, and 43,000 people died as a result of traffic accidents.

According to the National Inventory of Anthropogenic Emissions and Removals of Greenhouse Gases (GHG), in 2016, road transportation contributed to about 13% of all carbon dioxide emissions. According to the São Paulo State Climate Change Program - PROCLIMA, CO₂ from fossil fuel combustion (coal, oil, natural gas, peat) is responsible for about 60% of the greenhouse effect, remaining in the atmosphere for hundreds of years (CETESB, 2022), contributing to global warming.

Given these numbers, for Brazil to meet the targets set in the National Plan on Climate Change related to transportation, it is necessary to encourage improvements in the public transportation system. According to Carvalho (2011), bus systems that use diesel fuel are less polluting in terms of emissions compared to individual vehicle trips. To meet climate change targets and ensure resilience, investment in low-carbon transportation is essential, also ensuring resilience to the impacts of climate change (IPCC, 2020).

Transportation plays a significant role in sustainable development, as it promotes economic growth, social inclusion, urban expansion, activity distribution, and equity in the use of urban space (ABREU; SANTOS, 2019; QUINTERO-GONZÁLEZ, 2019; MEAD, 2021). However, transportation is also a major culprit, as it is responsible for a significant share of greenhouse gas emissions, highlighting the need for investments in research and public policies that encourage the development of less polluting vehicles, as well as promoting public

transportation. In the same vein, Machado and Piccinini (2018) point out that while transportation is necessary for urban development, it also has negative effects on the economy and the well-being of the population.

As Abreu and Santos (2019) explain, efficient transportation systems are fundamental for the sustainable development of cities, as the lack of transportation hinders citizens from physically accessing jobs, healthcare services, education, and other needs.

According to Maciorowski and Souza (2018), the concept of sustainability, though lacking a consensus definition, is based on the worsening transportation problems and the need for a new approach to mobility planning.

In the terms of the Center for Sustainable Transport (CTS, 2002), a sustainable transportation system must meet the requirement of limiting emissions and waste according to the planet’s capacity, while minimizing the consumption of non-renewable resources.

Limited public budgets in developing countries and concerns about fiscal sustainability in developed countries emphasize the need to focus on the efficiency of transportation investments. Efficiency allows countries to achieve a specific economic goal with lower levels of investment (KYRIACOU; MUINELO-GALLO; ROCA-SAGALÉS, 2019).

5 RESULTS

In the last decade, urban mobility has been recognized in Brazil as a public policy priority at the federal, state, and municipal levels, also establishing criteria and guidelines for the implementation of urban public transportation as a guarantee of accessibility, coupled with the results of the study conducted by Kyriacou, Muine-lo-Gallo, and Roca-Sagalés (2019) suggesting that simply increasing public investment in transportation infrastructure will not lead to efficient results in the absence of good governance.

There is a growing awareness that inefficient infrastructure investment is determined by inadequate governance (KYRIACOU; MUINELO-GALLO; ROCA-SAGALÉS, 2019). Given these factors, Brazil has the significant task of fulfilling the guidelines established in the National Urban Mobility Policy and, as a result, offering public transportation as an instrument to mitigate global warming and meet SDG 11, target 11.2, established by the UN.

According to SEEG (2021), some solutions for urban mobility have been suggested, such as territorial planning, reducing motorized trips, and prioritizing active mobility and collective passenger transportation.

Nieuwenhuijsenÿ (2020) showed that cities can become healthier through better urban and transportation planning. To this end, public policies focused on changes in land use and occupation, reducing car dependency, and advances in public transportation are essential, along with the greening of cities, citizen involvement, collaboration, leadership, and systemic approaches.

Villada and Portugal (2015) note that Transit Oriented Development (TOD) favors the connection between urban planning and transportation, as it considers land use and high-capacity and non-motorized transportation to generate high passenger demand in the public transportation system while also creating pleasant and safe neighborhoods, valuing development in inner city areas. The same authors state that it is essential to have a high-quality high-capacity transportation mode station, be it a subway or BRT.

Quintero-González (2019) suggests implementing TOD for cities in Colombia and developing alternative urban public transportation systems, recommending the implementation of subways, electric transportation, and bicycles.

6 CONCLUSIOS

Discussions about more efficient and sustainable transportation methods are taking place worldwide. The sustainability of cities depends on good transportation methods. Research results indicate that government intervention can be important for establishing more sustainable transportation modes.

In this regard, public policies focused on land use and occupation are crucial. Generally, motorized transportation occurs because workplaces are far from residences. As long as public transportation presents issues with timeliness and high costs, citizens tend to prefer individual motorized transportation, compromising urban sustainability. Reducing car dependency and advancing public transportation depends on systemic approaches, in terms of land use and occupation policies, and adequate urban design.

Road infrastructure through avenues, streets, walkways, and individual, collective, and active transportation provides conditions for urban mobility, which can be achieved by quality access to urban public transportation services, aiming to contribute to target 11.2 of Sustainable Development Goal 11 of the 2030 Agenda.

Air and environmental pollution are harmful results of using individual vehicles as the primary mode of transportation in cities and metropolitan regions, exemplifying the lack of incentive for urban public transportation.

Despite the PNMU guidelines for urban mobility, there are gaps from public managers in creating urban mobility plans, investing in urban road infrastructure, and implementing policies related to urban public transportation, highlighting the challenges that must be overcome for Brazil to meet SDG 11, target 11.2.

There is no doubt about the urgent need to invest in implementing alternative public transportation methods and ensuring access to safe, accessible, and sustainable transportation systems in all Brazilian municipalities.

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