Urban Public Transport as a Basis for Sustainable Mobility Development in the Transition from Private Vehicles to Urban Public Transport: A Case Study of Elbasan

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https://doi.org/10.18280/ijsdp.181126

Received: 26 July 2023
Revised: 9 October 2023
Accepted: 29 October 2023
Available online: 30 November 2023

Keywords:
urban transport terminal evaluation, transportation modernisation, sustainable urban mobility, logistics, spatial development

ABSTRACT

This study is aimed at evaluating the functionality of urban transport terminals in Elbasan City, identifying potential shortcomings in their modernization process, and providing actionable recommendations to enhance the quality of urban transit services. The study also investigates the challenges and impacts associated with transitioning from private vehicles to urban public transport systems within the city. Various research methods, including analytical, classification, functional, and statistical approaches, were employed. The research scrutinizes the unique aspects of the city's urban functioning and pinpoints the errors made during terminal modernization, further exploring their underlying causes. It also examined strategies to improve transport mobility. Analyzing the system's operation is crucial to understanding its effectiveness, growth, and the complexities associated with the shift from private cars to urban public transport in Elbasan. This research also evaluates urban transport terminal-related concerns, their importance in the context of urban transport, and their implications. Based on the findings, recommendations were proposed to address these concerns. The study's findings underscore the importance of enhancing urban public transport. It highlights that boosting the transportation potential is not only crucial for meeting the community's transportation needs but also plays a pivotal role in advancing logistics.

1. INTRODUCTION

Urban public transportation is a vital component of city infrastructure, enabling mobility of people and goods. An efficient public transport system promotes economic growth, reduces traffic congestion and environmental impact of private vehicles, and improves overall quality of life in cities. At the core of urban public transport are multimodal terminals that integrate different transportation modes like buses, trains, metro etc. These terminals facilitate seamless transfer between modes and provide various passenger amenities. However, developing efficient urban transport terminals remains a challenge worldwide.

Following Shumka et al. [1], the development of public logistics as an element of improving the quality of life of residents using permanent logistics services is an important step that will lead to progressive service for residents and the development of the settlement. However, the problem of improving public logistics was not mentioned, as some mistakes were made at the stage of route development and during the operation of this process, which is related to the issues of determining and optimising indicators at the stages of design, operation, and development of logistics routes, as well as due to the growing need for cheap transportation.

The repercussions of rapid urban growth, as highlighted by Ševčenko-Kozlovska and Čižiūnienė [2], involves an increase in the number of private cars and an in the load on urban transport, which is operated at full capacity or almost at full capacity. Now, in this area, it is necessary to increase the number of public transport terminals to increase the number of operating vehicles and modernise logistics processes, which will raise the quality of transport services to a high level.

However, following Odame et al. [3], the calculation of transport needs for the medium and long-term perspective should be based on the existing directions of development of a particular business segment and should consider the state of the economy in general. The entire public transport system was analysed, and it was determined that the intercity transport market is an extremely important indicator of the country's economic situation. Public transport participates in the production processes of economic entities within the framework of transporting manufactured products and provides logistics services to objects of economic relations (the country, enterprises, and people) [4].

This suggests a pressing need to enhance the efficiency of public transport and foreign trade processes through more advanced terminal improvements. Gorji et al. [5] note that the demand for a highly developed public transport system increases even more with integration into the European and global geo-economy, and therefore becomes the basis for the effective inclusion of any state in the world community and taking a position in it that meets the characteristics of a highly developed country.

The correlation between the degree of urban transport development, its usage levels, and the efficiency of various logistical aspects, such as those within a city, has not been
fully considered. Following Pastor Monteza et al. [6], the advancement of logistics management theoretical features of public transport networks in cities is determined by many factors. The most important of them is the need to divide the available financial income of households between the purchase of various goods and discussions that would make it possible to meet the needs of the population.

Prior studies have highlighted the importance of advancing public transportation for economic development and integration into the global economy. However, there is limited evaluation of the functionality and modernization needs of urban public transport terminals themselves. The aim of the study is to perform an objective analysis to identify problems and mistakes in the process of improving urban public transport terminals as the basis for sustainable mobility development for moving from private vehicles to urban public transport, at the current stage of development of this sector on the example of Elbasan city.

2. METHODOLOGY

This study utilized a mixed methods approach combining quantitative analysis of secondary data with a qualitative review of public transport and terminal development policies and plans.

To evaluate the functionality of Elbasan's public transport terminals, passenger volumes and service frequency data was collected from publicly available statistics published by the Albanian Ministry of Transport and Infrastructure. These metrics were analyzed to assess capacity utilization and identify bottlenecks.

Qualitative analysis involved reviewing Elbasan's public transportation strategic plans and national policies around multimodal terminal development. Documents were selected based on relevance to the research objectives. A deductive coding process was used to extract information on modernization needs and transition challenges.

To assess the impacts of transitioning from private to public transportation, a literature review was conducted to synthesize evidence on effects on congestion, emissions, safety, costs, and other domains. Relevant academic studies and government reports published since 2010 were searched in databases like Scopus and Web of Science.

Quantitative data was analyzed using Microsoft Excel to calculate summary statistics and create visualizations. Qualitative data was organized and coded using NVivo. A narrative synthesis approach was then used to integrate findings across the quantitative statistics, document review, and literature synthesis.

This triangulation of different data sources and analysis techniques aimed to provide a comprehensive evaluation of Elbasan's public transport terminals and the potential impacts of enhancing the public transportation system. The methods employed allow for replication and extension of the study to other cities.

3. RESULTS

To ensure reliable transport for the population and productive operation of public transport in various cities, it is necessary to develop the production of urban transport, namely with the use of advanced urban public transport terminals, especially in the precise design and modelling of these terminals, which are most often used for public transport, to increase the logistics potential of transporting the population in cities and regions. The construction of the multimodal terminal in Elbasan, next to the railway station, is important for the mobility of the population. Its strategic location means that it is an important infrastructure hub and will remain so in the long term. At the same time, increased use of urban public transport will reduce the use of private cars, which will have a direct impact on reducing air pollution from exhaust gases and noise, as well as indirectly affecting household finances. The proposal aims to make urban public transport more attractive, flexible, and efficient. Modern terminals allow passengers to change from one mode of transport conveniently and quickly to another, reduce waiting time and improve the level of service, comfortably wait for the next flight, and provide access to various services such as cafés, shops, toilets, luggage storage, waiting areas, destinations, and safe departure and arrival. One of the key elements of the everyday culture of using public transport is status interaction. The status of a passenger is often determined by social position, economic status, and appearance. As a result, discriminatory practices may arise, such as denial of access to transport based on appearance or ethnicity.

An important issue that needs to be addressed today is the mistakes in the development and improvement of urban public transport terminals that increase the logistics potential of transporting citizens in cities and their modelling, the reliability of the services provided and the provision of safe transportation to the population by this facility, namely public transport, the efficiency of their mechanisms in remote areas and further development in the use of public transport data in the city, and sometimes by rail mechanisms. Benefits of building a multimodal terminal in Elbasan:

- lowered traffic jam rate;
- higher urban bus system efficiency;
- reduced bus arrival delays;
- increased travel times coordination between routes;
- reduced the number of road accidents;
- lower fare;
- an improved system and route efficiency (increased attractiveness of transport hubs);
- lowered air pollution [7].

For example, improving public transport and promoting cycling is necessary to reduce congestion and congestion. Reliable infrastructure for cycling and walking can also reduce the number of cars on the road, reduce congestion and promote a healthy lifestyle, with congestion damage in European cities estimated at €80 million [8]. It is necessary to find and resolve the causes of errors in the operation of public transport and the impact of these errors on the quality of comfort provided to residents in cities. Data on the modes of transport used by residents of the municipality of Elbasan, obtained as a result of a survey conducted by the Institute for Transport Studies, show that:

- 32% of residents travel by foot;
- 11% travel by bike;
- 11% use public transport;
- 49% use personal vehicles (cars, motorbikes) (Figure 1).
Urban public transport is one of the most important services provided by the municipality for the normal functioning of mobility in the city, albeit at a low level of about 11% [10]. The development of new methods to address the challenges of the development, design, and improvement of urban public transport terminals to increase the logistics potential of public transport in cities has made tremendous progress and promise. Efficient transport terminals are an important factor in improving the functioning of the passenger transport network, providing favourable conditions for passenger service, improving the quality of service, and facilitating the expansion of the public transport network. Currently, there are 8 urban public transport lines, 6 suburban lines, 33 intercity lines and 8 international lines in Elbasan [11].

Modern electronics and computerised data processing of public transport signage, which are the basis for sustainable mobility development for shifting from private vehicles to urban public transport, can help significantly increase the capacity of these processes and mechanisms and increase the demand for the use of public transport hubs in cities if they are improved. As traffic congestion in growing megacities becomes more and more severe, leading to lower productivity, higher transport costs and deteriorating environmental conditions in cities, the construction of transport terminals in large cities is essential to ensure efficient and safe passenger transport. The degree of development and quality of a country's transport system can be used to judge the level of its transport. The above areas in Elbasan are currently playing an active role in the transition process, but to help passengers, all urban, suburban, and intercity routes should be integrated in a way that reduces travel time from origin to destination. In this case, passengers travelling long distances must change lines or transfer to two or three lines.

In general, the problem of optimising the elimination of errors in the improvement of urban public transport terminals has not been fully resolved.

Since the early 1950s, multimodal transport terminals have become commonplace in many developed cities around the world [15]. These terminals are designed to provide a convenient transition between different modes of transport, such as buses, trams, metro and rail. The deteriorating environmental situation and the negative impact of passenger and freight transport on the environment is a serious problem for many countries, including the European Union.

According to the European Commission, about 23% of CO₂...
emissions from transport come from cities [16]. The relationship between supply and demand in Elbasan’s urban transport systems is driving the need for more and better transport infrastructure, as well as the implementation of integrated urban development and traffic management plans in the city, as shown in Figure 2.

Figure 2. Distribution of economic sectors in Elbasan by percentage
Source: Compiled by the authors

Public transport mechanisms and their terminals are often used due to their efficiency and low cost of transportation, and there is currently an increasing interest in this process in many cities to increase logistics potential [17]. Dynamic changes in the quantity and quality of demand for transport services are an integral part of the development of modern societies. As the population grows and the economy develops, people become more mobile and have more opportunities to travel around the city and beyond. The European Union (EU) is one of the main sponsors of research and innovation in urban mobility. The EU Framework Programme provides funding for a range of research aimed at addressing urban mobility issues such as congestion, pollution, and inefficient transport [18].

Currently, multimodal terminals are the most widespread and developed at various stages due to the interest of companies and citizens in cities in the European Union and beyond. The expansion of the regional administrative territory and the increase in the number of users of urban public transport are important factors that require the construction of multimodal terminals and the integration of urban public transport routes. This can be done, for example, by building new routes that cover the surrounding area and provide connections between different modes of transport. Reallocation iterations that reduce the attractiveness of private transport and prioritise public transport can include measures such as increasing the number and frequency of public transport routes, reducing fares, and improving service quality. To improve the efficiency of public transport, several measures can also be taken to make public transport faster, safer, and more attractive to users, such as creating separate lanes for public transport on roads.

A prerequisite for the reliable functioning of urban public transport terminals in many cities is the sustainable operation of both public transport and urban transport in general. The administrative-territorial reform approved in May 2014 merged 12 other administrative units into the municipality of Elbasan in Albania [19]. This reform was introduced to improve governance and provide better services to citizens. Transport costs are one of the main factors affecting the long-distance freight market. Changes in transport prices can be caused by several factors, such as rising fuel costs, changes in taxes and tariffs, and market competition.

As a result, it turns out that the existing urban public transport terminals, which increase the logistics potential of public transport in cities, do not meet modern requirements and are considered inefficient in terms of expanding the production of innovative elements. The city of Elbasan is at an advanced stage of restructuring its urban transport system. This is an important step in the development of the city, which improves the quality and accessibility of transport services for residents and reduces the negative impact on the environment. Restructuring can include various measures, such as replacing old vehicles with more modern and environmentally friendly ones, improving infrastructure for cyclists and pedestrians, expanding the public transport network, and improving the regulatory framework. The result of the restructuring should be a more efficient and sustainable transport system that meets the needs of residents and contributes to the development of the city. The emergence and development of infrastructure is an important factor in economic development and improving the quality of life. Infrastructure provides easy access to goods and services, increases productivity and efficiency of production, reduces the cost of transporting and storing goods, and promotes tourism and other economic sectors.

4. DISCUSSION

The quality of research carried out on multimodal urban public transport terminals to identify errors and problems in the functioning of this facility and to improve their efficiency is one of the most pressing conditions of our time, and some problems require immediate solutions. The increase in the number of vehicles and population growth leads to an increase in demand for travel and transport services, which can lead to the overloading of transport infrastructure and a decrease in the quality of services provided, on the other hand, it can also create opportunities for the development of new transport technologies and innovations that promote mobility and improve the quality of transport services. The main components of the transport system may include road, rail, water and air transport and the associated infrastructure that ensures the smooth and efficient operation of the system.

This study, conducted to improve multimodal urban public transport terminals that increase the logistics potential of public transport in cities, allowed us to better understand the causes of errors in operation, especially in the development of logistics routes, assess the possibility of solving these problems and identify at what stage they may occur. The construction of terminals, if properly designed and located, can help to address the imbalance between the existing transport infrastructure and the mobility needs of local communities. Demand for urban freight transport is determined by several factors, such as production and consumption in the city, the presence of large industrial enterprises, the development of small and medium-sized businesses, trade, and services. It is worth noting that in the
development of design and modelling methods for improving multimodal urban public transport terminals, many countries have made a powerful step forward over the past few years [20].

While Tetiana [14] proposed customized scheduling and vehicle allocation models for optimizing departures at transport hubs, this paper argues that physical infrastructure and layout improvements are needed before such operational optimizations can be effective in the Elbasan context. The qualitative document analysis enabled a more comprehensive assessment of the upgrades required compared to solely using quantitative metrics.

The results indicate that enhancing Elbasan's public transport system can reduce congestion, emissions, costs, and road accidents while improving accessibility. Multiple studies have similarly found that public transit expansion achieves sustainability and mobility benefits in cities [7, 16]. The mixed methods approach strengthened these conclusions by triangulating across literature review, document analysis, and ridership data.

This research proposes modernizing terminals, integrating routes, and reallocating street space as strategies to facilitate the transition from private to public transportation in Elbasan. While some previous studies have focused narrowly on infrastructure interventions like adding bus lanes [19], the current study adopts a more systemic approach considering terminals, operations, and policy dimensions. The qualitative policy analysis specifically highlighted the need for holistic initiatives encompassing regulation, land use planning, and transit investments.

Balancing sustainable transport and urban transport improvements requires cooperation between different stakeholders, including local authorities, transport operators, engineers, and city residents. Designed artificial roads are typically paid for by users to offset construction and maintenance costs.

When improving multimodal urban public transport terminals, as well as public transport and their elements to better handle a complex technical process, process models should adequately describe the essence of the work and be simple and implementable. Considering the principles of sustainable development, urban public transport is a more acceptable option for passenger transport in cities, as it reduces the use of private cars, reduces emissions, and facilitates road infrastructure.

ALICE is an initiative that brings together more than 280 companies, associations, and organisations from more than 20 European countries to develop a common strategy for the development of logistics and supply chain management technologies. The initiative focuses on developing innovative solutions and creating favourable conditions for their implementation in the European logistics sector.

The professionalism of the staff and timely diagnostics of equipment play a key role in ensuring the efficiency of public mechanisms to increase the logistics potential of urban transport in cities. In most cases, urban public transport offers cheaper fares than private vehicles, thus reducing travel costs and providing access to more people. Dedicated lanes for public transport can improve urban traffic conditions by reducing congestion and increasing the speed of public transport. They can improve air quality in cities by increasing the efficiency and convenience of public transport, reducing fuel and operating costs, and reducing pollutant emissions from vehicles parked in congestion [21].

Currently, it is necessary to improve the quality of various methods and devices for improving multimodal terminals of urban public transport to improve logistics services, for the effective operation of the entire mechanism, using new methods, it was decided that to begin with, in the process of improving these terminals, it is necessary to improve the quality of public transport, especially individual parts in them. The entire mechanism of logistics and public services was analysed, and it was decided that to apply various constructions, especially theoretical ones, it is necessary to have a basic knowledge of physical devices and their quantity, which will help to understand the process of improving multimodal urban public transport terminals to increase the logistics potential of public transport in cities under appropriate conditions. It can also be added that, due to its size and scale, the Port of Rotterdam's operations have a significant impact on the environment. Air pollution, noise and emissions from ships can harm the environment and the health of residents. The Port of Rotterdam is taking steps to reduce its carbon footprint and to introduce more environmentally friendly technologies.

As highlighted in the analysis of the Port of Rotterdam, maritime transportation hubs like ports can contribute significantly to air pollution, noise, and other environmental hazards that impact community health. This aligns with European Commission data indicating that urban transport accounts for around 23% of transport-related CO₂ emissions [16].

The results of this study suggest that expanding and improving public transit systems can help mitigate these environmental externalities in multiple ways. First, by reducing private vehicle usage, public transport can directly lower greenhouse gas emissions, local air pollutants, and noise pollution. Second, consolidating passenger transport through efficient multimodal terminals instead of individual routes enables further optimization of energy, land use, and resource efficiency [7].

Specific recommendations to leverage public transport’s environmental benefits include transitioning to electric buses to reduce emissions, designing green terminals with features like solar panels and natural lighting, and integrating active mobility like walking and biking access to stations. Additionally, policies like congestion charging and low emission zones could restrict private vehicle use and incentivize the shift to transit. Applying these suggestions in Elbasan and other cities would help create more sustainable urban mobility systems.

Referring to Li and Wang [22] definition, since fuel costs are an important determinant of the cost of transport services, rising fuel prices may be one of the reasons for the growth of road transport costs. A reduction in transport costs can be caused by lower fuel costs, but it can also be caused by competition in the transport market. High competition in the transport market can force transport companies to reduce prices to attract customers and thus reduce transport costs.

This shows that there are coincidences with the studies carried out by this author, for example, in the modern world, when designing and modelling methods for improving automotive mechanisms, it is necessary to consider all the factors that affect the quality of the presented type of work to increase the logistics potential of road transport. However, this research did not consider the fact that an important property of cost savings in road transport is a high level of competition in a highly saturated transport market.
As an important global logistics hub, the port of Hamburg ensures the efficient transport of goods by all modes of transport, according to researchers Ma et al. [23]. Connected to many terminals around the world, the port ensures the smooth flow of goods between different regions. From Hamburg, sea routes connect to major ports on all continents, making international transport possible. In addition, the port has well-developed rail and road connections, enabling goods to be transported via national and international rail and road networks. The Port of Hamburg also plays a very important role in containerised transport. It offers a wide range of container services and easy access to container terminals where cargo can be transhipped or transferred to other modes of transport.

However, for the correct operation of urban public transport and multimodal terminals, it is necessary to check the buildings on an ongoing basis, which will soon lead to a high logistics potential of public transport in the country. Therefore, there are differences with this work in that the author did not notice the importance of the peculiarities of using this type of terminal, timely study of data and possible causes of malfunctions, for further promising development of the use of urban and public mechanisms to increase the prospects of the logistics sector in the city of Sufyan et al. [24] note that due to the large number of trains, passengers and vehicles passing through the area around Grand Central Terminal, there is a lot of congestion on the roads around the terminal, which makes it difficult to access the terminal and causes traffic delays.

The research results on the characteristics of the Grand Central Terminal have been analysed and considered more precisely. It can be added that the increase of the logistics potential of public transport directly depends on the improvement and innovation of logistics services and the provision of quality service of multimodal terminals and their mechanisms, and ensuring the comfort and safety of passengers is the main task of the Grand Central Terminal. Cleanliness, sufficient lighting, information boards, alarms and safe routes are essential elements of terminal management.

Kar et al. [25] noted in their study that road expansion increases traffic, but it is not the only factor that affects it. Other factors include an increase in population and vehicle fleet size, an increase in the volume of goods transported due to improved economic conditions, and a deterioration in the quality and availability of public transport in urban areas.

However, road expansion is only one of the factors of traffic growth, but not the main one. It can also be noted that this is related to the insufficient competition equality between different modes of transport and developed urban public transport and reduced dependence on road transport, which causes a difference between this study and the author's research [26]. Following Abu-Rumeileh et al. [27], Charing Cross is an important interchange point for various modes of metro and rail transport. With so many travellers arriving and departing, it is very difficult to find the right route or platform to transfer to.

Beyond environmental outcomes, enhancing Elbasan's public transport based on the study findings can lead to economic, social, and governance benefits. Specific examples include reduced congestion and transport costs, improved access for disadvantaged groups, and better coordinated urban planning. To achieve these potential gains, municipalities should invest in upgrading terminals, create dedicated bus lanes, and implement integrated smart ticketing and passenger information systems. Effective policies may encompass public-private partnerships, comprehensive mobility plans, and streamlined regulatory frameworks [28]. Further implications include increased public transport financing, multi-jurisdictional coordination, and leveraging of emerging technologies like electric and autonomous vehicles. By comprehensively addressing terminals, operations, policy, and innovation, cities can reap the full advantages of public transport advancement.

5. CONCLUSIONS

This research carries important implications for the advancement of public transportation systems and sustainable mobility in cities. By evaluating the functionality of terminals in Elbasan, the study provides novel evidence to inform upgrades that can improve service quality, operations, and environmental performance. The findings indicate that investing in multimodal facilities and better integrating routes can facilitate the shift away from private vehicles toward more efficient shared transit.

The results highlight the need for continued research and innovation in emerging technologies for low-emission buses, autonomous vehicles, intelligent transportation systems, and responsive on-demand services. Further work should explore how these technologies can be integrated with and enhance conventional public transport. Additionally, future studies could usefully assess new financing and partnership models to fund large-scale terminal projects and system expansions.

On a practical level, the recommendations can guide municipalities and transport agencies in designing people-centric terminals, creating dedicated bus lanes, optimizing schedules, implementing smart ticketing, and adopting supportive policies. By taking such actions, cities can unlock the diverse benefits of high-quality public transportation, from reduced congestion and emissions to improved safety, affordability and equity of access. This study contributes actionable evidence to inform transport planning and policy at municipal to national levels.

In conclusion, advanced public transport enabled by multimodal terminals is crucial for sustainable mobility in the 21st century. This research indicates that realizing the potential of public transit requires comprehensive initiatives encompassing infrastructure, operations, regulation, and innovation. The findings and recommendations provide key insights to support the improvement of terminals and services in Elbasan and beyond. With sound planning and investment, cities can transition toward efficient, low-carbon mobility that serves the needs of diverse populations.

REFERENCES


