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An Examination of the Rise of Informal Public Transport Systems in Developing Countries and the Critiques About Bus Rapid Transit Systems as a Desired Solution

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Abstract

This article provides a review of the general characteristics of Informal Public Transport (IPT) systems, the reasons behind the increasing use of these systems in developing countries, and the evaluation of Bus Rapid Transit Systems (BRTS) as an alternative solution to IPTs. IPTs, whose use has increased significantly in many countries where Formal Public Transport is insufficient, are different in their service, operation, finance, monitoring and labour features. These systems' usage has increased in developing countries for many economic, social and political reasons such as low income, rapid population growth, increase in demand, urban macroform, job opportunities and more flexible routes. However, besides the positive effects of these systems, there are many adverse effects. It is challenging to transfer the public transport schemes made in developed countries directly to these countries, and understanding the reasons in detail allows to offer the right solution. Nevertheless, BRTS, which are segregated busways, is seen as a solution in many countries, and there are many agreeing and disagreeing arguments for this idea in the literature. Although there are examples where these systems improve public transport systems, there are many examples where they do not contribute to the solution. As a result, it has been reached that the diversity of the reasons for the increase in the use of IPT systems is high, and BRTS can be an alternative, producing spatially, economically, environmentally and politically appropriate solutions according to the local characteristics of the countries can be more beneficial than a single solution.

Keywords: bus rapid transit systems, developing countries, informal public transport

Gelişmekte Olan Ülkelerde Ara Toplu Taşıma Sistemlerinin Yükselişinin ve Hızlı Otobüs Taşımacılığı Sistemlerinin Çözüm Olarak Değerlendirilmesinin İncelenmesi

Öz

Bu makale, Ara Toplu Toplu Taşıma (Informal Public Transport - IPT) sistemlerinin genel özelliklerini, bu sistemlerin gelişmekte olan ülkelerde artan kullanımının arkasındaki nedenleri ve IPT'lere alternatif bir çözüm olarak Hızlı Otobüs Taşımacılığı Sistemlerinin (Bus Rapid Transit Systems - BRTS) değerlendirilmesini sunmaktadır. Resmi toplu taşımacılık sistemlerinin yetersiz olduğu birçok ülkede kullanımı önemli ölçüde artan IPT'ler hizmet, işletme, finans, izleme ve işçilik özellikleri bakımından farklılık göstermektedir. Bu sistemlerin kullanımı gelişmekte olan ülkelerde düşük gelir, hızlı nüfus artışı, ulaşımda talep artışı, kentsel makroform, iş olanakları ve daha esnek güzergahlar gibi birçok ekonomik, sosyal ve politik nedenlerle artmıştır. Ancak bu sistemlerin olumlu etkilerinin yanı sıra birçok olumsuz etkisi de bulunmaktadır. Gelişmiş ülkelerde yapılan toplu taşıma programlarının doğrudan bu ülkelere aktarılması zordur ve gelişmekte olan ülkelerde güncel durumdaki IPT kullanımının nedenlerinin ayrıntılı olarak anlaşılması doğru çözümün sunulmasını sağlayabilecektir. Ayrılmış otobüs yolları olan BRTS birçok ülkede ulaşım kaynaklı problemlere çözüm olarak görülmektedir ancak literatürde bu çözüme yönelik olumlu ve olumsuz eleştiriler yer almaktadır. Bu sistemlerin toplu taşıma sistemlerini iyileştirdiği örnekler olsa da çözüme katkı sağlamadığı pek çok örnek bulunmaktadır. Sonuç olarak, IPT sistemlerinin kullanımının artmasının nedenlerinin çeşitliliğinin yüksek olduğu ve tek bir çözüme bağlı kalmaktansa bölgenin yerel özelliklerine göre mekansal, ekonomik, çevresel ve politik olarak uygun çözümler üretilmesi gerektiği sonucuna ulaşılmıştır.

Anahtar Kelimeler: ara toplu taşıma sistemleri, gelişmekte olan ülkeler, hızlı otobüs taşımacılığı sistemleri

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An Examination of the Rise of Informal Public Transport Systems in Developing Countries and the Critiques About Bus Rapid Transit Systems as a Desired Solution

The need to reduce the rising use of motor vehicles with transportation plans and improve sustainable transportation modes to meet the increases in mobility is growing worldwide (Black, 2018). Transportation problems, especially in developing countries, should be evaluated based on the adequacy of public transport (PT) services. Formal Public Transport (FPT), which requires high-level organization and government regulation, and Informal Public Transport (IPT), which has informality in services, have importance in this direction (Kumar, Zimmerman, and Arroyo-Arroyo, 2021). However, the two systems have many differences, as can be seen in Table 1. Although the provision of PT is the duty of the government, resources and capacity are insufficient for PT systems in developing countries (Kumar, Singh, Ghate, Pal, and Wilson, 2016). For this reason, decreases in FPT and increases in IPT are observed, and it should be questioned whether this causes a degradation in transport systems or is the reason for this (Kumar et al., 2021). In many developing countries, Bus Rapid Transit Systems (BRTS) are seen as the desired solution to PT problems, and investments are made in this direction by utilizing the examples of implementations in the world (Wood, 2014). For this reason, it is necessary to examine the reasons for existence, characteristics, and effects of IPT in detail and to examine whether BRTS will be a definitive solution to PT problems and negative consequences. In this study, the basic features of IPT systems will be examined, the reasons for their widespread use in developing countries will be evaluated, and a critical discussion will be presented on seeing BRTS as the desired solution.

2. Methodology

In this paper, relevant publications are first analysed to understand IPT and BRTS systems better. In addition, understanding the characteristics of these systems in developing countries is added to the research content. Various databases, especially Web of Science and Scopus, are used to access these publications. Related keywords are defined as public transport, informal public transport, FPT, IPT, developing countries, bus rapid transit systems, and BRTS. These keywords are used in different combinations to find common articles. Where relevant, the searches were extended by adding the necessary country names. In addition to electronic databases, official website publications of developing countries are also analysed. Although many studies from the literature are evaluated, 40 of them are found suitable for evaluation within the article. The reason for this is the neglect of studies that do not mention the findings on the reasons for the emergence, effects and results of IPT and BRTS systems in developed countries.

3. Informal Public Transport (IPT)

With the rapidly increasing urbanization and mobility in developing countries, PT services have become unable to meet the needs (Behal, Kumar, and Tiwari, 2020). Because highly regulated FPTs have to comply with all government rules (in terms of schedule, routes, stops, operations, fares), they are costly for these countries (Kumar et al., 2021). Therefore, small-scale operators have started the IPT system without government support to meet this demand. This system, also known as Intermediate Public Transport and Paratransit, includes privately operated PT modes such as rickshaws, mini-buses and taxis (Kumar et al., 2016). These modes are called by different names in different countries such as Combis, TroTro, Matatu, Chapa (Figure 1) but have the same similar features (Behrens, Saddier, Pickup, and Durant, 2021). These modes generally consist of small, ageing, low-performance motor vehicles (Cervero, 2000).

Table 1. ***Dimensions of FPT and IPT (Cervero, 2000)***

Dimension	**Formal**	**Informal**
Economic Standing	Middle and Upper Class	Lower Class, Poor
Political Influence	Strong, Empowered	Weak
Legitimacy	Legal, Regulated	Illegal, Unregulated
Society and Culture	Modern	Traditional
Internal Organization	Orderly, Vertically Integrated	Less Structured, Horizontally Integrated
Assets and Capitalization	Intensive	Minimal
Financing and Credit Access	Commercial Banks	Family and Loan Sharks
Technology	High Tech	Low tech
Skill Levels	Knowledge−Based, Cognitive	Labor−Based, Adaptive
Legal Status	Registered	Unregistered
Supply		
Service Structure	Fixed Route, Standardized	Variable Route, Adaptive
Delivery	Line−Haul, Trunk−Line	Distribution, Feeder
Scheduling	Fixed Timetable	Market Driven, Adaptive
Reliability	Reasonably Dependable	Inconsistent
Vehicle Type	Large	Small to Medium
Ownership	Public and Private	Private
Market Perspective	Monopolist	Entrepreneurial
Labor	Semi−Skilled	Semi−to−Non−Skilled
Organization	Bureaucracy	Route Associations
Demand & Price		
Market Focus	Mixed	Niche
Main Trip Purposes	Work, School Shp,	Mode Access
Trip Distances	Medium to Long	Short to Medium
Customer Relations	Impersonal	Interpersonal
Socio − Demographics	Low to Moderate Income	Low Income
Fare Structures	Fixed, Uniform	Variable, Differentiated

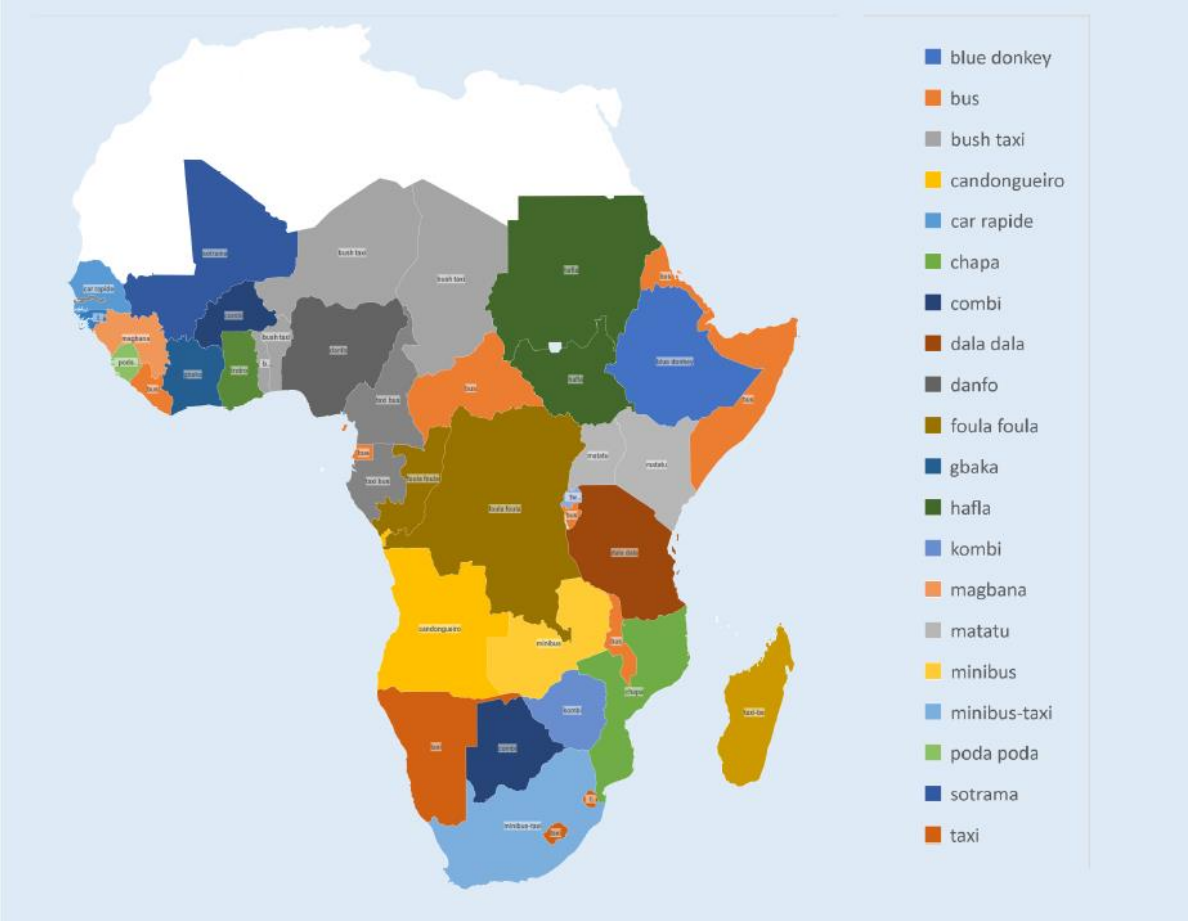

Figure 1. Common IPTs in African cities (Behrens et al., 2021)

It is possible to evaluate the IPT sector with its service features, operation system and financial aspects (Kumar et al., 2021). IPT services are provided whenever the operators want, and they depart from the terminals when sufficient capacity is reached for the operator or with a fixed service frequency (Kumar et al., 2016). They can stop to pick up or drop off passengers wherever they want without having formal stops. They can change the route and do not have a regular schedule (Cervero, 1998b). Remarkably, IPT modes are accessible and adjustable by different groups (Vuchic, 2007). For example, while small vehicles can serve areas with low passenger volume, taxis provide more personalized service, and rickshaws provide this service to different segments of society. Pricing generally focuses on profit maximization as IPTs are served by private individuals and operators (Shimazaki & Rahman, 1995). Also, sometimes the fare of IPT modes can be higher because they provide high-frequency service, and it is decided in three ways as fixed, metered and negotiated (Shimazaki & Rahman, 1995). Besides, IPTs are politically weak, under-represented officially, and the system of operators and drivers is maintained by associations or unions (Cervero, 2000). Management is generally carried out according to the net-cost model operation system (Cervero, 2000). In addition, situations such as excessive passenger intake, use of old vehicles, and low use of clean fuels are encountered in these vehicles for profit (Kumar et al., 2016). All these general features of IPT modes are summarized in Figure 2.

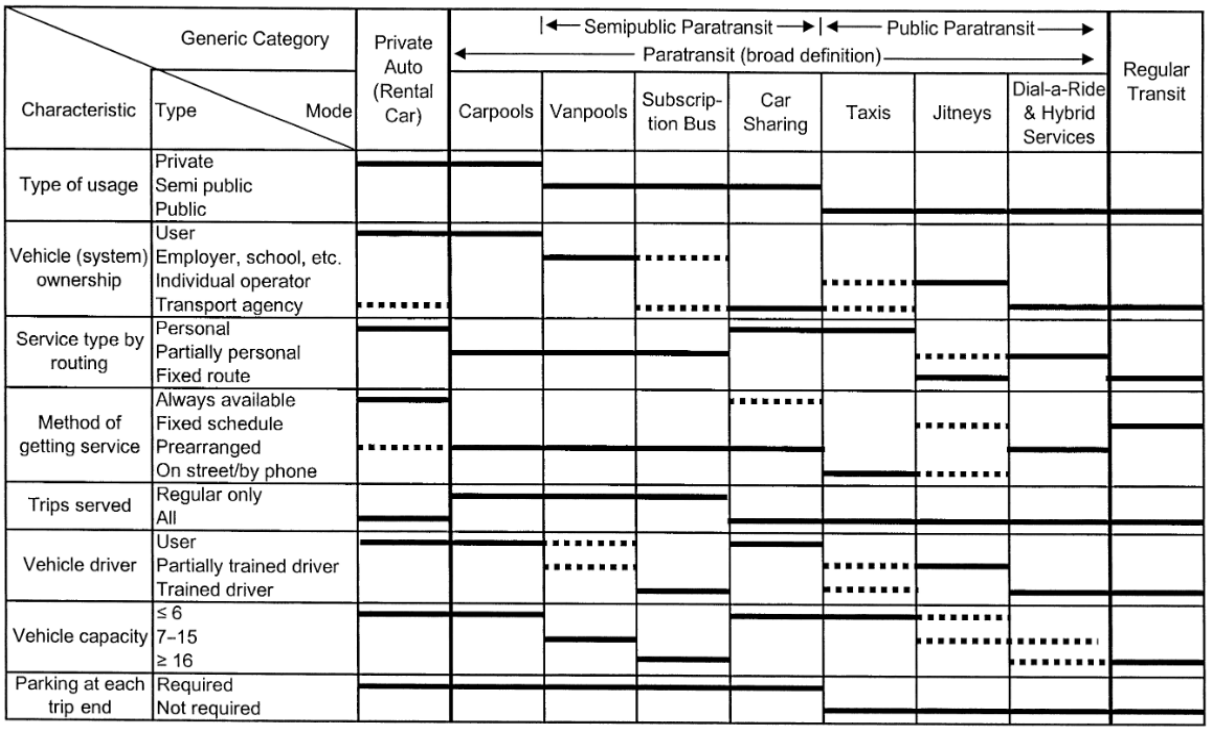

Figure 2. Basic features of IPT (Vuchic, 2007)

IPT has examples in many parts of the world. For example, when IPTs in five regions in India were examined, Tata Magics, Mahindra Gios, Chakdas, Kadukas, minibuses, motorized and bicycle rickshaws drew attention, and it was observed that they played an essential role in meeting the transportation needs of the population (Kumar et al., 2016) (Figure 3). For example, it has been seen that the manoeuvring feature of the bicycle rickshaw provides the flexibility of movement in narrow and busy streets, and IPTs are more common in urban areas. However, it has also been observed that the lack of local follow-up regarding compliance with the legislation and the violation of transportation conditions (such as carrying capacity, route, license) are common. When PUJs and tricycles in the Philippines are examined, it has been observed that their use has become a habit in society, and they only prefer FPT for long-distance journeys (Guillen, Ishida, and Okamoto, 2013). It was observed that the developments in FPT could not change this habit. Although in some countries, decisions were made entirely independent of the formal administration, for example, the routes of Daladas minibuses in Dar-Es-Salaam were fixed by the Surface and Marine Transport Regulatory Authority, or the fare and route of the Dolmuş were fixed by the municipalities in Türkiye (IUT India, 2014).

IPT systems also have adverse effects due to traffic congestion, air and noise pollution and negative contributions to traffic safety (Cervero, 2000). The first effect is that they increase traffic congestion during rush hour by providing irregular scheduling and service (Dumba, 2017). Another effect is that competition between drivers for passengers increase accident rates (Özbilen, 2016). For example, in Ankara (Türkiye), 54% of urban traffic accidents are caused by Dolmuşs (Shimazaki & Rahman, 1995). Also, the preference of high demand routes due to competition causes low demand routes to be entirely out of service (Cervero, 2000). Another impact is the safety problem caused by the drivers not having the necessary training and supervision and inadequacy and disrepair of the vehicles. For example, only half of the paratransit operators in Mexico are legally licensed (Cervero, 1998a). In addition, since the regulatory institutions are weak, there is no way for passengers to report their opinions about the service (Özbilen, 2016). Finally, their pricing cannot be integrated into transit systems (Adam Smith Institute, 1989).

Figure 3. IPT modes in India (Kumar et al., 2016)

In conclusion, IPT systems have emerged as a result of a need in many countries, and their importance has gradually increased. These systems have both positive and negative effects on these cities. It is necessary to understand why these systems are important in developing countries and make appropriate developments accordingly to solve their negative effects. For this reason, in the continuation of the study, the factors that make IPT widespread in developed countries will be examined.

4. Factors Contributing to the Rise of IPT in Developing Countries

IPT is the most common form of transportation in the world's poorest countries, especially for low-income people, and over the years, many factors have driven IPT to become widespread (Cervero & Golub, 2007). These are FPTs' inability to meet demand, rapid population growth, unplanned urban settlements, urban sprawl, increase in travel distances, inadequate transportation infrastructure, ease of adaptation of IPTs, and job opportunities for people (Kumar et al., 2021).

The most important reason for the rise of IPT is the inability of FPT services to meet the market demand (Cervero & Golub, 2007). In areas where FPT systems are irregular, unreliable, or non-existent, IPT has started to provide requisite service, especially for workers (IUT India, 2014). For this reason, IPT systems that emerged to fill these gaps and ensure that unserved regions receive service were valued and evaluated as gap fillers (Cervero, 2000). For example, in Mexico, the usage rate of minibuses and Pesero taxis, which emerged due to the decrease in the capacity of the formal bus systems and the less service area of the Metro-rail system outside the city centre, increased by 40% in 10 years (Wirth, 1997). Although there are still many security problems due to cartels today, their use is high because people do not have other alternatives to reach their jobs and they provide the link between metro stations and settlements. Also, due to insufficient municipal budgets in a significant part of Africa, transportation planning has been inadequate, and IPTs have become the only reliable service (Cervero & Golub, 2007). For this reason, people in South Africa have volunteered to pay individual fares for door-to-door services (IUT India, 2014).

The second reason is rapid population growth that occurs when transportation systems are inadequate (Dumba, 2017). For example, in Sub-Saharan Africa, the population of big cities is increasing by 4% annually (CFR, 2007). Also, it is seen that the already overpopulated population will be much higher in the coming years, and approximately 72% of the urban population lives in slum conditions (CFR, 2007). It is not unexpected that the mode these people can afford is IPT. However, income has started to rise with the increasing population, which has led to an increase in individual vehicle use (Kumar et al., 2021). The inadequacy of transport infrastructure and services in developing countries also reinforced the effects of this situation. For example, individual car ownership in Ghana has increased significantly over the years, as seen in Figure 4 (Obeng-Odoom, 2010). However, as Obeng-Odoom (2010) mentioned, traffic congestion has become an urgent problem because road infrastructure has become unable to handle this demand, and therefore IPT has gained importance. Also, less than 15% of the urban land is reserved for streets in Sub-Saharan African cities and cannot meet the demands of the growing population (Kumar et al., 2021).

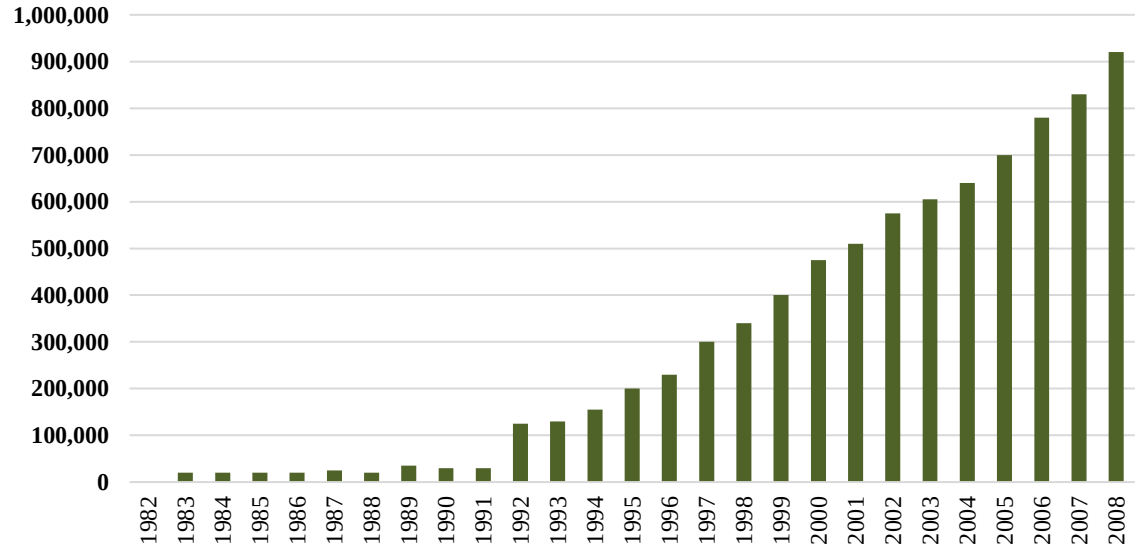

Figure 4. Change in individual car ownership in Ghana (Obeng-Odoom, 2010)

Holistic planning of land-use and transportation is one of the cornerstones of creating a sustainable city plan. For this reason, unplanned urban sprawl causes an inadequate PT system due to the spread of settlements to the city periphery and their inadequate relationship with the transportation network (Trubka, Newman, and Bilsborough, 2010). As Daisa et al. (2013) mentioned, cost-effective use of existing infrastructure that can be provided with infill settlements is not provided with urban sprawl. On the contrary, with urban sprawl, the density of the journeys decreases, the trip distances get longer, and therefore it becomes complicated for developing countries financially and politically to create a fixed route and system for PT. For example, in Sub-Saharan African cities, individual traffic flow has many-to-many travel due to homogeneous urban structure and low densities (Kumar et al., 2021). For this reason, IPT has started to gain importance in cities that do not have high-demand corridors where transportation systems will be concentrated. As another example, migrations from rural to urban in Ankara (Türkiye) in the mid-1950s affected the urban form, and the slums located in the urban fringe started the rising period of Dolmuş (Özbilen, 2016) (Figure 5).

In addition, IPT systems have operational flexibility that can efficiently adapt to the existing transport network and individuals' daily needs (Behrens et al., 2021). In IPT systems, standard routes and pricing can be changed easily and not monitored (Kumar et al., 2021). In addition, working hours are longer than FPTs (Cervero, 2000). As in India, the use of these services has increased due to the flexibility of services and pricing and the speed of adapting to changing demands (Kumar et al., 2016). For example, in Jaipur, managers work on the routes to ensure driver compatibility, and instant adjustments can be made according to the situation (Kumar et al., 2016). Other advantages of small vehicles in these cities are they can be more frequent and manoeuvrable, and individuals feel more private and safer (Cervero, 1998b). Especially in peak hours, the demands have increased due to the physical advantage. Another reason is that it can be relatively cheaper in some cases due to competition (Adam Smith Institute, 1989). For example, in Dar-es-Salaam, it has been observed that 70% of families with an informal economy prefer informal modes (Joseph et al., 2020). This is because fares depend on the individual decisions of the driver. Apart from the station, taking passengers by stopping everywhere in a competitive environment has also increased the preferability as it makes it easier for people to access the mode of transportation (Kumar et al., 2016). Also, as Behrens et al. (2021) mentioned, real-time route deviations provided more door-to-door service to passengers.

IPT systems have also been valued in creating job opportunities for low-skilled people, as most of the drivers are people who migrate from rural areas to cities (Cervero & Golub, 2007). It has been seen as an important employment area to use the idle labour force, and it has been evaluated as a source of income and a resource that can reduce poverty (Behrens et al., 2021). For example, in the Philippines, the role of IPT is quite significant in the transportation sector of approximately two million people work (Guillen et al., 2013). About 19,000 drivers work in the IPT sector in Nairobi, and it is among the most prominent informal economy sectors (Khayesi & Nafukho, 2016). Emerging business areas with IPT such as the maintenance, local vehicle production, and assemblage have also increased the demand (Cervero, 2000). For example, Sub-Saharan Africans are generally young, have little education and cannot get formal jobs, while IPT supports them as it does not have any criteria (Kumar et al., 2021)

In summary, many economic, social, and political reasons have led to the spread of IPTs in developing countries. This spread can be summarized as the inability to manage the decisions taken in line with the needs of the society by the government because of insufficient resources. In general, Bus Rapid Transit Systems (BRTS) are considered a desirable solution for solving transportation problems in developing countries.

Time Period / Topic	Urban Macroform Transformation	Modes of Transportation in the City	Important Incidents Affected Transportation			Issues of Transportation	
1920s	Densely crowded citadel town	Walking, Horsecarts, Private Car, Suburban Train	Small size settlements dominated by pedestrian trips because of topographical thresholds	Preparation of Lörcher Plan and Jansen Plan enabling a planned development		Sharp increase in the number of automobiles as a result of the establishment of the Republic	
1930s	Expansion of Old City towards south and east	Walking, Private Car, Taxi, Suburban Train, Kaptı-Kaçtı, Public Bus	Rapid increase in the motorized transportation demand	Introduction of municipality (public) bus operations		Lack of transportation service through the old city center in the first half	
1940s	Quaquaversal Expansion of old city and the beginning of unauthorized housing	Walking, Private Car, Taxi, Suburban Train, Public Bus, KaptıKaçtı, Taxi Dolmuş, Trolleybus	International transaction difficulties because of budget constraints during Second World War	Fire in the municipality bus garage		Lack of spare parts of the vehicles because of WW II	Insufficiency of Public Bus Fleet in Meeting Demand
1950s	Rapid Authorized / Unauthorized Residential Development of the City	Walking, Private Car, Taxi, Suburban Train, Taxi Dolmuş, Trolleybus, Minibus, Dolmuş	Leibrand's report on inefficient transportation network	Reorganization of public bus operations	Yücel-Uybadin plan transportation proposals	Inefficiency of radially operating bus operations of EGO	The beginning of the private entrepreneurship dominance in urban transport
1960s	Highway based development of urban macroform	Walking, Private Car, Taxi, Suburban Train, Taxi Dolmuş, Trolleybus, Minibus-Dolmuş, Station-Dolmuş	Establishment of minibus and automobile production factories	Reorganization of dolmuş operations and emergence of a new type of dolmuş	Restriction in the number of taxi and dolmuş vehicles	Rapid increase in the number of motorized vehicles	Decrease in the share of publicly operated public transport vehicles

Figure 5. Relation between urban macroform and IPTS in Ankara (Özbilen, 2016)

5. Arguments on Bus Rapid Transit Systems (BRTS)

Bus Rapid Transit Systems (BRTS) is a bus-based transit system with segregated busways, formal management, fixed stations, and routes (Wright & Hook, 2007). Nowadays, there are BRTS in 177 cities, carrying around 33 million people daily (BRT Data, 2021). One of its important features is that it can be up to 20 times cheaper than light rail transit systems and up to 100 times cheaper than metro systems (Wright & Hook, 2007). Alternative PT methods which are effective and inexpensive are sought in developing and developed countries, and BRTS investments are considered valuable (Hensher & Golob, 2008). BRTS is preferred over rail systems with higher user capacity and operating costs, in case of the city has a sufficient road network in medium to high-density regions where infrastructure is insufficient (Ibarra-Rojas, Delgado, Giesen, and Muñoz, 2015). However, there are also opposing opinions regarding seeing BRTS as the desired solution for traffic congestion and low-quality PT in developing countries. These counter-views includes institutional barriers, political and technical inadequacy, the opposition of existing systems, insufficient financing, and spatial inequality in developing countries (Lindau, Hidalgo, and de Almeida Lobo, 2014).

In many studies on BRTS, it has been stated that it may positively affect developing countries. One of the ways to avoid traffic congestion is to prevent sharing road capacity with cars, and although light and heavy rail systems meet this, BRTS is a less costly method (Basso, Feres and Silva, 2019). It is also considered that it provides rapid, high quality and safe PT, increases passenger volume, and supports PT-oriented development by providing sufficient capacity to the community (Deng & Nelson, 2011). In addition, there are many examples that BRT studies are generally effective in reducing traffic pressure with affordable costs, and travel time savings can reach 35% (Levinson, Zimmerman, Clinger, and Gast, 2003). When the BRTS recommended for Kampala (Uganda) is evaluated, it is calculated that the average travel time can be reduced by up to 50% (Vermeiren et al., 2015). In another example, Mexico City, after BRTS, it was observed that people's exposure to traffic-induced air pollution was considerably reduced, and they were seen as safer (Wöhrnschimmel et al., 2008). In summary, BRTSs are considered necessary for developing countries due to their low infrastructure expense, capability to operate without subvention, their ability to be implemented in a short time (1-3 years), and their easier and scalable adaptation to city structures (Wright & Hook, 2007).

When the opposing arguments are examined, first, as Kumar et al. (2021) mentioned, the PT market and operating system of each city differ, and the types of services should be shaped correspondingly. In addition, there are different components and development stages of BRTS development, and if this order is operated incorrectly, the effectiveness of the investment decreases. For example, in Mexico City, in addition to the benefits, Metrobus' "fostering" policy was found more complex, costly, slowing system development, politically compelling and unsustainable, contrary to expectations (Flores-Dewey & Zegras, 2012). In this direction, it is not guaranteed that the effects of BRT investment made in another developed country will provide the same results by policy tourism in developing countries (Wood, 2014). For example, Sub-Saharan African cities have a lower infrastructure and less financial adequacy than Latin American cities, so it is difficult for projects to operate with the same system (Kumar et al., 2021). As mentioned above, since there is no systematic PT management in developing countries where IPT systems are common, it will be challenging to switch to the regulated and controlled system, which is the requirement of the BRT system (Lindau et al., 2014).

Secondly, issues such as government support, finance, infrastructure needs, political and technical competence are crucial for the success of BRTS. As Pickrell (1992) mentioned, decision-makers can realize transit projects that they cannot afford politically and economically by underestimating the costs of these systems. One reason for this is, for example, the lack of

up-to-date data on urban characteristics, livelihoods, population, and mobility characteristics of many African cities (Vermeiren et al., 2015). Also, few developing countries prioritize urban transport policies (Lindau et al., 2014). In this direction, the design and implementation stages can be challenging as there is no experience, political framework, and financial management in these projects, which require significant investments in these countries. For example, in Lagos, Nigeria, queues began to form at the BRT bus stops, as in Figure 6, which was stated to be due to the slowness in the ticketing process (The Guardian, 2017). The person travelling by car may be stuck in traffic, while the person who wants to use the PT may be late due to the queue in this system (Basso et al., 2019). However, as Adebambo and Adebayo (2009) examined, although it did not end PT problems, it increased passenger satisfaction and provided the integration of different modes in Lagos. In addition, the safety of pedestrian crossings should also be considered when separating bus lanes that will allow buses to go faster on main urban arteries. However, it raises concerns about the quality of PT as there is no priority road safety inspection in developing countries (Lindau et al., 2014). This situation is an example of the results of the construction of the system without holistic evaluation.

Figure 6. BRT queues in Lagos (The Guardian, 2017)

As mentioned above, one of the reasons for the widespread use of IPT systems in developed countries is urban sprawl. So, although the single corridor development serves certain parts of the city, it has difficulties providing full communication between the areas where the population using PT live or work (Kumar et al., 2021). For example, in Lima (Peru), which became dependent on the use of IPT with the deterioration of PT quality and city macroform in the 20th century, 18 districts are connected by a 26 km BRT lane (Jauregui-Fung et al., 2019). However, it contributes to solving the congestion in the north-south corridor and reducing travel times, while IPT in the rest of the city (Mototaxis) addiction continued (Figure 7). Even after BRT and the metro system, the demand for IPT modes has been 30 times higher than the demand for FPT modes. As explained by Jauregui-Fung et al. (2019), the problem here is that the PT system is managed without being integrated, having autonomous regulatory authority, and not fully serving the city's urban structure. In other words, the existence of BRTS solely was not enough to solve PT problems in Lima.

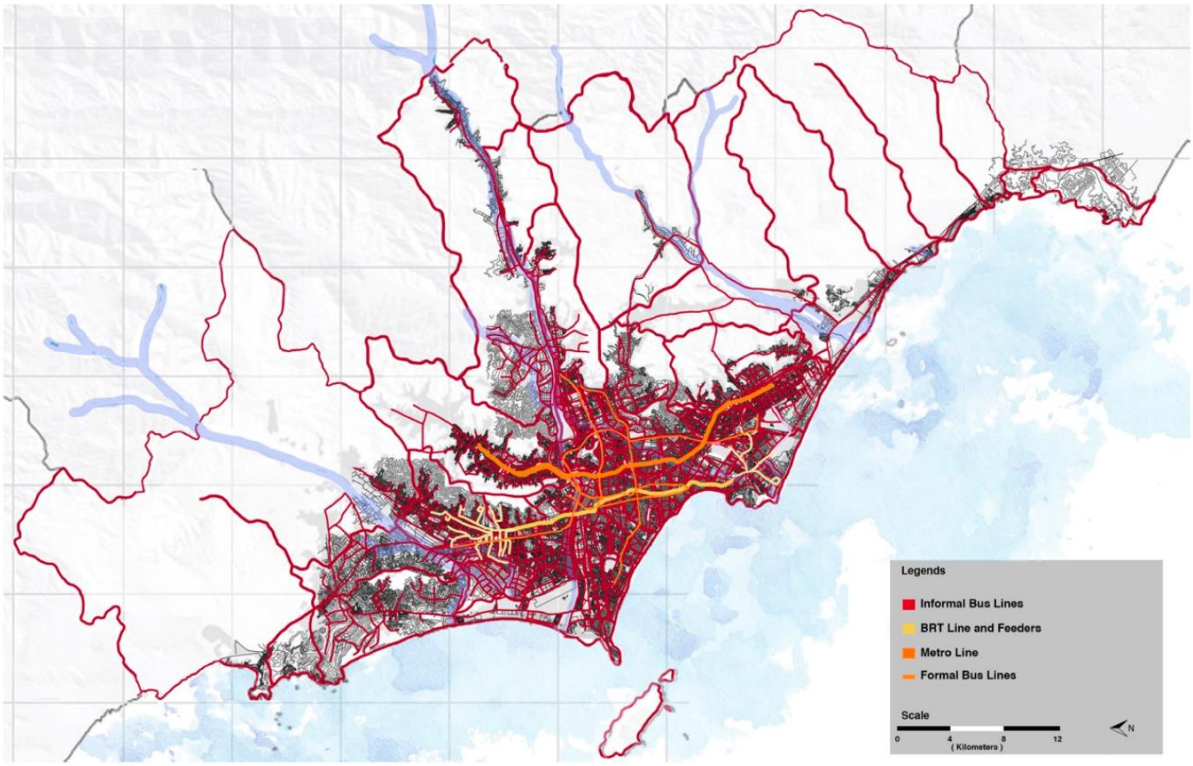

Figure 2. IPT and BRT lines in Lima (Jauregui-Fung et al., 2019)

Another concern is the social impact of these investments. Due to high urban inequalities in developing countries, the impact of investments for segments of society can be different (Vermeiren et al., 2015). It is thought that changes in property values resulting from BRTS may support social segregation observed in developing countries (Deng & Nelson, 2011). For example, walking spatial accessibility to the BRTS in Cali (Colombia) was calculated relatively high for middle-income groups but limited for highest and lowest income groups (Delmelle & Casas, 2012). Also, for Kampala (Uganda), four groups (extremely poor, poor, middle income and rich) were interviewed to understand the effects of BRTS designed to mitigate the negative impact of minibuses and low-income groups were observed to be vulnerable to physical exclusion from BRT (Vermeiren et al., 2015). In addition, the dedicated line required by the BRT system can challenge the existing inadequate transportation infrastructure, and people who do not use PT may perceive the development of a dedicated line as an intervention in their rights (Kumar et al., 2021).

As a result, there is no single truth for the improvement of PT systems, projects should be prepared by determining the dynamics of each city accurately. In short, PT systems need to be improved by considering the financial, legal, institutional political situation of the cities, PT market, capacity, the socio-economic structure of the society, the people working in these systems and future concerns (Kumar et al., 2021).

5. Conclusion

PT systems are one of the primary modes for managing increasing mobility in developing countries. Therefore, IPT modes, consisting of flexible and small vehicles created in line with the needs and operated informally, are the most common PT types. Although IPTs have not the most comfortable mode for passengers in developing countries, they can be the only option that people have, provide employment and adaptable service to places where FPT cannot serve

(Kumar et al., 2016). For this reason, considering cities' economic and political conditions, rapid transformation is complex, and positive effects can be increased with regulations, follow-up systems and measures to improve functioning and service. In this direction, improvement in regulatory authority and proper infrastructure facilities, provision of social benefits to drivers, economic support required for the maintenance of vehicles, production of alternatives for the fuel types used in IPT vehicles, and formulation of systems that will ensure the safety and information of passengers should be provided for the reformation of IPTs (IUT India, 2014). Also, there are many positive and negative approaches to BRTS seen as a solution to PT problems. Although it reduces travel times and seems cheaper, it is thought that directly copying these systems, the compatibility of operating costs, unique macroforms and social structures may be problematic. BRTS will be successful when stakeholders are aligned, capacity to meet the complexity of projects is achieved, the adequate institutional framework is established, technical, legal, and economic capacities are increased, and adequate funding is provided (Lindau et al., 2014). In addition, policy and institutional reforms on vehicle purchasing, transit regulations, urban design are required in developing countries to implement BRTS (Adebambo & Adebayo, 2009).

As a solution recommendation in Türkiye, instead of copying BRTS applications directly, it is necessary to ensure the integration of IPT and FPT systems and to make arrangements following contemporary applications. It is necessary to adopt practices that will not deprive any segment of society using the Minibus-Dolmus system by analysing them. As mentioned above, the spatial distribution of the service of IPTs in Türkiye is spread over wide areas, it provides job opportunities for many people, and it is used extensively at the points where FPT is lacking. Replacing this system directly with another system will not work in Türkiye either. For this reason, issues such as making service improvements, ensuring the inclusion of IPTs in the transit systems, providing driver training and monitoring systems, defining their relations with FPTs in more detail, and replacing these systems with rail systems, where possible, should be addressed instead of replacing the system completely.

In summary, in developing countries, designing solutions following local conditions and constraints should be the primary consideration and causes of PT problems should be determined correctly. It is necessary to improve the FPTs and IPTs, which are evaluated with sufficient data infrastructure, and ensure that the projects are operated, managed, and monitored correctly by providing equal opportunities to everyone in terms of local, sustainable, and spatial, economic, and environmental aspects.

Ethics Committee Approval Statement

Ethical approval is not applicable, because this article does not contain any studies with human or animal subjects.

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