

Exploring Urban Changes: The Impact of Mass Rapid Transit (MRT) Construction in the Context of Development in the Klang Valley, Malaysia

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Abstract

The Klang Valley is a city located within the state of Selangor. As known, Selangor is home to 7.8 million residents and continues to grow over time. This population increase has led to a rise in private vehicle ownership on the roads, with approximately 500,000 new vehicle registrations occurring each year. This increase in vehicles has paved the way for rail transport to operate more extensively to alleviate traffic congestion in the Klang Valley area. Rail transportation provided in and around the Klang Valley area, such as the MRT, will play a crucial role in addressing this traffic issue. The objective of this study is to explore the impact of MRT construction on land use in the Klang Valley area from 2008 to 2022. The method employed in this study involves exploring the changes in land use that have occurred in the Klang Valley area. The study findings indicate that there have been changes in land use before and after the construction of the MRT in the Klang Valley area, with significant developments and infrastructure built around the MRT station areas. The impact of this study reveals a rapid process of urbanization in the Klang Valley area with the existence of the MRT system. The MRT system has influenced land use patterns, urban growth, and infrastructure development in the Klang Valley. This study is crucial in understanding the changes in land use that have occurred in the Klang Valley before and after the construction of the MRT system.

Keyword: MRT, Landuse, Klang Valley, Urban, Transportation

Introduction

Transportation is one of the most important economic sectors for any country. This is because it has the potential to provide benefits or advantages to the environment, society, and the economy, whether at the local or global level (Yahya & Safian, 2023). According to MOT (2022), there are various types of transportation available, including road networks, rail networks, navigation, and aviation. The transportation sector has a significant influence on sustainable development. This is because transportation infrastructure with a complex

network is crucial for sustainable development as it connects cities, facilitates human activities, and contributes to the socio-economic aspects of a country (Zheng et al., 2021). According to Martin et al (2021), transportation networks also facilitate urbanization processes, help generate connections, contribute to socio-economic growth, and improve the quality of life for residents in a country, especially Malaysia. Rail transportation is also one of the alternative transportation options available in a country, including Malaysia, as it is environmentally friendly and does not rely on fossil fuels.

According to Tarmizi and Tahir (2021), Mass Rapid Transit (MRT) is known as a public transportation system that has three main characteristics: first, mass, which implies high carrying capacity; second, rapid, which signifies quick travel times and high frequency; and finally, transit, which means stopping at designated stations for each route. MRT can be defined as a large-scale public transportation service capable of carrying a large number of passengers at high speeds and arriving at designated times. In Malaysia, the announcement for the MRT project was made by the former Prime Minister, Dato Seri Najib, in June 2010, and the project was fully approved by the government in the same year but in December (Berita Harian, 2016). The construction of the first MRT line began on July 8, 2011, and the full opening of the MRT line was on July 17, 2017, covering a distance of 47 km for the Kajang Line, with 9.5 km of it being underground tunnels consisting of 7 underground stations (Khoo and Ooi, 2023; Mstar, 2017; Kadir et al., 2020). According to the Mass Rapid Transit Corporation (2023), travel demand in the Klang Valley is estimated to reach 18 million trips per day by 2020. Therefore, the second MRT line, the Putrajaya Line, began full operation on March 16, 2023, stretching from Sungai Buloh to Serdang and ending in Putrajaya for a distance of 57.7 km, with 13.5 km of it being underground tunnels and 10 new underground stations (Khoo and Ooi, 2023). The construction of the MRT project has been a catalyst for sustainable development and has boosted economic activities in Malaysia. This is because the economic spillover from this MRT development has generated increases in property values, with property prices expected to increase between 10 and 20 percent and land use density along the corridor (New Straits Times, 2017).

Urban public transportation is advancing in line with the times due to the existence of sophisticated technologies to shape or build more efficient public transportation systems that can benefit every sector within a country and also preserve the environment. In Malaysia, urban public transportation is increasing with the introduction of rail transportation such as the MRT. Rail transportation like the MRT is referred to as "Green Transport" (da Silva et al., 2018). This is because the services provided by this transit rail transportation are faster, more convenient, and can reduce pollution, among other benefits. Cities implementing the MRT system are those with dense populations in the area. This is because, with the facilitation of the MRT system, residents in these areas can easily travel to other destinations without experiencing traffic congestion. The densely populated city of Kajang has adopted the MRT system. The Kajang MRT Station serves as the first and last station for the Sungai Buloh–Kajang MRT line. The MRT also acts as an interchange station with other rail services, namely the KTM Komuter (Kajang Station) (Sunoto et al., 2021). The existence of the MRT system in the city of Kajang has influenced land use around the area, where more residential areas, services, and other developments have been established in the vicinity of Kajang. Moreover, Kajang has also become a focal point for the public due to transportation facilities like the MRT.

Transit-oriented development (TOD) in the context of urban planning is defined as a type of urban development oriented towards transit, which is a solution to reduce dependence on private vehicles such as cars and encourages public transportation and walking. The concept of Transit-Oriented Development (TOD) has existed in Malaysia for some time, but it wasn't until the early 2010s that it gained significant traction in urban areas. This shift coincided with the introduction of public transportation initiatives like the MRT (Mass Rapid Transit) system. TOD has nine main planning principles: Diverse, High Intensity, Connected, Inclusive, Livable, Resilient, Smart, Green, Low Carbon, and Optimizing Resources (TOD, 2018; Jaafar Sidek et al., 2020). These principles depict the relationship between transportation and land use. They also form the TOD Standard Framework, which can be used to assess and plan neighbourhoods. Furthermore, each principle is further defined with objectives and performance metrics to explain the meaning of achieving the principle and how to do it (ITDP, 2023). Through these TOD planning principles, the MRT system greatly influences land use patterns in urban areas with the system as it focuses on high-intensity development at stations and their surroundings. Additionally, the MRT system will also provide high-capacity and stable Information and Communication Technology (ICT) infrastructure to support an Internet of Things (IoT) based environment, thus enhancing the quality of life for communities around urban areas (TOD, 2018).

Therefore, the purpose of this article is to explore the impact of MRT construction on land use in the Klang Valley from 2008 to 2022.

Study Area

The Klang Valley is a metropolitan area located in Malaysia, situated between the states of Selangor and Kuala Lumpur. The Klang Valley is one of the most important areas in Malaysia as it serves as the center for economic activities, trade, and dense urban areas. Additionally, the metropolitan area of the Klang Valley also encompasses several other major cities such as Petaling Jaya, Shah Alam, Klang, and others. The high population and population density have made the Klang Valley one of the densest metropolitan areas in Malaysia. In terms of ethnic composition, it shows that the Malay community is the majority population, accounting for 50.59%, followed by the Indian community at 11.62%, the Chinese community at 29.03%, other ethnic groups at 0.72%, and non-citizens at 8.04% (Department of Statistics Malaysia, 2021). Employment opportunities provided in the Klang Valley cover various fields, leading to population migration and resulting in large cities in the Klang Valley experiencing high population densities, with the current population reaching 6 million people (Rostam, 2006). The Klang Valley covers an area of approximately 1,750 km². It shares borders with the state of Perak to the north, Pahang to the east, Negeri Sembilan to the south, and faces the Strait of Malacca to the west (Leong et al., 2015). The Klang Valley has many attractions for visitors and locals alike, such as the Shah Alam Bird Park, i-City Shah Alam, Sunway Lagoon Theme Park, and many more.

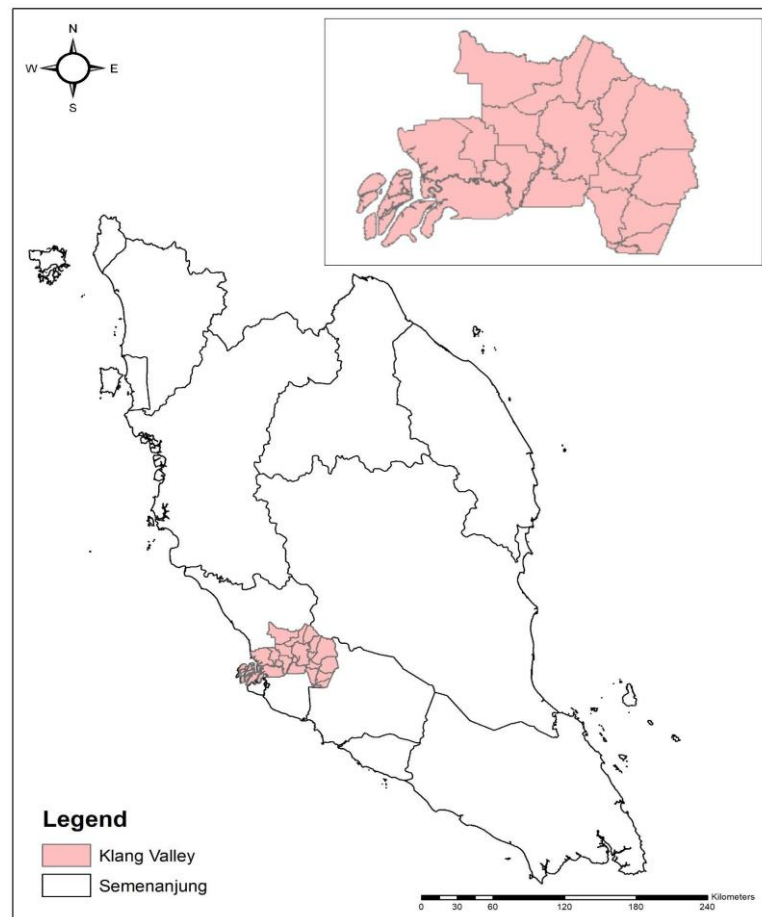


Figure 1: Study area

Methodology

Study Design

This research adopts an exploratory approach to analyze the impact of MRT construction on land use in the Klang Valley from 2008 to 2022. The study design is exploratory as it seeks to uncover and understand the relationship between MRT development and changes in land use patterns without imposing preconceived hypotheses. Through a comprehensive review of existing literature and available data, the study aims to provide insights into the evolving dynamics of urban development in response to transportation infrastructure changes.

A thorough literature review will be conducted to gather existing knowledge and insights on the impact of MRT systems on urban development and land use patterns. Academic journals, conference proceedings, government reports, and relevant publications will be consulted to understand theoretical frameworks, methodologies, and findings of previous studies. The literature review will encompass studies that focus on similar urban contexts and transportation infrastructure projects to provide a comprehensive understanding of the factors influencing land use changes in response to MRT construction. The review will include an analysis of empirical research, theoretical perspectives, case studies, and policy documents to identify trends, gaps, and areas for further investigation. Relevant keywords and search terms will be used to systematically search databases such as PubMed, Scopus, Web of Science, and Google Scholar. Inclusion and exclusion criteria will be applied to select studies based on relevance, credibility, and methodological rigor. Data extraction will involve identifying key concepts, variables, methodologies, and findings from

each study to inform the research questions and analysis framework. The literature review process will be documented to ensure transparency and reproducibility of the findings.

The synthesis of previous studies on Mass Rapid Transit (MRT) systems reveals a comprehensive understanding of their multifaceted impacts on urban development, transportation, economy, society, and the environment. Research findings consistently demonstrate the significant influence of MRT projects on urban development patterns, with documented increases in property values, changes in land use mix, and the emergence of new commercial and residential developments around MRT stations (Cervero and Murakami, 2010; Guerra and Cervero, 2011). Furthermore, MRT systems have been shown to promote the modal shift from private vehicles to public transportation, resulting in reductions in traffic congestion, air pollution, and travel times (Loo and Lam, 2012; Litman, 2019). Economically, MRT projects stimulate growth and investment in surrounding areas, fostering increased business activity, job creation, and infrastructure development along MRT corridors (Rode, 2012; Zhau and Zhang, 2021). Socially, MRT systems improve accessibility and mobility for diverse socio-economic groups, contributing to social inclusion and reducing disparities in access to essential services and employment opportunities (Marans and Lee, 2015; Verma et al., 2020). Moreover, MRT projects offer environmental benefits by reducing greenhouse gas emissions, energy consumption, and dependence on fossil fuels, thus supporting sustainability and climate change mitigation efforts (Lachapelle and Polzin, 2014; Cao and Wu, 2021). Despite these benefits, challenges such as financing, project delays, construction disruptions, and governance issues remain prevalent, highlighting the need for effective planning, coordination, and stakeholder engagement processes (Albalade and Bel, 2012; Bertolini et al., 2017). Overall, the synthesis of previous research underscores the transformative potential of MRT systems in shaping urban landscapes and fostering sustainable development pathways.

The implementation of Mass Rapid Transit (MRT) systems brings about significant changes in urban development dynamics. Previous research, as demonstrated by studies such as those conducted by Cervero and Murakami (2010) and Guerra and Cervero (2011), consistently indicates that MRT projects serve as catalysts for property development and urban revitalization in their vicinity. This phenomenon is largely attributed to the accessibility and connectivity offered by MRT stations, which attract businesses, residents, and investors to surrounding areas. The presence of MRT infrastructure often leads to the emergence of mixed-use developments and vibrant urban hubs, where commercial, residential, and recreational spaces converge. Moreover, MRT corridors become focal points for commercial activities and public amenities, transforming previously underutilized areas into bustling transit-oriented communities. This trend underscores the transformative impact of MRT systems on reshaping urban landscapes and fostering sustainable urban development pathways.

Previous Studies

Mass Rapid Transit (MRT)

According to Das (2020) in his article titled "Persamaan Struktur Loyalty Modelling Pengguna Public Transport Railway MRT- SBK Greater Kuala Lumpur Malaysia," passenger loyalty is measured by the willingness of passengers to use similar public transportation. The purpose of this study is to identify the factors influencing passenger loyalty in using public transportation, especially the MRT for the Sungai Buloh to Kajang (SBK) route, with 555 respondents contributing to the study. Structural equation modeling (SEM) was employed to

investigate the relationship between service quality, service value, passenger satisfaction, and passenger loyalty. The study's findings indicated that these models recorded average errors and absolute index ratings within acceptable criteria, with each ≤ 0.09 and ≥ 0.94 , respectively. The research revealed that passenger loyalty to the MRT-SBK is largely influenced by service attributes such as vehicle safety, convenience, punctuality, comfort, and cleanliness of facilities. This study aids MRT service providers in optimizing resources to enhance user satisfaction and increase passenger loyalty to MRT.

In the study "Assessing MRT Feeder Bus Services Performance Through Passenger's Satisfaction Level in the Selected Stations of Klang Valley, Malaysia" by Oladejo et al. (2021), it is stated that increased mobility in the Klang Valley, such as congestion, parking issues, and air pollution, has led to a more sustainable use of public transportation in the city. Mass Rapid Transit (MRT) feeder buses are seen as a guarantee to reduce the increasing congestion in the Klang Valley if managed efficiently and sustainably. This research extends the exploration of MRT feeder bus service quality by assessing passenger satisfaction levels. Surveys were distributed to 303 respondents who used MRT bus services to MRT stations. While most respondents were satisfied with the overall quality (exceeding 80% satisfaction), punctuality issues, waiting and travel times and frequency of feeder service connections left much to be desired. The study also found significant relationships between gender and fear of crime, as well as bus stop conditions. Therefore, actions need to be taken to provide a safer environment for female users, as the majority using MRT feeder bus services are women.

According to the study by Kadir et al. (2020), titled "Travellers' Perception of Worship Facilities for Multimodal Users of MRT SBK Line," the opening of the Sungai Buloh-Kajang (SBK) MRT System has been well-supported by transit researchers and public transportation advocates. The study was conducted to record users' perceptions of worship facility amenities provided at each MRT station. Correlation analysis results showed that both socio-demographic characteristics and travel patterns influenced perceptions to various statistically significant levels. The study findings indicated that worship facilities were most utilized by low-income MRT passengers, the general public, particularly the education sector, and MRT users commuting within the Klang Valley every month. Improvements in ventilation systems, size and design of prayer rooms, floor cleanliness, lighting, mirror design, and shoe rack/clean area design were most sought after by public transportation MRT users.

According to the study by Lim et al. (2022), titled "The Impact of Perceived Accessibility to MRT Service and Perceived Neighbourhood Safety on Quality of Life: A Study in Malaysia," the Malaysian government's efforts to improve the quality of life of its citizens saw the launch of a new Mass Rapid Transit (MRT) service in Selangor in 2017. While past studies support the notion that access to public transportation services enhances Quality of Life (QoL), no study has directly examined the relationship between perceived accessibility to the new MRT service and QoL. Therefore, a cross-sectional study was designed to examine the effects of perceived accessibility to the new MRT service and safety perceptions on QoL. A total of 214 MRT users were sampled using online convenience sampling and asked to report their accessibility to MRT services, neighbourhood safety, and QoL. The study's findings provided the first empirical evidence of the benefits of MRT services on quality of life and underscored the need to develop public transportation services in Malaysia.

Landuse

The implementation of Mass Rapid Transit (MRT) systems has had a significant impact on land use patterns in the Klang Valley, Malaysia, as highlighted in several studies. According to

Zulkifli et al (2017), the Malaysian government's investments in rail-based and road-based public transportation projects in the Klang Valley have prompted a transition in travel modes among users, leading to increased reliance on public transportation.. This shift has implications for land use, influencing factors such as urban form, employment levels, and population density. The study specifically focused on evaluating land use density, diversity, and passenger volume at LRT stations along the Kelana Jaya and Ampang LRT lines, providing insights into how MRT systems shape land use dynamics.

Additionally, Yakob et al (2012) emphasized the role of MRT systems in driving sustainable urban housing development. Their study underscored the potential of housing development to promote social equity, stimulate economic growth, and foster environmental conservation. However, challenges such as non-compliance issues in land use regulations were identified as hindrances to achieving sustainability in the housing sector. Understanding the impact of MRT systems on land use is crucial for effective urban planning and development, as it provides insights into how transportation infrastructure influences spatial patterns and socio-economic dynamics within urban areas (Yakob et al., 2012).

Discussion

Economic Impact

The construction of the MRT system has provided benefits to the Malaysian economy in terms of job creation, increased property values, and infrastructure investment. The Mass Rapid Transit (MRT) Line 1 project not only created job opportunities for the younger generation but also fostered a team of young contractors (Berita Harian, 2016). This was made possible through a program known as the Young Entrepreneurs Program (MYEP) initiated by Mass Rapid Transit Corporation (MRT Corp), National Entrepreneurship Corporation Berhad (PUNB), and Construction Industry Development Board Malaysia (CIDB) (MRT, 2017). Selected participants undergo a year-long intensive and practical training where they acquire the necessary skills and knowledge to become entrepreneurs in the construction industry (Roslan et al., 2021). The objective of this program is to provide opportunities for the younger generation to enter the construction industry. The MRT project, being a mega project, offers them valuable experience and knowledge, enabling them to enhance their skills as contractors (Najmuddin, 2015). Fourteen young graduates have successfully been trained as contractors and have also secured several work packages under the MRT SBK Line (Berita Harian, 2016). Furthermore, the implementation of the MRT system has the potential to stimulate the economic growth of Malaysia. This is because the MRT serves as a vital artery for attracting investors to Malaysia, as it facilitates their movement from one destination to another. Recognizing its role in attracting foreign investors, the Malaysian Investment Development Authority (MIDA) organized a visitation program to the MRT with various foreign business councils in Malaysia (Metro, 2017). These include the India Industry Consortium, the French-Malaysian Chamber of Commerce and Industry (CCTIM), the Japan-Malaysia Trade and Industry Council (JACTIM), the EU-Malaysia Chamber of Commerce and Industry (EUMCCI), the Italy-Malaysia Business Association (IMBA), and the German-Malaysia Chamber of Commerce and Industry. It is evident that the MRT system in place, will revitalize urban areas in Malaysia, as it becomes a focal point for the public when utilizing the MRT service.

Impact on Social and Environment

The implementation of the MRT system as public transportation can provide benefits to both the country and the residents in urban areas. One noticeable benefit of having the MRT system is the reduction of traffic congestion that often occurs in cities, especially during peak hours. This is because urban residents can use the MRT services provided in their area to travel anywhere without worrying about traffic congestion. Evidence shows that since the introduction of the MRT system in Malaysia, traffic congestion has been successfully reduced, with nearly 40,000 cars being taken off the roads each day as people prefer to use the MRT system (Malaysia Gazette, 2017). In addition to reducing traffic congestion, the implementation of the MRT system can also improve air quality. A total of 363,130 tons of CO₂ emissions can be reduced annually with the introduction of the MRT system in Malaysia, and the concentration of PM_{2.5} in the atmosphere can be reduced by 0.61 µg/m³ annually, equivalent to (2%) (Kwan et al., 2016). Better air quality can prevent urban residents from being exposed to any harmful diseases caused by air pollution. It is evident that the MRT system in place, can promote sustainable urban development by creating healthier cities in terms of better air quality due to reduced traffic congestion. Additionally, the MRT system can also facilitate urban residents in moving to destinations quickly and comfortably, and the fare charged for using the MRT system is also affordable.

Challenges and Future Prospects

Challenges encountered during the implementation of the MRT system encompass site, design, planning contexts, construction capabilities, and operations (MRT Corporation, 2017). Piling works for the MRT construction project from Sungai Buloh station to Kajang station represents the most high-risk construction activity. This is attributed to the six risks associated with piling works at MRT construction sites, namely structural collapse, unsecured loads, movement of concrete mixer trucks, heat or fire or hazardous smoke, machinery movement or mechanical failure, chemical hazards, and soil collapse or falling piles. If any of these risks occur, it will halt piling works at the MRT construction site, leading to the temporary cessation of construction activities (Ahmad et al., 2019). In addition to the challenges faced during piling works, there are other challenges during MRT construction, such as worker accidents caused by factors related to materials and equipment used during the construction project at the construction site (Juhari & Arifin, 2020). Worker accidents may arise if materials and equipment used during construction are not properly practiced or if negligence occurs during construction work. Furthermore, soil challenges also contribute to the challenges during MRT construction projects. This is because there has been a transition in geological structure, where the soil structure from limestone has changed to hard rock, slowing down tunneling work for the MRT project.

Due to the high demand from users or residents in urban areas for public transportation, especially rail transportation like the MRT, the government will resume the MRT Line 3 (MRT 3) project that was deferred during the previous government. This project will commence in the second half of 2021. With the implementation of the MRT 3 project, it will also increase land utilization in the future. This is because there will be more construction processes involving housing, infrastructure, shopping centers, and others. This occurs because the area will become a focal point for the public, thus boosting the country's economy.

Conclusion

The construction of the MRT system in the Klang Valley has demonstrated that land utilization in urban areas is increasingly active. This is evident due to various types of construction and infrastructure developed around the Klang Valley, such as housing, shopping centers, services, and more. The increasing land utilization has also contributed to the process of urbanization in the Klang Valley area, leading to an increase in demand for public transportation services among urban residents as it facilitates movement to various destinations without worrying about congested traffic conditions at certain times. The rapid urbanization process in the Klang Valley has opened opportunities for the government to introduce the second MRT line (Putrajaya Line) and also the construction of the MRT 3 line. Transit systems such as the MRT need to be implemented in any city to create a sustainable public transportation system. This is because public transportation systems like the MRT provide convenience and comfort for urban residents to reach specific destinations without needing to drive their vehicles. Therefore, responsible parties must play their roles in improving the existing MRT stations in the Klang Valley to provide comfort for public transportation users and attract the interest of the public to use public transportation. Aligned with SDG 11, the transportation system is one of the drivers of sustainable urban development and can support the 2030 agenda towards a sustainable and inclusive environment.

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