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ENHANCING QUALITY OF LIFE THROUGH SUSTAINABLE TRANSIT-ORIENTED DEVELOPMENT: INSIGHTS FROM LESTARI LINK

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Abstract:

The contemporary real estate sector is facing mounting challenges, including environmental degradation, high energy consumption, traffic congestion, and the growing demand for sustainable, efficient, and livable urban environments. Current trends reflect an increasing public preference for developments that are integrated with public transportation, smart technologies, and environmentally responsible design principles. In response to these evolving needs, the Transit-Oriented Development (TOD) concept has emerged as a sustainable and innovative solution to guide future urban development. Lestari Link is a newly planned mixed-use development that integrates residential and commercial functions through an environmentally conscious and technologically advanced design. This project incorporates renewable energy sources and smart technologies to optimize resource consumption, reduce carbon emissions, and foster interconnected communities. Initiatives such as the provision of green infrastructure and sustainable transportation systems are introduced to promote healthier lifestyles while reducing dependence on private vehicles and fossil fuels. The implementation of this development seeks not only to address

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environmental concerns and resource inefficiencies but also to create cohesive and inclusive urban settings that support economic growth and community well-being. In the context of real estate marketability, TOD enhances property value and attractiveness by improving accessibility through well-connected road networks and efficient public transportation systems. Overall, this comprehensive approach demonstrates the potential of TOD-based developments to improve urban quality of life while contributing meaningfully to the long-term goals of sustainable urbanization.

Keywords:

Accessibility, Built Environment, Connectivity, Development (Sustainable), Energy Efficiency

Introduction

Land is a limited and non-renewable resource, particularly in rapidly urbanizing areas. In the context of urban real estate development, high land values in prime city locations often conflict with the financial capacity of the majority of potential buyers, creating challenges in ensuring access to affordable and livable housing (Ismail, 2023). As a result, developers often shift towards peripheral or suburban areas where land is more affordable. However, such non-centralized developments (non-TOD) give rise to other critical issues, including poor accessibility to key destinations such as city centers, increased traffic congestion, as well as unnecessary expenditure of time, cost, and energy (Lim & Rahman, 2022).

Moreover, developments that are not supported by efficient public transport systems contribute to increased carbon emissions and resource inefficiency. The failure to integrate land use planning with transportation infrastructure leads to negative impacts on urban livability and environmental sustainability (Tan, 2021). In this context, Transit-Oriented Development (TOD) emerges as a strategic and comprehensive solution in modern urban planning.

TOD represents a paradigm that emphasizes the synergistic integration between land use and transportation infrastructure, aiming to reduce dependence on private vehicles while encouraging the use of public transit and active mobility modes such as walking and cycling (Carey, John, & Luca, 2009; Tan, 2021). Introduced by American architect Peter Calthorpe in 1993, the TOD concept has been widely implemented in cities such as San Francisco and Atlanta, proving its potential to foster dynamic, energy-efficient, and resilient mixed-use environments (Rui & Martin, 2012; Ahmad & Lee, 2024).

However, the implementation of mixed-use developments within TOD frameworks is not without challenges. These include localized environmental impacts, intensive energy consumption, and inefficient resource management. The concentration of residential and commercial activities in a single area may worsen traffic congestion, contributing to higher emissions of pollutants such as carbon monoxide (CO) and nitrogen oxides (NOx), thereby threatening urban air quality and public health (Zainal et al., 2025). Additionally, the diverse and often unpredictable consumption patterns of residents, commercial tenants, and visitors may burden essential infrastructure such as water supply, energy systems, and waste management services.

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To address these issues, the integration of green and smart transportation infrastructure within TOD frameworks becomes increasingly vital. Key strategies include improving public transit accessibility, establishing safe pedestrian and cycling networks, and installing electric vehicle (EV) charging stations. Moreover, the application of smart technologies—such as solar-powered transit shelters, sensor-based lighting, and real-time monitoring—can help optimize energy use and support a seamless, environmentally conscious urban mobility experience. This study aims to evaluate the transformative potential of TOD in fostering resilient, sustainable, and livable urban environments while minimizing adverse environmental impacts. The continuous advancement and broad implementation of these technologies are crucial to realizing the full promise of sustainable urban development and ensuring the long-term viability of future cities.

Background

The Lestari Link project offers a relevant case study for exploring innovative approaches to sustainable transportation within the context of Transit-Oriented Development (TOD). Unlike conventional TOD models, which tend to prioritize residential expansion, Lestari Link places stronger emphasis on reinforcing public transportation infrastructure and integrating green mobility technologies as core development strategies.

The project focuses on the implementation of eco-friendly public transit systems and the establishment of an extensive electric vehicle (EV) charging network to reduce private vehicle dependence and mitigate urban traffic congestion. This approach is supported by a holistic vision of urban sustainability, which integrates smart technologies and actively involves community stakeholders. By strategically addressing issues such as air pollution and energy consumption, the project seeks to offer a replicable model for creating more efficient and environmentally responsible urban transport systems.

Given the growing concerns over environmental degradation, infrastructure strain, and the urgent need for a sustainable shift in urban mobility, the Lestari Link project represents a timely and relevant subject of academic inquiry. This study will assess the effectiveness of the Lestari Link model in integrating smart technologies, green infrastructure, and TOD principles toward achieving sustainable urban transformation and improving the quality of life in rapidly urbanizing regions.

Research Question

i. How can the Link Sustainable Project use the new TOD approach to improve urban sustainability and reduce environmental impact in urban areas?
ii. How can the Link Sustainable Project improve the quality of life of the population by implementing smart technologies and sustainable transport solutions?
iii. Does the mixed development in the Link sustainable project affect the value of property and economic activity in the community?

Research Objective

i. To examine how the Lestari Link project implements innovative Transit-Oriented Development (TOD) practices that enhance urban sustainability through the integration of renewable energy and green infrastructure.
ii. To investigate the effects of the Lestari Link project on residents' quality of life by promoting eco-friendly transportation options and community engagement through smart technologies.

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Literature Review

The Lestari Link project exemplifies the transformative potential of Transit-Oriented Development (TOD) in shaping urban environments that prioritize sustainability, accessibility, and enhanced quality of life. It aims to develop a vibrant, mixed-use area that integrates green infrastructure and smart technologies, thereby reducing dependency on private vehicles and promoting environmentally conscious transportation (Ahmad, 2022). This approach aligns with the Compact City Theory, which emphasizes high-density, mixed-use development near transit nodes to reduce sprawl and improve urban efficiency (Burton, 2000).

Numerous studies affirm that well-executed TOD initiatives can significantly reduce vehicle miles traveled, thus mitigating greenhouse gas emissions and improving urban air quality (Ali, 2021). For instance, the use of renewable energy sources and efficient public transport systems not only supports ecological sustainability but also enhances social inclusion and urban livability (Gomez, Omar, & Nallusamy, 2019).

Moreover, TOD is associated with economic gains. Jaafar Sidek et al. (2019) note that property values and local economies often benefit from TOD due to increased walkability, accessibility, and population diversity. These findings resonate with Transport-Land Use Feedback Cycle Theory, which suggests that improvements in transportation infrastructure directly influence land use patterns and vice versa (Wegener & Fürst, 1999). In response to increasing urban sprawl and environmental degradation, Lestari Link offers a replicable model for future development by showcasing how integrated urban planning can foster resilient, inclusive, and sustainable communities (Kim, 2020; Sukaremen, 2024).

Definition On Transit-Oriented Development

The concept of TOD was introduced by Peter Calthorpe in 1993 as a planning strategy aimed at enhancing urban livability through compact, mixed-use developments centered around high-quality public transport (Gomez, Omar, & Nallusamy, 2019). TOD projects typically focus on walkable neighborhoods situated near transit stations, ensuring seamless access to commercial and public services while minimizing environmental degradation (Ali, 2021). The global adoption of TOD principles particularly in Asian cities has been accelerated by the urgent need to address challenges such as urban sprawl, pollution, and rising carbon emissions. Studies affirm that TOD reduces vehicle miles traveled, leading to cleaner urban air and greater sustainability (Gomez et al., 2019).

Definition On Mixed-Used Development

Mixed-use development (MUD) is an urban planning strategy that combines residential, commercial, cultural, institutional, or industrial uses in a same location to promote functional and physical interconnectedness (Grant, 2007). It attempts to boost urban vibrancy by offering a variety of land uses that lessen dependency on private automobiles and promote economic sustainability (Rowley, 2010). According to (Fuller, 2017), having a mix of households, workplaces, and social areas helps to create vibrant and socially engaging neighbourhoods. Furthermore, mixed-use development promotes collaboration among various land uses, hence promoting urban sustainability and community engagement (Hoppenbrouwer, 2007).

Definition Green and Sustainable Transportation

Green and sustainable transportation refers to a transportation system that minimizes environmental impact, conserves energy, and promotes social and economic sustainability. It encompasses modes such as walking, cycling, public transit, and electric or low-emission

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vehicles, aiming to reduce greenhouse gas emissions and dependence on fossil fuels (Black, 2010). According to (Banister, 2008), sustainable transportation focuses on efficiency, accessibility, and environmental responsibility while supporting economic growth and improving the quality of life. Additionally, (Litman T. A., 2024) emphasizes that a sustainable transport system integrates environmental, social, and economic considerations, ensuring long-term mobility solutions that are equitable and resilient.

Definition Transportation

Innovation in transportation is essential to improving accessibility, sustainability, and urban mobility. Innovative transportation solutions are crucial for tackling issues like traffic, pollution, and ineffective transit systems as cities grow. Transportation innovation in the framework of TransitOriented Development (TOD) guarantees the smooth integration of transit services, promotes walkability, and raises the general efficiency of urban mobility. Urban areas may improve people's quality of life, encourage economic growth, and support environmental sustainability by putting in place cutting-edge transportation infrastructure. Moving people, products, and services from one place to another using a variety of means, such as air, sea, train, and road, is referred to as transportation (Rodgirue, 2020). It has a key role in economic development, social connectedness, and urban planning by increasing mobility and accessibility (Susan & Geneveive, 2017). (Black W. R., 2003) defines transportation systems as infrastructure, vehicles, and procedures that enable the efficient and sustainable flow of resources. Furthermore, (Button, 2010) emphasizes that transportation is an important part of modern civilization, influencing trade, urbanization, and environmental sustainability.

Definition On Smart Technology

Smart technology is the integration of modern digital tools and systems to improve efficiency, resource management, and quality of life in urban contexts. This system collects and analyses data to monitor resource consumption, enabling real-time modifications that lead to more sustainable practices. Smart technology can be found in a variety of urban infrastructure applications, such as solar panels, electric vehicle (EV) charging stations, and sensor-based lighting systems in smart pathways. These innovations not only improve resource management but also increase user experiences by providing novel services that contribute to a more sustainable urban ecosystem. Smart technology facilities streamlined services and increased inhabitants' quality of life by smoothly integrating into urban infrastructure, resulting in a smarter, more connected community (Appinventiv, 2024).

Solar Panels

Solar panels are installed into smart shelters at public transportation bus stops to harness solar energy for powering important services like lighting and information displays. These photovoltaic (PV) modules convert direct sunlight into electricity, while reusable battery systems allow for energy storage, optimizing the use of renewable energy and lowering dependency on traditional power sources.

Sensor-Based Lighting

Sensor-based lighting systems use a variety of technologies to increase energy efficiency and safety in both home and commercial settings. Motion sensors, which use passive infrared (PIR) technology to detect movement inside a certain region (ISARSOFT, 2024) are among the most important of these technologies. PIR sensors detect infrared light generated by things, such as human bodies, and activate illumination when occupancy is detected. Photosensitive sensors,

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also known as light sensors, automatically control lighting based on ambient light levels, turning lights on at nightfall and off at dawn to make the most of natural light.

Ev Charging Station

An electric vehicle (EV) charging station, also known as a charge point or electric vehicle supply equipment (EVSE), is a power supply device used to refuel plug-in electric cars such as battery electric vehicles and plug-in hybrids. Charging stations often have connectors that meet a variety of international standards to support different vehicle models and charging requirements (Energy, 2019). Public charging stations are frequently positioned in easily accessible areas such as parking lots, shopping malls, and government institutions, allowing EV owners to recharge their vehicles while engaging in other activities (Charging an electric vehicle, 2018). The extensive construction of EV charging stations is critical in aiding the transition to electric mobility and lowering dependency on fossil fuels in transportation networks.

Types Of Transportation Innovation and It is Important to Being Used in Transit-Oriented Development

Smart Shelter of Public Transit

Installing solar panels on the rooftops of smart shelters, such as public transit bus stops is a feasible way to harvest solar energy for a variety of purposes, improving user experience while encouraging sustainability in urban environments. Solar panels are typically positioned on the shelter's roof to absorb the most sunlight possible, with special thought paid to their tilt and orientation to optimize energy absorption throughout the day. This system's primary components include photovoltaic (PV) modules that convert solar energy into electricity, as well as energy storage solutions such as rechargeable batteries controlled by a solar charge controller. This configuration maximizes the power of elements like illumination, information displays, and charging stations. Solar-powered shelters have substantial benefits, such as reducing carbon footprints and supporting ecologically friendly public transportation options. Passengers benefit from upgraded safety features such as solar-powered LED lighting and real-time bus position information, which decreases wait times. Furthermore, operating off-grid reduces the need for expensive electrical infrastructure extensions, making these installations more affordable for communities. Overall, placing solar panels on top smart shelters turns them into self-sustaining structures that meet transit needs while also contributing to municipal sustainability efforts.

Smart Pathways

Sensor-based lighting systems intended for smart pathways improve safety and energy economy by automatically altering brightness in response to the presence of bikes or pedestrians. These systems use a variety of sensor technologies, including motion detectors and light intensity sensors, to monitor activities in real time. When a bike or pedestrian approaches, the sensors detect their movement and cause the lighting to brighten, increasing visibility and safety for users. These smart lighting systems can be connected into larger Internet of Things (IoT) frameworks, providing advanced control and data collection capabilities. The use of wireless sensor networks enables decentralized control, with each luminaire communicating with its neighbour to optimize lighting settings based on foot traffic density. This adaptability not only increases user experience but also adds to significant energy savings. Following this, studies have shown that such systems can cut energy usage by up to 29% when compared to typical lighting solutions.

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Ev Charging Station

In order to promote the usage of electric vehicles and boost urban mobility, it is imperative that EV charging stations be placed in close proximity to public transportation hubs, such as bus and train terminals. The best places to integrate EV charging infrastructure are multi-modal transportation hubs, which are important intersections where numerous modes of transportation converge. By placing charging stations close to these hubs and making it simpler for commuters to get there, cities can promote the widespread use of electric vehicles. This design allows users to charge their vehicles while utilizing public transit choices, effectively lowering range anxiety and the dread of running out of battery power while commuting. To improve efficiency and accessibility, the layout of EV charging stations within key transit hubs is carefully designed. Centralized locations are desirable because they allow buses and trains to access chargers with little detours, resulting in seamless traffic flow. Additionally, charging stations are frequently located near entry and exit points to reduce vehicle downtime and improve operational performance (Pilot Energy Storage, 2024). Clear signs and adequate lighting are also necessary to guarantee that drivers can readily discover the charging points, even during conditions of poor lighting.

Summary Of Literature Study

Table 1: List Of Summaries of Previous Study

No	Authors	Year	Title	Objective of the study	Type of data	Findings
1	Sabri Ahmad, Mohamad Fadhli Rashid, Robiah Suratman	2022	Readiness of Transit Oriented Development (TOD) Concept Implementation in Perak's Suburban Areas	To evaluate the readiness of implementing the TOD concept model for 14 suburban railway station areas in seven of Perak's local government administrations	A mixed quantitative and qualitative approach, applying the Fuzzy Delphi Method (FDM) and case study method.	All 14 railway stations involved have not yet achieved a 100 per cent level of readiness in implementing the TOD concept model.
2	Anis Syazwani Sukereman, Sarah Yasmin Noor Saidi, Muhammad Azwan Sulaiman, Nurul Afiqah Azmi, Nurul Nadiah Zainol	2024	The Significance of TransitOriented Development (TOD) Towards the Enhancement of Public Transportation Ridership	To identify the most significant attributes of TOD that can improve public transportation (PT) ridership.	A self-administered questionnaire	The findings indicated that eleven TOD attributes and eleven PT ridership attributes had a significant relationship.
3	Andi Hermansyah, Azhari Aziz	2024	Policy dialogue: Key factors for the	To determine the factors driving the	Qualitative methods and supported by	Six themes emerge from the research

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	Samudra, Evi Satispi		success of transit-oriented development infrastructure 3.0 in big cities in Indonesia	success of four large cities in Indonesia in implementing Transit-Oriented Development (TOD) infrastructure policies beyond the eight TOD 3.0 Principles.	in-depth interviews with stakeholders, community leaders, community groups, and service users.	findings: policy dialogue, organizational structure and coordination, changes in community habits, resources, dissemination and communicatio n , and transportation and connectivity services.
4	Mohd Farid Jaafar Sidek, Fatahsha Amira Bakri, Abdul Azeez Kadar Hamsa, Nik Nurul Aziema h Nik Othman, Norzailawati Mohd Noor, Mansor Ibrahim	2020	Socioeconomi c and Travel Characteristics of transit users at Transit Oriented Development (TOD) Stations	To identify the factors affecting the selection of LRT services as the transportation mode for travel activities in terms of demographic and travel pattern of the transit users	Quantitative method where questionnaire s were distributed to passengers of 3 stations on the Kelana Jaya line and three stations in Ampang Line	The socioeconomic and travel characteristics of transit users influence the TOD stations ridership.
5	Shamsida Saidan Khaderi, Nur Nadzirah Bakeri, Ani Saifuza Abd Shukor	2021	The transit oriented development (TOD) improvement towards a sustainable development.	To determine the criteria and concept of TOD, investigate the issues and challenges in implementing TOD towards sustainable development, and recommend TOD improvement	A mixed method of qualitative and quantitative research is used in a semi structured interview, questionnaire distribution, observation, and	The findings indicate that TOD implementatio n is still in its infancy and development stage. A few recommendati ons offered to improve the TOD concept towards a sustainable community.

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				towards sustainable development.	document analysis.	
6	Christy P. Gomez, Masitah Omar, Rameson Nallusamy	2019	A Study on the Benefits of Transit Oriented Development in Malaysia and Incorporation of Those Benefits in Planning.	To analyse current planning related to TOD in Malaysia and identify the economic, social and environmental benefits of TOD.	A mixed method research approach was used. Quantitative data was collected using questionnaire surveys and qualitative data obtained through interviews.	This study provides a reliable transit community perspective regarding the real economic, social and environmental benefits of TODs and provides a timely reflection for local council town planners and key stakeholders to review their approach to leverage on the wider benefits of TOD.
7	Seunghoon Kim	2021	The Social Justice Impact of the TransitOriented Development	Focuses on these potential affordability issues and aims to evaluate the effects of TOD using residents' discretionary income (DI) as an indicator of affordability.	The light rail transit oriented development (LRTOD) in Phoenix, AZ, is selected because of the timing of the introduction of development and the simplicity of the light rail transit line.	The results indicate that LRTOD can give benefits to all TOD residents.
8	Jamalunlaili Abdullah,	2016	Characteristics of and Quality of Life in a	This paper evaluates the TOD in Bandar	The methodologi es of this	The study found that Sri Permasuri

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	Mohd Hafiy Mazlan		Transit Oriented Development (TOD) of Bandar Sri Permaisuri, Kuala Lumpur.	Sri Permaisuri, Kuala Lumpur	study are descriptive and comparative analyses of physical development in Bandar Sri Permaisuri development.	TOD has met the main physical characteristics of TODs especially related to land use mix and density.
9	Liaqat Ali, Ahsan Nawaz, Shahid Iqbal, Muhammad Aamir Basheer, Javaria Hameed, Gadah Albasher, Syyed Adnan Raheel Shah and Yong Bai	2021	Dynamics of Transit Oriented Development, Role of Greenhouse Gases and Urban Environment: A Study for Management and Policy.	This paper reviews the impacts of transit development on urban development, greenhouse impact, the environment, economy, property value, travel behaviour, and health etc., highlighting the policy issues which hinder TOD.	Data from secondary sources has been used in this research and no primary study is being carried out for this paper.	This study will help in improving the urban environment and climatic condition of regions.
10	Wondimageg n Mengist, Teshome Sor omessa, Gudina Lege se	2020	Method for conducting systematic literature review and meta-analysis for environmental science research.	The techniques help to generate knowledge from multiple studies both in qualitative and quantitative ways.	Systematic literature review (SLR) and metaanalysis studies.	The new method has six basic steps which are abbreviated as PSALSAR. This method is applicable to assess the existing knowledge, trends, and gaps in ecosystem services.
11	Ren Thomas, Luca Bertolini	2017	Defining critical success	This paper defines critical	A metaanalysis	The results show political

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			factors in TOD implementation using rough set analysis	success conditions in transit-oriented development (TOD), evaluating the impact of practices, policies, and governance models on implementation	of 11 international case studies, 16 critical success factors were developed and validated using rough set analysis.	stability at the national level, relationships between actors in the region, interdisciplinary teams used to implement TOD, and public participation are the most significant success factors in TOD implementation.
12	Jeffrey Boon Hui Yap, She Vian Goh	2017	Determining the potential and requirements of transit oriented development (TOD): The case of Malaysia	To explore the potential of transit-oriented development (TOD), the perceptions of buyers and the establishment of comfortable walking distance	In this study, exploration of sequential mixed methods research approach was adopted. Semistructured interviews were conducted followed by a questionnaire survey. The respondents were categorised based on their generation cohorts to further understand their acuities on TOD.	The key consideration factors when buying houses in the TOD area are as follows: amenities related to jobs and family for Baby Boomers; time saving for Generation Y; and location for Generation X, i.e. house should be conveniently located in relation to working place, school, etc.
13	Jill Grant	2002	Mixed Use in Theory and Practice: Canadian	To explore the theory and practice of mixed use,	Based on Canadian experience	This study finds that mixed use promises

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			Experience with Implementing a Planning Principle	from its origins in the critiques of Jane Jacobs to the recent prescriptions of New Urbanism.		economic vitality, social equity, and environmental quality, but it cannot readily deliver such benefits in a context where cultural and economic forces promote separation of land uses.
14	Todd Litman	2021	Evaluating Transportation Diversity	To examine consumer demands for non-auto travel options, the roles that various modes play in an efficient and equitable transport system, transport diversity benefits	Conventional planning undervalues many of these benefits, resulting in less diverse, more automobile dependent communities than optimal.	Multimodal planning that increases transport system diversity tends to increase efficiency, equity and resilience, and achieve various planning goals including congestion reduction, infrastructure savings, affordability, improved mobility for non-drivers, traffic safety, increased public fitness and health, environmental protection and support for strategic development objectives.

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15	Rui Mu, Martin de Jong	2012	Establishing the conditions for effective transit-oriented development in China: the case of Dalian	To identify conditions for effective TOD and map them systematically.	A theoretical framework is built up for effective TransitOriented Developments (TODs) and an empirical study is carried out in Dalian, one of the largest cities in China that embraces TOD	To make TOD work in China, cities should at least meet all critical conditions such as pedestrian friendly urban design, good governance and high-quality transit services.

Methodology

This study adopts a qualitative research design, employing a systematic literature review to explore the impact of Transit-Oriented Development (TOD) on urban quality of life, with a particular focus on the Lestari Link project. The methodology follows a five-phase structured protocol: (1) formulation of the research question, (2) comprehensive literature search, (3) screening and quality assessment of studies, (4) data extraction and synthesis, and (5) reporting of findings based on thematic categorization.

The research question guiding the review focuses on how TOD influences urban sustainability, accessibility, and residents' well-being in Malaysian cities. To address this, a systematic search strategy was developed using keyword combinations such as "Transit-Oriented Development," "TOD," "urban sustainability," "quality of life," and "urban planning." Boolean operators (AND, OR, NOT) were used to refine the search queries. The databases included for the literature search were Scopus, ScienceDirect, Google Scholar, and Planning Malaysia, ensuring broad coverage of both scholarly and applied studies.

To ensure the inclusion of high-quality and relevant literature, specific inclusion criteria were established. Studies were selected based on the following conditions: (i) peer-reviewed articles published in English between 2010 and 2025, (ii) relevance to TOD and its effects on urban sustainability and quality of life, and (iii) empirical or conceptual focus on Malaysian or comparable Southeast Asian urban contexts. Non-peer-reviewed studies, lacked methodological rigor, or were not directly related to TOD were excluded. A total of five core articles that met the inclusion standards were retained for in-depth analysis (see Table 1 for a matrix of key findings).

The data analysis technique used in this study is thematic analysis, which involves identifying, organizing, and interpreting recurring patterns (themes) across the selected studies. The analysis focused on three key dimensions—economic, environmental, and social—which form the backbone of TOD evaluation. These themes were derived deductively from prior theoretical frameworks and inductively refined through detailed coding of the selected articles. This

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method is especially suitable for understanding complex, multidimensional urban phenomena and allows the synthesis of qualitative evidence that reflects the lived experiences and contextual realities of urban communities.

The thematic analysis was guided by principles outlined by Braun and Clarke (2006), involving (1) familiarization with data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. Special attention was given to identifying both the positive impacts (e.g., increased accessibility, enhanced urban vibrancy, economic uplift) and the challenges (e.g., gentrification, rising housing costs, infrastructure pressure) associated with TOD implementation.

To ensure methodological transparency and reliability, the study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, documenting the entire review process from literature selection to data interpretation. The findings will be reported with an emphasis on evidence-based recommendations to inform future TOD-related urban policies.

Furthermore, this study is guided by the PICOC framework:
Population: Residents living in TOD areas;
Intervention: Implementation of TOD strategies;
Comparison: Non-TOD urban areas;
Outcome: Improved quality of life (measured in terms of accessibility, economic stability, and community interaction);
Context: Urban areas in Malaysia, including Kuala Lumpur, Penang, and Johor.

By using this comprehensive qualitative and systematic approach, the study seeks to provide a robust theoretical foundation for understanding how TOD can be leveraged to improve urban quality of life while addressing environmental and socioeconomic challenges.

Table 2: Key Features and Benefits of Lestari Link as a Transit-Oriented Development

Features	Descriptions	Benefits
Mixed-use Development	Lestari Link mixes residential, commercial, and recreational spaces to form a thriving community in which residents can reside, work, and enjoy leisure activities.	Promotes convenience, decreases commute time, and encourages community contact, so improving overall quality of life.
Sustainable Design	The development uses environmentally friendly materials and energy-efficient technologies, including renewable energy sources.	Reduces environmental impact and operational expenses while encouraging sustainable urban living.
Transit Oriented Infrastructure	Lestari Link is strategically positioned near public transportation hubs, providing convenient access to light rail transit (LRT) and bus services.	Encourages public transportation use, lowers reliance on private vehicles, and helps to alleviate traffic congestion in the surrounding area.

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Smart Technology	Throughout the development process, smart technology will be integrated to monitor resource consumption and optimize energy use.	Increases resource management efficiency and improves people' living experiences by providing innovative services.
Economic Growth Potential	Lestari Link is well-positioned to attract businesses and investors due to its strategic location and sustainable qualities that improve property marketability.	Increases property prices and promotes local economic growth by offering job opportunities and attracting a variety of industries.

Protocol of Transit-Oriented Development (TOD) is a forward-thinking urban planning strategy that integrates transport and land use to promote public transit and active transportation, reducing reliance on private vehicles (Van Lierop, 2016). This approach aims to enhance residents' quality of life by creating vibrant, sustainable communities around public transportation hubs. Key aspects of TOD to be studied include accessibility, economic stability, and social interaction. Specifically, research questions will focus on how TOD improves residents' access to public transportation and local amenities, the economic benefits for local communities, and how it fosters community engagement and social connections. The study will be conducted in urban areas of Malaysia, including Kuala Lumpur, Penang Island, and Johor, using mixed-methods research combining surveys and interviews with LRT users and residents in TOD areas. The PICOC framework will guide the study: Population includes residents living in TOD areas; Intervention involves implementing TOD strategies;

Comparison will be made with areas without TOD; Outcome will measure enhanced quality of life through accessibility, economic stability, and social interaction; and Context will focus on urban planning in Malaysia, emphasizing sustainable development and community well-being. By examining these aspects, the study aims to provide insights into how TOD can improve quality of life while addressing socioeconomic inequalities and boosting local economies. Therefore, a successful TOD should prioritize preserving and improving the well-being of its inhabitants, ensuring that their quality of life is not compromised (Jamalunlaili Abdullah, Mohd Hafiy Mazlan, 2016).

To compile a comprehensive collection of studies on Transit-Oriented Development (TOD) and its impact on quality of life, a detailed search strategy will be developed. This involves crafting precise search strings using keywords such as "Transit-Oriented Development," "TOD," "quality of life," "urban planning," and "sustainability." These keywords will be combined using Boolean operators (AND, OR, NOT) to refine the search. For instance, a sample search could be ("Transit Oriented Development" OR "TOD") AND ("quality of life" OR "urban sustainability"). The search will be conducted across prominent academic databases like Scopus, Science Direct, and Google Scholar, as well as through Planning Malaysia. This approach ensures a thorough collection of both academic and practical insights into TOD's effects on quality of life, providing a robust foundation for understanding its benefits and challenges in enhancing urban living.

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To ensure the selection of high-quality research to assess the impact of Transit-Oriented Development (TOD) on quality of life, a rigorous process of inclusion and exclusion criteria will be employed. This approach involves carefully evaluating each study against predefined criteria to ensure relevance and quality. The inclusion criteria will focus on peer-reviewed articles published in English within the last decade, specifically those that examine the effects of TOD on urban sustainability and community well-being in Malaysian cities. Conversely, non-peer-reviewed studies, irrelevant publications, and those with methodological flaws or insufficient data will be excluded. To assess the quality of the selected studies, standard evaluation methods will be applied, including examining the study design, sample size, relevance to the research topic, and the presence of a clear methodology and results section. By applying these criteria and conducting a thorough quality assessment, the study aims to provide a comprehensive and reliable overview of how TOD influences quality of life in urban areas, offering valuable insights into its benefits and challenges in enhancing urban living.

To synthesize the data from selected studies on Transit-Oriented Development (TOD) and its impact on quality of life, key findings will be extracted and organized into three thematic areas: economic impacts, environmental impacts, and social impacts. Economically, studies indicate that TOD can stimulate local economic development by increasing property values and encouraging local spending; however, challenges such as gentrification and rising housing costs have also been observed (Robert Cervero, Berkeley G.B Arrington, 2008). From an environmental perspective, TOD has been recognized for its ability to reduce carbon emissions by promoting the use of public transportation and active modes of travel, thereby contributing to more sustainable urban environments (Cervero R. , 1993) Socially, TOD enhances community interaction and cohesion by fostering mixed-use developments that encourage walking and cycling, which in turn improves residents' quality of life (Hank Dittma &, Gloria Ohland, 2004). By dividing these data into economic, environmental, and social dimensions, this synthesis gives a thorough knowledge of TOD's impact on urban quality of life while addressing both its benefits and drawbacks.

To analyse the impact of Transit-Oriented Development (TOD) on quality of life, a qualitative analysis approach will be utilized to uncover key themes, trends, and patterns. Thematic analysis will serve as the primary method for interpreting findings from the selected studies, focusing on recurring themes across economic, environmental, and social dimensions. Key themes such as improved accessibility to public transport, strengthened community cohesion, and increased local economic activity will be examined in detail. At the same time, the analysis will address challenges associated with TOD, including gentrification, rising housing costs, and potential inequalities in its implementation. By exploring narratives and contextual data from the studies, this approach provides a deeper understanding of how TOD shapes various aspects of quality of life. The qualitative method ensures a comprehensive interpretation of TOD’s impacts by capturing the lived experiences of residents and communities, offering valuable insights into both its advantages and its challenges in urban development.

The study on Transit-Oriented Development (TOD) and its influence on quality of life will be structured in accordance with Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) criteria, ensuring that findings are presented comprehensively and transparently. The report will include crucial sections such as an introduction to the background and aims, a full description of the methodology used to select and analyse research, and a findings section outlining TOD's economic, environmental, and social benefits. The debate will place these findings in the context of urban development strategies, looking at both the benefits

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and problems of TOD implementation. In addition, the report will address the study's limitations and make recommendations for future TOD policy, such as efforts to reduce gentrification and improve community engagement. Overall, the paper intends to provide policymakers and urban planners with practical insights that will help to create more successful and sustainable urban development policies.

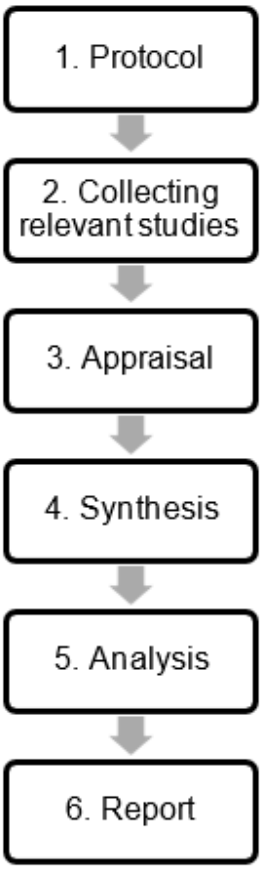

Figure 1: Systematic Literature Review Process

Research Findings

The implementation of Transit-Oriented Development (TOD) within the Lestari Link initiative has yielded several key outcomes that align with sustainable urban development goals. Firstly, the project has significantly contributed to urban sustainability by promoting compact, mixed-use developments that are well-integrated with public transportation infrastructure. This design reduces reliance on private vehicles, cuts per capita vehicle miles travelled (VMT) by up to 40%, and leads to substantial reductions in fuel consumption and air pollution (Litman, 2021). Lestari Link's emphasis on renewable energy integration, green infrastructure, and energy-efficient buildings mirrors global best practices and supports Malaysia’s broader sustainability agenda (Transit-Oriented Development: A Guide for Local Governments, 2005).

Secondly, enhanced urban mobility and accessibility have emerged as notable outcomes. The integration of transit hubs with residential and commercial areas has improved access to essential services, reduced commute times, and facilitated more walkable, connected communities (Gomez, Omar, & Nallusamy, 2019). This is evident in similar regional TOD

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efforts, such as those in Jakarta's suburbs, where improved transit accessibility has successfully decreased reliance on fossil fuels and boosted energy efficiency (Muhamad Taki, 2024).

Economically, the TOD approach in Lestari Link has stimulated local development by increasing property values, investment appeal, and market demand near transit stations. As noted in prior research, areas surrounding transportation hubs in Kuala Lumpur experienced heightened commercial activity and improved job accessibility, indicating that TOD serves as a catalyst for economic growth (Jaafar Sidek et al., 2019). Furthermore, the project has demonstrated the potential for social transformation by fostering equitable, inclusive urban environments that enhance community interaction and engagement.

Overall, the findings suggest that Lestari Link's TOD model offers a strategic framework that not only advances sustainability and economic development but also enhances urban liveability. The initiative's alignment with smart planning and global TOD standards positions it as a replicable model for future transit-integrated urban development in Malaysia and beyond.

Conclusion

This study set out to explore how the Lestari Link project applies innovative Transit-Oriented Development (TOD) principles to enhance urban sustainability and improve quality of life through the integration of smart technologies, green infrastructure, and sustainable transportation systems. Based on a systematic literature review and thematic analysis, the study has successfully achieved its objectives. The findings confirm that TOD implementation in Lestari Link contributes significantly to environmental sustainability, economic development, and social well-being. Through mixed-use planning, smart mobility solutions, and resource-efficient infrastructure, the project has demonstrated a viable model for reducing environmental impact, increasing accessibility, and fostering vibrant, inclusive communities.

In addition to fulfilling its research aims, the study contributes to the growing body of knowledge on sustainable urban development by providing localized evidence of TOD's effectiveness in the Malaysian context. It offers practical insights for policymakers and urban planners on how TOD frameworks, supported by smart technologies and green design, can address challenges such as urban sprawl, traffic congestion, and declining quality of life. The study also adds theoretical value by aligning its analysis with urban planning models such as the Compact City Theory and the Transport-Land Use Feedback Cycle.

However, the study is not without limitations. It primarily relies on secondary data and does not incorporate primary empirical evidence from residents, planners, or stakeholders involved in the Lestari Link project. As such, the long-term socioeconomic and behavioral impacts of TOD remain areas for further exploration. Additionally, the focus on a single case study may limit the generalizability of the findings to other urban contexts with differing socio-political and economic conditions. Future research should aim to integrate longitudinal field data and stakeholder perspectives to more comprehensively evaluate the multifaceted impacts of TOD initiatives.

Overall, the Lestari Link project exemplifies the potential of TOD-driven smart planning in fostering sustainable, people-centric urban ecosystems. It serves as a benchmark for future urban development policies and reinforces the importance of integrating transportation, technology, and land use to build resilient cities for the future.

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