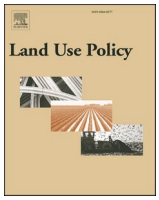
Land Use Policy 152 (2025) 107501

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol



Ambiguity in state-owned land property rights increases transaction costs in China's transit-oriented development projects

Dongsheng He [a], Jinshuo Wang [b], Guibo Sun [c,*]

[a] Department of Urban Planning and Design, The University of Hong Kong, Hong Kong, China
[b] Urban Infrastructure Transition Lab, Hong Kong, China
[c] Department of Planning, Property and Environmental Management, The University of Manchester, UK

ARTICLE INFO

Keywords:
Institutional arrangement
Transaction cost
Property rights
Transit-oriented development
Rail plus Property

ABSTRACT

This paper provides compelling evidence that the ambiguity in state-owned land property rights increases transaction costs in China's transit-oriented development (TOD) projects. The constitution defines the state as the *de jure* (legally defined) owner of urban land, but tiers of local government share the *de facto* (practically controlled) land property rights; this ambiguity complicates land use right transfer for TOD. Through expert interviews, document analysis, and case studies in Guangzhou, we identified three critical issues. First, ambiguity in *de facto* land property rights has led district governments to relocate the metro depot site from a profitable plot suitable for metro scheduling and property development to land plots that are less advantageous and far away from the station. Second, the coexistence of land allocation and leasing approaches under state ownership discouraged an optimised land assembly for the TOD project. Rigid acquisition sizes designated in land allocation for infrastructure discouraged coordination and prolonged negotiations between the district government and the metro company. Finally, the district government faced a disproportionate fiscal responsibility compared to their land leasing share from the municipal government. They are thus passively against the TOD project using their land use planning power. These transaction costs delay the TOD project and jeopardise the outcomes, resulting in depots far from metro stations, housing adjacent to industrial areas, and oversized commercial spaces on urban fringes. We argue that the ambiguity in state-owned land property rights is rooted in China's historical, cultural, and institutional contexts, driving high transaction costs for urban infrastructure development.

1. Introduction

Transit-oriented development (TOD) is a planning doctrine for urban rail transit system. It promotes high land use efficiency by advocating high-density, connective, and multi-functional development in transit areas (Sun et al., 2020; Suzuki et al., 2015). The decision-making process of TOD projects has been highlighted because it is associated with the project duration, cost, and physical environment outcomes. For instance, project development mechanisms determine how stakeholders collaborate and coordinate. Meanwhile, how TOD projects are developed affects stakeholders' financial interests and risks. Policymakers and planners are keen on optimising the decision-making mechanisms to improve project efficiency and effectiveness. In the past decades, China has seen a rapid rise in TOD projects (Yang et al., 2020). Previous research mainly focused on the economic and social effects of metro infrastructure development, such as land capitalisation and travel behaviour change (He et al., 2024; Sun and Du, 2023). However, there is a limited understanding of TOD projects' decision-making processes and how they determine the outcomes.

The transaction cost theory provides a perspective to understand the decision-making process of involved actors in economic activities. The seminal research on transaction cost dates back to Coase's *The Nature of the Firm* in 1937. The concept emphasises that the cost of coordinating and managing transactions can influence the decision of stakeholders, but the term "transaction cost" emerged in the 1970s. The concept of transaction costs stimulates research on New Institution Economics (Coase, 1998), seeking to explain the origin, creation, purpose, and evolution of institutions in economics (Klein, 1998). As the foundation of economic activity, transactions are regarded as a "basic unit of analysis" to analyse the effects of institutions (Williamson, 1989). A transaction can be understood as a (partial) transfer of property rights regarding goods or services (Buitelaar, 2004). The concept of property

* Corresponding author.
E-mail addresses: hedsh3@connect.hku.hk (D. He), nju1127095@hotmail.com (J. Wang), guibo.sun@manchester.ac.uk (G. Sun).

https://doi.org/10.1016/j.landusepol.2025.107501
Received 29 June 2024; Received in revised form 9 January 2025; Accepted 3 February 2025
Available online 12 February 2025

rights is fundamental to the transaction cost theory. Property rights refer to the rights to own, make profits, and transfer property (Lai and Lorne, 2014). Since transactions generally involve property rights transfer among stakeholders, property rights are central to understanding transaction costs. Institutional arrangements on property rights determine the choices and interactions of actors involved in a transaction, including decisions on whether and how to proceed. Enforceable and well-delineated land property rights are conducive to reducing transaction costs (Buitelaar, 2004; Chen and Wang, 2022).

Transaction cost theory has been used to examine land development (Lai and Tang, 2016; Shahab, 2022). The land development generally includes land use preparation, planning, and land transfer (Buitelaar, 2004). Since each stage involves the transfer of land property rights, reaching an agreement on each stage could be treated as a transaction. Several studies elaborated on how institutional arrangements incur transaction costs in land development. They found unsupportive institutions may cause high transaction costs between actors (e.g., different tiers of government, land users, and developers), leading to project delays, actors' withdrawal, undesirable land development outcomes, and postponement of the transaction (Lai and Tang, 2016; Shahab, 2022). Therefore, transaction cost theory can offer a useful lens to analyse how institutional arrangements on land property rights affect land development processes and outcomes and provide implications for reducing these costs (Clinch et al., 2008; Webster and Lai, 2003).

In China, the public ownership of urban land enables a state-led approach to land acquisition, land use planning, and land transfer (Lai and Tang, 2016). Land development in TOD projects involves complex institutional arrangements. As the *de facto* landowners, municipal and lower-tier (e.g., district or county) governments are involved in the land development. Meanwhile, the coexistence of non-profitable (e.g., transport) land use and profitable (e.g., residential and commercial) land use determines that different land use rights transfer methods (e.g., land allocation or leasing) are needed to form compatible land in TOD projects (Wang et al., 2019). However, land property rights delineation and multiple rounds of land transfers may hinder land acquisition in urban development projects (Chen and Wang, 2022), leading to stakeholders' conflicts. While the constitution vaguely defines the state as the *de jure* owner of urban land, the *de facto* land property rights are often jointly shared by different tiers of governments with ambiguities, creating competing interests in land leasing and complicating the land use rights transfer.

There is a limited understanding of how land institutions determine the decision-making and outcomes of TOD projects in China. The Rail plus Property (R+P) model is a widely adopted TOD strategy in China, originating in Hong Kong. This model integrates metro stations with high-density residential and commercial developments above depots, promoting mixed land use and generating land and housing price premiums. In its ideal form, the R+P model incorporates metro depots and stations into a cohesive design, supported by well-connected pedestrian networks that ensure accessibility and proximity between the metro and its surroundings. Based on expert interviews, document analysis, and site study, this paper investigated an R+P project in Guangzhou. We aim to contribute to the literature in three aspects. First, this study investigated how land property rights determine the land development of TOD projects from a transaction cost perspective. We assumed that ambiguity in land development institutions would incur high transaction costs in decision-making processes. Second, this study investigated the interplay between institutional arrangements, property rights, and the development outcomes of TOD projects. The local government prioritised land leasing fee sharing, compromising the design outcomes. Third, current research on ambiguous land property rights in China mainly focuses on collectively owned rural land (Lai and Tang, 2016; Sa, 2020). We extended the debates between ambiguous land property rights and infrastructure development to the urban land realm in China.

While this study is grounded in the context of China's state-led land institution, we aim to provide insights to other regions facing a similar issue where ambiguous state-owned property rights that arise from institutional changes, power imbalances, or weak enforcement increase transaction costs in urban infrastructure development. The paper is organised as follows. Section 2 reviews studies on land development, transaction costs, metro financing, and land development institutions of TOD in China. Section 3 presents the method and contextual background. Section 4 describes the institutional arrangements of the R+P project in Guangzhou. Section 5 analyses the decision-making of the case on land development from a transaction cost perspective. Section 6 concludes the papers with discussions and policy implications.

2. Related work

2.1. Transaction cost theory and land development

Transaction cost is a key concept in New Institution Economics (North, 1987). Its common definition is the non-production costs involved in the transfer of property rights regarding goods or services (Williamson, 1996). This definition parallels Coase's analysis of the "costs of using the price mechanism" (Shahab and Viallon, 2021). It generally encompasses time and monetary costs throughout the transaction process, such as information collection, negotiation, and contract design and signatory, due to market actors' bounded rationality and incomplete information (Williamson, 1989). Transaction cost theory has been applied to land development research (Clinch et al., 2008; Webster and Lai, 2003). Alexander (1992) introduced the concept of transaction cost into urban planning and land development, proposing that planning can be viewed as a coordination process (Alexander, 1992). His study emphasised that institutional design is crucial for coordinating planning processes when organisations engaging in strategies and goal achievement navigate diverse stakeholder interests. His insights sparked insights to tackle planning and development challenges from the perspective of transaction costs (Shahab, 2022).

The land development process usually includes stages such as land preparation, land use planning, and land transfer among stakeholders (Buitelaar, 2004). Land development involves a shift in control over land property rights, and agreements reached at each stage could be regarded as individual transaction units (Buitelaar, 2008). Research on land development has applied transaction cost theory to assess the efficiency, effectiveness, and equality of policy and elucidate specific instruments, such as transferable development rights programmes in North America (Shahab et al., 2018) and land readjustment policy in China (Chu et al., 2024). Studies also used transaction costs theory to analyse institutions of property development (Buitelaar, 2004), urban regeneration (Lai and Tang, 2016), and infrastructure planning (Whittington, 2012). In addition, studies assessed the distribution of transaction costs (e.g., magnitude, distribution, and timing) among stakeholders in land development (Shahab, 2022).

Transaction cost studies offer a valuable lens for analysing institutional arrangements of land development practices (Lai and Tang, 2016; Shahab et al., 2018). High transaction costs could arise due to unclarity of property rights, asset specificity, uncertainty, or timing (Tang et al., 2004; Zhuang et al., 2020). Each land plot is distinct and immovable, and land ownership tends to be fragmented (Buitelaar, 2008). Land preparation accompanies property rights demarcation; information search and negotiation costs are thus inevitable. Land use planning generally requires achieving agreements for land use composition and development intensity. It involves complying with land development regulations; developers must follow the rules and get permits, and reaching agreements and addressing conflicts of interest can be time-consuming (Gao et al., 2018). In addition, land property rights transfer requires contractual agreements and enforcement costs. A few

studies also attribute unsupportive institutional arrangements with increased transaction costs for land development in infrastructure projects (Whittington, 2012).

2.2. Land financing the metro infrastructure in China

China has had extensive metro development since 2008. Municipal governments are in charge of financing metro projects. A typical procedure is that municipal governments submit a metro plan on a five-year basis for approval from the State Council and proceed with construction (Sun and Webster, 2024). Municipal governments established a state-owned enterprise, the metro company, to manage the metro projects. Revenue from land transfer is the financial pillar of local governments by leasing urban land in China (Sun et al., 2020; Zhang et al., 2024). The leasing fee will be used for public infrastructure financing, including for metro projects. In return, the infrastructure-stimulated further economic growth is expected to pay the infrastructure debt (Sun and Webster, 2024).

Local governments and property developers have used TOD as a land development strategy to mitigate fiscal pressures in China. The R+P model, borrowed from Hong Kong, has been widely adopted. Since the 1980s, the Hong Kong Metro has implemented the R+P model. R+P projects develop high-density commercial and residential spaces above the metro station or depot. The revenue from property development can recover the metro investment (Cervero and Murakami, 2009). As the neighbouring city to Hong Kong, Shenzhen pioneered the R+P model in China to finance metro lines, starting in 2000s (Yang et al., 2020). Other cities, including Guangzhou, learned from this model, pushing the TOD project to become the metro financing method.

2.3. Institutional arrangements for TOD projects

The structure of institutions determines the involvement of key stakeholders in land development, with land property rights holding a central position. The public-owned urban land system in China grants the central government the *de jure* land property rights on behalf of the public (Zhu, 2019). However, local governments control land property rights in practice. A local government in land development generally has at least two tiers: the municipal and district- or county-level governments. They all have *de facto* urban land property rights within their jurisdictions, but the property rights sharing among them is not fixed and subject to their political and economic status (Chen and Wang, 2022). The share of *de facto* land property rights can vary with institution design at the local government level in China.

To develop a TOD project, land preparation usually requires land acquisition from previous users because of the limited greenfield reservations. State-led land acquisition is the sole legal channel through which the land plot could be developed, including for TOD (Lai and Tang, 2016). It includes site selection and boundary delineation, and the users would be compensated with the amount subject to the land size and use type. Local government has a dual-track land transfer method (Lin, 2010), land allocation and land leasing, to develop mixed-use land plots in a TOD project. Land allocation deals with non-profitable land use purposes (e.g., transport infrastructure) that could be allocated without generating land leasing revenue. The granted land use right only encompasses the use right, excluding the right to derive benefits from the land (Chen and Wang, 2022). Land for metro depots is allocated as this type. Land leasing deals with transferring profitable land use rights through public auction. The air right for property development above the depot land should follow the land leasing procedures (Wang et al., 2019).

Subject to these complex institutional arrangements in land development at local governments, this study will investigate the relationship between state-owned land property rights and transaction costs in TOD projects in China.

3. Case study

3.1. Study context and data

Our study case is in Guangzhou, where metro systems are prioritised in urban development strategy because of rapid population growth, increasing from 7.01 million in 2000 to 18.83 million in 2023. Guangzhou embarked on an ambitious metro plan: There were only five metro lines with 150 km of track in 2008, but it increased to sixteen metro lines with 621 km by 2023. The massive metro expansion created a huge financial burden for the local governments. Relying on government subsidies is insufficient to support the massive investment, urging alternative financing options. Guangzhou adopted the R+P model, which was applied in Hong Kong and Shenzhen, and has launched over 10 R+P projects since 2017, aiming to address the financial pressure. The massive investments and active R+P experiments made Guangzhou an ideal case for this study.

The case study was based on multiple data sources. The primary data were interviews with 12 experts in Guangzhou (Table S1). The selection of interviewees was based on two criteria. First, the interviewee has working experience in TOD projects in Guangzhou. Second, the selected interviewees covered sectors of architecture, urban planning, transport planning, land acquisition, and real estate development related to TOD. Each interviewee was invited to a 1-hour interview, and 10 interviews lasted between 1 and 2 hours. The semi-structured interviews include questions on R+P development strategies, rationales, development mechanisms, collaboration and conflict among stakeholders, and spatial outcomes and problems of R+P projects (Table S2). The interviews were conducted between July 2023 to May 2024. At this time, Guangzhou had finished its first round of R+P projects by the municipal state-owned enterprise, Guangzhou Metro. Stakeholders have a good understanding of the institutional arrangements of R+P projects. This study used a snowball sampling method. The interview started with a small group of experts invited by the authors. Interviewees were requested to refer colleagues involved in R+P projects. In addition to the expert interviews, we interviewed 12 residents who live in housing from the R+P projects. The resident interviews focused on the reasons for the choice of the estate and their assessment of the design outcomes of R+P projects. Moreover, we collected secondary data on planning and policy documents and reports about R+P regulations from the government, as well as documents and online materials, including planning and policy documents and media news.

All interviews were transcribed and coded. The process started by developing a coding scheme based on our analytical framework described later. Thematic analysis is a suitable method because of our wide variety of research questions and topics (Braun and Clarke, 2021). The interviews were analysed using thematic analysis to identify and report patterns and themes in the qualitative data uploaded to NVivo12 software. First, we familiarised ourselves with the interview transcripts from the interviews. Second, iterative test rounds of coding were conducted to refine the coding scheme. We coded the transcripts iteratively but systematically using NVivo and generated 14 nodes and 52 sub-nodes (Table S3). Third, we generated initial themes and multi-faceted groupings of codes enriched by interpretation. Fourth, we discussed, refined, and reviewed themes throughout the writing process. Fifth, we refined and named the themes. Last, we developed the results and discussions based on the thematic analysis.

3.2. Policy and document related to R+P

We reviewed key policy documents issued by the Guangzhou municipal government to implement R+P projects from 2012, when the R+P practice was initiated, to 2020, when the first wave of R+P projects was created (Table 1). These documents outlined the institutional arrangements for land development of all R+P projects in Guangzhou, including procedures for land acquisition, compatible land use (e.g.,

Table 1
Key policy documents on R+P projects in Guangzhou between 2012 and 2020.

Number	Issued year	Title of the policy document	The main content related to R+P project
D1	2012	Work plan on promoting land and property development along metro line and the land reserve planning (the first wave) in Guangzhou from 2012 to 2016	It advocated integrated land development in transit station areas, and encouraged innovative financing mechanisms
D2	2014	Implementation suggestions for economical and intensive land use in Guangzhou	It specified land allocation does not have a fixed lease duration, and land leasing for profitable category need to use public auction with a maximum duration (e.g., 70 years for residential land)
D3	2016	Implementation suggestions to facilitate land and property development along metro lines in Guangzhou	It prioritised property development above the metro depot to finance metro projects
D4	2017	Detailed implementation schemes to facilitate the integration of property and metro lines in Guangzhou	It created institutional arrangements for land acquisition, planning approval, and land leasing revenue distribution
D5	2020	Optimised schemes for land acquisition coordination between municipal and district government in Guangzhou	It regulated the land leasing distribution share of district government from 5 % to 12.75 %

floor-level land use rights leasing), and land leasing fee distribution schemes. They also established frameworks to coordinate public sectors, such as planning, transport, and natural resources bureaus, to ensure the implementation of R+P projects. In particular, one document issued in 2020 focused on optimising the distribution of land leasing shares between municipal and district governments. Despite introducing new policies after 2020, they did not touch much upon the change in land development procedures and regulations of R+P projects.

4. Institutional arrangements of land development in R+P projects

Based on our document analysis and interviews, Fig. 1 illustrates the relationship between property rights and land development in TOD projects in China. As land owners, the local government plays a dominant role in the land development process of TOD projects, reinforced by its planning approval rights. It manages the land development procedures, including land preparation, land use planning, and land transfer. Concurrently, land development involves at least two tiers of government, municipal and district or county, depending on local planning discretion and land ownership sharing. As a result, competing interests could arise regarding land property rights and decision-making in land development for TOD projects.

Our analytical framework highlighted the stakeholders involved at each stage, as well as the transactions and challenges associated with land development in R+P projects in Guangzhou (Fig. 2). Land preparation requires collaboration between the metro company and the district government to identify metro depot sites and define project boundaries (Document D4). The municipal government reviews the plans for depots, stations, and tracks, among others. Once land acquisition is approved, the municipal or district government negotiates land use rights with previous users, provides compensation and revokes the rights.

However, confirming land plot locations and sizes is often a time-consuming process due to complexity and fragmentation in land property rights, including ambiguities within those rights (Interviewee R7). The local government desires the land above metro depots for property development. During this process, key stakeholders—including the municipal government, district government, and metro company—negotiate the planning parameters. Typical land use planning involves defining the general layout, floor area ratio, and composition of land uses. Given the stakeholders' interests in economic gain, this process often led to conflicts (Interviewees R11 and R12). Another challenge in land planning was land compatibility. Metro depots were designated for non-profitable use, with the government allocating land use rights to the metro company at a low price or no cost. However, R+P projects contradicted this non-commercial nature, as the air right above the metro depot is now being used for profitable purposes, such as residential and

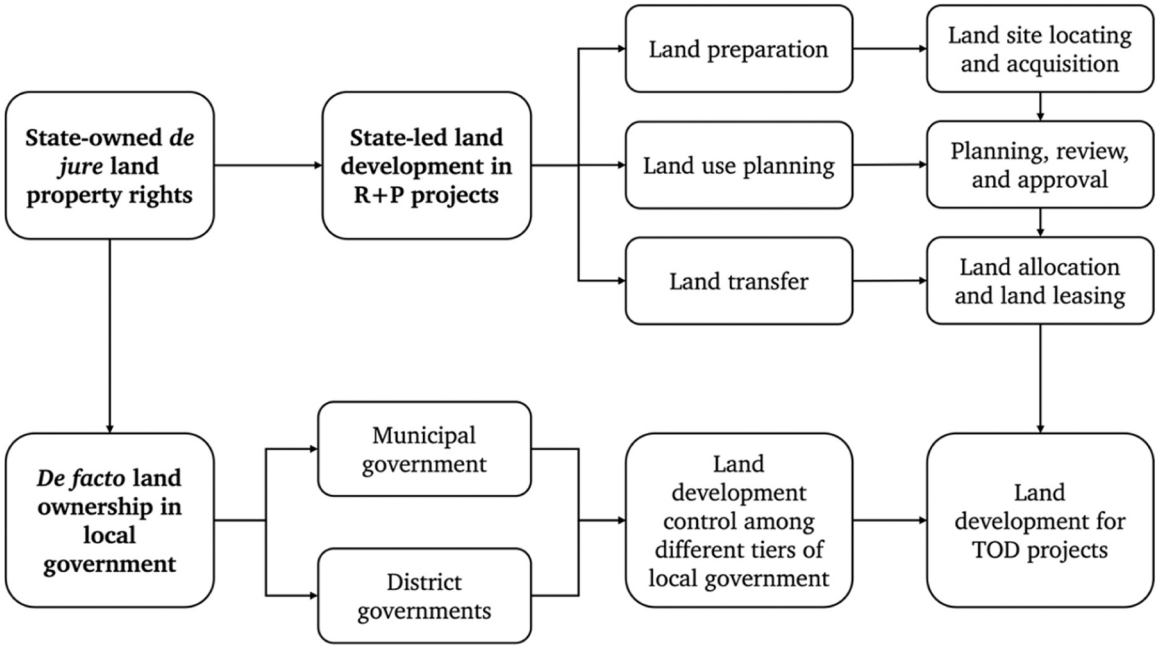


Fig. 1. Land property rights related to land development in TOD projects in China.

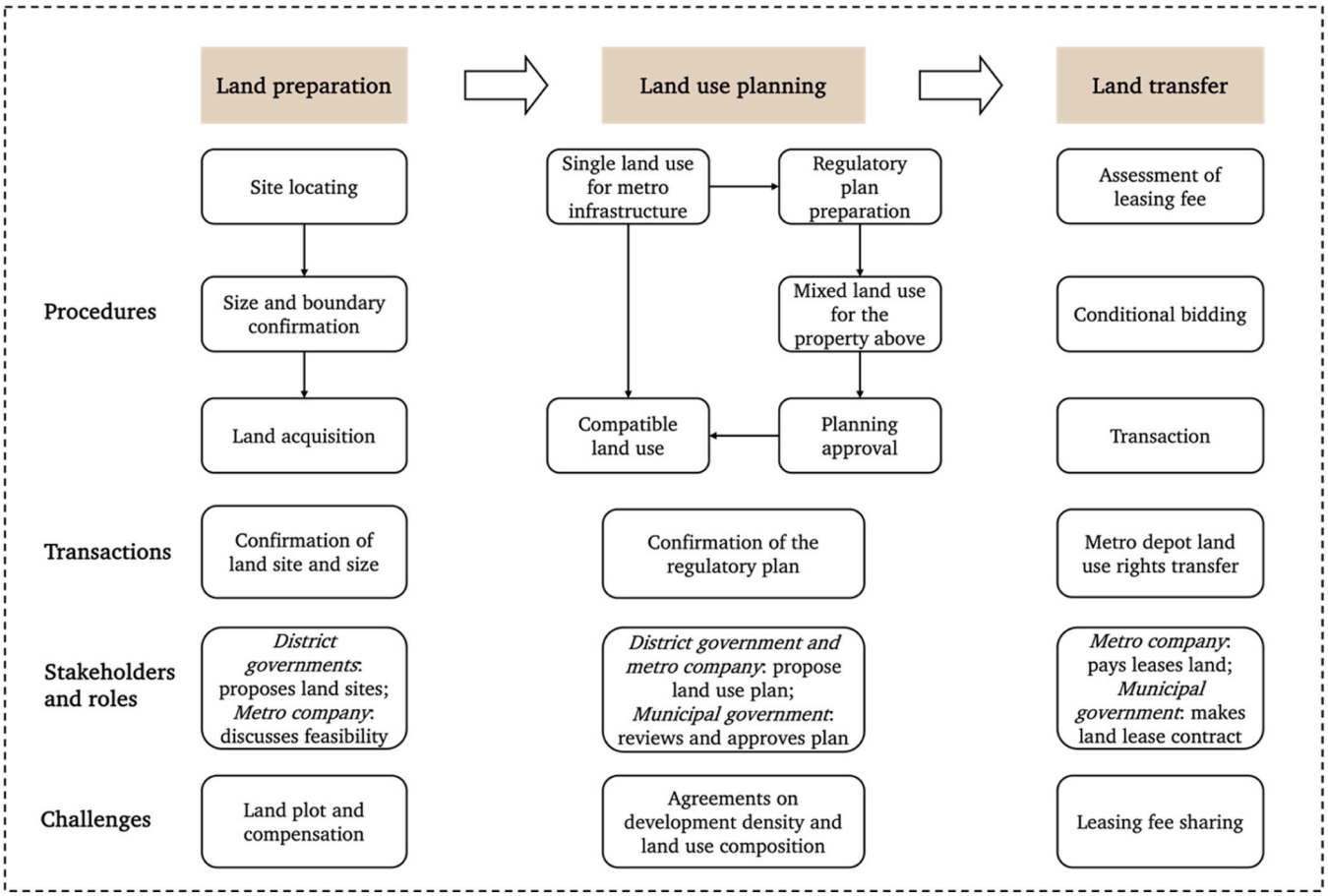


Fig. 2. The analytical framework of land development of TOD projects in Guangzhou.

commercial spaces. To address this issue, the local government devised land use rights into floor-level units and guaranteed the land above the depot leased to the metro company.

The metro company requires a planning revision to achieve land compatibility and to acquire two rounds of land transfer to obtain separate rights for profitable and non-profitable land use. Furthermore, profitable land use necessitates a public auction in the land market. Guangzhou established exclusive bidding conditions to ensure the metro company secures the development rights above the depot. After the planning bureau revises regulatory plans to ensure compatibility with profitable land use, the metro company pays the land leasing fee for these purposes, obtaining the complete land use rights for R+P projects.

Property development has become a key issue for metro depots in an R+P project. However, because the institutional arrangement was established solely for land allocation for transport use and has remained unchanged, there are at least two challenges for TOD projects. First, metro depot sites were commonly located far from stations. This isolation was intended to reduce land acquisition costs and enhance engineering viability (Interviewees R2 and R3). However, residents living in the property above the metro depot complain about the long distance to the metro station, ironically (resident interviewee). Second, stakeholders often have different agendas to benefit from R+P projects. Because proximity to stations can have higher housing premiums, the metro company has advocated integrating metro depots with stations for their economic gains. As a complex with profit and non-profitable spaces, stakeholders need to cope with compatibility, profitability and economic interests related to the land development of the TOD projects (Interviewee R8).

5. Land development of DG New Town R+P project

This section examined depot site relocation, land plot size confirmation, and land use planning of the DG New Town project (alias for anonymity) from a transaction cost perspective. Land development of this R+P project took six years to complete, significantly longer than the others in Guangzhou, which usually took three or four years. The delay was caused by site relocation, plot size confirmation, and regulatory plan revisions. The site selection was negotiated between 2017 and 2019, and the land size confirmation was finalised after a few rounds of negotiations between 2019 and 2022. Land use planning has been revised multiple times between 2021 and 2023. The scheduled operation time of the metro was also delayed from 2022 to 2024. The transactions involved help us better understand the interplay between land property rights and the TOD project and the transaction costs that lead to it.

The Line X extension (alias for anonymity) was proposed in the *Guangzhou Rail Transit Construction Plan (2015–2025)* . The plan was submitted to the State Council for review and received approval in 2017. The extension line includes four stations, spanning a 9.5 km underground track. The estimated cost for the project was 5.70 billion CNY, with construction scheduled to take place in 2019. A metro depot near DG New Town was designated in the project (Fig. 3).

Given the thriving housing market, the Guangzhou Metro benefited from the R+P model between 2017 and 2020. This approach reduced reliance on government subsidies in metro construction and maintenance, as shown in the annual financial report (Yang and Duan, 2023). Consequently, the Guangzhou municipal government expanded the R+P

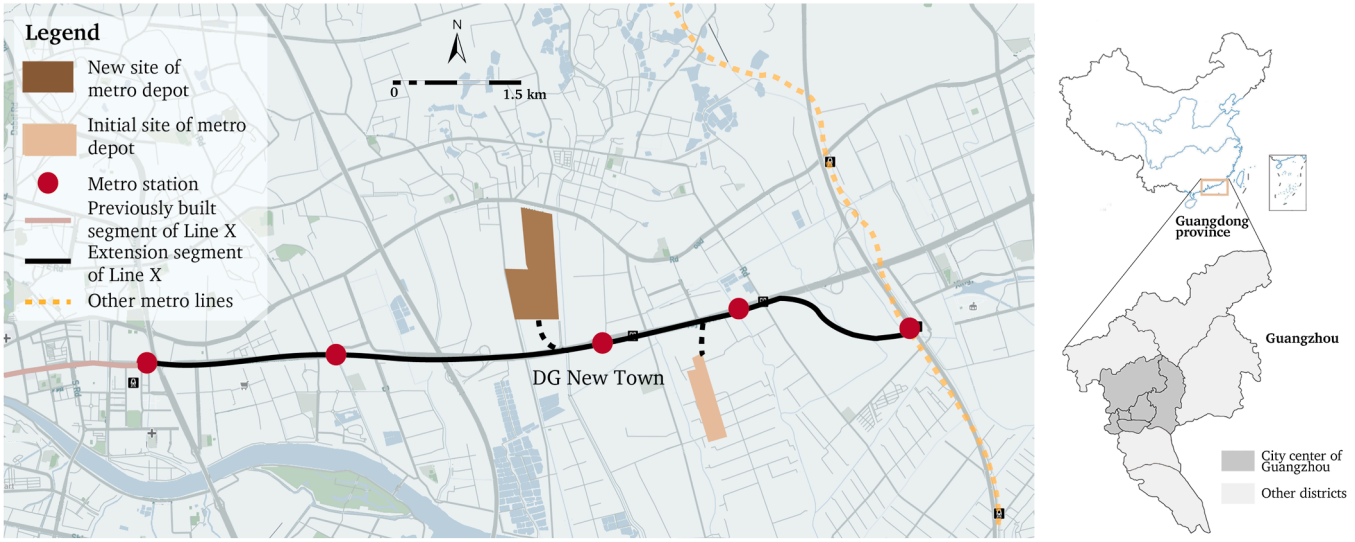


Fig. 3. The locational changes of metro depot site pre- and post-negotiations in local governments.

projects in the subsequent plan. They announced that almost all metro depots will implement the R+P model, including the DG New Town metro depot.

The *Guangzhou Overall Rail Transit Construction Plan (2015–2020)* shows that the metro depot of Line X extension was initially planned for a location in the southern part of the DG New Town station (light brown polygon in Fig. 3). Reports from media indicated that the detailed site design was underway in 2017. In June 2018, the preliminary design suggested that the metro depot would cover an area of 18.1 ha, with 430,000 m^2 designated for housing and commercial development above the depot. However, in 2019, the Guangzhou Urban Planning Commission announced that the depot was relocated to a new site (dark brown polygon in Fig. 3). Following the relocation, the municipal government, the Y district government (alias for anonymity; located in suburban areas), and Guangzhou Metro engaged in multiple rounds of negotiations regarding the land plot size and land use planning between 2019 and 2022. The revised regulatory plan, released in May 2023, indicated that the land size for the R+P project changed to 42.5 ha, with a 678,000 m^2 property development floor size. Upon confirmation of the regulatory plan, the land leasing of air rights took place in 2024.

5.1. Ambiguous de facto land property rights

Local authorities claimed that the new location would support comprehensive urban redevelopment and efficient land use, but they did not disclose the reason for relocating the metro depot. According to the interviews, there were multiple rounds of negotiations between the municipal and district governments regarding the site selection and relocation, and the district government firmed the new site to reduce their economic loss from land leasing sharing with the municipal government.

The Guangzhou municipal government switched rules for land leasing revenue sharing between the municipal and district governments. Normally, the district government can retain 60 % of land revenue and turn over the left to the municipal government. This rule applies to most district-led land development projects. However, the municipal government had the authority to label a TOD project as a key municipal project; then, they would control the land acquisition and leasing of the projects from the districts, and the share of land leasing revenue to the district government would be significantly reduced to 5–12.75 % (Interviewee R1 and R2; Document D5). All R+P projects in Guangzhou were re-labelled as key municipal projects after the municipal government saw the benefits from related land leasing premiums. This has created huge tension and transaction costs between the municipal and district governments.

> "*The key municipal project is a levy for the municipal government to dominate the land development. The district governments are required to provide land plots for metro depots within the jurisdiction while having discretion for the site location. They lack the incentive to provide profitable greenfield plots under the current land leasing sharing scheme* (Interviewee R2)".

Table 2 illustrates the *de facto* rights of the district government for the initial site of the metro depot in the two scenarios. The initial site was a greenfield with high land leasing potential and less land preparation costs. As a district-led project, the district government could transfer the land plots into lucrative residential and commercial land and receive 60 % of the land leasing revenues. In contrast, as a key municipal project, the district government would only receive a tiny amount of land revenue, resulting in economic loss for the district government.

Initially, the Y District government had no alternative land to change the metro depot site. However, in 2019, the district government reached an urban redevelopment agreement with the land user of an industrial land plot with undetermined future use. This new site was industrial land requiring high compensation fees to be paid to the previous land user for redevelopment. This meant there would be limited land leasing revenue after deducting acquisition costs regardless of the *de facto* property rights and land leasing distribution. By contrast, if the newly

Table 2
Two scenarios of *de facto* land property rights for the metro depot site of Line X extension.

Scenario	*De facto* land property rights of the district government	Key stakeholders	Outcomes
Scenario 1: Land plot leased by the district government	The rights to get 60 % of the revenue from land leasing	Y district government, municipal government, and developers	The district government led land development and can maximise their revenue
Scenario 2: Land plot leased for R+P as key municipal project	The rights to get 5 %–12.75 % of the revenue from land leasing	Y district government, municipal government, and metro company	The district government suffered economic loss

Data source: interviews and policy documents

available plot was used for the metro depot, the cost and labour in the land acquisition could be transferred to the metro company and the municipal government. Therefore, the district government was incentivised to change the plan by allocating this new site to the metro depot.

The ambiguous *de facto* land property rights associated with land leasing sharing increase the transaction costs between the Y district and municipal governments. The district government claimed that the original land plot for the depot was designated for a different purpose and proposed a site relocation. Due to information asymmetry about available land plots in the district jurisdiction, Guangzhou Metro had a weaker negotiation position (Interviewee R1). However, they still wanted to retain most of the benefits through negotiations backed by the municipal government. As a result, the confirmation of the metro depot site was delayed over two years due to the relocation. There was a preliminary site plan for the original plot in 2017, but the new plan was needed and remade until 2019, following the site relocation. The final site can not integrate the metro depot with the station: The distance to the metro station is over 1 km for most locations of the land plot (Fig. 4). It is not a TOD project anymore. Instead, TOD is used as market branding for metro companies to sell housing above the depot.

> "*The district governments dominated land preparation. Considering the irreplaceable contribution of the Y district government, the municipal government and Guangzhou Metro did not have much bargaining power regarding the site relocation* (Interviewee R1)."

5.2. Coexistence of land allocation and land leasehold

There are two tracks of land use right transfer: allocation and leasehold. Rigid institutional arrangements of land acquisition in land allocation constrained the feasibility of land assembly to optimise R+P projects. Land assembly refers to consolidating multiple land plots into a larger plot for development. The regulations of state-owned land property rights involving non-profitable land use must adhere to land allocation. The government can only allocate the fixed size for metro operations according to the regulations. The *Engineering Technical Standard of Urban Rail Transit Depot* specified the maximum size subject to the length of the metro line alignment and service conditions. Typically, each metro line was designed with two depots in Guangzhou, with one every 20 km track, and the size of each land plot ranged from 20 to 50 ha (Interview R3 and R7). The land size for the depot used was determined first, and then the regulatory plan was revised to include land use compatible with the property development above. However, the land plot size and boundary followed by land allocation can not accommodate the R+P model's profitable residential and commercial development.

> *"The metro depot land acquisition in Guangzhou has limited flexibility. Planners can only incorporate additional small and isolated patches into the metro depot acquisition. In most cases, the size and boundary must follow the engineering criteria for land allocation* (Interviewee R4)*"*.

The northwest area of the new metro depot site was near H Industrial Park (Fig. 3; alias for anonymity). The Industrial Park and the metro depot were in the same regulatory plan. The Y district government desired a comprehensive redevelopment of the metro depot and the Industrial Park. To accomplish this, the district government commissioned the renowned design institute Skidmore, Owings & Merrill (SOM) to carry out the urban design for this planning unit in 2021, covering a total area of 103.4 ha. From a logical standpoint, urban designers recommended transforming industrial land into commercial space in the southern and northern parts of the area (Interviewee R1). However, the coexistence of land allocation and land leasehold made this potentially optimised land assembly challenging. Approval from the Municipal Development and Reform Commission (MDRC) was required if the district government planned to incorporate the industrial zone and develop it into a larger land plot to benefit from the R+P for their jurisdiction. The Y district government worried that MDRC is unlikely to support land acquisition for larger land plots that exceed the needs for transport infrastructure use. The land assembly can be procedurally lengthy and politically risky (Interviewee R4). When the district government assigned the task to its *jiedao* (township) in the district jurisdiction, they did not want to include H Industrial Park in the redevelopment plan due to its contribution to tax income and GDP to the town. The industries accounted for 37 % of the district's GDP in 2021. Given the uncertainty and resistance, the district government ceased incorporating H

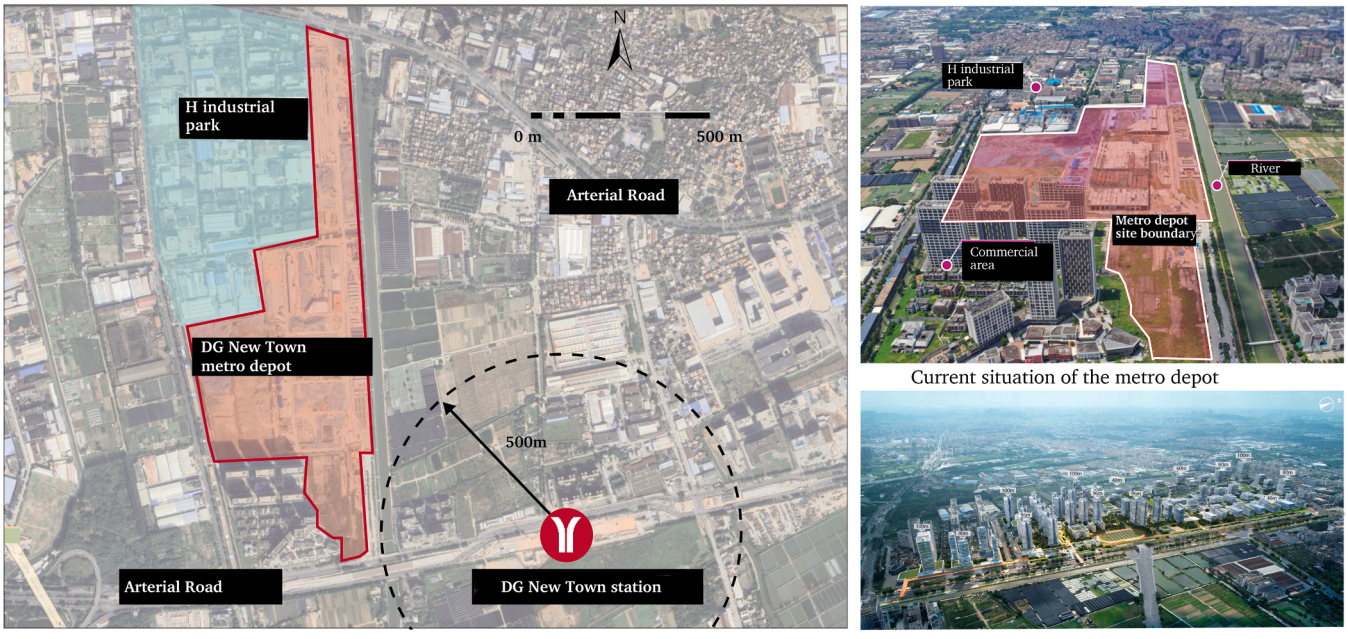


Fig. 4. Schematic diagram of the metro depot and prospective plan for the R+P project.

Industrial Park in the land assembly for the TOD project.

> *"If the district government wants to incorporate extra land plots into the R+P project, they have to get approval from the MDRC. However, MDRC does not support land assembly according to the land allocation regulation if it has exceeded the needs for transport infrastructure use* (Interviewee R2)*"*.

The Y district government decided to develop the 42.5-hectare plot occupied by the former factory without assembling additional land. As a result, Guangzhou Metro had to revise the regulatory plan in April 2022. The strict land allocation regulations limited the possibility of expanding the land plot size for mixed residential and commercial development. Instead of integrating the industrial zone redevelopment into the project, Guangzhou Metro had to adjust the layout of the metro depot to mitigate the negative impact on its later residential development due to the site's proximity to industrial land. The time and effort on SOM's design work were in vain due to the revision. Noted as industrial land generates disamenities (e.g., noise and smell), planning regulations prohibit residential land from being located near industrial land. In addition, placing housing next to industrial land was unfavourable in the market. Guangzhou Metro revised the layout plan and put commercial land near the industrial park. District government and Guangzhou Metro bore transaction costs for land boundary adjustment, including enforcement costs for revising the planning layout. The bidding for property development above the deport leaves no space for optimising neighbourhood connectivity. As a result, the R+P project was located adjacent to industrial land with a sub-optimal spatial layout.

> "*The general distribution of commercial space was not optimal, but it was the only solution given that industrial space was not incorporated in the project* (Interviewee R1)*"*.

5.3. Unmatched financial obligation and land leasing share

After finalising the site and land plot boundary, a land use planning revision was needed. When Guangzhou Metro submitted a preliminary plan to the Y district government for review in March 2021, the district government insisted that commercial space should be at least 30 % of the total floor areas (version 1 in Table 3). The revised regulatory plan was released to the public in 2021, revealing that the project's floor area size was 792,800 m^2, with 240,100 m^2 designated for commercial space, accounting for 30.2 % of the total floor area size. The plan included two super high-rise buildings (120–150 m) erected in southern and northern parts. However, the height became a concern for the Municipal Planning and Natural Resources Bureau, urging a reduction in building heights and the floor area ratio in the preliminary regulatory plan in September 2022. As a result, the floor area was reduced to 615,200 m^2 in the revised plan (version 2). The overall development intensity was no longer profitable for the metro company, leading Guangzhou Metro to negotiate with the municipal government and propose another round of planning revision in 2023 (Interviewee R1). Considering the economic downturns, the Municipal Planning and Natural Resources Bureau approved increasing the floor area to 675,000 m^2. However, the proportion of commercial space requested by the district government remains unchanged (version 3).

The three iterations of regulatory plans showcased tensions and conflicts between the municipal government, Y district government, and Guangzhou Metro, particularly on allocating commercial space and development intensity. The conflicts over commercial space stemmed from ambiguous *de facto* land property rights. In China, local governments are responsible for providing public services. The increasing revenue from land leasing allowed them to expand urban areas and match public services needed, such as primary and secondary schools and hospitals (Interviewee R8). These service expenditures rely on high revenue distribution, where the district governments receive 60 % of land leasing revenue if TOD is a district-led project. However, the budget can be tight when the revenue is reduced from 5–12.75 % when it becomes a key municipal project. In the case project, the district government must provide public services for the anticipated 15,000 residents, leading to long-term costs for public service provision (Interviewee R2). The financial burden from the TOD project does not match the land leasing share due to the *de facto* property rights. Consequently, the district government revised the regulatory plan to expand commercial space, aiming to increase the tax base, leading to over 30 % commercial space in the project, which would not be profitable for the metro company as this commercial development will be on the urban fringe which can not large-scale commercial activities.

Another contention in the regulatory plan was on development intensity. Development intensity, mainly floor area ratio, is a key factor in the project's financial feasibility. Guangzhou Metro proposed a plan with a high development intensity to build more housing. Although the plan was initially approved, the municipal government worried about the public criticism of the super high-rise and the engineering feasibility of the depot structure. This led to a reduction in the floor area ratio. Since 2021, Guangzhou has had a downturn in the housing market (Interviewee R3). Given the location and development intensity, Guangzhou Metro argued that they could not make profits and requested an increase in the floor area ratio, leading to the third round of regulatory plan revision. The final regulatory plan is a trade-off among three key stakeholders. The oversized commercial space diminished the R+P's development potential.

> *"120,000 square meters of commercial space is excessive for this area. The geographical location and immediate environment cannot support such a massive commercial development in the short term. Based on the experience from the previous project, a proper commercial floor area would be approximately 20,000 square meters* (Interviewee R1)*"*.

5.4. Distribution of transaction costs

Table 4 outlines the land development procedures, key stakeholders, and transaction costs in the DG New Town R+P project. We analysed the distribution of transaction costs among three key stakeholders at each stage. The time cost on site selection, land plot confirmation, and land use planning needed two to three extra years to finish. Three stakeholders all bore the time costs. The metro company seems to take more transaction costs than the municipal and Y district governments, both in terms of monetary expenses and effort, due to its lower position in the political hierarchy, even though they are not passive recipients in the

Table 3
Land use planning in regulatory planning revisions for the DG New Town R+P project.

The version of regulatory plan and released time	Total floor area in the project (thousand m^2)	Residential floor area in the project (thousand m^2)	Commercial floor area in the project (thousand m^2)	Proportion of commercial floor area (%)	Floor area ratio
Version 1 (2021.8)	793	553	240	30.2	1.87
Version 2 (2022.9)	615	510	105	17.1	1.45
Version 3 (2023.5)	678	575	123	18.1	1.60

Data source: Guangzhou Municipal Planning and Natural Resources Bureau.

Table 4
Land development procedures, transaction costs, and share distribution in three stages of the DG New Town project.

Development stage	Transaction	Procedures	Primary transaction costs	Reason for the transaction costs	Distribution of transaction costs
Land preparation	Site selection	Discussed and approved a land plot	• Information search for sites • Time costs of site selection and relocation • The administrative process of site relocation	• Ambiguous *de facto* land property rights	• Three actors bore a two-year project delay • Y District government took information search costs for the site • The municipal government took the enforecement costs • Three actors bore three-year time costs • Metro company took the research costs for layout plan and revision • The district government bore enforcement costs • Three actors bore time costs of a two-year planning revision • Three actors took the negotiation and enforcement costs • The municipal government and metro company bore the costs
	Size and boundary confirmation	Discussed and confirmed the land plot size	• Time costs of discussing size and boundary • The administrative process of revising the general site plan	• Uncertainty of the land assembly due to dual-track land use right transfer	
Land use planning	Regulatory plan proposal and alteration	Negotiated floor area ratio and proportion of commercial land	• The administration of planning revision and approval • Time costs of negotiation and planning revision	• Disproportionate fiscal burden compared to share of land leasing revenues	
Land transfer	Land use rights transfer of metro depot	Land use rights valuation and transfer	• The administrative process of appraisal and transfer	• Information search	

negotiation and frequently seek the municipal government's backup (Sun and Webster, 2024).

Higher transaction costs were incurred in the land preparation and land use planning stages, with lower costs in the land transfer process. Ambiguous *de facto* property rights led to significant information search and negotiation costs during the land preparation. Specifically, two land leasing revenue share scenarios incentivised the district government to initiate the site relocation in pursuit of potential land leasing revenues. This resulted in additional enforcement costs for the municipal government and metro company due to changes in project location. The completion of land preparation was delayed due to site relocation. Moreover, the district government incurred additional information search costs, and the municipal government had to rerun the procedures required for land preparation. Once the regulatory plan was finalised, land transfer was completed through an exclusive bidding process between the municipal government and the metro company, a practice for all R+P projects but not fair market behaviour (Sun and Webster, 2024). These transaction costs postponed the Line X extension operation from 2022 to 2024.

We also noted political struggles between the municipal and district governments embodied in the transaction costs of the TOD projects—this involved re-centralizing power from the districts to the municipal government, especially concerning decision-making for land development. District governments used to control land development. However, the municipal government projected its authority over land development to expedite metro construction and TOD projects. As the municipal government pursued short-term benefits and consolidated administrative and economic resources, it overlooked tailored coordination, especially incentives for the district government. This led to conflicts and increased negotiation costs in key municipal projects. Unmatched planning obligations and economic sharing due to ambiguous *de facto* land property rights resulted in tensions between the district and municipal government. In response, the district government resisted removing power by redesigning the site locations and land use composition to increase its economic gain.

The high transaction costs resulted in unfavourable land development and suboptimal design outcomes, including undesirable metro proximity, adjacency to industrial land, and excessive commercial spaces. The ambiguous land property rights resulted in the design outcomes deviating from optimal results and hindered integration between the metro station and land development above the depot. The excessive commercial space was planned due to discrepancies in land leasing sharing and obligations inherent in *de facto* property rights for the district government. Therefore, land use planning deviated from an optimal regulatory plan but became a tool to tackle economic conflicts and power struggles in local governments in China.

6. Discussion and conclusion

This paper investigated how state-owned land property rights in China influence the land development decision-making and outcomes of TOD projects from a transaction cost perspective. We identified three critical issues. First, ambiguity in *de facto* land property rights has led district governments to relocate the metro depot site from a profitable plot suitable for metro scheduling and property development to land plots that are less advantageous and far away from the station. Second, the coexistence of land allocation and leasing approaches under state ownership discouraged an optimised land assembly for the TOD project. Rigid acquisition sizes designated in land allocation for infrastructure discouraged coordination and prolonged negotiations between the district government and the metro company. Finally, the district government faced a disproportionate fiscal responsibility compared to their land leasing share from the municipal government. They are thus passively against the TOD project using their land use planning power. These transaction costs delay the TOD project and jeopardise the outcomes, resulting in depots far from metro stations, housing adjacent to industrial areas, and oversized commercial spaces on urban fringes.

The impact of ambiguous land property rights on land development in the Chinese context is still debated in the literature (Chen and Wang, 2022; Ho, 2001). The debate around ambiguous land property rights in China has primarily focused on collective rural land (Sa, 2020). This study extends the debate to urban land realm. We found the Guangzhou municipal government established two ways to distribute land leasing revenue (district-led and key municipal projects), indicating two *de facto* land property rights sharing between owners. Information asymmetry allowed the district government to relocate the depot site, resulting in additional enforcement and time costs for stakeholders (e.g., planning and administrative procedures). While ambiguous land property rights may hinder urban redevelopment projects (Lai and Tang, 2016), such ambiguity might give local governments the discretionary space to proceed with rapid land development within the political system. These ambiguities are deeply rooted in China's historical, cultural, and

institutional contexts, with discrepancies between *de jure* (legally defined) and *de facto* (practically controlled) land property rights as a key driver. The ambiguity in state-owned land property rights can emerge between the tiers of government due to unspecified, overlapping, and evolving institutional arrangements.

Our study confirmed that the co-existence of land allocation and land leasing in China will likely incur high transaction costs in TOD projects due to inconsistent land acquisition and right-to-get revenue embodied in two land transfer approaches. R+P projects in China require non-profitable and profitable land categories, necessitating a dual-track land transfer (Wang et al., 2019). In contrast to TOD projects in Hong Kong or Japan (Sun and Webster, 2024), where land plot boundaries can be negotiated among stakeholders, R+P projects in China are constrained to follow land allocation regulations for transport infrastructure use. This created restrictive institutional settings for optimising the land assembly and added negotiations and enforcement costs among stakeholders in land acquisition.

Our finding showed that negotiations and high transaction costs exist in land use planning despite the municipal government, metro companies, and district governments all being public actors. Previous studies implied that transaction costs were generally between property owners and developers in land development projects (Lai and Tang, 2016). We revealed that high transaction costs arose from unmatched obligations and rights over land leasing revenue between the municipal and district governments. Due to the ambiguous *de facto* property rights, the long-term financial burden of providing and maintaining public services for the TOD project does not align with the land leasing share for the district government. It pushes the district government to use land use planning legal power to maximise economic benefits by adding an oversized commercial space. This land development logic is consistent with findings from recent studies (Hu et al., 2019). The municipal government sought to consolidate decision-making power and introduced new institutional arrangements to strengthen its control over land development in the R+P projects. However, their pursuit of monopolising political and economic resources led them to overlook tailored institutional arrangements for coordination. While the district government was required to adhere to instructions from the municipal government, they negotiated to relocate the site and maximise economic benefits, as economic losses outweighed the time costs (Sun and Webster, 2024). In China, high transaction costs in land development are also situated in local governments, unlike in private-owned land property rights, where private developers bore most of the costs (Shahab et al., 2018).

Our method might have two limitations. First, the use of the snowball sampling method introduces potential bias. By recruiting interviewees through referrals, there is a risk of forming homogenous samples, as participants may share backgrounds, perspectives, or networks. However, this study does not aim to generalise findings to a broader or fully representative population. Instead, the primary objective is to gain in-depth insights into specific processes and decision-making dynamics regarding TOD. To mitigate potential bias, we ensured that initial participants were selected from diverse roles and institutions involved in the R+P project. This helped provide a range of perspectives to inform the analysis. Second, while transaction cost theory offers a valuable explanatory framework for understanding land development decision-making, it has limitations in its ability to precisely measure and quantify the influence of institutional arrangements on the process. Although this approach does not provide exact numerical measurements, it sheds a nuanced understanding of the impact of institutional arrangements.

The study can make notable contributions by revealing the complex interplay between institutional arrangements, land property rights, and design outcomes in TOD projects in China from a transaction costs perspective. While this study focuses on China, its implications extend to international contexts. Although private land property rights systems are prevalent globally, countries like Vietnam, Saudi Arabia, and others with centralised governance models retain public land ownership regimes. In such contexts, ambiguities in public-owned land property rights often arise due to discrepancies between *de jure* (legally defined) and *de facto* (practically controlled) property rights. These ambiguities can lead to similar challenges in land development, including misaligned planning decisions, inefficient land use, and increased transaction costs. Our findings highlight the broader relevance of addressing ambiguous public-owned land property rights and their impact on land development outcomes, contributing to land use policy insights for policymakers and practitioners to improve the efficiency of land development.

CRediT authorship contribution statement

Dongsheng He: Writing – original draft, Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jinshuo Wang:** Writing – review & editing, Formal analysis. **Guibo Sun:** Writing – original draft, Writing – review & editing, Resources, Funding acquisition, Formal analysis, Conceptualization, and Supervision.

Declaration of Competing Interest

None.

Acknowledgements

This study was partly supported by the NSFC (No. 52078446). Dr. Jinshuo Wang was supported by the HKU Strategic Interdisciplinary Research Scheme and contributed to the draft of the paper while affiliated with HKU as a postdoctoral fellow. The funders had no role in study design, data collection and analysis, publication decisions, or manuscript preparation.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.landusepol.2025.107501.

Data availability

The authors do not have permission to share data.

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