Paving the way to growth: Transit-oriented development as a financing instrument for Shanghai's post-suburbanization

Jie Shen
School of Social Development and Public Policy, Fudan University, Shanghai, China; Email: shenj@fudan.edu.cn

Fulong Wu
Bartlett School of Planning, University College London, London, UK; Email: fulong.wu@ucl.ac.uk

Abstract. Chinese suburbs are dominated by extensive high-density projects around transit-oriented development (TOD), but the form of development and the role of rail transit have not been fully investigated. Based on a case study of the No. 9 metro line in Songjiang, Shanghai, this paper examines the logic and implementation of TOD in China. We argue that rather than an effective tool for curbing suburban sprawl, TOD is appropriate to facilitate suburban growth by linking land sales, property development, and infrastructure funding for suburban growth. Rail transit, therefore, functions as an instrument for financial leverage. Despite great economic success, however, the provision of public facilities and services for the large number of residents has raised new challenges for the local government.

Key words. Post-suburbanization; infrastructure; TOD; Chinese cities

1. Introduction

Recent suburban changes across the globe have come to mark a departure from the traditional view of suburbs as a homogenous, auto-dependent, middle-class residential enclave (Harris, 2010; Quinby, 2011). Some scholars thus suggest that the term 'post-suburbanization' should be applied to describe contemporary global suburban growth: "a process of de-densification (classical suburbanization) is partly converted, inverted or subverted into a process that involves densification, complexification and diversification of the suburbanization process" (Charmes and Keil, 2015: 581; Phelps and Wu, 2011;

Keil, 2018). The concept de-centres the Anglo-American suburban model and provides a useful vocabulary for incorporating peripheral growth on the global scale. Existing literature has done much to analyse the forms, functions, material and imaginative practices, as well as causes and prospects of post-suburbanization in a variety of geographical contexts (e.g., Phelps and Wu, 2011; Hamel and Keil, 2015; Harris and Vorms, 2017).

In this context, the role of infrastructure is pivotal. On the one hand, formal planning and policy discourses on popular development models, such as 'transit-oriented development' (TOD), 'smart growth' and 'new urbanism', tend to highlight infrastructure as the key element for a sustainable (sub)urban form (Mees, 2010; MacCleery et al. 2012; Grant et al., 2013). On the other hand, echoing recent work on infrastructures within the broad societal context (see Graham and Marvin, 2001; McFarlane and Rutherford, 2008; Easterling 2014), suburban infrastructures are critically examined as a highly contested terrain rather than merely technological artefacts and systems (Addie, 2016; Filion and Keil, 2017). Accordingly, the conceptual framework 'the infrastructure is the message' highlights that infrastructures are generative of distinct suburban landscapes, governance regimes, and lifestyles. Moreover, the determining effects of suburban infrastructures on society stem from their general nature rather than the content of messages they transport (Filion, 2013).

The existing literature on suburban infrastructure is mostly grounded in experiences of Anglo-American cities. However, it is less clear how infrastructure has shaped suburban landscapes beyond the 'North'. Since obstacles and solutions to post-suburbanization can be highly differentiated in global suburban contexts, the infrastructure messages are diverse (Keil, 2017). The rationales behind the development of certain kinds of infrastructure systems are contingent upon local conditions, as the lived experiences of residents in suburbs with similar infrastructures and morphologies can be highly varied. For example, the inertia of suburban infrastructures based on morphology and lifestyle is particularly relevant to Anglo-American suburban experiences (Filion, 2015). However, infrastructure deficits are more pressing for cities in many developing

countries that are experiencing an explosive growth in the urban population. Therefore, we need to pay attention to the localized application of planning principles and infrastructures beyond the original, technical aspects.

Chinese cities have experienced unprecedented suburban growth since 2000. In contrast to earlier exclusively industrial or residential developments, the new strategy has focused on the development of multifunctional new towns and the creation of a polycentric metropolitan region (Shen and Wu, 2017). The new feature of suburban development is referred to as a "polycentric structure" (Feng et al., 2008) or "post-suburbia" (Wu and Phelps, 2011). Notably, mass transit systems have been extensively developed to support this round of suburbanization (Cervero and Day, 2008). In the early 2000s, there were only 4 cities boasting a metro system, with a total of 7 lines and 146 km. By 2015, 26 cities had 116 lines in operation, bringing the total length to 3,618 km. Since then, another 18 cities, including some second and third tier cities, have received approval for their metro system plan and will soon have metro systems (Chinese Association of Metros, 2016). Consequently, transit-oriented, high-density developments represent a dominant form of suburb in China.

Nonetheless, little has been done to examine the role of infrastructures in shaping Chinese suburbs. So far, most existing studies confine their analysis to transportation issues. With the concept of TOD, this mode of suburban development is treated as a solution to the car-dependent sprawl (e.g., Cervero and Day, 2008; Mu and De Jong, 2012). However, viewing transport infrastructure as only technical systems, these studies have overlooked the societal conditions of infrastructure as well as the far-reaching consequences on the spatial, economic, and social dimensions of the cities and suburbs.

In view of these criticisms, this paper aims to examine the logic and implementation of TOD in China. We have adopted the extended concept of post-suburbanization to capture the peripheral growth in China, because Chinese suburbs feature transit and high-density development. In this way, the study also aims to contribute to the existing literature on post-suburbanization on two

fronts. First, viewing rail transit as an outcome of social actions rather than a neutral transportation technology, the study reveals the concrete mechanisms of China's infrastructure-led (sub)urbanization. Second, the study examines a case where an infrastructure system is actually appropriated beyond its original design through concrete place-specific dynamics. It therefore highlights the importance of context-dependent analysis for understanding the social relations and processes of suburban infrastructures.

This research is based on a detailed case study of the No. 9 metro line in Songjiang, Shanghai. It is the first outer suburban district to have a metro link to the central city. The major empirical materials were drawn from semi-structured interviews with key stakeholders from 2009 to 2010. Noting the significance of the No. 9 metro line in the rise of Songjiang as a suburban growth pole, supplementary interviews were conducted in 2014 to further investigate the development of the rail transit project. Because the first and second phases of the No. 9 metro line were opened in 2007 and 2012 successively, the timing of data collection was appropriate for investigating the development process and outcomes of the project. Besides, the latest developments were followed up by secondary data analysis of planning and policy documents, official statistical yearbooks, and population census data, as well as media reports and relevant academic research in Chinese.

In total, 46 interviews were conducted. Based on the established local contact, a 'snowball' approach was adopted to gain access to target interviewees. Elite interviewees (32) included government officials, design and planning consultants, academics, managerial staff from government development companies, property developers, and real estate agents. We collected information on development strategies, the rationale underlying the strategies, policy-making and development processes; the interests of different stakeholders; key governance challenges and mechanisms; and outcomes of the rail transit project, such as economic and population growth, housing markets etc. Resident interviewees (14) were selected based on their origins (local native, migrants from other places, and residents from the central city), their type of housing

(villas and apartments), and the locations where they were living along the metro line were included. The interviews focused on the reasons for settling in Songjiang, residential preferences and choices, satisfaction with suburban living, etc.

2. Contested infrastructures in a post-suburban world

The recent popularity of an integrated approach in planning and policy programmes has had significant impacts on infrastructure policies in suburban development across the world (Hine and Grieco, 2003; Hull, 2005). It is widely noted that the decisive role of transport and communication in urbanization is not only shaped by technological innovation, but is also associated with socio-economic changes. In response, physical, social, and environmental goals are increasingly integrated into transport and infrastructure projects (Hesse, 2013). For example, concepts such as TOD (Curtis et al., 2009) or compact city projects (Neuman, 2005) are widely embraced by city governments across the world. These newly invented urban design solutions aim to achieve density and compactness, as well as non-car-dependent lifestyles through pedestrianization, cycling, and public transport (Mees, 2010; MacCleery et al. 2012; Grant et al., 2013). Although many of these concepts originated to address problems of suburbanization in US cities, they are also valued as an opportunity to achieve sustainable development in developing countries that are experiencing rapid urbanization.

Responding to McFarlane and Rutherford's (2008) call to open up ''the 'black box' of urban infrastructure, however, the latest suburban studies have rediscovered the 'deep societal reach of infrastructures' (Filion and Keil, 2017: 8). A wide range of social actors have diverse views, interests, and powers in the decision-making processes. Meanwhile, suburban infrastructures have profound effects on both inequality and societal norms. Addie (2016) further developed a conceptual framework to examine social relations and processes internalized by infrastructures. Suburban infrastructures can be viewed as in, of, and for suburbs and invoke social relations in the politico-economic (infrastructure of suburbanization), experiential (infrastructure of suburbanism), and mediatory

(mediatory infrastructure) dimensions.

Building on these accounts, there is a need to further recognize the interconnected but contextual nature of suburban infrastructure across global contexts. The diversity of post-suburban regimes has been widely noted (Hamel and Keil, 2015; Harris and Vorms, 2017). Different dimensions of suburban infrastructures can be evident in different settlement types (Addie, 2016). While issues of collective consumption and production are pressing in mature suburbs, the suburbanization of capital is more dominant in new and declining suburbs (Phelps, 2015). Accordingly, infrastructures are shaped and contested by differentiated socio-spatial relations across diverse geographical contexts.

In particular, Keil (2017) challenges the taken-for-granted trajectories of innovations from the Global North to the Global South and perceptively points to parallel pathways of development. Successful examples originating in developing countries include not only formal infrastructures, such as the TransMilenio Bus Rapid Transit project in Bogotá, Colombia, and the trinary road system in Curitiba, Brazil, but also various informal modes like vans, motorcycles, and pedicabs in many Asian cities (Cervero and Golub, 2007; Cervero, 2013). Infrastructures may also be used in different ways beyond the original designs. For instance, the development of a metro railway system in Delhi contributes greatly to presenting a positive image of the city (Siemiatycki, 2006), and the installation of cable cars in Cazucá, Colombia, is part of the slum beautification projects (Álvarez-Rivadulla and Bocarejo, 2014). Similarly, while the concept of TOD originates from an anti-sprawl movement in North America, it has been adapted and tailored to meet local needs for accommodating rapid urban expansion in many Asian cities. It is in this sense that infrastructural innovations go beyond mere technology and are driven by people in specific local contexts (Simone, 2004).

Transit oriented development for planned suburbanization in Asia

TOD is among the recent efforts to retrofit suburbs in North America

(Dunham-Jones and Williamson, 2011). It is a planning tool of recentralization through physically integrating public transit and urban land use, that is, high-density and mixed land use urban development concentrated around a train station (Calthorpe, 1993; Curtis et al., 2009). In order to address the negative effects on the environment caused by dispersed suburbanism (Filion, 2015), the TOD approach aims to change existing suburban development patterns and to chart a sustainable urban future. Meanwhile, as an important element in New Urbanism design, it also is expected to breed a new way of (sub)urban life through developing an alternative transportation system. In this context, TOD essentially reflects a strategy aimed at integrating environmental and social goals into transportation infrastructures in the suburbs (Hesse, 2013).

Although TOD as a planning tool is now widely practised across the world, the rationales underpinning this mode of development can vary significantly. This is particularly the case in Asia. In most Asian cities, there is no tradition of suburban neighbourhoods of automobile-oriented, single-family houses. Instead, like many other developing countries, the suburbs feature a more monocentric urban form than cities in developed countries (Cervero, 2013:9). Rather than creating a compact urban form, cheap and convenient rapid transit is important for making people travel further. As a result, many rail transit projects have been an integral part of planning for polycentricity. More often than not, the aim of a mass rapid transit system was to relieve the problem of congestion through the development of sub-centres (Chorus, 2009; Yang and Lew, 2009). In other words, TOD, which was originally designed as a tool for repairing sprawl, has been repurposed to facilitate planned suburbanization. However, as one recent study on Tokyo has shown, the dense, mass transit-oriented suburban development did not guarantee the development of new suburban employment centres as planned (Phelps and Ohashi, 2018).

Agents, institutions, and methods for the development of rail transit vary across these countries. In Singapore and Hong Kong, the state became directly involved in such projects by setting up various agencies (Yang and Lew, 2009; Cervero and Murakami, 2009). In Japan, the government typically worked on stimulating

private investment via various policy instruments instead (Chorus, 2009). In Southern and Southeast Asian cities, along with decentralization and privatization reforms, private developers are emerging as investors, builders, and managers of suburban infrastructure through public–private partnerships (Dupont, 2007; Kennedy, 2007). Yet difficulties in building partnerships among central, state, and city governments have usually been a serious impediment to mass transit projects (Sreedharan, 2002).

China is a latecomer in the development of public mass transit systems. Similar to its neighbours, the development of the railway network in Chinese cities went hand-in-hand with the development of suburban areas. Meanwhile, the 'Rail + Property' development program in Hong Kong was widely referred to as a role model by city governments and urban planners (Cervero and Murakami, 2009), that is, to finance railway investments through dense property development near railway stations. Nonetheless, the replication of this model in China is not easy, even though Hong Kong's MTR Corporation has been invited to join a few rail transit projects in some large cities (Chang, 2013). Importantly, since the land is in the hands of local governments, railway operators can hardly engage in property investment and management and capture land values themselves. Instead, as rail transit projects bring about a booming housing market in the suburban districts, the benefits associated with rail transit actually go to suburban governments. Therefore, the implementation of TOD in Chinese cities actually goes beyond merely financing infrastructures to target suburban growth.

3. Infrastructure as a financial instrument: transit-oriented development for post-suburban growth in China

Suburban development in China has evolved from socialist industrial satellites in the pre-reform era to government-sponsored residential and industrial relocation immediately after economic reform, and finally, to the recent development of new town projects. The post-suburban characteristics of Chinese suburbs can be noted in the existing literature. First, prevailing high-rise buildings, suburbs in China are far more intensified. Although luxury villas and gated communities are emerging, they are exclusive to a few extremely rich

families (Shen and Wu, 2013). Second, the rising suburban nodes in China are economically significant with a mixture of employment, commercial, residential, and other functions (Wu and Phelps, 2011). In particular, manufacturing industries are economic drivers of Chinese new towns (Shen and Wu, 2017). Last but not least, Chinese suburbs are socially diverse. Suburban residents have different socioeconomic attributes, ranging from wealthy families living in luxury villas, and relocated middle-class families, to rural-to-urban migrant workers living in private rental houses (Shen and Wu, 2013; Shen and Xiao, 2019). Chinese suburbs are post-suburban spaces in the sense that they are underpinned by the "urbanization of the suburbs" (Wu, 2013:194).

Existing explanations of suburban development in China include economic decentralization and the change in urban land-use (Zhou and Ma, 2000), the rise of state entrepreneurialism (Wu and Phelps 2011), and the housing demands from both the new urban rich and migrants (Shen and Wu, 2013). Fundamentally, the forms and processes are a spatial fix in China's contemporary accumulation regime. Housing development is used to subsidize industrialization. Meanwhile, the development of employment centres and the relocation of university campuses reflect the process of metropolitanization (Shen and Wu, 2017). Nonetheless, the infrastructures that enable the entire system to work have received little attention. Empirical studies have revealed a strong association between infrastructure investment, urban expansion, and economic performance (Wu, 2010; Li et al., 2017). Yet the mechanism through which infrastructures contribute to suburbanization remains unclear. As Zhou and Ma (2000) pointed out, in the case of China, since suburban locations were not preferred to inner-city locations, significant improvements in transportation and communication infrastructures are critical to reduce the resistance to relocating to the suburbs. But the role of rail transit in recent round of suburban development goes beyond moving people. By taking the form of TOD, infrastructures function as a financial instrument for post-suburban growth.

Historically, infrastructure deficits had long been a major impediment to suburban growth in China. Before the 1980s, vast areas immediately outside the

city proper were underdeveloped rural areas, scattered with a few state industrial satellite towns. Because the central government controlled infrastructure investment and maintenance, local governments had limited resources to fund urban infrastructure projects (Wu, 1999). Instead, state-owned enterprises in satellite towns developed infrastructures with funds allocated from the sectoral departments in central government. Since industrial development was given a high priority, urban infrastructures were deemed costly and non-productive, and investment in living facilities and services was very limited. As a result, these satellite towns were unattractive to residents. Thus, a large proportion of workers still commuted from the central city to the suburbs.

After economic reform, the importance of infrastructure for attracting foreign capital investment was widely recognized by local governments. Meanwhile, along with a series of reforms on central-local fiscal relations, multiple sources of funding, particularly extra-budgetary revenue, became available for urban infrastructures (Wu, 1999). The development of economic development zones relied heavily on the provision of cheap serviced land with urban infrastructures by state-owned development companies (Yeh and Wu, 1996). In particular, the large-scale construction of ring roads and arterial roads facilitated industrial relocation and population redistribution (Zhou and Ma, 2000). However, the central city did not show any sign of a decline. Most people were passively relocated to the periphery by urban redevelopment projects (Zhou and Ma, 2000), but equipped with better facilities and services, central areas remain the preferred place to live and work.

Since 2000, Chinese cities have witnessed a widespread development of suburban new towns. In contrast to previous stages, one important reason for this round of suburban development was to facilitate a booming suburban land and housing market. All the new town plans placed an emphasis on the provision of quality infrastructures to attract property investment. In particular, rail transit systems were rapidly expanded into the outer suburban area, bringing about unprecedented economic and population expansion on the urban edge (Cervero and Day, 2008).

Clearly, rail transit has become critical because it is an effective way to move people between the central city and the peripheries. Despite the recent increase in the total number of private automobiles, the prevalence of car ownership is far less in China than in developed countries. In the United States, at the peak of suburbanization in 1960, nearly 79% of households owned one or more automobiles (Rosetti and Eversole, 1993). In contrast, in China, by 2014, on average, there were about 29 private passenger cars per 100 households (NBSC, 2015). Moreover, a large proportion of potential new suburbanites are those who have been squeezed out by the cost of living in the city centre, and most of them cannot afford a private automobile (Shen and Wu, 2013). Thus, public transportation, particularly rail transit, is the most common choice for commuting (Yao and Wang, 2014).

While rail transit systems are rapidly expanding into the outer suburbs, the label of TOD is widely used by planners and developers. The spatial form usually conforms to the original design of TOD. Mixed-use projects integrating retail outlets, offices, hotels, and housing are built atop or directly connected to stations. Clusters of high-rise, high-density apartments are particularly common along the line and in the areas surrounding suburban metro stations. However, in many cases, TOD principles are applied superficially since the implementation of the original idea has encountered many difficulties. The obstacles lie in mechanisms of urban development in China (Doulet et al., 2017). For one, along with the rise of state entrepreneurialism, the short-term economic benefits of infrastructures usually take priority over long-term sustainability. For another, fragmented governance, such as difficulties in coordinating interests among governments, as well as technical departments, also make it very difficult to achieve cross-functional goals.

Under such circumstances, the popularity of TOD needs to be fully understood with reference to the political economy of urban development in China. The spatial form of this development pattern fits well into the idiosyncratic institutions of urban development, because it links land sales, residential

development, and infrastructure funding in one project. As widely noted in the existing literature, in response to increasing fiscal pressure under strengthened fiscal and land controls, local governments adopted an idiosyncratic "land-infrastructure-leverage" strategy of urban development (Tsui, 2011). On the one hand, the state relied heavily on land revenue to pay for public expenditure on pro-growth projects (Lin and Yi, 2011), while on the other hand, local government financing vehicles (LGFVs) were set up to leverage initial money for infrastructure projects through market borrowing, such as bank loans, urban investment bonds, or collaboration with trust companies (Li and Chui, 2017). Infrastructure functions as the nexus in the process, however. Thus, the state needs to borrow money first to initiate infrastructure projects and bet on a booming land and real estate market. For the local government and its LGFVs, infrastructure is no longer merely part of the low-cost incentives to attract investors, as it was in the development of industrial zones. First, it is an important fixed-asset of the state and is ideal collateral to increase leverage. Second, infrastructures, particularly transportation systems, are critical for raising land and property values and, in turn, increasing land revenue. In this sense, infrastructure can be understood as kind of a financial instrument.

In practice, various infrastructure projects are usually the responsibility of one specialized urban investment corporation (*chengtou*). The role of *chengtou* is usually analogized as the manager of the urban infrastructure on behalf of the government (Interview with senior researcher, Department of Strategic Development, Shanghai Municipal Investment Group Corporation, 6 March 2014). In other words, the main task of the corporation includes the financing, construction, and daily operation and maintenance of various infrastructures. It first uses state-owned assets, mostly infrastructure, to borrow money on the market. It then sets up project corporations for constructing new infrastructure. For rail transit and other transportation infrastructure projects, because the operation can hardly make immediate profits, initial capital usually includes both cash and land plots. After the land price rises with the improvement of accessibility, revenue from land leasing for commercial and residential uses is then used to pay the debt or to finance other infrastructure projects.

Sometimes, private partners may be invited to co-invest in rail transit projects. In some cases, operation of the system is outsourced to transportation companies. However, because metro fares are kept low, these companies would barely be able to operate simply by depending on the revenue from the metro fares. Therefore, most of them also receive subsidies from the government (Chang, 2014). In some cases, there are collaborative private partners, such as the developers, who would have privileged access to land plots for real estate development along the railway line.

This mode of infrastructure development also favours collaboration among different governments. Historically, within China's peculiar system of 'city administering county' (*shi guan xian*), the central city possesses the legislative capacity to administrate its suburban counties and leads the development of the regional economy. However, since the late 1990s, the annexation of suburban counties into urban districts directly under the jurisdiction of the central city has become ubiquitous (Zhang and Wu, 2006). Meanwhile, in most cases, districts have been given more autonomy and greater incentives to promote local growth. In transportation infrastructure projects, the revenue comes from land within the jurisdiction of individual districts. Inputs and gains for the governments can be clearly defined by boundaries, which makes it easier for them to co-invest in a single project.

4. Transit-led suburban development in Shanghai

As one of the megacities in China, Shanghai has a long history of state-led peripheral development. In the 1950s, Shanghai was positioned as the largest industrial base in China. The municipality proposed to develop five satellite towns to accommodate massive industrial development. Then, in the 1970s, along with the arrival of two national industrial bases, namely, Baosteel Complex in Baoshan and Shanghai Petrochemical Complex in Jinshan, another two key satellites were intensively constructed. However, due to the lack of living facilities and services, these towns were unattractive to residents, and although a number of factories were allocated to the satellites, most workers still lived in the center.

It is against this backdrop that the extension of rail transit into the suburbs becomes particularly important in bringing about suburban growth.

Shanghai has made significant achievements in rail transit development in the past twenty years. The first metro line, with only five stations and a length of 6.6 km, opened in 1993. Since then, the system has witnessed rapid growth, significantly during the years leading up to the 2010 Shanghai World Expo. At present, there are 16 lines, 389 stations, and an operating route length of 666 kilometers, making it the largest rapid transit system by that measure, and the second largest by number of stations in the world (Li, 2018).

In particular, rail transit is penetrating rapidly into the remote outer suburbs (Figure 1). In response to rapid urban expansion in the late 1990s, Shanghai planned to develop a metropolitan structure through decentralizing growth into suburban new towns. However, accessibility is of particular importance when bringing about suburbanization. Considering that the level of car ownership in Shanghai and China is still relatively low, mass transit, rather than a high-speed system, helps transport as many people as possible. The municipality proposed constructing four metropolitan lines in its 1999 master plan. According to one planner who was involved in the making of the plan,

> Different from previous versions, the 1999 master plan placed great importance on the development of new towns in the outer suburbs… The aim was to facilitate population decentralization and reduce growth pressure on the central city. But people will be ready (to live in the suburbs) only if the transportation infrastructure makes it easy to travel (between the central city and the suburbs). So the plan placed great importance on rapid transit linking the new towns and the central city, which has been gradually built up over the years. (Former Deputy Chief Engineer, Shanghai Urban Planning and Design Research Institute, quoted in Xu, 2014)

According to the long-term plan, all eight suburban districts and one county would be linked to the central city. To date, six suburban districts have rapid transit links to the central city, while the remaining three (Fengxian, Jinsha and Chongming) will have theirs in the next few years (Shanghai Municipal

Development and Reform Commission, 2016).

[Figure 1 is about here]

Shanghai is well known for institutional innovations to facilitate the development of the rail transit system. First, the achievement is a result of a very typical development mode combining market instruments and planning centrality under state entrepreneurialism in China (Wu, 2018). When Shanghai launched the grand plan to build 200 km of operational lines within five years in 2000, it set up a mode of development known as "four separation" (*si fen kai*), i.e., the separation of investment, construction, operation, and supervision. The aim was to involve multiple stakeholders and to run the projects based on market mechanisms (Chen, 2003). Two state-owned investment corporations, Shanghai Municipal Investment Corporation and Shanghai Jiushi Corporation, set up a joint rail investment company - Shanghai Shentong Metro Corporation Limited - to raise money on the capital market. The construction and daily operation of each project was contracted to professional companies. These came under the supervision of the Shanghai Transportation Management Bureau.

This mode of development was based on market mechanisms. Vertically, each company was an independent market player with its own interests. Relationships among these companies were based on contracts. Horizontally, the investment company would choose contracting companies to construct or operate the metro lines through public bidding. This institutional arrangement effectively helped leverage capital investment, reduce costs, and speed up the overall progress. But the government soon found it difficult to coordinate the interests of multiple market agencies, which greatly impeded the progress of the system.

In 2004, Shanghai municipality determined to construct a subway network before 2010 Expo. Like in other cities, with the mega-event as a pretext for promote urban construction (Shin, 2012; Bao et al., 2017), the mayor called for the use of "all the power of the city (*ji quanshi zhi li*)" to complete the task (Interview with senior researcher, Department of Strategic Development,

Shanghai Municipal Investment Group Corporation, 6 March 2014). Shentong Group was established to be in charge of the investment, construction, and operation of all the metro lines in Shanghai, and state-owned professional construction and operation companies were gradually merged into the group. This was to reduce the transaction costs in the mode of "four separation" and to promote the efficiency of the project. Meanwhile, a government department, Shanghai Rail Transport Construction Headquarter (*Shanghai Guidao Jiaotong Zhihui Bu*), was established to make overall development plans and to coordinate among multiple stakeholders. This arrangement was vividly known as "two wheels", according to the former office director of Shentong Group: "When the government was needed, the government took up the matter. When the enterprise was needed, the enterprise came forward" (Former office director of Shentong Group, quoted in Jin, 2013).

Second, within this institutional framework, the project was funded through a new financing mode called network syndicated loans (*wangluo yintuan*), which was particularly useful for the development of rail transit in suburban areas. According to the vice president of Shentong Group,

> Building the rail transit network had two major functions. In central areas, it would help solve traffic congestion. [The principle of the plan was] "Money follows people". In suburban areas, it would facilitate the development of new towns. [The principle was] "People follow money." (Vice president of Shentong Group, quoted in Li, 2014)

In total, the municipal government needed to raise 132.24 billion Yuan (58% of the total investment) from bank loans (Li, 2014). Such a large sum of capital could only be obtained by borrowing from multiple banks, but all the banks wished to invest in projects in the central areas where profits could be expected. Indeed, it is difficult to obtain loans for projects in the remote suburbs. Shentong Group therefore packaged all the projects as one to balance the risks and returns at different locations, thus greatly improving the credit score of the whole project. In a way, the project of TOD integrates various land development projects to make them a 'standard' financial product for investors.

Finally, district governments had become self-motivated partners of the municipality. After annexing suburban counties and converting them into districts, Shanghai municipal government decentralized both fiscal and administrative power to district governments. Although district governments were required to share taxes with the municipality, they were granted the right to organize economic development and public affairs. As a result, they developed strong incentives to promote local growth and compete with each other for infrastructure projects. For example, according to General Counsel of Xinmin Rail Transit Development Corporation, the No. 5 Metro Line was proposed and then mostly funded by the district government of Minhang (a suburban district) (Xu, 2018). The municipality held that, as suburban district governments would benefit greatly from the metro extension, they should bear more costs. In central districts, given the high cost of resettlement and relatively low profit from land sales, Shentong Group usually subsidizes resettlement and the development of stations along the line. For suburban districts, however, local governments were required to share the construction costs with Shentong. Besides, the suburban district governments must finance the land preparation and the development of stations within their jurisdictions on their own.

In this context, it is common for suburban districts to borrow first and use land revenue to pay off the debt afterwards. In contrast to the acute land scarcity in the central city, suburban districts have vast amounts of land for sale. In the case of the development of the No. 5 metro line, for instance, the district government borrowed 400 million Yuan from China Development Bank, but it was paid off soon after the completion of the project in a booming market:

> After the opening of the light rail, land and real estate market boomed along the line, and all kinds of taxes also greatly increased. The district government had no debt at all, as if the light rail was entirely free! (General Counsel of Xinmin Rail Transit Development Corporation, quoted in Xu, 2018)

In the development of the No. 16 metro line linking Lingang New Town to central Pudong, the financing model was clearly called “Rail + Property,” an essentially land value capture approach:

> [The state or state-affiliated development corporations] control land development to boost value of the plots surrounding the site. The income from land and property development is then used to balance the investment in rail transit construction. (Shanghai Pudong Rail Transit Investment Corporation, 2013: 52)

To illustrate the process in detail, the next section explores the development of the No. 9 Metro Line, the first rail transit linking the outer suburbs and the central city, in Songjiang district.

5. The development of the No. 9 Metro Line

5.1 Bidding for infrastructure projects under suburban entrepreneurialism

Songjiang lies at the far southwestern edge of the metropolitan area. It was incorporated into Shanghai and designed as one of its industrial satellites in the 1950s. Due to a lack of living facilities, however, workers were unwilling to settle there. As a result, there was no significant population growth in the town, with the population increasing from 50,672 in 1958 to just 52,492 by 1978 (Shanghai Songjiang Almanac Editorial Board, 1991). Thanks to a range of market-oriented reforms, Songjiang saw rapid growth in the industrial sectors in the 1990s, but it remained a remote suburb unattractive to residents and real estate capital.

In 2001, when Shanghai launched its first round of suburban new town projects known as 'One-City-Nine-Towns', Songjiang was selected by the municipal government as the first major site for suburban new town development. To a large extent, the project aimed to promote real estate development in the suburbs (Interview with previous chief planner, Shanghai Municipal Planning and Land Resources Management Bureau, 14 January 2009). Therefore, while the municipal government has normally shared land-leasing fees with suburban local district governments since 2001, Songjiang District Government was exempt from this policy and was able keep all the land leasing fees. Songjiang government also had significant incentives to collect revenue from land sales to facilitate industrial development. Nonetheless, as an outer suburban district, Songjiang had never been a favorable residential area. Although the land price was far less than that in the central districts, few investors were optimistic about

commercial and housing projects there (Interview with Deputy Director of Songjiang Planning and Land Resources Management Bureau, 13 July 2010).

Clearly, being the first district to have a metro line linked to Shanghai would be a significant competitive advantage for the suburb. In particular, local government officials emphasized the impact of the metro line on the property market and industrial development. Rail transit was seldom mentioned as a sustainable mode of transportation.

> The metro line is the lifeline of Songjiang. It is important because it has 'activated' not only Songjiang New Town, but also four other townships in the north. It has greatly increased the potential of a booming housing market. People from the central areas now come and buy houses here. (Interview with deputy director, Songjiang Chengtong Rail Transport Investment and Development Co., Ltd, 7 June 2010)

> When we promote industrial investment, of course, we always mention convenient transportation via the metro line to Hongqiao Transport Hub and the central city as a favorable advantage. (Interview with Deputy Mayor of Jiuting Township, 11 June 2010)

Therefore, the district government started out to build a light rail by itself as early as 1998. After it was assigned as a major site of Shanghai's new town project, Songjiang district government began to lobby the municipality to give priority to the No. 9 Metro Line. Before that, Songjiang had successfully attracted a university town project that accommodated seven universities moving out from the central city. This proved to be a significant bargaining chip in acquiring support from the municipality. Because half of the total population of the university town, i.e., about 50,000 students and staff, needed to go back home to Shanghai at the weekend, it led to extreme traffic pressure on the bus-based transport system, so a metro link to the city was urgently needed. This was a major reason why the municipality finally agreed to develop the No. 9 metro line first (Interview with Deputy Director of Songjiang Planning and Land Resources Management Bureau, 13 July 2010). Thus, Songjiang became the first outer

suburb to have a metro link to Shanghai.

The No. 9 metro line was one of four metropolitan rail lines proposed in the Shanghai 1986 Master Plan. It would start from Fengjing in southwestern suburban Shanghai, run through the central city, and lead to Chongming Island in the northeast. But due to a lack of funds, it was hard to imagine at that time when it could be constructed (Interview, Deputy Dean, Shanghai Urban Planning and Design Research Institute, 24 May 2010). The final route now runs through the city, from the southwest end of Songjiang South Railway Station, via a number of major hubs in central Shanghai, to the northeast end of Caolu township in Pudong district, another newly-planned suburban site for affordable housing development (Figure 1). The first phase was a 30.5 km line from Songjiang New Town to Yishan Road in Xuhui, via four townships in Songjiang and four stops in Minhang, where it was joined to the established central metro network. In effect, it connected the urban core with all the peripheral settlements along the line.

5.2 Transit-oriented development as a financing instrument

In the beginning, urban planners aimed to apply TOD principles to the stations along the No. 9 metro line. The model was operationalized so as "to arrange public facilities around the stations, while creating a range of densities with the highest being at the station, gradually tapering outwardly" (Liu et al., 2011: 61; translated from Chinese). However, in practice, the principles of TOD were not strictly followed, and the degree of implementation varied. For example, in addition to high-rise apartments, low-density government offices were also developed within the immediate vicinity of the Songjiang New Town Station. Importantly, the original aim of TOD, i.e., to achieve urban sustainability, was not the major consideration. Instead, the economic benefits of such a spatial arrangement were well recognized by local governments. For instance, after the site of the station was chosen, Jiuting Township changed an earlier version of the development plan and relocated its central business district closer to the station while some plots near the station originally intended for commercial development ended up as real estate projects (Pan and Xu, 2011).

Shentong Group, as the agent of the municipality, invested in and organized the project. The construction of the line was outsourced to Shanghai MTR Construction Co. Ltd., a joint venture of Hong Kong MRT Co. Ltd. and Shanghai International Group (a state-owned financial holding group). However, although Shentong Group exclusively funded the segments passing through the central districts, segments in suburban districts were co-funded by Shentong Group and the suburban district governments. Because the line passed through Songjiang and Minhang, these two suburban districts had to contribute to the investment of the segments in their jurisdictions. Moreover, they were required to undertake primary land development and develop stations along the line on their own. After the project had been completed, Shentong Group was responsible for the daily operation of the line. Shanghai Municipal Urban and Rural Construction and Transportation Committee supervised the project.

Songjiang was in charge of building a 22.4 km^2 segment and six intermediate stations. The total investment was 4.5 billion Yuan, two thirds of which was raised by the local authority itself. A development company, Chengtong Rail Transit Investment and Construction Corporation (CRTICC), was established by the district government to carry out relevant tasks on Songjiang's behalf. Songjiang Urban Investment Corporation (SUIC), the state-owned corporation specializing in financing and operating infrastructure projects, assisted with the process of borrowing money from banks for the project. Using some of its fixed assets, such as roads and bridges, as collateral, SUIC obtained a 3 billion Yuan syndicated loan from eight banks in 2000. With this amount of money, CRTICC was able to complete the pre-construction work. Township governments did not invest money in the project, but they contributed the land along the line and helped with resettlement.

Meanwhile, in order to cover the cost, various pieces of land near each station were given to CRTICC. After primary development, the land could be leased out for real estate development, while CRTICC could keep 70% of the total lease fee as their profits. Despite the high price, plots near the stations were very popular because of a good market expectation. In this way, there were usually many

high-rise apartments surrounding the metro stations, i.e., the Chinese version of TOD. Developers explained that the aim of building the high-density design surrounding the stations was to offset the high land cost on the one hand, and to target the market of white-collar commuters on the other (Interview with real estate developer, Shanghai Shilihe Real Estate Co., Ltd, 11 June 2010).

The line began operating on December 29, 2007, and its last section, connected to the Yishan Road station, was opened on December 28, 2008. The management and operation of the line was then transferred to Shentong Group. Passenger numbers have been increasing since its inauguration. However, ticket prices are fixed to remain at a low level by the municipal government. Like many other metro lines in Shanghai, the No. 9 metro line actually runs at a loss for Shentong Group, which is largely subsidized by the municipality every year[1].

The non-profitability of the line is not a problem for CRTICC and Songjiang. The district grasped the essence of suburban transportation, that is, that the value of suburban transportation does not lie in moving people, but in raising the price of the land it passes through (Fishman, 1987: 143). The debt of 3 billion Yuan was the largest sum ever borrowed by the government, and it was not without risk at the time. But for the banks, this offered good lending opportunities.

> This is, of course, a good loan for the banks. The district government would back its subsidiary companies anyway. (Interview with Deputy Director, Songjiang Chengtong Rail Transport Investment and Development Co., Ltd, 7 June 2010)

> It was not difficult to borrow money from the banks at that time. First, they trusted state-led projects. After all, they were state-owned banks. Second, there would be also huge benefits. There was land. No need to worry about the repayment at all. This proved to be true. They all made a fortune from

[1] In Shanghai, there are three types of state-owned corporations. The public service-type of corporations are responsible for delivering public services. The function-type of corporations are established for carrying out specific tasks; they are evaluated based on the completion of the tasks rather than profits, but they need to maintain a balanced budget themselves. The competition-type of corporations are evaluated based on economic performance. Shentong Group belonged to the public service type of corporations. They are directly subsidized by the state with money from other sources.

the project in the end. (Interview with Deputy Director of Songjiang Planning and Land Resources Management Bureau, 13 July 2010)

As expected, the announcement of the No. 9 metro line immediately resulted in a rise in the price of land along the line. During the periods of construction, by gradually leasing out the land, CRTICC maintained a balance between capital returns and next-stage investment. Along with the maturity of the area in the following years, CRTICC saw the land in its possession dramatically increase in value year after year. When it leased out the last two pieces of land in 2010, the price had reached as high as approximately 10 million per mu (15 mu = 1 ha). After a land sale of about 320 mu in total, the company easily paid off its debt.

5. 3 Consequences: transit-led suburbanization

Due to the opening of the No. 9 metro line, the travel time between Shanghai and Songjiang has been greatly shortened, and the sites in the northeast of the district are within a 1-hour commute of the center of Shanghai. Thus, it has become possible to work in the central or inner suburban districts and live in Songjiang. When discussing the impacts of the metro line on Songjiang, interviewees highlighted its significance for bringing population to this remote suburb.

> “Building a new town" is only material production. But only people make it a real city. In this sense, the No. 9 metro line is particularly important. (Interview with Deputy Director of Songjiang Planning and Land Resources Management Bureau, 13 July 2010).

According to the most recent 2010 census, Songjiang had become the district with the greatest population growth rate of nearly 150%. Although Songjiang New Town can hardly be said to have become an “anti-magnet” to control continuous urban sprawl, the population in the new town had increased from 271,400 in 2000 to 684,300 in 2010, making it the most populous suburban new town in Shanghai. However, more importantly, one after another, townships along the line had become population growth poles. Taking Jiuting Township and Sijing Township as examples, the first and second stops of the metro line when entering Songjiang from Shanghai, both used to be small market towns in

suburban Shanghai. In 2000, the total population of Jiuting was only 20,111. By 2017, the population within the total area of 32 km^2 was estimated to be more than 260,000[2]. Following Jiuting, the total population of Sjing Township increased from 19,685 in 2000[3], 94,279 in 2010[4], to 142,264 in 2015[5].

The route turned the suburb into a true settlement and consequently activated a housing market in north Songjiang. The fiscal revenue of Jiuting ranked first in the district. The real estate industry contributed to nearly half of its total GDP. By 2010, the township government had sold almost all the land and had begun to promote the service industry as a new growth pole (Interview with Deputy Mayor of Jiuting Township, 10 June 2010). In Sijing, the government enjoyed the huge profits from land sales as a result of spillover benefits from Jiuting, which now contributed 60% of the fiscal revenue of the township government (Interview with Director of Village and Town Construction Management Office, Sijing Township, 9 June 2010). According to the Deputy Mayor of Sijing, each year, the government spent 200~300 million Yuan on resettlement and infrastructure development. Since the land price had increased by about 7 million Yuan per mu, the government had easily earned 1,400 million Yuan by leasing just one piece of land in 2009 (Interview with Deputy Mayor of Sijing Township, 9 June 2010).

The effects of the metro line surely go beyond the economic sphere. Although Chinese suburbs feature a high-degree of heterogeneity, led by the development of rail transit, high rise buildings have become dominant along the line. Rail transit brought about opportunities to make great profits from high-density development:

> We originally proposed some low-density developments. But after the launch of the No. 9 metro line project, we increased the floor to area ratio. We did not follow the original plan for economic benefits. There would be a market for apartments. But for the government, higher density means

[2] According the official websites of local governments, the total population living in Jiuting Township was 100,429 by the end of 2016, and the total population in Jiuting Subdistrict was 160,885 by the end of 2017. See http://jtz.songjiang.gov.cn/; http://jltjd.songjiang.gov.cn/

[3] The data is drawn from the 2000 fifth population census.

[4] The data is drawn from the 2010 sixth population census.

[5] The data is drawn from the official website of Sijing township government, see http://sjz.songjiang.gov.cn/

higher land price. (Interview with Deputy Mayor of Jiuting Township, 10 June 2010).

This is particularly the case for the townships where the development was less planned than in the new town, as local officials indicated:

> Homebuyers in Jiuting are mainly new graduates and white-collar workers. They could not afford apartments near their jobs in the central areas. But housing prices were much cheaper here. Xinqiao Township nearby, which is bypassed by the No. 9 metro line, is quite different. Villas and holiday resorts are the mainstream of property development. Homebuyers are groups of higher socio-economic backgrounds, such as journalists, government staff etc. However, Jiuting won Xinqiao over in terms of the total economic output of the real estate industry. (Interview with Deputy Mayor of Jiuting Township, 10 June 2010)

> Real estate development here used to be mainly villas. But now, with the arrival of rail transit, it is impossible to control the density. (Interview with Deputy Mayor of Sijing Township, 10 June 2010)

Even in Songjiang New Town, while there were low-density residential quarters as planned, high rise buildings dominated the housing development near the metro stations (Figure 2 and 3).

[Figure2 and 3 are about here]

Enjoying great benefits from this mode of development, the district government soon began extending the line further southward to develop a new area of 66.8 km^2 in the south of Songjiang New Town, i.e., the southern district of Songjiang New Town in 2009 (Interview with General Manager of Songjiang New Town Development Corporation, 24 March 2014)). The total cost of the extension for 5.35 km was 2.7 billion Yuan, which was again shared by the Shentong Group and the Songjiang district government in the ratio of 1:2. Different from the first phase of Songjiang New Town, which originally aimed to attract residents from the central city by creating a suburban living environment, the new area featured high-rise buildings to attract young homebuyers, and became a new city rather

than a suburb (Interview with Deputy Director of Songjiang Planning and Land Resources Management Bureau, 13 July 2010). The project was carried out by CRTICC, but becoming aware of the huge profits from property development, the company developed and ran the properties near the stations itself this time,

> We planned to undertake some high-density developments at the stations, such as office building, hotels etc. The land around the stations belongs to public utility land-use type, and a public auction is not needed. Different from land sales, this will be long-term benefit. The new district party secretary encourages holding more state-owned assets and not selling them all. Once the land was all sold, it would be much more difficult to plan and manage. (Interview with deputy director, Songjiang Chengtong Rail Transport Investment and Development Co., Ltd, 7 June 2010)

One important consequence of rapid population growth along the line, however, is the inadequate capacity of providing infrastructures and services. Ironically, interviewees living in Jiuting and Songjiang all listed transportation as the primary issue. With a daily ridership of 750,000 in 2015, the No. 9 metro line in Songjiang has become one of the busiest lines in Shanghai (Zhang, 2016). Problems, however, were exacerbated particularly after the metro line was further extended to south Songjiang in 2012. The extension triggered another round of population growth. Consequently, during peak hours in the morning, carrying commuters from stations all the way along, the train is almost fully loaded when it arrives at Jiuting, meaning people from Sijing and Jiuting can hardly get on the train. Besides, providing enough social services has also been a severe problem with primary and nursery schools in Jiuting, Sijing and Songjiang New Town all overcrowded. The provision of infrastructure could hardly keep up with the rapid population growth rate (Songjiang District Construction and Management Committee, 2017).

The increasing demand reached far beyond the capacity of the township governments, which used to serve less than one-tenth of the present population. As a real estate developer complained about the inadequate investment of Jiuting Township in public facilities:

> This is the problem of suburban governments. They are not as efficient as governments in the central city. We actually had to resettle residents all by ourselves. The government did not invest in public goods. They apportioned the building of schools, activity centers, etc. to developers. (Interview with General Manager, Shanghai Olympic Garden Property Development Corporation, 11 June 2010)

Facing growing pressure from residents, in 2015, the district government established a new administrative unit, Jiuliting Subdistrict and separated it from Jiuting Township. The subdistrict covers an area of 6.79 km^2 on the northern side of the No. 9 metro line. Led by intensive development of high-rise apartments, it is the densest area in Jiuting Township. The total population was about 100,429 by the end of 2016. However, there were only three nursery schools, three primary schools, and one middle school[6]. As a subdistrict, the public facilities of Jiuliting were taken over by the district government. This administrative adjustment aimed to reduce the burden on the township government. This, however, would be not easy since there was not much land left within the area (Huang, 2016).

6. Conclusion

This study examines a detailed case study of Songjiang new town, Shanghai, China, which allegedly applied a TOD approach. Intriguingly, on the face of it, the physical form right next to the metro station meets the definition of TOD that originated from current planning efforts in the West to achieve a compact, public-transit-dependent suburban environment and a new way of suburban life. In Songjiang, this form of development was appropriated as a nexus linking land sales, residential development, and infrastructure funding. The rail transit project was used as an instrument for financial leverage. It raised funds from different governments and converted land near the transit station into real estate projects. Therefore, rather than a sustainable solution to suburban sprawl, this form of development has turned out to be a precondition for suburban growth. Rail transit has effectively triggered mass suburbanization in Shanghai. The

[6] This is drawn from the official website of Jiuliting subdistrict government, see http://jltjd.songjiang.gov.cn/

adoption of TOD actually facilitates the expansion of urban development into the suburbs. Thus, in China, TOD has been promoted not as a post-suburban planning principle to curb the low-density sprawl of automobile-driven suburbs but rather as a way to finance suburban development.

The case of China has also indicated that it is insufficient to attribute the effects of infrastructures based merely on the nature of the infrastructure (Filion, 2013); the effects are actually mediated through place-specific political economic processes. Similar infrastructure systems are constructed for different purposes. Thus, TOD in China is fundamentally different from the original American neo-traditional design principle. Rather than being repurposed for social and environmental ends, for example, more sociable and compact suburban life (Filion, 2015) and building positive images (Siemiatycki, 2006), rail-transit projects largely function as an instrument for financing suburban development. While socio-spatial relations are held in common across suburban infrastructures, the concrete processes are differentiated (Addie, 2016).

However, gambling on the future appreciation in the value of the land and buildings is speculative and risky. Along with the vast investment in infrastructure, there has been a rapid increase in local government debts, but as the economic growth is slowing down, there is a risk of facing the reverse "infrastructural trap" (Kirkpatrick and Smith, 2011). Moreover, as it turns out, this mode of development faces difficulties in fulfilling social reproduction for the increasingly large numbers of new residents in such a short time. In the booming towns along the line, such as Jiuting, the demand for addressing the under provision of infrastructures and services has actually become a great political pressure for the local governments.

References

Addie, Jean-Paul D. (2016) Theorizing suburban infrastructure: A framework for critical and comparative analysis. *Transactions of the Institute of British,* 41(3): 273–285

Álvarez-Rivadulla, María José and Bocarejo, Diana (2014). Beautifying the Slum: Cable Car Fetishism in Cazucá, Colombia. *International Journal of Urban and Regional Research* 38 (6): 2025–2041

Bao Jigang, Liu, Yi and Li, Xun (2017). Urban spectacles as a pretext: the hidden political economy in the 2010 Asian Games in Guangzhou, China. *Urban Geography,* https://doi.org/10.1080/02723638.2017.1395602

Calthorpe, Peter (1993). *The Next American Metropolis: Ecology, Community and the American Dream.* Princeton Architectural Press, New York

Cervero, Robert and Golub, Aaron (2007) Informal transport: a global perspective. *Transport Policy,* 14, 445–57

Cervero, Robert and Day, Jennifer (2008). Suburbanization and transit-oriented development in China. *Transport Policy,* 15(5), 315–323

Cervero, Robert and Murakami, Jin (2009). Rail and property development in Hong Kong: Experiences and extensions. *Urban Studies,* 46(10), 2019–2043

Cervero, Rrobert (2013). Linking urban transport and land use in developing countries. *Journal of Transport Land Use,* 6 (1), 7–24

Chang, Zheng (2014). Public–private partnerships in China: A case of the Beijing No.4 Metroline. *Transport Policy,* 30(2013), 153–160

Charmes, Eric and Keil, Roger (2015) Post-suburban morphologies in Canada and France: Beyond the anti-sprawl debate. I*nternational Journal of Urban and Regional Research,* 39(3), 581–602

Chen, Yixin (2003). An exploratory study on the "Four Separations" System of Rail Transit in Shanghai. *Urban Public Transport,* 1, 24-25 (in Chinese)

Chinese Association of Metros (2016). Annual statistical and analytical report on urban rail transit. http://mt.sohu.com/20160527/n451677866.shtml. Accessed on 23 September 2016.

Chorus, Paul(2009). Transit Oriented Development in Tokyo: The Public Sector Shapes Favourable Conditions, the Private Sector Makes it Happen. In Curtis Carey, Renne, John L., Luca Bertolini (2009). *Transit-oriented development: Making it Happen.* Ashgate, Burlington, 225-238

Curtis Carey, Renne, John L., Luca Bertolini (2009). *Transit-oriented development: Making it Happen.* Ashgate, Burlington

Doulet, Jean-François, Delpirou, Aurélien and Teddy Delaunay (2017). Taking

advantage of a historic opportunity? A critical review of the literature on TOD in China. *Journal of Transport and Land Use*, 10(1), 1–17

Dunham-Jones, Ellen and Williamson, June (2009). *Retrofitting Suburbia: Urban Design Solutions for Redesigning Suburbs.* Chichester: Wiley

Dupont, Véronique (2007). Conflicting stakes and governance in the peripheries of large Indian metropolises – an introduction, *Cities,* 24(2), 89–94

Easterling, Keller (2014). *Extrastatecraft: the power of infrastructure space.* Verso, London

Feng, Jian, Zhou, Yixing and Wu, Fulong (2008). New trends of suburbanisation in Beijing since 1990: from government-led to market-oriented. *Regional Studies,* 42(1), 83- 99.

Filion, Pierre (2015). Suburban inertia: the entrenchment of dispersed suburbanism. *International Journal of Urban and Regional Research,* 39(3), 633–640

Filion, Pierre (2013). The infrastructure is the message: shaping the suburban morphology and lifestyle. In: Roger Keil, (eds.) *Suburban constellations: governance, land, and infrastructure in the 21st century.* Berlin: Jovis, 39–45

Filion, Pierre and Keil, Roger (2017) Contested Infrastructures: Tension, Inequity and Innovation in the Global Suburb, *Urban Policy and Research,* 35:1, 7-19

Fishman, Robert (1987). *Bourgeois Utopias: The Rise and Fall of Suburbia.* New York, NY: Basic Books

Grant, Jill L., Nelson, Arthur C., Forsyth, Ann, Thompson-Fawcett's, Michelle, Blais, Pamela and Filion, Pierre (2013). The future of the suburbs. Suburbs in transition/The resettlement of America's suburbs/Suburbs in global context: the challenges of continued growth and retrofitting/Suburban urbanity: re-envisioning indigenous settlement practices/Toward a new suburban America: will we catch the wave/Optimistic and pessimistic perspectives on the evolution of the North American suburb/Response. *Planning Theory and Practice,* 14, 391–415

Graham, Steve and Marvin, Simon (2001). *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition.* Routledge, New York

Hamel, Pierre, and Keil, Roger (Eds.). (2015). *Suburban governance: A global view.*

Toronto: UTP.

Harris, Richard (2010) Meaningful types in a world of suburbs in Clapson M and Hutchinson R (eds.), S*uburbanization in global society*, Emerald Group, Bingley 15–48

Harris, Richard and Vorms, Charles (eds) (2017). *What's in a Name? Talking about 'Suburbs'.* Toronto: University of Toronto Press.

Hesse, Markus (2013). Cities and Flows: Re-Asserting a Relationship as Fundamental as it is Delicate. *Journal of Transport Geography,* 29, 33–42.

Hine, Julia, and Grieco, Margret, (2003). Scatters and clusters in time and space: implications for delivering integrated and inclusive transport. *Transport Policy* 10 (4), 299–306.

Hull, Angela (2005). Integrated transport planning in the UK: from concept to reality. *Journal of Transport Geography* 13 (4), 318–328.

Huang, Yongdi (2016). After the establishment of a subdistrict | Songjiang Jiuliting: do white collars in North Jiuting see hope for the future? Shangguan News, 8 June 2016 (in Chinese) Available at http://www.jfdaily.com/news/detail?id=19903, accessed 5 April 2018

Jin Jiamo (2013). My metro complex. Shanghai Communication and Traffic, 3. Available at http://www.shcti.cn/cc/vxhhk.jsp?hkid=39&zbtid=697, accessed on 8 April 2018 (in Chinese)

Keil, Roger (2017). *Suburban planet. Making the world urban from the outside in.* Cambridge, UK: Polity

Keil, Roger. (2018). Extended urbanization, "disjunct fragments" and global suburbanisms. *Environment and Planning D: Society and Space,* 36(3), 494-511

Kennedy, Loraine (2007) Regional industrial policies driving peri-urban dynamics in Hyderabad, India. *Cities,* 24(2), 95–109

Kirkpatrick, L. Owen and Smith, Michael P. (2011). The infrastructural limits to growth: Rethinking the urban growth machine in times of fiscal crisis. *International Journal of Urban and Regional Research,* 35(3), 477–503

Li, Chaosu, Song, Yan and Yan, Chen (2017) Infrastructure Development and Urbanization in China. In Tang, Zongli (eds) *China's Urbanization and Socioeconomic Impact.* Springer, Singapore: 91-107

Li, Jie and Chiu, Rebecca L. H. (2017). Urban investment and development corporations, new town development and China's local state restructuring – the case of Songjiang new town, Shanghai. *Urban Geography,* https://doi.org/10.1080/02723638.2017.1382308

Li, Lei (2018). 2017 Annual report on traffic operation in Shanghai. *Shanghai Observer,* 29 March 2018, available at http://www.jfdaily.com/news/detail?id=84282 (in Chinese), accessed 8 April 2018

Li, Wei Y. Z. (2014). The secret of Shentong's syndicated finance. *Capital Shanghai*, 3: 86-87 (in Chinese)

Lin, George C.S. and Yi, Fangxin (2010). Urbanisation of capital or capitalisation on urban land? Land development and local public finance in urbanising China. *Urban Geography,* 32 (1), 50-79

Liu Chang, Pan, Haixiao, and Jia, Xiaohua. 2011. The influence of rail transit on the planning and development of metropolitan peri-urban areas. Urban Planning Forum 6(198): 60–67 [In Chinese]

MacCleery, Rachel, Peterson, Casey and Stern, Julie D (2012). *Shifting suburbs: reinventing infrastructure for compact development.* Urban Land Institute, Washington DC

McFarlane, Colin and Rutherford, Jonathan (2008). Political infrastructures: Governing and experiencing the fabric of the city. *International Journal of Urban and Regional Research,* 32(2), 363–374.

Mees, Paul (2010). *Transport for suburbia: beyond the automobile age.* Earthscan, Sterling

Mu, Rui and de Jong, Martin (2012). Establishing the conditions for effective transit-oriented development in China: the case of Dalian. *Journal of Transport Geography,* 24, 234–249

National Bureau of Statistics of China (NBSC) (2015). National Data. http://data.stats.gov.cn/easyquery.htm?cn=C01&zb=A0G0J&sj=2014, accessed on 16th, September 2016

Neuman, Michael (2005). The compact city fallacy. *Journal of Planning Education and Research* 25 (1), 11–26

Pan, Haixiao, and Xu, Mingcai (2012). The dream of TOD in Shanghai peripheral

areas. Working paper. Available at https://issuu.com/vilmouv/docs/pan-the-characteristics-of-land-use--3-17, accessed 10 May 2019

Phelps, Nicholas A. and Fulong Wu, eds. (2011) *International perspectives on suburbanization: a post-suburban world?* London: Palgrave Macmillan

Phelps, Nicholas A. (2015). *Sequel to Suburbia: Glimpses of America's post-suburban future*. Cambridge: The MIT Press

Phelps, Nicholas A. and Hiroaki, Ohashi (2018). Edge City Denied? The Rise and Fall of Tokyo's Outer Suburban "Business Core Cities". *Journal of Planning Education and Research,* https://doi.org/10.1177/0739456X1877347.

Quinby, Robert. (2011). *Time and the Suburbs: The politics of built environments and the future of dissent.* Winnipeg: Arbeiter Ring Publishing

Rosetti, Michael A. and Eversole, Barbara S. (1993). *Journey to Work Trends in the United States and its Major Metropolitan Area, 1960–1990.* US Department of Transportation, Federal Highway Administration, Washington DC

Shanghai Municipal Development and Reform Commission (2016). Report on environmental impacts of Shanghai Rapid Rail Transit Construction Plan 2017-2025). Availed at http://www.envir.cn/docs/2016/20160418709.pdf, accessed 8 April 2018

Shanghai Pudong Rail Transit Investment Corporation (2013). Souvenir book to commemorate the running of Shanghai metro line 16. (in Chinese)

Shanghai Songjiang Almanac Editorial Board (1991).*Songjiang County Almanac.* Shanghai: Shanghai People's Publishing House. (In Chinese)

Shen, Jie and Xiao, Yang (2019). Emerging divided cities in China: Socioeconomic segregation in Shanghai, 2000–2010. Urban Studies, doi.org/10.1177/0042098019834233

Shen, Jie and Wu, Fulong(2017). The suburb as a space of capital accumulation: The development of new towns in Shanghai, China. *Antipode,* 49(3), 761–780

Shen, Jie and Wu, Fulong (2013). Moving to the suburbs: Demand-side driving forces of suburban growth in China. *Environment and Planning A*, 45 (8), 1823–1844

Shin, Hyun Bang (2012) Unequal cities of spectacle and mega-events in China.

CITY: analysis of urban trends, culture, theory, policy, action 16(6), 728-744

Siemiatycki, Matti (2006). Message in a Metro: Building Urban Rail Infrastructure and Image in Delhi, India. *International Journal of Urban and Regional Research*, 30(2), 277–92

Simone, AbdouMaliq (2004). People as infrastructure: intersecting fragments in Johannesburg. *Public Culture,* 16, 407–29

Sreedharan, Padmashree E. (2002). Delhi MRTS Project. *Indian Railways,* April, 81–87

Songjiang District Construction and Management Committee (2017). Suggestions on a Fast Track for the Approval of Educational Planning and Construction Projects in Areas with Rapid Population Growth. 24 April 2017, available at http://qrd.songjiang.gov.cn/detailzs.aspx?Cod=557&Contentid=_9KUA2B4IV&catalogId=020, accessed 6 April 2018

Tsui, Kai Yuen (2011) China's infrastructure investment boom and local debt crisis. *Eurasian Geography and Economics* 52, 686–711

Wu, Fulong and Phelps, Nicholas A. (2011). (Post) suburban development and state entrepreneurialism in Beijing's outer suburbs. *Environment and Planning A,* 43(2), 410-430

Wu, Fulong (2013). Chinese suburban constellations: the growth machine, urbanization and middle class dreams, in Keil, Roger (ed.) *Suburban Constellations: Governance, Land and Infrastructure in the 21st Century.* Berlin: Jovis Verlag, pp. 190–194

Wu, Fulong (2018). Planning centrality, market instruments: Governing Chinese urban transformation under state entrepreneurialism. *Urban Studies* 55(7): 1383–1399

Wu, Weiping (1999) Reforming China's institutional environment for urban infrastructure provision, *Urban Studies,* 36(13), 2263–2282.

Wu, Weiping (2010). Urban infrastructure financing and economic performance in China. *Urban Geography,* Vol. 31, 648–667.

Xu, Daofang (2014). Transportation planning is the soul of urban planning. *Dongfang Daily* 2 May. (in Chinese)

Xu, Yixun (2018). A memoir on constructing the No. 5 Metro Line., 38-40(in Chinese). *Shanghai Party History and Party Building*, 4, 38-40

Yao, Yongling and Wang, Shuai (2014). Commuting tools and residential location of suburbanization: evidence from Beijing. *Urban, Planning and Transport Research,* 2(1), 274–288

Yeh, Anthony G.O. and Wu, Fulong (1996). The new land development process and urban development in Chinese cities. *International Journal of Urban and Regional Research,* 20 (2), 330–353

Yang, Perry Pei-Ju and Lew, Seng How (2009). An Asian Model of TOD: The Planning Integration in Singapore. In Curtis Carey, Renne, John L., Luca Bertolini (eds.) (2009). *Transit-oriented development: Making it Happen.* Ashgate, Burlington, 90-106

Zhang, Jingxiang and Wu, Fulong (2006). China's changing economic governance: Administrative annexation and the reorganization of local governments in the Yangtze River Delta. *Regional Studies,* 40(1), 3-21

Zhang, Yuxin (2016). The No. 9 and No. 17 metro line may be connected. *Morning News,* 15 July 2016 (in Chinese)

Zhou, Yixing and Ma, Laurence J. C. (2000). Economic restructuring and suburbanization in China. *Urban Geography,* 21(3), 205–236

Figures and Tables

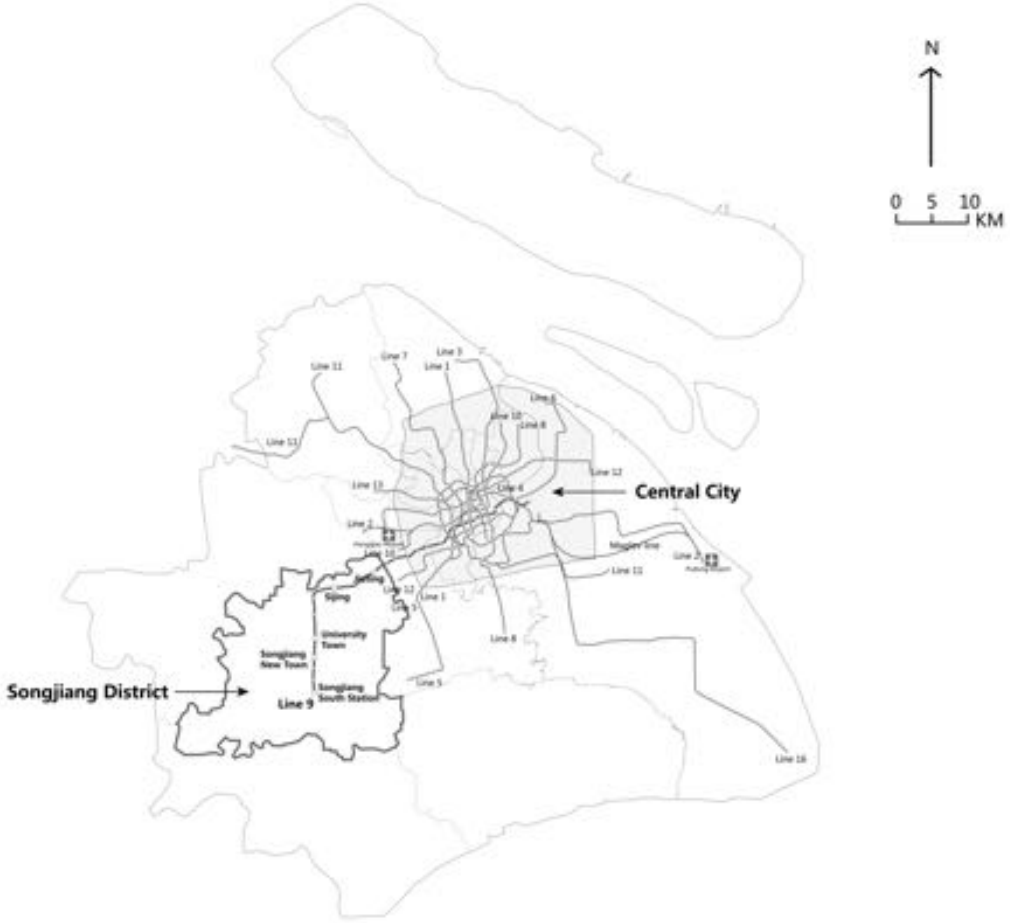

Figure 1 No. 9 metro line and major stations in Songjiang, Shanghai

Source: drawn by the authors

Figure 2 High-rise buildings along the No. 9 metro line near Songjiang University Town Station

Source: Author's photograph

Figure 3 Commercial and Residential development near Jiuting Station

Source: Author's photograph