

## **Challenges of Tokyo's Urban Rail for Better-Coordinated Service**

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### **INTRODUCTION**

Many governments have deregulated the urban public transport (PT) market mainly by reducing government controls on PT services while increasing greater competition among private enterprises. Typically, governments have shifted the urban PT system from their direct operation to private operations under government guidance. This shift could improve the efficiency of urban PT markets to some extent, but it may also bring new challenges in PT service. Private firms pursue profits from PT services whereas governments tend to seek social welfare from PT. This difference often causes a mismatch in the goals of the urban PT market, which could lead to poor performance of PT service. For example, the improvement of intermodal connectivity, such as between bus and rail or car sharing and trams, is one of the highest priorities for governments while it may be less important for PT private operators, who are concerned only with profit. To realize an integrated urban transportation market, it is essential to balance transportation strategies that incorporate multiple perspectives of different stakeholders, including both private and public players.

How then can an integrated urban transportation market be realized? This question may be quite challenging since its solution is context oriented, depending on socio-demographic, geographical, technical, historical, or cultural conditions of a given PT market. In addition, it should be noted that emerging technologies, such as electric vehicles, management systems based on information and communication technology (ICT), and new sharing concepts, could influence the strategies. The solution should satisfy a government's target while not losing the advantages of private sector participation, such as their financing capacity for infrastructure investment and their professional skills/experience for improving operational efficiency.

This study reports three cases pertaining to efforts made for better coordination between the private sector and/or between the public and private sectors in the urban rail market in Tokyo, which has a relatively long history of a private-oriented market. Then, implications are drawn from these cases and further issues are raised regarding market regulations and the role of the government in the PT market.

### **CHALLENGES OF PRIVATE-BASED URBAN RAIL MARKET IN JAPAN'S METROPOLITAN AREAS**

Japan's metropolitan areas—Tokyo, Osaka, and Nagoya—have dense and widespread urban rail networks, which provide high-performance urban transportation services. This has contributed not only to the daily lives and business activities of local people,

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but also to economic development for higher productivity and better international competitiveness. In particular, Tokyo is well known as a rail-oriented megacity in which huge traffic demand generated from a population of more than 30 million has been handled well with a sophisticated urban rail system.

As shown by Kato (2014), one of the unique characteristics of Tokyo's urban rail market is that many rail services are provided by private rail companies. More than 20 private rail operators provided rail services in the Tokyo Metropolitan Area as of 2015, and most owned and operated their rail infrastructure. Note there is no case in Japan in which multiple rail operators share the same rail infrastructure for their operations, although rail operations could be separated from rail infrastructure ownership (one company could provide rail services using rail infrastructure owned by another organization). This means that urban rail operations in Tokyo are regionally monopolistic.

The fact that mainly private companies operate and develop urban rail has positively influenced the efficiency of urban rail services in Tokyo. For example, multiple private rail operators often provide services connecting the same pair of cities with different routes, which leads to lower fares and faster service through competition to gain more ridership. One such example is the competition among three rail operators: JR East, Keikyu Co., and Tokyu Co., all of which connect Tokyo to the city of Yokohama using three different lines. Another example is airport access from the central business district (CBD) in Tokyo to Narita Airport, which is provided via different routes of two rail operators: JR East and Keisei Electric Railway Co. In addition, they provide travelers with multiple rail route options, which improve the robustness of airport access service in Tokyo.

Although such a private-oriented urban rail market contributes to efficient transportation services in Tokyo, it sometimes suffers from poor coordination among different services. A typical issue relating to poor coordination in Tokyo's urban rail network is connectivity at rail stations. As the Tokyo Metropolitan Area has a geographically widespread area, average travel distance becomes longer; then, many urban rail users in Tokyo have to change trains at least once at connection stations, even in a single journey. According to Kato et al. (2003), more than 80 percent of travelers using rail for home-to-work and home-to-school journeys change trains at connection stations at least once in the Tokyo Metropolitan Area. When connectivity is not well coordinated between rail lines, the service level for rail users is poorer because they may need to walk long distances between stations, or they could face physical barriers, such as vertical steps for handicapped people and exposure to rain, snow, and wind without protection along connection routes between stations. There are many poor-performance connection stations in Tokyo. Kato et al. (2003) reported there are more than 30 connection stations whose walking times for connection are more than 7 minutes.

Another issue relating to the poor coordination of Tokyo's urban rail network is a missing link problem. The missing link refers to an unlinked space between two rail stations that are closely located in a distance of typically less than 1 km. Suppose there are two stations, both of which are the terminal stations of two different lines, located close to each other. Under such conditions, passengers who want to connect between both rail lines should walk or use other secondary transportation modes, such

as bike-sharing or short-distance bus. If a new rail line connecting the two stations were to be newly constructed, passengers could pass directly through the two rail lines without transfer, which should save travel time, reduce the fatigue of walking, and even improve traffic safety. Unfortunately, many missing links remain in Tokyo's urban rail network. For example, Tokyu Kamata station, a terminal of the Tokyu Tamagawa line, is located about 800 m from Keikyu Kamata station, which is located along the Keikyu Airport line. Tokyu Kamata station belongs to one private company, Tokyu Co., whereas Keikyu Kamata station belongs to another private company, Keikyu Co. If a new 800 m-long rail line were to be introduced to connect the two stations, many areas in the western part of Tokyo and Saitama Prefecture, including the major cities of Shibuya, Shinjuku, and Ikebukuro, could be connected directly with Haneda Airport, one of Tokyo's international/domestic airports, by direct-through trains. This is expected to generate huge social benefits. Although the new line has been proposed for a decade, there has been no consensus among stakeholders about introducing it.

### **EFFORTS TO IMPROVE URBAN RAIL CONNECTIVITY IN TOKYO**

Many measures have been taken already to overcome Tokyo's urban rail connectivity problems, which have been recognized widely. This study considers three efforts made in the past: direct-through rail operations, the Barrier-Free Act, and the Act to Enhance the Convenience of Urban Railways.

#### ***Direct-through Rail Operations between Suburban Rails and Metros since the 1970s***

Currently, many suburban rail services are connected directly to the metro services in the CBD of Tokyo. This is the so-called "direct-through operation," which first was proposed by the Council for Urban Transport in 1956 and has been introduced gradually since then into many rail lines in the Tokyo Metropolitan Area.

Introduction of the direct-through rail operation is usually guided by long-term urban rail investment plans, which are proposed by a council commissioned by the Minister of Land, Infrastructure, Transport and Tourism as of 2015. It should be noted that the plan has no statutory power to force rail operators to follow the proposal. Usually, the investment necessary to realize the direct-through service is financed by private rail companies and the metro operators themselves. Note there are two metro operators in Tokyo: a public organization, the Tokyo Metropolitan Government; and the government-owned Tokyo Metro Ltd. Co., formerly the Teito Rapid Transit Authority, which was changed into the company in 2004.

The direct-through operation first enables passengers to change from a suburban rail line to a metro line without physical transfers between connecting stations. In addition, it is in line with the government policy that aims to reduce in-station congestion and realize an efficient and convenient urban rail network, which improves economic productivity in Japan's capital city. Although the investment for direct-through operations requires huge construction costs, it benefits both suburban rail and metro operators. This is because the introduction of direct-through operations improves convenience for commuters, inducing greater housing demand along the rail lines in neighborhood suburban areas, increasing rail ridership, and finally, leading to additional profits for operators. In addition, rail depots that used to be located in

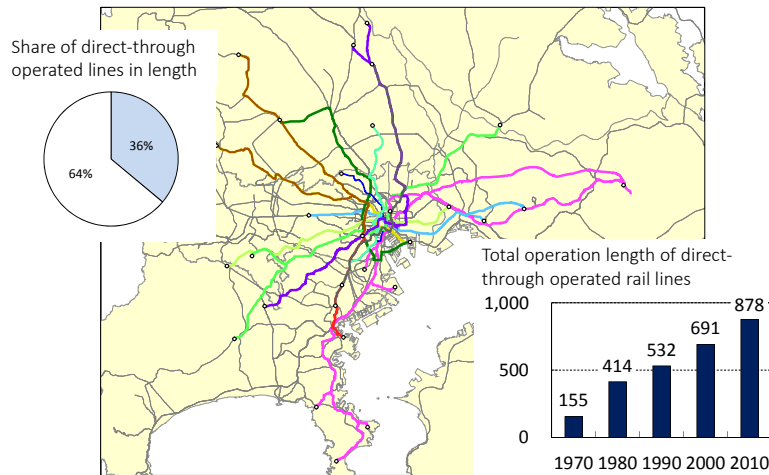


Figure 1: Direct-through rail network in Tokyo and time-series changes

urbanized areas are removed or relocated to rural areas, which could reduce their maintenance costs, or even give them another opportunity to redevelop the former depots into more profitable businesses.

The direct-through operation has become popular in Tokyo because it provides a win-win-win solution for urban rail passengers, the government, and rail operators. As of 2010, the total length of rail network under direct-through operations reached about 880 km, or more than 35 percent of the total urban rail network in the Tokyo Metropolitan Area, as shown in Figure 1. It should be noted that this approach inspired the interconnection of RER, the SNCF's suburban lines with metro lines in Paris (Sato and Essig, 2000).

### ***Barrier-Free Act in 2000 and Related Subsidy Schemes***

Connectivity has been highlighted as one of Tokyo's particular transportation policies since 2000. One of the reasons is that Tokyo has been experiencing rapid aging in its demographic trend. There are strong expectations of an increase of aged rail users who may have walking handicaps in the coming super-aged society in which more than 30 percent of the population will be 65 years or older. The development of a seamless urban rail network has become one of the policy targets for the national government, as shown in the long-term urban rail development plan of 2000 (Kato, 2014). Another reason is that the government shifted its policy focus from quantitative to qualitative investment after 2000. Construction of new rail lines used to be the main issue in urban rail planning until the 1990s, when rail capacity was so poor that in-vehicle congestion was serious in Tokyo. However, in-vehicle congestion gradually has been becoming less serious owing to both the decrease of rail demand and the accumulation of sufficient facilities investment (Kato, 2014).

The national government introduced the Barrier-Free Act in 2000, making the installation of elevators and escalators at large-scale rail stations mandatory (Kato, 2014). According to a government review, as of 2010, 77 percent of rail stations whose daily passengers numbered 5,000 or more had installed barrier-free facilities, as shown in Figure 2 (MLIT, 2012). As the further growth of the number of aged rail users is

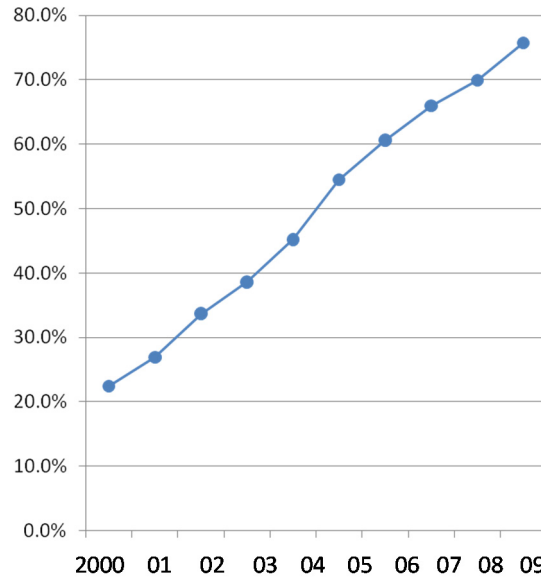


Figure 2: Share of stations with more than 5,000 passengers/day that have introduced the non-step route in the Tokyo Metropolitan Area

Source: MLIT (2012)

expected in the coming decade, the national government revised the Act in 2011 with a new policy target: that 100 percent of rail stations whose daily passengers number 3,000 or more must install barrier-free facilities. According to an updated government review, as of March 2015, rail stations with 3,000 or more daily passengers and that have installed barrier-free facilities comprise 96.6, 89.4, 97.0, and 95.1 percent of the total in Saitama, Chiba, Tokyo, and Kanagawa prefectures respectively (MLIT, 2015).

Furthermore, the national government has introduced subsidy schemes for the financial support of the introduction of barrier-free facilities in rail stations. One is a subsidy scheme for “barrier-free facilities investment projects in transportation infrastructure,” which was introduced in 1998. Under this scheme, the national government provided a subsidy to private rail companies of up to one-third of the total investment cost. The barrier-free facilities include elevators, escalators, slopes, handrails, and special toilet facilities for handicapped people in railway stations. This scheme ended in 2011 but was reorganized into another scheme, the “subsidy for sustenance and improvement projects in regional public transport” in 2011. Under the new scheme, both the national and local governments provide subsidies to rail companies of up to one-third of the total cost. This scheme covers rail stations with daily passengers of 3,000 or more. It should be noted that the new scheme requires the relevant local government to set up a council that consists of local stakeholders, including rail companies, to develop an investment plan. The council is required to collect opinions from the public to develop the investment plan. As council members should include multiple private rail companies at each station where two or more rail operators provide their services, it could be possible to coordinate different rail companies through the council’s discussions. In addition, the council system has another advantage in that the rail station facilities may be coordinated with urban planning in the neighborhood of the rail station because urban planners from local

governments usually are required to participate in the council. Thus, the rail station development could be harmonized with urban redevelopment under the guidance of the council.

### ***Act to Enhance the Convenience of Urban Railways in 2005***

The Act to Enhance the Convenience of Urban Railways was enacted in 2005, and aims to improve the quality of urban rail services in metropolitan areas: Tokyo, Kinki, including Osaka, and Chukyo, including Nagoya. The act deals with the “project to enhance the convenience of urban railways,” which has two components: a project to increase the speed of rail service (ISRS) and a project to smooth mobility in rail stations (SMRS). The ISRS is an investment to reduce travel time for rail users by constructing new rail links connecting existing rail lines while the SMRS is an investment to reduce transfer time in rail stations and remove difficulties in the use of other rail station facilities by improving routes for seamless connections in existing rail station facilities. Under the act, both projects assume the separation of rail operators from the infrastructure constructor/owner. The latter can receive a subsidy equivalent to one-third of the construction cost from the national government as well as another subsidy equivalent to one-third of the construction cost from the local government. The remaining construction cost is paid by the infrastructure constructor/owner itself through debt finance. The rail operators borrow the infrastructure from the owner by paying a charge to the owner. The infrastructure owner repays the debt with revenue from the charge. It should be noted that the act stipulates that the infrastructure constructor/owner should be either a semi-government corporation<sup>2</sup> or the Japan Railway Construction, Transport and Technology Agency (JRJT)<sup>3</sup>. Figure 3 illustrates the finance structure of the project based on the act.

The charge paid by the rail operators to the infrastructure constructor/owner is determined based on excess profits accruing to the rail operators from the project. The excess profit of each rail operator is calculated by subtracting the expected profit of the operator in the case without infrastructure investment from that in the case with investment. The expected profits in both cases are estimated using travel demand forecasts, in which profit is defined as revenue minus the cost of operating both existing and new infrastructure.

The act requires the local government to set up a council that consists of local stakeholders, including the rail operators, infrastructure constructor/owner, and local government for the SMRS project, but it does not require them to set up a council for the ISRS project. For the latter project, the act stipulates that the rail operators and infrastructure constructor/owner should voluntarily agree on the project, including the

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<sup>2</sup> The shareholders of a semi-government corporation are typically local governments and private rail operators.

<sup>3</sup> The JRJT is an independent administrative institution, which is involved in construction and technical support for railway and other transportation projects throughout Japan.

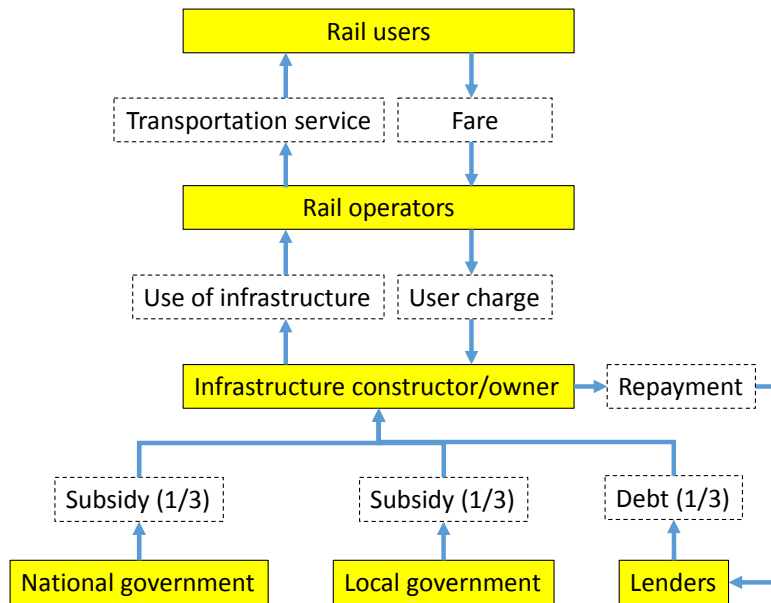


Figure 3: Finance structure of the project to “Enhance Convenience of Urban Railways” under the Act

charge. However, in case they cannot reach agreement, the act permits the minister to arbitrate disputes between them.

The act is expected to solve the missing link problem and poorly coordinated connection stations in the metropolitan areas. Yokota (2012), who interviewed stakeholders in ongoing projects using the act, summarized the advantages of the act as follows: (1) the subsidy rate is higher than the other scheme; (2) the excess profit covers the changes in the operator’s profit stemming from existing services in networks other than the new infrastructure; (3) no additional initial charge should be levied on the newly introduced line<sup>4</sup> (for the ISRS project by removing a missing link); (4) the consultation process is institutionalized so that consensus is built easily (for the SMRS project); and (5) the rail station can be improved in coordination with neighborhood urban development (for the SMRS project).

It should be noted that the ISRS project assumes that the rail companies voluntarily propose a new project for removing the missing links following the act. Their main incentive for voluntary actions is the subsidy from the national and local governments, whose rate is higher than that of other schemes. However, this act may have some drawbacks. One is an unclear process for determining the charge paid by the rail operators to the infrastructure constructor/owner. This may seem a risk for the rail operators. Another uncertainty is that the act does not state the period of the

<sup>4</sup> Note that a new fare table, including the initial fare, should be applied only to the newly introduced rail section if that infrastructure would be independently owned and operated by a different company. This means rail users who pass through the section should pay three charges to the three rail companies: the existing two rail companies plus the new rail company who operate the new section. However, the act permits the rail operators to apply the existing fare tables even for the newly introduced rail section, and thus, rail users who pass through the section should pay the two charges only to the existing rail operators.

charge payment clearly. Theoretically, the rail operators should keep paying the charge to the infrastructure constructor/owner, even after the debt finance of the owner is completed, until the total amount of the payment charge reaches the total investment cost. This may reduce the willingness of private operators to propose such projects. Actually, only three projects have applied the scheme since the act was introduced 10 years ago.

### **WHY POOR COORDINATION REMAINS IN TOKYO'S URBAN RAIL**

Although much effort has been made, as shown, poor connection stations and missing links remain in Tokyo. Why have these problems not been solved? The reasons may vary depending on the local context of each case, but may be summarized generally into the following five reasons.

First, investment for improving connectivity may not be profitable for private rail companies although it contributes to enhancing user's convenience or generating positive social benefit. This is often true because fare collection from the in-station or station-to-station connection is technically impossible or economically difficult, and this leads to poor motivation for private companies to invest in connection facilities. However, development of a new ICT system to collect fares from connection could overcome this problem.

Second, private companies tend to have a narrower scope in which they consider only existing resources. In particular, in a shrinking market, such as Japan's urban rail market, their business style should be conservative, in which they focus on keeping current services, and this may give them poor incentives to have the broader perspective of improving the entire urban transportation network. This suggests that sociodemographic changes influence the motivation of private companies to improve the PT service.

Third, the private companies may not want to cooperate with rival companies to avoid losing their existing customers. Even if both companies could gain positive benefits in the long run through cooperation, they tend to think their strategies from short-term viewpoints only. This suggests that governments should play an important role in proposing long-term transportation strategies beyond the short-term strategies of private companies.

Fourth, private companies do not want to face the burden alone of an investment cost to improve connectivity. In the practice of rail development in Japan, there is an implicit rule that a proposing player should pay the entire project cost, even if that project could benefit other stakeholders; this makes private rail companies hesitate to propose a new project. This suggests that a planning process in which private companies can propose projects more proactively should be institutionalized.

Fifth, many areas that require the improvement of rail service connection already have been so urbanized that the construction cost has become expensive. In addition to the difficulties of land acquisition, construction in urbanized areas requires high-skilled engineering work to avoid noise/vibration emissions, damage to existing facilities, and suspension of neighborhood economic activities. These may be regarded as investment risks by private companies, suggesting that the investment risk should be shared by both private and public sectors, possibly through public-private partnership, when the investment contributes to social benefit.



## **DISCUSSION**

What policy implications are derived from the abovementioned cases for promoting better connectivity? Five implications are summarized as follows. First, the cases revealed that one of the most important factors for success is a mechanism to give incentives to private companies to participate voluntarily in the connectivity improvement projects. In this sense, the direct-through operation may be a successful case while the Act to Enhance the Convenience of Urban Railways may be the less successful case. The incentive mechanism should be designed carefully by governments.

Second, evidence from the three cases shows that the institutionalization of the decision-making process is critical. For instance, the Barrier-Free Act and the SMRS projects under the Act to Enhance the Convenience of Urban Railways require local governments to establish councils at which multiple stakeholders should join the discussions. This enables private companies to negotiate with other stakeholders.

Third, subsidies or government financial support for private companies could provide companies with incentive to support the government's policy goals but its effectiveness depends on the project design. This is because the private companies are so sensitive to uncertainties that they may hesitate to participate in the projects when they consider that they include significant risks for their business. Careful design of the subsidy scheme is strongly required for public-private partnerships.

Fourth, the change in Tokyo's sociodemographic pattern toward rapid aging should affect the PT market design, including the government subsidy scheme and regulations. The shrinking market makes private companies conservative in their business style while social needs for improving the PT service may increase. Governments should play a role in promoting better PT service from private companies.

Finally, technological development relating to fare collection in particular could influence private companies' motivation for connectivity-improvement projects. To realize a more universal fare collection system, technological development should be made in more sophisticated smartcards or new mobile phone-based devices.

## **CONCLUSION**

This study investigated three cases of efforts made to improve the coordination of urban rail services in Tokyo among private companies and government. It is true that Japan's rail market has been developing in uniquely compared with other countries. The question then arises whether it is too exceptional to provide implications for other countries. Probably not. Tokyo's cases could answer the following four questions regarding PT market organization and innovation.

(1) Which roles should governments retain?

Tokyo's urban rail suggests that governments should guide stakeholders toward better coordination because private companies often have difficulties cooperating voluntarily with others. Poor coordination causes substandard PT network connectivity. The government should provide private companies with opportunities to participate in discussions for a harmonized transportation market as well as provide financial incentive to join the discussions.

(2) Have reforms generated meaningful competition in all cases?

From the evidence of the long history of completion in Tokyo's urban rail market, competition really is meaningful. However, unfortunately, Tokyo's experiences may indicate too much competition among rail operators, which could cause poor performance in the PT market. This may suggest that the government should encourage harmonized competition in the PT service.

(3) Do shifts in population demographics and urban form disrupt established tendering and organization approaches?

Tokyo has experienced rapid aging and shrinking urban area. Although Tokyo's urban rail system continues to be a private-oriented rail market, the increase of aged or handicapped PT users in the future will require more investment for barrier-free facilities and connection improvement, both of which may not be profitable for PT companies. As a private-led operation system may not work well for meeting such social needs, it should be changed gradually to a system more like a "public-private partnership." The recent efforts made in Tokyo's urban rail market for better connectivity could be regarded as part of a long-run institutional transition to meeting social needs.

(4) What are the challenges in coordinating PT services with urban redevelopment?

Tokyo's barrier-free facilities provides one such answer. Rail station facilities are managed by rail companies, whereas redeveloped areas could be managed by urban developers; thus, coordination between the rail station and redeveloped areas is often a difficult task for both the rail companies and the urban developers. One of the solutions in Tokyo is a council system in which different players are involved in discussions for the integrated design of urban and station facilities. At the same time, the national and local governments jointly provide subsidies to rail companies only when a coordinated project plan is prepared.

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