A Study on Transit-Oriented Development Strategies Surrounding High-Speed Rail Hub

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Abstract

Thailand agreed with China to promote the strategic partnership through a memorandum of understanding on the cooperation on Thai railways infrastructure development on the strategic framework for the development of Thailand's transportation infrastructure 2015-2022 Since Thailand is located a hub of land transportation connectivity among ASEAN countries. Thai-Chinese high-speed rail project (phase 1: Thailand's capital Bangkok to Nakhon Ratchasima province) is one of the megaprojects in long-term benefits under the strategic framework by the government-to-government process.

This high-speed rail (HSR) project was approved by the Prayut cabinet in July 2017 and was expected to operate in 2025. There are two primary reasons why Thailand decided to invest in the HSR project. The first reason is to support the strategy of the development of the international railway network and the second reason is to boost the regional economic development along the pathway.

However, a feasibility study of the HSR project was not feasible since the (direct) economic benefit was 8.56 % and financial benefit could not evaluate the value. Both values are lower than the benchmark in economic benefit (12 %) and financial benefit (5 %) based on the Office of National Economic Development Council. This is Thailand's government is facing how to drive it to sustainable development in the long run.

A feasibility study still recommended that if the Thai government utilized the land development around the HSR hubs (or transit-oriented development), an economic benefit would increase from 8.56 % to 11.68 % and approach criterion. Hence, TOD becomes one of the alternative strategies to boost economic value. Yet, Thailand's government does not have the practical know-how and experience in how to make it happen around the transit stations. Meanwhile, Thailand faced a limitation of land development surrounding the transport station, such as the Town Planning Act 1975, the Constitution of the Kingdom of Thailand 2017, and Expropriation and Acquisition with Immovable Property Act 2019.

This dissertation is originated from a feasibility study of the HSR project and aims to develop a comprehensive study to provide the TOD strategies around the HSR hub toward sustainable development in Thailand. The strategic deliberation is based on the components of TOD in terms of the HSR hub and urban development. The research gap is sixfold: to investigate the barriers of the Thai government for the HSR project, to explore the international policy ideas, measures, and tools to implementation; to describe the change of macroeconomic and indirect economic benefit, to examine the size of the station catchment area, to determine the primary and secondary feeder access mode choice to the HSR hub, and to examine the tension between HSR hub and urban development.

The result shows that TOD plays a significant player among four principal barriers (operation service, TOD, new organization and panel, and fate structure) to drive the HSR project to sustainable development based on the mechanism of the barriers of the Thai government for the HSR project. However, TOD is a combination between transport planning and urban development by improving a relatively high level of transport connections and high-density, mixed-used-use, cycling- and pedestrian-friendly land use surrounding transit stations. Other barriers are necessary for the HSR project and need to solve in the initial phase.

The operation service is the political issue about signaling and telecommunication with track work in the section of Bang Sue and Ban Phachi. If the Thai government determines to use shard tracks in this section, the safety and reliability should perceive for railway passengers in advance. The new organization and panel to drive the HSR project should act for railway operation and urban development since the HSR is an advanced technology and

needs to hire experts to the joint venture (for land development) and hire the private sector (for O&M section). Ministry of Finance and SRT are the joint manager to reduce the financial risk. The fare structure for the HSR project can complete with private transportation and train's first-class and second-class, while other modes of transportation system cannot beat. The developer should provide the marketing measures to support demand.

Meanwhile, urban development involves several components to implementation (e.g., actors, transport and urban planning, and legislation and regulation), but the Thai government does not have the practical know-how to make it happened. An international transferable TOD concept from international viewpoints can be learned the decision-making from the best practices of other governments to promote and support the Thai context (i.e., specific areas for special development, land and community management, positive measure for town planning, organization, investment, and legislation and regulation). Legislation and regulation are the key factors to drive other factors to successful TOD based on international experience. Thailand has similar development with Japan in terms of legislation and regulation. Yet, Thailand lacks many legislations and regulations such as urban renewal, land collection, and integration between transit stations and urban development when compared with Japan. Besides City Planning Act is related to many acts in different government agencies. It affects the management and decision-making because of viewpoints.

On the Thai side, the hard regulation is land expropriation around transit stations and needs revision because the development cannot take benefit to developing commercial areas. Besides, the Thai government does not have the financial tool to support the developers and investors of the TOD project.

At the regional level, the Fukushima Shinkansen station can stimulate the macroeconomic for the long run after the operation. The performance after the operation of the Fukushima Shinkansen station outperforms the performance before the operation of Fukushima Shinkansen station on a small scale, even though the station is a big size and locates on the mainline. Meanwhile, in the case of the short-term, the economy has weak productivity performance in some duration because it receives the risk to endure external factors such as oil crisis, economic bubble, and inflation rate. Hence, policy implementations to regulate transportation demand are a considerable tool for economic activity and social welfare.

In terms of economic development, the development of the Fukushima Shinkansen station is not only generative economic growth but also originates economic development in Fukushima prefecture. Because after the opening of the Fukushima Shinkansen station during 1990-2000, there has been an upward trend in the human development index of 0.33 percent per year due to support factors (longevity factor and standard of living factor), even though the number of outpatients has significantly undergone a rapid change.

At the urban and station-area level, the Fukushima Shinkansen station is evaluated the station catchment area by drawing the circular shape around the station via ArcGIS. This approach does not take geography into account when the area developed at a different time and the researcher cannot grasp the natural obstacle within the station catchment area. A radius of the station catchment area is 12.4 and 17.6 km based on dense network and land value perspective, respectively. The station catchment area (12.4 km) beats only California cities since Fukushima city has a limitation of land to develop for urbanization. The specific results from the case study may not provide all factors affecting land value that influenced change in land value because of lack of sufficient data, namely public investment in infrastructure, change in land-use regulation, and landowner's investment. For these reasons, this research focuses on only the population and economic factors. The population, primary industry, secondary industry, and tertiary factor are a significant impact on land value from a macro perspective.

Meanwhile, in the case of the Nakhon Ratchasima HSR hub, the catchment area surrounding the city center of NKR is a radius of 5.18. the light rai (LRT) transit project is selected as the primary feeder service in this dissertation. The survey results on access mode choice indicate the LRT (32.19 %) and songthaew shuttle services (11.76 %) as the primary and secondary feeders. The share of private vehicle use to access the HSR hub is as high as 48.08 %. As a result, it is necessary to convince motorists to switch from private vehicle use to public transport as modes of transport to access the HSR hub. Specifically, in the primary development zone, private vehicle use accounts for the largest proportion of the access mode choice to the HSR hub (78.31 %). In the secondary development zone, the LRT and songthaew shuttle services make up 76.42 %, consisting of 59.97 % and 16.45 % for LRT and songthaew shuttle services, respectively.

The Multinomial logit (MNL) analysis results indicate that the significant variables of the primary feeder are travel distance, travel cost, and the availability of LRT line, while those of the secondary feeder are middle- and high-income brackets, car ownership, travel distance, travel cost, the availability of songthaew shuttle routes, and

the availability of LRT lines. The MNL analysis also indicates the travel distance, travel cost, and the availability of the LRT line as the common significant variables for the primary and secondary feeder services.
The Tobit analysis results show that the significant demographic variables are income, car ownership, and motorcycle ownership, given tangible improvements are made to the facilities and infrastructure surrounding the Nakhon Ratchasima HSR hub. The expected willingness to pay of the survey respondents for the primary and secondary feeder services to access the HSR hub is 1.094 USD/trip/person, vis-à-vis the travel costs of songthaew shuttle and LTR service (from the farthest LTR station to the HSR hub) of 0.25 USD and 0.50 USD, respectively. The finding demonstrates that the commuters are willing to pay if significant improvements are made to the facilities and feeder service quality, especially to the songthaew shuttle service.

To redevelopment around Nakhon Ratchasima HSR hub, an extended butterfly model is modified assessment for node and place model. Nakhon Ratchasima HSR hub is located in Nakhon Ratchasima municipality and beside the CBD, but it is classified as an unbalanced node with a moderate node-index score on average (0.40) and a low place-index score on average (0.33), given that the maximum score of node-index and place-index is 1. The classification implies that transportation supply is significantly higher than urban activities of station areas. With the weighting method for subjective evaluation, a sensitivity analysis is adopted to validate the results and check for the potential uncertainties in weights and data. Sensitivity analysis is calculated with 16 scenarios by changing ± 10 % of weight values of each criterion and indicator at a time. The newest node-index score on average ranges from 0.36 to 0.41, while the newest place-index score on average ranges from 0.32 to 0.37. The results from all scenarios are not significantly affected by sensitivity analysis.

Therefore, this research would be useful to the high-speed rail project in Thailand as well as other cities in developing countries to motivate more TOD strategies in the future and to drive the high-speed rail project to sustainable development.