Financial resource mobilization for high-speed railway projects in the world, lessons for Vietnam

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Abstract: In the railway network plan for the period of 2021 – 2030, with a vision to 2050, the Vietnamese Government aims to complete the North – South high-speed railway route – the first phase (from 2025 – 2030) and invest in Hanoi – Vinh and Nha Trang – Ho Chi Minh City routes. In order to realize the above goal, the Ministry of Transport has agreed with the Ministry of Planning and Investment to submit the “Project of investment policy on construction of North – South high-speed railway” to the Politburo in 2023. However, in reality, it is extremely difficult to mobilize enough resources to complete the “super project”. Choosing the right financing mechanism is critical to the success of the project. The article studies the experience of capital mobilization in a number of countries with developed high-speed railway systems or whose economies and societies have many similarities with Vietnam; analyzes achievements and difficulties. Based on the actual conditions of Vietnam, we can draw important lessons and recommend forms of implementation consistent with actual policies and resources, in order to invest on schedule and achieve the results in accordance with the tasks set forth by the Government.

1 Introduction

In Vietnam, high-speed railway (HSR) is a completely new field and no similar project has so far been approved, started and built. The concept of “high-speed railway” appeared officially in the Law on Railway Transport No. 06/2017/QH14. Accordingly, high-speed railway is a type of electrified double-track national railway which has a speed of at least 200 km/h and a gauge of 1,435 mm [1].

In the world, High-Speed Railway (HSR) has nearly 6 decades of development. Japan was the first country to develop this system, which started operation in 1964. Currently, 20 countries around the world have dedicated railways with a maximum speed of at least 250 km/h and most are in Europe and Asia. As of September 1st, 2022, in accordance with the data reported by International Union of Railways (UIC), 58,839 km of high-speed railway line around the world has been currently operating; and 19,710 km has been being in the construction progress [2], as shown in the following table:

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**Table 1.1.** Length of high-speed railway lines operating in 20 countries around the world as of September 1st, 2022 [2]

<table>
<thead>
<tr>
<th>No.</th>
<th>Operating country</th>
<th>Start year</th>
<th>Length of high-speed railway in operation as of 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Japan</td>
<td>1964</td>
<td>3,081 km</td>
</tr>
<tr>
<td>2</td>
<td>Italy</td>
<td>1977</td>
<td>921 km</td>
</tr>
<tr>
<td>3</td>
<td>France</td>
<td>1981</td>
<td>2,734 km</td>
</tr>
<tr>
<td>4</td>
<td>Sweden</td>
<td>1990</td>
<td>860 km</td>
</tr>
<tr>
<td>5</td>
<td>Federal Republic of Germany</td>
<td>1991</td>
<td>1,571 km</td>
</tr>
<tr>
<td>6</td>
<td>Spain</td>
<td>1992</td>
<td>3,661 km</td>
</tr>
<tr>
<td>7</td>
<td>Finland</td>
<td>1995</td>
<td>1,120 km</td>
</tr>
<tr>
<td>8</td>
<td>Belgium</td>
<td>1997</td>
<td>209 km</td>
</tr>
<tr>
<td>9</td>
<td>United States of America</td>
<td>2000</td>
<td>735 km</td>
</tr>
<tr>
<td>10</td>
<td>United Kingdom</td>
<td>2003</td>
<td>113 km</td>
</tr>
<tr>
<td>11</td>
<td>China</td>
<td>2003</td>
<td>40,474 km</td>
</tr>
<tr>
<td>12</td>
<td>Switzerland</td>
<td>2004</td>
<td>176 km</td>
</tr>
<tr>
<td>13</td>
<td>South Korea</td>
<td>2004</td>
<td>873 km</td>
</tr>
<tr>
<td>14</td>
<td>The Netherlands</td>
<td>2006</td>
<td>90 km</td>
</tr>
<tr>
<td>15</td>
<td>Turkey</td>
<td>2009</td>
<td>1,052 km</td>
</tr>
<tr>
<td>16</td>
<td>Austria</td>
<td>2012</td>
<td>254 km</td>
</tr>
<tr>
<td>17</td>
<td>Poland</td>
<td>2015</td>
<td>224 km</td>
</tr>
<tr>
<td>18</td>
<td>Saudi Arabia</td>
<td>2018</td>
<td>449 km</td>
</tr>
<tr>
<td>19</td>
<td>Morocco</td>
<td>2018</td>
<td>186 km</td>
</tr>
<tr>
<td>20</td>
<td>Denmark</td>
<td>2019</td>
<td>56 km</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>58,839 km</strong></td>
</tr>
</tbody>
</table>

In fact, the investment cost of HSR lines is very large, the payback period is long and the financial efficiency is not high, but the socio-economic efficiency is high, not to mention many factors having a great impact but being difficult to quantify such as developmental space restructuring, change of market share structure of transportation specialties, environmental pollution … Therefore, the records from countries with developed railway infrastructure in the world show that the participation of the private economy accounts for a small proportion. Some countries choose investment capital completely from the State, some countries choose the form of PPP, in which public investment is the main, accounting for over 80% (infrastructure cost) such as Japan, Taiwan, United Kingdom, while the private investment accounts for about 20% (vehicles, equipment for operation).

In Vietnam, in accordance with the proposal of the Ministry of Transport in the report submitted to the Politburo, the total investment of the North – South high-speed railway project is 61.67 billion USD. The use of all public investment capital for investment is impossible, when the GDP of Vietnam in recent years has averaged 401 billion USD and the public debt has been 43.1% of GDP. Therefore, the Ministry of Transport proposes to invest in the form of PPP, in which public investment is the main, accounting for over 80% (infrastructure cost) such as Japan, Taiwan, United Kingdom, while the private investment accounts for about 20% (vehicles, equipment for operation).

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is completely in line with the orientation of the Government, which is: Domestic resources are basic and long-term; State budget plays a leading and decisive role; External resources are important creating breakthroughs [3], [4]

Although there is a policy, a specific investment plan, including a plan for financial resource mobilization for project implementation, has not been proposed so far. Therefore, it is crucial to study the process of investment in construction of high-speed railways in the world, based on specific conditions in Vietnam, in order to learn and draw lessons from experience in financial resource mobilization for the project.

2 Research methods

Data collection method: The secondary data for the research of the authors are collected from the reports of the Ministry of Transport, the legal regulations of the State, the scientific research projects at home and abroad having been published or accepted in relation to the article.

Analysis and comparison method aims to evaluate the investment experiences of countries with developed HSR systems, thereby drawing lessons for Vietnam.

3 Experience in financial resource mobilization for high-speed railway projects

3.1 Experience in Europe

In Europe, a number of countries such as France, Spain, Italy, and Germany have quite good high-speed railway systems with names such as TGV (Train à Grande Vitesse) in France, ICE (Inter City Express) in Germany, AVE (Alta Velocidad Española) in Spain. Funding for the HSR project is obtained from a variety of sources, including governmental agencies (federal, state and local governments), state-owned enterprises and private investors [5], in two forms: fully funded by the government or in the form of PPP (with substantial government contributions). [6]:

3.1.1 Full public financing

This model entails government financing total capital costs and assuming the role of long term developer and owner. It was very popular in Europe during the early stages of HSR development, such as the original French TGV systems (including the South-East, Mediterranean, European East and Rhine–Rhône), Belgium, Germany, Spain and Italy. Public financing can be direct (approximately 40 percent of EU rail infrastructure is done this way), or through a combination of direct government support and finance by national railway companies (as in Italy and France). [7]

There are two main categories of public financing alternatives used for HSR: accumulated public funds or government borrowing [5]. Accumulated funds are broadly derived from consolidated tax revenue, or infrastructure levies, while public sector borrowing includes general bonds, infrastructure bonds, infrastructure revenue bonds, or public trading enterprise borrowing. The most common form of public sector borrowing is via long-term bonds. [8]

France is a country applying many different financial models, developing in accordance with the external environment and the efficiency of the project. The first high-speed railway
route – Paris – Lyon (also known as TGV Sud-Est) is fully funded by the loan from SNCF (The Société Nationale des Chemins de fer Français / French National Railway Company), which is a company wholly owned by the French government, whose main source of revenue comes from the operation and performance of passenger and cargo transportation services. At the same time, since 1990, SNCF has sold railway carriages to local government and expanded its business scope to the international network. That was an important source of revenue for SNCF to continue borrowing to invest in the Paris – Lyon high-speed railway route. The result was a spectacular success in terms of both passenger traffic and revenue generation with a financial return of 12%/year and an estimated socio-economic benefit of 15%/year to 30%/year. The project has been fully depreciated after only 12 years of operation. [6]

3.1.2 PPP financing with government assistance

Private sector funding derived from private debt, private equity or mixed private instruments [8]. There are 3 types of PPP mechanisms in the European HSR project with different scope to private participation: Broad-based PPP, PPP for infrastructure only, PPP for superstructure only, specifically as follows:

a. Broad-based PPP
   - Russia: The Moscow – Saint-Petersburg HSR route is more than 600 km long, with 50% of the financial resources mobilized from the Government and the rest from the private sector, granting operation franchise to the investors within 30 years with payment from the Government. During that time, although the Government bears operational and revenue risks, the infrastructure franchisee will be responsible for the maintenance. The private partners participate in investment scope from civil works to electro-mechanics and rolling stock, operation scope from construction to operation and maintenance. At the same time, the private sector will also have the right to determine the quantity of intermediate stations and the location of any of them. [9].

b. PPP for infrastructure only (including civil works, electro-mechanics, construction and maintenance)
   - France: France is the first country in Europe applying this form. In 2006, the French Government developed a PPP policy framework for HSR projects, with the goal of attracting 40 billion EUR to complete 2000 km by 2020. There are two PPP models:
     1. The Government is responsible for operation and maintenance and covering the risks. The private sector is responsible for investment in construction and maintenance of the route in accordance with the term of the PPP contract, while the operation responsibility remains with RFF (Réseau ferré de France). After the operation, public payments will be made to the private partners in accordance with the prepared plan to cover capital investment and maintenance costs (such as the LGV project linking Le Mans with Rennes, 132 km long, completed in 2016), or the debts will be refinanced, benefiting from low interest payments (the LGV project, Contournement Nîmes – Montpellier bypass, 70 km long, completed in 2017). The private capital involved in the two projects is over 50%, respectively 1.9/3.3 billion EUR and 1.5/2.3 billion EUR, of which most is bank loans, and the rest is owner’s equity. [6]
2. Grating the operation and fee collection franchise to the private investors. The private sector bears design, construction and operation risks, including traffic risks. The Government finances 50% of construction investment costs [5, 10]. It has been successfully applied with the LGV SEA (LGV Sud Europe Atlantique) route connecting Tours and Bordeaux, 300 km long and the Perpignan – Figueres route across the French – Spanish border, 45 km long. During the investment process, the Perpignan – Figueres route concession agreement extended its period from 50 years to 53 years, the supporting public investment capital added 62 million EUR, increasing the proportion from 50% to 57% of the amount of investment.

- United Kingdom: Applying the BOOT (Build – Own – Operate – Transfer) Contract, with the capital from the private sector in its entirety. The HS1 project (HS1 is the 109 km rail line between St Pancras International in London and the Channel Tunnel) with the construction cost of 5.8 billion GBP was built by London and Continental Railways (LCR), and raised its funds by selling government-backed bonds. After completion of construction, the franchise was granted to another investor for 30 years for operation and maintenance, and the infrastructure and land ownership remains with the State. During the operation process, the State has a policy to finance fares. The HSR2 project from London to the West Midlands has a similar model.

The investment and operation process encountered some difficulties, causing the results to be not as expected, because of the following reasons: Excessive demand forecasting and large costs due to vertically integrated construction, which made LCR very difficult to maintain its business. The United Kingdom Government had to expand financial support, such as guaranteeing 3.75 billion GBP of loans and paying for roads and bridges, in addition to a grant of 1.75 billion GBP of financial support. In return for these loans, the United Kingdom Government has agreed to receive 35% of operating revenue of HS1. After the financial restructuring, the infrastructure ownership and the infrastructure management were separated. The private entity pays the infrastructure rental based on the actual revenue.

- Spain: This PPP covers infrastructure only (civil works, electro mechanics, construction, 25-year maintenance contract) and excludes rolling stock and operations [11]. 40% of construction costs is financed by the State-owned Infrastructure Manager, while 60% is from private capital or long-term debt. Granting the operation franchise to the investors within 25 years, with the payment by the Government. The Government bears the revenue risk in operation.

c. PPP for superstructure only Netherlands – Belgium High-Speed Line South (HSL South). The State provides financial support for electro-mechanical equipment, construction site and maintenance (accounting for 86% of investment costs). Applying the DBMF (Design – Built – Maintain – Finance) contract. After completion of project, it will be implemented in two separate franchise methods:

- Operation franchise of the superstructure (above the track) to the investor within 25 years.
- Operation franchise of the transport, commercial service supply on train lines to the investors within 15 years.
3.2 Experience in Asia

a. Japan. Japan was the first country developing the HSR system, also known as Shinkansen, in 1964. Currently, Japan has a network including 9 high-speed railway lines (with a total length of 3,081 km), serving 22 major cities of the country and spreading over 3 main islands, along with 3 more lines being under construction.

The HSR investment and management model of Japan is implemented in the form of PPP between JRTT (Japan Railway Construction, Transport and Technology Agency) owned by the State and private joint stock companies – JR (JR Center, JR East, JR West, …).

Regarding infrastructure investment: JRTT is responsible for the construction of high-speed railway lines. After completion, JRTT owns the lines and leases them to the operators (JR). The investment capital will be provided by the Government, in which the capital from the central budget accounts for two-thirds and the remaining one-third is from the local budget.

Regarding operation: JR companies are responsible for train procurement and operation, payback fee collection, and infrastructure rental payment.

In order to ensure financial feasibility, the Japanese Government approves the HSR investment if the following criteria are met: (1) The stable financial source is guaranteed for the project; (2) The projects with operating costs are offset by fare revenue; (3) The investment is effective and the benefits are greater than the costs; (4) The construction is invested by the JR operator; (5) Obtaining the consent of the relevant local authority to terminate the operation of the parallel railway lines. [12]

b. China. As of September 1st, 2022, the high-speed railway network of China reached 40,474 km; it is expected to reach more than 45,000 km in the long-term strategy and more than that of the rest of the world combined.

The financial resources for investment in HSR in China are provided by: (1) The Government, accounting for 40–50%, through lending by banks and state financial institutions, (2) 40% from bonds issued by the Ministry of Railways (MOR) and (3) the remaining 10 – 20% from provincial and local governments. As of 2022, China State Railway Group Company, Ltd. has about 900 billion USD in debt. However, due to the influence of high-speed railway network having extended beyond the railway industry, which comes from the purposes of people’s livelihood, social cohesion, changing urban development method, and promoting tourism activities and local economic growth, … although the business of many high-speed rail lines is in a state of loss, China still focuses on developing the transportation infrastructure in general and the high-speed railway network in particular, provided that it attempts to limit the loss to the lowest level in the shortest time. [12]

c. Taiwan. Selecting the form of BOT investment for the entire construction and equipment. The winning investor – Taiwan High-Speed Rail Corporation – undertakes the investment cost of construction and equipment, accounting for 80% of the total cost. However, with some risks in the investment process, the Taiwanese Government had to rescue the investors many times with policies such as loan interest rate reduction, purchasing more shares to raise ownership from about 20% at the initial time to about 64%, and extending the term of project operation contract by 35 years to 70 years. Some of the main reasons leading to the failure of Taiwan to apply the PPP model to the high-speed railway are as follows:
• The financial calculation is too optimistic, the connection between the stations and other areas has not yet been good: The prepared operation plan forecasted the number of passengers per day of about 240,000 people. However, there were only 80,000 people in actual operation. The main reason is that the distance between the station and the city center is quite far in the context that the accessible transport system fails to meet the demand, causing great obstacles to attracting train passengers.

• Unsuitable initial technology selection: At first, the winning unit – Taiwan High-Speed Rail Corporation – used European technology platforms including TGV of France and ICE of Germany. However, the difficulties of investment capital source, along with the derailment and capsizing of Germany with ICE, made Taiwan High-Speed Rail Corporation reopen the tender for technology selection. Finally, Japanese technology was selected based on the aspects of technique, reliability as well as commitment of loans from the Japanese Government.

• Large cost burden due to vertically integrated construction: Since Taiwan High-Speed Rail Corporation carries out civil works except for a section of the route in Taipei, the very large investment amount, annual depreciation and interest rate-based costs cause pressure on profits. This is the main factor making Taiwan High-Speed Rail Corporation difficult to continue doing business. [13]

d. **Concessional loan.** India: it was granted an ODA loan by the Japanese Government with a term of 50 years and an interest rate of 0.1% to support the investment capital of HSR system, and it committed to technology transfer in the way of “Made in India”. Thus, in essence, the selection of high-speed railway technology by India has had factors derived from funding sources as well as commitment to technology transfer and human resource training. The high-speed railway technology of India will follow exactly the same as that of Japan.

Laos: The HSR project with the section from Kunming (China) to Vientiane (Laos) with a length of more than 1,000 km and a total investment of 5.9 billion USD, equivalent to about one-third of GDP of Laos, completed on December 3rd, 2021. Of which, 60% of the costs of the project are borrowed from Export – Import Bank of China. The project is expected to boost tourism, trade and investment growth, and reduce transportation costs by 40 – 50% between Kunming and Vientiane and between Kunming and Laem Chabang Port of Thailand. However, Laos is facing the risk of extremely large debts from China, having previously carried about 1.5 billion USD in debt from China. This forced the Lao Government to transfer some land and other resource use rights to China and to make concessions to Chinese developers of special economic zones. Currently, Laos has more than 10 special economic zones, about half of which are run by Chinese companies. [14]

## 4 Lesson learned for Vietnam

The content presented above shows that in order to invest in HSR network development, the role of the State is very important. Some countries have almost no involvement of private economy. Many countries mobilize their capital under the PPP model, but the proportion of State capital is large, accounting for around 50%. However, each country chooses different forms of PPP, the scope of participation of the private sector is also different, depending on the economic policy of each country.
Vietnam has a long terrain with a narrow coastal plain, the North – South corridor is the backbone of socio-economic development of the country. North – South transport corridor, with the section of Hanoi – Ho Chi Minh City through many large urban areas with a population size of more than 500,000 people and a distance of 300 – 500 km, is very suitable for HSR development. Specifically, in 20 provinces / cities with the project passing through, there are 10 urban areas with a size of more than 500,000 inhabitants such as Hanoi City, Thanh Hoa, Vinh, Da Nang, Thua Thien Hue, Quy Nhon, Nha Trang, Bien Hoa, Ho Chi Minh City.

The current policy of Vietnam in mobilizing capital for investment in the construction of North – South HSR route is: “Using state budget capital, non-budget capital and other lawful capital sources. Attracting all economic sectors, including foreign investors, to invest” which is completely reasonable. The proposal of the Ministry of Transport to the Politburo is to invest in the form of PPP, in which the mobilized state capital accounts for 85.27%, including mobilization from land auctions at 50 stations (TOD) and public investment capital. The rest is capital from the private sector, accounting for 14.73%, in line with the current policy and practice of HSR industry development. However, the ways of mobilization, the fields participated in by the private sector, the ways of management, the ways of payback, the choice of definite transfer or lease of property use right and the duration (in years) have been still unknown.

At the same time, Vietnam can study the experience of countries around the world to have the policies to mobilize reasonable financial resources for investment in the construction of North – South high-speed railway route. Specifically:

Firstly, in order for the high-speed railway project to be invested and operated effectively, it is necessary to have a very high political determination of the State and the Government, in which the prerequisite is the plans for allocation of capital source and formulation of capital structure, as well as the policies on capital exploitation and use during the investment in order for phasing of investment in each section of railway in accordance with the planned route. It should not rely too much on the private sector, or it will encounter risks like Taiwan.

Secondly, regarding investment resources: In addition to concentrating State resources and attracting ODA and concessional loans from International Donors, it is necessary to promote socialization in railway business and transportation support services; develop strategies and processes to attract all economic sectors, including foreign investors, to participate in.

Thirdly, improving the legal system and legal framework on the management, use and operation of HSR works, creating a healthy and equal competitive environment among economic sectors involved in railway business, because the investment in the construction of North – South high-speed railway route is a long process, requiring a large amount of capital, along with stable and long-terms mechanisms and polices.

Fourthly, it is necessary to develop a strategy and plan for the development of high-speed railway system in a systematic and consistent manner (such as the high-speed railway system of China), with specific targets and measures to match the goals of economic development to 2030, with a vision to 2050. The North – South HSR project is a large-scale project with complex technology and techniques, so it is necessary to have strategies, synchronous, accompanied by high requirements on safety, technical and management capacity and be in line with the natural and socio-economic conditions of the country in the investment in the HSR project.

Fifthly, it is necessary to supplement the policies related to the ability to connect high-speed railway with local transport network; at the same time, to combine with land use
planning and mechanisms and policies in investment, business and operation in station areas as well as lease of grounds and yards to create new demand in changing modes of travel, re-distribute the labor sector, as well as promote the development of new urban centers.

Sixthly, because the investment rate for high-speed railway construction is 4 – 5 times higher than that for highway construction, it is necessary to determine that the state capital plays a leading role, especially in undertaking the investment in the construction of railway infrastructure items (including: site clearance, construction of foundations, tunnels, viaducts, railway systems, and sleepers), at the same time, to encourage the capable domestic and foreign investors to participate in the investment and supply of rolling stock, equipment systems and control systems, as well as the investment and development of services around stations and yards.

Seventhly, technology selection and operating speed range should be analyzed and compared right from the project preparation stage; at the same time, continuing to review and adjust in the next stages to find the optimal technology in operating and saving energy for train. The decision on choosing train speed and the coordination between cargo train and passenger train should be analyzed based on the benefits and investment costs, as well as the demand for meeting the future volume of traffic and the characteristics of topographical conditions on specific sections of the line.

Eighthly, the main factors determining the socio-economic and financial success in the investment in high-speed railway project are the processes of optimizing construction costs, operation costs and maintenance costs, delivering the value of time savings for each passenger and reducing environmental pollution costs, reducing noise impact and mitigating accidents, while removing congestion from existing transport networks. Simultaneously, the above factors also deliver larger economic benefits, in creating an incentive policy, forming and promoting the development of high-speed railway network. Besides, it can be seen from the lessons of countries such as Taiwan or the United Kingdom, that the PPP projects will be in a state of lock-in, leading to the project failure, once the traffic is not as expected.

Finally, in order for project implementation, the preparation of human resources is crucial, from investment, construction to operation, which takes a long time (5 – 10 years). After the project is approved for investment policy, it is required to conduct training immediately to reduce operating costs and actively grasp technology.

5 Conclusion

The investment in the construction of North – South high-speed railway route is a breakthrough in the transport infrastructure system, in line with the driving force of socio-economic development of the country. Attracting investment capital for project implementation is very important, because the successful project will open an attractive transport market for private transport businesses to invest in and operate. Through the above analysis and research, the authors found that the optimal financing method for high-speed railway (HSR) in Vietnam is PPP, in which the State resources must play the leading role, with a proportion of > 50%. With the current policy in Vietnam, the private sector can raise capital through the following sources: owner’s equity, business cooperation contract (BCC), signing business cooperation contracts with contractors and investors with financial capacity and domestic and international experiences, issuance of corporate bonds, financial – credit institutions, securities market, and use of land funds.

The article summarizes the financial resources of HSR in some countries with developed HSR systems in Europe and Asia, although each of them has different investment
and operation methods, even different financial models apply to different parts within a country. These are important suggestions to help the Vietnamese Government draw lessons and choose forms of implementation consistent with actual policies and resources.

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