A Current Review of High Speed Railways Experiences in Asia and Europe

Aleksander Purba[1, a)] Fumihiko Nakamura[2, b)] Chatarina Niken DWSBU[3]
Muhammad Jafri[4] and Priyo Pratomo[5]

[1] Civil Engineering Department, Faculty of Engineering, Lampung University, Jalan Sumantri Brojonegoro No 1 Gedung Meneng, Bandar Lampung 35145, Indonesia
[2] Graduate School of Urban Innovation, Yokohama National University, 79-1 Tokiwadai, Hodogaya-ku,Yokohama 240-8501, Japan

Corresponding author: aleksander.purba@eng.unila.ac.id
nakamura-fumihiko-xb@ynu.ac.jp

Abstract. High-Speed Railways (HSR) is currently regarded as one of the most significant technological breakthroughs in passenger transportation developed in the second half of the 20th century. At the beginning of 2008, there were about 10,000 kilometers of new high-speed lines in operation in Asia and Europe regions to provide high-speed services to passengers willing to pay for lower travel time and quality improvement in rail transport. And since 2010, HSR itself has received a great deal of attention in Indonesia. Some transportation analysts contend that Indonesia, particularly Java and Sumatera islands need a high-speed rail network to be economically competitive with countries in Asia and Europe. On April 2016, Indonesia-China consortium Kereta Cepat Indonesia China (KCIC) signed an engineering, procurement, and construction contract to build the HSR with a consortium of seven companies called the High-Speed Railway Contractor Consortium. The HSR is expected to debut by May 2019, offering a 45-minute trip covering a roughly 150 km route. However, building, maintaining and operating HSR line is expensive; it involves a significant amount of sunk costs and may substantially compromise both the transport policy of a country and the development of its transport sector for decades. The main objective of this paper is to discuss some characteristics of the HSR services from an economic viewpoint, while simultaneously developing an empirical framework that should help us to understand, in more detail, the factors determining the success of the HSR as transport alternative based on current experiences of selected Asian and European countries.

INTRODUCTION

China and Indonesian state-owned companies have signed a US$5,585 billion deal to build the first high-speed

(84) WhatsApp | (256 unread) - chata | University of Lampun | Turnitin | My Files | Prosiding Internation | Sistem Penilaian Ang
unila.turnitin.com/viewer/submissions/oid:7867:12729655?locale=en
Aleksander Purba Prosiding International AIP A Current Review.pdf

world, most existing HSR services, particularly in Asia region, are characterized by relatively high load factors, or at least higher than other equivalent rail services. This is explained by the fact that HSR lines are specifically designed for passenger traffic in dense traffic corridors, with minimal intermediate stops, and marketing focus centered on the travel time and price [2].

HSR performs very well in terms of market share in corridors of 400-600 km but not as good with other key parameters that do not reach some minimum thresholds to offset the high investment costs associated with the construction of this rail infrastructure. Many lines are heavily subsidized, so high load factors and market shares are compatible with a poor social return. It is not surprising that HSR investment is more popular among politicians and the general public than among economists [3]; [4]; [5]; [6]. In implementing such a program, it is essential to identify the factors that might influence decision-making and the eventual success of the HSR project, as well as foreseeing the obstacles that will have to be overcome. By so doing, authors identify lessons for policymakers and investors working on the implementation of HSR projects, particularly current experiences in Asia and Europe regions.

ASIA REGION

In this section, authors apply a simple implementation framework to four key cases of HSR- network development in Asia region: Japan, China, South Korea, and Taiwan as shown in Fig. 1, authors inquiry is based on a review of the extant literature of these cases, as well as on our own research data.

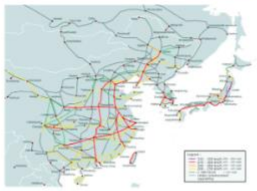
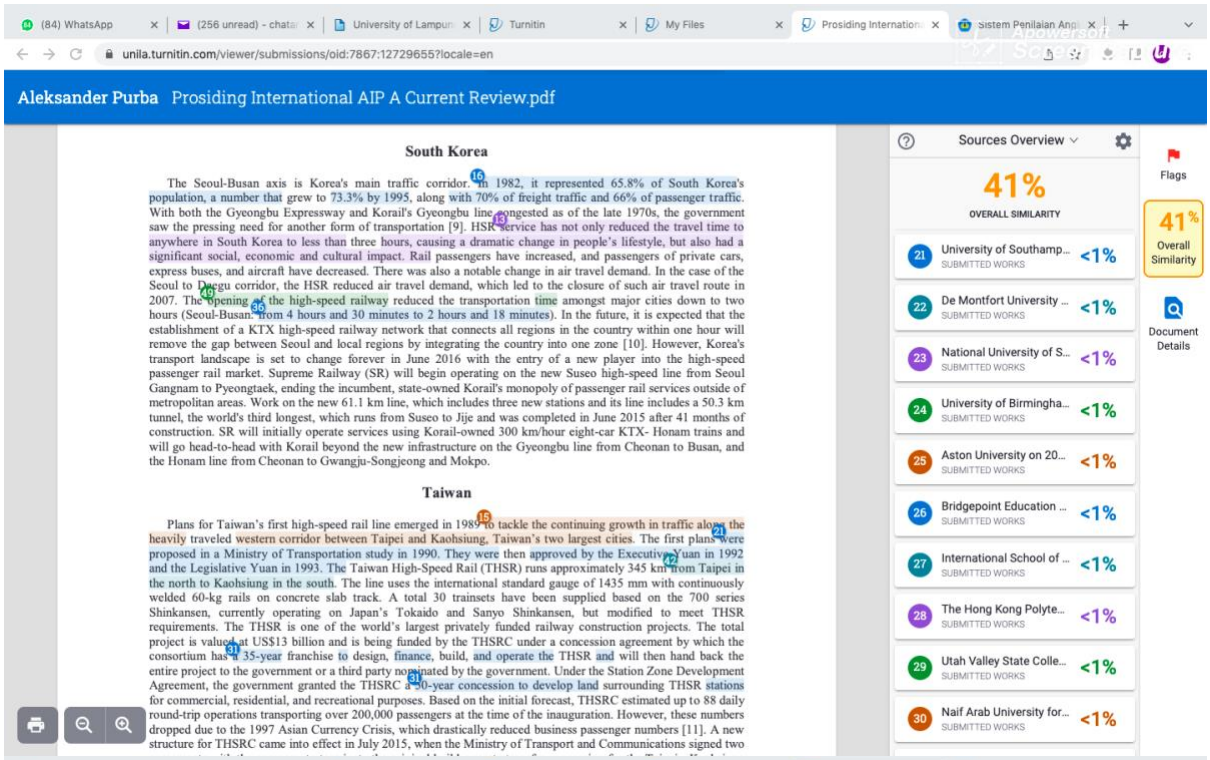
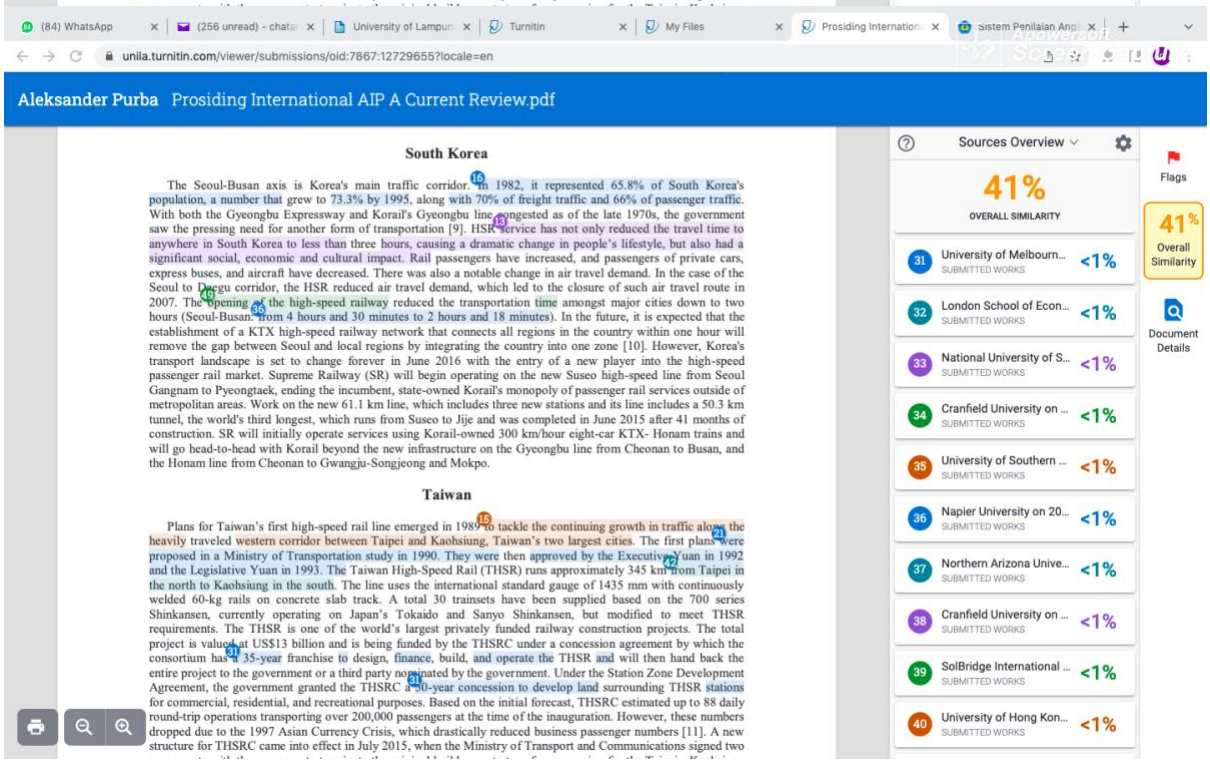


FIGURE 1. Network of high-speed rail services in Asia

Japan

Japan was a pioneer in the building of HSR where the first link in its network, connecting Tokyo to Osaka, came into service in 1964. The world's first HSR line, known as the Shinkansen, was built in a corridor well suited to rail travel, and the train was built to expand capacity on an overcrowded route. Construction was financed with loans from the World Bank and the Japanese government. The railway repaid the loans in seven years. After that, operating profits on the line were used to cross-subsidize local trains. The success of this line encouraged expansion,


(84) WhatsApp
(256 unread) - chata
University of Lampun
Turnitin
My Files
Prosiding Internationa
Sistem Penilaian Angk
unila.turnitin.com/viewer/submissions/oid:7867:12729655?locale=en
Aleksander Purba Prosiding International AIP A Current Review.pdf
South Korea
The Seoul-Busan axis is Korea's main traffic corridor. In 1982, it represented 65.8% of South Korea's population, a number that grew to 73.3% by 1995, along with 70% of freight traffic and 66% of passenger traffic. With both the Gyeongbu Expressway and Korail's Gyeongbu line congested as of the late 1970s, the government saw the pressing need for another form of transportation [9]. HSR service has not only reduced the travel time to anywhere in South Korea to less than three hours, causing a dramatic change in people's lifestyle, but also had a significant social, economic and cultural impact. Rail passengers have increased, and passengers of private cars, express buses, and aircraft have decreased. There was also a notable change in air travel demand. In the case of the Seoul to Daegu corridor, the HSR reduced air travel demand, which led to the closure of such air travel route in 2007. The opening of the high-speed railway reduced the transportation time amongst major cities down to two hours (Seoul-Busan: from 4 hours and 30 minutes to 2 hours and 18 minutes). In the future, it is expected that the establishment of a KTX high-speed railway network that connects all regions in the country within one hour will remove the gap between Seoul and local regions by integrating the country into one zone [10]. However, Korea's transport landscape is set to change forever in June 2016 with the entry of a new player into the high-speed passenger rail market. Supreme Railway (SR) will begin operating on the new Suseo high-speed line from Seoul Gangnam to Pyeongtaek, ending the incumbent, state-owned Korail's monopoly of passenger rail services outside of metropolitan areas. Work on the new 61.1 km line, which includes three new stations and its line includes a 50.3 km tunnel, the world's third longest, which runs from Suseo to Jije and was completed in June 2015 after 41 months of construction. SR will initially operate services using Korail-owned 300 km/hour eight-car KTX- Honam trains and will go head-to-head with Korail beyond the new infrastructure on the Gyeongbu line from Cheonan to Busan, and the Honam line from Cheonan to Gwangju-Songjeong and Mokpo.
Taiwan
Plans for Taiwan's first high-speed rail line emerged in 1989 to tackle the continuing growth in traffic along the heavily traveled western corridor between Taipei and Kaohsiung, Taiwan's two largest cities. The first plans were proposed in a Ministry of Transportation study in 1990. They were then approved by the Executive Yuan in 1992 and the Legislative Yuan in 1993. The Taiwan High-Speed Rail (THSR) runs approximately 345 km from Taipei in the north to Kaohsiung in the south. The line uses the international standard gauge of 1435 mm with continuously welded 60-kg rails on concrete slab track. A total 30 trainsets have been supplied based on the 700 series Shinkansen, currently operating on Japan's Tokaido and Sanyo Shinkansen, but modified to meet THSR requirements. The THSR is one of the world's largest privately funded railway construction projects. The total project is valued at US$13 billion and is being funded by the THSRC under a concession agreement by which the consortium has a 35-year franchise to design, finance, build, and operate the THSR and will then hand back the entire project to the government or a third party nominated by the government. Under the Station Zone Development Agreement, the government granted the THSRC a 50-year concession to develop land surrounding THSR stations for commercial, residential, and recreational purposes. Based on the initial forecast, THSRC estimated up to 88 daily round-trip operations transporting over 200,000 passengers at the time of the inauguration. However, these numbers dropped due to the 1997 Asian Currency Crisis, which drastically reduced business passenger numbers [11]. A new structure for THSRC came into effect in July 2015, when the Ministry of Transport and Communications signed two
Sources Overview
41%
OVERALL SIMILARITY
21 University of Southamp... SUBMITTED WORKS <1%
22 De Montfort University ... SUBMITTED WORKS <1%
23 National University of S... SUBMITTED WORKS <1%
24 University of Birmingha... SUBMITTED WORKS <1%
25 Aston University on 20... SUBMITTED WORKS <1%
26 Bridgepoint Education ... SUBMITTED WORKS <1%
27 International School of ... SUBMITTED WORKS <1%
28 The Hong Kong Polyte... SUBMITTED WORKS <1%
29 Utah Valley State Colle... SUBMITTED WORKS <1%
30 Naif Arab University for... SUBMITTED WORKS <1%
Flags
41% Overall Similarity
Document Details


(84) WhatsApp
(256 unread) - chata
University of Lampun
Turnitin
My Files
Prosiding Internationa
Sistem Penilaian Angk
unila.turnitin.com/viewer/submissions/oid:7867:12729655?locale=en
Aleksander Purba Prosiding International AIP A Current Review.pdf
South Korea
The Seoul-Busan axis is Korea's main traffic corridor. In 1982, it represented 65.8% of South Korea's population, a number that grew to 73.3% by 1995, along with 70% of freight traffic and 66% of passenger traffic. With both the Gyeongbu Expressway and Korail's Gyeongbu line congested as of the late 1970s, the government saw the pressing need for another form of transportation [9]. HSR service has not only reduced the travel time to anywhere in South Korea to less than three hours, causing a dramatic change in people's lifestyle, but also had a significant social, economic and cultural impact. Rail passengers have increased, and passengers of private cars, express buses, and aircraft have decreased. There was also a notable change in air travel demand. In the case of the Seoul to Daegu corridor, the HSR reduced air travel demand, which led to the closure of such air travel route in 2007. The opening of the high-speed railway reduced the transportation time amongst major cities down to two hours (Seoul-Busan: from 4 hours and 30 minutes to 2 hours and 18 minutes). In the future, it is expected that the establishment of a KTX high-speed railway network that connects all regions in the country within one hour will remove the gap between Seoul and local regions by integrating the country into one zone [10]. However, Korea's transport landscape is set to change forever in June 2016 with the entry of a new player into the high-speed passenger rail market. Supreme Railway (SR) will begin operating on the new Suseo high-speed line from Seoul Gangnam to Pyeongtaek, ending the incumbent, state-owned Korail's monopoly of passenger rail services outside of metropolitan areas. Work on the new 61.1 km line, which includes three new stations and its line includes a 50.3 km tunnel, the world's third longest, which runs from Suseo to Jije and was completed in June 2015 after 41 months of construction. SR will initially operate services using Korail-owned 300 km/hour eight-car KTX- Honam trains and will go head-to-head with Korail beyond the new infrastructure on the Gyeongbu line from Cheonan to Busan, and the Honam line from Cheonan to Gwangju-Songjeong and Mokpo.
Taiwan
Plans for Taiwan's first high-speed rail line emerged in 1989 to tackle the continuing growth in traffic along the heavily traveled western corridor between Taipei and Kaohsiung, Taiwan's two largest cities. The first plans were proposed in a Ministry of Transportation study in 1990. They were then approved by the Executive Yuan in 1992 and the Legislative Yuan in 1993. The Taiwan High-Speed Rail (THSR) runs approximately 345 km from Taipei in the north to Kaohsiung in the south. The line uses the international standard gauge of 1435 mm with continuously welded 60-kg rails on concrete slab track. A total 30 trainsets have been supplied based on the 700 series Shinkansen, currently operating on Japan's Tokaido and Sanyo Shinkansen, but modified to meet THSR requirements. The THSR is one of the world's largest privately funded railway construction projects. The total project is valued at US$13 billion and is being funded by the THSRC under a concession agreement by which the consortium has a 35-year franchise to design, finance, build, and operate the THSR and will then hand back the entire project to the government or a third party nominated by the government. Under the Station Zone Development Agreement, the government granted the THSRC a 50-year concession to develop land surrounding THSR stations for commercial, residential, and recreational purposes. Based on the initial forecast, THSRC estimated up to 88 daily round-trip operations transporting over 200,000 passengers at the time of the inauguration. However, these numbers dropped due to the 1997 Asian Currency Crisis, which drastically reduced business passenger numbers [11]. A new structure for THSRC came into effect in July 2015, when the Ministry of Transport and Communications signed two
Sources Overview
41%
OVERALL SIMILARITY
31 University of Melbourn... SUBMITTED WORKS <1%
32 London School of Econ... SUBMITTED WORKS <1%
33 National University of S... SUBMITTED WORKS <1%
34 Cranfield University on ... SUBMITTED WORKS <1%
35 University of Southern ... SUBMITTED WORKS <1%
36 Napier University on 20... SUBMITTED WORKS <1%
37 Northern Arizona Unive... SUBMITTED WORKS <1%
38 Cranfield University on ... SUBMITTED WORKS <1%
39 SolBridge International ... SUBMITTED WORKS <1%
40 University of Hong Kon... SUBMITTED WORKS <1%
Flags
41% Overall Similarity
Document Details

the railway development plan through 2020. The Beijing–Tianjin HSR, the first of a new generation of HSR, opened in August 2008 with a maximum speed of 350 km/hour. In addition, China has built a number of new 200 km/hour express passenger railways and 200 km/hour mixed-used railways. In China, HSR lines on high-density corridors such as Beijing-Shanghai and Beijing-Guangzhou tend to have a maximum design speed of 350 km/hour. HSR corridors with more modest volumes of passengers have a maximum design speed of 250 km/hour. Generally, both of these types of HSR are passenger-dedicated lines (PDL) and are newly built as green-field projects. At the end of December 2013, most of the metropolitan regions in China are either connected or in the process of being connected, to lines with a maximum speed of 200 km/hour or above [13].

The China HSR system will span 30,000 kilometers, connect more than 250 cities and regions with a total population of about 700 million, mobilize 4 billion travelers per year, and add 1,600 billion kilometers to China's domestic passenger throughput annually (i.e., four times the total domestic passenger throughput in Japan today) by 2020. Many economically challenged cities in the west and central China will be revitalized because of the hub effect created by the HSR system. Some cities will even see passenger flow growing by as much as 10 times in the coming decade, making them strategically important targets for many industries such as hotel, catering, logistics, and properties. Until now, most of China's economy vibrancy has been trapped on the eastern and southern coasts of China, and as one travels across the region, the huge asymmetries in economic development make different cities look more like different countries. Those who visit Shanghai-centered coastal China, for instance, will find this region more like well-developed countries such as the US and Europe and less like central and western China, even though the coastal region and the central/western regions occupy the same continent. While regional economic differences are not rare in a global economy, China's regional differences are by far the most disparate of any in the world [14].

EUROPE REGION

Fig. 2 presents the HSR services network throughout Europe. UK is now closer to building HSR infrastructure but until now they have been reluctant to give the definitive approval, and the money allocated to HSR has not gone beyond financing the cost of the evaluation of its economic and financial viability. Other countries, like France and Spain, have been keener on HSR than other European countries like Norway or Sweden, for example, whose governments are still studying whether this type of investment is socially worthy. Spain is a unique case because, with much less traffic density than other countries (and much less congestion) in the conventional rail network, it is going to very soon be one of the first countries in the world measured in HSR kilometers. HSR has since remained firmly on the European rail agenda and has led to an expansive HSR network, together with plans to grow the network from under 10,000 kilometers in 2008, to 22,000 kilometers by 2020, and in excess of 30,000 kilometers by 2030 [15].