EBU European Business Institute LUXEMBOURG

How Can PPP-Financed Railway Infrastructure in Thailand Boost Logistics and Strengthen "the Belt and Road" Economic Integration?

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Abstract: The purpose of this paper is to apply bibliometric analysis method to investigate how the advancing financing mode public private partnership (PPP) and its strengths will facilitate the construction of the Thai-Sino railway. As PPP is one of key components in Thai-Sino railway investment, the related policies of the two countries play significant roles during the PPP process. The authors will study what roles both government policies play in Thailand's infrastructure construction and reveal the further impact that Thailand's complementation of infrastructure will bring to the future development of the local logistics industry. Additionally, this paper will explore the influence that the successful open to traffic of the Thai-Sino railway will bring to Thailand's profound economic cooperation with other economic entities in BRI regions. This paper will study how a developed logistics industry will help Thailand better integrate into the regional economic development. Finally, this paper will provide recommendations on how value added of PPP railway would help emerging economics to better integrate into BRI.

Keywords: public-private partnership; Thai-Sino railway; logistic industry; Thai-Sino economic cooperation; belt and road initiative; regional economic integration

1. Introduction

Thailand has significant position in international maritime, international aviation and regional logistic in south-east Asia. The Deputy Prime Minister of Thailand, Somkid Jatusripitak has announced that Thailand must be the main hub among the CLMVT (Cambodia, Laos, Myanmar, Vietnam, and Thailand) countries and rail transport will be the key player here. However, according to the global competitiveness report, Thailand ranked the thirty-second in the infrastructure quality ranking and ranked the lowest in the railroad quality construction compared with some nearby countries and regions in Asia. From 2016 to 2021, the contribution of logistics cost to total gross domestic product (GDP) in Thailand fluctuated slightly around 14%. Transportation cost accounted half in the cost structure breakdown of logistics industry in Thailand in 2021. To some extent, it reflects the urgent need for Thailand to enhance its infrastructure construction. Public-Private Partnership plays an important role in any investment that needs high initial capital such as a railway project. It is a mutually preferred choice because the government aims to retain political, legal, and project selection risks, while the private sector aims to retain construction and operational risks. It will be an effective impetus since it has been extensively used in many sectors worldwide to provide alternative funding for public infrastructure (Rahman et al., 2019). It has absolute advantages in transferring of risks to the private party, transferring new technologies from the private party, more transparency in the economy, and saving the government budget for conducting other public investments (Ministry of Finance State Enterprise Policy Office, 2021). As a result, this paper will study how PPP will help facilitate the construction of the Thai-Sino railway, together with the analysis of both countries' related policies. Meanwhile, China has put forward the Belt and Road Initiative (BRI) development strategy, which aims to build connectivity and co-operation across several main economic corridors encompassing Thailand. Its investments, by building infrastructure, have positive impacts on countries involved (OECD, 2018). One of the typical examples is Thai-Sino railway. Learned from China's successful experience in

constructing high speed railway via PPP, Thailand can bring forth new ideas on how to better carry out the financial mode of its railway transportation and improve the working efficiency of logistic industry. It will develop markets for Thailand's products in the long term and to alleviate industrial excess capacity in the short term. Thus, this paper will study how the construction of Thailand's infrastructure will help promote local logistics industry's development. Finally, the successful open to traffic of Thailand-China railway and rail corridors in the future will boost Thai's integration into BRI regions and this paper will provide instructive suggestions on how value added of PPP railway would help emerging economics to better integrate into BRI.

2. Literature Review

2.1. Public-Private Partnership

The literature offers many definitions of PPP and debates over how the term should be defined (Ball, 2011). This phenomenon can be explained, at least partially, by the fact that PPP is a vague construct that is used by the international community. According to World Bank, Public-private partnerships (PPPs) are a mechanism for government to procure and implement public infrastructure and/or services using the resources and expertise of the private sector. Where governments are facing ageing or lack of infrastructure and require more efficient services, a partnership with the private sector can help foster new solutions and bring finance. It combines the skills and resources of both the public and private sectors through sharing of risks and responsibilities. This enables governments to benefit from the expertise of the private sector, and allows them to focus instead on policy, planning and regulation by delegating day-to-day operations. The term PPP is of a very general nature, with various origins from different countries, regions, and organizations (Zhang et al., 2015). The following table shows some typical definitions of PPP in partial Asian and European countries.

Table 1. Typical definitions of PPP in partial Asian and European countries.

Country/Region	Lao	Thailand	China	United Kingdom
Definition	A PPP (Public-Private Partnership) is a partnership between the public sector and the private sector for the purpose of delivering a project or a service conventionally provided by the public sector. PPP is a contractual arrangement and is commonly characterized as: 1.A long-term arrangement between the public and the private sector. 2.For the purpose of providing a public service. 3.With risks allocated to the party best able to bear them. 4.Often supported through private financing. 5.Lao PDR Public-Private Partnership Policy.	Public Private Partnership ("PPP") refers to projects where the government and the private sector have cooperated to construct or invest in a project that would otherwise be a state undertaking. Typically, the PPP will involve infrastructure development, for example: the power and electricity sectors, telecommunication, ports, water and sanitation, transport (toll-roads, railroads), mining and plantations, etc.	In mainland China, public-private partnerships (PPPs) have been defined as the partnership between government and the private capital. Country or upper-level governments are in charge of implementing the PPP projects within their territory.	PPP (Public Private Partnership) is the general term for partnerships which involve everything from operating facilities and providing services on behalf of the public to flexible methods of financing these services. The UK was the first country in the world to develop the concept of public private partnerships (PPPs) for public services projects. Through partnership with the private sector, PPPs enable the delivery of efficient, cost-effective, and measurable public services whilst minimizing the financial risk.

Sources: ADB Bank

A delving analysis of PPP definitions, in addition to the above, suggests three general categories: (a) contractual-perspective (e.g., Garvin, 2010), (b) partnership-focused (e.g., Nijkamp et al., 2002) and (c) function-specific (e.g., IMF, 2006). Though these categories have their various own focuses, at the same time they complement each other, making PPP a more comprehensive and significant tool to help build large-scale infrastructure. As a result, Public-Private Partnership (PPP) can not only effectively reduce the financial pressure for the government but also inject the social capital efficiency in the government sector domain (Carbonara et al., 2018).

2.2. PPP Railway

Efficient rail transport can be an important catalyst for economic growth and development. Rail transport can stimulate trade, link production sites to regional and international markets, promote national and cross-border integration of regions and facilitate access to labor markets, education and health services (World Bank, 2021). Private investment in railways is not a new phenomenon. In fact, railways were originally built and operated by private companies in most parts of the world. However, with time, it became clear that network economies and reduced scope for competition put railways in a situation where a pure market was not the most beneficial system, and States began to take over their construction and operation (Bernardino et al., 2010). The recent move to attract private sector participation was driven by railways losing competitiveness to road and air. These two sectors have witnessed huge investments in the past few decades. The reasons for railways' deteriorating market share were inadequate investment in infrastructure, poor services, lack of market orientation, and overstaffing in railway companies. To address these problems, some governments restructured their public railway organizations into private companies/corporations. Some others opted for organizational and/or regulatory reforms to create a better policy environment for private participation.

2.3. PPP Financing

Due to the huge investment scale of PPP projects and the collaboration between various professions in the whole life cycle, the comprehensive ability of social capital is highly required. It is difficult for a single social capital to be fully competent for all the work, so social capital mostly participates in PPP projects in the form of a consortium. As private capital plays a crucial role in PPP process, it holds large scale of private financing. Globally, the PPP market reached a record high of $68.6 billion in 2007, and although PPP financing continued to be strong throughout 2008, by 2009 the impact of the credit crunch began to take effect so that the market was worth $55.5 billion by the end of 2009. In the projects the private sector designs, builds, finances, and operates infrastructure assets, such as roads, hospitals, and schools, in return for a revenue stream that is used to repay debt, fund construction and operations, and provide a return to investors. This revenue stream takes the form of an annual unitary charge paid by the public sector procurer (Chen et al., 2024; Yu et al., 2024).

The development of PPP model in China has embedded its own unique style. In the process of new urbanization, due to rapid urbanization and fiscal decentralization, local governments choose to set up financing platform companies to alleviate the shortage of funds for local government construction through 'local financing' and accumulate large debt risks. The PPP model can not only broaden the source of funds, but also improve the efficiency of project construction, strengthen the government supervision function, alleviate the level of local debt, and help to improve the quality and efficiency of new urbanization construction. In the process of promoting PPP projects in China, the inconsistency between the goals of local governments and the central government leads to games, such as the game of fiscal and tax payment and the game of financial supervision and local governments that compete for growth, which plays a vital role. We will explore whether local government debt promotes economic growth in the neoclassical framework and whether PPP can be used as an alternative to local financing platforms to boost private investment and economic development.

To explore the heated topics of retrieved words of railway financing and economic integration, the author

use Citespace as vivid tool combined with the bibliometrics analysis results from WoS and CNKI, expressing the current situation of the construction of PPP in Thailand and PPP's future developing trend. The general direction of railway financing is related with behavior, fiscal policy and dynamic response analysis. Similar with the economic integration displayed below, China also plays a crucial role in railway financing.

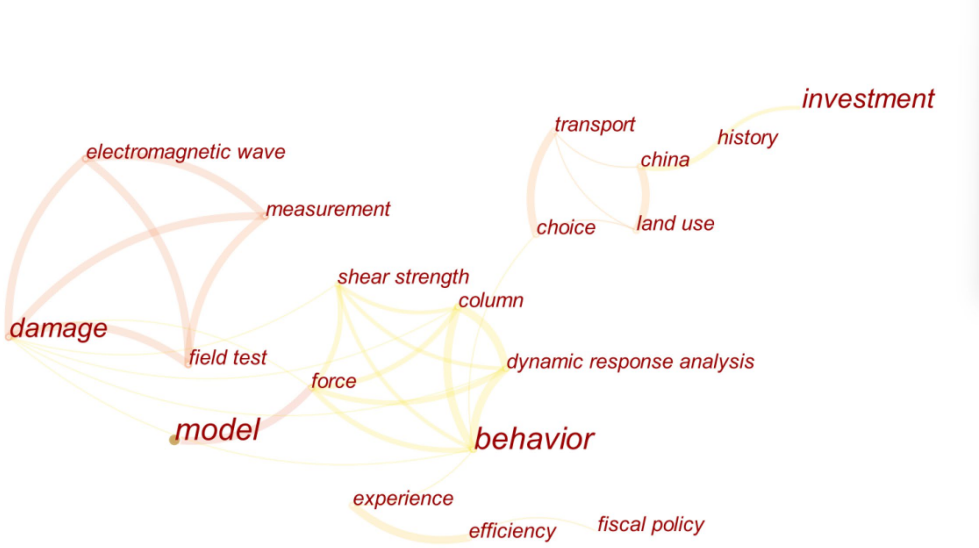

Figure 1. Keywords cluster analysis of railway financing.

2.4. PPP Logistics in Thailand

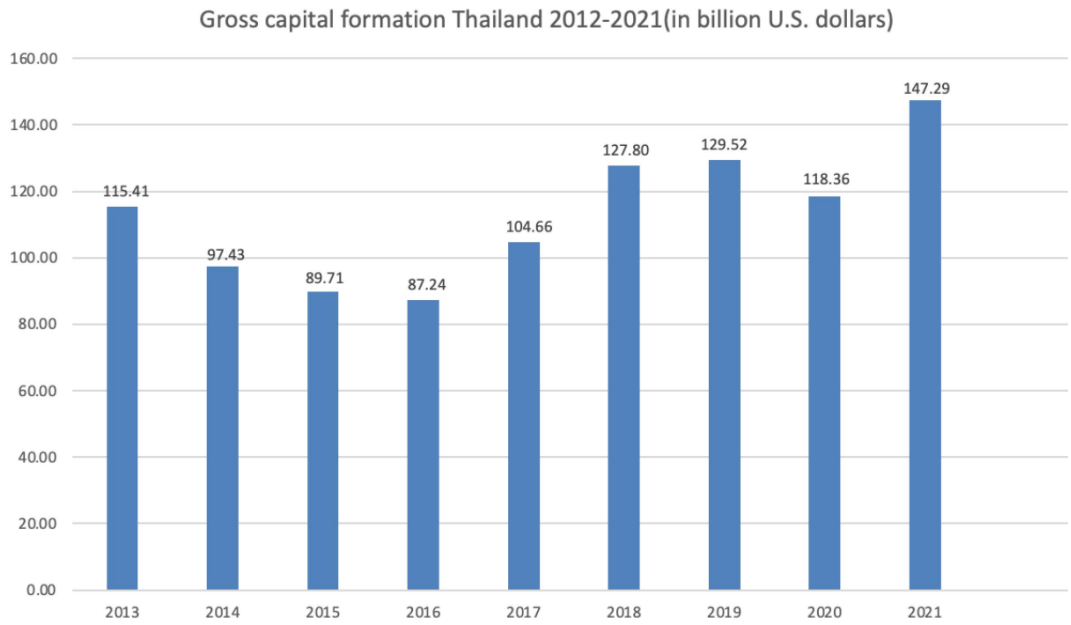

Figure 2. Gross capital formation Thailand 2012-2021 (in billion U.S. dollars).
Source: World Bank

From the figure above the gross capital formation in Thailand increased by 28.9 billion U.S. dollars, nearly 24.42 percent, in 2021. As a result, the gross capital formation in Thailand reached a peak in 2021 with 147.29 billion U.S. dollars. While the gross domestic product (GDP) from the transport and storage sector in Thailand

rose from 2012, 666.33 billion Thai baht and reached a peak of 983.78 billion Thai baht. Though it experienced the fluctuation, yet it displayed an upward trend of development.

2.5. Railway Economy

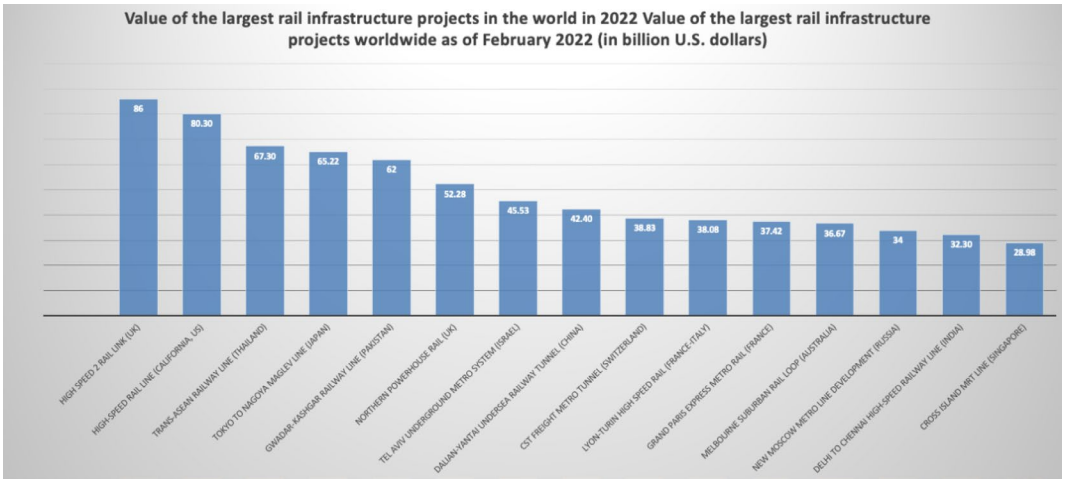

Figure 3. Value of the largest rail infrastructure projects in the world in 2022.
Source: global data

The table shows the value of the largest rail infrastructure projects in the world in 2022 till February 2022 in billion U.S. dollars. Among the fifteen projects listed above, the trans-asian railway line (Thailand) which usually refers to the Sino-Thai railway, ranked third which shows the huge potential of such railway and its relevant influence on domestic logistic industry development in Thailand which owns prosperous future.

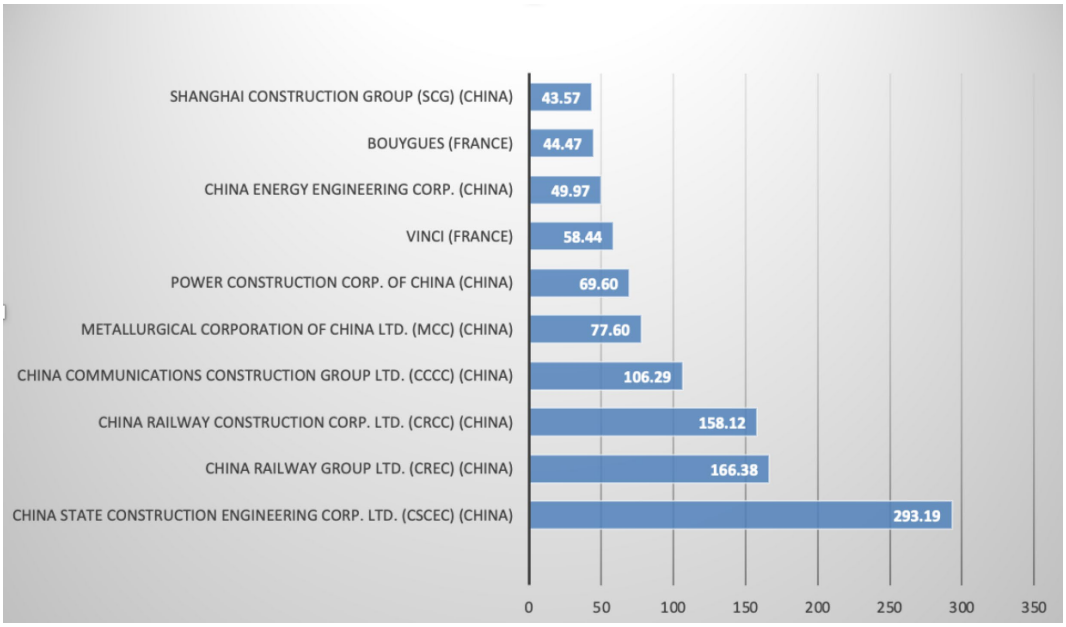

Figure 4. Top 10 largest construction firms based on revenue in the world in 2021 (in billion U.S. dollars).
Source: Global Powers of Construction

The diagram shows top 10 largest construction firms based on revenue in the world in 2021 (in billion U.S. dollars). The figure above shows China owns a prominent scale and reputation in railway construction nowadays. Eight out of ten are belong to China, thus the Sino-Thai railway can use the experience of Chinese railway as reference.

2.6. Transportation Infrastructure

Transportation infrastructure (airports, ports, rail, roads, urban transport) is indispensable to sustainable socio-economic development and trade. They link peoples and regions and connect firms to markets. Efficient transportation infrastructure is a major contributor to enhanced productivity. It is anticipated that very significant investments will need to be made in the transportation sector globally over the next 20 years to meet the increased demand arising from population and economic growth. This will entail both the construction of new infrastructure, as well as the refurbishment and expansion of existing infrastructure, to accommodate both increased traffic flow and the increase in the size of transports (e.g., larger planes and ships). While the greater part of this demand is expected to come from developing economies, the infrastructure that will be required in developed countries is also forecast to be substantial. PPPs provide a useful avenue for governments to access additional capital as well as technical expertise in the private sector to meet the very substantial demand from their populations for new and expanded transportation infrastructure in the coming decades (Xu et al., 2024).

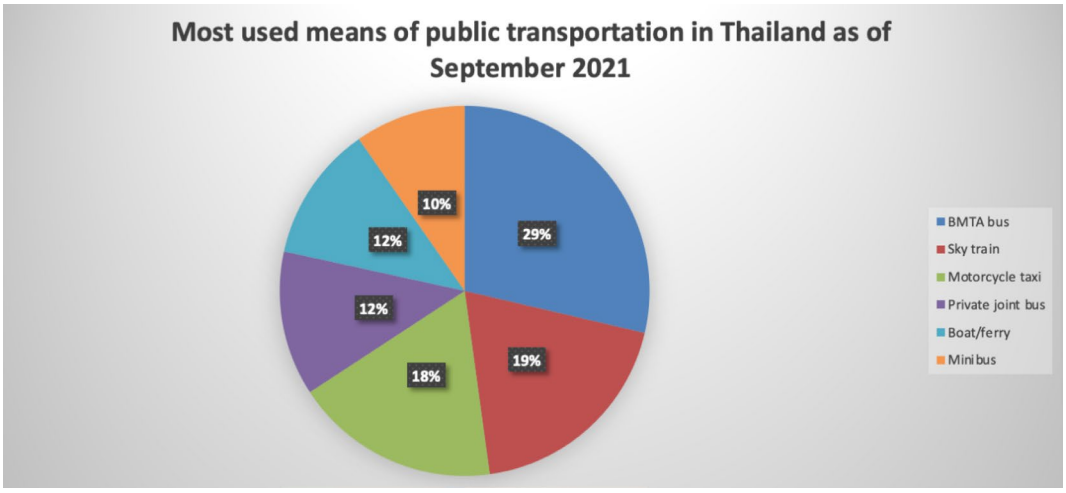

Figure 5. Most used means of public transportation in Thailand as of September 2021.
Source: Prachachat Business Newspaper 2021

Given Thailand as an instance, the most used means of public transportation in Thailand as of September 2021 is BMTA bus, followed by sky train and motorcycle taxi which accounted for 19% and 18% respectively. Among all the means mentioned above, the train is not included. Thus, it is obvious to obtain the huge shortage of the trains' market and popularity application in Thailand.

2.7. BRI

The Belt and Road Initiative (BRI) plays a vital role in mobilizing economic and social development and improving national and international connectivity. The Belt and Road Initiative (BRI) was proposed by the government of China in 2013 with the goal of further integrating regional and global economies through trade promotion and exchange culture and technology among countries in Europe and Asia. To that end, the Chinese government has been actively engaging in basic infrastructure development such as road, highway, and high-speed railway construction across European and Asian continents to enhance trade and improve logistics networks among the participating countries (Khamphengvong et al., 2022). These projects are considered as the utmost importance of the international strategic cooperation with the aim of promoting joint development and cooperation between China and the world. The strategy is to allow the participating countries to become a member of the global economy, develop connectivity, and strengthen economic cooperation between Asia, Europe, Africa, and Latin America (Soong, 2021). Former studies concerning about BRI have also strongly proved

that BRI mainly influences the tendency of financial integration. Examples of BRI projects illustrate the importance of BRI and regional sustainable economic development (Yu et al., 2020; Popescu et al., 2023).

The major finding is that BRI participation substantively increased the per capita income of local economies by 4.5 percent. This finding is robust to controlling for time-varying country characteristics, both country and year fixed effects, using different measures of economic growth, and accounting for the influence of other policies. Via examining the dynamics of the relation between BRI participation and local economic growth, it confirms that the impact of the Belt and Road Initiative on local economic growth materializes and becomes as much larger as time passes. Despite the insignificant effect in the first year after BRI participation, strong and significant effects were found in the third year after BRI participation, which implies that the initiative has more influence on local economies as implementation and development deepen, and Eurasian economies benefit much more from BRI participation than those in Africa and America. According to the study, it suggests that foreign trade and foreign direct investment are two important ways to boost local economic growth after BRI participation (Ma, 2022).

2.8. Thai Railway Development

Table 2. Major infrastructure projects in development worldwide as of May 2022.

Major infrastructure projects in development worldwide as of May 2022, by value (in billion U.S. dollars)	
High-Speed Rail Line (United States)	113
Skagerrak Railway line (Norway, Sweden)	110
High Speed 2 Rail Link (United Kingdom)	86
Trans-Asean Railway Line (Laos, Thailand, Cambodia, China, Singapore, Malaysia)	67.3
Tokyo to Nagoya Maglev Railway Line (Japan)	65.22

Source: Design Build Network and Verdict

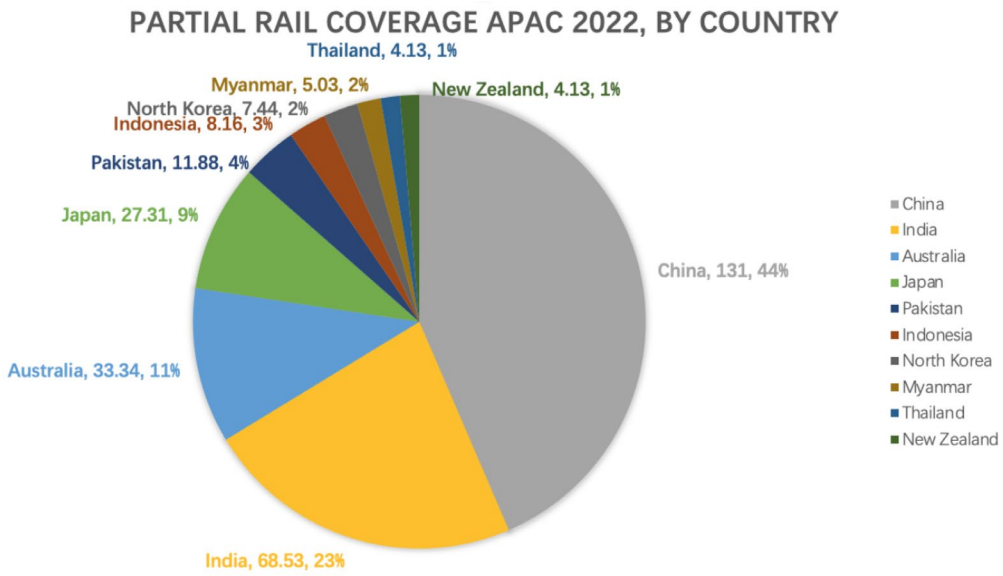

Figure 6. Partial Rail Coverage APAC 2022, by country.

According to the GlobalData and Verdict, published by Design Build Network and Verdict in 2022 October, Major infrastructure projects in development worldwide as of May 2022, by value, the Trans-Asean Railway Line (Lao, Thailand, Cambodia, China, Singapore Malaysia) holds the value of 67.3.

According to the data released by Global Firepower, in 2022, China had the highest railway coverage compared to other listed countries in the Asia-Pacific region, amounting to 131 thousand kilometers. This was followed by India with a railway coverage 68 thousand kilometers in 2022. Thailand was equipped with a railway

coverage 4.13 thousand kilometers in 2022, the same as Zealand.

In recent years, with the rapid economic development of society, it is increasingly more convenient for people to travel. Travel modes tend to be diversified, but the most common ways to travel are by highway and rail transport. Promoting and influencing the growth of the national economy by fully developing the advantages of highway and rail transport while achieving sustainable development between the transport industry and the national economy have been proven to be hot topics in recent research (Sun et al., 2018).

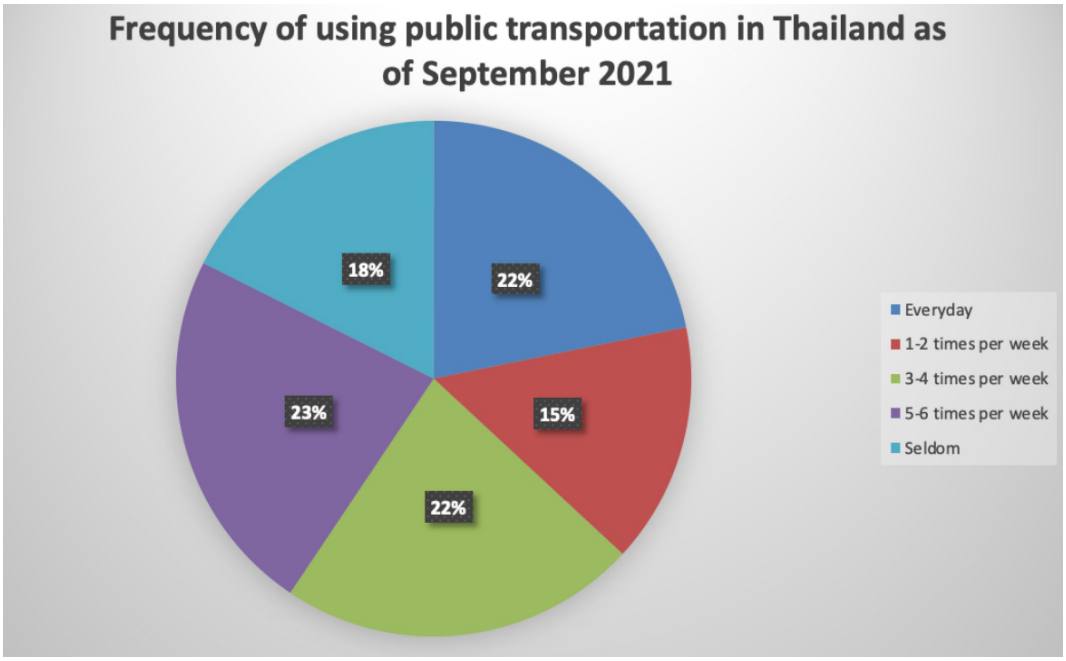

Figure 7. Frequency of using public transportation in Thailand.
Source: Prachachat Business Newspaper

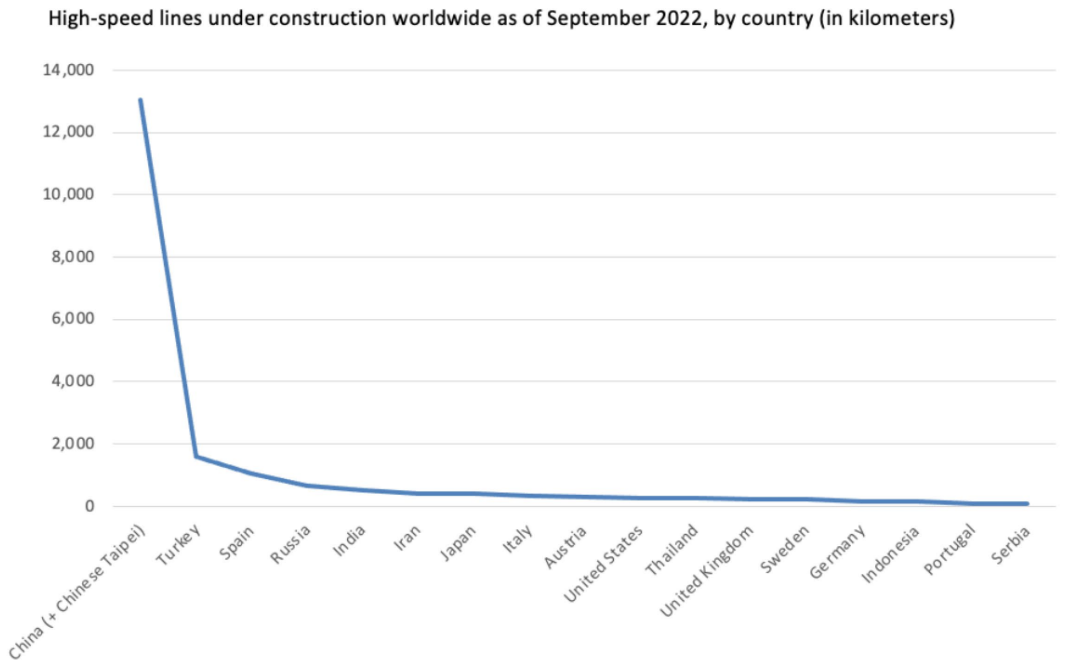

Figure 8. High-speed lines under construction worldwide as of September 2022.
Source: UIC

As of September 2022, China was the country with the largest high-speed network under contrition, with over 13000 kilometers of all tracks under way. It made up most of the worldwide high-speed network construction that year, among all the 17 countries listed above, Thailand ranked 11.

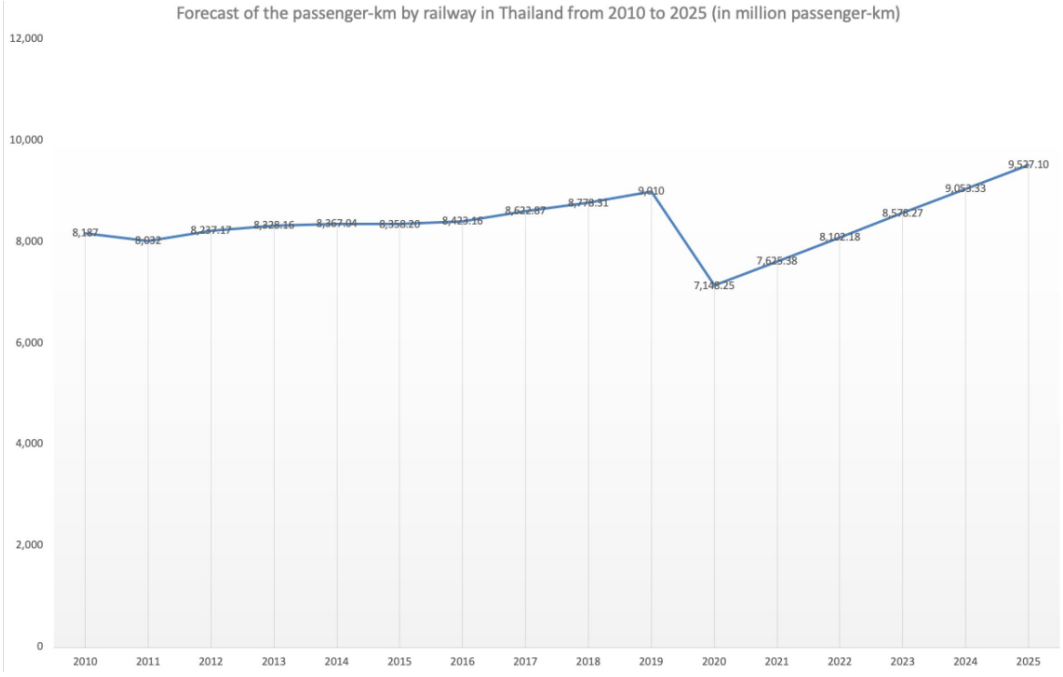

Figure 9. Forecast of the passenger-km by railway in Thailand from 2010-2025.
Source: Statista

This statistic shows the volume of rail passenger transport in Thailand through 2025. This figure is projected to reach 9,527.10 million passenger-kilometers by 2025.

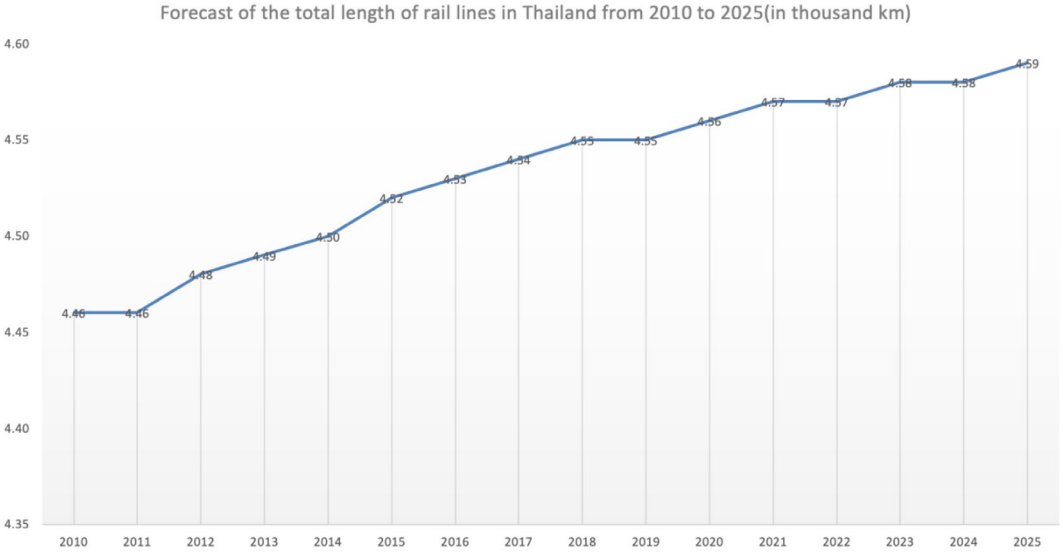

Figure 10. Forecast of the total length of rail lines in Thailand from 2010 to 2025.
Source: Statista

This statistic shows the length of rail lines in Thailand through 2025. This figure is projected to reach 4.59 thousand kilometers by 2025. The shown data are an excerpt of Statista's Key Market Indicators (KMI). The KMI are a collection of primary and secondary indicators on the macro-economic, demographic, and technological

environment in up to 150 countries and regions worldwide. All indicators are sourced from international and national statistical offices, trade associations and the trade press and they are processed to generate comparable data sets (Kwok et al., 2024).

2.9. Economic Integration

The global economy in the second half of the 21st century has experienced rapid development of economic integration. Trade liberalization has contributed to regional and global economic integration in a process of reducing tariff/nontariff and investment barriers and boosting trade and investment among member economies, thus, it can be viewed as an effective way to have an impact on economic growth. The development of EU and NAFTA could be termed the two most successful integration arrangements. At the same time, several attempts at economic integration were started and developed by Asian countries (Ma, 2022). From the figure below, we obtain the main theme of economic integration related with is trade, globalization. Meanwhile, many foreign researchers also keep their focus on China.

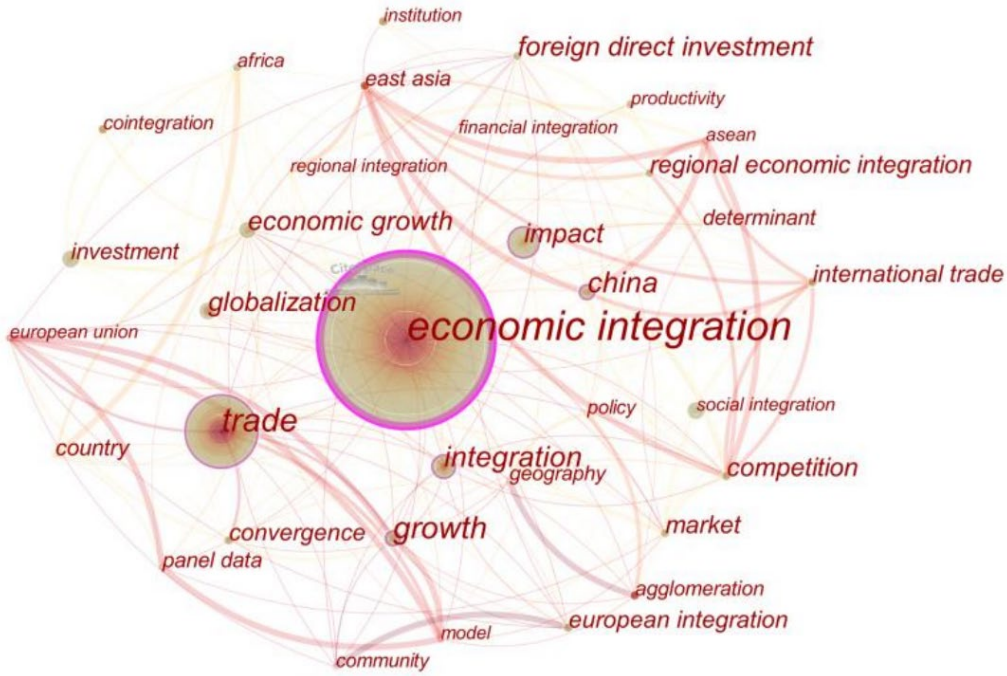

Figure 11. Keywords cluster analysis of economic integration.

This paper aims to answer these unanswered questions:

1. *How can PPP financing help facilitate Thai railway construction?*
2. *What are the roles of each government policies about PPP in infrastructure development?*
3. *How does the Thai railway help promote its logistics?*
4. *How would a developed logistic system help Thai better integrate into the regional economic development?*

3. PPP Rules and Regulations Among Thailand and China

One sources of the infrastructure financing in Thailand is Public private partnership. Currently, PPP is a preferred alternative source for infrastructure investment which accounted for 24.8% in the investment according to the transportation action plan 2018. However, using PPP may be restricted in certain subsectors that the government allows private sectors to participate via a PPP contract. A match should be formed between local development planning and investment plans to promote sustainable of PPP investment (Xu et al.,2024). Since Thailand is now facing a fast-approaching rail reform initiative, and given Sino-Thai railway is a cooperation

project, identifying the status of railway operations and policy implementation environment in both countries will be effective. Both Chinese and Thailand's rules and regulations should be taken into consideration to compare their varieties and be taken advantage of to better push forward the accomplishment of railway.

3.1. PPP Rules in Thailand

PPP rules in Thailand has experienced a lasting time for evolution. It has dramatically changed from protecting public interest to allow more private participation with more information disclosure and investigation at the same time. Governance in Thailand was formally adopted from the international financial organization such as World Bank and IMF to comply with borrowing conditions after the Asian financial crisis emerged in 1997. Approximately twenty years after the PPSU Act 1992 was implemented, the PISU Act 2013 was formulated as a response to the past experiences of public agencies. A PPP agency was established in the State Enterprise Policy Office (SEPO) under the Ministry of Finance to assist the newly formed PPP policy committee, primarily in creating the necessary regulations, promoting PPP employment, and facilitating the project agencies to carry on private participation projects to comply with PPP laws and regulations. The seven PPP principles were indicated in the Act. The ancillary regulations were also issued as guidelines for the practitioners based on the defined principles. However, ambiguous definitions as claimed in the PPSU Act 1992 such as "State undertaking" and "Participation". Newly, the government of Thailand had launched the PPP Act 2019. It emphasizes "partnership" and PPP objectives. Several unclear definitions were clarified.

In Thailand, SEPO under the Ministry of Finance, is the central PPP coordinating body and the secretariat of the high-level PPP Policy Committee chaired by the Prime Minister (World Bank, 2021). Public-private partnerships (PPPs) were formally introduced into the Thai legal framework by the promulgation of the Private Participation in State Undertakings Act BE 2535 (1992) (PPSU Act). For two decades the PPSU Act served as the basic piece of legislation governing PPPs in Thailand; however, it lacked clear-cut criteria addressing matters of scope, duration, and authority about initiating and implementing PPPs. To clarify those criteria, the Private Investments in State Undertakings Act BE 2556 (2013) (PISU Act) was enacted. The PISU Act explicitly states that Thailand needs infrastructure construction and various other forms of public services, an imperative that is echoed in many other state policies, development goals and plans. PPP rules in Thailand has experienced a lasting time for evolution. It has dramatically changed from protecting public interest to allow more private participation with more information disclosure and investigation at the same time. From the PPP Act 2019, Thailand seeks for more private participation, more supporting measures, and private's innovations.

3.2. PPP Rules and Regulations in China

The trajectory of PPP evolution in China has experienced four phases, including emergence, growth, recession, and revival. During the past two decades, Chinese government conducted series abundant investment towards the fundamental infrastructure to further enhance domestic urbanization reform. Funds from government alone are unlikely to be available to finance such large investments and so, reforms need to be undertaken by the Chinese government regarding the investment and financing of infrastructure projects. PPP was thus introduced in China to alleviate this problem (Chan et al., 2009). The state-led promotion of Public–Private Partnerships (PPPs) in China is providing an innovative solution (Yu et al., 2018). As in previous years, China retained its position as EAP's largest PPI investment destination attracting US$10.6 billion across 60 projects, marking a 69 percent increase from 2020 levels (World Bank, 2021). Due to growing traffic demand, enormous investment requirements, and high fiscal pressures, China has witnessed a reshaping of financing policies in large transport infrastructure projects from public financing to Public–Private Partnerships. As a result, the provision of transport infrastructure services in China has been steadily moving from the realm of government to that of private sector. In the same period, governments at the central and regional levels were actively

engaged in this institutional transition by devising corresponding policies and enacting new rules and regulations (Mu et al., 2011).

Traced back to the origin of Public-private partnerships (PPPs), authors found it have been developing in China since the very late 1980s, but the year 2014 might prove to have been a landmark year in this development. In November 2013 the Third Plenum of the 18th Communist Party of China emphasized the decisive role that market forces should play in the Chinese economy. The Party's actions in 2014 confirmed this direction, particularly as it relates to PPPs, resulting in many associated circulars, regulations, declarations, and debates (Wang et al., 2022).

According to the Notice on further promoting the development of government and social capital cooperation (PPP) standardization and sunshine operation posted in 2022, the document expresses the four ranges of how to better enhance the cooperation between government and social capital via doing a good project preproposal, promoting the standard operation of the project, preventing the risk of hidden debt, and guaranteeing the sunshine operation of the project. However, currently China has no specific fundamental law on PPP. The legislative framework of PPP mainly consists of relevant laws, regulations, and regulatory documents. The PPP-related documents in force are relatively low in the legal hierarchy.

Sound institutions are very important for PPP success and that there is a need for China to create a PPP-enabling institutional environment. The public-private partnership (PPP) financing mode has developed rapidly since its introduction into China's municipal engineering construction. The proposed information integration framework is the core decision-making mechanism of URT project financing and further operation in China in recent decades. It can provide a supporting reference for URT project management in other countries (Huang et al., 2022). The abundant experience and positive impact railway laws and regulations have achieved in Chinese infrastructure construction can also provide reference meaning and improve relevant rules of railroad management in Thailand.

4. Thailand's Infrastructure and Logistics

The general transportation cost in Thailand includes diverse methods of transportations, such as taxis, trains, busses and so on. This is specifically related to daily routine while for the general aspect, the Thai government plans to shift the country's main transport mode from road and air links to trains. Rail transport is the new transportation trend in the world. The gross domestic product (GDP) from the transport and storage sector in Thailand from 2012 to 2021 showed upward trend until 2019 when its value was slightly below 1000 billion Thai baht. However, influenced by the COVID-19, GDP from transport and storage sectors dramatically decreased to approximately 750 billion Thai baht. Compared with value added of other alternative transportation for railways, railway transport's value added was merely 0.6 billion in Thai baht which showed its great potential in driving forward the logistic activities' development by improving its construction. This section will study costs of diverse transportation departments and their impact on the economic structure to provide new perspectives for Thailand break the dilemma. Many manufacturers outsource their logistics activities by hiring shippers to improve their transportation efficiency, resulting in an increased number of outsourcing firms. The shipper that receives a job from the customer needs to use vehicles from various carriers to meet the relevant demands. However, the failure rate of logistics outsourcing remains high. The major problem for every organization is that transportation costs and competition rates tend to increase every year, causing many small companies to close their businesses (Maneengam & Udomsakdigool, 2022).

Infrastructure investment helps raise economic growth rates, offers new economic opportunities, and facilitates investment in human capital.

5. Alternate Project Finance Options for Railway in Thailand

Thailand has developed transport infrastructure and public transport systems, such as air, road, water, and rail transport, on varying levels. Rail transport is one of the public transportation systems prioritized by the Ministry of Transport in Thailand. The 20 Years' Thailand Transport System Development Strategy (2017–2036) focuses on developing transport infrastructure, especially rail transport that remains an incomplete network, supports this initiative. The rail transport system in Thailand can be categorized into intercity rail, which provides services for passengers and goods transportation between cities, and urban rail, which offers services for passengers in Bangkok and its vicinity.

Besides, the government has continually provided support and developed the urban electric train system to ensure that routes cover essential metropolitan areas. People living in areas with access to electric trains have increasingly changed their means of transport from personal cars, public buses, and taxis to electric trains. The reason for this change is that they can avoid traffic jams and experience convenience in traveling, as evidenced by the increasing number of passengers using the electric train system in urban areas per year. For instance, in 2019–2020, the Bangkok (Mass) Transit System Skytrain (BTS Skytrain) had 236 million passengers and the Metropolitan Rapid Transit (MRT) pointed to an average of 102 million passengers per day. The Airport Rail Link (ARL) had 16.9 million passengers in the same year.

Furthermore, regarding the Thailand Transport System Development plan, the urban electric train system is considered and mentioned to be developed, covering Bangkok and counties as well as the major cities in every region in Thailand. Thus, the findings can be applied to the formulation of marketing strategies or policies for various services in the future (Nattiya et al., 2021).

In Thailand's experience, due to intensive costs of infrastructure procurement, it was challenging for the Thai government to deliver public infrastructures without incurring burdens on government's balance sheet. Therefore, the government encouraged the private investment by introducing the PPP scheme in public infrastructure procurement. At present, the Public-Private Partnership Project Delivery Plan 2020 – 2027 is developed to conform to the Master Plans on the Infrastructure and Social Development under the National Strategy 2018–2037. It contains 92 PPP projects, which total projected investment is worth 1.09 trillion Baht. The 30 projects of this delivery plan are road and railway projects located in Bangkok and in other major cities responsible by Ministry of Transport and Ministry of Interior. Hence, it is important for the government to understand governance problems emerging in PPP transportation projects to further improve project success. The research questions of this study are what the governance problems emerging in the past PPP transportation projects in the experience of Thailand, and what practices the government used to cope with those problem (Navalersuph & Charoenngam, 2021).

The first one is high-speed rail (HSR) program. The high-speed rail (HSR) project connecting 3 airports will be implemented on existing infrastructures and route corridors of existing ARL (Airport Rail Link Line). This HSR project adopts the standard-gauge rail track system. Its additional extensions are from Phayathai – Don Mueang and Lad Krabang – U-Tapao (Rayong). The project will connect 3 international airports - Suvarnabhumi Airport, Don Mueang Airport, and U-Tapao Airport. Its corridor contains 9 high-speed stations, namely, Don Mueang, Bang Sue, Makkasan, Suvarnabhumi, Chachoengsao, Chonburi, Sriracha, Pattaya, and U-Tapao. The business space development to support the railway services in Makkasan area, which belongs to SRT (State Railway of Thailand) of 150 rai, needs to be integrated with the development of the HSR line extensions to maximize benefits and value. Moreover, the area of 25 rai at Sri Racha station can be also re-developed as a Transit-Oriented Development (TOD) immediately (Sresakoolchai & Kaewunruen, 2020).

From the aspects of cost, volume, future development potential and added value of the logistics industry in Thailand, other components such as aviation and water transportation are compared. PPP can bring great benefits to the logistics industry in Thailand compared with other alternative railway project financing schemes.

Additionally, taking other new methods into consideration, as a crucial component of a smart city, the intelligent transportation system is the core of the development of urban transportation, whereas new energy vehicles comprise a critical element in ITS (Xu et al., 2024). In the long term, developing intelligent transportation plays crucial role in saving cost and improving efficiency.

6. Cases

One significant result of BRI in Lao PDR is that Lao PDR expects to increase its export to China by about 60% and have around 380,000–1,150,000 Chinese tourists through railway. Laos is among the Southeast Asian countries that had engaged China on infrastructure cooperation well before the Belt and Road Initiative (BRI) was launched in 2013 (Visansack et al., 2022). Subsequently, Laos has embraced the BRI openly and receptively. Laos's most expensive and controversial project, the Vientiane-Boten railway, is China's signature BRI venture in Laos. The country's BRI engagement also includes special economic zones. The rail venture aims to transform Laos from a landlocked country to a "land-linked" one, which will extend connectivity, increase trade, and attract investment (Cheng, 2021). The development strategy Thailand takes is transit-oriented development (TOD) which caters to current globalization's unbundling. In the current globalization's unbundling, the movement is people. In instant era, train is the strategic transportation mode in the digital economy where people use smartphones and tablets during the travel time. Therefore, value added of PPP mode mainly plays a crucial role in generating the density of people and jobs via jointly developing the railway and urban cities as a set. Compared with the existing China-Laos railway which has provided great convenience for the flow of large numbers of people and goods between China and Laos, driving economic development and vitality along the route. Thai-Sino railway should learn from its experience and improve its own value added of PPP railway to help Thailand integrate into BRI regions.

7. Conclusion and Recommendations

After comparing various definitions of PPP and relating it to Thailand's railway, further to its logistic and economic integration, the article obtains that Thailand's infrastructure construction is embracing a prosperous booming period, accompanied with the great emphasis laid on by local government which can compensate the present shortage of transportation dilemma. Moreover, taking the successful instances of China-Lao and Chinese domestic rail construction as experiences, Thailand can adjust their actions in rules and regulation perspectives to better suit local circumstances. Finally, considering the deep relationship between railway and logistic, Thailand needs to push transportation-oriented direction and make the full use of the rail to integrate into the trend of internationalization.

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