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Public-private partnership in high-speed railway infrastructures: elements for improvement

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Abstract

European railway transportation is not as efficient as it could be. Public-private partnerships can yield higher efficiency in railway transport. There are a few implemented infrastructures through public-private partnerships and, in many of them, the result has not been the expected one. The purpose of this research is to develop a list of recommendations and good practices that allow governments, private investors, and railway stakeholders to take better and more efficient decisions on the implementation of new high-speed rail lines. Consequently, this research has analysed through seven case studies, all the high-speed lines designed through public-private partnerships in Europe. The research methodology is based on exploratory case study and on the identification of critical success factors. This article has made it possible to develop a list of recommendations and good practices.

Keywords: public-private partnership (PPP); high-speed line (HSL); high-speed train (HST); investment; finance.

1. Introduction

High-speed rail infrastructures are critical elements that produce the following benefits in society: greater economic development, reduced poverty and inequality, increased job creation, and environmental sustainability. In addition, railway infrastructures generate a high social return and improve the well-being of the population. The governments of each region are responsible for the provision of public services and the infrastructures necessary to operate them. For this reason, investments in railway infrastructure are often part of the social pact between governments and citizens (World Bank, 2017).

For the development of high-speed railway infrastructures, it is necessary to have both the economic investment and the knowledge to be able to carry them out. When a public administration does not have either of these two

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resources, investment, or knowledge, or wishes to execute the infrastructure in a more efficient way than a traditional contracting, public administrations have the option of carrying out these infrastructure developments through a public-private partnership (PPP).

In this way, it is a possible and achievable objective to achieve greater efficiency in high-speed rail transport, which can be obtained through the construction and operation of the infrastructure through PPPs, by achieving a reduction in public funding. Thanks to the mobilization of private investment, it allows maintaining the sustainability of public finances, obtaining a better capacity for project management, and promoting optimization and innovation provided by the private sector. At all times, but especially at these times when public sector spending is very high, collection is affected by economic cycles, which hinder the public financial sustainability of a long-term project and the high existing indebtedness, which is an important limit to the financing these projects can seek on the markets. As such, PPP is especially relevant, given these commented limitations of fiscal policy, and the fact that rail transportation is a sector with such intensive capital needs in order to build infrastructure. This will contribute to efficiency gains in the provision of services, lower costs and free the public sector from the pressure of investment spending in a few years, being able to structure it more appropriately over time thanks to PPP. In this way, it will contribute to the fulfilment of the stability objectives of the country in which the action is carried out, it will ensure the necessary investment to carry out the infrastructures, and it will increase efficiency in the economy as a whole since these works will not be seen delayed due to lack of funds derived from a compromised public budget restriction (European PPP Expertise Centre (EPEC), 2015; Rotellar-García, 2019).

The PPP model has been successfully applied in different public services, including airport rail links and conventional rail (Dehornoy, 2018). However, very few high-speed lines have been built through PPPs and in many of them the result has been contrary to expectations. Therefore, based on these experiences, there is a need to study the reasons why PPPs are not successful in the field of high-speed rail infrastructures, and how failures, mainly attributed to the decisions made by public administrations and private investors, can be avoided. Therefore, the objective of this research is to develop a series of elements for improvement that serve as a tool for governments, private investors, and interest groups in decision-making, before the construction of new high-speed rail lines, and thus be able to obtain all the socio-economic benefits provided by investments in high-speed rail infrastructure implemented through the PPP model.

2. Research methodology

The applied research methodology has been the exploratory and collective case study theory defined by the most influential authors in this field, Yin (2009) and Stake (1995), as well as the identification of critical success factors (CSF) defined by Rockart (1982).

The study has consisted of the following stages: (a) the collection of a wide range of data from the railway infrastructure concessionaires, railway infrastructure managers, railway undertakings, public authorities, and railway-specific publications; (b) the classification of the data into six areas: project, infrastructure, transport service, contract, corporate structure, and investment; (c) comparison of the case studies; (d) identification and analysis of the CSFs; and (e) development of the elements for improvement and good practices for governments, private investors, and railway stakeholders.

3. Case studies

The research analyses, through seven case studies, all the high-speed lines designed through PPPs in Europe. The first of these is the Channel Tunnel Rail Link (CTRL), which was later renamed High Speed 1 (HS1), is located in England and links London to the British side of the Channel Tunnel and connects through an underwater rail tunnel to France.

Fig. 1. HS1 line.

The second case is the Hogesnelheidslijn Zuid (HSL-Zuid) high-speed line, which in English means south, which is located in the Netherlands and connects Amsterdam with the Belgian border through the town of Breda, to connect with the rest of the European high-speed network.

Fig. 2. HSL-Zuid line.

The following three case studies are from French lines. France is the country in Europe that has most implemented the PPP model in high-speed rail infrastructures. The third case is the French line Bretagne-Pays de la Loire (BPL) that connects the towns of Le Mans and Rennes. The fourth case is the French line Sud-Europe Atlantique (SEA) that connects the towns of Tours and Bordeaux. The fifth case is the Contournement Nîmes-Montpellier (CNM) a by-pass between the French cities of Nîmes and Montpellier.

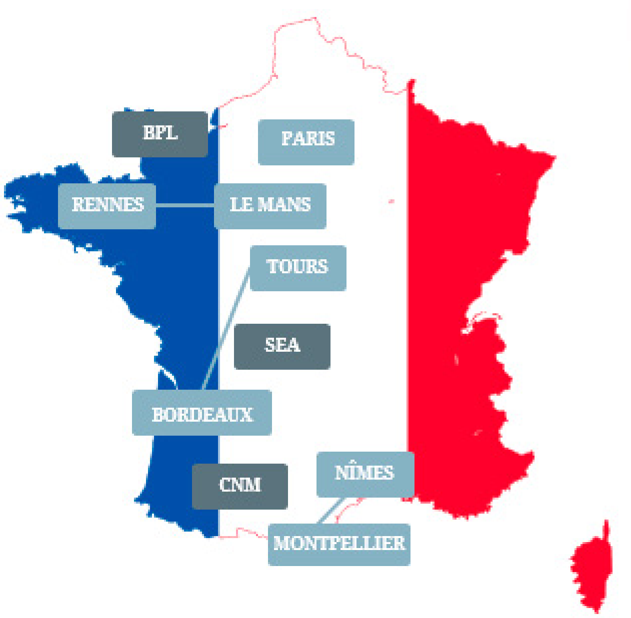

Fig. 3. BPL line, SEA line and CNM by-pass.

The sixth case is the Figueras-Perpignan high-speed international section. This section has made it possible to connect Spain with France at high-speed using Union Internationale des Chemins de fer (UIC) gauge.

Fig. 4. Figueras-Perpignan high-speed international section.

The last case study is the Rede Ferroviária de Alta Velocidade (RAVE), the Portuguese high-speed rail network. Portugal designed a network through six PPP contracts whose purpose was to connect with the Spanish high-speed network and with the rest of Europe through UIC gauge. Five PPP contracts were defined for the development of the substructure and superstructure. In addition, a PPP contract was designed whose scope was the design, supply, installation, financing, and maintenance of the European Rail Traffic Management System (ERTMS) signalling system and the Global System for Mobile Communications-Railway (GSM-R) communications system, for the entire network. Within this project, only the Lisbon-Poceirão section was awarded, which was later terminated, and the rest of the sections were not awarded, since the project was abandoned due to the international financial crisis of 2008.

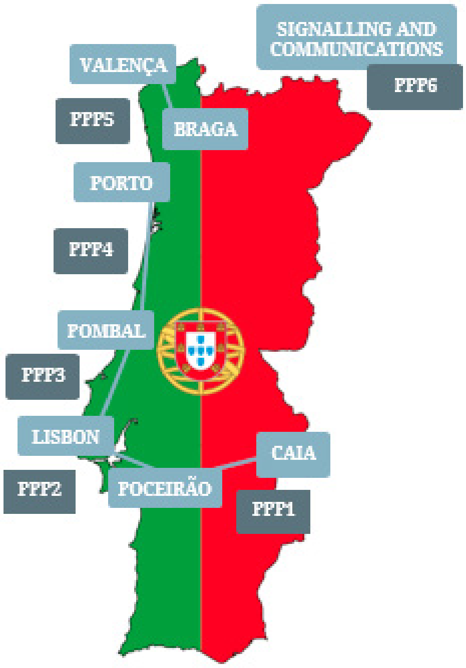

Fig. 5. RAVE.

4. Analysis and discussion of the CSFs

Once the seven case studies have been compared, the following list of elements for improvement has been concluded.

4.1. Cross-border cooperation for international sections

In the case of the international section Figueras-Perpignan and the Portuguese high-speed network, both projects were defined through bilateral Spanish-French and Spanish-Portuguese summits. At these summits, important points were defined such as the layout and the track gauge to be implemented, which was the UIC. However, we have other opposing cases, such as that of the Dutch Zuid line, for which Belgium requested the payment of financial compensation to accept the interconnection route between the two countries (Boletín Oficial del Estado, 1998).

Therefore, with these experiences, a good understanding between neighboring countries is essential for the development of common infrastructures and it is recommended that the cross-border section be the responsibility of both countries. For this alliance to be solid, it is necessary to ensure the participation of stakeholders, guarantee a coherent objective for all participants and ensure that the results of the cooperation bring similar benefits to both sides of the border (Galko, 2016).

4.2. Substructure and superstructure work in the same contract

The separation of substructure and superstructure works means that it is almost impossible not to make mistakes in engineering designs since a modification in the substructure also means modifying the superstructure. On the Dutch

Zuid line, these works were contracted separately, which involved engineering rework due to the lack of coordination between the awardees of the substructure and superstructure (Von der Heidt, Gillett, Charles, M.B., and Ryan, 2009).

Firstly, it is necessary to indicate that the substructure supports the superstructure and transmits the loads to the foundation. Secondly, the superstructure is the area above ground level that receives the loads from the trains which are then transferred to the substructure. So, it is clear that there is an interaction between the substructure and superstructure. Therefore, it is recommended that the scope of design and construction works for the substructure and superstructure always be carried out by the same contractor (Giannakos, 2010).

4.3. A separate contract for signalling and communications systems

ERTMS signalling and GSM-R communication systems represent the greatest technological risk in railway infrastructures, due to the constant evolution of technical specifications and their obsolescence. Since the first technical specification of the ERTMS system in 2000, 12 new versions of this document have been published. With regard to the GSM-R communication system, it will be replaced by a new one called Future Railway Mobile Communication System (FRMCS) In addition, the separate tendering of this work means that there may be greater competition in the substructure and superstructure tenders, as the number of ERTMS and GSM-R technologists is very limited and would mean that only a very small number of partnerships could be created. Therefore, it is advisable to treat signalling and communication systems independently due to their importance and continuous updating, as well as to facilitate competition and reduce costs (European Commission, 2020).

4.4. Availability risk transferred to the private party

Of the different PPP contracts in some of them, the winning company assumed the risk of availability, as in the case of the HSL-Zuid line, the BPL line, and the CNM by-pass. In other cases, the successful bidder assumed the traffic risk, such as the HS1 line or the Figueras-Perpignan international section. And for the Portuguese high-speed rail network, a mixed formula was chosen based on availability and traffic. After the commissioning of these infrastructures and the start of transport services, lower than expected economic income has been observed, leading to the renegotiation of the contract and subsequently, becoming publicly administered, only in those infrastructures in which the traffic risk was assumed by the winning company. This being the case of the HS1 lines and the international section Figueras-Perpignan. Therefore, it is much safer, not only for the private investor but also for the public administrator, to carry out PPP contracts in which the risk of availability is transferred to the concessionaire (Lawther, and Martin, 2014).

4.5. Proven purchase of rolling stock

With the commissioning of the new infrastructures, new high-speed rolling stock was also put into service by rail operators in the cases of the French SEA and Dutch HSL-Zuid lines. Regarding the rolling material to operate, HSL-Zuid launched a joint purchase with the Netherlands, to acquire new high-speed trains to operate in the Netherlands and carry out international routes with Belgium. For the award of this contract, offers were presented from the railway constructors Siemens, Bombardier, and Alstom, whose offers were based on modifications to vehicle models already in operation; however, the technologist Ansaldo Breda was the only manufacturer that fulfilled all the technical requirements based on a train model that still had to be developed. In 2004, Ansaldo Breda won the contract. According to planning, the trains were to be available in 2006, in order to carry out tests and start operating in 2007. The infrastructure was completed and received in 2007, however, until March 2012, the new vehicles were not available. In December 2012, international services connecting Amsterdam with Brussels began. In January 2013, the vehicles were discontinued for commercial service due to failures that occurred during operation. For this reason, it is very important for a railway operator to buy already tested railway vehicles or make modifications on models already in service because their reliability is known, and also the delivery plan will be more realistic and more achievable (Geluk, 2012).

4.6. Savings in travel times

In the case studies, the reductions in travel times compared to the conventional railway ranged from 8 minutes for the Paris-Nantes connection on the BPL line, to 7 hours and 21 minutes for the Lisbon-Madrid connection within the project of the Portuguese High-Speed Network. As we can see, the time savings are quite significant, so when implementing these new infrastructures, it is very important to improve travel times compared to conventional rail or other ways of transport (Rede Ferroviária de Alta Velocidade (RAVE), 2006; SNCF Réseau, 2016).

4.7. Conservations of existing stations in the conventional rail network

In reference to the commercial stops on the lines under study, there is a tendency to continue with services at existing stations on the conventional rail network. For the BPL, HSL-Zuid, and SEA lines, the existing stations remain on the new route, and only adaptation works are carried out to the new infrastructure. In the case of the CTRL infrastructure, a mixed model is adopted, in which the St. Pancras in London, the platforms of Ashford station are adapted and those of Stratford and Ebbsfleet are built. In the case of the Portuguese High-Speed Network, a mixed model is also adopted, with the construction of the Évora station in the Poceirão-Caia section, the Leiria station in the Lisbon-Pombal section, and the Averio station in the Pombal-Oporto section. In the case of the international section Figueras-Perpignan, due to the characteristics of the infrastructure, there is no stations. For only the CNM by-pass, all the stations, in this case those of Montpellier Sud de France and Nîmes-Manduel-Redessan, are newly built. Therefore, the tendency to maintain existing stations in the designs of new high-speed lines has several advantages, such as favouring inter-modality in the city centre, the creation of exchanges with other ways of transport, and quick access to final destinations, and the reduction in the necessary investment (National Audit Office, 2012).

4.8. Responsibility of the rail infrastructure manager for the interfaces between the new infrastructure and the existing network

In the cases of the French lines, the integration between the new lines and the existing network was carried out through a contract independent from that of PPP and for which the railway infrastructure manager, in this case, SNCF Réseau, was responsible. In the case of the Dutch HSL-Zuid line, a traditional contract independent from that of the PPP of the superstructure was made to connect the substructure of the new high-speed line with the conventional rail network (Priemus, 2011).

In the connection between a new high-speed rail line with the existing rail network or another high-speed line, the most significant risks lie in the signalling system. To connect lines equipped with the ERTMS Level 1 or 2 signalling systems of different Technologists, it is necessary to develop an interface for the interlocking or the RBC. This need leads to a separate contract for these interfaces to be necessary and for it to be managed by the infrastructure manager for lines within the same country or by the States for cross-border interfaces.

4.9. Inclusion of the activities of maintenance in the PPP contract

The PPP contracts include infrastructure maintenance activities in their scope, which translates into a double advantage for the contracting administration. The successful bidders will carry out a better design and choice of materials and components to reduce corrective maintenance needs and will also finalize and comply with the planning since they mainly receive the most significant payments during the maintenance phase (Engel, Fischer, and Galetovic, 2010).

5. Conclusion

This research analysed through seven case studies; all the high-speed lines designed through PPPs in Europe. This study has required the application of an exploratory approach and the identification of CSFs. The purpose of this research was to develop a list of elements for improvements will allow the governments, private investors, and stakeholders to be able to achieve all the socio-economic benefits that PPPs bring in the field of high-speed rail infrastructures. This article has made it possible to develop the following list of recommendations and good practices, cross-border cooperation for international sections, substructure and superstructure work in the same contract, a separate contract for signalling and communications systems, availability risk transferred to the private party, proven purchase of rolling stock, savings in travel times, conservation of existing stations in the conventional rail network, responsibility of the rail infrastructure manager the interfaces between the new infrastructure and the existing network, and the inclusion of the activities of maintenance in the PPP contract.

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