

THE DELIVERY OF HIGH-SPEED RAIL PROJECTS THROUGH PUBLIC-PRIVATE PARTNERSHIPS; CASE STUDIES FROM PORTUGAL AND BRAZIL

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1. INTRODUCTION

Following the example of many countries, Portugal and Brazil decided to implement their HSR networks. Brazil was, at that time, undergoing a period of great development, and the accessibility plans to the realization of the FIFA football world cup triggered the start of the big endeavour; by the Portuguese side, despite the not-so-good economic performance during those years, the country decided to modernize its railway network by linking its two biggest cities and connecting them to the European HSR network (TEN-T corridors).

Those were epic times regarding the infrastructure development in both countries. Particularly in Portugal, a dramatic bolster of its transport infrastructure was underway. During the 5-year period before the launching of the Portuguese HSR project, several PPP contracts were signed, corresponding mainly to road PPP schemes.

As in every country, the advantages of the HSR line were challenging. On one hand, several social benefits, time saving, reliability, punctuality, security and several positive externalities, on the other hand a project with external finance boosting the economy, creating jobs, increasing tax incomes and contributing to the GDP growth for decades.

The present work will try to give a twofold contribution:

- (1) to the understanding of the failures of both projects and main reasons to be put on hold, and,
- (2) to conclude about the lessons to be taken from the two projects, regarding a possible future relaunching

2. LITERATURE REVIEW

• About high-speed rail

As there is not a standard high-speed rail definition, the UIC, a reputed authority on the subject, defines, as its main characteristics, a “system” with new lines designed for speeds above 250 km/h, with all its components, such as trainsets, admitting the upgrade of existing lines for design speeds between 200 and 220 km/h.

Because there is the possibility of making use of different types of lines, the European Council Directive 96/48 defined the HSR infrastructure as a system comprising 3 different types of lines: new lines built for the purpose, designed for speeds above 250 km/h; upgraded lines for a design speed around 200 km/h and finally other upgraded conventional lines where it is not possible to upgrade them due to different constraints.

The E.C. (1996) definition is broadly than the one from UIC, and matches perfectly the different HSR systems existing inside the European Union.

Rus et al. (2009), have defined four different models regarding the different ways of the network exploration: from exclusive exploitation, where HSR trains and conventional trains do not share the same infrastructure, to a fully mixed model, with both trains using both tracks. Two models are in the middle: the mixed conventional and the mixed high-speed, with the conventional or the high-speed trains sharing both lines.

Rus model is useful to compare the different models existing in Europe, such as the Spanish - an exclusive exploitation model - or the German, a fully mixed model. Because the models implemented in Europe are slightly different, Dunn and Perl (1994) considered the German model as the most flexible one.

The use of existing lines are useful to avoid excessive investments in the inner cities Rus et al. (2009), avoiding the extra costs when taking the train to central stations.

Rus et al. (2009) and Campos et al (2007) make a clear differentiation of the French and Spanish models, based on a central strong hub, due to the fact that the countries have their major cities at a competitive HSR distance, what makes the HSR implementation like a star with a central big hub. Differently from those, the German and Italian models are implemented along a distribution line.

Rus et al. (2009), define as competitive distances the ones above 1 hour - to allow a modal shift from car to trains - and under 4 hours, to allow a competitive advantage with the air transportation.

The same scholars teach about other demand metrics related to the HSR, discouraging the implementation of a new HSR line when there will be less than six to seven million passengers during the first year of operation. The European Commission considers these thresholds for HSR project evaluation (E.C., 2008).

Albalate and Bel (2014), suggest political reasons for the “star shape” implementation of the Spanish HSR project, centred in Madrid.

When celebrating 40 years of the Shinkansen HSR system, scholars defend this line as the case study to be taken firstly into consideration when planning a new HSR train. Scholars always remark that the option for the HSR service (Tokaido line) was the answer to a demand problem.

Several authors (e.g., Dunn and Perl, 1994) recognize the Paris- Marseille HSR line of the French TGV as the most accomplished line, able to pay by itself.

Albalate and Bel (2014), recognize that the great success of the French TGV was its market orientated development, far from political and regional pressures. The comparatively small growth of the French system, when compared to the Spanish system, was its approach towards feasibility and sustainability.

After several years of slow expansion, the French government decided, during President Sarkozy mandate, to strongly expand its network using PPP schemes.

The Spanish network grew so substantially - more than 25 000 km over a period of 25 years - that soon occupied the second position in the world ranking (the first position considering only the European countries) as the most extension network, only surmounted by China (Albalate and Bel, 2014).

Although its great expansion, the Spanish network has a deficit operation in the majority of its lines (Albalate and Bel, 2014). Some stretches of the lines still present passenger/km ratios below unacceptable thresholds. Even the Madrid-Barcelona line has had an unsatisfactory demand growth during the last decade.

- PPPs in infrastructure projects

As occurs with high-speed rail, there is not a standard definition for a PPP. Engels et al (2011), define PPP as a long term agreement between public and at least one private entity, to build or improve an infrastructure for a long period of time. The private should do the construction works and maintenance, and, at the end of the

concession period, deliver the infrastructure back to the State. As a remuneration for its works, the concessionaire receives fees from the future users or availability payments by the State (or both).

The European Commission (2004), has its own definition: *“The term public-private partnership (“PPP”) refers to forms of cooperation between public authorities and the world of business which aim to ensure the funding, construction, renovation, management and maintenance of an infrastructure or the provision of a service”*

The main goal of a PPP is to bring the private experience and capacity to finance the infrastructure projects, being expected, through gains of performance, benefits to the public sector and to the future users.

One of the great advantages of the PPP contracting is related with the risk allocation. As a way to minimize costs, the agreement between the public and private parties is based on a risk allocation, so that each party will bear the risks more suitable for it. It should start in the planning phase, and the client should provide the risk allocation scheme in the tender documents (Bing et al, 2004). It is important to remark that risk transfer is one of the major features when deciding and promoting a project through a PPP scheme, therefore, without a proper risk transfer, an important assumption related to the advantage of the PPP model will not be fulfilled (Marques and Berg, 2011).

The PPP schemes are many times used as a way to hide public debt, by transferring infrastructure payments to future exercises, what can be dangerous. Nevertheless, with a proper use, PPP schemes allow, with the relief of the public budget, to invest in more needed public services.

There are several PPP schemes; the most used models for the infrastructure development are the DBFO and the DBFOM.

The main advantages and disadvantages of a PPP deal can be easily summarized:

- Advantages: Bringing the private party expertise, risk allocation, financing by the private, life cycle management.
- Disadvantages: Its use to circumvent budget deficits, lack of expertise on the public side, biased feasibility studies, reduced competition.

The decision to use a PPP scheme must be preceded by suitable feasibility studies, cost-benefit analysis (CBA) and the public-sector comparator (PSC), where it can be seen whether the best way to contracting would be: the traditional way or through a PPP scheme.

The use of PPP themes in heavy railway is still limited, and was never tested, neither in Brazil nor in Portugal. Both countries only have had experiences on light-rail PPP contracts. There are not many HSR PPPs in the world; this topic is be addressed in the following section.

3. INTERNATIONAL CASE STUDIES ON HSR PPP SCHEMES

Taiwanese High-speed rail project (THSR)

The Taiwanese HSR project was the first PPP project on high-speed rail; it was implemented as a BOT model, had a total cost of USD 18 billion, and was the first operator outside Japan to use the Shinkansen Technology.

One of the layout options, when implementing the line, has been to avoid city centres, because of the highly construction costs. Therefore, the stations were implemented away from the cities, being necessary transfer options, such as shuttles and conventional rail and metro.

The project have had serious problems due to the demand forecast, far below than the originally predicted. Being the demand usually overestimated, the case was much worst due to a terrible economic crises that affected the country. The reflection of the demand was seen in all transport modals. Another think that have contributed to the lack of passengers was the lack of the previewed transfer options. Other factors that may have affected the lack of growth in ridership were the relocation of factories to China, high ticket prices, the too many train stops finnaly and the growth of interest rates.

The government have had to take measures in order to avoid the companies bankruptcy, such as injecting money as a financial bailout, by taking more shares in the company and by extending the concession period.

Dutch High-speed rail project (HSL-Zuid)

The HSL-Zuid DBOM 25-year concession agreement was signed in 2001, and construction ended in 2007, a couple of months before schedule. Nevertheless, the operation, granted in another concession for the period of 15 years, only started in 2009.

When deciding the implementation layout, the Dutch government has opted for a risky business structure: to assume the construction risks, which the government procured by the traditional model, and separating the operation from the infrastructure maintenance. The signalling and telecom (S&T) has been procured in another package. The high risk assumed by the government led to serious problems: serious construction costs overruns, arising from the traditional contracting; interface problems between the infrastructure and the systems company, the concessionaire receiving availability fees without train operation and the operator (90% public companies) having to pay access fees without having the operating service. The double-headed project management have, as well, contributed to worsened things. The operator enter into bankruptcy as a consequence of paying access charges without the correspondent farebox revenues. Moreover, as different trains from the original planned are running in the line, the concessionaire is claiming against the state for extra spending on the line maintenance.

Binational French-Spanish Perpignan-Figueres link

The Perpignan-Figueres is another example of a HSR PPP concession. The project is an international railway link, included in a TEN-T priority corridor, connecting the French and the Spanish HSR networks. The contractual framework adopted was a DBOFM for a 50-year period. The concessionaire should assume the risks of the construction, finance, operation and maintenance and be rewarded by levying tolls on train operating companies.

Problems have arisen due to the fact that links to each country network have been delayed, and therefore, the link could not be accessed by trains. At the beginning of 2014, the company was in financial difficulties, due to the fact that the tolls charged were insufficient to pay the bank debts. The concessionaire sought judicial protection to avoid bankruptcy. Later, in 2017, both governments took control of the concessionaire, in order to avoid the disruption on the international service (Dutzik et al, 2011).

Perpignan-Figueres was another project suffering from demand forecasts far from reality. As a matter of fact, the revenues were about one third of those predicted.

Other more recent HSR PPP experiences:

Other more recent HSR experiences exist, although with not sufficient data for their evaluation, by the reason that operation did not start or is still in an early stage. From these, the French project Tours - Bordeaux is the most advanced one.

The Tour-Bordeaux line, with its 308 km of extension, was contracted as a DBFOM model. This contract has the particularity of the demand risk being borne by the private, therefore it will be interesting to monitoring its performance during the upcoming years. Nevertheless, it started with the relative comfort of having a demand forecast of nearly 18 million passengers in the first year of operation. Even with the possibility of a biased forecast, the figures seem comfortable. The main reason for such a demand is the strong Paris hub, that has been proved to be an efficient feeder of the French TGV (Campos et al, 2007).

Another French line developed under a PPP scheme was the Bretagne - Pays de Loire, a line with an extension of 182 km, inaugurated in July 2017. As opposed to the Tours-Bordeaux, the demand risk stayed with the public sector. Nevertheless, both projects have had a substantial upfront investment by the public sector, of more than 50% in both cases (in the Bretagne- Pays de Loire the figure is more likely 70%).

Another French HSR PPP contract was signed for the Nîmes and Montpellier bypass. A DBFO model will run the link, that is similar to the Perpignan-Figueres, being, as well, a TEN-T corridor. The concession will be run during 25 years by the private, that will receive, as reward, an availability fee.

One of the interesting projects ongoing is the Russian Moscow - St. Petersburg. The line, with an extension of 600 km and a demand forecast of 14 million, will be maintained by the private involved in its construction. The project was tendered as a DBOT model and awarded to Deutsch Bahn (DB), in a global package that included the construction and systems and train supply. After an assisted operation, the system operation will be transferred to the Russian public operators, as well as the technology. DB will be paid for the construction after the commissioning, and yearly as a reward for the maintenance, during a concession period of 30 years.

With much less information available, China has launched its first HSR through a PPP scheme: the Hangzhou - Shaoxing - Taizou. With an extension of 269 km, this concession contract will last 34 years, with a 4-year construction period included. A mixed consortium, led by the private partners which hold 51% of its stakes, will run the concession. The construction is scheduled to start in 2018.

4. PORTUGUESE RAV AND BRAZILIAN TAV

The Portuguese HSR project begun in 1988 when first decisions were taken by the Portuguese minister council. Different studies have been commissioned and, in 2000, a public company with the aim of developing the Portuguese HSR network, RAVE, was created. After almost a decade developing several studies and commitments with Spain and the E.U. because of the international connections and subsidies, the first public tender was launched in 2008, the Poceirão - Caia, and subsequently, in 2009, the connection between Lisbon and Poceirão, that included a major bridge over Tagus river.

The business model adopted consisted of the launching of a model in a public-private partnership, where 5 sections of the entire stretch would be launched for construction under 5 PPP contracts for the substructure and track superstructure and maintenance in the 3 priority axes, and another maintenance contract as a single PPP for the signaling and telecom to be implemented on the 3 axes. The management of circulation and allocation of capacity would remain the responsibility of traditional public sector companies. Figure 1 provides an illustration of the Portuguese HSR business model.

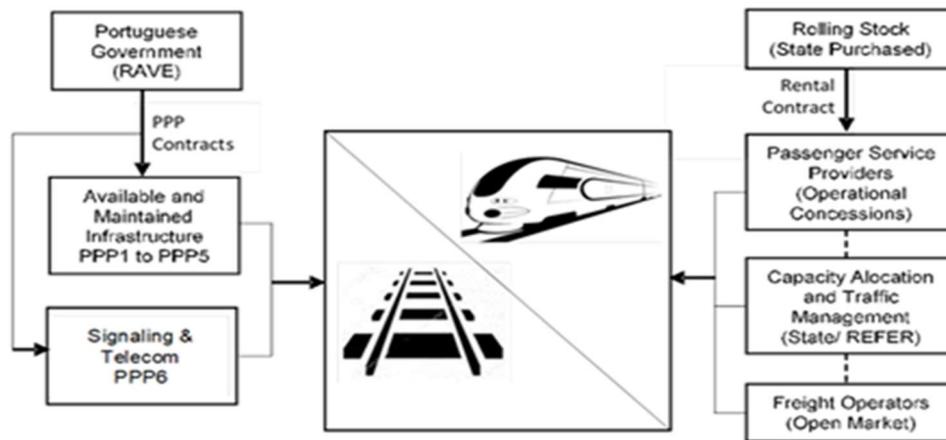


Fig. 1: Portuguese HSR business model for operation

TAV

The birth of the Brazilian HSR project dates back from the 1990s, where alternative transport studies between Rio de Janeiro and São Paulo were developed in cooperation with the German government. The Brazilian “bullet train” project took its final draft by integrating the Rio de Janeiro to São Paulo railway connection to the railway express connection between São Paulo and Campinas, called “*Expresso Bandeirantes*”, that was being developed by the government of the State of São Paulo. The definitive start of the project happened when it was included, in 2007, during the presidential mandate of Lula da Silva, in PAC program.

Although the great enthusiasm in the launching of the project, at that time important not only for the transport infrastructure itself, but as well to contributing to the international projection that the country was experimenting those years (Brazil was one of the BRIC countries, what meant undergoing a spectacular development), everything has been planned to deliver its striking project before the football World Cup (the same that Russia is doing this year, with the plans to deliver the Moscow - St. Petersburg before the Russia World cup 2018).

After several announcements of different models and scoring criteria (between 2007 and 2009), the call for tender was finally issued in July 2010, but things did not happen as predicted. The first concession model was refused by the market, and even after the government postponing the submission dates twice, any bids were offered by the final submission date (July 2011).

Critics always have been sceptical about TAV project, arguing that: Rio São Paulo was a less-than-one-hour flight, and therefore the HSR would not be able to beat the flight transportation; the Capex was far from the reality; the Rio São Paulo minimum ticket price would not be affordable by the middle classes, and finally, the demand forecast seemed to be overestimated (as usual).

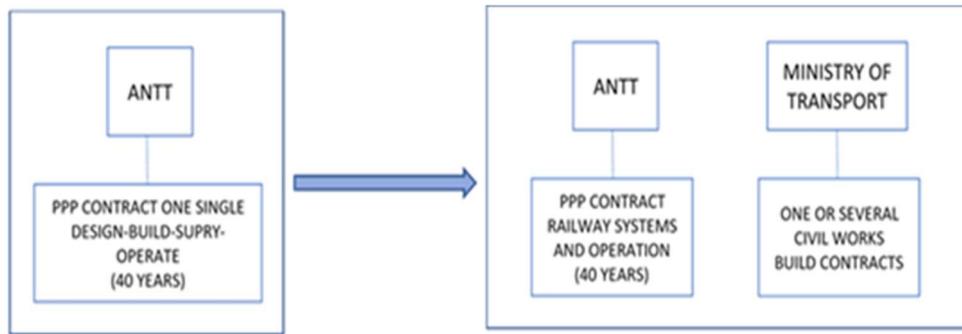


Fig. 2: Organizational structure of the TAV before and after the tender conceptual changes

After market consultations, the government relaunched the project in 2012, with major changes in the model. The government gave up from the vertically integrated model, as a single design-build-supply-operate model, by splitting the tender in three different tenders; the first one for choosing the supplier of technology, that should maintain the infrastructure and operate the trains, a second tender to award the final design according to a preliminary design that was as well part of the operation scope, and finally the third one to selecting the construction companies.

This new concession model produced immediately a major change in the awarding criteria, from the lowest tariff price of the train service for passengers to the best price to be paid to the awarding authority for the concession (as in the new model the infrastructure construction was to be a cost for the granting authority). It is important to highlight that all models previewed the demand risk to be allocated to the private.

Additional measures to make the operation concession more attractive were taken, such as the National Development Bank (BNDES) stronger involvement in its financing and by increasing the public stake in the consortium, from the initially predicted 30% to 45%.

Despite this new version with additional incentives, the project has remained not attractive to the private. One of the reasons for firstly launching the operation contract was to push the project forward, by at first tendering the lower-risk scope and therefore avoiding the shadows of the underestimated construction upfront costs. Nonetheless, changes in tender documentation continued to be produced, such as newly introduced criteria of considering the operating own estimates of the construction costs in the awarding formula. Furthermore, new incentive packages continued to be added, such as a reduction in the minimum payment for the award. The Public Ministry entered with a process for the tender suspension, and eventually new changes were made. Finally, without major explanations, the government opted for the “sine die” suspension of the project.

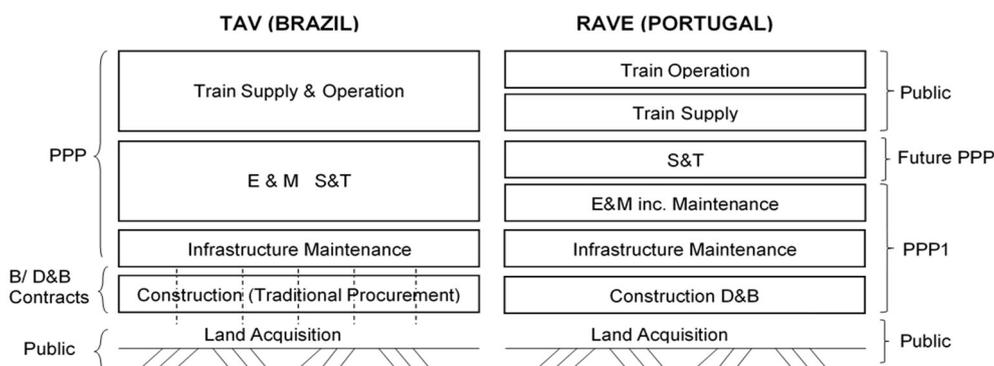


Fig. 3 - HSR project scopes in Portugal and Brazil, through vertical separated models

5. DISCUSSIONS AND SUGGESTIONS

The main topics for the discussion are related with the necessity of these projects for both countries. Firstly, it is of great evidence the serious degradation of both economies during the first years of the project implementation.

Despite the economic crisis and its effects on the infrastructure market, a serious investigation is ongoing in Portugal about the excesses that have been committed through PPP contracting. Portugal is a country with a highly competitive construction market, with narrow construction margins and therefore, the construction of a HSR system should be expected to be “low-cost”, as soon as the minimum standards to get a competitive procurement are guaranteed.

One of the matters that is more consensus generating between scholars, is the fact that the infrastructure investment on HSR does not pay for itself. In the literature review, it was been shown that figures between 50 to 70% of the infrastructure investment have been supported directly by public subsidies.

It is possible to summarize the main issues that have contributed to the cancellation of the TAV project: unsupported estimates of the construction costs; the allocation of the demand risk to the concessionaire; difficulty in attracting strong bidders, and eventually in achieving competition and the serious doubts about the demand forecast and the travelers willingness to pay.

The adoption for a different business model appears to be far more interesting; analyzing the different business models from the literature review, a model similar to the one implemented in Russia, seems far more adequate.

Some extra observations should be made in respect to the Brazilian project: it was unattractive for the private sector; it was not interesting for the international players; it was uninteresting for the public sector; the financing was not attractive to the national development bank (BNDES), and it was not feasible, at that time, using that business model.

Nevertheless, it is essential to bring to these conclusions the highly positive facts regarding the project, such as: the railway transport of passenger being inexistent in such routes; the lack of capacity of existing transport alternatives such as air transportation and roads; the huge population figures of São Paulo and Rio de Janeiro; the fact of having the 5th busiest air route in the world and all the advantages related to the HSR transportation; As discussed, RAVE has made several attempts in order to minimize some of the specific risks of the venture, implementing measures in order to: bolster competition, namely through the facilitation of feasibility studies ahead of the tender process; launching contracts that the national contractors could cope with; the attraction of international players and promoting feasible funding;

It was indeed the political risk, caused by the huge financial crisis that led Portugal to a bailout, the main reason for the project cancellation as a whole. But there were other reasons contributing to the project cancellation, such as the low ridership potential; the missing link to Lisbon and the cancellation of the new Lisbon airport.

To end this reflection, and looking back the several aspects shown in this work, it stands clear that many reasons could be pointed for the suspension of both projects. Perhaps there were not gathered the elementary conditions to pursue these contracts. Moreover, the TAV had not a convincingly structured model, as remained evident by its successive changes during the process.

6. CONCLUSIONS

During this work, it was possible to quote several scholars about PPP on infrastructure and as well about HSR systems. By the analysis done, it can be stated that contracting a HSR through a PPP scheme is fairly plausible. They have had, in broad terms, a good performance through the evaluation period (that was short).

The major problems related with the PPP projects considered in the literature review that are related with the PPP business model itself, were the assumption of certain constraints that eventually did not happen.

Making a compilation of all case studies, and through the lessons learned with the scholars contributions, the essential question is, when it comes to a PPP contract, in trying to achieve a good deal between the parties with the best risk allocation possible in order to avoid a misbalanced contract for one of the parties. In those case studies, it can be stated, without any risk of being wrong, that the problems that have arisen from those PPP projects, would have been seriously worst without the private contribution. As stated, several lessons could be learned about the case studies used for the benchmarking: the construction activities under the PPP schemes, were generally delivered on time and budget; the construction pursued by traditional contracting was far more expensive than expected (as in HSL-Zuid); the public sector had serious difficulties in managing the interfaces originated by the unbundled projects; the Portuguese case, although cancelled, has proven that, through PPP schemes, the governments can make better deals in the construction; with the exception of the Dutch case, by its particular characteristics, the different implementation of the projects by the private went really fast, and that the public entities have a much different pace.

As seen, the PPP models for the different projects, though having their own singularities, have achieved its main objectives, and therefore there is no evidence that PPP schemes are not adequate to develop HSR.

One of the objectives of this dissertation, was to analyze the two projects, TAV and RAV, in terms of its layout, procurement processes, feasibility, business models and risk assessment, in order to understand the reasons for having been put on hold, and to extract the lessons to be learned about those failures.

If, in the case of the Brazilian project, there appears to be no doubt that the project was duly suspended, the same conclusion regarding the Portuguese project cannot be extracted, at least directly. In fact, after about six years after its suspension, the evolution of the situation forces to weigh some additional facts, such as the commitment with the E.U. to build the TEN-T corridors and all the costs involved, not only in the abandoned HSR project but as well in the new freight line that is being built in the same corridor. Moreover, the same amount of European funding, in the case of the HSR project relaunching, is unlikely to be verified.

About the Brazilian TAV, it is possible to conclude that the project had serious shortcomings that eventually led to its end. The Portuguese case is a different situation. It can be said that the contractual model chosen for its implementation was fairly good, and that the tender process went particularly well. The problem arising with the project have had more to do with its feasibility, as there was no sound evidence that the operation could be feasible, due to its doubtful viability, namely because of its reduced demand forecast. Moreover, it is important to highlight the innovations that were applied during the tender phase in order to improve competitiveness.

Furthermore, during the short life of the RAV project, several events occurred that have worsened its born-weak viability: the cancellation of the international Lisbon airport project, and the railway connection to Lisbon.

Although having passed through this big failure, the Brazilian project apparently gathers all the conditions to be successful, if properly driven, to end these conclusions, it is likely that the two projects will be relaunched in the near future.

Further studies

It would be interesting to better studying the real costs of construction and operating an HSR system, as there exist different information available about the real costs. Another issue that would worth being studied is related with the demand. It would be an interesting contribution to the HSR studies, now too much focused on social-economics impacts and on the modal shifting. Finally, the case studies that have been considered during this work should be followed and surely will be the subject for several academic works in the near future. The French TGV line Tours-Bordeaux, would be, in particular, of the foremost interest, as it will be the first high-speed rail PPP in Europe, with the concessionaire bearing the demand risk, being tested.

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