IESE Business School
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PPP for CITIES
Specialist Centre on PPP in Smart and Sustainable Cities

WITH THE SUPPORT OF:
UNECE

PPP FOR CITIES CASE STUDIES

BARCELONA TRAM SERVICE (SPAIN)

Josep Navarro, Joan Enric Ricart, Francesc Trillas,
Miquel Rodríguez Planas & Jordi Salvador

With the collaboration of Barcelona's Autoritat del Transport Metropolità (ATM)

September 2017

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The Specialist Centre on PPPs in Smart and Sustainable Cities (**PPP for Cities**) is a research, innovation and advisory center that aims to provide public administrations throughout the world with support in the organization, management and development of projects involving collaboration between the public and private sectors in the smart cities arena.

It is also a partnership platform between companies and administrations from all over the world where they can further explore the dynamics of public-private partnerships, create guides to good practices and standards and design solutions to the issues facing cities.

The center is led by IESE Business School and is part of the United Nations' International Centre of Excellence on PPPs program. It has the support and sponsorship of Barcelona City Hall and other public administrations and private companies.

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Abbreviations

AGE	Administración General del Estado (General State Administration)
AIReF	Autoridad Independiente de Responsabilidad Fiscal (Independent Authority for Fiscal Responsibility)
AMB	Àrea Metropolitana de Barcelona (Metropolitan Area of Barcelona)
AMTU	Associació de Municipis per la Mobilitat i el Transport Urbà (Association of Municipalities for Mobility and Urban Transport)
ATM	Autoritat del Transport Metropolità (Metropolitan Transport Authority)
CiU	Convergència i Unió (Convergence and Union, an electoral alliance)
DBFOT	design, build, finance, operate and transfer
DSRA	debt service reserve account
ECB	European Central Bank
EIB	European Investment Bank
EMEF	Enquesta de Mobilitat en Dia Feiner (Workday Mobility Survey)
EMT	Entitat Metropolitana de Transport (Metropolitan Transport Body)
EPC	engineering, procurement, and construction
FCC	Fomento de Construcciones y Contratas (a construction company)
FGC	Ferrocarrils de la Generalitat de Catalunya (Catalonia Government Railroads)
FMB	Ferrocarril Metropolità de Barcelona (Metropolitan Railroad of Barcelona)
GDP	gross domestic product
Mpta	millions of pesetas
O&M	operations and maintenance
PPP	public-private partnership
PSC	Partit dels Socialistes de Catalunya (Socialdemocratic Party of Catalonia)
SPV	Special-purpose vehicle
TRAM	Tramvia Metropolità (Metropolitan Tram System)
UPC	Universitat Politècnica de Catalunya (Polytechnic University of Catalonia)
VAT	value-added tax

Quick Facts

Highlights

This project consisted of designing, building, financing, operating and transferring two tram networks in the metropolitan area of Barcelona. With 41 trams, 29.1 kilometers of track, 56 stations and close to 27 million users per year, this mode of transport runs through the Southwestern and Northeastern outskirts of the city of Barcelona to Barcelona city center.

The aim of this project was to satisfy the need for medium-distance travel, using an environmentally friendly mode of transport. The new networks added to the already existing metro and bus networks a new mode of transport improving public transport's capacity and efficiency in the Barcelona metropolitan area.

Location: Barcelona, Spain.

Characteristics of the Trambaix (Southwest) Public-Private Partnership (PPP) contract

Type of project: Greenfield project[a]
Size and scope: 23 trams, 15.1 km of tracks, 29 stations, 17,679,804 passengers in 2016
Delivery mode: Design, build, finance, operate, and transfer (DBFOT)
Initial estimated investment: 36,160 millions of pesetas[b] (€217,325,976.95) net
Contract announced: December 24, 1998
Contract signed: April 2000
Start of construction: June 2001
Planned start of operations: Fall of 2003/beginning of 2004
Actual start of operations: April 2004
End of contract: April 2032
Payment method: Mixed payment system (technical fare = user fee + public subsidy)
Duration: 28 years (the contract was initially signed for 25 years but in 2009 it was later extended for three more years)
Contracting authority: Autoritat del Transport Metropolità (ATM)

[a] The term *greenfield* project refers to a project that is completely new.

[b] Peseta was the Spanish currency before adopting euro (166.386 pesetas = 1 euro)

Trambaix bid-winning consortium

Bid-winning consortium: Tramvia Metropolità SA
Initial members: Alstom (25.35%), FCC Construcción SA (18.53%), Grup Sarbus (18%), Necso SA (now known as Acciona) (11.65%), Comsa (11.65%), BanSabadell Inversió Desenvolupament SA (5%), CGT Corporación General de Transportes SA (3.41%), CGEA Connex (3.41%), Soler i Sauret SA (2%), Société Générale in Spain (1%)
Current members: Globalvía Inversiones SAU (43.39%), Alstom (24.08%), Moventia (20%), Detren Compañía General de Servicios Ferroviarios SL (4.58%), Ferrocarril Metropolità de Barcelona (2.5%), Ferrocarrils de la Generalitat de Catalunya (2.5%), FCC Construcción SA (1%), Comsa Emte Concesiones SLU (1%), Transdev Group SA (0.95%)
EPC contractors[c]: Alstom, FCC Construcción SA, Necso SA (now known as Acciona), Comsa
O&M contractors[d]: CGEA Connex, Grup Sarbus, CGT Corporación General de Transportes SA, Soler i Sauret SA
Financing method: European Investment Bank €136.1 million (44.80%), own funds €30.5 million (10.04%), project credit €89 million (29.30%), VAT credit €22.6 million (7.44%), subordinated credit €3.4 million (1.12%), subsidy €22.2 million (7.31%)

[c] Engineering, procurement and construction.

[d] Operations and maintenance.

Characteristics of the Trambesòs (Northeast) PPP contract

Type of project: Greenfield project
Size and scope: 18 trams, 14.0 km of track, 27 stations, 9,136,086 passengers in 2016
Delivery mode: Design, build, finance, operate, and transfer (DBFOT)
Initial estimated investment: €205 million net and interest
Contract announced: January 31, 2002
Contract signed: July 2002
Start of construction: January 2003
Planned start of operations: Fall of 2003/beginning of 2004
Actual start of operations: May 2004
End of contract: April 2032
Payment method: Mixed payment system (technical fare = user fee + public subsidy)
Duration: 28 years (the contract was initially signed for 25 years but in 2012 was extended for three more years)
Contracting authority: Autoritat del Transport Metropolità (ATM)

Trambesòs bid-winning consortium

Bid-winning consortium: Tramvia Metropolità del Besòs SA
Initial members: Alstom (25.35%), FCC Construcción SA (19.03%), Grup Sarbus (19%), Necso SA (now known as Acciona) (11.65%), Comsa (11.65%), BanSabadell Inversió Desenvolupament SA (5%), Detren Compañía General de Servicios Ferroviarios SL (4.82%), CGT Corporación General de Transportes SA (1%), CGEA Connex (1%), Soler i Sauret SA (0.5%), Société Générale in Spain (1%)
Current members: Globalvía Inversiones SAU (44.01%), Alstom (20.9%), Moventia (22.56%), Detren Compañía General de Servicios Ferroviarios SL (4.58%), Ferrocarril Metropolità de Barcelona (2.5%), Ferrocarrils de la Generalitat de Catalunya (2.5%), FCC Construcción SA (1%), Comsa Emte Concesiones SLU (1%), Transdev Group SA (0.95%)
EPC contractors: Alstom, FCC Construcción SA, Necso SA (currently Acciona), Comsa
O&M contractors: Grup Sarbus, CGT Corporación General de Transportes SA, Detren
Financing method: European Investment Bank €125.1 million (45.18%), own funds €30 million (10.83%), project credit €88.8 million (32.07%), VAT credit €33 million (11.92%)

1. Background of the Project

Before the modern tram system appeared in the city, Barcelona had a traditional tram network, which operated in the city for almost a century before disappearing in 1971.

A few years after the demise of the old network, the transport authority of the Barcelona metropolitan area started thinking about reintroducing trams. In 1987, the Entitat Metropolitana de Transport (Metropolitan Transport Body, EMT) started the first studies to reintroduce trams in the Southwest of the city.

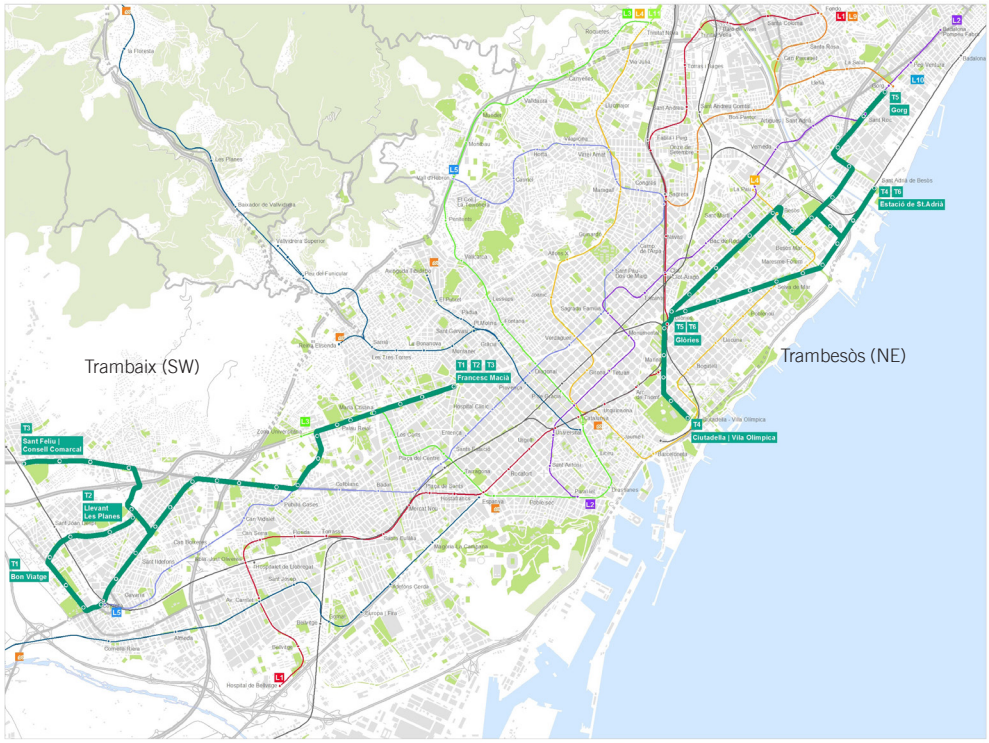
In 1989, the EMT published the original plan for the modern Barcelona tram system. This plan conceived of a tram line covering the whole of the avenue Avinguda Diagonal, from the Zona Universitària ("University Area") to the seafront area Diagonal Mar.

In 1997 the Autoritat del Transport Metropolità (Metropolitan Transport Authority, ATM) was created with the aim of bringing together and coordinating all the transport authorities in the metropolitan area. The consortium's shareholders were Catalonia's government (the Generalitat de Catalunya), with a share of 51%, and the metropolitan area's local authorities, with the remaining 49%. After the authority had been set up, the Catalan government, which had rail transport competences in Catalonia, gave the ATM the mission to create a rail network in Barcelona's metropolitan area.

Therefore, after making some modifications to the original EMT project, the ATM designed the final layout of the Barcelona metropolitan area's tram system. The final project consisted of two separate networks at the two extremes of Avinguda Diagonal, an avenue that crosses the whole city. The networks were created with the aim of integrating, renewing and providing cohesion to the outskirts of the Barcelona metropolitan area by improving transport connections within and between the area's cities.

2. Overview and Purpose of the Project

Figure 1. Tram networks



Source: Information provided by ATM.

The tender process for the Barcelona tram networks was divided into two contracts, one for the southwest (the so-called Trambaix line between Francesc Macià square and the Baix Llobregat area) and another for the northeast (the Trambesòs line between the district of Sant Martí and the municipality of Sant Adrià de Besòs).

The Trambaix network was announced in 1998. The contract was awarded in 2000, construction started in 2001 and the whole project was finished in 2007.[1]

Once construction had started on the Trambaix network, it was the turn of the Trambesòs network. The Trambesòs contract was announced at the beginning of 2002 and it was awarded in the fall of the same year. This network started to be built in 2003 and construction finished completely in 2008. Both contracts consisted of DBFOT projects.

3. Tender Process

The design of the Barcelona metropolitan tram system divided it into two different networks at the each end of the avenue Avinguda Diagonal. Then, given that there were going to be two networks, the ATM decided to announce two tender processes in order to find a concessionaire for each of the networks.

Table 1. Members of the bidding teams

GROUP B
FCC Construcción SA
Alstom Transporte SA
GROUP C
Europroject SA
Construcciones y obras públicas civiles SA
GROUP D
Actividades de construcción y servicios SA (ACS)
Caixa d'estalvis de Catalunya

Source: Information provided by ATM.

3.1. Trambaix

In 1998, the ATM decided to hold an international tender to design, build, finance, operate and transfer a tram system in the Baix Llobregat area (in the southwest of the Barcelona metropolitan area). Interested bidders had to submit a layout plan and a financial offer and needed to demonstrate a certain amount of experience of designing, building and operating transport networks.

Three groups of firms submitted offers that fulfilled all the requirements. Table 1 shows the principal partners in each team. Table 1 in Exhibit 2 shows all of them.

The bidding was divided into two rounds. In the first one, the teams had to prove that they fulfilled the required conditions. Once this was done, they had to present their proposal with the technical specifications and the budget in the second round.

The bidding involved the drafting of the project, and the construction and operation of the tram network. The bidders had some general guidelines about the layout but the final design and the building budget were part of the tender process.

Then each firm would submit a basic offer, plus alternatives improving the layout of the project especially in areas such as improvements in the route, facilities, garage, operation system, and financing systems[2]. Each of these areas of improvement may also include alternatives at different cost. Table 2 shows the best offer from each team. All the offers are shown in Exhibit 2.

The "integrated TramMet" option, from group B, had the highest number of points,and it was awarded the project. After the bidding, the ATM decided to make some modifications to the layout of the tram system. These modifications involved increasing the construction budget from €217,326,000 to €230,792,000.

Table 2. Financial offers

Group	Project	Budget	Points
B	Integrated TramMet option	€217,326,000	88.8
C	Option 1, financial offer ii	€263,862,000	61.19
D	Option A	€246,583,000	64.15

Source: Information provided by ATM.

[1] Different parts of the networks were inaugurated at different times, depending on the progress of construction – which is outlined in Exhibit 1.

[2] ATM Tender documents. 19.1.B Contents of the proposals for the second phase of the tender. Solutions for the improvement of the base project.

3.2. Trambesòs

The Trambesòs network tender process started in 2002, when the ATM decided to hold a contest to design, build, finance, operate and transfer a tram system in the northeast of the Barcelona metropolitan area. In contrast to the Trambaix case, where there were three bidders, this tender process had only one bidder in the first round. The shareholders of the bidder company were almost the same as the ones that won the Trambaix tender. The only difference in the partnership was the inclusion of Detren Compañía General de Servicios Ferroviarios SL. This company specialized in operating rail transport systems.

As only one bidder took part in the tender process, the contract was awarded to this bidder. The final budget was €200.5 million plus financial expenses and taxes.

4. Internal Project Characteristics

4.1. The Contracting Authority

The Autoritat del Transport Metropolità (Metropolitan Transport Authority or ATM) is an interadministrative consortium set up in 1997, which belong to the area comprising the counties [*comarques*] of Alt Penedès, Baix Llobregat, Barcelonès, Garraf, Maresme, Vallès Occidental and Vallès Oriental.

The administrations within the consortium are the Catalan government or Generalitat de Catalunya (51%) and local governments (49%), namely the Barcelona City Council (Ajuntament de Barcelona), Àrea Metropolitana de Barcelona (Metropolitan Area of Barcelona or AMB) and Associació de Municipis per la Mobilitat i el Transport Urbà (Association of Municipalities for Mobility and Urban Transport or AMTU). There is also the presence of representatives from the state central government (AGE) on ATM's governing bodies, as observers.[3]

The ATM is responsible for the following functions:

1. Planning infrastructure and services
2. Relations with public transport operators
3. Financing the system via public administrative bodies
4. Organizing fares
5. Communications
6. The future regulatory framework
7. Other mobility-related functions

Finally, the current light rail and tram networks were promoted by the ATM via the delegation of powers held by the Government of Catalonia and the Metropolitan Area of Barcelona (AMB, formerly the EMT).

4.2. The SPV Created for the Project

To build and operate both networks, the companies created three firms:

- Tramvia Metropolità SA, the company created to build the Trambaix network
- Operadora del Tramvia Metropolità SA, the company created to operate the Trambaix network[4]
- Tramvia Metropolità del Besòs SA, the company created to build and operate the Trambesòs network

Tramvia Metropolità SA and Tramvia Metropolità del Besòs SA had almost the same shareholders, with some small changes in proportions and the inclusion of Detren in the Trambesòs tender.[5]

However, Operadora del Tramvia Metropolità SA was 80% owned by Tramvia Metropolità SA and 20% owned by FMB and FGC.[6]

4.3. Members of the Bid-Winning Teams

The most important shareholders in the three firms were:

- **Alstom**: With sales of €6.9 billion, 31,000 workers and a presence in 60 countries, Alstom is one of the world's leading companies at building and maintaining trains.
- **FCC**: One of the most important construction companies in Spain, it is on the Ibex 35[7] stock exchange.

[3] ATM, "The Consortium: Autoritat del Transport Metropolità," www.atm.cat/web/en/atm.php, last accessed September 2017.

[4] The public authorities and the concessionaires agreed to merge Tramvia Metropolità SA and Operadora del Tramvia Metropolità SA in order to have only one concessionaire. This process is explained further in section 4.3.

[5] Pie charts showing the shareholder proportions can be seen in Exhibit 2. For the exact proportions, see the contract information on pages 8 and 9.

[6] FGC operates a network of light trains that connect some cities to the Barcelona metropolitan area.

[7] The IBEX 35® is the index made up by the 35 most liquid securities traded on the Spanish Market.

- **Grup Sarbus**: One of the leading's public transport companies in Catalonia, it specializes in bus transport. It has lengthy experience in this sector and is well established in Catalonia.

- **Acciona Construcción**:[8] This Spanish construction company is more than a century old and has a presence on five continents. The company had in 2016 a backlog of 7,527 million euros, 83% international.

- **Banco Sabadell**: This is one of the top 5 banks in Spain. The company was one of the main banks in charge of providing funding for the construction of the tram networks.

- **Globalvía**: In 2007, FCC and Caja Madrid – one of the most important construction companies and one of the biggest savings banks in Spain, respectively – decided to found Globalvía for managing and operating infrastructure. Nowadays, Globalvía runs 32 infrastructure projects around the world, and has offices in Madrid, Chile, Mexico, New York, and Ireland.

In the 2012-2013 period, once the tram system was fully built, some of the companies whose main business was construction and engineering (FCC, Acciona and Comsa) decided to sell their shares. The company that bought those shares was Globalvía, which at that time had Bankia and FCC as shareholders.

After buying the shares from FCC, Acciona and Comsa, Globalvía became the most important partner of the Barcelona tram system, with almost 50% of the shares.

In addition to these changes, the public companies FGC and EMT also became shareholders. This was a consequence of the merger, in September 2008, of Operadora del Tramvia Metropolità SA and Tramvia Metropolità SA.

The operational structure was simplified and the public operators became shareholders of Tramvia Metropolità SA, with 5% between them.[9]

4.4. Finance and Funding

The Barcelona tram system was funded principally using EIB loans. EIB funding represented 44.8% of the Trambaix network and 45.18% of the Trambesòs network. The second most important funding source was the project credit, principally supplied by Banco Sabadell and Société Générale, both shareholders in the concessionaires. The third and fourth most important funding sources were own funds and VAT credit.

Table 3. Company financing of the project

	Tramvia Metropolità del Besòs SA		Tramvia Metropolità del Besòs SA	
Application	**Amount (€M)**	**% of total**	**Amount (€M)**	**% of total**
Initial investment	230.8	75.97	200.5	72.41
Financial costs	29.4	9.68	19.8	7.15
DSRA*	4.8	1.58	4.8	1.73
VAT	0	0	33	11.92
Others	38.8	12.77	18.8	6.79
Subtotal	303.8	100	276.9	100
Financed	**Amount (€M)**	**% of total**	**Amount (€M)**	**% of total**
Own funds	30.5	10.04	30	10.83
EIB loans	136.1	44.80	125.1	45.18
Project credit	89	29.30	88.8	32.07
VAT credit	22.6	7.44	33	11.92
Subordinated credit	3.4	1.12	0	0
Subsidy	22.2	7.31	0	0
Subtotal	303.8	100	276.9	100

* Debt Service Reserve Account.

Source: Information provided by TRAM.

[8] At the time the contract was signed, this company was known as Necso SA.

[9] Pie charts showing the shareholder proportions can be seen in Exhibit 2. For the exact proportions, see the contract information on pages 8 and 9.

4.5. Construction Process

During the building of the project, there were some cost overruns. These resulted mainly from project modifications, where the ATM decided to change some of the project's characteristics. Table 4 disaggregates the investment and the cost overruns taken on by the ATM.

Table 4. Investment and cost overruns

	Trambaix		Trambesòs	
Expenditure	**Amount (€)**	**% of final cost**	**Amount (€)**	**% of final cost**
Initial project with modifications	222,146,881	73.83	215,873,661	81.62
Overruns		**% for overrun**		**% over total overcost**
Complementary projects	16,589,565	21.07	6,647,177	13.67
Building overruns	243,883	0.31	3,753,550	7.72
Price revisions	18,844,194	23.94	19,884,440	40.91
Expropriations	14,237,953	18.08		
Project honorarium	8,704,881	11.06	10,000,000	20.57
Term increase	20,021,380	25.43	8,218,254	16.91
Agreement with county council	87,435	0.11	106,633	0.22
Total overcost	78,729,291	26.17	48,610,054	18.38
Final cost	300,876,172	100	264,483,715	100

Source: Information provided by TRAM.

In Table 4, one can see that the cost overruns represented 26.17% of the final cost for the Trambaix network and 18.38% for the Trambesòs network. Unforeseen effects[10] were responsible for most of the cost overruns – 78.93% for the Trambaix network and 86.33% for the Trambesòs network.

Of the unforeseen effects, the principal one in the Trambaix case is the term increase, caused mainly by the delay in obtaining the land. This in turn led to other cost overruns relating to expropriations and price revisions. In the Trambesòs case, the principal cause of unforeseen cost overruns was price revisions.

4.6. PPP Payment Method

The total income in both networks is divided into four components: an annual payment, a technical fare, advertising income, and sales of single tickets.

Annual subsidy. The ATM pledged to pay a capital subsidy for the Trambaix to fund the entire infrastructure cost. This payment had to be made between 2003 and 2015, at a rate of €11,942,110.51 per year plus interest.

In the Trambesòs case, instead of a capital subsidy, the public authorities would have to pay an annual fixed fee of €13,050,000 plus VAT per year between 2004 and 2021.

Technical fare. This is in response to the Barcelona public transport network's integrated payment system. The system allows travelers, using the same ticket, to use all of the public transport network, to make transfers without paying for an extra ticket and to buy tickets for more than one journey in order to enjoy discounted prices.

Table 5. Structure of yearly income

	Trambaix	Trambesòs
Annual subsidy	€11,942,110.51 a year plus interest	€13,050,000 net per year
Technical fare	See Exhibit 3	See Exhibit 3
Advertising income	60%	60%
Self-financing	100% of the income from sales of individual tickets	

Source: Information provided by TRAM.

[10] Unforeseen effects are the sum of all the cost overruns without the complementary projects.

Therefore, tickets are often not bought in the station where the means of public transport is going to be boarded. To distribute the income, the ATM takes all the money from sales of all tickets other than single tickets in order to pay the operator for the service, depending on the price per user and the number of users.

The technical fare covers the investment, the operational costs and the industrial profits from the operator.

To calculate the amount of the technical fare, the ATM and the concessionaire defined four different demand bands, depending on the number of users. The bands are multiplied by the number of actual users in order to calculate the fare.

Exhibit 3 provides a graphical representation of the band payment method. The lines represent the demand bands. In the example of the Trambaix case, the 52% line is band 1 and the 100% line is band 3. Areas A to D are the actual demand.

For all travelers in area A, payment is at the band 1 price. For those in area B, payment is at the band 2 price, and so on so forth. Each jump between bands produces a reduction in the marginal income per user. Despite both tram networks having this system, the calculation of the bands is different and depends on the specific characteristics of each network.

Advertising income. In both concessions the concessionaires obtain 60% of net income.[11]

Self-financing. At the tram stations, multiple-journey tickets and single tickets are sold. Single tickets are going to be used for the tram service, so there is no need for the ATM distribution policies to come into play and the concessionaire receives the income from those tickets directly.

4.7. Risk and Risk Mitigation

As in any PPP project, a proper risk assessment was crucial. An important point in the literature is the transmission of the risk to the party that can best deal with it.[12] In this project, the different risks can be divided as follows:

- **Land and space risk**: This risk was taken by the city councils involved in the project, which were in charge of carrying out the expropriations being the beneficiary the ATM.
- **Design and construction risk**: This risk was assumed by the concessionaire, which was in charge of designing the layout and building the project.
- **Financial risk**: This risk was taken by the concessionaire, principally by the financial institutions that made up the partnership – that is, Banco Sabadell and Société Générale. Nevertheless, almost 50% of the project was financed by the EIB, which as a result took on part of the risk.

Table 6. Risk Sharing

	Trambaix	Trambesòs
Land and space risk	City Councils	City Councils
Design and construction risk	Tramvia Metropolità SA	Tramvia Metropolità del Besòs SA
Financial risk	Tramvia Metropolità SA	Tramvia Metropolità del Besòs SA
Operations and maintenance risk	Tramvia Metropolità SA	Tramvia Metropolità del Besòs SA
Demand risk	ATM, Tramvia Metropolità SA	ATM and Tramvia Metropolità del Besòs SA

Source: Information provided by ATM.

[11] The remaining 40% is for the ATM.

[12] Contract theory studies how economic actors deal with contractual arrangements, generally in the presence of asymmetric information. This theory states that the risk should be assigned to the party that can control the risk's origin or the party that is best able to absorb the risk in cases of high risk aversion. See Engel, Fischer and Galetovic (2014).

- **Operations and maintenance risk**: This risk was borne by concessionaire.
  - The Trambaix concessionaire was Operadora del Tramvia Metropolità SA until 2007 and Tramvia Metropolità SA from then on.
  - In the Trambesòs case, the concessionaire was Tramvia Metropolità del Besòs SA.
- **Demand risk**: This risk was not transferred in full and it remained principally in the hands of the public authority. Nevertheless, the final revenues of the concessionaires depend partially on the evolution of the band system payment (that depends on the total number of users).

4.8. Technical Elements and Facilities

The technical elements are among the most important points in this kind of contract. The most important elements of the tram contracts are set out in Table 7.

Table 7. Technical elements

	Trambaix	Trambesòs
Trams	23	18
Stations	29	27
Track network	15.1 km	14.0 km
Depot and workshop area	21,000 m^2	11,100 m^2
Parking tracks	7	5
Workshop tracks	7	4
Photovoltaic solar plant	104.4 kWp (kilowatts-peak)	

* Each tram can carry 218 passengers and two trams can be attached to each other at peak times.

Source: Information provided by TRAM.

In addition, the depot and workshop have a warehouse of spare parts, a ticketing workshop, a paint workshop and a control and communications center. At the control center, they have information in real time about the position of each train and real-time images of the inside and outside of the trains.

Workers in the control centers can monitor what is happening in the networks. This allows the tramway teams to send help if there is an accident or to send doubled trains if they detect a peak in demand.

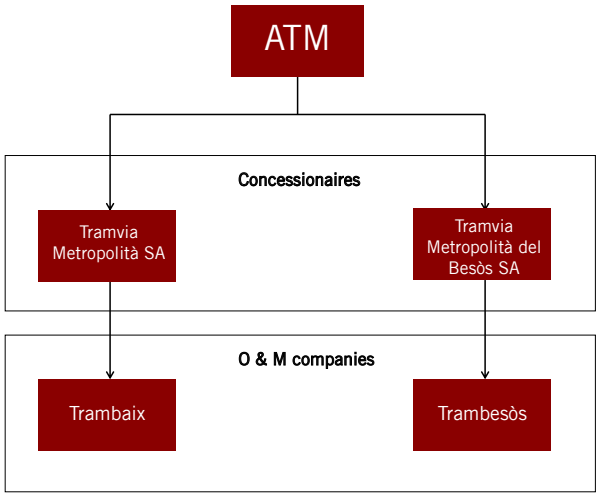
4.9. Governance

The uncertainty of how the future will affect a PPP contract makes governance a key issue in long-term contracts. Solving disagreements that might arise among stakeholders as a result of different unexpected situations is a matter of governance. The impossibility of predicting every possible scenario and writing them into contracts is what makes a contract "incomplete."[13]

The main agents involved in the project are:

- The ATM, the contracting authority. This institution's objective is to establish and speed up cooperation between the various public administrative bodies that own the public transport networks and infrastructure in the metropolitan area of Barcelona
- The concessionaires:
  - Tramvia Metropolità SA
  - Tramvia Metropolità del Besòs SA

Figure 2. Barcelona tramway's organizational structure



Source: Information provided by ATM.

[13] In practice, contracts cannot specify what is to be done in every possible eventuality. See the previous footnote 10 on contract theory for more.

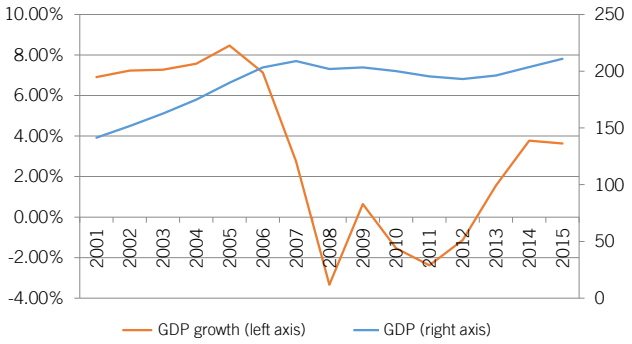
5. External Project Characteristics

5.1. Economic Conditions

Both contracts were awarded in the early 2000s.[14] As we can see on the main axis of Figure 3, Catalonia's GDP was growing by around 7% a year at that time. Catalonia's debt levels were less than 10% of the autonomous community's GDP. This made the environment appropriate for starting an important infrastructure project like the tramway one.

The situation changed completely in 2008 when the GDP growth rate fell from 7.17% to 2.75% as a consequence of the financial crisis of 2007. The final part of the tram system had been inaugurated in June 2008. This meant construction had already finished before the significant fall in GDP and the budgets that were to be introduced in the following years.

Figure 3. GDP evolution

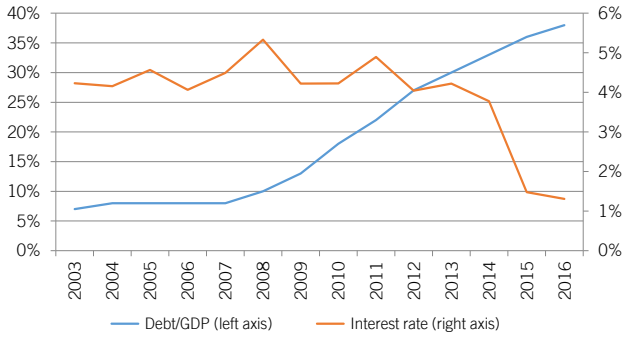


Source: Information provided by AIReF.

In 2009, the year after the construction period finished, Catalonia's GDP had a negative growth of 3.34%. Despite the small recovery in 2010, the economy returned to negative growth in 2011 and this continued until 2014.

The fall in economic activity was accompanied by a rise in the amount of debt of Catalonia's regional government. Its debt level went from 7.76% of GDP in 2007 to 37.69% in 2016. So, in nine years the level of indebtedness grew by 386%, as shown in Figure 4.

Figure 4. Evolution of Catalonia's interest rate and debt



Source: Information provided by AIReF.

Thanks to the expansive monetary policy followed by the ECB, this spectacular rise in the amount of debt in the hands of the regional government did not produce a high rise in the average interest rate as would be expected.

5.2. Social/Civil Conditions

The southwest and northeast of the Barcelona metropolitan area are densely populated areas. Figure 5 shows that those areas have more than 5,000 inhabitants per square kilometer.

In Figure 5, we can see that, in addition to the city of Barcelona, the population density is higher in the cities of L'Hospitalet de Llobregat, Sant Joan Despí, Cornellà de Llobregat and Esplugues de Llobregat in the south, and Santa Coloma de Gramenet, Badalona and Sant Adrià de Besòs in the north. It should be noted that in 2016 L'Hospitalet de Llobregat was the 16th biggest city in Spain and Badalona the 22nd according to the local register of inhabitants.[15]

[14] The Trambaix tender was awarded on April 27, 2000, and the Trambesòs one on July, 2002.

[15] Instituto Nacional de Estadística. 2017. *Detalle municipal*. [Online]. [Last accessed September 2017]. Available from: http://www.ine.es/dynt3/inebase/index.htm?padre=525.

Figure 5

Source: Information provided by ATM.

5.3. Political Conditions

The Catalan political environment was stable at the beginning of this project. From 1980 to 2003 the government remained in the hands of CiU, a centrist liberal Catalan nationalist alliance. In 2003, the Socialists' Party of Catalonia (PSC, a social democratic party) formed a new government in a tripartite alliance. In 2010 during the economic crisis a CIU-led government was elected. The party stayed in power until 2015 when a political alliance in which CIU was the leading political party was elected.

However, the Catalan government was not the only public institution involved in the tram project. The other important public authority involved was the Barcelona City Council. During the drafting of the project and the construction period, the city's government was in the hands of the PSC. This party pushed for reintroduction of the tram project and, in the final years of its government, started speaking about the need to connect both networks.

In 2011, CiU won the city council elections. It was not in favor of connecting the two tram networks. Its proposal for solving the increasing congestion problems of the bus network on the avenue Avinguda Diagonal was to improve the existing bus network.

In 2015, Barcelona en Comú (Barcelona in Common) – a new social democratic platform founded with the aim of political renewal – won the city elections. However, the group did not have not an absolute majority so it had to rule with the help of the PSC, among others. With this new government, the plan to unite the tram networks was back on the table.

These political changes did not affect the project performance thanks to a politically independent management structure.

6. Benefits of the Project

6.1. For the City's Residents

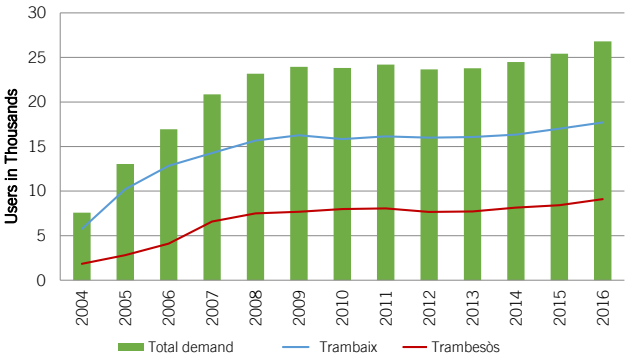
The addition of the tram system to the existing bus network increased the capacity of public transport lines. People in the areas covered by the tram networks had more public transport options, including with a new form of transport that was considered more comfortable[16] and environmentally friendly.[17]

[16] The tram obtained the best rating in the Workday Mobility Survey (Enquesta de Mobilitat en Dia Feiner).

[17] The tram system is partially powered by solar energy.

To test the trams' acceptance, we have plotted in Figure 6 the evolution of users from the first inauguration in 2004 up to 2016. We can see how the level of users stabilized in 2009, the first full year with the entire layout of both networks fully working. In 2015 the tram system surpassed the milestone of 25 million users for the first time.

Figure 6. Tram users



Source: Information provided by TRAM.

The huge difference in demand between the two networks is remarkable. This difference is mainly because of three factors:[18]

- The higher population density in the Trambaix area and lack of alternatives
- The presence of a university campus in the Trambaix area, where the tram is the best public transport option
- The emergence of the financial crisis during the redevelopment of the Trambesòs area

Figure 7. Carretera d'Esplugues

2001

2017

Source: Information provided by TRAM.

The Trambaix project's aim was not only to improve public transport connections in the southwest of the Barcelona metropolitan area. The project sought to do this at the same time as the surrounding areas were being redeveloped and renewed. The old car-only roads were being transformed into nice and spacious boulevards with the tram tracks in the middle. In Figure 7, we can see a photo from 2001, before construction started on the tram system, and another one after construction.

Once the Trambaix construction had started, it was the turn of the Trambesòs network. At the beginning of 2002, the Trambesòs contract was announced and, in July of the same year, the contract was awarded. Construction started on the network in 2003 and finished completely in 2008.[19] Both contracts were DBFOT contracts.

As in the Trambaix case, the Trambesòs network was seeking to improve public transport at the same time as the surrounding areas were being renewed. The northern cities in the Barcelona metropolitan area have traditionally been middle-low income areas.[20] Through the Trambesòs project, the public authorities were trying to improve social cohesion and integration in those areas. The tram system was part of a broader city strategy, which envisaged the introduction of other public services such as a new university campus of the UPC (which opened in 2016) and the Parc del Fòrum waterfront complex. We can see in Figure 6 how the number of Trambesòs tram users increased in 2016, partially thanks to the opening of the university campus.

[18] The first two factors were taken into account when the tender process was designed and demand forecasts were being estimated.

[19] Different parts of the networks were inaugurated at different times, depending on the progress of construction – which is outlined in Exhibit 1.

[20] Information provided by ATM.

Figure 8. Plaça de les Glòries Catalanes

2001

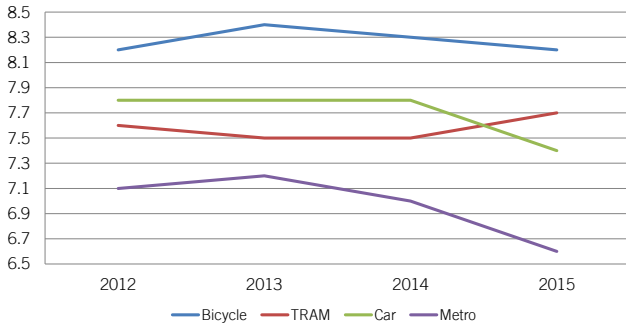
2017

Source: Information provided by TRAM.

As an ATM source said, the Trambesòs network is a symbol of the progress made by dilapidated areas that have tried, through improved public transport connections, to reduce the disrepair of these areas and integrate them with the rest of the Barcelona metropolitan area.

Every year, the ATM carries out its Workday Mobility Survey (EMEF) on the quality of transport in the Barcelona metropolitan area. Using the survey, we can see the evolution of the acceptance rate of the area's tram system. In the graph in Figure 9, we have plotted the most important means of transport and their average acceptance rate.

Figure 9. Average acceptance rate



Source: Information provided by ATM.

We can see how the bicycle is, of the four analyzed options, the preferred one in each year. Likewise, the metro is the least preferred option in each year. In addition, the metro's average acceptance rate has been decreasing. On the other hand, the tram has followed a path of increasing acceptance and, in 2015, it was preferred to the car for travel inside the metropolitan area. Therefore, from the users' point of view, the trams should be considered a success.

6.2. For the Contracting Authority

Usually, the most important points about using a PPP structure are sharing risks and taking advantage of the concessionaire's know-how. Such contracts are usually implemented in a field where the public authorities have little experience or the public authorities cannot deal with the risk properly.

Therefore, in those cases, thanks to the PPP contracts, society pays a price – in the form of profits – to the private company in order to use its know-how. Then, thanks to this know-how that society has bought, the final social cost should be lower than with public provision under certain circumstances.

The ATM considers the main benefits of using a PPP structure the following:

- Transfer risk of construction over-cost
- Reducing construction time
- Partial transfer of demand risk
- Concessionaire benefiting from lower operating costs that can benefit public authority if it does exist competition in tender process
- Risk transfer for the renovation of equipment during the operating period
- Insurance cost transferred to the operator

6.3. For the Bid-Winning Companies

The bid-winning companies benefited financially and in terms of their reputations. On the one hand, they were guaranteed a profit if the demand was at least half that expected. So their demand risk was very limited, meaning they were almost certain to make a profit.

On the other hand, in the Trambaix network, they did not have any capital risk because the public authorities were paying the capital investment.[21]

However, the financial profits were not the only gains. The project had important reputational effects as the partnership would become more prominent in the tram construction market.

7. Evaluation

7.1. PPP Methodology

This PPP project is the result of a contract between metropolitan institutions in Barcelona and a private operator, to build and operate two tram lines that connect the city center with two different areas on the outskirts. The two lines are integrated into the city's public transport network. Operations started in 2004 and the planned duration of the contract is 28 years (including a three-year extension). The project therefore bundles together the construction and operation of the service, providing incentives for whole-life cost reduction.

The private consortium that won the bidding process for each network committed itself to financing the investments, receiving in exchange both subsidies and receipts from user fees. These receipts are restricted because they are integrated into the ticketing system of the Barcelona region's whole public transport network. The combination of subsidies and user fees is standard in public transport projects, both when they are public and when they are subject to a PPP contract. Although in theory some demand risk could have been allocated to the company, in fact the risk transfer had little influence on demand, which is a function of income, travel preferences, urban characteristics and the existence of alternatives.

In principle, the fact that the project aims to bundle together a number of activities that previously were isolated fits in with the principles of incentive theory as applied to PPPs. In this way the operator can take into account the impact of its decisions in one activity segment on other segments, thereby achieving economies of scope and better control of the lifetime costs.

Another strength of the project is that, despite its short experience so far, it has already survived two significant political changes in the Barcelona City Council, which changed its mayor in 2011 and again in 2015. However, this being a wider metropolitan project, Barcelona City Council changes are not representative of the more stable political cycle in the metropolitan area as a whole.

A positive aspect of this project is the involvement of the European Investment Bank. The presence of an international financial institution with a public mission and high standards ensures that there will be pressure to achieve efficiency and financial discipline. The participation of international financial institutions has been pointed out as something positive in PPPs, especially when the duration of the contract is very long, in recent work by the Nobel Prize winner Joseph Stiglitz and other researchers[22].

The project's main weakness is the absence of an initial social cost-benefit analysis and the very limited ex ante competition in the bidding process. For one of the lines there were three bidders but for the other one only the winning bidder submitted an offer in the first round. This very limited competition raises doubts about the managerial team's ability to maximize productive efficiency. The absence of an independent and transparent social cost-benefit analysis, performed with the highest standards and with full transparency, raises the possibility of cost overruns or underestimation and the potential overestimation of benefits. An ex ante social cost-benefit analysis should have taken into account the possibility of alternative means of transport for the same routes. To this extent, some hidden liabilities due to cost overruns may not be transparent to the public. The public authorities should be held accountable, at least politically, for their passenger forecasts, which could be made public. Some of the land expropriations were controversial in this project but the company had little control over the cost of expropriations, so it made sense for this risk to be borne by the public authorities.

[21] See section 4.6, "PPP Payment Method."

[22] Arezki, R. et al (2017). From global savings glut to financing infrastructure. Economic Policy, Volume 32, Issue 90, 1 April 2017, Pages 221–261.

Some regulatory possibilities that arise when there are two monopolies with similar characteristics have not been explored. For example, it would be possible to practice yardstick competition[23] but this is limited by the fact that the same consortium is operating the two lines. Yardstick competition would imply using one line's costs to make decisions on the subsidies or user fees of the other line. Whereas user fees are restricted and must be in accordance with those of the integrated public transport network, the subsidies could be made contingent, to some extent, on some measure of the other line's unit costs, subject to some kind of quality threshold.

Overall, the PPP project is a sensible one after the bidding process. Although the project did not pass a rigorous cost-benefit analysis and the bidding process was very restrictive, once an operator had been selected, the project had the characteristics of a standard PPP. Perhaps some more revenue for the project could have been secured if there had been a higher valuation of the real estate obtained through the project. Good governance is guaranteed by Barcelona's generally well-functioning metropolitan institutions and the integration of the project into the public transport network, which guarantees that the authorities and the contractors will be aware of the need to maintain high standards of transparency and a fair process.

7.2. City Strategy

The Barcelona tram service is a fundamental part of the transport system in the city of Barcelona. Furthermore, the tram system affects multiple dimensions of the city, the most significant ones being mobility, the environment, urban planning, the economy and social cohesion. The trams have a tremendous impact on the environment because of the traffic that moves from private cars or even buses to clean trams as well as the influence that the trams may have on the use of other forms of transport in the city (most significantly, bikes and walking). Overall, these two tram networks are a backbone for the city and have many implications for urban planning in Barcelona. Last but not least, the connection with the surrounding cities in the metropolitan area has a tremendous impact economically and in terms of social cohesion. People in the tram networks' areas now have easy connections to get to work and go shopping in Barcelona. The economic and social cohesion effects of new integrated forms of mobility. Overall, the interactions among these factors are so significant that any related decision should be the consequences of a strategic plan for the city. The impression is given that, while part of Barcelona's mobility plans, these kinds of strategic integration have not been much considered in the design, planning and deployment of the two tram systems.

When the infrastructure is taken in isolation, the design of the contract and the implementation of the plan seem to follow current best practice, as the PPP analysis shows. However, this infrastructure is so essential and central that the strategic integration is notable by its absence. Was the impact of this plan or of alternative plans on the city's environmental problems taken into sufficient account? Were the evolution of other forms of mobility and the connections with the tram system considered? Was the positive or negative impact on commercial activities in the city taken into account? Was the job creation impact considered? Was the infrastructure used to reinforce technological connectivity?

Already focused in the planned infrastructure, the value creation in the contract seemed quite positive. The change in ownership between the construction phase and the operational phase may surprise readers as a great deal of the value created comes from bundling design, construction and operations. I interpret this as an internal move from one division to another so the bundling benefits are obtained (and value created) and such benefits are distributed internally to use the best expertise needed in each phase.

Finally, at the governance level, the very important role of the ATM as a contracting partner can be highlighted. The ATM integrates not only the geography of the metropolitan area but also many different modes of transport that are present in that geographical area. As work starts on plans to integrate the two tram networks and complete the connection of the whole of the Avinguda Diagonal, it is possible to see the capacity of the current governance to renegotiate unfinished operations with a new plan for a different Barcelona in the future. It is to be hoped that this time those involved will take the time to consider the strategic implications of such changes.

[23] Andrei Shleifer (1985). "A Theory of Yardstick Competition." *Rand Journal of Economics*, 16(3): 319 327.

Table 8. Barcelona Tramway

PPP Methodology	Trambaix		Trambesòs	
	Existing	Details	Existing	Details
1. Procurement method & Bidding process				
1.1. Value for Money analysis or CBA*	–	–	–	–
1.2. Real Competition for the Contract	Yes	Three bidders	No	One bidder
1.3. Tender evaluation committee	Yes	External	Yes	External
2. Contractual issues & incentives				
2.1. Building	Yes	DBFOT	Yes	DBFOT
2.2. Quality verifiable	Yes	Via outflow	Yes	Via outflow
2.3. Externalities	Yes	Positives	Yes	Positives
2.4. Duration		25 years		27 years
3. Risk, finance & payments				
3.1. Construction & Operation Risk	Not transferred	The ATM pays the whole investment	Transferred	The ATM investment payments depends on demand
3.2. Demand Risk	Not transferred	The ATM ensures the operating costs are covered	Not transferred	The ATM ensures the operating costs are covered
3.3. Policy & Macroeconomic Risk	No			
3.4. Payment Mechanism	Usage + availability + capital subsidy		Usage + availability	
3.5. Special Purpose Vehicle (SPV)	Yes	Tramvia Metropolità SA and Operadora del Tramvia Metropolità SA	Yes	Tramvia Metropolità del Besòs SA
4. Governance				
4.1. Transparency	No		No	
4.2. Participatory decision-making process	Not observed		Not observed	
4.3. Legal framework	Yes	General Regulation of the Public Administration Contract Law, approved by Royal Decree 1098/2001	Yes	General Regulation of the Public Administration Contract Law, approved by Royal Decree 1098/2001
4.4. Distribution of tasks	Contracting	ATM	Contracting	ATM
	Renegotiation	ATM	Renegotiation	ATM
	Regulation	Catalan and Spanish governments	Regulation	Catalan and Spanish governments
	Operations and quality	Tramvia Metropolità SA	Operations and quality	Tramvia Metropolità del Besòs SA
5. Building process				
5.1. Cost Overrun	Yes	€78,729,291.00	Yes	€48,610,054.00
5.2. Delayed deadlines	Yes	Several months	Yes	Caused by expropiations
6. Potential Benefits				
6.1. Possible price certainty	Yes		Yes	
6.2. Transfer of responsabilities to private sector	No	The demand risk remains with the public administration	No	The demand risk remains with the public administration
6.3. Scope and incentives for innovation	Yes	Intallation of Wi-fi on the tram	Yes	Intallation of Wi-Fi on the Tramway
6.4. Savings in public payments	No	The public administration pays a higher average interest rate to the concessionaire than the regional government	No	The public administration pays a higher average interest rate to the concessionaire than the regional government
6.5. Life-cycle approach	No	The operation is in the hands of Operadora del Tramvia Metropolità SA	Yes	The same firm builds and operates the network
6.6. Incentive to be on time	Yes	The greater the delay, the shorter the operating period will be	Yes	The greater the delay, the shorter the operating period will be

Source: Prepared by the authors.

7.3. Achievement of United Nations Sustainable Development Goals

Table 9.

Sustainable Development Goals	Tramways Barcelona	
	high Impact	Moderate Impact
1. No poverty		
2. Zero hunger		
3. Good health & well-being		
4. Quality education		
5. Gender equality		
6. Clean water & sanitation		
7. Affordable & clean energy	✓	
8. Decent work & economic growth		
9. Industry innovation & infrastructure	✓	✓
10. Reduced inequalities		✓
11. Sustainable cities & communities	✓	
12. Responsible consumption & production		
13. Climate action	✓	
14. Life below water		
15. Life on land		
16. Peace, justice & strong institutions		
17. Partnership for the goals	✓	

Source: Prepared by the authors.

As seen in Table 9, the Barcelona tram service allows some of the United Nations Sustainable Development Goals to be achieved. The goals on which this project will have the most obvious impact are those numbered 7, 11, 13 and 17. Goals 7 and 13 are related in this project as, thanks to the tram system's use of renewal energy, it is clear that this form of transport helps achieve the goal of using more clean energy (goal 7) and helps reduce climate change (goal 13). Success in getting people to use this kind of transport guarantees the achievement of those goals.

Other Sustainable Development Goals on which the project has a high impact are goal 11 (sustainable cities and communities) and goal 17 (partnership for the goals). Goal 11 – related to goals 7 and 13 (on the use of renewal energy and public transport) – is about guaranteeing a more sustainable city from an environmental point of view. However, sustainability might also be from a social point of view, as the tram system gives people an alternative means of transport that is cheaper than private cars and gives low-income workers access to jobs at a more competitive commuting cost than was the case prior to the introduction of the trams. For goal 17, it is obvious that this project is an example of good cooperation between public and private partners.

In addition to these main effects, the tram system has had an impact on other Sustainable Development Goals to a lesser extent, such as goal 9 (industry, innovation and infrastructure) and goal 10 (reduced inequalities). For goal 9, the introduction of a tram system in Barcelona using a PPP contract allowed the concessionaires and the public authorities to know the costs and benefits of this kind of project. Since the Barcelona experience, tram systems using PPP contracts have appeared in other cities in Spain, including Seville, Zaragoza or Málaga. These new systems have added to those that already existed in cities such as València and Alicante (Alacant), the pioneers in reintroducing the tram to modern cities using direct public provision. For goal 10, the reduction of inequalities can be looked at indirectly and as a result of achieving goal 11. The more options lower-income residents are given, the more inequalities are reduced. And the tram system has offered more options to this social class.

8. Conclusions

The Barcelona tram network is a successful PPP in all the analyzed areas, principally in the PPP methodology. Furthermore, as pointed out in the "City Strategy" analysis (section 9.2), the project is performing the very important task of increasing cohesion on the outskirts of the metropolitan area. It also allows some of the United Nations Sustainable Development Goals to be achieved, especially goals 17 and 11.

Another indicator of the project's success is that the expected passenger levels have been achieved in both networks. Exhibit 3 shows that the user levels were around the levels expected. Therefore, we should point out a great job has been done in making the forecast and achieving the predicted levels.

The final construction expenditure was close to the amount expected. In addition, the main budget deviations were the result of changes carried out by the ATM to improve the project. On this basis, we can conclude that the Barcelona tram project is a successful PPP.

Despite this success, we have to remark on the lack of competition during the tender process, especially in the Trambesòs network, where there was only one bidder. Nevertheless, the price per kilometer of track in the Trambesòs network is pretty close to the price for the Trambaix network. Therefore, the level of monopolistic rent does not seem to be large. However, for future contracts, the metropolitan authorities should try to increase the number of bidders in the spirit of improving competition.

Finally, we have analyzed possible reasons why the public administrative bodies decided to use a PPP contract instead of direct provision. We found that, in line with the scientific literature, the relative contracting costs – in the form of extra costs and construction time – were the most important reasons behind the PPP decision. However, no study has been done to find out the potential benefits of using a PPP instead of using public provision. So it would be interesting to carry out a study on the period following the end of the contracts to elucidate the benefits of the chosen PPP structure in the current contract and the potential benefits of a new contract. Such a study would serve the purpose of helping to decide what to do once the contract is finished, whether it would be socially desirable to continue with a PPP or, on the contrary, whether it would be socially optimal to provide the tram service directly.

Exhibit 1. Network Openings

TRAMBAIX Start of construction: June 2001		
Opening data	**Line**	**Characteristics**
April 2004	T1,T2, T3	Francesc Macià to Sant Martí de l'Erm (halt)/ Montesa 11.8 km 23 stations + 1 halt
May 2004	T3	Montesa to Sant Martí de l'Erm 0.6 km 1 station
January 2006	T3	Sant Martí de l'Erm to Consell Comarcal (Torreblanca) 2.2 km 3 stations
April 2007	T3	Torreblanca to Sant Feliu I Consell Comarcal 0.6 km 1 station

Source: Information provided by TRAM.

TRAMBESÒS Start of construction: January 2003		
Opening data	**Line**	**Characteristics**
May 2004	T4	Glòries to Estació de Sant Adrià 4.8 km 10 stations
July 2004	T4	Glòries to Ciutadella I Vila Olímpica 1.8 km 4 stations
October 2006	T5	Glòries to Besòs 2.6 km 4 stations
May 2007	T5	Besòs to Sant Joan Baptista 2.2 km 4 stations
September 2007	T5	Sant Joan Baptista to Gorg 2.2 km 3 stations
June 2008	T6	Rambla de la Mina 0.6 km 1 station

Source: Information provided by TRAM.

Exhibit 2. Bidder Information

Table 1

Members of the Bidding Teams
GROUP B
FCC Construcción SA
Alstom Transporte SA
Alstom Transport
Marfina SL
Arande SL
Comsa
Necso Entrecanales Cubiertas SA
Acciona
Soler i Sauret SA
CGT Corporación General de Transportes SA
CGEA Connex
BanSabadell Inversió Desenvolupament SA
Société Générale in Spain
GROUP C
Europroject SA
Construcciones y obras públicas y civiles SA
Empresa Sagalés SA
Azvi SA
Générale de Transport et Industrie (GRUP VIA-GTI)
Idom Ingeniería y Consultoría SA
Cintra, concesiones de infraestructuras de transportes SA
GROUP D
Société européenne pour le développement des transports publics (Transdev)
Construcciones y obras públicas y civiles SA
ACS, Actividades de contrucción y servicios SA
Caixa d'estalvis de Catalunya
CDC PROJECTS SA
Dragados y construcción P.O. SA
MOHN SL
OBRAS y contratas Javier Guinovart SA
SEMALY SA
SIEMENS SA
SIEMENS AKTIENGESELLSCHAFT

Source: Information provided by ATM.

Exhibit 2. (Continued)

Table 2

Group B financial offer			
Project	**Price: Mpta**	**Price: €M**	**Points**
Base option	49,893	299.863	81.8
Financial option	48,736	292.909	5.3
Integrated financial option	48,736	292.909	86.3
TramMet option	36,160	217.326	87.3
Integrated TramMet option	36,160	217.326	88.8

Source: Information provided by ATM.

Table 3

Group C financial offer			
Project	**Price: Mpta**	**Price: €M**	**Points**
Option 1, financial offer i	43,903	263.862	58.69
Option 2, financial offer i	44,056	264.782	56.75
Option 3, financial offer i	45,929	276.039	52.09
Option 4, financial offer i	45,212	271.730	51.15
Option 1, financial offer ii	43,903	263.862	61.19
Option 2, financial offer ii	44,055	264.776	59.25
Option 3, financial offer ii	45,929	276.039	54.59
Option 4, financial offer ii	47,081	282.963	53.65

Source: Information provided by ATM.

Table 4

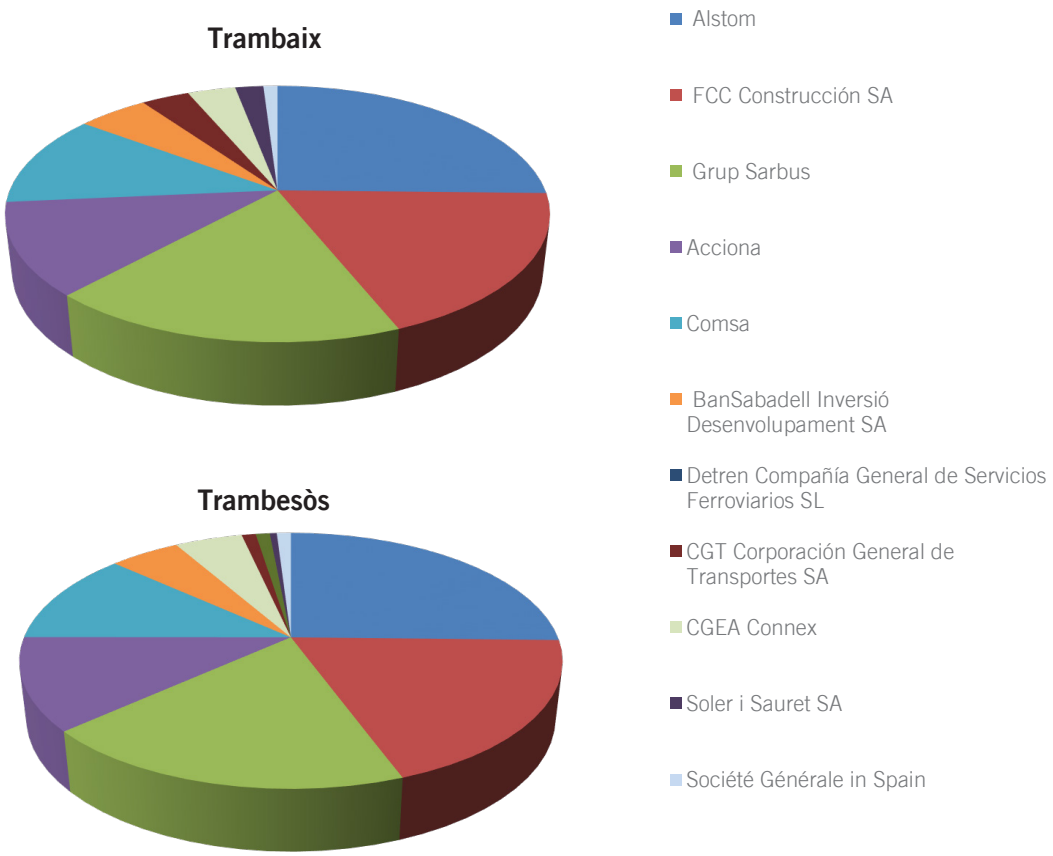
Group D Financial offer			
Project	**Price: Mpta**	**Price: €M**	**Points**
Option A	41,028	246.583	64.15
Option B	31,720	190.641	50.73

Source: Information provided by ATM.

Exhibit 2. (Continued)

Figure 1

Initial consortium members

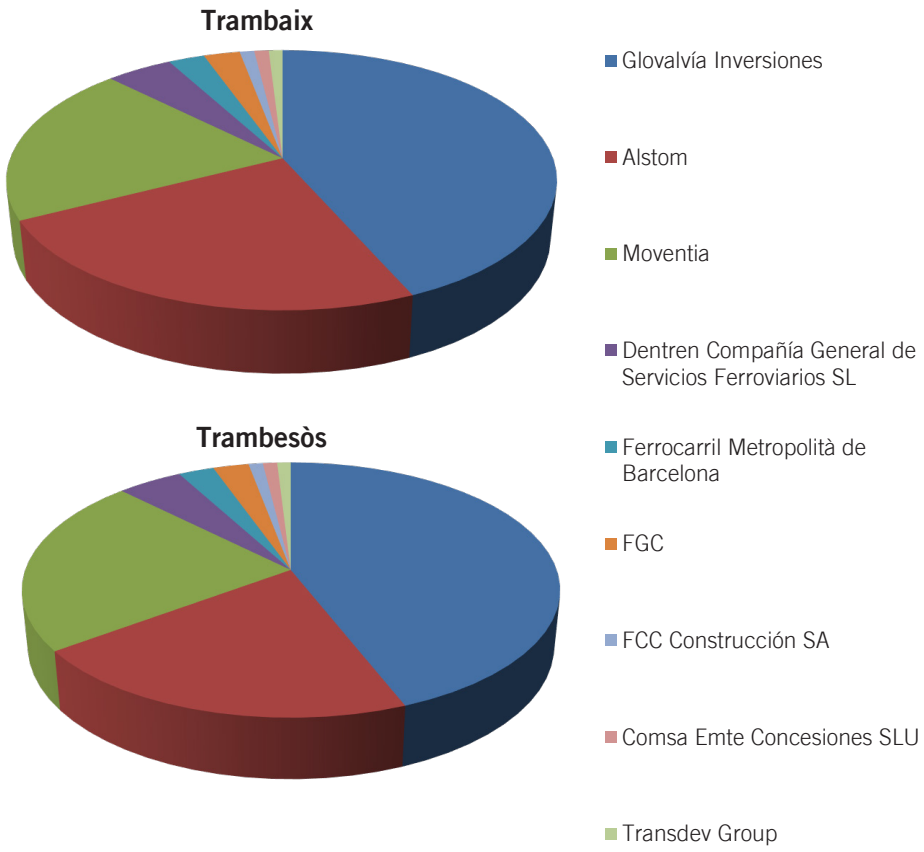


Source: Information provided by TRAM.

Exhibit 2. (Continued)

Figure 2

Current consortium members



Source: Information provided by TRAM.

Exhibit 3. Payment Method

Trambaix band payment system		
	Expected validations	Technical fare of band
Band 1[a]	52%	$\frac{\textit{82\% levy+OE+CB}}{\textit{No. of validations expected in band 1}}$
Band 2	80%	$\frac{\textit{15\% levy}}{\textit{difference between No. of validations expected in bands 1 and 2}}$
Band 3	100%	$\frac{\textit{3\% levy}}{\textit{difference between No. of validations expected in bands 2 and 3}}$
Band 4	120%	*34% of the weighted average tariff* [b]
Band 5	More than 120%	*20% of the weighted average tariff*

Source: Information provided by ATM.

Trambesòs band payment system	
	Technical fare of band
Band 1	$\frac{\textit{investment amortization assigned to band 1+OE+CB}}{\textit{No. of validations expected in band 1}}$[c]
Band 2	$\frac{\textit{investment amortization assigned to band 2}}{\textit{difference between No. of validations expected in bands 1 and 2}}$
Band 3	$\frac{\textit{investment amortization assigned to band 1}}{\textit{difference between No. of validations expected in bands 2 and 3}}$
Band 4	*34% of the weighted average tariff* [d]
Band 5	*20% of the weighted average tariff*

[a] 82% levy: Construction, insurance and financing costs, etc. These costs are fixed in the contract.
OE: Operating expenses (OE) resulting from the operating activities.
CB: Concessionaire benefits (CB). The ATM ensures 10% of industrial profits go to the concessionaire.

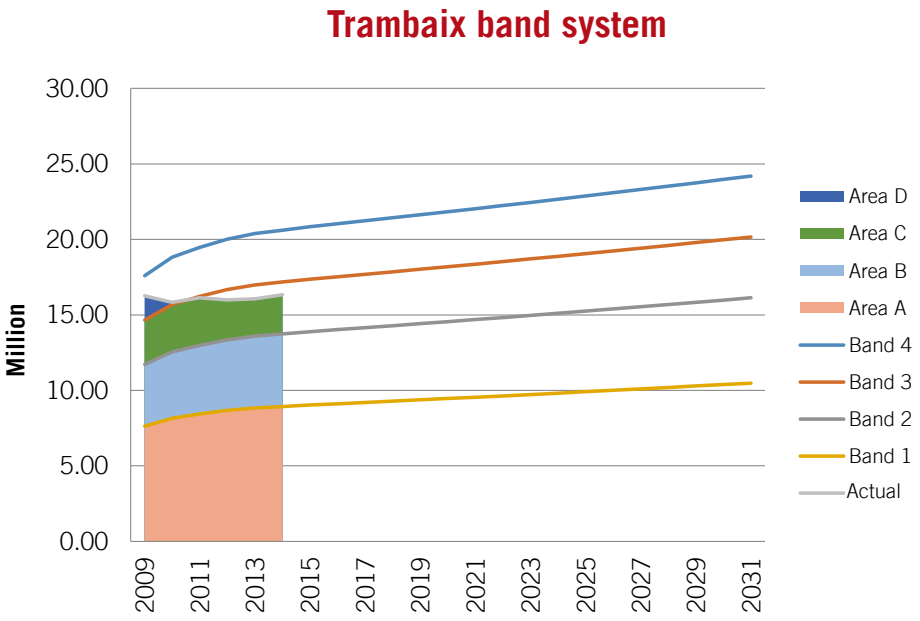
[b] The weighted average tariff is defined as: $\frac{\textit{Distribution of integrated system tariff+ single ticket income}}{\textit{No.of validations}}$

[c] This investment amortization will consist of the part of the investment that has to be amortized once the annual payment has been deducted.

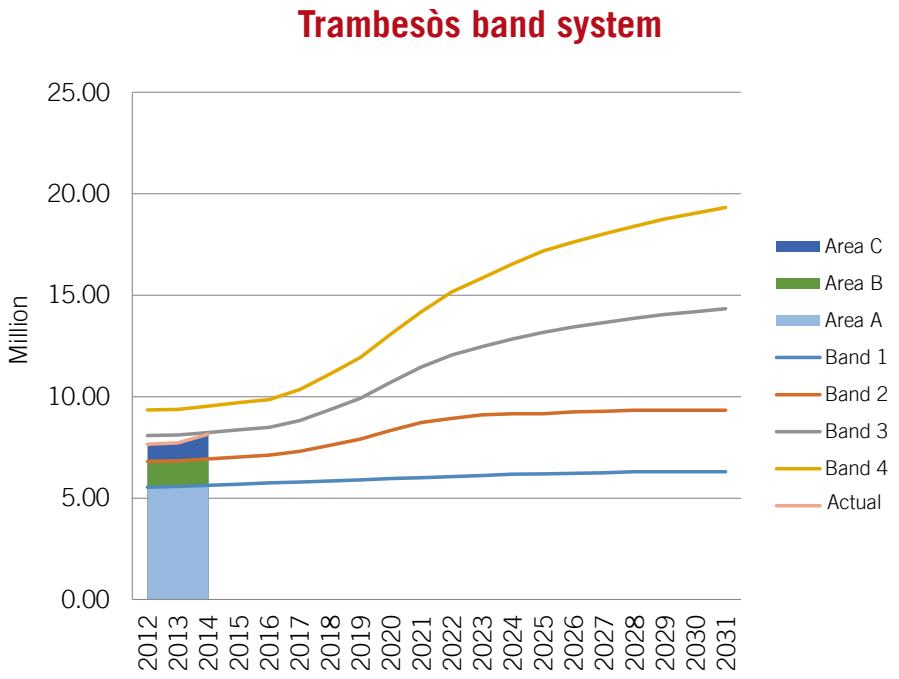
[d] The weighted average tariff is defined as: $\frac{\textit{Distribution of integrated system tariff+ single ticket income}}{\textit{No.of validations}}$

Source: Information provided by ATM.

Exhibit 3. (Continued)

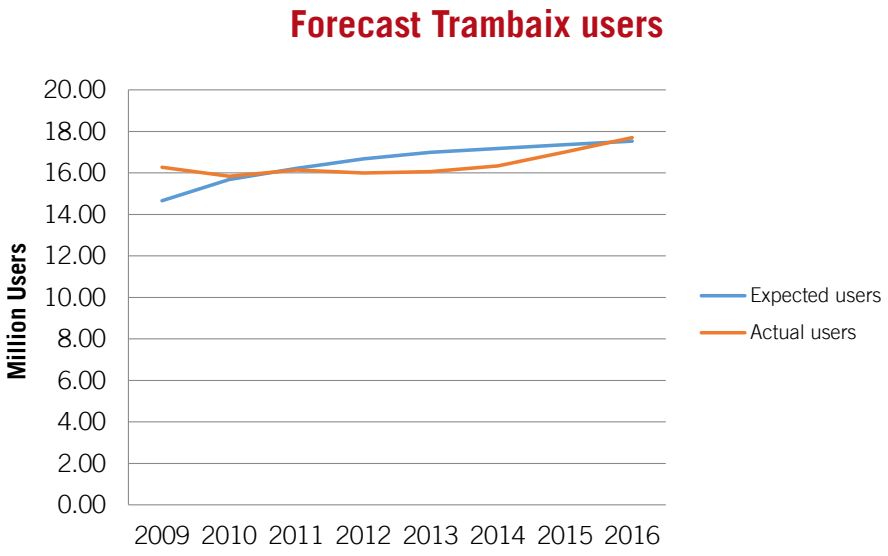


Source: Information provided by ATM.

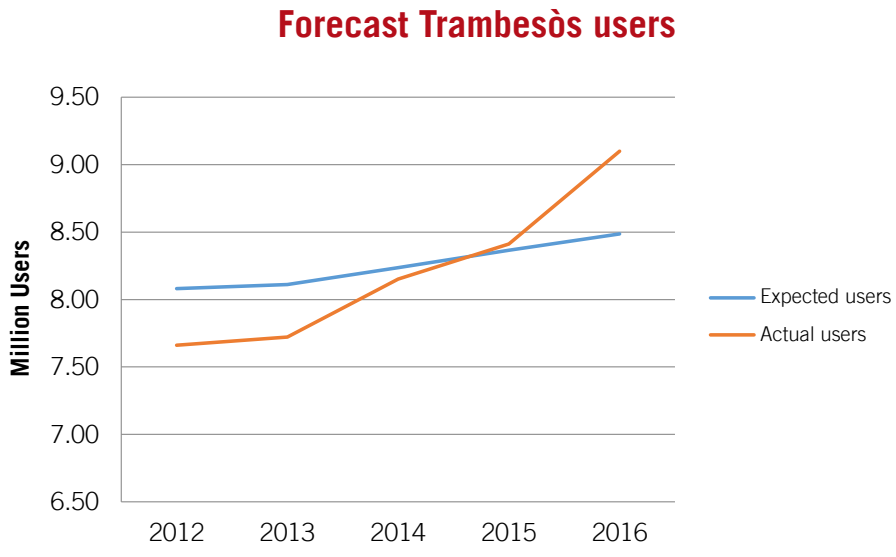


Source: Information provided by ATM.

Exhibit 3. (Continued)



Source: Information provided by ATM.



Source: Information provided by ATM.

References

- ATM (1999). “Convocatòria de concurs públic internacional restringit d’adjudicació de la redacció del projecte, la construcción i l’explotació d’un sistema de tramvia/metro lleufer en el corredor Diagonal – Baix Llobregat de l’àrea de Barcelona”. Plec de clàususles administratives particulars.

- ATM (2000). “Contracte per a la redacció del projecte, la cosntrucció i l’explotació d’un sistema de Tramvia en el corredor Diagonal – baix Llobregat de l’àrea de Barcelona”. November 17th, 2000.

- ATM (2001). “Signatura dels convenis de gestió expropiatòria de bens i drets afectats pel traçat del Tramvia Diagonal – Baix Llobregat” Press release. April 27th, 2001.

- ATM (2002). “Convocatòria de Concurs Públic Internacional de concessió del sistema de tramvia Glòries – Besòs (Estació del Nord – Glòries – Gran Via – Fòrum 2004 – Sant Adrià de Besòs – Badalona)” July, 4th, 2002.

- ATM (2003). “Contracte de concessió del sistema de Tramvia Sant Martí - Besòs.” January 3rd, 2003.

- ATM (2007a). “El TRAM allarga el servei de la T3 fins a Sant Feliu de Llobregat.” April 21st, 2007

- ATM (2007b). “El TRAM allarga el servei de la T5 fins a Sant Adrià de Besòs” May 6th, 2007.

- ATM (2013). “Pla director d’infraestructures del transport públic col.lectiu de la regió metropolitana de Barcelona 2011-2020.” November, 2013.

- ATM (2014a). “El tramvia de Barcelona transporta més de 200 milions de viatgers en 10 anys de servei” April 3rd, 2014.

- ATM (2014b). “Las redes tranviarias de Barcelona”. 9 de mayo de 2014

- ATM (2016). “Pla d’acció en la lluita contra el frau a Sant Adrià de Besòs i Badalona.” February, 2016

- Barcelona City Council (Ajuntament de Barcelona) (2016). “Estudis previs per a la connexió de les xarxes Trambaix i Trambesòs.” https://bcnroc.ajuntament.barcelona.cat/jspui/bitstream/11703/97342/1/estudisprevisstramviapremsa.pdf.

- Engel, Eduardo, Ronald Fischer, and Alexander Galetovic (2014). “Finance and Public-Private Partnerships.” In *Financial Flows and Infrastructure Financing*, edited by Alexandra Heath and Matthew Read, Sydney: Reserve Bank of Australia, 193 222. https://www.rba.gov.au/publications/confs/2014/pdf/conf-vol-2014.pdf.

- Hart, Oliver (2003). “Incomplete Contracts and Public Ownership: Remarks, and an Application to Public-Private Partnerships.” *The Economic Journal*, 113(486): C69 C76. doi:10.1111/1468-0297.00119.

- Alegre i Valls, Lluís (technical director of the ATM) (2016-2017). Interviews by Miquel Rodríguez and Josep Navarro. Barcelona, October 2016.

- Cabrera, Eduard (head of the ATM infrastructure management service) (2017). Interviews by Miquel Rodríguez and Josep Navarro. Barcelona, December 2016.

- Calvet, Francesc (head of the ATM planning service) (2016). Interviews with Miquel Rodríguez and Josep Navarro. Barcelona, October 2016.

- Carsi, Joan (2016). “Barcelona Tramway Project Finance.” PowerPoint presentation, February, 2017. IESE Business School, Barcelona.

- Lussich Obes, Marina (2005). Análisis coste-beneficio de implantar el tranvía en el tramo central de la avenida Diagonal entre plaza Francesc Macià y plaza de Glòries. Barcelona: Associació per a la Promoció del Transport Públic (Association for the Promotion of Public Transport). https://transportpublic.org/images/pdf/20051000-tramvia_diagonal.pdf.

- Psyma (2014a). "Estudi de satisfacció dels viatgers de Trambaix." Study prepared for TRAM. PPT. June 2014.

- Psyma (2014b). "Estudi de satisfacció dels viatgers de Trambesòs." Study prepared for TRAM. PPT. June 2014.

- Riol Jurado, Ricardo (2015). Informe sobre la millora del transport públic associada a la connexió dels tramvies per la Diagonal. Barcelona: Associació per a la Promoció del Transport Public (Association for the Promotion of Public Transport). http://transportpublic.org/images/pdf/20151126-tramvia-diagonal.pdf.

- Shleifer, Andrei (1985). "A Theory of Yardstick Competition." *Rand Journal of Economics*, 16(3): 319 327.

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