Developing High Speed Rail Projects
Defining the Business Model

Carlos Fernandes
RAVE, CEO
Portugal
Development of a High Speed Project

Technical & Planning Questions

1. What should the **network shape** be and which **cities** should be served?
2. What should the **travel time** be and therefore the **design speed**?
3. How should the **articulation with the conventional rail** network be made?
4. How should the **articulation with other transportation modes** be made? (airports, ports and road)
5. .......

Financial & Management Questions

1. How should the public sector develop and coordinate the project? (**Public Sector’s Role**)
2. What type of **involvement of the private sector** & what level of **Risk transfer**?
3. What type of **procurement**?
4. How should the project be **financed**?
5. How to breakdown the value chain of the project?

**BUSINESS MODEL**
What is the Business Model that best helps reach these goals?

- Financial Affordability
- Minimization of Risks
- Delivery of the Project on Time
- High Level of Service / Quality
Defining Business Models
Basic Questions

What level of private involvement and risk transfer?

How to breakdown the value chain of the project?
Defining Business Models
Basic Procurement Options

- **Traditional Procurement**
  - Production risks: Public
  - Market risks: Public
  - Financing: Public
  - Term: Short or medium

- **PPP** (Wide range, major flexibility)
  - Production risks: Private
  - Market risks: Public, private or mixed
  - Financing: Public, private or mixed
  - Term: Medium or Long

- **Privatization**
  - Production risks: Private
  - Market risks: Private
  - Financing: Private
  - Term: Lifetime

Production risks include construction, maintenance, etc.
Market risks include demand, charging, etc.
Defining Business Models

PPP Concept

**PPP Key Aspects**

- **Output focus**: design, build and maintenance risks with private partner
- **Results/quality award**: performance payments
- **Life cycle approach**: medium to long term contracts
- **Public finance as much as possible**: but keeping private partner with money at risk
- **Transfer risks that private partner can control**
## Defining Business Models
### PPP Concept

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Greater guarantees of meeting deadlines</td>
<td>✓ Longer procurement process</td>
</tr>
<tr>
<td>✓ Less cost overruns</td>
<td>✓ Higher transaction costs</td>
</tr>
<tr>
<td>✓ Improved cost efficiency</td>
<td>✓ More financial costs</td>
</tr>
<tr>
<td>✓ Higher level of innovation and optimization</td>
<td>✓ Greater vulnerability to changes</td>
</tr>
<tr>
<td>✓ Quality warranty for long term</td>
<td>✓ Demands of expertise</td>
</tr>
</tbody>
</table>

### Suitable Applications
- Large investments
- Green field projects
- Technical stability environment

### Major Challenge
- Cultural change both in public and private sector
Defining Business Models
Basic Questions

What level of private involvement and risk transfer?

How to breakdown the value chain of the project?
Defining Business Models
Breakdown of a High Speed Project
Defining Business Models
Breakdown of a High Speed Project

Key Aspects

- **Size**: Determinant to model efficiency and project attractiveness
- **Specificity**: Beware of suppliers’ dependence on some components
- **Risk**: Major risk in one component may affect the whole project
- **Lifecycle**: Contract term should be linked to assets lifecycle
- **Interfaces**: Difficult to deal with for public partner
- **Market condition**: Projects should be made attractive for the market
Benchmark Analysis
HSL Zuid
(Netherlands)

Traditional Procurement (Spain)

Perpignan-Figuera
(Spain & France)
# Defining Business Models
## International projects – HSL Zuid (Netherlands)

### Business Model

<table>
<thead>
<tr>
<th>Traffic Management</th>
<th>State/Railway manager (ProRail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passengers operation</td>
<td>Public + Private (Joint venture NS + KLM)</td>
</tr>
<tr>
<td>S&amp;T Superstructure</td>
<td>One PPP</td>
</tr>
<tr>
<td>Substructure</td>
<td>Several building contracts</td>
</tr>
</tbody>
</table>

### Advantages
- **Life Cycle** transfer of superstructure to a private entity
- **Hybrid financing** through Public Subsidies & Availability Payments

### Disadvantages
- Complex Interfaces between Super & Substructure – Public sector in the middle at great cost
- Deficient specifications in required S&T version

### Facts
- **Opening date:** 7 Sep 2009
- **Length:** 77.7 miles (125 km)
- **Max speed:** 186 miles per hour (300 km/h)
- **Investment:** $9.952 Billion (€7.154 Billion)
Defining Business Models

International projects – Perpignan / Figueras (Spain and France)

<table>
<thead>
<tr>
<th>Business Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Management</td>
<td>State/Railway manager</td>
</tr>
<tr>
<td>Passengers operation</td>
<td>Public + Private companies</td>
</tr>
<tr>
<td>S&amp;T Sub &amp; Superstructure</td>
<td>One PPP</td>
</tr>
</tbody>
</table>

Advantages

- **Life Cycle cost** optimizing
- Off balance sheet treatment
- **Simple Interfaces** (vertical integration between Sub, Superstructure & S&T)

Disadvantages

- Bi-national project with a difficult tender procedure
- Isolated piece (tunnel) with poor integration with the entire line
- Additional costs of financing due to the 50 year demand risk (toll payments from primarily the two public national train operators)
- Difficult on large scale projects

Opening date: 2009

Length: 28 miles (45 km)

Max speed: 186 – 217 mph (300 – 350 km/h)

Investment: $ 1.391 Billion (€1.000 Billion)
Defining Business Models

International projects – Traditional Procurement (e.g. Spain)

Business Model

Traffic Management | State/Railway manager
Passengers operation S&T | Public companies
Sub & Superstructure | |

Advantages

✓ Speedy procurement phase
✓ Lower Transaction Costs
✓ Applicable to small & large scale projects

Disadvantages

✗ Life Cycle Cost difficult to apply
✗ More risks kept on the public side (e.g. design, construction & maintenance)
✗ Higher probability of cost overrun or time delay
# Defining Business Models

**Benchmark Analysis**

<table>
<thead>
<tr>
<th></th>
<th>France 1980/90</th>
<th>United Kingdom Decade 90</th>
<th>Holland 2005</th>
<th>Perpignan-Figueras (France-Spain) 2005</th>
<th>Bordeaux-Tours (France) 2007</th>
<th>Brazil 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public</strong></td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
<td>Public</td>
</tr>
<tr>
<td><strong>Public</strong></td>
<td>Private(PPP)</td>
<td>Public and Private</td>
<td>Public and Private</td>
<td>Public and Private</td>
<td>Public and Private</td>
<td>Private(PPP)</td>
</tr>
</tbody>
</table>

**Strategic Role**
- Regulation
- Planning
- Establishment of Requirements
- Articulation of the System

**Financial Role**
- Design
- Build
- Maintain
- Operate

**Operational Role**
- Design
- Build
- Maintain
- Operate

## Trend
- Reduction of public risk exposure
Defining Business Models

International Trend

Breakdown of the Value Chain

Private sector involvement

1 Start of operations
2 Start of studies / contracts signed
The Portuguese Business Model
### The Portuguese Business Model

#### Infrastructure

<table>
<thead>
<tr>
<th>Capability</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>$700 Million</td>
<td>$1.9 – 2.8 Billion each</td>
</tr>
</tbody>
</table>

#### Capacity Allocation and Railway Traffic Management (State/REFER)

- **Signaling / Telecommunications (PPP6)**
- **Substructure / Superstructure (PPP1)**
- **Substructure / Superstructure (PPP2)**
- **Substructure / Superstructure (PPP3)**
- **Substructure / Superstructure (PPP4)**
- **Substructure / Superstructure (PPP5)**

- **National & International experience**
- **Lifecycle / Useful Life**
- **Dimension of the investment**
- **Level of national incorporation**
- **Assure high level of competition**
- **Keep the strategic role with the public sector**
## The Portuguese Business Model

### Infrastructure

<table>
<thead>
<tr>
<th>PPP Substructure / Superstructure</th>
<th>PPP Signaling / Telecommunication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope:</strong> Design, Built, Finance and Maintain</td>
<td><strong>Scope:</strong> Design, Supply, Installation and Maintain</td>
</tr>
<tr>
<td><strong>Concession Period:</strong> 40 years</td>
<td><strong>Concession Period:</strong> 20 years</td>
</tr>
<tr>
<td><strong>Payment Mechanism:</strong> Availability (75%)</td>
<td><strong>Payment Mechanism:</strong> Availability</td>
</tr>
<tr>
<td>Maintenance (25%)</td>
<td></td>
</tr>
<tr>
<td>Demand (+-2%)</td>
<td></td>
</tr>
</tbody>
</table>

**PPP5** Braga-Valença 2010

**PPP4** Pombal-Porto 2011

**PPP3** Lisbon-Pombal 2010

**PPP6** Signaling / Telecommunications
PPP Tender Launched on February 2010

**PPP2** Lisbon-Poceirão / $ 2.7 Billion
PPP Tender Launched on March 30, 2009
Bids Delivered on August 31, 2009

**PPP1** Poceirão-Caia / $ 1.9 Billion
PPP Tender Launched on June 2, 2008
Contract award on December 10, 2009
The Portuguese Business Model

Financial Structure for Infrastructure

- **Public Payments**
  - Public Funding
  - Construction Period (Approx. 4Y)
  - Operation Period (Approx. 36Y)
    - Performance Payment (75%)
    - Maintenance Payment (25%)
    - Traffic/Demand Payment (±2%)

- **Financing Model**
  - European Investment Bank Loan
  - Commercial Banks Loan
  - Equity

5 Infrastructure PPP’s + 1 Signaling & Telecommunications PPP
The Portuguese Business Model
Performance Regime for Infrastructure

Basic Principles:

1. to reward a Concessionaire who makes the railway assets available with full line capability over both tracks, for the whole operational day

2. to reward a Concessionaire who maintains in good condition other assets that do not directly affect the availability of the railway.

Concessionaire’s payment will be made against its performance
The Portuguese Business Model
Performance Regime for Infrastructure

Payment Deductions

\[ D_t = D_p + C_p \]

- Deductions by non-availability
  - Minimum Limit of Availability, above which no deductions
  - Non-availability Rate expressed in €/NAU
  - Bonus scheme encourages performance above the minimum limit
  - Occurrences not attributable do not imply deductions
  - Length default maintenance without deductions
  - Incentives for early programming of maintenance interventions

Deductions by assets conditions
The Portuguese Business Model
Performance Regime for Infrastructure

Availability Concept

Speed (km/h) × Line extension (km) × Number of tracks (#) × Time (h)

Non-Availability Unit (NAU) Concept

\[ \text{NAU}_{av} = (350 - v) \times r \times k \times t \]

- Elementary Unit of Non-Availability
- Time of event
- Extension affected
- Number of tracks affected
- Speed allowed
Lisboa
To be developed directly by the State (REFER/RAVE)

Évora, Oeste, Leiria, Coimbra, Aveiro, Porto, Braga and Valença
Integrated in PPP deals

New Lisbon Airport Station
To be developed by the NLA Concessionaire

Elvas/Badajoz
Still to be defined between Portugal and Spain
The Portuguese Business Model

Operation and Rolling Stock

**Freight Sector**

- Already liberalized sector

**Passenger Traffic**: Rolling Stock acquisition + Operation service

- **Main alternatives analyzed**
  - A) State acquires Rolling Stock and leases it back to the Operator(s)
  - B) Future HSR Operator(s) acquires the Rolling Stock

**Relevant Issues**

- Future liberalization of international passenger traffic
- Negotiation with Spain about the exploitation model for cross-border services
- Time needed for Rolling Stock acquisition
- Compatibility of Rolling Stock lifecycle w/ transferring demand risk to the future Operator(s)

**Chosen Alternative**

- **Rolling Stock Acquisition**: Tender to be launch by the government
- **Operation Service**: Procurement Process to be defined in 2010, articulated with the EU directive on passenger services liberalisation
Main Results
Main Results on the Lisbon-Madrid Axis

Cost Reduction of the Construction Investment

- **PPP1 (Poceirão-Caia)**
  - Initial conservative approach
  - Permanent questioning technical options
  - Usage of optimization tools
  - Detailed treatment of critical areas
  - Incentive for competition through the business model:
    - Freedom of conception and optimization
    - Release of information, long before tender initiated
    - Clear and transparent rules for the tender

The HSL between Poceirão and Caia (103 miles), with a construction cost dropped to $16.7 M per mile, is one of cheapest ever built.
Developing High Speed Rail Projects
Defining the Business Model

Carlos Fernandes
RAVE, CEO
Portugal

cjfernandes@rave.pt