Job generation in sustainable freight in land transport

Executive summary

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Direction studio: Manel Ferri Tomas and Silvina Rabach Anonek

Authors: Manuel Colomer Lluch, Luis Cuena Barron, Manuel Garí Ramos, Albert Vilallonga Ortiz

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1. Preface

The present study is an attempt to conduct an in-depth analysis of the current freight transport system in Spain. Economic, social and environmental effects, as well as job generation were taken into account for the development of this project. Criteria for development of a sustainable freight transport systems are based on a preliminary analysis of future prospects. The study also produced estimates on the number of direct and indirect jobs associated with the new, sustainable freight transport system proposed.

The very nature of land freight transport led to the division of the study into two main parts. The first section focuses on freight transport (interurban and international) through a detailed study of heavy freight trucks (over 3.5 t) and freight trains. The other section analyzes urban freight distribution, a short-distance transport system almost exclusively monopolized by vans and light commercial vehicles (less than 3.5 t), with clear exceptions as distribution on hybrid bicycles.

Both systems are clearly related and share a number of common characteristics, but a close examination reveals significant differences:

- Differences in statistical information
- Contrasting scientific literature
- Dissimilar territorial distribution of transport
- Distinctive management and organization (by public authorities), and different infrastructure
- Different participating agents and transported goods

2. Objectives of the study

The main objective of this study is to prove that the promotion of rail freight and sustainable urban freight distribution represent an opportunity for job creation and imply a contribution to sustainable development.

Specific objectives include:

- Description the land freight transport model in Spain
- Analysis of the impact of land freight transport
- Analysis of the regulatory framework and policies favorable to sustainable freight transport
- Study of the evolution of jobs (2005-2010) in the rail freight sector
- Development of future projections (2020) for freight transport demands. Definition of job scenarios
- Analysis of environmental and external costs scenarios for 2020
- Presentation of best practices of sustainable freight transport on national and global scales
- Development of proposals and innovations to promote sustainable freight transport
- Study of the nature, need and significance of urban freight distribution
- Analysis of solutions, experiences and alternatives to promote sustainable urban freight distribution

3. Methodology

In order to prove the basic hypothesis of this study (i.e. sustainable freight transport promotes sustainable jobs and sustainable development) researchers analyzed the structure and dynamics of land freight transport in Spain and compared energy consumption data. The analysis confirmed the need to promote electrified railways as an alternative to prevailing truck-based freight transport. Further on the study explains the causes for the limited use of rail freight, as well as the difficulties faced by this sector to overcome underutilization and create growth opportunities.

The detailed description of rail transport is followed by statistical data on the evolution of jobs in all professional categories and groups, as well as indirect jobs in the sector. Researchers used data from public agencies, company reports and interviews with key informants from the sector. Given the limited availability of statistical information on jobs in the railway sector, sector job estimates were completed with information provided by companies. This process also allowed researchers to make an assessment of subcontracted jobs in the sector.

Once modal split was calculated for the period 2005–2010 (tones/ kilometers) it became possible to establish a relation between jobs and transported goods, and calculate projections for 2020. Input-Output on the Spanish economy tables were used as complementary assessments to estimate the impact on jobs of a shift in the demand of railway transport by 2020. The alternative and complementary estimates obtained strongly support the conclusions of this study.

Regarding the perspective for 2020, the study includes two scenarios: a trend-based, *Business as Usual* scenario that maintains the modal split of 2010, and a one based on a substantial improvement of railway use, called “environmental scenario” due to the environmental benefits it represents. Those two scenarios were combined with three levels of freight demands and jobs estimates were calculated for six different situations. This procedure allowed an assessment of effects in different theoretical frameworks.

The starting point of this study is the causal relation between policies to promote sustainable mobility and the development of the rail sector. It includes a compilation of regulatory acts, as well as regional and administrative strategies that affect the development of sustainable freight transport.

The study includes a series of proposals and initiatives to promote a new mobility model for sustainable freight transport based on information collected from several sources, interviews with experts from public agencies, railway companies, universities and trade union organizations. The initiatives and proposals seek to develop a new freight transport model with opportunities and solutions to the current economic crisis.

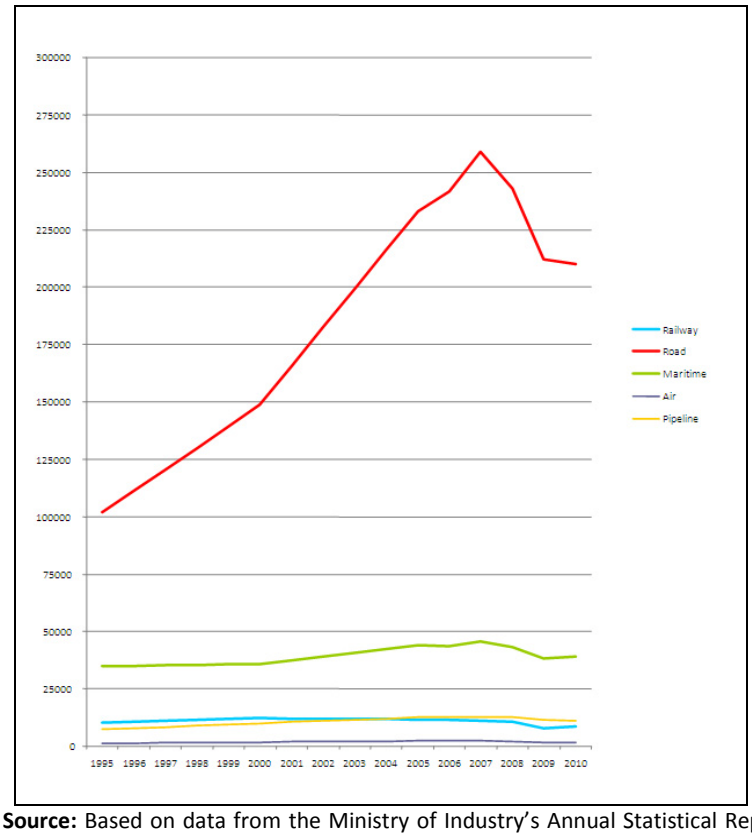
4. The Spanish freight transport model

The current model of land freight transport in Spain is almost totally based on road transport. Rail transport represents a reduced fraction of around 4% of all the tones/kilometer transported in the country. Railways barely represented 1% of the total land freight transport in 2010, which is clearly a negligible percentage[1].

[1] Ministry of Industry. Annual Statistical Report 2010.

In a context of growing volumes of freight transport, railway share is gradually decreasing. This factor is clearly visible if railway growth is compared to other modalities, and it is notably significant, given the outstanding growth of road transport which doubled. Railway transport shrank to almost half its volume (tone/kilometer) in the last quarter of a century.

Graphic 1. Modal split in Spain 1995 – 2010

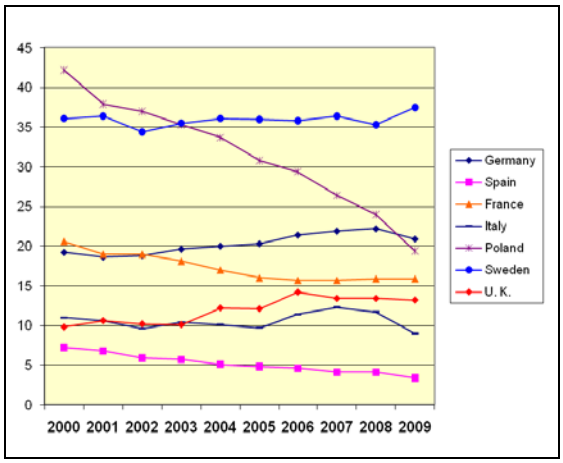


Source: Based on data from the Ministry of Industry's Annual Statistical Report 2010, and data from observatories of road (2012) and rail transport (2011)

Compared to other EU countries, Spain presents a considerably low use of rail freight. In 2010 Spain had the fourth lowest railway quota in the EU27 (4.2%), only preceded by Ireland, Greece and Luxembourg[2]. The average rail quota in the EU was 17% (data included road, railway and inland navigation).

[2] Eurostat (European Commission) June 2012

Graphic 2. Rail freight transport quotas in the EU



Source: Based on Eurostat data (July 2012)

Considering that maritime transport is accountable for 62% of freight in and out of the country, the volume of railway transport to and from port facilities is a clear indicator of the poor performance of this sector. In the ten main Spanish mainland ports with railway connections, only 7.95% of freight was transported by rail.

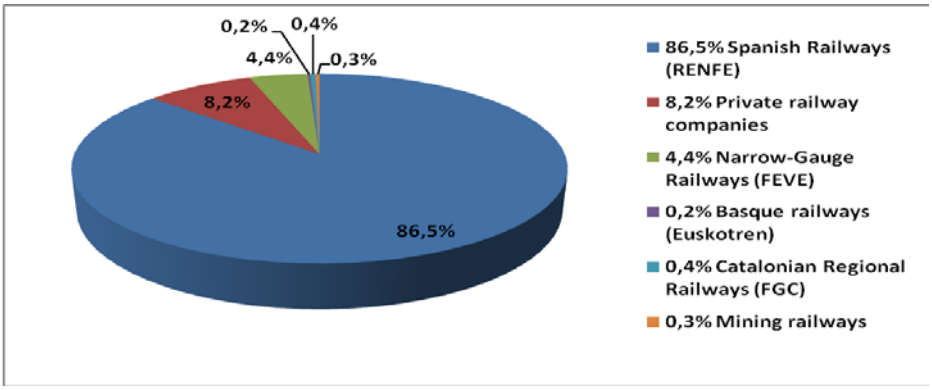
Another significant indicator which is both the cause and the consequence of the uneven balance between truck and rail freight is productivity by modality, and more specifically load capacity and utilization. In the case of mobile wagon fleets there has been a sharp decrease. During the five-year period analyzed by this study nearly half of all wagons were lost, in contrast, the number of authorized motor vehicles for freight transport increased steadily until the onset of the economic crisis.

In terms of goods transported by rail on global and national scales, constant plummeting is observed in all types of wagons, particularly in specialized types (bulk cargo, metallurgy, vehicles, etc.). Containers' transport by railway also decreased but it performed better and even had a slight increase in international trade operations.

The evolution of infrastructures for both modalities clearly shows the administration's bid for road transport to the detriment of rail freight. This situation had a major influence on the development of the current road transport model. Besides, a significant percentage of railway infrastructure built recently focuses on high speed rail for passengers, leaving aside freight.

The distribution of freight by railway companies still shows certain predominance of national railways (RENFE), although that primacy has decreased over the last five years in the same proportion that private companies came into play in 2007. Private rail's share has risen constantly. In the current scenario of decreasing rail freight transport, private companies have not managed to attract new freight flows. The current distribution suggests that freight transferred from national railways networks to private companies.

Graphic 3. Distribution of rail freight by companies in Spain (2010)



Source: Own research

Out of six companies operating in 2010, three represented over 90% of private rail (Comsa Rail Transport, Continental Rail and Euro Cargo Rail). The remaining three companies barely had any operations. All private railway companies combined did not exceed 8% of the total freight transported by rail[3].

4.1. Causes for the decline of rail freight

Some of the possible causes that hinder the full development of freight rail:

- Railways can hardly rival widespread practices as *Just in time*, which grant immediate delivery of exact amounts of demanded goods. Such practices depend on punctual demands in which trucks act as mobile storage facilities. Speed and flexibility prevail. Trucks excel trains in these two parameters
- In international operations, differences between Iberian track gauge (1,668 mm / 5 ft 5 $^{2}/_{3}$ in) and international standard (UIC) track gauge (1,435 mm / 4 ft 8 $^{1}/_{2}$) render railway networks slower, more expensive and less competitive, since rails required adjustment or the load must be transferred to other trains. Besides, changes in border railway administration require a change of locomotive and driver due to different signaling and lighting in each country and different labor regulation for drivers
- The very structure of the Spanish business network, with prevailing SMEs, limits the possibilities of rail freight. Big companies generate a bigger flow of commodities and are usually the major users of rail services
- Freight transport has become a secondary aspect of passengers' transport by train. Passenger and commuter transport have become a priority in urban and suburban areas and railways are congested. It is contradictory that most freight terminals are located in urban stations. The lower speed of freight trains is also an obstacle for the co-existence of both services which explains why most freight trains run during late night hours
- The coexistence of both rail systems becomes even more difficult, given the fact that freight trains are significantly heavier and represent additional damage and wear to railways. This factor implies bigger investment to maintain the quality standards of infrastructures that are also used for commercial passengers' trains. The deregulation

[3] *Spanish Railways Observatory Report, 2010.* Railway Foundation and Ministry of Industry 2011

of railway slots to grant high speed additional services did not meet the expected results.

- The analysis of land transport reveals a poor utilization of available resources (e.g. 65,000 km/year of average covered route by railway engine vs. 120,000 km/year, and 2.5 hours/day of effective train driving vs. 9 hours/day of truck driving) [4].
- Railway operators pay fees for the use of infrastructure which renders services even more expensive. Freight trucks only pay highway tolls which can avoided because there exist parallel non-toll roads.
- Big logistics centers built in the last decades for the reception, storage and distribution of goods lack railway. Railway terminals often lack the capability, equipment and additional services to grant railway-truck links (storage facilities, parking lots for trucks, packaging stations, etc).
- Railway transport confronts serious difficulties in terms of minor networks. It can hardly grant door-to-door services and eventually trucks have to be hired if efficient intermodality is not feasible.
- Spain cannot provide rail services to transport trailers and even semitrailers, due to the lack of platform wagons that could grant a swift and efficient intermodality.
- The Spanish railway system has structure gauge problems (regarding the minimum height and width of tunnels and bridges as well as the minimum height and width of the doors that allow a rail siding access into a warehouse) which makes impossible loading full trailers on the national railway network
- Existing infrastructure proves inadequate for long trains (600 m) which are more efficient for freight transport. Terminals and stations cannot accommodate long freight trains (in Europe usually freight convoys reach 750 m). This factor is an additional inconvenience for long trains arriving in Spain from Europe which have to re-distribute their cargo into several smaller convoys.
- Freight trains face difficulties to completely load return journeys and avoid running empty, particularly in the case of specialized wagons for one single product, single client operations and routes to single destinations.
- There is a significant number of non-electrified and diesel-based transport means that are obviously more expensive. Even though Diesel powered trains have higher freight volume but also more maintenance requirements. Diesel engines also imply more maintenance costs and consume more energy than electric engines[5].

5. Impacts of land freight transport

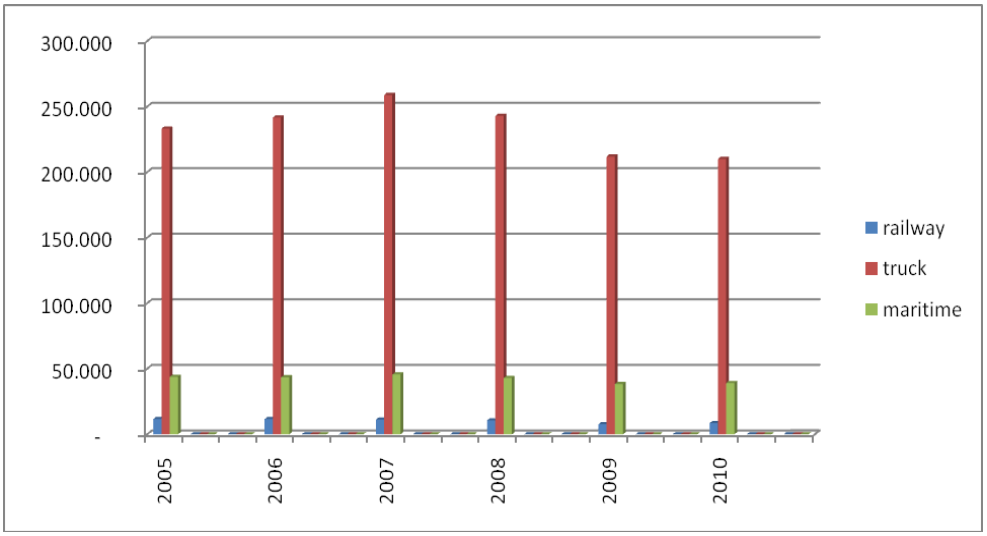
A freight model mostly based on road transport causes a series of impacts in terms of negative externalities, usually excluded from economic and financial data. It also implies significant social and environmental impacts.

Impacts are essentially excessive energy consumption (fossil fuels), increased emissions of CO_2, NOx and micro-particles, high rates of road accidents and traffic congestion in urban areas.

[4] Strategy for the promotion of railway freight transport in Spain. Ministry of Industry, 2010
[5] Railway Observatory. 2010 Report (Spanish Railways Foundation) Ministry of Industry, 2011

All these costs, although not absorbed by the transport sector have obvious economic impacts that a have a negative effect on citizens' life quality and are eventually assumed by society as a whole.

Graphic 4. Energy consumption by modality



Source: Own research

The *Handbook on estimation of external costs in the transport sector* [6] is the result of a study appointed by the European Commission in an effort to make a detailed account of the actual costs of transport for society.

Estimates on the total costs of freight transport generated by heavy trailers and railway in Spain in 2008 were calculated on the basis of average EU costs included in the mentioned study. Figures were still remarkable even though they met the expected results. Costs generated by road and rail transport amount to 6.1 billion euros of which 98.6% account for heavy trucks/trailers and rail barely represents 1.4% of total costs.

Table 1. External costs of land freight in Spain (2008)

	Tn /Km	€/ 1,000tn/Km [7]	Total externalities	%
Heavy trucks	242,978	25.1	6,098	98.6
Rail	10,653	8.2	87	1.4
		Total costs	**6,186**	**100**

Source: *External costs of transport in Europe, Delft, Infras and Fraunhofer, 2011*

The following example will illustrate how the situation would reverse if railway transport had a bigger share in land freight: if Spanish rails' quota would reach the EU average of 16.6% (instead of 4.2%), savings could amount to 575 million euros in just one year. Considering the current period of economic crisis, such savings would be good news for the Spanish economy.

[6] *Handbook on estimation of external costs in the transport sector*. INFRAS, Delft and Fraunhofer, 2008

[7] Costs of externalities in Spain (2008). Congestion costs are not included. Taken from *External costs of transport in Europe*, Delft, Infras y Fraunhofer, 2011

Estimates can also be drawn on fuel costs, considering that with a desirable 16.6% of rail quota, the land transport sector would need 48.7 billion MJ less to transport the same Tn /Km. This would represent savings estimated in 3.1 billion euros.

Total savings amount to 3.6 billion euros, an amount allocated for externalities of land transport and fuel costs. Considering the population of Spain of around 46 million, 3.6 billion euros would roughly represent 81 € per inhabitant[8].

6. Jobs in sustainable freight transport 2005-2010

As described in chapter 4 of this study, internal freight transport had a sharp decrease, particularly in the rail sector which reflected on the number of jobs.

A detailed analysis of jobs associated to freight transport should at least include activities directly associated[9] to the sector, and take into account indirect jobs generated by transport as the manufacture of rail machinery and vehicles, construction of railways and infrastructure.

This study includes indirect jobs associated to railway construction and assigns 10% of the registered staff to such activities. It is a moderate estimate considering only main railway construction activities. Repair and maintenance activities outside of construction and manufacture companies, as well as indirect jobs associated to manufacture of machinery are not included.

It must be noted that the study does not assess construction/maintenance activities carried out by different railway companies that represent a considerable number of jobs. A clear example is the volume of investment in repair and maintenance of conventional railways in 2010, which amounted to 8.8 billion €[10].

The following table shows total job figures for the period 2005-2010.

Table 2. Jobs in the rail freight sector in Spain (2005-2010)

	2010	2009	2008	2007	2006	2005
Total freight	**4,072**	**4,144**	**4,324**	**5,834**	**6,022**	**6,390**
Jobs in direct companies	**8,659**	**8,888**	**9,000**	**9,331**	**9,667**	**9,972**
Subcontracted jobs	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**
Total direct jobs	**10,695**	**10,888**	**11,000**	**11,331**	**11,667**	**11,792**
Direct indirect jobs in manufacture	**1,415**	**1,060**	**1,030**	**910**	**870**	**830**
Total direct + indirect jobs*	**12,074**	**11,948**	**12,030**	**12,241**	**12,537**	**12,622**

* Construction jobs are not included

Source: Own research based on interviews and company annual reports

[8] If we include costs generated by truck congestion based on EU average values (between 0,01386 € TKm and 0,02215 € TKm) costs in 2008 would be between 3.4 and 5.4 million €

[9] Operation of railway infrastructure, handling of cargo, planning and organization activities

[10] Annual Statistical Report. Ministry of Industry / ADIF Annual Report 2010

7. Land transport: urban freight distribution scenarios for 2020

The onset of the economic crisis makes difficult any forecasts or estimates, but the level of uncertainty regarding national and EU policies makes it next to impossible. That is the reason why this study considers three alternative levels of estimations for 2020.

The first projection, which we will call **"High"**, expects 450 billion Tn/km of freight to be transported in 2020 (550 billion Tn/km considering international freight operations destined to Spain or passing across the country to other destinations).

The **second level**, called **"Intermediate"** estimates total freight transport demands for 2020 to be 325 billion Tn/km, or 400 billion if international freight is included.

The third projection called **"Stationary"** estimates the total freight transport demand for 2020 to be around 280 billion Tn/Km (345 billion Tn /Km if international freight is considered).

Projections were combined with two different modal split scenarios.

The **first scenario** resembles the current modal split and it is called trend or **Business as Usual (BAU)**.

The **second scenario** would be the result of efforts implementing sustainable mobility policies. For the purpose of differentiation and analysis it will be called ***Environmental Scenario*** and it will be set within the goals of the national strategy to promote sustainable rail freight (PEITF). The strategy expects rail transport to represent 10% of modal split in Spain by 2020 which requires significant efforts by employers and policy-makers to reach high annual growth quotas. It also represents a necessary adjustment to cope with rising oil costs, environmental and social consequences. Public policies will eventually implement such adjustments. The White Paper on Transport[11] includes a proposal of 30% of modal split to be shared by rail and inland navigation.

Table 3. Modal split of freight by work scenarios

	Scenario	
	BAU	**Environmental**
Road	77.60%	70.80%
Rail	3.20%	10.00%
Pipeline	4.20%	4.20%
Maritime	14.40%	14.40%
Air	0.60%	0.60%
TOTAL	**100.00%**	**100.00%**

Source: Own research

[11] *White Paper 2011*. "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system"

Table 4. Volume and share of rail freight transport by projection and scenario

	Trend (BAU)	%	Required annual growth rate	Environmental	%	Required annual growth rate	Total demand	Required annual growth rate
High PEITF	17,600	3.2	8.8	55,000	10	23.4	550,000	7.4
Medium	12,800	3.2	5	40,000	10	19.2	400,000	4
Stationary	11,040	3.2	3.3	34,500	10	17.2	345,000	2.5

Source: Own research

Yellow columns in table 4 show expected annual growth of rail freight to reach 3.3% and 10% of modal split respectively. The last column represents the growth of freight transport demands for each projection.

8. Potential jobs in sustainable freight transport for 2020

Job projections for 2020 were made on the basis of empirical calculations developed in previous chapters of this study, as well as on data and information gathered along the process. The result was a series of ratios (jobs/million of Tn /km) that will be applied to projections of future demands.

In a *Business As Usual* scenario for high transport demands (maintaining a modal share of 3.2%) the resulting number of jobs would be of 16,214, (4,624 jobs more than in the current situation).

Table 5. Jobs in rail freight transport in BAU (trend) scenarios

		Projection	Stationary	Medium	High
		2010	2020	2020	2020
	Tn/km	8,577	11,040	12,800	17,600
Type of job	**Best ratio**	**Jobs in the sector**			
Subcontracted	0.17	2,000	1,897	2,199	3,024
Direct (freight)	0.42	4,072	4,641	5,381	7,398
Allocated	0.28	4,587	4,588	4,700	4,902
Indirect (machinery)	0.07	1,415	787	850	890
Indirect (construction)		--	--	--	--
TOTAL JOBS		**12,074**	**11,912**	**13,130**	**16,214**

Source: Own research

The same calculation (taking into account the promotion of environmentally sustainable scenarios for the three levels of demand) would result in a considerably higher number of jobs, associated to the increase of rail in the modal split. This means that even with a moderate, realistic growth projection the number of jobs would increase, aside from the obvious environmental advantages. It must be noted that total transport demand is an extrinsic factor, independent from public policies. However, modal split is affected by government policies, and therefore responsive to mechanisms that create quality and environmentally sustainable jobs.

Table 6. Jobs in rail freight transport in environmental scenarios

		Projection	Stationary	Medium	High
		2010	2020	2020	2020
	Tn/km	8,577	34,500	40,000	55,000
Type of job	Mejor ratio	Jobs in the sector			
Subcontracted	0.17	2,000	5,927	6,872	9,449
Direct (freight)	0.42	4,072	14,502	16,814	23,120
Allocated	0.28	4,587	7,687	8,000	11,249
Indirect (machinery)	0.07	1,415	1,390	1,450	1,950
Indirect (construction)		--	--	--	--
TOTAL JOBS		12,074	29,507	33,136	45,768

Source: own research

If freight rail transport reaches a 10% quota, the number of jobs generated might be 18,000 in the most conservative estimate, which means that even with thin estimates jobs would nearly triple current numbers.

Input-Output Tables offer lower results than direct calculations, due largely to differences in methodologies. For a volume of activity of 34.5 billion Tn /Km, the estimated increase amounts to 17,432 direct and indirect jobs. Input-output tables show an increase of 9,369 direct and indirect jobs (21,199 if induced jobs are considered) [12].

These findings lead to conclusions that corroborate the hypothesis assumed by this study: rail freight entails the generation of a substantially higher number of jobs than a conventional analysis might identify. The stereotyped view of a single engine driver versus dozens of truck drivers creates a considerable distortion of job estimates in the sector. Jobs in the rail sector combine a series of occupational profiles.

Each job in the rail freight and associated activities generates 0.64[13] indirect jobs. This sector also generates a considerable number of induced jobs (1.27[14] for each direct o indirect job) associated with the cost structure of rail transport.

9. Balance of environmental and external costs for 2020 scenarios

If the impacts of land freight transport in Spain are considered (see chapter 5), the environmental scenario for 2020 offers certain additional benefits in terms of jobs.

In such scenario energy savings could amount to 36.3 billion MJ per year. That would represent 7% savings in freight transport energy equivalent to the yearly energy consumption of a population of 2,923,452, i.e. approximately the population of the cities of Valencia, Seville, Zaragoza, Las Palmas and Bilbao combined.

[12] Input-Output tables allow the calculation of induced employment, i.e. jobs associated to a variety of activities in the broader economy (e.g. communications, retail services, etc.). The concept is associated to the traditional Keynesian multiplying effect.

[13] 3,659 indirect jobs associated to 5,710 direct jobs in the railway sector

[14] 11,830 jobs induced by 9,369 direct and indirect jobs

In terms of CO_2 emissions, the environmental scenario represents a decrease of 1,665,660 tones, an equivalent reduction of 8%.

NO_x and microparticle (MP) emissions would drop significantly in the environmental scenario, namely 79,368 (8%) tones less of NOx, and 2,266 tones (7%) less of MP. These indicators would have a positive impact on the quality of air in urban areas, and as a result, health improvements for the population affected by emissions.

The value of external costs would reduce in over 397 million €, representing savings of 8% in transport expenses, equivalent to the expenses of a population of **39,937**, i.e. household expenses of the city of Soria (a provincial capital) for a whole year.

Table 7. Summary of costs, savings and Jobs

	Current situation 2010		Environmental Stationary Scenario by 2020	
Routes in Tn/km				
Road	210,064		244,260	
Railway	8,577		34,500	
Road quota				
Railway quota				
Externalities Millions of €				
Road	5,272.6		6,131	
Railway	70.3		283	
Savings			-397	
Energy consumption Millions of MJ				
Road	413,826		481,192	
Railway	3,602		14,490	
Savings			-36,363	
equivalent				
Electricity consumption	*960,064*	*Average households*		
	869,113	*Equivalent tones of oil*		
	708	*Millions €*		
Emissions Millions of Kg CO_2				
Road	20,586		23,937	
Railway	213		932	
Avoided emissions			-1,666	
equivalent				
14.2 millions of €	*8.5 € tones emissions rights*			
41.6 millions of €	*25 € tones emissions rights*			
Emissions Millions of Kg Nox				
Road			**4**	
Transport			**859**	
Avoided emissions			**-79**	
Railway sector jobs				
total			total	increase
12,074	Direct estimates		29,507	17,433
	Input-Output table		33,273	21,199
			direct	*5,710*
			indirect	*3,659*
			induced	*11,830*

Source: Own research

10. Urban freight distribution

Urban freight distribution is the less known transport modality in Spain and the one that faces most difficulties. The rationalization of urban freight distribution is still an unsolved problem in nearly all Spanish cities with population over 100,000.

The analyzed cases and the results of this study lead to the following conclusions:

- Urban freight distribution is an essential factor for the socio-economic development of urban areas
- Freight distribution represents between 13%-18% of total urban journeys (most frequently 15%)
- Those journeys affect heavily urban traffic have a highly negative impact on health, environmental and living conditions in urban areas worldwide
- Multiple traffic appeasement solutions are available and they include measures to rationalize and improve urban freight distribution. However, society must envision a more ambitious goal: the changing of freight distribution patterns to achieve energy, economic and environmental efficiency
- Some specific solutions, often as simple as the use of electric bicycles for "last mile" journeys, are highly efficient and require the support of public authorities and society as a whole
- Lack of statistical information (especially data on labor and social factors) is an obstacle for the rationalization of urban freight distribution in Spain
- Public, private or joint R+D+i regarding the logistics of freight distribution is unfortunately insufficient. Spain has not started any implementation of intelligent transport systems
- No estimates or projections on the jobs associated with sustainable freight distribution have been calculated, however, activities that represent potential job sources have been identified. They include: statistical information, planning, consulting and advisory, as well as the promotion of electric transport systems, construction, intelligent transport systems and implementation of new technologies for urban freight distribution

Three basic elements must be taken into account when designing future strategies for urban freight distribution:

- means of transport
- timing and schedules of loading / unloading operations
- public urban space in which such operations are carried out

The most significant of these factors is the modal shift in freight transport. The modal shift of freight transport is aimed at achieving non-carbon modalities, which implies a bid for light electric vehicles (bicycles and small cars), combined with other sustainable forms.

Modal shift must be but part of a joint strategy on urban freight distribution.

11. Conclusions and proposals

The present study leads to a primary conclusion: **the bid for rail, electric vehicles and innovating solutions will not only generate social, economic and environmental benefits, it could also create quality jobs.**

That is why we recommend the development of guidelines on measures to improve rail share in freight transport and urban freight distribution and on more sustainable ways of urban freight distribution. This approach could increase the numbers of jobs associated to sustainable activities.

11.1. Proposals for interurban freight transport

Measures to achieve these goals include:

Intermodality

The integration of road and rail transport will result in maximum benefits from their respective advantages regarding load capacity, distance and time of journeys, accessibility and flexibility. Combining these two modalities could improve significantly their performance and efficiency.

Intermodality requires the refurbishing and linking up of rail terminals with road networks in order to grant a safe and swift transfer of cargo regardless of type (containers, trailers or semi-trailers).

It is recommendable to establish connections between rail and road transport companies and promote joint efforts and cooperation between them, instead of competition.

For a full intermodality it becomes necessary for railways to be linked to port facilities and networks whose freight volume is significant (both in long distance and short sea shipping). it is therefore recommendable for rail operators to establish representations in different port authorities to promote an effective exchange between the two modalities.

Infrastructure and logistics

Existing infrastructure is mostly underutilized, and no new infrastructure building projects are required. Adequate management and adjustment of infrastructure to support long trains is a basic requirement. The building of new rail sidings would increase the quality and productivity of rail services, as well as load capacity. This will help reduce operating costs and allow Spanish railways to comply with EU standards regarding long train convoys facilitating international traffic.

Metropolitan areas concentrate a substantial part of freight transport demands but freight rail terminals are not regarded as a priority. It is recommendable to build alternative freight rail circuits and increase commercial speed (freight operations are usually carried out during night hours).

Railway terminals must have the adequate equipment and additional services for the storage of specific cargo, such as dangerous and perishable commodities. Equipment and services for the handling of freight imply an added value for rail transport.

European rail integration

It is essential to promote the full operational compatibility (interoperability) of the EU rail network to overcome infrastructure and management barriers between countries that contribute to the isolation of Iberian rail systems and make international freight transport more difficult and expensive.

In order to achieve this goal, Spanish authorities must add a third gauge to the existing Iberian rail system in border areas. The adjustment of Spanish rails to international standards would definitely eliminate all inconveniences associated to track gauge differences.

EU authorities should promote and regulate rail systems to achieve a common EU electrification and signaling system, as well as common health and safety standards. A common EU authority should be created to address an effective integration of rail systems.

Regular freight lines

Regular lines to serve multiple container transport companies in areas with heavy container traffic could be a solution to handle the freight of small and medium-size companies and to avoid return journeys of empty trains.

Rail safety

Freight rail safety levels must be kept. Freight rail is currently the modality with the lowest accident rates. Safety must be enforced to achieve even higher levels. Compromising the safety levels of freight rail to reduce operating cost is a grave mistake. Safety is one of the strong values of freight rail and it acquires even more relevance with the transport of hazardous commodities.

Electrification of rail services

Rail services must maintain their competitive advantages in terms of environmental performance, energy efficiency and lower costs associated with electrically-powered trains.

The current scenario with a growing use of diesel engines and 40% of the rail network still non-electrified, calls for the promotion of electric engines through specific measures such as the implementation of reduced tariffs for the use of railway infrastructure. It must be taken into account that electric engines return power to the electric network through the energy generated by braking.

Road transport tariffs

The implementation of a tariff system for the use of road infrastructure is a factor to be considered in Spain. Such measures would have a twofold objective: reducing excessive road transport use and promoting rail. Reducing railway tolls and financing railway maintenance costs would improve the rail network and allow bigger volumes of freight to be transported by train.

Decisions on the use of a modality would be based on the advantages and disadvantages of the service (real costs attributable to each modality and system). Benefits could be used to promote the modalities with more efficiency and less external costs.
The basis for such tariff systems could be the EU Directive 2006/38/EC of 17 May 2006 *on the charging of heavy goods vehicles for the use of certain infrastructures*[15], which establishes a distance-based charge or toll for heavy vehicles (>3,5 Tn) in the Trans-European high-speed rail network (TEN-R)[16].

[15] DIRECTIVE 2006/38/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures
[16] European Federation for Transport and Environment: Eurovignette. Taxes on the use of infrastructure. Barcelona. 2008.

- Following the example of Switzerland[17] that implemented in 2001 a toll on heavy vehicles based on maximum load, emissions and distance, Austria (2004), Germany (2005) and the Czech Republic (2007) all implemented charges for the use of all highways and some speedways. The amount of the toll depends on the size of the vehicle (number of axles) in all three cases, and on emissions in the last two countries. Several EU countries are considering similar measures, namely: Belgium, Denmark, Slovakia, France, Holland and Sweden. Some of these countries already have a highway toll on heavy vehicles over (>12Tn) depending on emissions. The extension of the toll to the whole road network to vehicles over 3.5Tn is currently being considered by the authorities.

Spanish authorities should consider the introduction of a similar system for the whole road network and for vehicles over 3.5Tn, taking into account the experience and results achieved in Switzerland. Tolls could be based on the maximum authorized load and on emissions/ euro. Tolls would be re-invested in the improvement of freight rail services, as in the case of Switzerland.

The system should include the latest available technology (such as GPS localizers) for the management of services and the control of possible violation of driving regulations. Monitoring the system would allow authorities to analyze statistical data of freight traffic to improve de system. It could also be a source of qualified jobs.

Environmental tax regulation

Freight transfer from road to rail may have an environmental tax policy with a persuading effect on the intensive use of oil-based transport. Cleaner alternatives could benefit from these changes.

Environmental taxes have twofold purpose:

- Sharp reduction of oil imports. Dependence on oil is a heavy burden for the Spanish economy: 90% of the energy consumed in the country comes from imported oil
- Minimization of greenhouse and other polluting emissions from the transport sector

Measures could focus on CO_2 emission taxes which already exist in some countries, as well as on tax increases on the import of oil-based fuels.

VAT regulation on energy and electricity could be arranged proportionally so that the biggest consumers would be charged higher taxes. In any case it is recommendable to conduct an appropriate monitoring of energy consumption to detect irresponsible practices.

It becomes essential to change the current regulatory framework on taxes (oil-based fuels, vehicle registration, vehicle circulation taxes, corporate tax, etc.). Changes in tax policies must be aimed at balancing tax deductions on the basis of energy, water and resource savings.

The framework for such regulatory changes must be an *Environmental Tax Law* which becomes even more necessary after the adoption of the Sustainable Economy Law of February 2011.

[17] Chapter 9 on best practices details the land freight transport model is Switzerland and the implementation of a railway service for trailers

The Spanish Tax Authority (AEAT)[18] stresses that this law did not include any fiscal measures to correct energy consumption patterns.

Planning, management, participation and training for the promotion of railway transport

Basic proposals in this field include:

- Creation of an agency, depending on the Ministry of Development, exclusively focused on the promotion of freight rail transport. The agency would not only conduct the management of rail networks, but also design and monitor the implementation of measures. It would also coordinate and monitor policy implementation at different levels (sector and regional), private and public initiatives in this field

- Designation of an agency for full stakeholder participation and negotiation for the development of rail freight. Stakeholders include public authorities, rail operators, managers of rail infrastructure, representatives of private logistics companies, port authorities, rail trade unions, as well as representatives of sectors associated to rail freight activity (automobile industry, wholesale trade, etc.)

- Creation of a freight rail transport observatory to process information regarding offer/demand, job statistics and data on the evolution of energy and environmental indicators. The observatory would also compile and disseminate best national and international practices in this field

- Development of special, certified vocational training programs for specific tasks, functions and professional profiles associated to rail freight transport. It is essential for the development of the sector to have a well trained, technically updated staff that will render it more competitive

10.2. Proposals to improve urban freight distribution

Three basic elements must be considered for the development of future urban freight distribution programs:

- Freight transport means
- Timing and schedules
- Public urban space where loading and delivery are carried out

Modal shift

Modal shift is the cornerstone for changing of freight transport patterns and reducing oil consumption. This modal shift implies a bid for light electric vehicles (bicycles and small cars) complemented by other sustainable forms of transport.

Modal shift must not be an isolated measure but part of a joint strategy on urban freight distribution. Such strategy requires a bid on integrated actions that take into account space and time factors. Measures like the creation of micro-platforms and night unloading operations prove highly effective. Approaching these measures separately makes efficiency

[18] Basic tax modifications introduced by the 2/2011 Act of March 4, on Sustainable Economy (Published on March 5 by the Spanish Tax Authority

assessment very difficult. An integrated approach will require in any case individual *trial and error* assessments.

Therefore, modal shift strategies must combine several courses of action:

- Selecting measures for the rationalization of deliveries
- Adopting decisions to provide adequate means and facilities
- Analysis of modal adjustments
- Introduction of support technologies

Mobility planning

Society must address the resolution of problems associated with the design and implementation of policies to achieve an integrated urban distribution within the scope of sustainable urban mobility. In such a context municipal and public authorities are responsible for:

- Engaging high profile experts in the field of urban mobility, urban planning and economy and arrangement of urban spaces
- Arranging all available resources for R+D+i to improve sustainable mobility
- Forwarding clear and updated information to citizens on sustainable mobility and feasible alternatives
- Allowing and promoting citizens' participation (with representatives from all stakeholders) prior to any decisions on guidelines and solutions. Local authorities must provide information of general interest, monitor the process and work with affected citizens with an active approach
- Developing plans for Urban Sustainable Mobility and Urban Freight Distribution as cohesive elements for the city. These measures must be consistent with partial decisions that affect the loading, unloading and distribution of urban freight
- Developing, whenever possible, rationalization programs to relocate supply centers near the cities in order to avoid long distance journeys of freight distributors. This approach requires cooperation between municipal agencies to negotiate with different authorities the rearrangement of globalized distribution patterns
- Raising awareness and understanding to facilitate the implementation of solutions and alternatives

Conclusions

This study reveals three basic aspects associated with sustainable freight transport:

- Local authorities should not limit their role to "*traffic police*" functions. It becomes necessary to have a totally new approach that implies a political and cultural shift in most municipalities
- Decision–making must be made on the basis of democratic principles. Municipalities must adopt a roadmap for the transition to sustainable urban environments

- The debate on solutions for urban freight distribution is a complex process and it should be approached on the basis of practical examples and assessments. There is no room for dogmatic practices

However, no significant steps towards sustainable freight transport will be taken until the "*de-carbonization*" of freight distribution is thoroughly addressed.