Ex post Evaluation of investments in Road and Rail Transport Infrastructure Supported by European Regional Development Fund and Cohesion Fund

Executive Summary

ERDF

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MINISTERIO DE HACIENDA Y FUNCIÓN PÚBLICA
SECRETARÍA DE ESTADO DE PRESUPUESTOS Y GASTOS
DIRECCIÓN GENERAL DE FONDOS COMUNITARIOS

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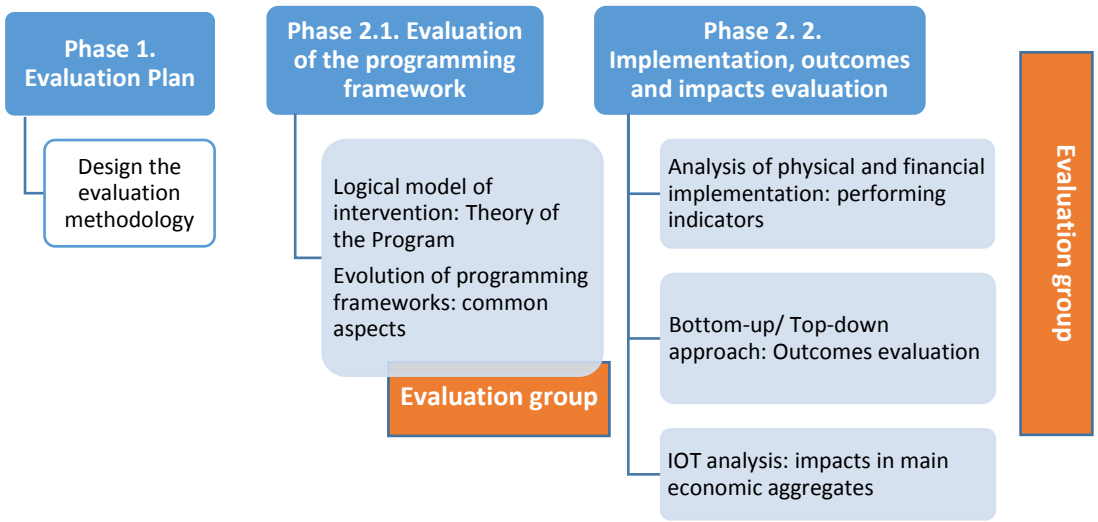
1. METHODOLOGIC APPROACH OF EVALUATION

Expost Evaluation of the investment in road and rail transport infrastructure supported by European Regional Development Fond (ERDF) and Cohesion Fund (CF), is a voluntary exercise of reflexion and analysis promoted by the SGPEPC[1]. The main aim is "**to know and assess the effects and impacts that cohesion policies in the field of transport infrastructure by road and rail, supported by the CF and ERDF, have had in the Spanish territory and economy"**. Specifically:

- To value the programming framework that has supported the implemented actions, in term of objectives and strategies, and how it relates to the needs and context in which they had been developed.
- To analyse the implementation of the Funds in the 2000-2006 and 2007-2013[2] program periods, and identify the main outcomes and effects resulted of the investment in transport infrastructure by road and rail.
- To know the impact in the main aggregates (income and employment) of the investment in road and rail infrastructures (IOT analysis).
- To deduce the learning lessons for the new 2014-2020 programing period.

Following a public tender, the successful bidder submitted and validated with SGPEPC a detailed work plan (derivable: Phase 1_Evaluation Plan), which defined the evaluation approach, phases, methodology and research techniques, deliverables, research team, timeline and participatory sessions of the Evaluation Group (EG). The evaluative process has responded to the following scheme:

Figure 1. Evaluation Process



Source: Prepared by the authors.

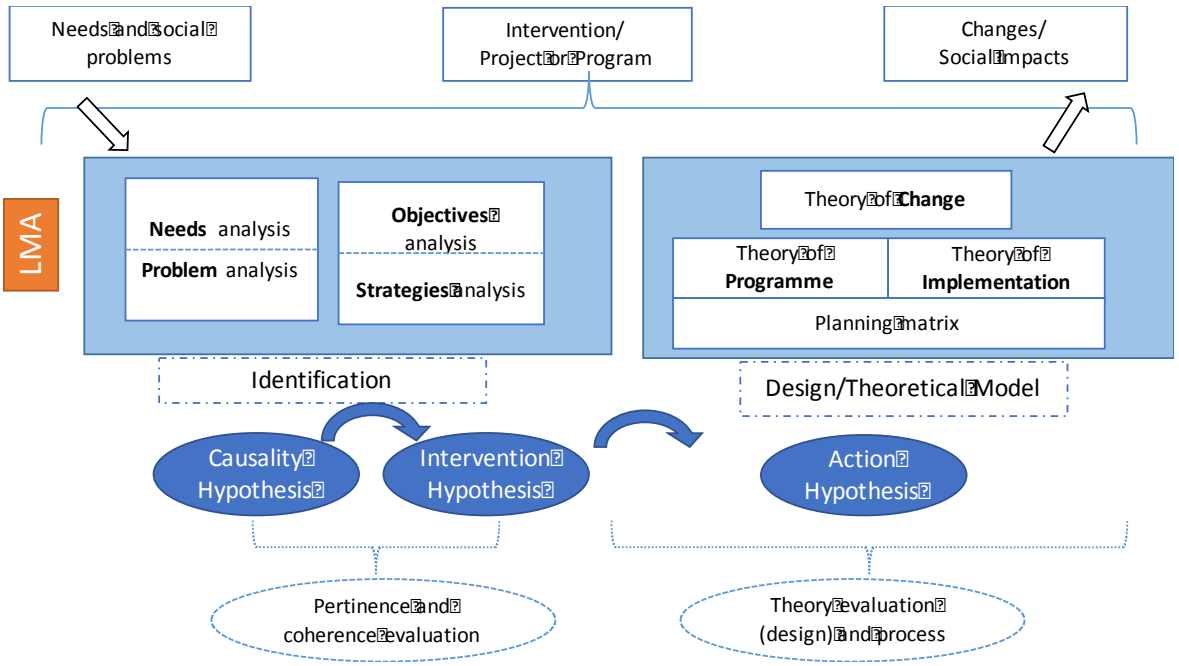
[1] SGPEPC. Secretaria General de Programación y Evaluación de Programas Comunitarios.
[2] As an application of the n+2 rule for the implementation of the Funds, the 2007-2013 period is extended to 2015. Therefore, some indicators are dated in that year.

Each phase is feeding the next and are the base to the institutional improvement, identification of learning lessons and good practices, improving of the programing, and the accountability for the presentation of the outcomes and impacts.

With a participatory evaluation approach, EG, managed by the SGPEPC, has had a relevant role in all the evaluation process. It has participated in the different evaluation tasks to ensure the quality of the works, to facilitate the access to the information and data, and to validates conclusions. The participation and contribution of the stakeholders is essential to understand all the factors that have and any kind of impact in road and rail infrastructure.

The evaluation process implemented has based on the analysis of the relations underlie intervention, just as the following diagram:

Figure 2. Evaluation Methodology Approach. Programme Theory



Source: Adapted from Ivan Touza.

This model relates the Logical Framework Approach (LMA) and the Programme Theory, so its allows:

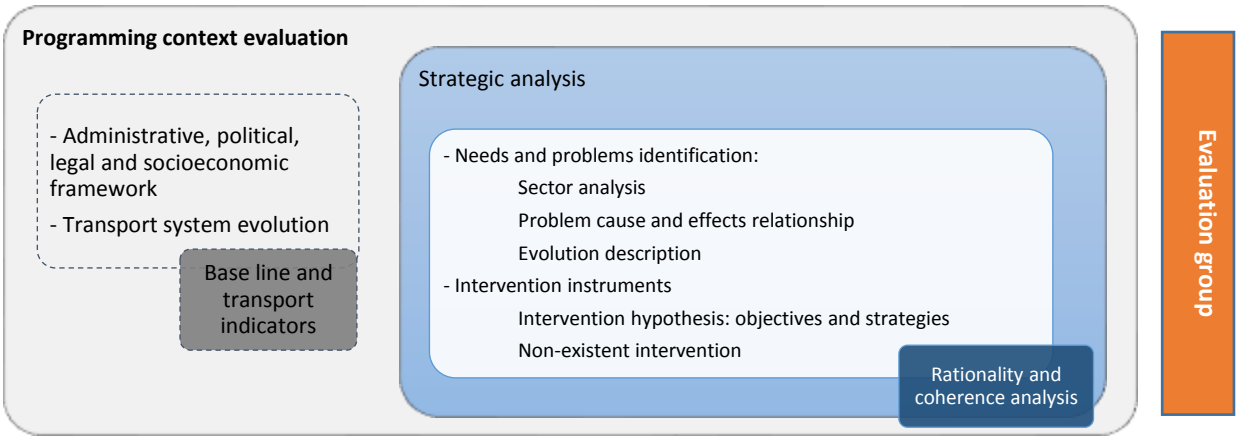
- To know **why** and **for what** the investment have been made, that means in which reality and how the problems and needs have been affected. **Causality Hypothesis.**
- To understand the reasons those justified the implemented strategy, as the better option for change or improve the reality. **Intervention or Implementation Hypothesis.**
- To identify how the mechanism for the change are working (respond from the developed activities and actions), in which circumstances and conditions. **Action Hypothesis.**

Application of techniques, processing and data analysis, and report writing involves the triangulation of information from documentary analysis and fieldwork to strengthen quantitative and qualitative approaches, and to obtain a more complete and plural data by using the advantages of both approaches and minimizing their potential weaknesses.

2. EVALUATION OF THE PROGRAMMING FRAMEWORK

The evaluation of the strategic programming framework is based on the analysis of the several elements that have supported planning periods with the objective of know what mechanisms produce the changes in the object of evaluation. The conclusions were presented and validated by EG.

Figure 3. Scope of programming evaluation



Source: Prepared by the authors.

The deliverable has been progress report: Phase 2_1: Analysis of the programming framework.

As general conclusion, the strategic framework has stayed stable during the period, and its evolution has based on the changes of the transport system and the national and European policy priorities.

a. EVOLUTIVE ANALISYS OF NEEDS

At the end of the period 1993-2013, it´s observed an **important improving of the all indicators of road and rail transport**, both absolute value and relative position of Spain in the European Union. The high volume of public investment in the transport system has favoured the convergence process of Spain with Europe in terms of stock and quality of transport infrastructure.

Launching a **high-quality road** (HQR) **network system** has solved the problem of resources of road infrastructures, which has permitted to finish the linkage intra and interregional, and with the European Transport Net (TEN-T). This solution has been in accordance with the strategies of the frameworks, where it has been a priority to ensure a high-quality service to the mobility and a high safety transport. Spain reach the first place of European countries in term of density road: from 12,99 km/1.00km^2 to 29,70 km/1.000 Km^2 (the European average is 24,50 km/1.000 Km^2).

Rail infrastructures have a radial model with Madrid in the middle and connection with the most important regional towns. The investment priorities have been focused in the High-Speed Trains (HST). In 2015 Spain

is the EU´s countries with more kilometres of HST: 2.871 km[3], whereas the European average is 286 km. The investment effort in medium and short distances have had a residual importance.

In **accessibility and mobility**, the problem most intensely tackled is the need of improve the connection between regions and abroad. There has been an important progress in terms of structuring and accessibility, so in 2014, all the main city has been connected by high quality roads, and 25 main cities (51% of total) are connected by HST: Madrid, Sevilla, Córdoba, Ciudad Real, Huesca, Guadalajara, Zaragoza, Lleida, Málaga, Tarragona, Toledo, Segovia Valladolid, Barcelona, Girona, Cuenca, Albacete, Valencia, Orense, Santiago de Compostela, A Coruña, Alicante, Palencia, León, and Zamora (in 2016).

There are two core TEN corridors across Spain: Mediterranean Corridor and Atlantic Corridor, that have experimented an important progress since 1993, when only the 30% of capitals were connected.

This improvement of connection has promoted the mobility and passengers and goods traffic. In 2014, the relation between the road mobility and GDP was 21,77 vehicles-km/M€ in Spain, same value that the EU-28 average, and the intensity of rail transport has reached a value higher than UE-28 average (in 2014 the Spanish data is 18,4 thousand trains-km/M€).

In 2014, passengers and goods traffic by road in Spain was 222.689,3 million vehicles-km, with a concentration in conventional road and highways. The impact of the crisis has induced an important decrease both in volume of vehicles-km and vehicles/day in all type of roads, so on in 2014 this volume is less than the value in 2033 (-5,8%). In the case of goods, the decrease is biggest (-21% between 2014 and 2007), particularly in tonnes transported.

The rail traffic reached 25.368 million of passengers-km, with a rise of 17,2% from 2007. This increase was obtained by a long-distance passenger raised (53,5%), because of the placing in service of the HST lines, which offset and exceeded the rest kind of train services.

The goods transport by rail amounted 11.131 million ton-km, declining by almost 28%, which has been attenuated by the increase registered in recent years, and to which the traffic corresponding to Private companies, whose growth has been exponential since its appearance in 2007, going from 96 million ton-km in 2007 to 2,700 in 2014.

In relation to the indicators of quality and sustainability, it is noteworthy the progress in the reduction of road accidents. This improvement contributes the alignment of Spain with the European Road Safety Strategy.

Another quality indicator is the speed of circulation. On average the road in 2014 on Spanish motorways and highways was 101.51 k/h, while on conventional roads it was 80.06 km/h. In rail, the average speed of trains in Spain is 130.9 km/h in long-distance and high-speed commercial services (OFE, 2014), and has manifested a growing performance achieving an increase of 32.9 km/h on average since 2003.

[3] Data from Eurostat: Union Internationale des Chemins de Fer (updated March 2016), high speed department; national source

On the other hand, the externalities of transport that directly affect the environment are, together with the accident with victims, the fundamental elements for the sustainable and safe development of the transportation system for the users, which makes the analysis of sustainability a fundamental axis in the study of the sector.

In the transport sector, because of the nature of the fuels, emissions of pollutants, and greenhouse gases (GHG), are linked to energy consumption more intense than in other sectors. Spain has a greater relative weight in greenhouse gas emissions by the transport sector (27.5%), than the European Union average (23.7%).

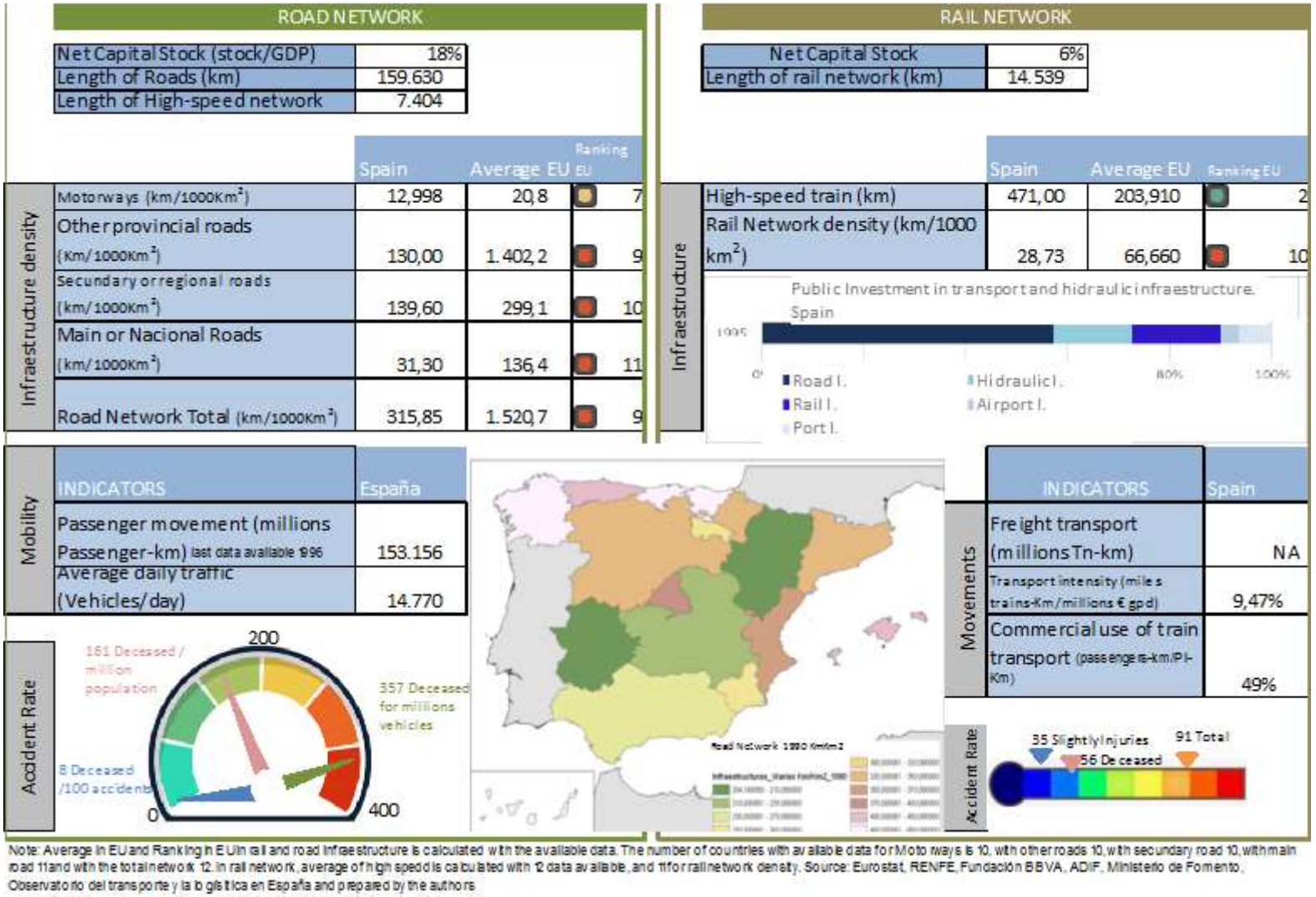
Within the transport sector, the road sector is by far the most GHG emissions produced (94.4% of the total sector), and the railway sector with the lowest direct emissions (0.3%)[4]. In general, GHG emissions in this sector increased until 2007, gradually declining since then.

Road transport is also by far the most polluting gas, although it is present a reduction in total emission over these years. The reduction in carbon monoxide production since 1993 has been spectacular (-91.1%), although organic compounds (-93.1%) and sulfuric oxides (-99.4%) have been higher, although its weight in the total was much smaller.

The production of polluting gases in rail transport is reduced compared to road transport, accounting for 0.2% of the total pollution from these gases in transport. In addition, throughout the period considered has been reduced in all types of gases

[4] This figure does not include the indirect emissions produced by the generation of energy required for rail transport.

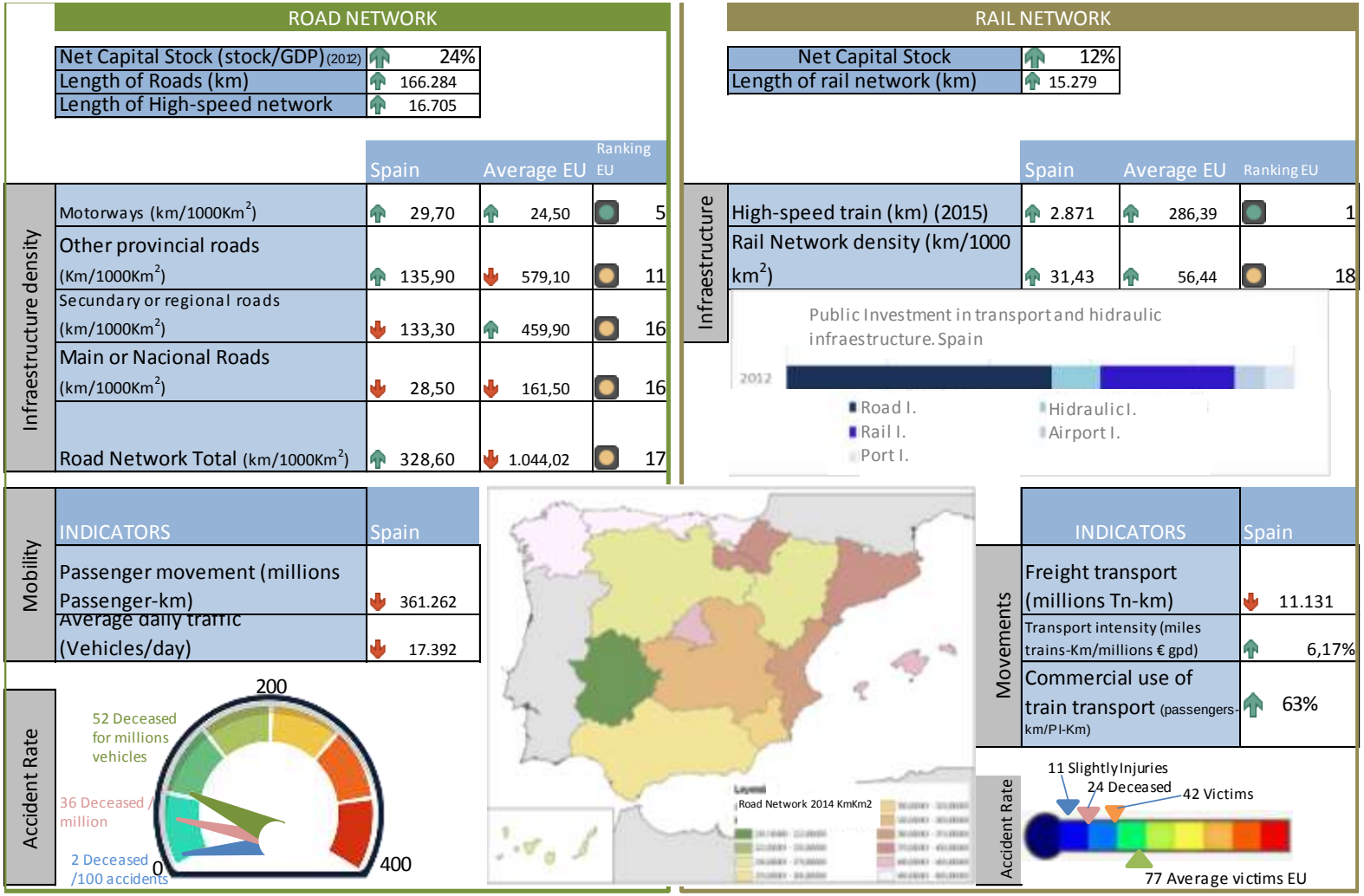
Figure 4. Scorecard 1993



Note: Average in EU and Ranking in EU in rail and road infraestructure is calculated with the available data. The number of countries with available data for Motorways is 10, with other roads 10, with secundary road 10, with main road 11 and with the total network 12. In rail network, average of high speed is calculated with 12 data available, and 11 for rail network density. Source: Eurostat, RENFE, Fundación BBVA, ADIF, Ministerio de Fomento, Observatorio del transporte y la logística en España and prepared by the authors

Source: Prepared by the authors.

Figure 5. Scorecard 2014



Note: Average in EU and Ranking in EU in rail and road infraestructure is calculated with the available data. The number of countries with available data for Motorways is 23, with other roads 18, with secundary road 18, with main road 20 and with the total network 22. In rail network, average of high spedd is calculated with 25 data available, and 25 for rail network density. Source: Eurostat, RENFE, Fundación BBVA, ADIF, Ministerio de Fomento, Observatorio del transporte y la logísitica en España and prepared by the authors

Source: Prepared by the authors.

The common problems and challenges tree is drawn from the quantitative analysis of road and rail transport system indicators, plus documental research, which is represented by SWOT, with the following characteristics:

- Maintenance of the main problems over the period (1994-2013), although it is corroborated a general improvement by main indicators, and an evolution from a generalized lack of stock problem, to being focused in certain territories, which produces an unbalanced situation.

  There is an important effort to increase the road and rail stock km (in absolute and relative terms), while it is still necessary an intervention in the second level of problems: some points and connexions (accessibility problems), technique elements (quality and modernity problems), and in factors related network management (management system problems).

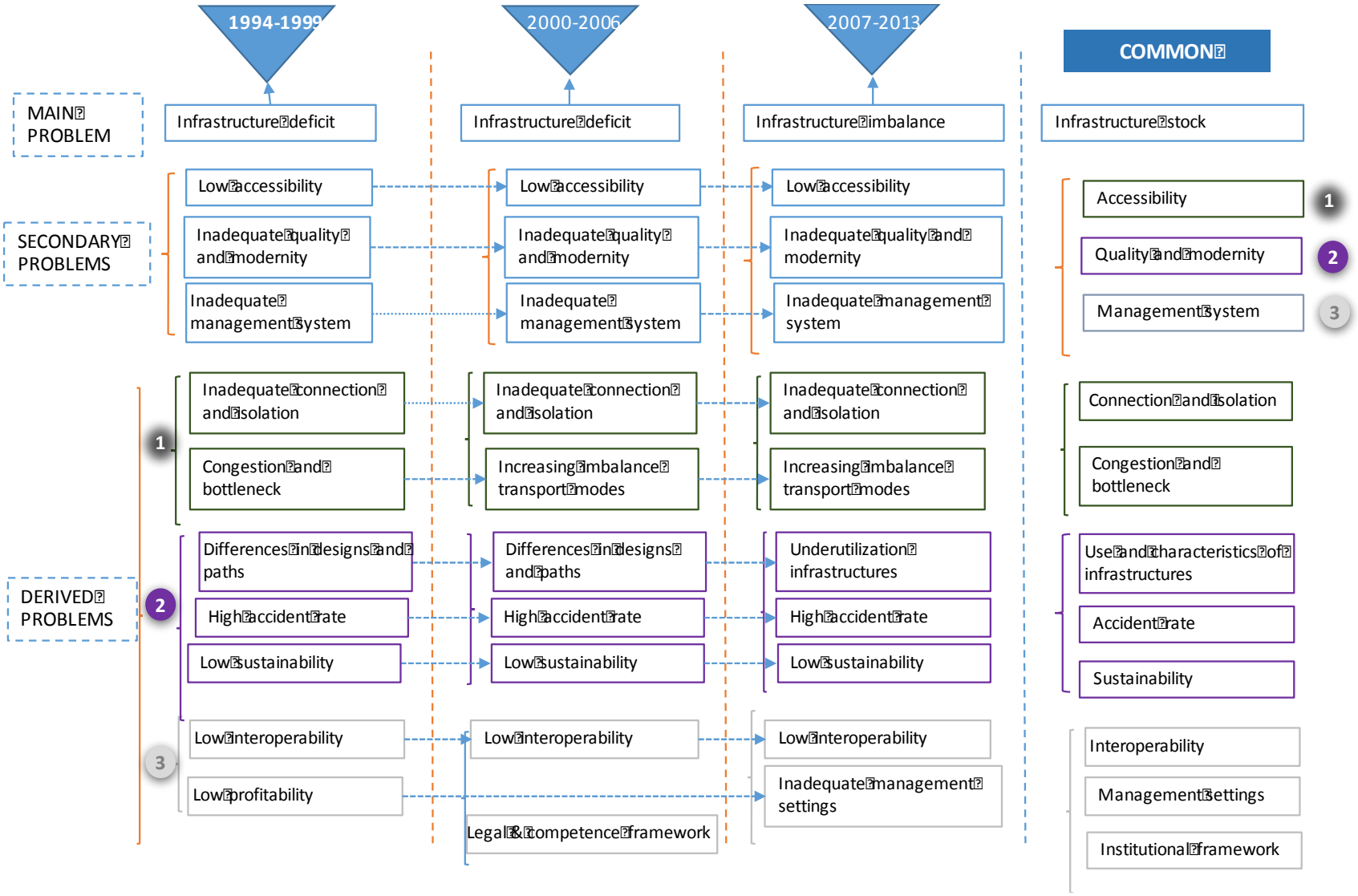
- Because of the evolution to a more mature transport system, it is appreciated differences in accessibility problems. From a high number of unconnected areas or zones with congestion and bottleneck problems, to a situation of an appropriated development of the outer connection at the end of the period. Despite the improvement, some regions have still an inland connection problem, in part because of prioritized of investment in high-capacity roads for both highways and railways, in front of the secondary network.

- Concerning quality and modernity, problems, there is still a concern to reduce accident rates, just like improve the sustainability of the transport system, although in a focused way, since there has been an important advance through the period in expanding the option of train as an alternative to the road, opting for safer routes and according to external connectivity, and incorporating standard security solutions. All this, does not make the problem disappear, but its weight in the whole, going from generalized to localized.

  The problem that presents the most erratic behavior is the one related to the differences in the designs and paths, so that the primacy of high capacity roads generates the appearance of deficiencies in secondary networks and underutilized infrastructures.

- The problems of the management system become relevant, so that, in addition to the lack of interoperability (which is present throughout the period), other management parameters (linked to social profitability) are added depending on the Framework; or the institutional context (such as the legal and competence Framework).

Figure 6. Problems and challenges evolution



Source: Prepared by the authors.

b. EVOLUTIVE ANALYSIS OF OBJECTIVES AND STRATEGIES

The evolution of planning, in terms of the programming of objectives presents the following features:

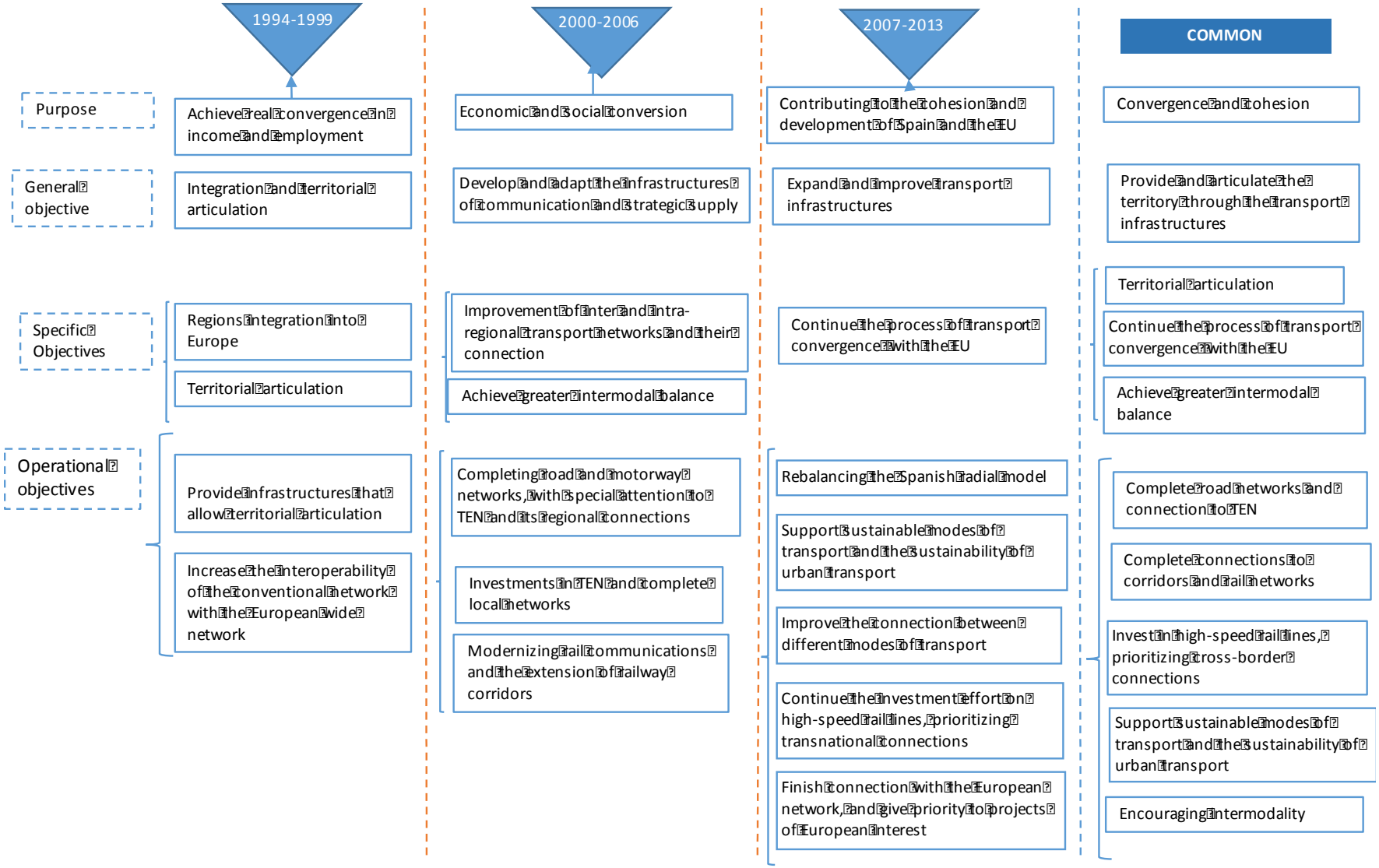
- The formulation of purpose of the framework evolves for most economic approaches to others those include social and environmental components, where the "Convergence and cohesion of regions" is the inspiring principles of European policy.
- The general objective, it has hardly changed over the period, in accordance with the main problem: To provide and articulate the territory through transport infrastructures.
- The specific and operational objectives are articulated to answer to the general objective, and although they are also related with problems and challenges that are established in each framework:
    - Territorial joint: it is specially linked to answer the accessibility problems and its derived problems. This objective at the operational level translates into conclude networks and connections, as well as finalizing the corridors.
    - Convergence in transport with the EU: this convergence is understood in a double plane, on the one hand, it tries to align itself with the trend to impulse of the high speed and transnational connection that facilitates passengers and goods mobility, as the same time as it affects in safer and lower accident rates transport modes. From this point of view, problems related to use and maintenance of infrastructures and accident are being addressed. In the other hand, convergence arise in terms of sustainability, betting on more sustainable modes of transport that come to give an answer by the planning to the challenges detected in this issue.
    - To achieve a greater intermodal balance: it is presented as a response to one of the problems and challenges that have increased their relevance throughout the Frameworks: the high dependence of the road as a mode of transport and the need to establish alternatives and complementarities to them.
- At operational objectives level, there is greater variability, due to the specialization and detail of the planning. As the Frameworks are developed, the planning experience and fund management rules objectives are becoming more concrete, so the degree of planning is also more specific, focusing mainly on the more operational level.

  In any case, the objectives converge on the needs to complete and improve the internal road networks and the connection to TEN, to invest in HST line, prioritizing transnational connections, favouring more sustainable transport modes and the sustainability of the urban transport and to promote intermodality.

To this end, the proposed strategies have evolved in the following way:

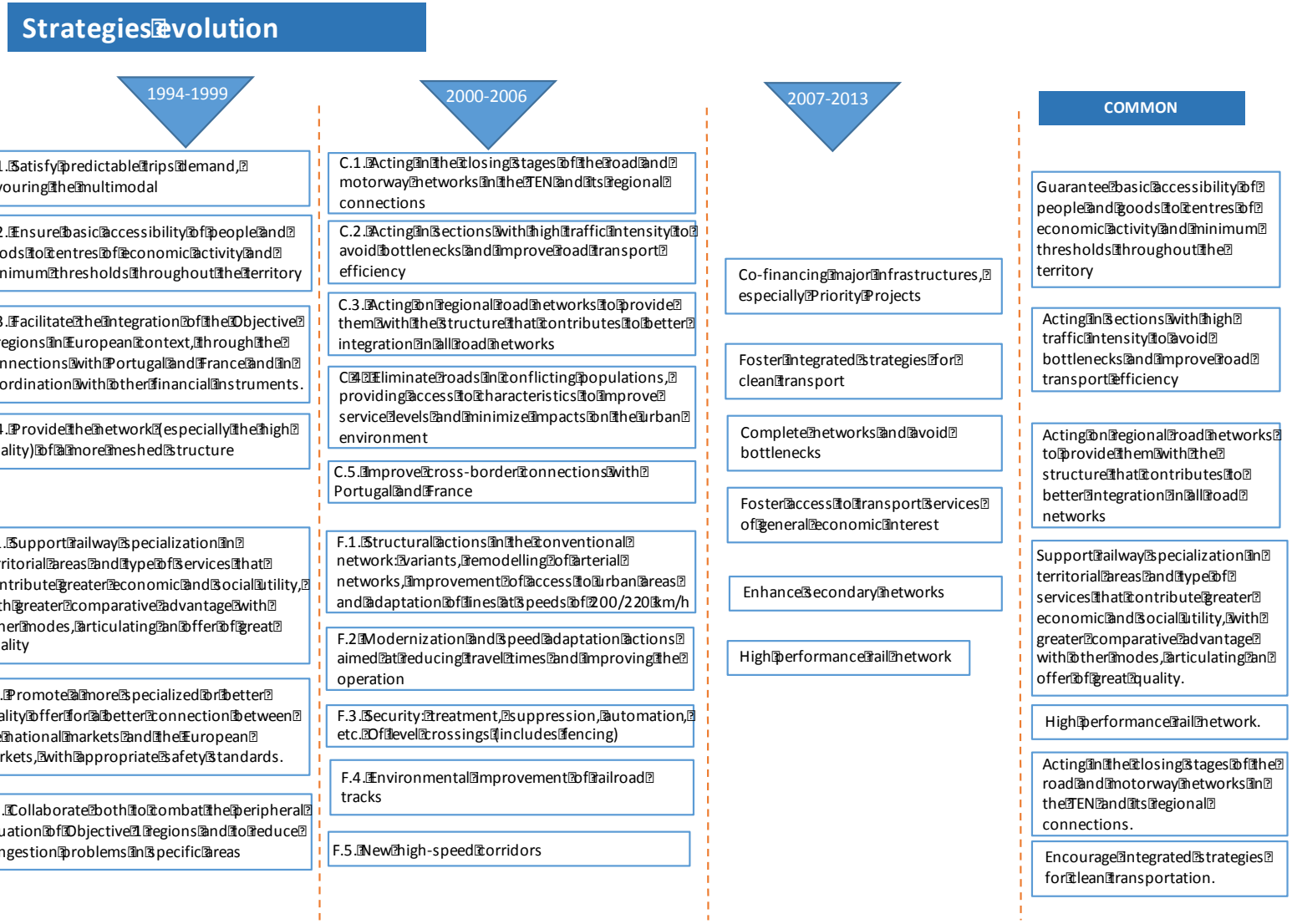
- Unlike the objective, as the frameworks have been progressed the strategies have been reduced their ranges, due in large part to the greater concreteness and delimitation of the actions that funds can co-finance.
- The defined strategies have been mainly focused on the two first problems: accessibility and quality and modernity, leaving management problems limited to intermodal.
- As the need of infrastructure stock has been met, the strategies have been evolved to solve specific connection problems (intra and interregional). The development connections with the rest of Europe, through the TEN, is presented in all Frameworks.
- In terms of quality problems, the strategies have been tended to solve those related to sustainability and technical designing.

Figure 7. Objectives evolution



Source: Prepared by the authors

Figure 8. Strategies evolution



Source: Prepared by the authors.

Following the analysis, it is necessary to verify the coherence of cause-effect relationships and means-ends, if there is a logical articulation between the different levels, and the pertinence, understood as the relation between the detected problems, the suggested objectives and designed strategies.

A "high incidence" and "low incidence" scale has been stablished, based on the estimation of the capacity of the proposed strategy to solve the identified problem, to assess the correspondence between needs and challenges and articulated activities to solve them[5].

If the existence of this relationship between the problems and the objectives has already been demonstrated, in this second level question poses the answers in the form of concrete strategies to the different problems and challenges.

- “High incidence” relationships are more frequently between strategic lines and problems and challenges of accessibility, from which it is deduced that there is a greater conviction about the direct effects that the actions of these lines have in the improvement of the problems of connection and isolation, and congestion and bottleneck problems.

  In this sense, for all the problems derived from this first group of needs there is at least one strategic proposal: to guarantee the basic offer of accessibility of passengers and goods, to intervene in sections with high traffic intensity, acting in the secondary networks, TEN, urban, rural and industrial areas.

- For the problems and challenges of quality and modernity of infrastructures, there is a clear relationship between the promotion of rail, intermodal and clean transport strategies (HST network and interoperability and to promote integrated strategies for clean transport); and the effects they may have on problems related to the sustainability of the transport system: pollution, emissions and energy consumption.

  The challenges related to the modernity and quality of infrastructures find a strategic response, in most cases with a weaker impact, in the actions of the acting in the closing sections of the road and motorway networks in the TEN; and favouring the railway specialization. In this regard, they are more geared towards rail transport infrastructures, which, by road, also in line with the evolution of regions and eligible expenditure in the different programmatic frameworks.

- The problems related to the management system are those that have a lower response, partly based on the lower incidence of European funds on this subject.

[5] These relationships have been discussed and approved with the EG, so it responds to the qualified opinion of the members, plus the documentary work done by the consulting team.

Figure 9. Problems-objectives and strategies common relationship

Problems	Objectives/ Strategies						
	Guarantee basic accessibility of people and goods	Acting in sections with high traffic intensity to avoid bottlenecks and improve efficiency	Acting on regional road networks	Support railway specialization	High performance rail network	Acting in the closing stages of the road and motorway networks in the TEN and its regional connections.	Encourage integrated strategies for clean transportation
1. ACCESSIBILITY							
1.1. CONNECTION AND ISOLATION							
1.1.1. Incomplete secondary networks	X		X				
1.1.2. Discontinuities in high road network	X	X			X		
1.1.3. Unfinished TEN connectivity	X				X	X	
1.2. CONGESTION AND BOTTLENECK							
1.2.1. In urban and metropolitan areas	X	X		X			X
1.2.2. In industrial and rural areas	X	X		X			X
2. QUALITY AND MODERNITY OF TRANSPORT SYSTEM							
2.1. USE AND QUALITY							
2.1.1. Speed, services, etc.	X			X		X	
2.1.2. Streaks and lines with weak traffic	X			X		X	X
2.2. ACCIDENT RATE							
2.2.1. Inadequate safety parameters			X		X	X	
2.2.2. Different stock levels				X	X	X	
2.3. SUSTAINABILITY							
2.3.1. Environmental heritage effects		X			X		X
2.3.2. Pollution		X		X	X		X
2.3.3. High energy consumption		X		X	X		X
3. MANAGEMENT SYSTEM							
3.1. INTEROPERABILITY							
3.1.1. Difficulty integrating network in international framework	X				X	X	
3.1.2. High road transport dependence				X	X		
3.2. MANAGEMENT SETTINGS &3.3. INSTITUTIONAL FRAMEWORK							
Week economic viability				X			
Inefficient management system				X			

High incidence

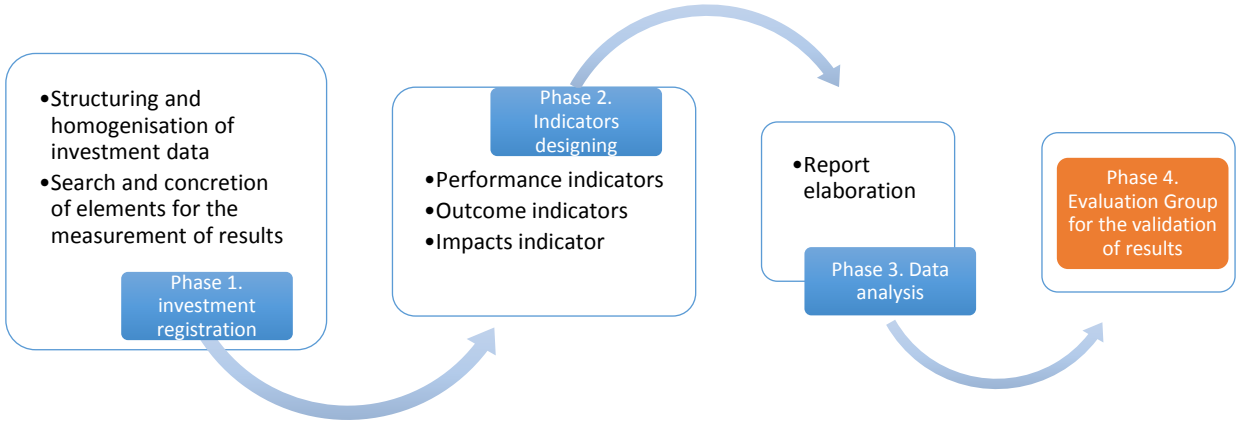
Low incidence

Source: Prepared by the authors.

3. IMPLEMENTATION AND OUTCOMES ANALYSIS

Once the EG has validated the theoretical framework of the road and rail infrastructures policy supported by CF and ERDF, implementation, outcomes and impact analysis is overtaken. The derivable of this analysis is the report Phase 2_2: Implementation analysis and outcomes and impact evaluation, which has been also presented and validated by EG. Final report and executive summary has been elaborated from derivable Phase 1, 2.1 and 2.2.

Figure 10. Working process in implementation and outcomes analysis



Source: Prepared by the authors.

The information resources have been the database of the ERDF and CF managed by SGPEPC, the information reported by ADIF[6] and Ministerio de Fomento, as well as data of reports, documents and other secondary research fonts. A work of debugging, unifying and processing have been done over the database, in which 6.457 records of investment have been validates for the study, as the following distribution:

	Number of records	% over total	Number of discarded records	Total Records
Rail	2.468	38,2%	58	2.526
Road	3.999	61,8%	995	4.994
Total	**6.467**		1.053	7.520

The investment listing has been done in accordance with the name of actions records on database, and when the description didn´t have had enough information there has been looked up in second research font. The criterions of listing have been as follows:

Type of investment	Type of infrastructure	Type of work
Conditioning and improvement (corridors and long-distance connections)	High quality and high speed	Works (construction)
New infrastructure (corridors and interurban connections)	Conventional network	Stations (train and bus)
Urban areas intervention	Urban infrastructures	Studies and technical assistance
Signs and safety		Signs and safety

[6] *ADIF: Administrador de Infraestructuras Ferroviarias.* Spanish Railway Infrastructure Administrator.

After the information has been recorded in indicators, the processing and analysis has been done, and the result is the implementation and outcomes evaluation of the investment.

It is important to point out that some actions have an impact on more than one problem, although it has been chosen to link them only to what the relational model establishes in a more direct way. In other cases, especially in new works, cross-sections include measures that affect several areas (connection, security, environment), although they are recorded only once, and for the problem in which it most intensely intervenes.

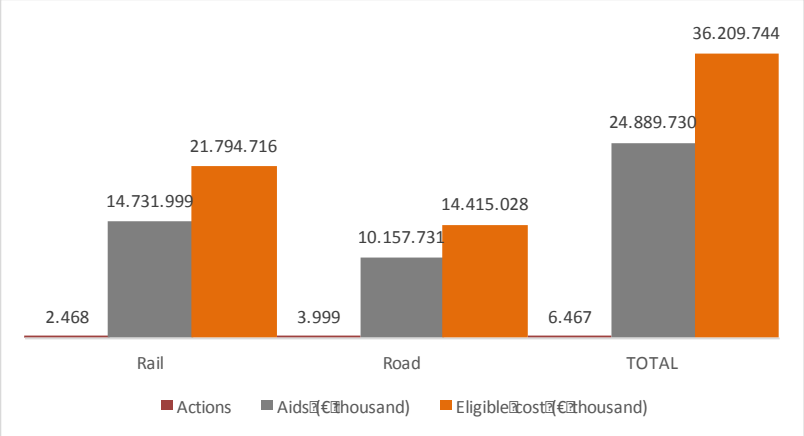
The outcomes analysis is also doing by phases. In a first phase, the matrix of problems-challenges and strategies for the regional and national level is related to indicators derived from cross-cutting sub-criteria by type of work, investment and infrastructure.

3.1. IMPLEMENTATION ANALYSIS

The **global implementation** analysis of the aid to road and rail transport infrastructures shows the **coherence between the context and the programming framework** (problems and challenges, objectives and strategies), and **the actions finally implemented**.

The sum of Funds earmarked for the development of the road and rail infrastructures network along the two periods under evaluation (2000-2006 and 2007-2013) amounted to 24.889.730 € thousand for an eligible cost of 36.209.744,2 € thousand, representing co-financing rate of 68,7%.

Figure 11. Distribution of actions, aids and total cost by type of infrastructure



Source: Prepared by the authors.

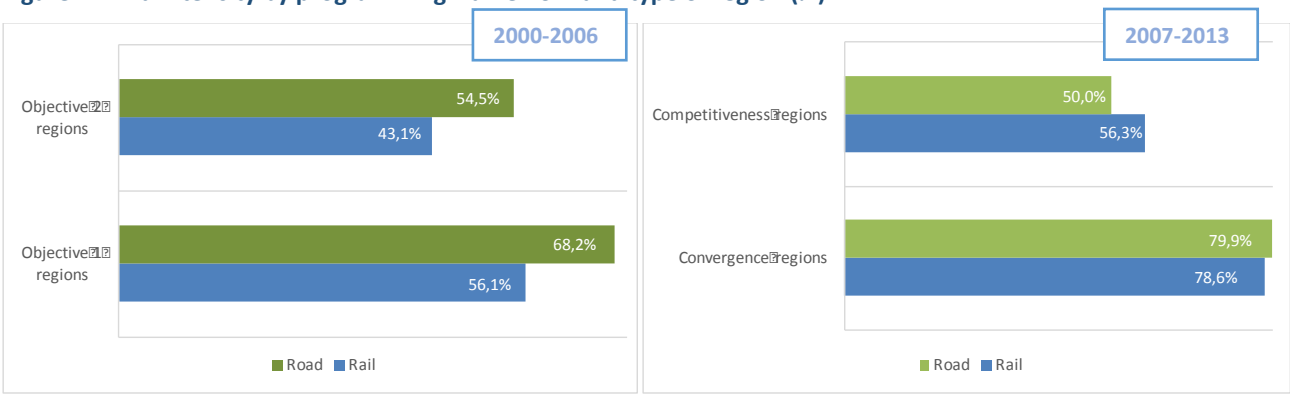
From the 6.467 actions recorded, the road infrastructures have been the highest percentage of action (more than of three in five), however the amount of aid has been higher in rail infrastructures (59,2% of the total), as well as the associated eligible cost to these actions, in accordance with the strategy of developing alternative ways to the road.

In terms of absolute aid investment, two type of regions can be distinguished: regions with a low concentration of aid, which includes the most developed regions, the Islands and the two autonomous

cities; and the high concentration of aid, where in additions to the relatively less developed regions (Objective 1 and Convergence), are those that have concentrated more actions on HST co-financed by CF.

If it is connected the aids and the eligible cost (aid intensity), it's verify the relevance of the Funds in the overall investment both in rail (67,6%) and road (70,5%), although uneven by regions.

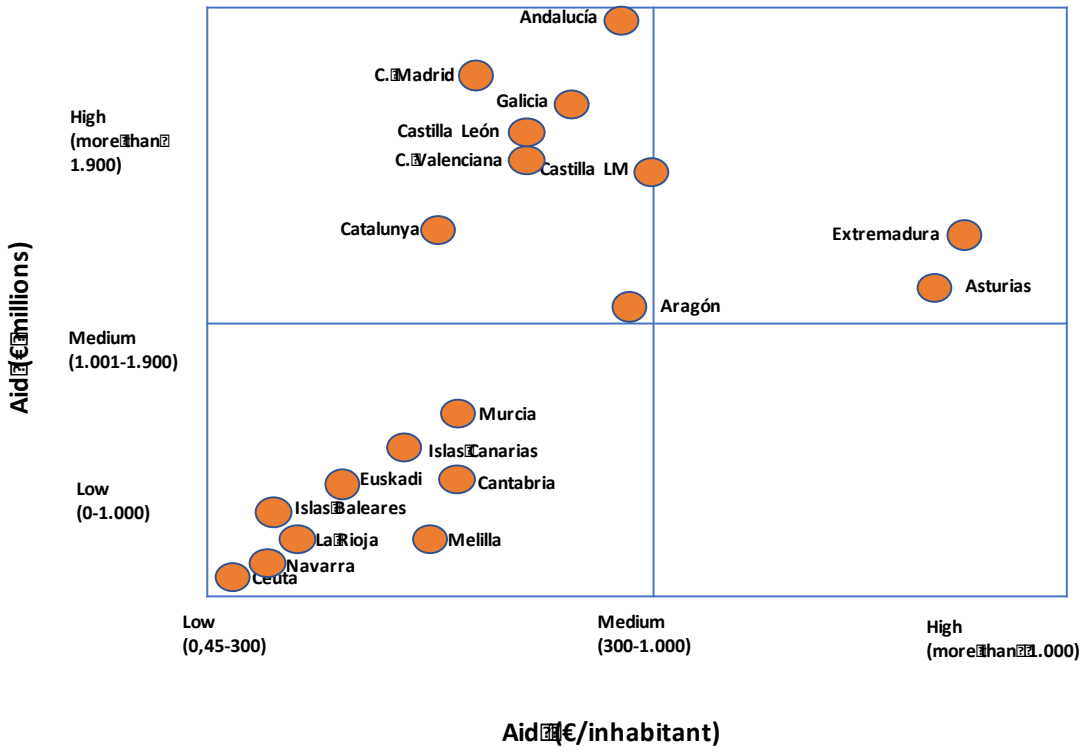
Figure 12. Aid intensity by programming framework and type of region (%)



Source: Prepared by the authors.

Per capita implementation shows a high dispersion in the amount invested according to each region, with important differences in the extremes (Asturias with 1,189 €/inhabitant and Ceuta with 0,45 €/inhabitant).

Figure 13. Distribution of total and per capita aid by regions



Source: Prepared by the authors.

The implementation **analysis by type of investment** verifies that the main destination of the aid has been for works in the high-quality roads and HST networks, with very similar proportions for the case of conventional network and those carried out in urban areas.

The distribution of rail investment shows a preference for this transport mode, which concentrated nine of each ten euros of aids. This is a reflect of the priorities settled by sectorial documents, and supported by European programming. In the case of road, it is also shown the priority of the works in high-quality network, but less concentrated and more presence of the other types.

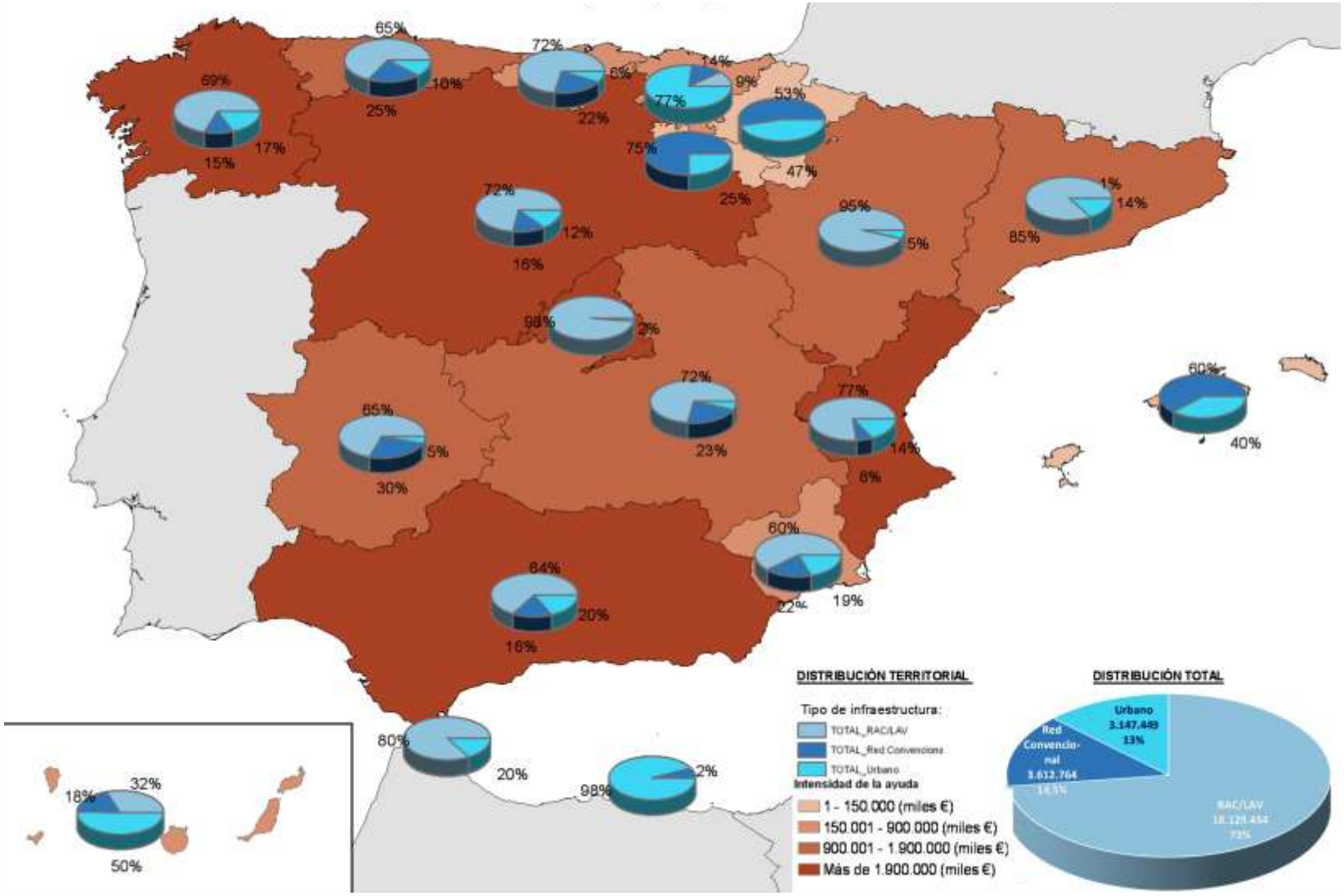
By territories, are **those with major problems of connection or congestion which have concentrated more funds, and those that have also allocated the most to the development of high-quality network**, matching up with the main Corridors. On the other hand, the territories most developed have prioritized investments al the local level.

The **implementation analysis by type of work shows that the main destination of the funds has been construction of new work**, and within it, the **high-quality and speed**, with shared efforts to improve the conventional network and the works in urban area.

By type of Funds, the **CF has concentrated its efforts on the railways** (especially in the second period) following the trend of sector programming, while the **ERD**F, which is more in line with territorial development strategies, has **continued maintaining a distribution more in line with the problems of the different regions**.

Finally, it is observed that, in line with the distribution of competences and possible agents, there has been **a plurality among the agents** involved in the implementation of the actions, although with a **greater representativeness of the Central State Administration**.

Map 1. Distribution of aids by type of infrastructure and regions

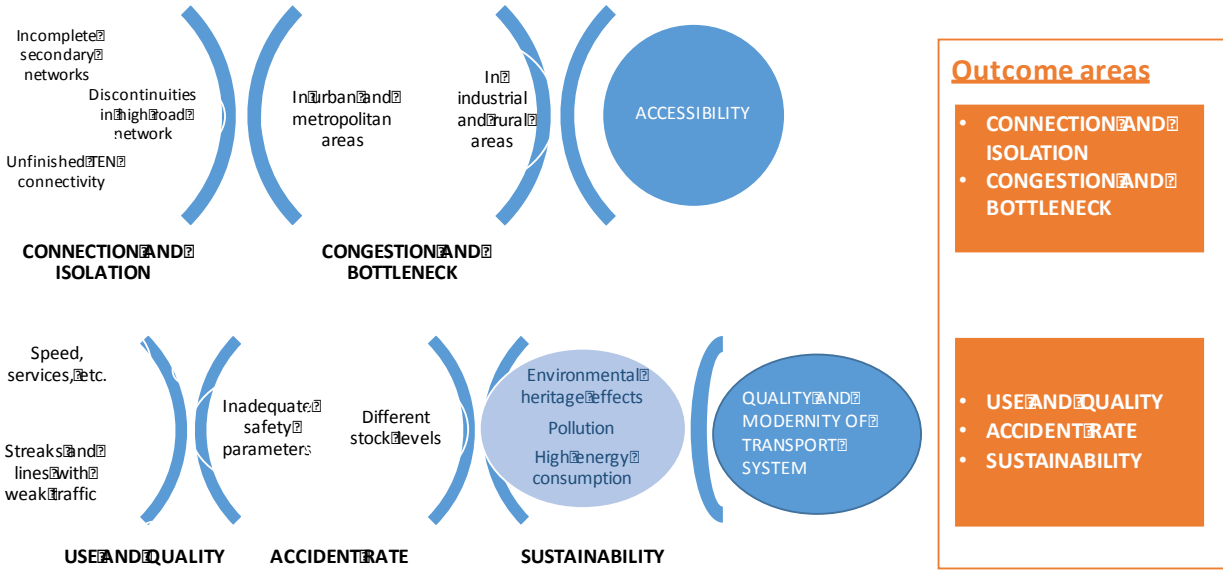


Source: Prepared by the authors.

3.2. OUTCOME EVALUATION

Outcome evaluation assessed the existing relations between investments carried out and problem solving, or the development of opportunities, from the hypothesis that these links are neither linear nor excluding, but achieving an optimal road and railway transportation system depends in the effect of a set of diverse actions, and the synergies and complementarities raised by other Policies implementation, different of those evaluated in this Report.

Figure 14. Areas of outcome evaluation



Source: Prepared by the authors.

The resulting aid distribution, in relation with the problems-challenges to be solved, show a high concentration of Funds in the connections improvement and reduction of the isolation (79,5% of total aids), and secondly, and strongly linked to this improvement, in solving bottlenecks and congestion situations in urban environments (12%).

The other two problems-challenges groups where there has been intervention are infrastructure´s use and quality and road safety improvement. These two groups represent a low percentage of the total investment made with Funds (6% and 2,6%, respectively).

Accessibility: Connection and isolation, and bottleneck and congestion

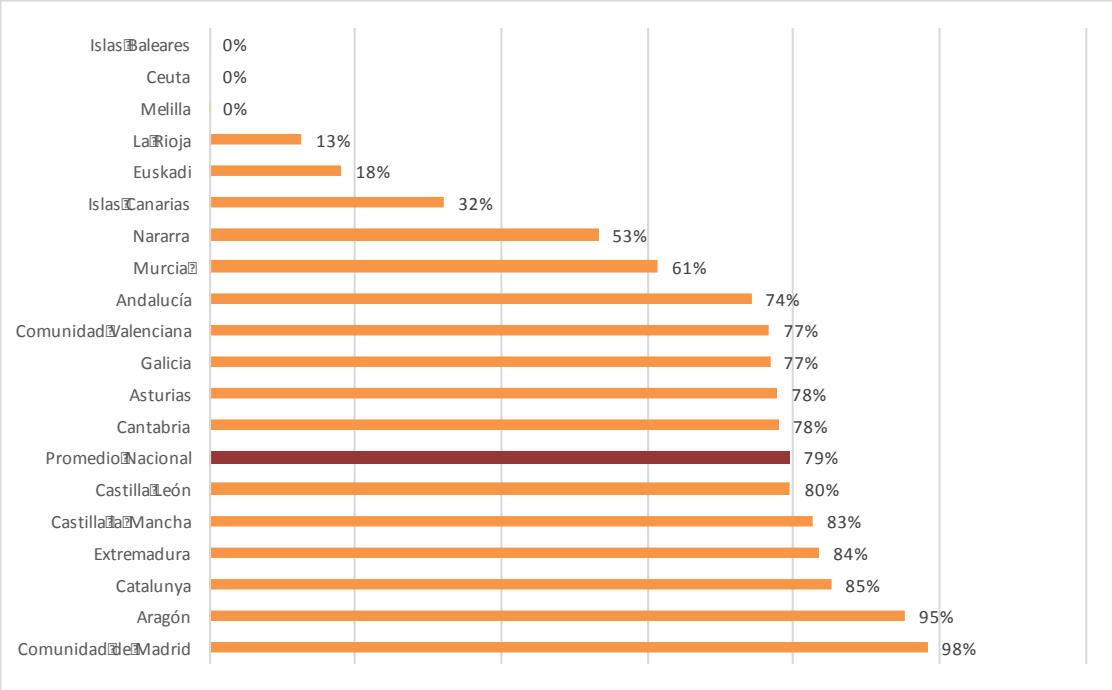
The European Union relies on the positive impact of transport infrastructure investments on socio-economic growth, therefore, one of the main objectives in the different programming framework has been to provide and articulate the territory through transport infrastructures. The EU Funds have had a very remarkable role in the development of the transport system, contributing to territorial articulation and cohesion, particularly by fostering the building of new high speed railway train lines and high quality roads, to solve the problem connection and isolation, by executing an important number of actions (1.796 investment records), representing 79,5% of the total executed by the funds in both periods.

Investments in roads through Funds have been significantly higher in the high-quality network, representing 74% of total aids in actions related to connection and isolation. However, there have been also actions developed on conventional roads, guaranteeing the global effectiveness improving connection.

Most of the budget, 13.032.822 € thousands, have been earmarked to high speed railway new infrastructures investments (98% of total aids driven to improve connection and isolation problems and 52,4% of total aids in both periods).

Regional distribution shows the effect of the actions co-financed with the Cohesion Fund, since it causes that in the most developed regions (Community of Madrid, Aragón and Catalunya), almost all aid focused on improving connection. Also, mention the high percentages of Funds used for improving connection and isolation in Extremadura, Galicia, Castilla La Mancha and Andalucía, objective 1 regions in the Framework 2000-2006 and Convergence in the Framework 2007-2013, and in Castilla León, Cantabria, Asturias and Valencia, objective 1 regions in the Framework 2000-2006 and Transition in the Framework 2007-2013.

Figure 15. Aid distribution by regions for a connection and isolation improvement (% total Aid)



Source: Prepared by the authors.

Concerning congestion and bottleneck problems, to overcome those it is needed a mobility policy combining the accessibility improvement to the main economic activity poles, the guarantee of the right of free accessibility to everybody, health protection in terms of air and noise pollution, sustainable and non-polluting development of transport compatible with economic competitiveness, and increase in comfort and traffic safety.

12% (2.986.376,4 € thousands) of total aids have been earmarked to this type of works, being the most developed regions (Euskadi, La Rioja y Navarra), together with Ceuta, Melilla and the Canary Islands), where a higher percentage amount of Funds has been devoted to this objective. Aids in Andalucia and

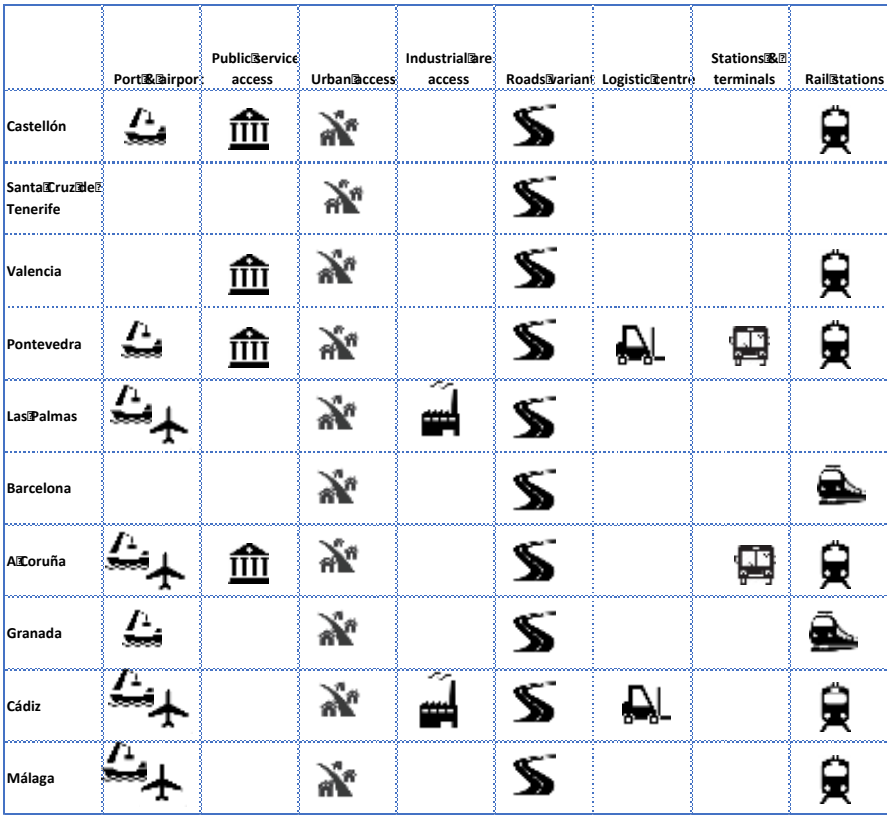
Galicia to solve these problems have also been significant; developing strategic works for improving access to its main ports, airports and industrial areas.

In roads, the Funds distribution have been focus on developing new infrastructures for connection and access, as well as improving the existing ones, increasing its capacity. Most of the actions have been aimed at developing access to other transport infrastructures (ports and airports), commercial and industrial areas, universities, etc., and to urban centres (ring roads, bridges, access roads, etc.)., as well as building variants to eliminate the traffic of the urban areas, avoiding discontinuity imposed by certain crossings in traffic circulation, improving the journey time and traffic safety.

In railways, connections have been developed in urban environments through subway lines and placing in services or improving the suburban and medium distance lines. Furthermore, there have been also important actions concerning stations and terminals remodelling, allowing train services and stops, particularly in high speed lines.

The provinces where there have been important improvements in congestion and bottleneck, due to the contribution of European investment strategy for road and railway transport infrastructures are: Castellón, Santa Cruz de Tenerife, Valencia, Pontevedra, Las Palmas, Barcelona, A Coruña, Granada, Cádiz y Málaga.

Figure 16.Main actuations for bottleneck improvements by province area



Nota: In Barcelona and Granada rail station investment are performances in urban transport/metro stations.
Source: Prepared by the authors.

A common feature of all these provinces is that they are coastal and have important commercial ports which are driving axes of the productive fabric, and act as logistical links with other countries and continents.

Quality and modernity of transport infrastructures

The Infrastructures technical conditions, as well as its conservation status, have an impact in the use and quality of the service provided for transportation. 6% of total aids for the period 2000-2015, have been earmarked to co-finance this kind of investments.

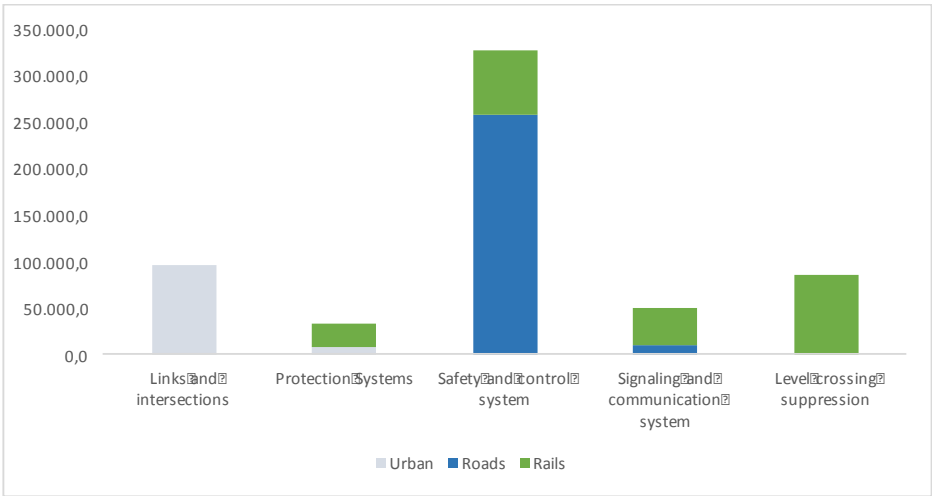
Throughout the evaluated period, there have been a variation in use (increase or decrease) of certain routes caused by the construction of alternatives better adapted for the traffic, and by investments improving technical conditions of high-quality roads and rail networks. In the rest of the network, mainly in the conventional roads, actions of improvement in the surface and sections are carried out, as well as some of landscaping restoration.

Railway aids are concentrated in actions of extension and renovation installations, together with improvements of the electrical system and electrification, both in the urban area and in the conventional network. In High Speed Railway, investments have been made only in the Madrid-Sevilla line, concerning its infrastructures and tracks expansion and rehabilitation.

Road safety is central in the effectiveness and efficiency of the transportation system. Just 2,6% of total aids (640.820 € thousands) have been earmarked to improve safety. Concerning regions, actions in this field have been only reached a significant percentage in Baleares, with a 25,7%. However, improvements in safety depends on the joint effect of all actions, and, in this sense, all the new constructions necessarily have the elements that guarantee a safe circulation

Investment with the largest volume of co-financing received, both in conventional roads networks and urban areas, have been those improving safety systems and control through a rearrangement of intersections and accesses to reduce manoeuvres of poor visibility and eliminate points of conflict in road sections, or population centres.

Figure 17. Aid distribution by work for improving use and quality infrastructure (% over aid)



Source: Prepared by the authors.

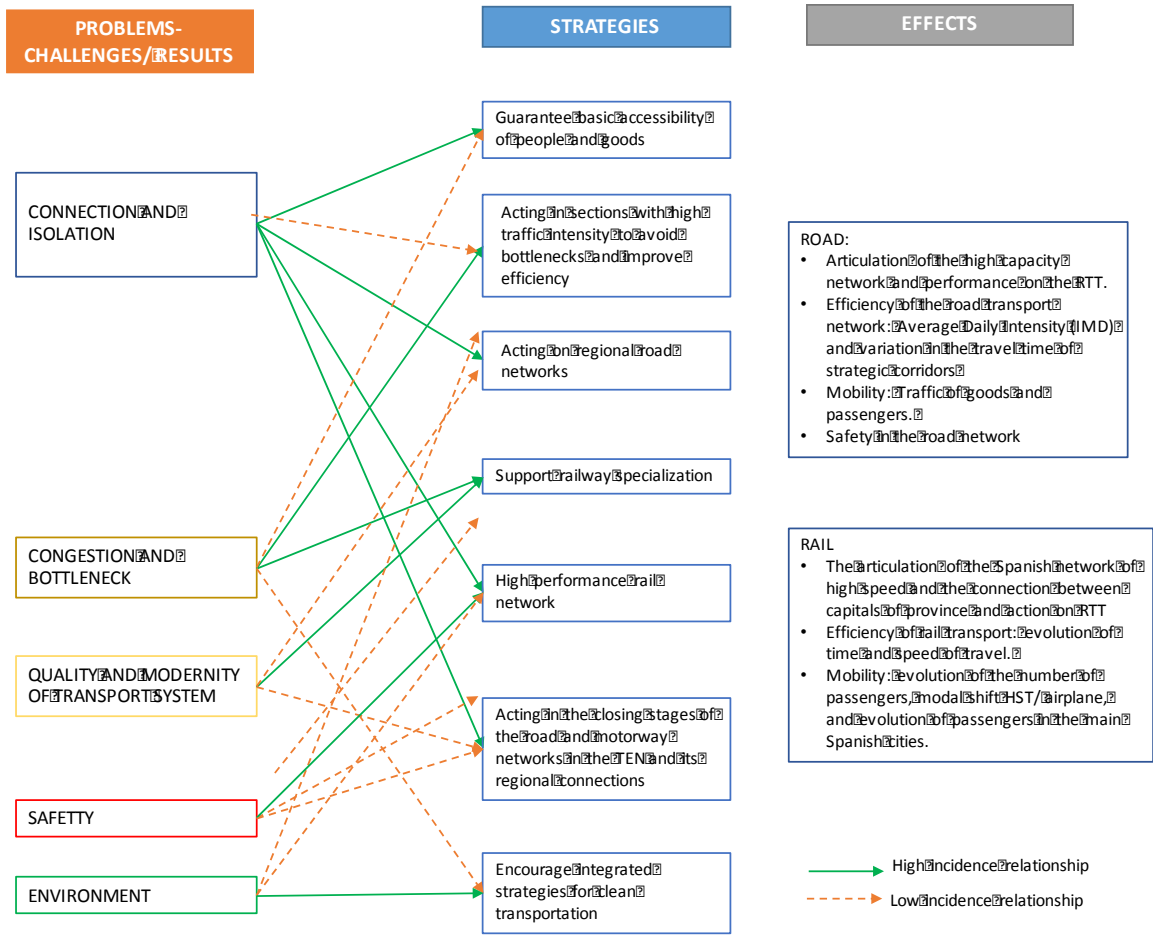
To improve the safety of the railway system, the main steps taken have been to eliminate and/or modernize level crossings, as well as safety and braking systems and signalling and communication systems.

Environmental outcome, understood as the contribution of European Funds for development of an infrastructural system of transport by roads and railroad that improves parameters of pollution, emission of greenhouse gases, energy consumption, etc., not only depends on the individual measures implemented but also on the combination of the effects of the investments made, together with those resulting from other infrastructural measures and policies and from other socio-economic and environmental areas.

3.3. EFFECTS EVALUATION

The effects evaluated (articulation, transport efficiency and mobility and safety), are those that have been strongly linked to the problems-challenges and action lines validated by EG, although the cause-effect relations are not unequivocal and all strategies lines has interaction in effects.

Figure 18. Efects relationship definition



Source: Prepared by the authors.

Effects on the road network

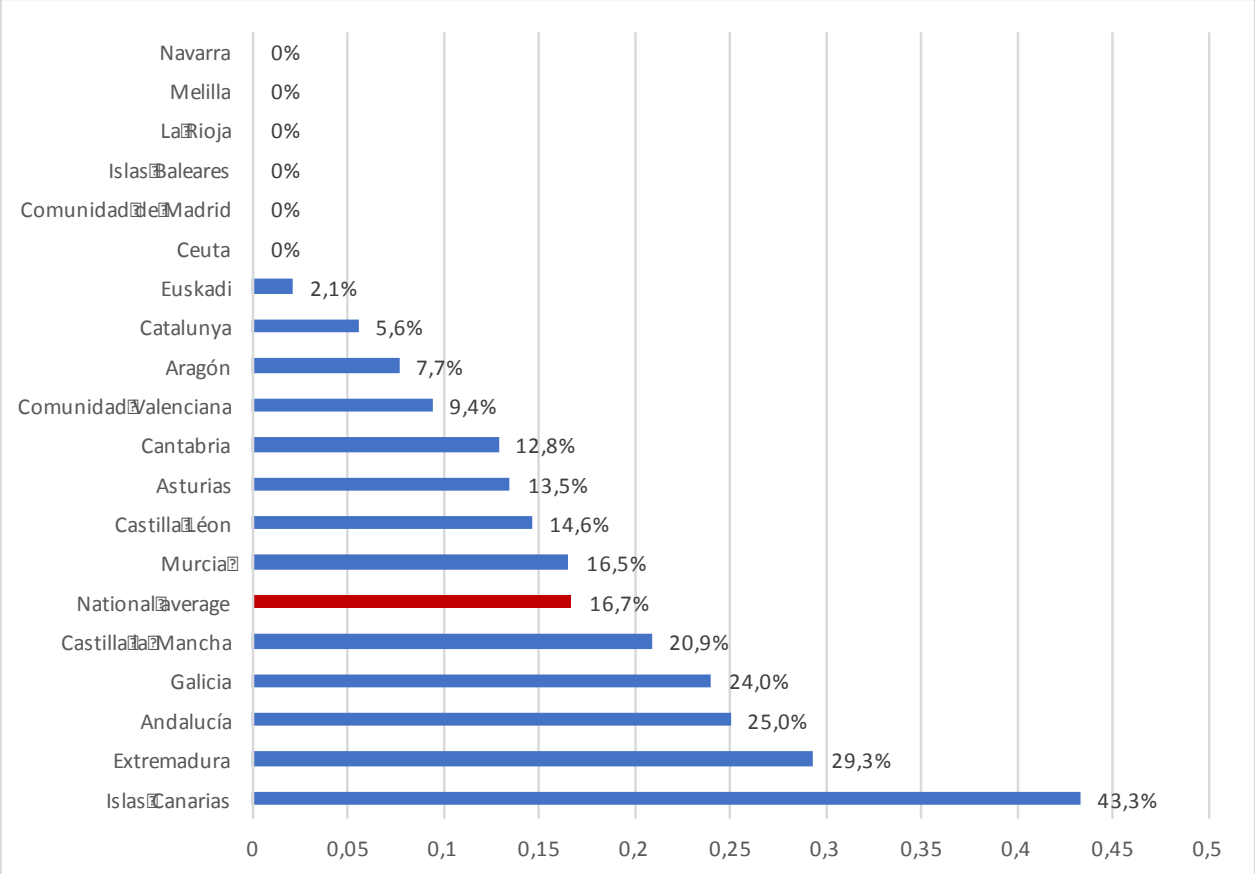
1. In terms of **articulation**, the investments made through the European Funds have aimed at the development of national corridors with high-quality roads, to achieve their optimum and complete functionality. These actions are part of the sector strategy to overcome the radial configuration of the road network, completing a mesh design.

It has also contributed to the development of the European routes, with investments with high intensities for four of them: in the north zone: E-70, E-82, in the central zone: E-903; and in the western zone: E-803.

Regions in which Funds have an important influence (measure as minimum of 10% of HQR Km co-financed over the total km of the HQR network) have been: Canary Islands, Extremadura, Andalusia, Galicia, Castilla la Mancha, Murcia, Castilla Leon, Asturias and Cantabria, so the analysis of the indicators will be limited to those regions.

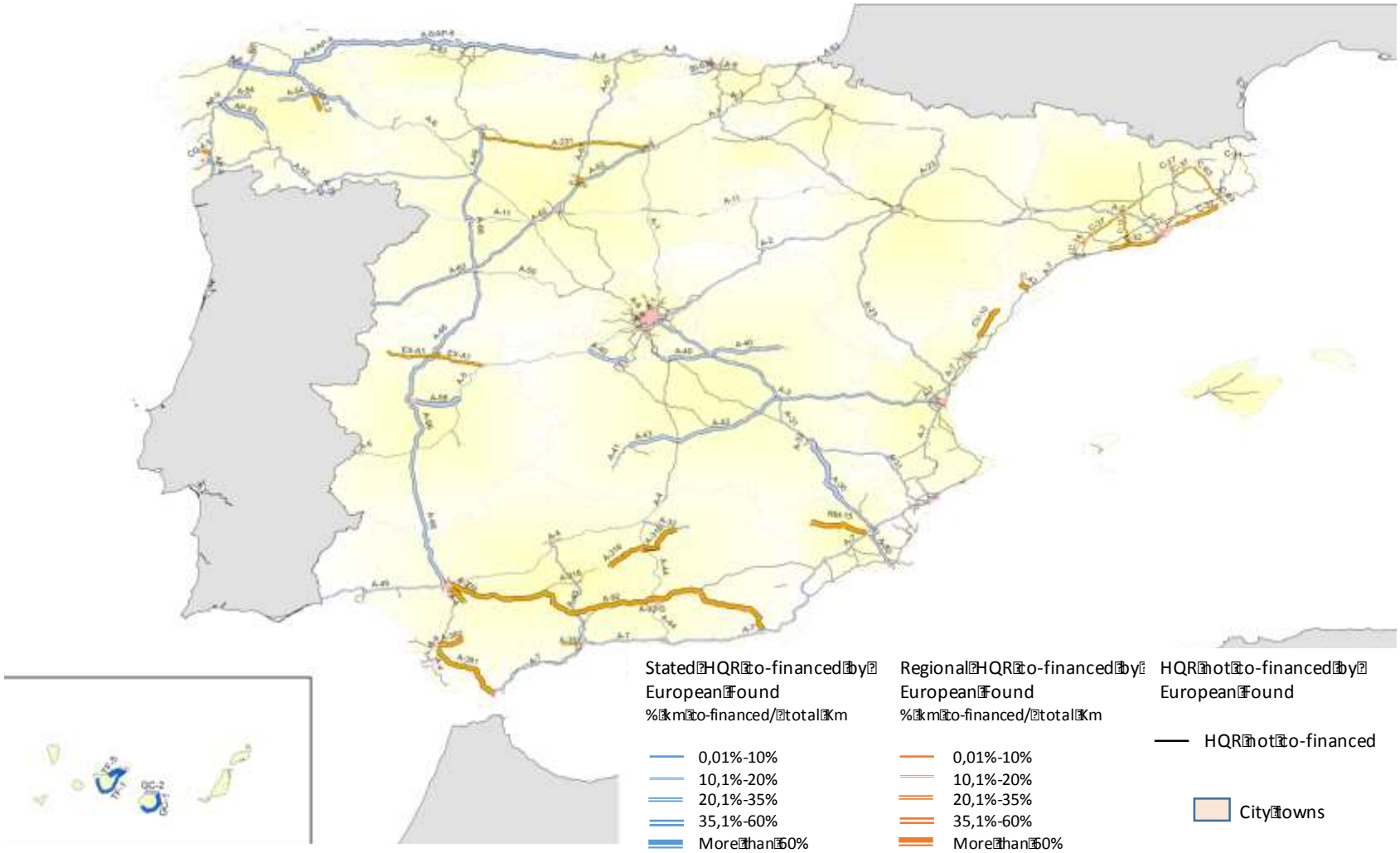
All these regions were Objective 1 in the Community Framework 2000-2006 and Convergence in 2007-2013, except Castilla León and Canary Islands, which became Pashing-in, and Cantabria, which was already considered Competitiveness in the second frame. In the case of the Canary Islands, although it has a high incidence of the Funds on the total of the high capacity network, it is necessary to consider its low representatively on the total, and the nature of insularity that contributes special characteristics to its system of transport.

Figure 19. km of High capacity roads built by Funds over total km of high capacity network in regions (%)



Source: Prepared by the authors.

Map 2. Development of high quality network



Source: Prepared by the authors.

2. In terms of **transport efficiency**, data extracted from the historical traffic series in the start and end years of the programming frameworks show a significant increase in traffic (IMD indicator) in the new corridors, by the replacement of conventional road by the high-quality ones. The national trend has suffered a decrease in the volume of daily traffic which enhance the effect in efficiency archived.

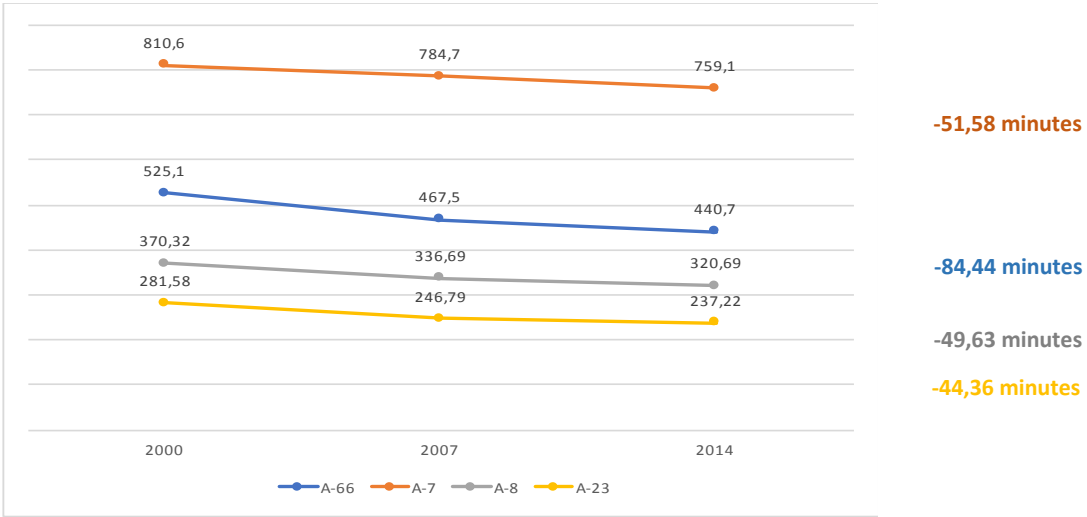
Table 1. IMD indicator in corridors highly financed by European Funds

Corridor		2000	2007	Year 2014	Variation (2014-2000)
A-66	León (LE-501)	7.330	11.067	8.141	11,1%
	Badajoz (BA-18/1; BA-358/1; BA-360/2)	10.269	11.836	14.828	44,4%
	Sevilla (SE-12/1; SE-247/2)	6.517	11.936	13.372	105,2%
	Average				**5025%**
A-7	Barcelona (B-507)	43.172	58.040	47.118	9,1%
	Valencia (V-501)	28.336	25.348	51.036	80,1%
	Granada (GR-21/2; GR-21/1)	6.312	8.351	6.954	10,2%
	Average				**33,8%**
A-8	Santander (S-15/1)	36.620	50.222	42.693	16,6%
	Oviedo (E-160; E-135)	1.769	11.171	11.592	555,3%
	Lugo (LU-113/2)	8.907	9.664	10.664	19,7%
	Average				**37,3%**
A-23	Castellón (CS-19/2; E-164)	6.403	10.630	10.336	61,4%
	Zaragoza (Z-20/2; E-350)	6.615	3.650	8.437	27,5%
	Huesca (E-324)	11.289	17.036	14.183	25,6%
	Average				**41,2%**
National Average		21.225	22.993	17.392	**-18,1%**

Source: Prepared by the authors from data of Ministerio de Fomento.

It is also observed that there is a reduction in the travel times in the routes analysed, as the weight of the high-quality roads increases over all networks.

Figure 20. Theoretical travel time indicator (minutes) in the main corridors of Spain



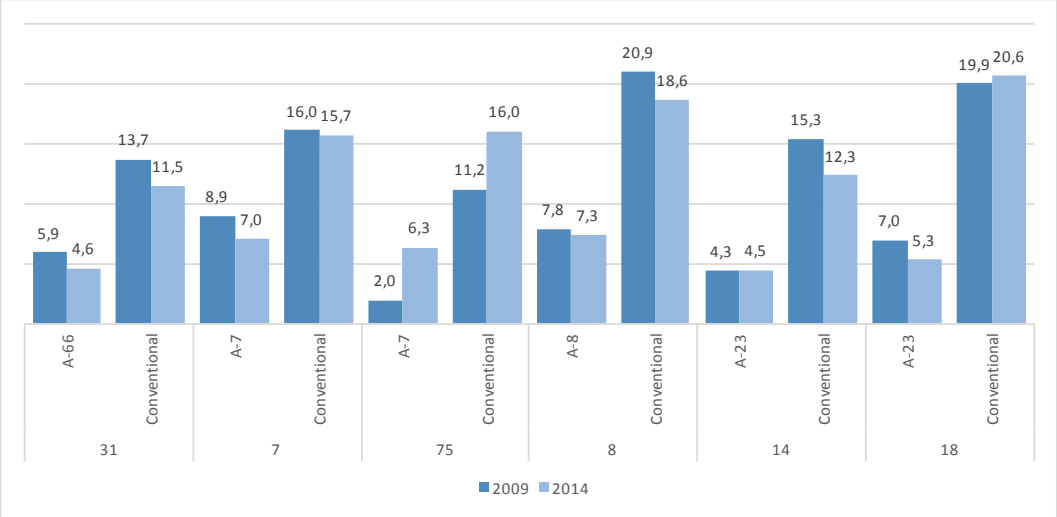
Source: Prepared by the authors from data of Ministerio de Fomento.

3. In terms of **mobility**, as volume of traffic, although the movement of passengers and goods have experienced favourable changes in the evaluated regions in the early years, these have not been maintained, especially by the decline of passengers. It can be concluded that there are other factors (such as economic and demographic), which have a more direct impact on the volume of traffic.

4. **Road safety** is a key issue, however the incidence of the road is limited, because there are other factors such as vehicle maintenance, human distractions, speeding, or traffic regulations, which have a greater influence on accident rate.

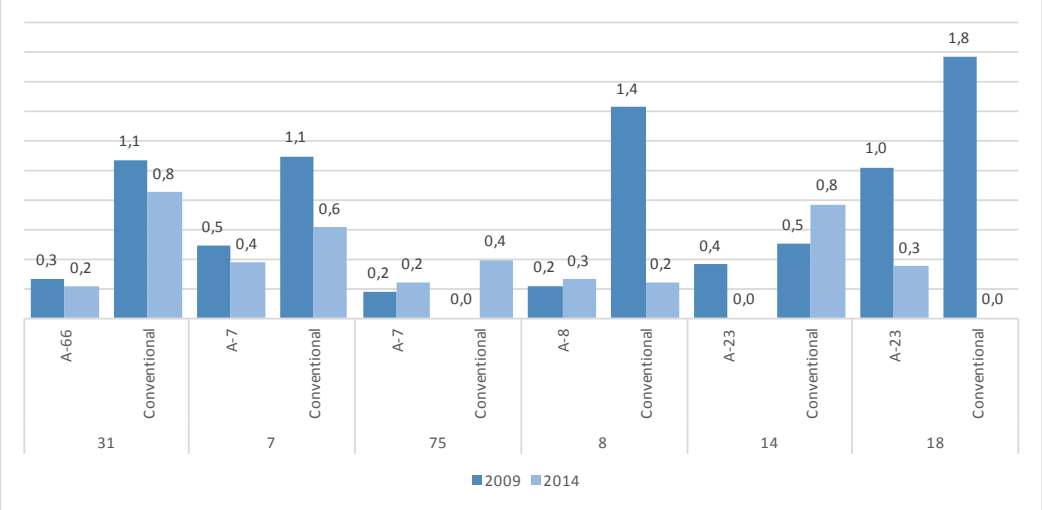
In spite, the building of new roads, the replacement of conventional roads with high-quality roads, and the incorporation of safety and signalling enhancement elements in conventional networks have contributed to improving the danger and mortality rates of the roads those have been co-financed in greater percentage by the European Funds.

Figure 21. Evolution of dangerousness index by itineraries of the State Road Network



Note: The result by route is presented according to itinerary (31, 7, 75, 8, 14 and 18) established in the State Roads Network.
Source: Prepared by the authors from Anuarios Estadísticos de Accidentes en la RCE.

Figure 22. Evolution of the mortality index for itineraries of the State Road Network



Note: The result by route is presented according to itinerary (31, 7, 75, 8, 14 and 18) established in the State Roads Network.
Source: Prepared by the authors from Anuarios Estadísticos de Accidentes en la RCE.

Effects on the rail network

1. In terms of **articulation** of the network, the construction of new infrastructures has significantly improved the connection between the regions. The Spanish HST network, catalogued as "radial-trunk", allows the connection of the main cities with a greater number of localities through capillary branches. More than half of the peninsular provincial capitals, 51%, have direct access to HST.

The average intensity of the aid, measured as a percentage of the total cost of the work, reaches 27.15%, with a significant variation by lines: from those with a lower intensity, such as the Valladolid-León line with 11, 1% financing of the total cost of, up to the Antequera-Granada line which has achieved a 64.8%

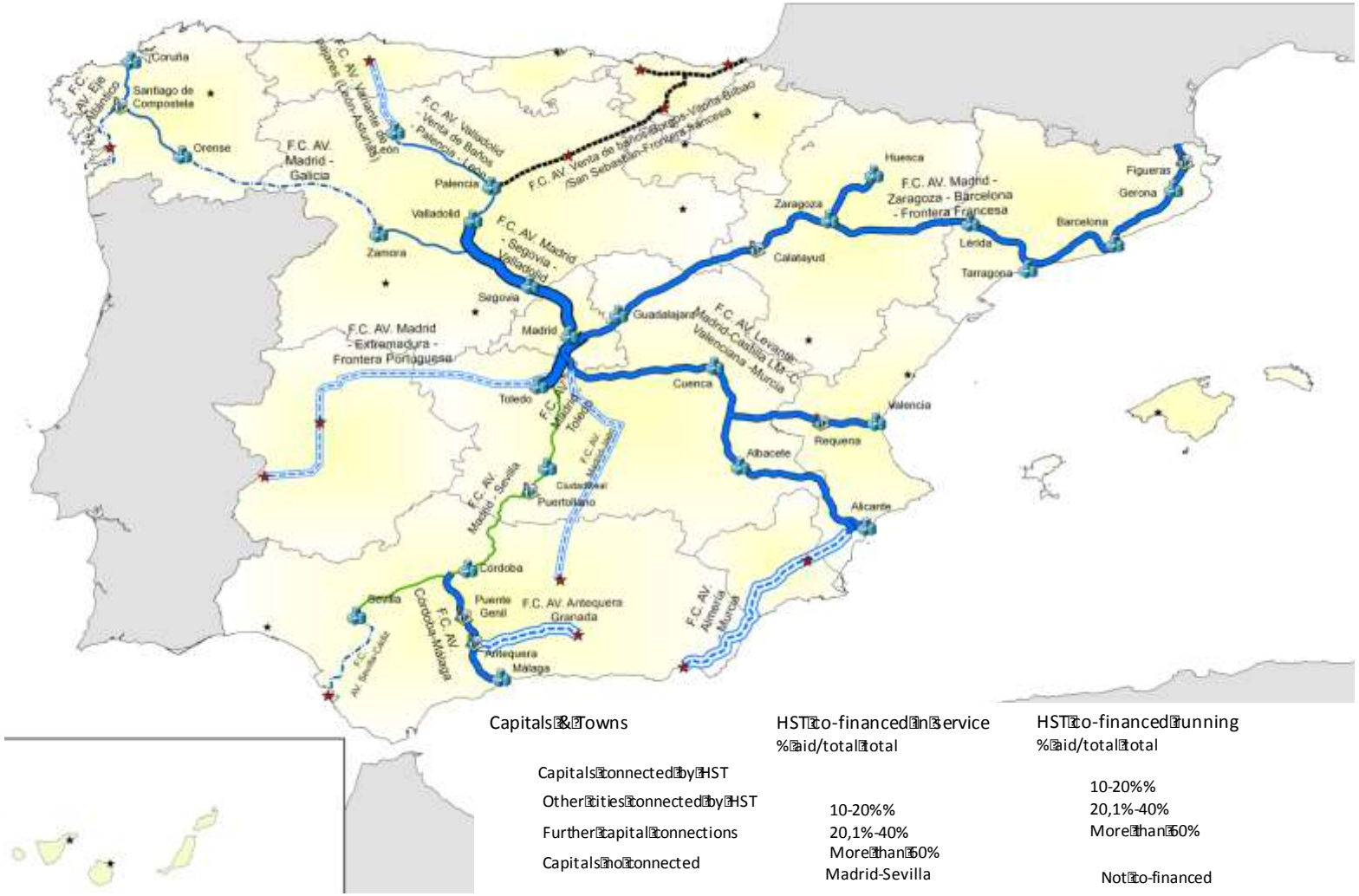
Table 2. Aid distribution by HST

	Aid (€ thousands)	Total Cost (€ Thousands)	% Aid/ Total Cost
Operating lines			
Córdoba – Málaga	953.600,20	2.790.016,60	34,20%
Madrid - Zaragoza - Barcelona - Frontera Francesa	3.383.411,90	13.961.390,00	24,20%
Madrid - Segovia – Valladolid	2.026.522,40	4.584.077,70	44,20%
Madrid – Toledo	102.236,60	224.035,20	45,60%
Levante: Madrid-Castilla LM -C. Valenciana –Murcia	2.525.004,80	10.702.234,00	23,60%
Eje Atlántico	402.704,00	2.150.291,60	18,70%
Valladolid - Venta de Baños - Palencia – León	125.550,90	1.132.110,90	11,10%
Lines running			
Cofinanciadas			
Madrid – Galicia	607.656,00	4.239.929,60	14,30%
Madrid - Extremadura - Frontera Portuguesa	488.976,10	1.374.622,20	35,60%
Antequera – Granada	1.065.098,40	1.643.822,60	64,80%
Almería – Murcia	354.158,40	859.882,40	41,20%
Variante pajares (León-Asturias)	704.803,80	3.510.568,10	20,10%
Sevilla-Cádiz	252.921,60	631.659,29	40,04%
Madrid-Jaén	35.387,80	180.361,90	19,62%
Lines running No Co financing			
Venta de Baños-Vitoria-Bilbao-San Sebastián-Frontera Francesa			
TOTAL	**13.028.032,90**	**47.985.002,09**	**27,15%**

Source: Prepared by the authors form ADIF data.

Actions in the HST lines have also contributed to the development of the TEN high-speed train network, although they have varying degrees of implementation, but none are currently completed.

Map 3. Highs Speed Trains co-financed intervention and connection between capitals



Source: Prepared by the authors form ADIF data.

2. In terms of **transport efficiency**, there is a reduction in travel times in the HST lines, which makes it the most attractive one and favours the substitution effect of the roads. On average, in those cities where the HST reached after 2000, the diminution in the travel time has been of 2 hours, which represents a reduction in the average duration of the trip of 51%.

Table 3. Time travel (in minutes) between Madrid and provincial capitals with high speed line

	Time (minutes)	Faster option by RENFE 7/3/17		
Province Capital	**2000**	**2017**	**Δ 2017/2000**	**Δ%2017/2000**
A Coruña*	500	333	-167	-33%
Albacete	120	91	-29	-24%
Alicante*	230	136	-94	-41%
Barcelona*	390	150	-240	-62%
Ciudad Real	50	50	0	0%
Córdoba*	105	100	-5	-5%
Cuenca	145	55	-90	-62%
Girona*	500	198	-302	-60%
Guadalajara	32	22	-10	-31%
Huesca*	280	133	-147	-52%
León*	233	126	-107	-46%
Lleida*	277	119	-158	-57%
Málaga*	250	140	-110	-44%
Ourense*	350	257	-93	-27%
Palencia	170	81	-89	-52%
Segovia	124	27	-97	-78%
Sevilla*	145	140	-5	-3%
Tarragona*	355	133	-222	-62%
Toledo	74	32	-42	-57%
Valencia*	207	102	-105	-51%
Valladolid	143	54	-89	-62%
Zamora	180	85	-95	-53%
Zaragoza*	180	75	-105	-58%
*** Cities at a distance from Madrid>300 km**				

Note: Seville, Cordoba and Ciudad Real were already on the Madrid-Seville line, so the time reduction is scarce.
Source: Prepared by the authors from data of Fundación de Ferrocarriles Españoles and RENFE.

The possibility of reducing travel times is since the introduction of HST lines in Spain has caused an increase in the average speed at which trains circulate.

Since 2000 to 2016 there has been an increase of at least 50% in the average speed of trains on the lines between Madrid and these main cities, so that in 2000 none of these lines were made at average speeds above 200 km/h, in 2009 only Madrid-Barcelona, and in 2016, in addition to this, already circulate at that speed the connections with Malaga and Valencia.

Table 4. Evolution of average train speed between Madrid and the provincial capitals

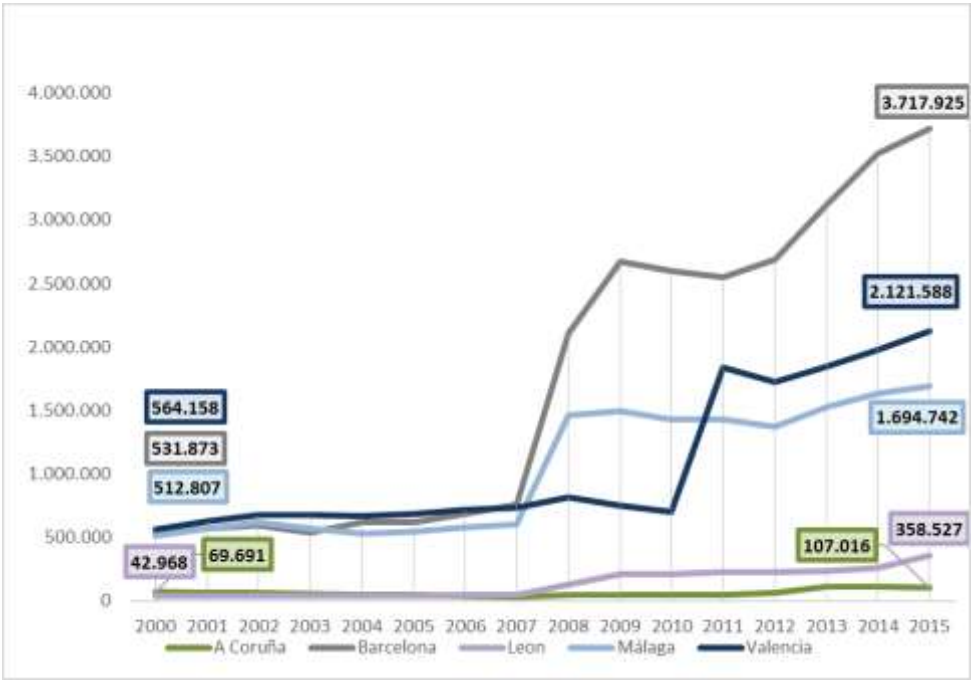
Capital	Speed (km/h)			Δ% 2016/2000
	2000	2009	2016	
A Coruña	90,16	96,28	135,32	50,08%
Barcelona	106,46	236,12	248,40	133,33%
León	106,96	155,56	164,50	53,80%
Málaga	129,33	193,58	214,16	65,59%
Valencia	143,19	143,99	233,88	63,34%

Source: Prepared by the authors based on the data extracted from RENFE y FFE

The case of A Coruña is an example of connections that partially use the HST lines, and although the effects are already appreciated, they will be expanded with the complete development of this line in high speed.

3. In terms of **mobility**, there is an important increase in the number of passengers in the HST lines, as well as the traffic of passengers in their reference stations. In contrast, medium-distance networks have not experienced the same growth. This corroborates that the HST is becoming an alternative mode of transportation for long distances for travellers.

Figure 23. Evolution of long distance passenger lines



Note: The data do not consider the demand for services called Medium Distance, which in the case of the Leon line have a great weight in the year 2000 (more than 50% of the demand), although not in the rest, where the MD service does not exist or would be residual.
Source: Prepared by the authors based on the data extracted from Fundación de Ferrocarriles Españoles.

Except for the line that covers Madrid with A Coruña, which has registered an increase of 54%, the rest have multiplied in an exponential way the number of passengers; those using the train to travel to Barcelona, Valencia and Malaga, have been multiplied by, approximately, 7, 4 and 3 respectively. This has simultaneously allowed an increase in service frequencies (trains day) in similar proportions, which means this is another factor of improvement in the quality perceived by the users and the attractiveness of the railroad.

This increase has meant a shift effects of passengers from the plane to the train. In 2004, the plane was the main mode of transport for long distance traveling, but it is corroborated the tendency of passengers to travel to the train when there are HST lines, except for Madrid and A Coruña: by 2015, the number of passengers traveling by train is much higher than those who do by plane, 62.3% in Madrid-Barcelona; 84.2% in the Madrid-Málaga; 87.5% in Madrid-Valencia and 100% in Madrid-León.

Figure 24. Evolution of train-plane passenger's replacement

Source: Prepared by the authors based on the data extracted from ADIF y AENA.

4. IMPACTS EVALUATION

Infrastructure investments have been given a crucial role in the development of productive activity and the well-being of society. In addition to their direct impact on production and employment, as the main macroeconomic variables, the activity of construction and improvement of infrastructures (civil works), have an effect in other sectors, due to their high pushing effect, or multiplier effect in the generation of additional investment in the rest of the economy from the investment made in the sector itself, and by the drag effect, understood as the demand for products and jobs in other branches of economic activity that generates to carry out its production and satisfy its own final demand.

For the impact evaluation, a demand model has been applied in which public investment was defined as the cost co-financed by the ERDF and Cohesion Funds for the periods 2000-2006 and 2007-2013 in road and rail transport infrastructure projects, and it was the exogenous element that drives economic activity and the generation of employment and income.

To distribute the investment in the sectors that affect this type of projects, and to be able to calculate the direct effects and drags that the investment has on the sector and the related ones, after consulting different sources, has opted for the classification of MOPTMA and Eurostat used in the study "Sector economic assessment of investment in transport infrastructure: application to the investment vector 1990-1998 in Spain"[7], which establishes the following breakdown:

Table 5. Investment allocation matrix

	Roads			Rail		
	%	2000-2006	2007-2013	%	2000-2006	2007-2013
Energy products	1%	103.488	39.470	1%	144.735	72.631
Steel products	0%			20%	2.894.700	1.452.619
Production of Non-Metallic Minerals	7%	724.413	276.288	10%	1.447.350	726.309
Industrial machinery	7%	724.413	276.288	5%	723.675	363.155
Electric material	0%			25%	3.618.375	1.815.773
Building and engineering works	77%	7.968.540	3.039.164	31%	4.486.784	2.251.559
Market services	8%	911.568	322.343	8%	1.191.156	605.610
TOTAL	**100%**	10.432.422	3.953.553	**100%**	14.506.775	7.287.656

Source: MOPTMA, adapted to 25 branches. Eurostat.

The Matrix Input Output (MIO) has been of the multiregional type, with data in 2005 from all regions except the Autonomous Cities of Ceuta and Melilla[8], obtained from the study "Multiregional Input-Output Model for the Evaluation of Spanish Water Flows" [9].

From the multi-regional Input Output table at 2005, has been applied the Euro method to obtain the multiregional Input Output table in 2006 and 2015. This method is the one used by Eurostat for projections of input-output tables of the European Union countries. The analysis has been based on the information available in the "Eurostat Manual of Supply, Use and Input-Output Tables".

A SAM (Social Accounting Matrix) model, or MCS (Social Accounting Matrix), has been used to calculate the impact through the IOT, which makes a classic decomposition of the multipliers broken down into direct, indirect and induced effects.

[7] Sectorial economic evaluation of the investment in transport infrastructures: application to the investment vector 1990-1998 in Spain. Tarancón Morán, Miguel A. University of Castilla - La Mancha, Spain. Regional and Sectoral Economic Studies. AEEADE. Vol. 2, No. 2 (2002).

[8] The lack of information on the interrelationships of Ceuta and Melilla within the multisector Matrix obliges to exclude these territories from the study of impact Input Output in order not to distort the model.

[9] "Multiregional Input–Output Model for the Evaluation of Spanish Water Flows". Rosa Duarte and Ignacio Cazcarro. University of Zaragoza. 2013.

- Initial investment impact, which responds to the same demand shock, according to data disaggregated by regions, activity sectors and type of infrastructures.
- Direct and indirect impact, are those of the first round and successive economic transactions, both in the sector in which it is invested and those with a trawling effect, excluding the effects of the initial investment.
- Induced impact, they are obtained by the extension of the model by endogenizing part of the demand and the consumption of the households, obtaining it with a vector that introduces inside the intermediate matrix a part of the primary inputs (GAV), and a part of the final demand. In this case, the induced impact is obtained by estimating consumption and demand after the first round of transactions.

4.1. IMPACTS ON PRODUCTION

Public investment resulting from the implementation of road and rail investment co-financed by the European Funds over the whole of the evaluation period (36.180.406 € thousands of co-financing) has had a positive impact on production, almost doubling its value (66.757.698 € thousands).

Due to the sensitivity of the sector to the economic situation, most of the impact has been concentrated in the period 2000-2006, which corresponds to an expansionary cycle, which has registered almost 70% of the investment, since they are initial investment impact, and the direct and indirect ones that have the greatest impact on the total.

However, in relative terms the impact has not been so influenced by the period, so that of each euro invested, an additional 0.85 euro cents have been generated, on average, directly and indirectly (0.63), and induced (0.25). This highlights the greater efficiency of public spending in the period 2007-2013, and the manifestation of deferred effects over time.

Table 6. Investment in infrastructure supported by European funds: impacts on production (€ thousand)

	Initial investment	Direct and indirect impact	Induced impact	Total Impact
2000-2006	24.939.197	15.204.519	5.691.473	45.835.189
Investment/ production impact	-	**0,61**	**0,23**	**0,84**
2007-2013	11.241.209	7.409.472	2.271.828	20.922.509
Investment/ production impact	-	**0,66**	**0,20**	**0,86**
TOTAL	**36.180.406**	**22.613.991**	**7.963.301**	**66.757.698**
Investment/ production impact	-	**0,63**	**0,25**	**0,85**

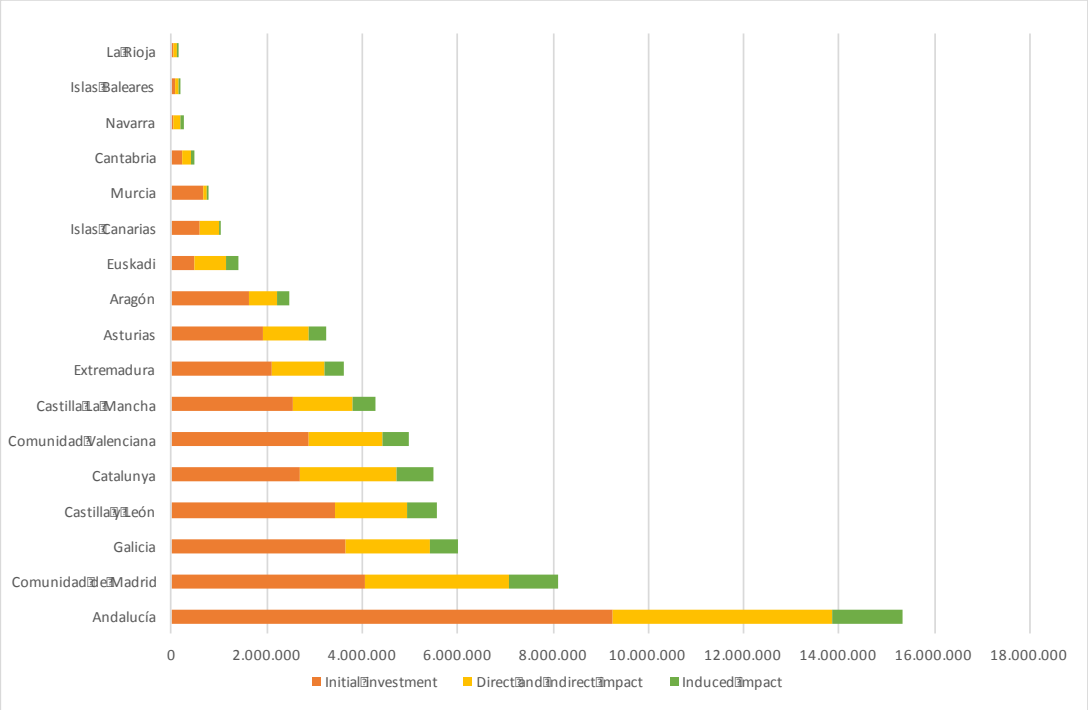
Note: Ceuta and Melilla ´s investment data are not included.
Source: Prepared by the authors. IOT Analysis.

By productive sectors, and in line with the investment distribution table used as a reference for the input-output analysis, those that have experienced a greater impact are those directly linked to infrastructure works, especially the building sector, that has concentrated more of one third of the total impact in absolute terms, and manufacturing of computer, electronic and optical products (11.63% of the total impact), and the manufacture of metal products (10.01%). In addition, the other sectors most closely linked to infrastructure works, non-metallic mineral manufacturing, and other business activities (including engineering, consulting and other professional services), also have had high values (to 8%).

In terms of territorial distribution, three main effects are identified:

1. In coherence with the areas in which the initial investment has been concentrated, and the productive specialization, the impacts in absolute terms has been higher. Thus, Andalusia is the region that has had the greatest impact, followed by Madrid and Galicia. In other hand, Catalonia and Euskadi, which despite a getting lower level of investment than other regions, have had a greater impact, due its specializations and economic relationship.

Figure 25. Impact of investment on production by regions. 2000-2015

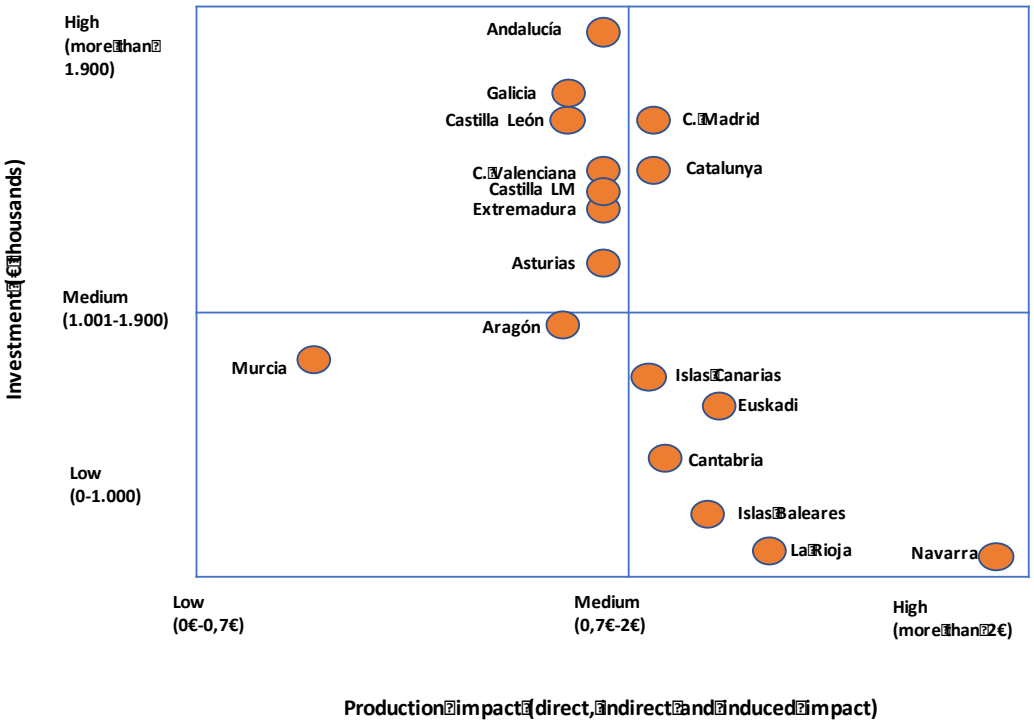


Source: Prepared by the authors. IOT Analysis.

2. Mainly due to the different dynamics of the economies and sectoral interrelations, there has been a displacement effect of the impact in some of the regions: where it is least invested the most effect occurs.

   In relative terms, Navarra, which was the region where direct funds have been invested less, was the one that has had the direct, indirect and induced impact rate plus raising, with € 6.7 generated by euro invested.

Figure 26. Relation between Initial investment and investment/total impact ratio on production by regions



Source: Prepared by the authors. IOT Analysis.

3. Since production impact is relativized according to the global production (GDP) of each region, there is a quantitative importance of the impact values reached.

   The impact represents a high percentage of GDP for a group of regions in which highlights the dependence of these regional economies on this sector of activity: Extremadura, Asturias, Castile-Leon, Castile-La Mancha, Aragon, Galicia and Andalucía, almost all correspond to the less developed relative, considered Objective 1 regions in the period 2000-2006 and Convergence regions in the 2007-2013 framework.

Table 7. Impacts of the investment in the GDP by regions. (thousands €)

	Production impact	% total impact /GDP 2006	% total impact /GDP 2015
Extremadura	3.606.500.236	13,2%	8,8%
Asturias	3.240.682.135	9,4%	5,7%
Castilla y León	5.557.223.246	8,9%	1,7%
Castilla La Mancha	4.290.338.174	7,7%	4,2%
Aragón	2.471.254.891	7,6%	0,2%
Galicia	6.014.806.971	6,2%	5,0%
Andalucía	15.323.812.841	5,9%	4,9%
Total	**63.307.472.001**	**5,9%**	**2,5%**
Cantabria	481.376.900	3,7%	0,3%
Comunidad de Madrid	8.102.112.636	3,6%	0,8%
Comunidad Valenciana	4.971.394.182	3,1%	1,9%
Islas Canarias	1.029.200.328	2,6%	0,1%
Catalunya	5.502.508.507	2,5%	0,3%
Murcia	776.460.098	2,0%	0,9%
Euskadi	1.388.277.918	1,8%	0,5%
La Rioja	119.104.134	1,4%	0,2%
Navarra	258.467.348	1,3%	0,3%
Islas Baleares	173.951.455	0,4%	0,3%

Source: Prepared by the authors. IOT Analysis.

4.2. IMPACTS ON EMPLOYMENT

Investment in road and rail transport infrastructures co-financed with ERDF and CF has generated 1.005.962 jobs in the overall of the period evaluated, especially in the first stage 2000-2006, which account for more than two thirds of the total jobs

Table 8. Investment in infrastructure supported by European Funds: impact on employment

	Initial investment	Direct and indirect impact	Induced impact	Total Impact
2000-2006	399.120	207.474	78.066	684.660
2007-2015	178.770	110.127	32.405	321.301
Total	**577.889**	**317.601**	**110.471**	**1.005.962**

Source: Prepared by the authors. IOT Analysis.

By economic sectors, the construction, which accounts for 40% of all jobs, stands out in relation to the investment in new routes and tracks those concentrate a large part of the Funds. In addition, it is an extensive sector in labour, so it is expected to concentrate more employment. In the second period, the impact of the crisis is reflected, although has been less because it is the real estate sector where it most

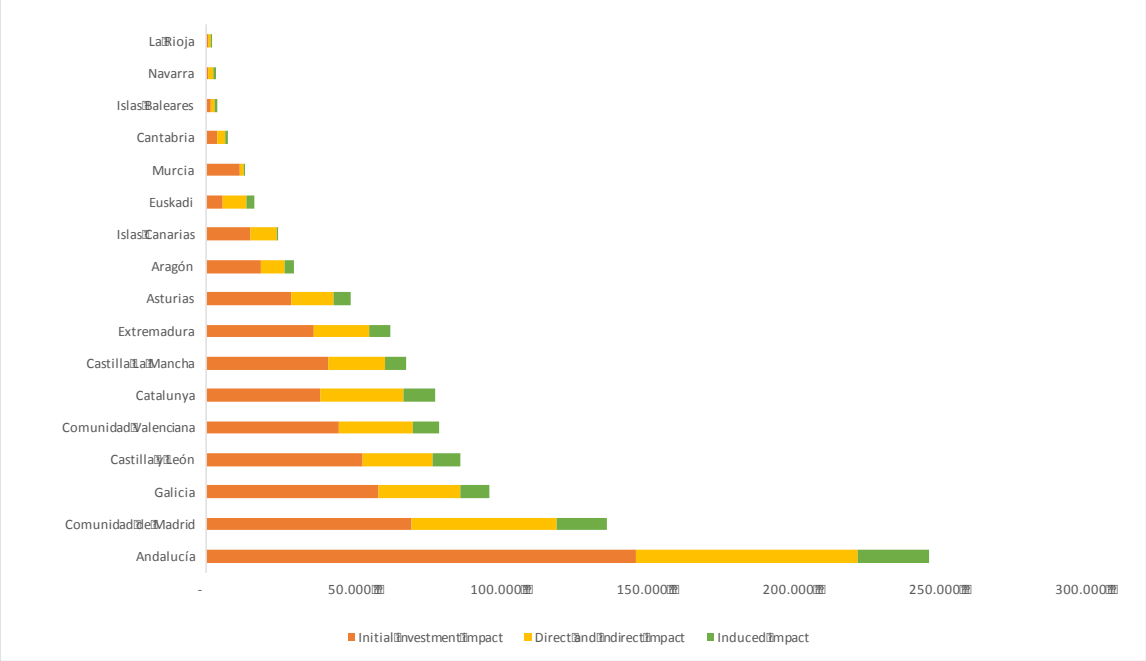
suffers from crises. Along with construction, the sectors that concentrate the most employments are other business activities (14.3%) and the manufacture of computer, electronic and optical products (8.6%).

In terms of territorial distribution, two main effects are identified, which should be considered when deciding on future investments in transport infrastructures:

1. There has been a concentration of impacts in absolute terms consistent with the areas where the initial investment has been higher, and the specialization and dynamism of the regional economy. Of the total employment, one in five is generated in Andalusia, followed by the Community of Madrid (13.60%) and Galicia (9.63%), regions that concentrate more investment.

On the other hand, Catalunya and Euskadi, with smaller investments, present values for the direct and indirect and induced impacts greater than those regions with largest initial investment.

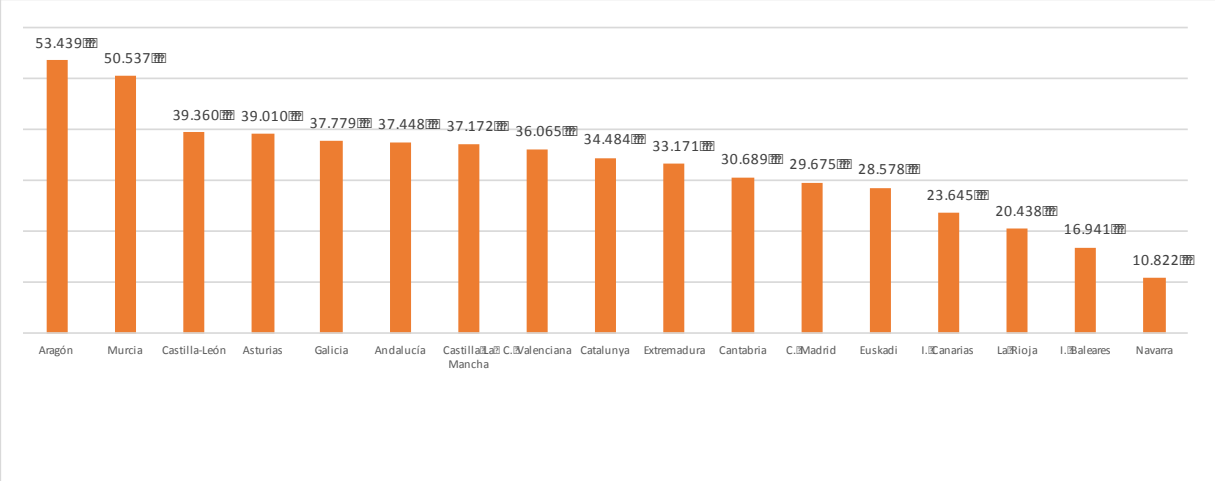
Figure 27. Impact of investment on employment by regions. 2000-2015



Source: Prepared by the authors. IOT Analysis.

2. Territorial component in terms of investment effort for the generation of a new job moves in a very long interval, although in more efficient territories the investment effort to generate new employment is less. Other labour market variables (wage and contract structure) or labour conditions (average wage), are influencing this ratio.

Figure 28. Relationship between initial investment and total generated employment by regions. 2000-2015



Source: Prepared by the authors. IOT Analysis.

A ratio of 35,966 € of direct aid for each created/maintain job is reached on average. In both periods the amount is similar, so the investment effort has not changed since it is a sector in which the innovation has a low impact, and, therefore, the efficiency improvements are low.

5. CONCLUSIONS AND LEARNED LESSONS

PLANNING

- There is a clear definition of the problem /challenge both main and derivatives, as well as its evolution, and the way in which it is treated in the different frameworks.
- The European programming has presented a significant presence and congruence with the diagnosis and the national sectorial proposals.
- The objectives and strategies have largely responded to these problems / challenges or to some aspect of them.

IMPLEMENTATION

Conclusions of implementation analysis

- The overall implementation analysis of the aid for road and rail transport infrastructure shows the coherence between the context and the programmatic model (problems and challenges, objectives and strategies), and the actions that have finally been carried out. The main destination of the aid has been for new investment in HQR or HST.
- By territories, those with the greatest connection or congestion problems are the ones that have concentrated the most Funds, and the ones that have most contributed to the development of the high-quality network, coinciding in large part with the main peninsular corridors. By contrast, more developed regions have prioritized investments at the local level.

Conclusions of outcomes evaluation:

- Aid distribution, in relation to the problems-challenges to be solved, shows a clear concentration in improving the connection and reducing the isolation of some territories (79.5% of total aid). Secondly, and strongly related to the improvement of those connection, Fund are focused in co-financed investments to solve bottlenecks and congestion in urban areas (12%).

- The European Funds have played a prominent role in the development of the transport system, contributing to the articulation and territorial cohesion, the commitment to the construction of new HST lines and HQR as quality and efficiency way to solve the problems of connection and isolation, for which a relevant number of actions have been executed.

Conclusions of effects evaluation:

Effects on the road network:

- Funds have contributed to the development of national corridors with high quality roads, to achieve their optimum and complete functionality. These actions are part of the sector strategy to overcome the radial configuration of the road network, completing a mesh design.

- Funds have contributed to improve transport efficiency, thanks to the significant increase in traffic (IMD indicator) in the new corridors by the replacement of conventional for high-quality roads.

- Although the movement of passengers and goods have undergone favourable changes in the evaluated regions in the first years, these have not been maintained. It can be concluded there are other factors (economic and demographic), which have a more direct impact on the volume of traffic.

- Building of new roads, the replacement of conventional roads with high-quality roads, and the incorporation of safety and signalling enhancement elements in conventional networks has contributed to improving the danger and mortality rates of the evaluated routes.

Effects on the rail network:

- Building of new HST infrastructures has significantly improved the connection between regions and contributed to the development of the TEN rail network.

- In terms of transport efficiency, has had a reduction in travel times between Madrid and HST connected main cities, and an increase in the average speed of traffic, which has made it the most attractive mode of transport for distances greater than 300 km and less than 180 minutes, favouring the effect of replacing the roads and planes.

- The number of passengers in HST has increased exponentially, which has allowed an increase in service frequencies (trains/day), improving the quality perceived by the users and the attractiveness of the railway.

Conclusions of impacts evaluation:

Impacts on production (or income):

- Public investment (36.180.406 € thousands of co-financing cost) has had a positive impact on production, almost doubling its value (66.757.698 € thousand), mainly in the period 2000-2006.
- In relative terms of each euro invested, an additional 0,85 euro cents were generated on average, directly and indirectly (0,63), and induced (0,25).
- By economic sectors, greatest impact is in those directly related to infrastructure works: construction (25%), manufacturing of computer, electronic and optical products (11,63%), and manufacture of metal products (10,01%).
- In terms of territorial distribution, three main effects have been identified:
    - Concentration of impacts in absolute terms consistent with areas where initial investment has been concentrated and the productive specialization.
    - Displacement effect of the impact: it some of the regions where are least invested has the greatest effect, mainly due to the different dynamics of the economies and sectoral interrelationships.
    - The quantitative importance of investment in less developed regions is in relation to the weight over their global production (GDP).

Impacts on employment:

- 1.005.962 jobs were generated in the overall evaluated period, especially in the first stage 2000-2006, which account for more than two-thirds of total employment impact.
- By economic sectors, the construction sector, which accounts for 40% of total employment, stands out over all.
- In terms of territorial distribution, two main effects have been identified:
    - Concentration of impacts, in absolute terms, consistent with the areas where the initial investment has been largest, and the specialization and dynamism of the regional economy.
    - The territorial component, in terms of investment effort to generate a new job, moves in a very long interval. Although in more efficient territories investment effort to generate a new job has been smaller. It is reached a ratio of 35,966 € of direct aid for each created/maintain job.

Learned lessons:

- L1: Due to the complementarity of the different means, once the intervention framework has been established, focusing efforts on some strategic aspects produces results with a multiplier effect, that is, it can be extended to other areas.
- L2: It is essential to consider the sector to diagnose and propose financing strategies with the European Funds.
- L3: When defining strategies for road and rail transport infrastructure, it is necessary to consider their complementarity with other economic, demographic, territorial, environmental or sectoral (industrial, communications, technological, ...) policies, to give joint answers to common problems.
- L4: The degree of influence in the territory of the different strategies must play a relevant role in deciding what type of infrastructure and works are financed. The joint results of measures of joint improvement, congestion, quality and safety, have a greater effect on the overall efficiency of the transport system than the isolated measures.
- L5: Improvement in the main indicators of road and rail transport is observed, especially in terms of the provision of infrastructure and its territorial articulation capacity. Overcoming other challenges and / or problems should be the priority in future frameworks, such as transport quality, environmental impact, management and competition, regulatory and institutional framework.
- L6: Complementarity of transport modes requires the design of strategies that promote their intermodality, as opposed to individualized solutions that only favour the substitution effect.
- L7: It is necessary to consider the different territorial dynamics, in terms of the capacity to generate production and employment, when making the decisions on the location of the investment to ensure that the sought cohesion is achieved.
- L.8: With a view to future interventions, actions should also focus on the management and services of those infrastructures, as well as intelligent transport systems.