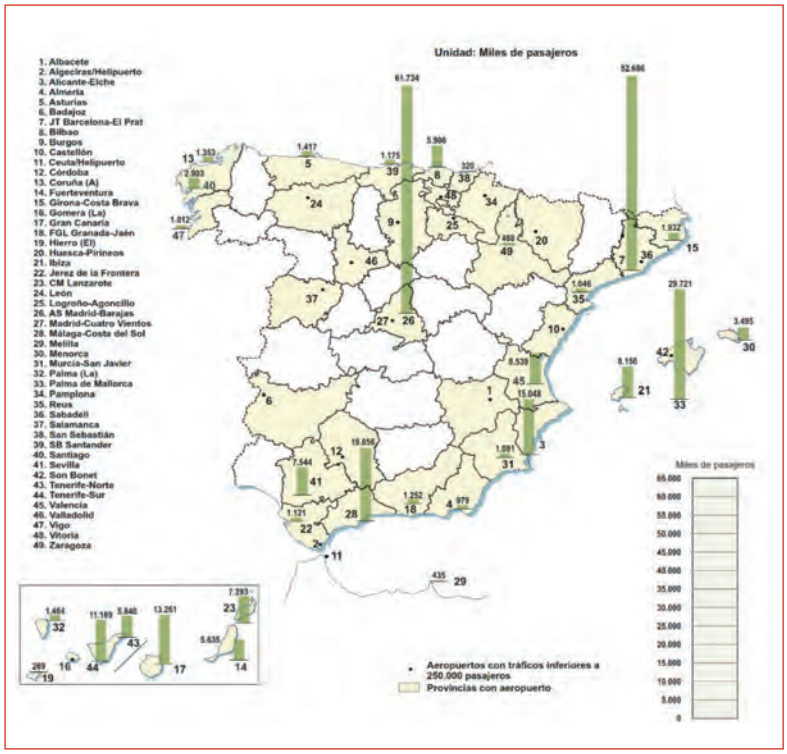
Asociación Caminos

Evaluation of Public Works in Spain

Airports
2023

• The airport network in Spain



AENA is a state commercial company which manages 46 airports and 2 heliports in Spain (it connects 90 countries and 370 destinations). Through its subsidiary company AENA INTERNACIONAL, it also manages 17 airports in different European countries and in America (12 in Mexico, 6 in Brazil, 2 in Colombia, 2 in Jamaica and 1 in the United Kingdom). 11 Brazilian airports will be managed by AENA starting 2023.

Among the airports handled by AENA is London Luton Airport (51% of the capital). AENA is the world's leading airport management company by passengers with nearly 275 million in 2019.

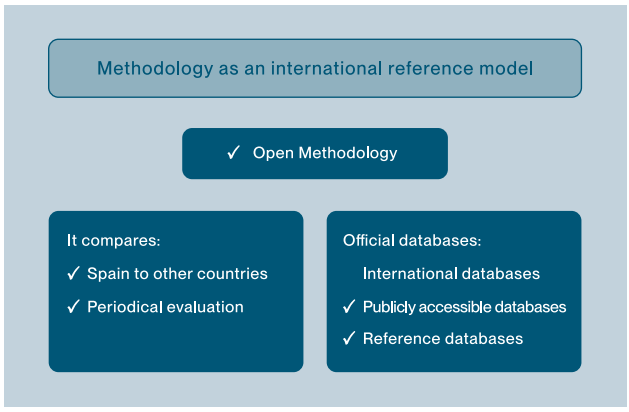
Airports indicators and evaluation by experts

Passenger traffic in Spanish airports has experienced a great growth during the last years, achieving the highest number ever with 275 million passengers in 2019.

The COVID-19 pandemic entailed a significant drop of the passenger's traffic in 2020, nevertheless the numbers are quickly recovering. The forecast for 2023 is that passengers traffic numbers achieved in 2019 will increase. In Spain, the Adolfo Suarez Barajas airport is among the airports with the largest international passenger traffic in the world.

The evaluation analyses six public works sectors in Spain: Roads, Railways, Ports, Airports, Water Cycle and Urban and Metropolitan Public Transport. **The methodology designed by the Asociación Caminos carries out an objective evaluation, it analyses quantitative indicators (economic and social in) in different countries. As well, it carries out a a qualitative evaluation, based on the opinions of a selected group of experts.**

The **quantitative evaluation** is developed carrying out a comparative study of 14 countries (Spain, Germany, France, United Kingdom, Italy, Turkey, USA, Brazil, Peru, Chile, Mexico, Japan, China, and India). This quantitative evaluation takes into consideration the most representative indicators of the sector, obtained from publicly accessible databases which are available in important multilateral organizations (like EUROSTAT, OECD, World Bank, UN, World Economic Forum, International Transport Forum, UIC, etc.).



To facilitate the assessment process, the data has been grouped eight common indicators in all sectors, called "Criteria".

The **quantitative evaluation** focuses exclusively on Spain and is it was conducted anonymously, and on a confidential basis analysing the responses of a survey questionnaire which was sent to a selected group of experts of the sector.

• Evaluation of the Airports (6.9)

Indicators: **Good**
Experts: **Sufficient High**

Rating		
Spain	7.1	C
Germany	8.4	B
France	7.0	C
United Kingdom	7.7	C
Italy	4.7	FX
Turkey	7.0	C
USA	8.6	B
Mexico	5.1	E
Brazil	5.7	E
Peru	5.2	E
Chile	5.9	E
Japan	7.3	C
China	7.3	C
India	5.4	E

Comparative Analysis of Spanish Airports in an International Context

The best rated country on a global level considering the agreed indicators was USA (8.6), followed by Germany (8.4). The countries who obtained high grades are France, United Kingdom, Japan, Turkey and China. Spain also obtained a good scoring (7.1), like France´s.

Spain achieved and excellent rate in Safety (10); a good rate in Capacity (7.6); Operation and Maintenance and Resilience (7.1, 7.5 and 7.2 respectively). A high pass in Performance, Financing, Adaptability to the Future and Sustainable development. And finally, Sufficient in Engineering and Innovation.

Evaluation of the Airports sector with indicators (Max 10)		
CRITERIA	RATING	
CAPACITY	7.1	C
PERFORMANCE	6.5	D
FINANCING	6.1	D
ADAPTABILITY TO THE FUTURE AND SUSTAINIBILITY	6.6	D
OPERATION AND MAINTENANCE	7.4	C
SAFETY	10.0	A
RESILIENCE	7.2	C
ENGINEERING AND INNOVATION	5.9	E
Evaluation by Objective Indicators	**7.1**	**C**
Indicators considered: 72		

Evaluation of the Airports sector with indicators (Max 10)		
CRITERIA	RATING	
CAPACITY	7.2	C
PERFORMANCE	7.7	C
FINANCING	5.9	E
ADAPTABILITY TO THE FUTURE AND SUSTAINIBILITY	6.7	D
OPERATION AND MAINTENANCE	6.0	D
SAFETY	7.4	C
RESILIENCE	7.4	C
ENGINEERING AND INNOVATION	5.7	E
Evaluation by experts	**6.8**	**D**
Answers received: 23		

Key conclusions of the report:

- The collaboration of private companies in the project and the construction of the airport works is excellent, nevertheless the involvement in its exploitation is very insufficient.
- The airport´s fundings rely exclusively on the landing fees and of non-aeronautical incomes. The funding is managed by AENA (leading airports management company) without the intervention of any other industry party apart from the client-supplier relationships.
- Reducing the carbon footprint is one of the main challenges in the sector. Currently, the airports carbon footprint impact is low compared to airlines.

Final evaluation of the Airports sector (Max 10)		
CRITERIA	RATING	
CAPACITY	7.1	C
PERFORMANCE	7.1	C
FINANCING	6.0	D
ADAPTABILITY TO THE FUTURE AND SUSTAINIBILITY	6.7	D
OPERATION AND MAINTENANCE	6.7	D
SAFETY	8.7	B
RESILIENCE	7.3	C
ENGINEERING AND INNOVATION	5.8	E
Final Weighted evaluation	**6.9**	**D**

- Regarding the sustainability, the following proposals are suggested: improve the rolling (decrease noise, increase the electric rolling of the (aircraft/push back) by apron and taxiways); Improve operational efficiency at airports with high air traffic (analysing the timeframes in the process); reducing the engine delay and stop timeframes, reduce gas emissions; improve the design of the terminals by using efficiency solutions and renewable materials, suggesting architectural solutions, applying geothermal solutions, increasing the use of renewable facilities and implementing more efficient in some airports, the air conditioning; generalize the use of BIM-based designs.
- In some airports the capacity of some sub-systems needs to be increased. For example, the airfields. More space is needs, especially in the terminals.
- The airport infrastructures must be designed considering situations that might create threats or adverse incidents. As a result, the infrastructures must have enough space for carrying out the appropriate control. Training is a key element for the personnel involved with security aspects.
- In the future, the funding effort will not be focused on building new infrastructures, rather than transforming, maintaining, and preserving the existing ones. The goal of the futures tasks will be to improve the sustainability, especially in the field of creating, reusing, and recycling renewable energy. As well as implementing advanced processes related to the digitalization, interconnection, continuous improvement, and modernization of the infrastructure of both terminals and taxiing and increasing the capacity of the key airports. Additionally, in expanding the capacity of the main airports to operate as HUBs, both in the terminals and operations building, and updating and improving the infrastructure of medium and small airports.
- Experts estimate that the annual investment that will be requires for developing the airport infrastructures in the following 10 years will be approximately between 7.000 and 10.000 million euros.

• Capacity (7.1)

Indicators: **Good**
Experts: **Good**

Does the provision and capacity of the public works sector meet current demands?

▪ Evaluation by Indicators

Total passengers transported -entries and departures- (Mills. passengers)
Total passengers transported -entries and departures- (Mills. passengers) / Real GDP ($)
Total air transport of cargo and mail (t) (EU+WORLD)
Total air transport of cargo and mail (t) / Residents
No. of airports / Mills. population
Number of airports / real GDP ($)
Total passengers transported -National aircraft and international lines of the country - (Mills. passengers) (WB)
Capacity of available seats for regular flights/ 1,000 residents
EU countries. Total passengers transported EU -entries and departures- (Mills. passengers).
EU countries. National air passenger transport in the EU (Mills. passengers).
EU countries. Passengers transported intra-EU -Includes fare. domestic flights - (Mills. passengers) EUROSTAT
EU countries. Passengers transported outside the EU (Mills. passengers). EUROSTAT
EU countries. Total air transport of cargo and mail (t). EUROSTAT
EU countries. Domestic air transport of cargo and mail (t). EUROSTAT
EU countries. International air transport of cargo and mail (t). EUROSTAT
EU countries. No. Commercial air flights (passenger, cargo and mail) (Mills.)

Rating		
Spain	7.1	C
Germany	8.0	B
France	6.6	D
United Kingdom	7.9	C
Italy	4.6	FX
Turkey	7.8	C
USA	9.8	A
Mexico	5.4	E
Brazil	7.0	C
Peru	2.3	F
Chile	2.5	F
Japan	8.1	B
China	7.8	C
India	6.9	D

According to the ICAO, the airport capacity is determined by multiple factors, including the operational area configuration and its utilization strategy. The indicators related to passengers show (not surprisingly) that the countries which receive more tourists have higher ratios; in absolute terms (referring exclusively to transported travellers) the USA, Japan, China, India, and the United Kingdom stand out; followed by Spain and, to a lesser extent, Germany, and France. Spain's tourism potential is reflected in these indicators.

In contrast to what happens with the indicators related to the Goods transport, in which Spain and Italy stand out as a very small number of goods are transported by air.

▪ Evaluation by experts and comments

1.1. How do you assess the capacity of Spanish airports to handle the current air traffic?	8.1	B
1.2. Considering the characteristics of the population in Spain and the important seasonality in many areas, how do you assess the capacity of the airport facilities to meet seasonal demand peaks?	7.3	C
1.3. Considering the characteristics of the population in Spain, the strong seasonality that there is in many areas, and the possible evolution of tourist destinations in the future, how do you value the capacity of the airport facilities for the foreseeable traffic growth?	6.3	D
Capacity Evaluation by experts	**7.2**	**C**

- Spain's airport network is one of the best in the world in capacity and services.
- In some airports, the capacity of some subsystems (like flight fields) needs to be expanded, to give response to foreseeable traffic growth. Also, it is required to increase the space (especially in the Terminals) in a flexible and quick way to adapt to the change in demand in a more efficient and sustainable way.
- The infrastructure supply is reasonably oriented to the services demand.
- The capacity of the Spanish airports in general is good, but in small airports there is an imbalance between capacity provided and the existing demand, this mismatch allows to manage a demand increase without expanding the current capacity.

• Performance (7.1)

Indicators: **Sufficient High**
Experts: **Good**

Are the current provisions and physical conditions of the public works sector adequate and proportionate to meet the users' expectations?

▪ Evaluation by Indicators

Global logistics index LPI WB (Logistics performance Index -LPI-)
Passenger traffic by nationality of companies - international and domestic (mills. passengers-km)
Passenger traffic by nationality of international companies (mills. passengers-km)
Freight traffic (mills. t-km) (WB)
Airport connectivity. GCI Score (WEF)
Efficiency of Air Transport Services. GCI Score (WEF)
EU countries. Passenger traffic transported (millions of passengers-km)
EU countries. National traffic and international transport intra-EU27 passengers (mills. Passengers-km). EUROSTAT
EU countries. International traffic extra-EU27 passengers (mills. Passengers-km).
EU countries. National and international intra-EU27 merchandise traffic (mills. t-km).
EU countries. International freight traffic extra-EU27 (mills. t-km).

Rating		
Spain	6.5	D
Germany	9.0	A
France	7.6	C
United Kingdom	9.2	A
Italy	4.3	FX
Turkey	6.3	D
USA	10.0	A
Mexico	4.2	FX
Brazil	3.5	FX
Peru	1.2	F
Chile	3.1	FX
Japan	8.7	B
China	9.1	A
India	5.3	E

The World Economic Forum indicator (WEF) "Airport connectivity" gives the highest rating to Japan, China, India, Germany, USA, United Kingdom and Spain (100 out of 100).

In the indicator "Service efficiency airport, also from the WEF, Japan stands out, with an index of 86.7 over 100. Spain obtains 76.6. In the group of the WEF indicators which create "The Global Competitiveness Index (which contains 141 countries in the world), Spain ranks seventh in the "2nd Pillar: Infrastructure" (with a rating of 90 out of a maximum of 100).

▪ Evaluation by experts and comments

2.1. How do you rate the quality of the air traffic management system in the Spanish airports?	8.3	B
2.2. How do you rate the quality of the services offered to airlines in Spanish airports (terminal services, aircraft services)?	7.7	C
2.3. How do you rate the quality of the complementary services offered to travellers at Spanish airports (information points, car rental services, air rooms, currency exchange, lockers, lost luggage, etc.) ?	7.7	C
2.4. Overall, how do you value customer service and the airport incidents management in Spain?	7.2	C
Performance Evaluation by experts	**7.7**	**C**

- In general, the Spanish network offers a service quality which is above the European average. The Spanish network is self-financed with the collection of fees for the using the facilities. As a result, it doesn't require additional financing from the Spanish General State Budgets.
- There has been a decrease in the quality of services provision in the recent years. Although in general terms the Airport services in Spain are good, there is room for improvement by creating high value business commercial activity around airports, which is known as "airport city".
- Passenger service can be improved by restructuring services related to service quality, for example, the VIP rooms.

• Financing (6.0)

Indicators: **Sufficient High**
Experts: **Sufficient**

Which amount of investment is allocated for financing the public works sector? Which amount is allocated for creating infrastructure? And for operation and maintenance?

▪ Evaluation by Indicators

Inversión en aeropuertos (mills. €)/Pasajeros (mills. Pasaj.)
Inversión en aeropuertos (€) / Carga (t)
% Inversión en aeropuertos (€) / PIB real (€)
Inversión en aeropuertos (€) / Habitantes
Transporte aéreo de pasajeros por mil unidades del PIB (USD)
Transporte aéreo de carga en toneladas-km por mil unidades del PIB ($)

Rating		
Spain	6.1	D
Germany	6.3	D
France	5.5	E
United Kingdom	7.5	C
Italy	1.7	F
Turkey	10.0	A
USA	6.8	D
Mexico	3.9	FX
Brazil		
Peru		
Chile	8.9	B
Japan	5.3	E
China	9.6	A
India	3.3	FX

The most representative indicator is the investment made in airports in relation to the national GDP. The average value of this indicator in the countries and years which have been analysed is 0.09%. The highest percent was achieved by Turkey (0.39%) in 2018. Spain obtained a low value, a 0.051% of GDP in 2019.

In the final rating, Spain obtained a final grade of sufficient high (6.1). This is considered one of the highest ratings among the European countries analysed. The best rating was obtained by Turkey (10), followed by China (9.6) and Chile (8.9).

▪ Evaluation by experts and comments

3.1. Do you consider that the current investment in airport facilities in Spain is enough?	6.5	D
3.2 How do you value the robustness of the current sources of funding of airport construction and works?	7.6	C
3.3 What do you think about how is being managed the investments in civil airport works in Spain?	5.2	E
3.4. What do you think about how private investment participates airport works projects, construction and/or operations in Spain?	4.4	FX
Financing Evaluation by experts	**5.9**	**E**

- The investment model in asset and infrastructure management for airport works airports, which is based on the award at the auction at the minimum cost, can lead to a decrease in the quality of the works, in addition to negatively affecting the engineering sector and airport construction works.
- The participation of private companies in the project and in the construction works is excellent, but the participation in its exploitation is very insufficient.
- Investment in airports depends exclusively on landing fees and non-aeronautical income. Aena manages and executes these investments, without the intervention of any other industry party apart from the client-supplier relationship.

• Adaptability to the future and sustainibility (6.7)

Indicators: **Sufficient High**
Experts: **Sufficient High**

Is the public works sector capacity and performance prepared to meet future expectations and demands? Are the resources and investment that have been made adequate for meeting the future needs of the sector? How are being implemented the different efforts whose goal is to gain environmental sustainability? Are there active measures being implemented in order to comply with the agreed objectives for decarbonising public works and transport?

▪ Evaluation by Indicators

Cumulative year-on-year growth rate. Airport investment / GDP
Cumulative year-on-year growth rate. Investment in airports/ (population + tourists)
Cumulative year-on-year growth rate. Investment in airports / passengers
Cumulative year-on-year growth rate. Investment in airports / cargo
Cumulative year-on-year growth rate. Investment in airports / Flight departures around the world from companies registered in the country.
% of domestic aviation CO2 emissions in total transportation CO2 emissions
% CO2 emissions from international aviation bunkers in emissions CO2 totals
Development of climate change mitigation technologies related to air transport.

Rating		
Spain	6.6	D
Germany	10.0	A
France	8.9	B
United Kingdom	6.7	D
Italy	3.7	FX
Turkey	7.0	C
USA	6.0	D
Mexico	3.5	FX
Brazil	3.6	FX
Peru	7.3	C
Chile	6.3	D
Japan	6.1	D
China	4.0	FX
India	4.1	FX

In order to analyse the indicators related to the investments made in airports regarding the future adaptability and sustainability, it has been taken into account the investment growth in relation with the GDP of the national population plus tourists, passengers, cargo and flight departures throughout the world of registered companies in the country. The indicators related with the accumulated year-on-year growth value very highly all the European countries which were analyzed (except Italy).

▪ Evaluation by experts and comments

4.1 How do you consider the instruments in place which are related to adapting the future air traffic demands?	6.3	D
4.2. How do you evaluate how the Spanish airports have adapted to the environmental protection?	7.3	C
4.3. How do you value the initiatives which are being implemented for reducing the CO2 emissions and the greenhouse effect and gases emissions in the construction, conservation, and maintenance of airports?	6.7	D
4.4. Do you consider adequate the measures implemented in order to reduce the environmental impact, construction water management in construction and airport conservation?	6.6	D
Adaptability to the future Evaluation by experts	**6.7**	**D**

- The carbon footprint is one of the main challenges of the sector. Currently, airports have a low involvement compared to the one made by the airlines. Nevertheless progress is being made in decarbonizating the airports facilities and airport parties, such as the handling agents.
- There is no real strategy in AENA regarding the sustainability, neither in the operation, nor maintenance nor in the airport construction.
- Regarding the sustainability, the following proposals are suggested: improve the rolling (decrease noise, increase the electric rolling of the (aircraft/push back) by apron and taxiways); Improve operational efficiency at airports with high air traffic (analysing the timeframes in the process); reducing the engine delay and stop timeframes, reduce gas emissions; improve the design of the terminals by using efficiency solutions and renewable materials, suggesting architectural solutions, applying geothermal solutions, increasing the use of renewable facilities and implementing more efficient in son airports, the air conditioning; generalize the use of BIM-based designs.

• Operation and maintenance (6.7)

Indicators: **Good**
Experts:: **Sufficient High**

Are public works being operated and maintained in accordance its needs? Is it being invested what is necessary to ensure the proper conservation and maintenance?

▪ Evaluation by Indicators

WB. Air transport, worldwide flight departures from registered companies in the country (x 1000) / (Inhabitants + tourists)
WB. Air transport, worldwide flight departures from registered companies in the country (x1000000) / GDP ($)
EU. No. Commercial air flights (passenger, cargo and mail) (Mills. X 1000000)/GDP ($)
EU. Punctuality in minutes on departures in the most important airports (airports>25 million passengers / year). Sep 2022
EU. Punctuality in arrivals in the most important airports (airports >25 mills. Passengers / year). Sep 2022
EU. Hub connectivity of the best airport in the country (2022)

Rating		
Spain	7.4	C
Germany	5.8	E
France	3.9	FX
United Kingdom	4.5	FX
Italy	4.4	FX
Turkey	8.2	B
USA	9.1	A
Mexico	5.3	E
Brazil	5.0	E
Peru	6.6	D
Chile	6.5	D
Japan	3.9	FX
China	4.1	FX
India	4.0	FX

To evaluate this criterion, it has been taken into account the number of flight departures and punctuality in minutes at departures and arrivals. Also, it has been considered the connectivity HUB of the best airport of each of the countries analysed. The combination of this criterion, which has been analysed by six indicators, give the best rating to the US, followed by Turkey and Spain.

▪ Evaluation by experts and comments

5.1. How do you value the investment made in the conservation and maintenance of the airport facilities in Spain?	5.9	E
5.2. Do you consider that the means applied to the operation, conservation and maintenance of the airport facilities are appropriate for meeting the user demands?	6.0	D
5.3. How do you assess the state of conservation and maintenance of the airports?	6.4	D
5.4. How do you assess the energy efficiency of airport facilities?	5.8	E
Operation and maintenance Evaluation by experts	**6.0**	**D**

- In recent years, there has been a deterioration in quality of the operation, conservation and maintenance of the airports.
- Emblematic airport facilities in Spain, like T4 of Madrid´s airport, suffer from a lack of conservation and maintenance to adapt to the expected service level. The investment in conservation and in new technologies, is insufficient to compete with the world's large airports.
- It is advisable to move forward in creating asset management plans that will allow great savings during maintenance.
- The Asset Management Plan must be efficiently included from the conceptual design phase in order to allow the airport management team to take decisions related to costs savings and consumption, process times and improve the useful life of the facilities.
- It is necessary to increase the investment in infrastructure conservation, as well as in new security technologies, boarding, flight information, etc.

• Safety (8.7)

Indicators: **Very Good**
Experts: **Sufficient High**

Is the public works sector safe for the users? Are effective measures being implemented for ensuring a safe performance and operations?

▪ Evaluation by Indicators

Fatalities on passenger flights
Fatalities in accidents in commercial air transport
Injured in commercial air transport accidents
Fatal victims of air accidents in aerial works
Injured in plane accidents at airport works

Rating		
Spain	10.0	A
Germany	10.0	A
France	9.3	A
United Kingdom	10.0	A
Italy	10.0	A
Turkey	10.0	A
USA	10.0	A
Mexico	10.0	A
Brazil	10.0	A
Peru	10.0	A
Chile	10.0	A
Japan	10.0	A
China	10.0	A
India	10.0	A

The indicators chosen correspond to those which usually are used: accidents with victims and fatalities.

The results of the indicators and the final evaluation is excellent in all the countries which were analyzed.

▪ Evaluation by experts and comments

6.1. How do you assess the measures currently adopted to prevent accidents on the roads?	6.6	D
6.2. How do you rate road equipment to prevent or reduce the effects of accidents on the large capacity network?	7.1	C
6.3. How do you rate road equipment to prevent or reduce the effects of accidents on the conventional network?	5.5	E
6.4. How do you consider the measures that are being taken to reduce road accidents in the future?	5.9	E
Safety Evaluation by experts	**6.3**	**D**

- In Spain, due to past experiences, the anti-terrorist security level is good. However, in the cybersecurity field, an effort must be made in order to prevent future attacks.
- Progress can be made and research can be made into safety control systems must be researched because it will allow a better passenger experience and it save time and hassle. It is important to take into account that one of the determining factors for choosing another mean of transportation is precisely the inconvenience of the passenger during this airport process.
- Using drone surveillance systems must be considered in order to perform better access control.
- Airports work with closed networks which has led to slow cybersecurity developments. The trend is overcome closed networks in the coming years, to improve cybersecurity at airports.

• Resilience (7.3)

Indicators: **Good**
Experts: **Good**

When threats and adverse incidents occur, what is the capacity of public works to prevent, protect and minimize the consequences for users, the environment, the economy and national security? Is the public work prepared to recover its initial state within a reasonable time when the threat or adverse incident has ceased? Are there alternatives for the service provision in case of threads or adverse incidents?

Evaluation by Indicators

EU. Hub connectivity of the best airport in the country (2022)
Direct airport connectivity. Airport Council International.
Indirect airport connectivity. Airport Council International.
Connectivity like airports. Airport Council International.
Connectivity as an airport HUB. Airport Council International.

Rating		
Spain	7.2	B
Germany	10.0	A
France	5.6	E
United Kingdom	7.6	C
Italy	4.1	FX
Turkey	2.8	F
USA		
Mexico		
Brazil		
Peru		
Chile		
Japan		
China		
India		

To assess resilience it is necessary to gather the data related to the technical characteristics of the airports design. As it wasn´t possible to get all this data from all the airports, it was decided to use for the assessment indicators which in an indirect way can provide information about the existing resilience in the airport network.

▪ Evaluation by experts and comments

7.1. How do you assess the capacity of airport facilities in Spain to provide their initial service conditions when adverse situations occur?	7.2	C
7.2. How do you assess the measures which have been adopted by the airport operators for restoring air traffic in the scenario that natural or provoked incidents take place?	7.4	C
7.3. How would you rate on a global level the implementation of contingency and self-protection plans of the airports which have been considered as critical infrastructures for the purposes of the application of legislation of the Critical Infrastructures protection.	7.1	C
7.4. How would you rate the Spanish airport network interconnections regarding their ability of maintaining the air travel in scenarios of destruction or when serious damage takes place within the network?	7.8	C
Resilience Evaluation by experts	**7.4**	**C**

- The Spanish airports are prepared for tackling security disruptions. Resilience is rated above the European average.
- Airport infrastructure must be designed taking into account threat situations or adverse risk episodes. As a results, it its necessary to design spaces in which the appropriate controls can be carried out.
- Providing training to the personnel is a key element.

• Engineering and innovation (5.8)

Indicators: **Sufficient**
Experts: **Sufficient**

Do you consider adequate the resources allocated to engineering in the design, construction, conservation, management, and operation of the public works sector? Is the investment made in innovation appropriate? What new techniques, materials, technologies, and operating methods are being implemented in order to improve public works? Is progress being made in digitalization, monitoring and sensorization during the complete cycle of public works? Is the information provided adequate for users?

Evaluation by Indicators

Position in Skytrax ranking
Number of patents. Aeronautics and Air Transport (OECD)
% of GDP allocated to Gross Domestic Expenditure on R&D (OECD R&D)
Gross domestic expenditure on R&D ($)/Population (OECD R&D)
% of GDP allocated to spending on basic research (OECD R&D)
% of GDP from private financing for Research and Development (OECD R&D)
% of GDP from public financing for Research and Development (OECD R&D)
Digitization. Participation in new technologies. GCI Score (WEF)
Digitization. ICT Infrastructure Index. (ND Index)
Digitization. % of people who use the internet
Engineering. Regulatory transparency. Engineering Services Trade RestrictionIndex.
Barriers to competition. Engineering Services Trade Restriction Index.
Restrictions on movement. Engineering Services Trade Restriction Index.
Restrictions on the entry of engineers from abroad. Constraint index Innovation index..
ND Gain Index

Rating		
Spain	5.9	E
Germany	8.1	B
France	8.7	B
United Kingdom	7.7	C
Italy	5.3	E
Turkey	3.7	FX
USA	9.3	A
Mexico	3.3	FX
Brazil	5.2	E
Peru	3.7	FX
Chile	3.7	FX
Japan	9.2	A
China	6.5	D
India	4.2	FX

In order to analyze the current state in which the airports on a global level, it was decided to address the state of R&D&I in different countries. In order to do this, the following database and report “Main Science and Technology Indicators, Volume 2021. OECD” have been selected in order to determine the applicable indicators. The indicator “Position in the ranking SKYTRAX” awards the highest ratings to Germany, USA, Japan, and China. Spain obtains a 6.

▪ Evaluation by experts and comments

8.1. Do you consider adequate the investment made in airports engineering design, construction, management, and conservation?	4.6	FX
8.2. How do you assess the knowledge and technical attitude of the current aeronautical engineers?	7.7	C
8.3. What do you think about the knowledge level taught in universities to aeronautical engineers?	6.6	D
8.4. How do you value that new techniques, technologies and materials are being used during the construction, conservation, and maintenance of the airport facilities in Spain?	6.5	D
8.5. How do you assess the measures implemented in the public tender for improving innovation in the sector?	3.4	FX
8.6. What do you think about the public-private collaboration in the research project related to the airport sector in Spain?	3.8	FX
8.7. How do you rate the recycling and decommissioning aircraft facilities and the aircrafts removal in Spain (Teruel airport, etc.)?	7.3	C
8.8. How do you assess the research, development and innovation regarding airports which is being carried out and developed in Spain?	4.5	FX
8.9. What do you think about the current technology that is being applied in airports?	6.2	D
8.10. What do you think about the progress being made in improving the digitalization and in monitoring the behaviour of the airport elements?	6.1	D
Engineering and Innovation Evaluation by experts	**5.7**	**E**

- It is necessary to improve in the administrative field for being able to implement new innovative solutions in a quick and easy way. Like for example, biometry and implementing hydrogen in the airport.
- There should be a higher investment in innovation by cooperating with the private initiative. It would be considered a win-to-win strategy.
- If there was a structured and organised relationship with all the sector parties (planners, designers, technology companies and builders), it would be possible to unify the objectives that would like to be achieved. And a result, it would be feasible to improve the innovation in this important sector in the Spanish economy.

Asociación Caminos

www.asociacioncaminos.es