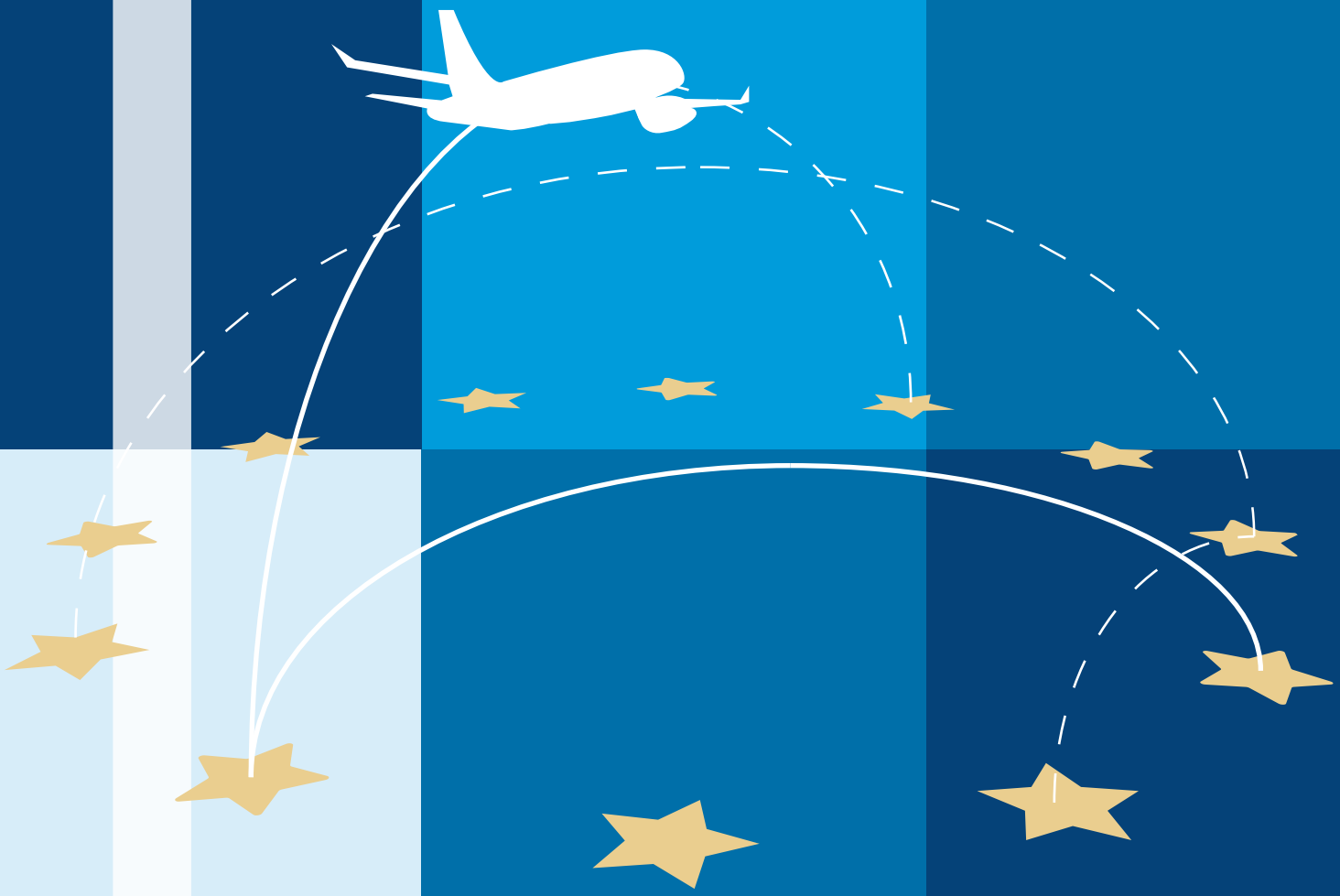
PROCEEDINGS

December 2017



Air Connectivity in European Regions

ARC
AIRPORT REGIONS CONFERENCE

Air Connectivity in European Regions

About Airport Regions Conference

Airport Regions Conference (ARC) is an association of regional and local authorities across Europe with an international airport situated within or near their territory.

ARC brings together a wide range of expertise at the interface of air transport and local and regional policies. A common concern is to balance the economic benefits generated by the airports against their environmental impact, notably the effect on the quality of life of local residents.

The members exchange best practices through the ARC network and reflect together on policy challenges ahead. As such the ARC also serves as a platform to express members' interests to the European Institutions.

This paper was issued in the light of an event on air transport connectivity organised by ARC and hosted by Estonian Member of European Parliament (MEP) Urmas Paet on 5 December 2017 in the European Parliament in Brussels, Belgium.

Welcome Words

Dear reader,

It was a delight hosting such a successful event on air connectivity, which is a crucial aspect to a wider European integration, and economic growth.

We are the best placed organisation to ensure sustainable future aviation policy. The voice of airport regions must be heard and taken into account. Involving all stakeholders is the only guarantee that all parties, can benefit from aviation activities.

Connectivity is key for economic and social well-being of all European citizens. It is important for both big airports or hubs, and regional airports. Hubs cannot function properly if they are not being “fed” by flights coming from all corners of the European continent. Regional airports, especially those located in remote areas in Europe, rely on aviation to be connected with the economic heart of Europe in order to secure welfare in the region. Therefore, we are thankful to MEP Urmas Paet for hosting the event on air connectivity in the European Parliament on 5 December 2017.

ARC has been involved from the very beginning in the process leading to the definition of Connectivity indicators by the European policy-makers. We welcome the open attitude of the European Commission and EUROCONTROL in this matter. An important step is that these indicators do not focus on the sole air connectivity, but that a specific attention has been paid to encompassing the hinterland, the territories served by the airport. This is a dramatic change of paradigm, that will allow to better envisage the relationship between the airports and their regions.

We would be happy to see our contributed expertise and feedback being translated into additional tools to improve air connectivity measurement. For this reason, we continue to advocate for the creation of a Connectivity Master Plan at European and local levels. We also would like the price of air fares included as an indicator to apprehend the accessibility of the connectivity.

The ARC approach is built-up with local touches from our members coming from all over Europe. This shows that all Europeans can efficiently contribute to the wider definition of policies.

Sergi Alegre Calero,
ARC President

What is Air Connectivity?

There is no commonly agreed definition for air transport connectivity. The International Civil Aviation Organisation (ICAO) describes air connectivity as "the ability of a network to move a passenger from one point to another with the lowest possible number of connections and without an increase in fare, focusing on, from a commercial perspective, minimum connecting times with maximum facilitation ultimately resulting in benefits to air transport users".

Aviation connectivity is a catalyst for economic growth, employment, trade and mobility in Europe.[1] The concept of cohesion is more interesting when reflecting on the notion of connectivity. Connectivity is key, because all regions in Europe should be included in the economic success of the EU (cohesion). This is only possible if they are (equally) connected with dynamic markets. This is not the case today, as remote areas, like in the peripheral regions (e.g. ARC member regions Iasi in Romania, the Canary Islands in Spain or Oulu in Finland), are not always benefitting from enough connections between their airport and the rest of Europe. Increasing connectivity enables local economies to grow by attracting new companies and creating new jobs. It also enlarges the mobility of citizens in remote regions in Europe.

It is often difficult for peripheral regions to be connected with the economic centre of Europe, often referred to as the "Blue banana"[2], which leads to economic disadvantages in these regions and economic equality in Europe.
A good instrument to tackle this, are the public service obligations (PSOs)[3] of having to ensure connectivity between remote areas and the densest regions in Europe. It is however questionable if PSOs are sufficient to guarantee a good connectivity and access for regions to the economic heart of the continent.

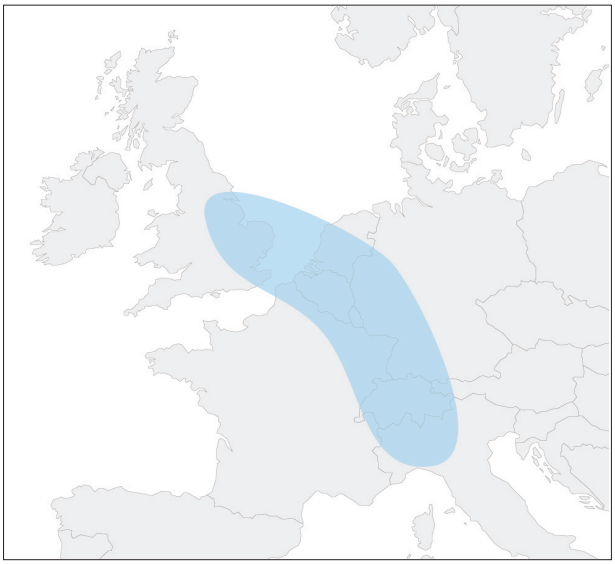


Figure 1 - "Blue Banana"

Figure 2 - Public Service Obligations in Europe
Source: Riko Merkert & Basil O'Fee, 2013, Transport Policy

1. This is a widely spread belief amongst industry, even though some elements of scepticism can be brought to emphatic figures that are sometimes provided (each added route equals 0,1% of growth of the GDP of an area: this assertion is sometimes met but is often disputed by counter partisans. More interesting studies are establishing a correlation between real estate value and connectivity).

2. The Blue Banana is a discontinuous corridor of urbanisation in Western Europe, often considered as the economic centre of Europe with a population of around 111 million. It stretches from North West England across Greater London to the Benelux states and along the Southern Germany, Alsace in France and Switzerland to Northern Italy. The concept was developed by RECLUS, a group of French geographers managed by Roger Brunet.

3. "In order to maintain appropriate scheduled air services on routes which are vital for the economic development of the region they serve, Member States may impose public service obligations on these routes. In case no air carrier is interested in operating the route on which the obligations have been imposed, the Member State concerned may restrict the access to the route to a single air carrier and compensate its operational losses resulting from the PSO. The selection of the operator must be made by public tender at Community level". Regulation (EC) No 1008/2008 of the European Parliament and of the Council of 24 September 2008.

Lawmakers on Air Connectivity

Mr. Urmas PAET
Member of European Parliament, ALDE, Estonia

Urmas Paet is an Estonian politician and member of the liberal Eesti Reform party. He currently is a Member of the European Parliament for the ALDE (Alliance of Liberals and Democrats in Europe). His expertise lies in the field of foreign and security policy and he is the most active in the Foreign Affairs and Security and Defence Committees in the European Parliament. He is also a member of the Committee on Budgets and the Delegation to the EU-Kazakhstan, EU-Kyrgyzstan, EU-Uzbekistan and EU-Tajikistan Parliamentary Cooperation Committees and for relations with Turkmenistan and Mongolia and in delegations for Japan, Afghanistan, the Korean Peninsula and Ukraine. He has previously been the Estonian Minister of Foreign Affairs (2005-2014) and Minister of Culture (2003-2005).

Mr. Paet stressed that air connectivity is often poor in Europe's peripheral regions and generates economic disadvantages in comparison with more central areas in Europe that are mostly well connected because of their geographical location.

Looking at the Aviation Strategy for Europe, proposed by the Commission, Mr. Paet finds it contradictory that the European Commission wants to improve air connectivity on the one hand, but remains strict for European airlines based in peripheral regions regarding the grants of state aid to airlines that are willing to operate in regions with poor connectivity. As a peripheral Member State, connectivity has always been a valuable topic for Estonia.

Ms. Merja KYLLÖNEN
Member of European Parliament, GUE/NGL, Finland

Ms. Kyllönen, representative of another peripheral country, Finland, supports the vision that there should be more focus on connectivity of remote regions with the economic centre of Europe. She stressed the importance of regions as suppliers for businesses in the European economic centre. She also supports the idea of stimulating intermodal transport systems, which involve multiple means of transport.

Ms. Margit MARKUS MOOSSEN
Counsellor for Transport (Aviation), Permanent Representation of Estonia to the European Union, Estonia

Air travel is the only serious option in Estonia to reach the rest of Europe (except for neighbouring countries Latvia, Sweden and Finland). Discussion on air-connectivity should therefore go further than mere checking if there is an air link with other cities, it is also about the frequency of flights. Connectivity should be business-friendly. It will affect the economy if there is only one flight per day (or even per week) to a certain city. Businesses will not settle in badly-connected regions since they can not operate properly because of the risk of being excluded from reaching other parts of Europe in case of a disruption.

Mr. Filip CORNELIS
Director of Aviation, DG MOVE, European Commission, Belgium

As part of the implementation of the Aviation Strategy for Europe, the Commission is prioritizing connectivity: it serves the people directly, it is a catalyst for the economy and it increases the GDP per capita in European regions.

It is crucial to link other modes of transport into an intermodal transport structure to ensure connectivity in Europe. Integrating other transport modes to aviation is a good start for that. Next to that, the Commission indicated that it will also focus on expanding airport capacity at the existing airports, in order to be able to receive and handle the expected future traffic. The PSO-strategy (Public Service Obligations) could be expanded as well, where justified. The Commission refers to the Airport Observatory -of which ARC is a member- to gather input on how connectivity should be improved in Europe and referred to the Connectivity Index, developed by the European Commission and the Network Manager EUROCONTROL.

City of Vantaa (Finland) on Air Connectivity

Mr. Jose VALANTA
Director of Business Development, City of Vantaa, Finland

A. Finland's dependency on Air and Sea Connectivity

Finland has a high dependency on connectivity by air and sea, because – as an old saying goes – the country is an Island located at the edge of the European North-East corner. Finland is missing the vital land connection to continental Europe and depends strongly on well-functioning air, rail, and harbour connections all year around. When leaving Finland overland, it is only possible to travel to Russia, Northern Sweden or Northern Norway.

The country's main airport, Helsinki-Vantaa, is not, and will not be, one of the most vivid airports in the world. However, the main passenger-harbour Helsinki is already the busiest harbour in the world with its 12,3 million passengers. Therefore, it is crucial that international agreements and a common EU-policy support the northern EU Member States and their vital objectives concerning connectivity and accessibility.

B. Finnish Aviation, Facts and Figures

Over 90% of the Finnish domestic and international air traffic goes through Helsinki-Vantaa airport. The total number of passengers carried in 2017 was 18,8 million. Air travel employs approximately 100.000 persons and accounts for 2-3% of the national GDP. Every 1.000 passengers equal 1 new job in the Finnish aviation industry.

135 direct flight connections connect Finland with the rest of the world. Of these, 19 flights per week are to Asia. Flying via Helsinki is the fastest route between Europe and Asia and Finland as a destination has gained popularity, especially in Asia. Helsinki-Vantaa Airport is the fifth largest airport in traffic between Europe and Asia. A first direct flight between Beijing and Rovaniemi is planned to be launched in 2019. Lapland will also be better connected with other European cities, especially by Christmas holiday charter flights. In 2017, Lapland received a total of 5.88 (statistics from 6/11/2017), which is 50 flights more than in 2016.

C. Finnish Airport Network as a Crucial Starting Point (vs. PSOs)

There are not many Public Service Obligation (PSO) flights ordered in Finland. Currently only two of total 21 airfields (Pori and Savonlinna) are operated and partially financed by the State. Far more important than PSOs for a populated country is the maintenance of the network-model that the EU has granted for Finland as a permanent special permit. This means that a single airport does not have to be profitable. Finland is regarded as a network within, in which unprofitable airports can be subsidised with the income of the profitable ones.

D. Connectivity Challenges: Role of Third Countries

Vantaa's long-term aim is to become the main "Northern Hub". In terms of Asian traffic, Helsinki-Vantaa has already made prominent progress to become a preferred connecting point between Europe and Asia. A major competitive advantage of flag-carrier Finnair is thanks to a bilateral air service agreement between Finland and Russia including the right to fly in Siberian air space to Asia. It is crucial for Finnair's success to maintain that agreement-status stable in order to maintain that time-benefit. If this agreement would be hazarded, a great share of Finland's Asia-traffic might be overtaken by hubs outside the EU, mainly the ones in the Middle East or Turkey (e.g. the new Istanbul or Dubai International Airport).

The European Commission's negotiations with third countries on comprehensive air transport agreements should be completed and demonstrate that negotiation mandates have promoted market access. Only then could the Commission grant new negotiating mandates to cover contracts. The time for any new mandates should also be limited. It is important for Finland that the section of the Commission communication "Securing competition in air transport", and in particular the part concerning China, should be taken into account. Finland has a significant number of bilaterally agreed air transport rights with China and these bilateral negotiations should also be safeguarded.

E. How to Maintain and Gain Position in a Territorial Competition?

There is no competition amongst Finnish airports, because Helsinki-Vantaa is the only hub-airport, good for over 95% of all air traffic to and from Finland. The airfields of Lapland are dedicated to tourism-traffic and attract a specific passenger profile. However, competition Is hard with hubs in other countries like Stockholm-Arlanda, Copenhagen, Frankfurt, Oslo, Amsterdam, etc. Growth comes with congestion, and the customer experience, operational reliability, target attraction factors, etc. are important factors in the competition.

Connectivity out of Helsinki-Vantaa airport via rail is growing significantly. This includes both domestic connections and connectivity capacity via rail (e.g. the future Helsinki-Tallinn tunnel). This tunnel is a twin city concept and synergy designed to extend the catchment area of Helsinki-Vantaa with the Baltic States. In the future, Finland wants to attract people 'from the Arctic Sea to Berlin' with the planned Arctic railway and Rail Baltica.

F. The Challenge of Reconciling Traffic Development and Noise Policies

Noise policies should be flexible and not restrict potential growth. The effects are not only sensible to the aviation business, but also to the local level housing and land-use possibilities in a drastic and in a very unfavourable manner. It requires constant balancing between air business and local hopes. Ongoing dialogue at local level and the responsibility of airport operators are key in this. Helsinki-Vantaa Airport is carbon neutral (since 07/2017), they have adopted "green landings" and Finavia is also performing accurate measurements constantly.

Measuring Air connectivity

Air transport connectivity can be measured. Which indicators to focus on, to measure connectivity, is a topic of discussion for all stakeholders involved. There is a tendency to only look at connectivity where airports are the origin and destination. In real life, however, airports are almost never the final destination of air-passengers. The measurement of so-called airport connectivity is valuable, but it does not indicate the quality of door-to-door connectivity, and by extension the complete passenger experience. An air journey does not start, nor end at airports, but at the passengers' front door or hotel entrance.

Air Connectivity Between Airports: SEO NetScan Connectivity Model

The airport industry, represented by Airport Council International (ACI)[4] differentiates between four types of air connectivity for measuring connectivity, using the SEO[5] NetScan Connectivity Model:

- **Direct connectivity** is the total number of direct scheduled flights offered from one airport.
- **Indirect connectivity** is the total number of indirect connections offered from an airport via an intermediate airport. The quality is defined by how fast the connection is defined with a score between 0 and 1, relative to an equivalent direct connection.
- **Airport connectivity** is the sum of direct and indirect connectivity at an airport.
- **Hub connectivity** is the total number of connections offered through a hub airport, excluding self-connections. Connections can be purchased as a package by the passenger from airlines. Each connection scores between 0 and 1 depending on its quality.

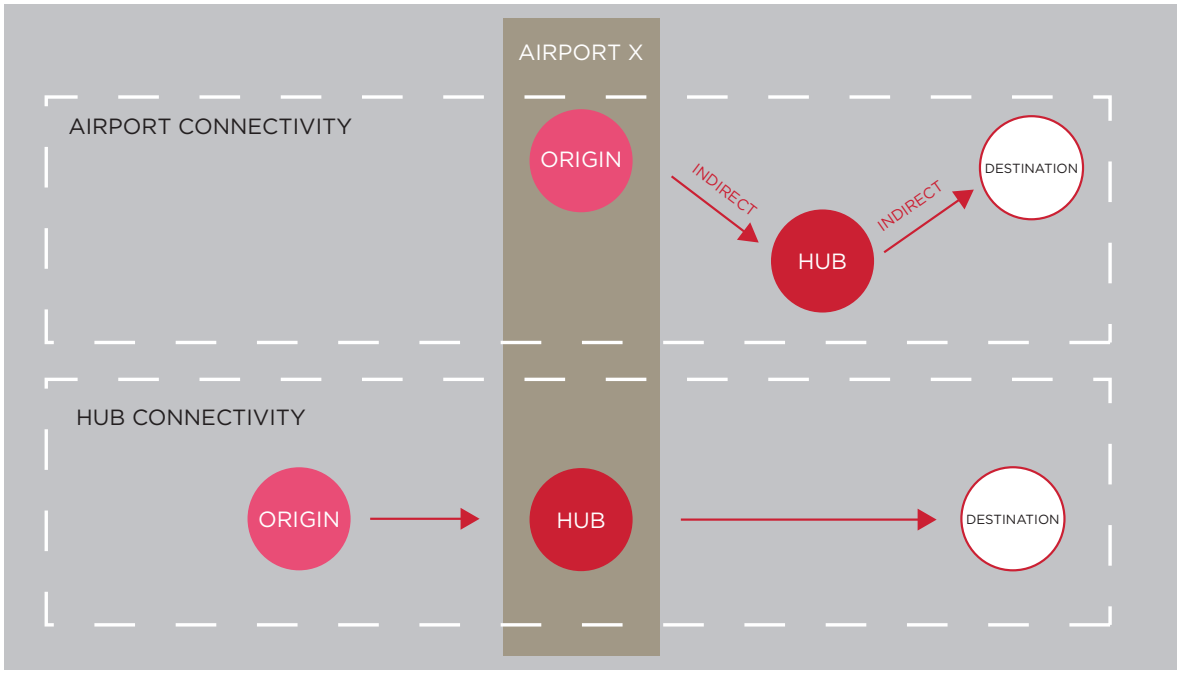


Figure 3 - SEO NetScan connectivity model
Source: SEO Aviation Economics

4. ACI Europe is an organisation based in Brussels, Belgium, representing over 500 airports in 45 European countries.

5. SEO Aviation Economics is a consultancy that carries out researches on air transport for governments, airlines and airports.

Air Connectivity Between Regions: EU Aviation Connectivity Index

Dr. David MARSH
Head of Forecasts & Network Intelligence, Network Manager, EUROCONTROL, Belgium

EUROCONTROL, European Network Manager, was appointed by the European Commission to create a EU Aviation Connectivity Index to indicate connectivity in Europe and between European regions. This index goes further than summing up the number of air routes between airports.

Dr. Marsh stressed the importance of a well described definition of "connectivity", because sometimes it can be unclear what stakeholders mean when using this term. EUROCONTROL is aware of the fact that surface access must be included when indicators for connectivity measurement are being defined. Connectivity indicates connections from door to door, not from airport to airport.

When defining indicators to measure connectivity and the quality of it, it is key to keep the indicators simple to improve usability. This is because connectivity is more about people than planes. When people are planning travels, they ask themselves important questions that are crucial for designing/planning of a well-connected Europe. Potential travellers will wonder firstly where they can go, or who they want to visit. Second, the duration it will take to go there is being considered. Third, they will look at the choices they have, regarding prices and the number of carriers.

EUROCONTROL came with four indicators that addressed the air connectivity in a certain region: the reachable population, travel time, flight choice and the number of carriers.

In addition, the passenger wants to know some more detailed information about the offered connections. It is important for possible future passengers to know whether they have to take a direct or an indirect flight to reach their destination. The type of airlines operating the flight is also useful to know. Low-cost carriers mostly operate point-to-point services, while full-service carriers often require the passenger to change planes at a hub. For tourist destinations, connections by non-scheduled leisure carriers ("charter") are important, so those are also included. Being able to travel at 'business-friendly' times is important for the economies in the connected regions.

6. "The first mile last mile problem" describes the difficulty in getting people from door-to-door at their destination. It is often difficult for passengers travelling from their home via an airport to a final destination. People living in lower-density suburbs that are often not within walking distance to existing public transportation options. Therefore, transit use in these areas is often less practical. Critics claim this promotes a reliance on cars, which results in more traffic congestion, pollution, and urban sprawl. Besides that, transportation to and from an airport is often more expensive and more polluting per kilometre than the flight the passenger is about to take.

Figure 4 shows how EUROCONTROL wants the indicators to measure air connectivity from door to door, the so-called "first mile last mile problem"[6]. For now, the system only takes into account driving time to the airport, but in the future, other means of transport will also be integrated.

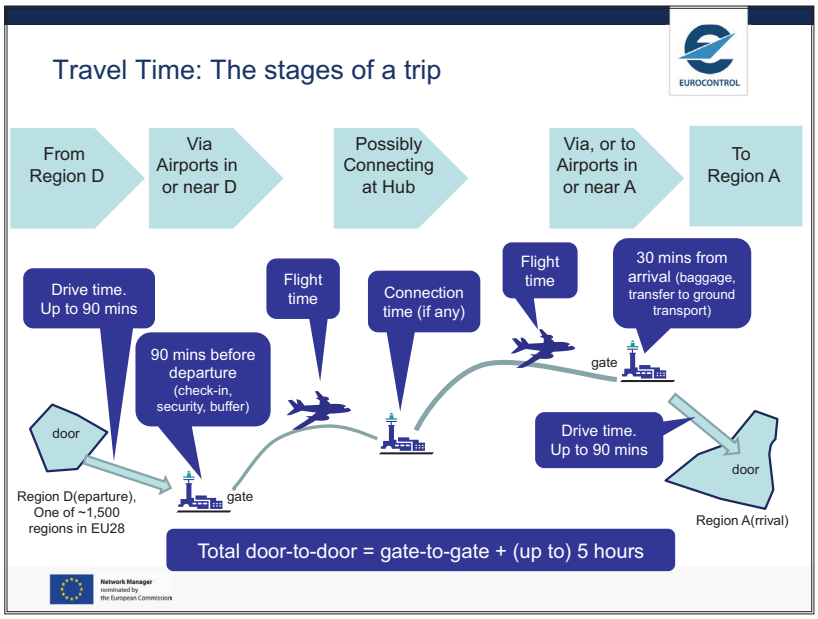


Figure 4 – Connectivity indicator: Travel time
Source: EUROCONTROL

A.Travel Time:
How long does it take to go from the origin to the destination?

The first indicator to measure connectivity between regions is travel time. As could be seen in figure 1 on the previous page, EUROCONTROL is taking into account the first mile last mile problem. This means that when measuring connectivity between regions, the Connectivity Index does not just look at airport-to-airport connectivity, but at door-to-door connectivity. It is important for users of the system to know how long it will take to go from their house to the pavement in front of their hotel or friends' house. To keep the system simple, EUROCONTROL has opted to use average driving times (of 90min.) to go from one's door to the airport. At a later stage, other modes of transport for ground access to the airport must be included in the system, such as public transport.

Figure 5 shows how the index works. It shows where you can get to in Europe from Tallinn, Estonia before 10 am. The lighter the colour of the region gets, the quicker you arrive in that particular region.

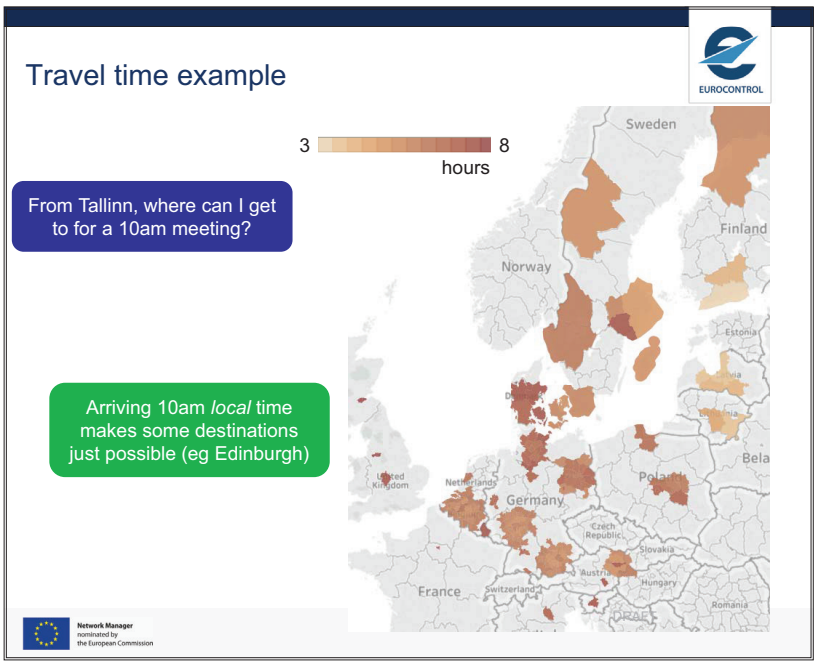


Figure 5 - Connectivity indicator: Travel time
Source: EUROCONTROL

When interpreting the graphs, it is important to know that only areas or regions which are indicated are accessible by plane in a certain time slot. Other locations can of course be reached via other means of transport, but these are not indicated on the maps. If driving time is under two to three hours, it is excluded from the index as nobody will use the aircraft in this case. The system is also not airport specific, in order to keep a high usability standard, though the influence of major airports is evident in the figure.

B. Reachable Population: Who can be visited?

The second indicator shows the population that can be reached out of a country or region. The picture shows that the map can show connectivity between countries, and between the smallest regions. Percentage of the region's population is probably easier to compare across Europe, than number of people.

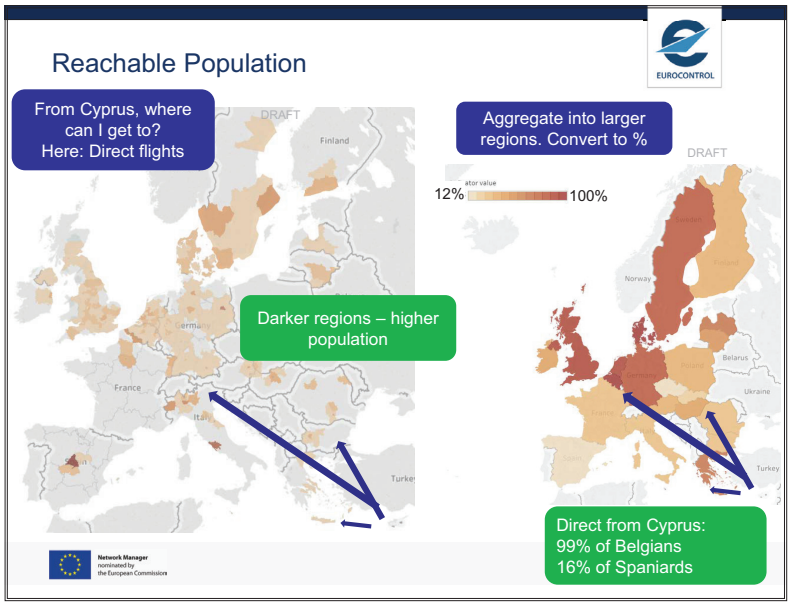


Figure 6 - Connectivity indicator: Reachable Population
Source: EUROCONTROL

The map on the right of figure 6 indicates that from Cyprus, 99% of all Belgians can be reached directly, but only 16% of Spaniards. On the left, making the regions smaller, it is clear that Madrid is very well accessible from Cyprus with a direct flight. This is due to the definition of regions, which still strongly depends on national standards. Madrid is one region, with 6 million citizens, while Paris is divided in multiple smaller regions. This is why Madrid is coloured much darker than Paris, but in general, Paris might be a bit better connected than Madrid.

NUTS[7] regions are generally based on existing national administrative subdivisions. In smaller countries, where the entire country would be placed on the NUTS 2 or even NUTS 3 level (eg. Luxembourg, Cyprus), the regions at levels 1, 2 and 3 are identical to each other (and also to the entire country), but are coded with the appropriate length codes levels 1, 2 and 3.

The NUTS system favours existing administrative units, with one or more assigned to each NUTS level. From the NUTS Regulation, the average population size of the regions in the respective level shall lie within the thresholds shown in figure 7.

For non-administrative units, deviations exist for particular geographical, socio-economic, historical, cultural or environmental circumstances, especially for islands and outermost regions (Eurostat,2013).

	Minimum population	Maximum population	Example DE	Germany
NUTS 1	3 million	7 million	DE7	Hessen
NUTS 2	800.000	3 million	DE71	Darmstadt
NUTS 3	150.000	800.000	DE71E	Wetteraukreis

Figure 7 - NUTS
Source: European Commission

7. NUTS stands for "Nomenclature of territorial units for statistics" (from the French version "Nomenclature des Unités territoriales statistiques") and is a geographical nomenclature subdividing the economic territory of the European Union into regions at three different levels. (European Commission)

C. Flight Choice: How can I get there?

The third indicator to measure connectivity is the flight choice. This indicator shows the amount of flights that are offered between regions, going from one per week (0.1) up to 42 per day (42) in the example shown; in an ideal booking system, covering every carrier, how many flight choices would you have to a given destination. 42 seems high, but this is due to the fact that these regions are situated in the catchment area of more than one airport. This is the case for the regions at the border region between Belgium, Germany and the Netherlands. This area can be served via Amsterdam Schiphol, Brussels (Zaventem), Charleroi, Cologne-Bonn, Düsseldorf, Eindhoven, Groningen, Weeze (near Duisburg), Maastricht-Aachen and others.

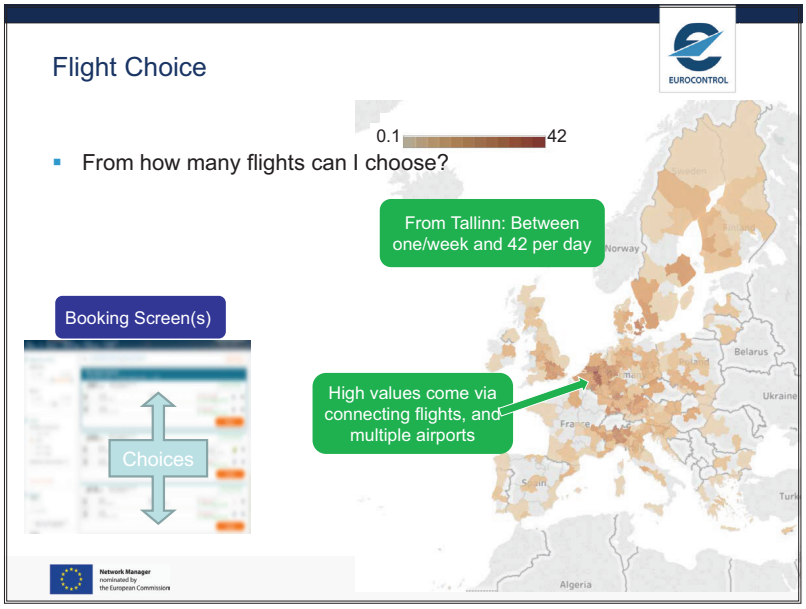


Figure 8 - Connectivity indicator: Flight choice
Source: EUROCONTROL

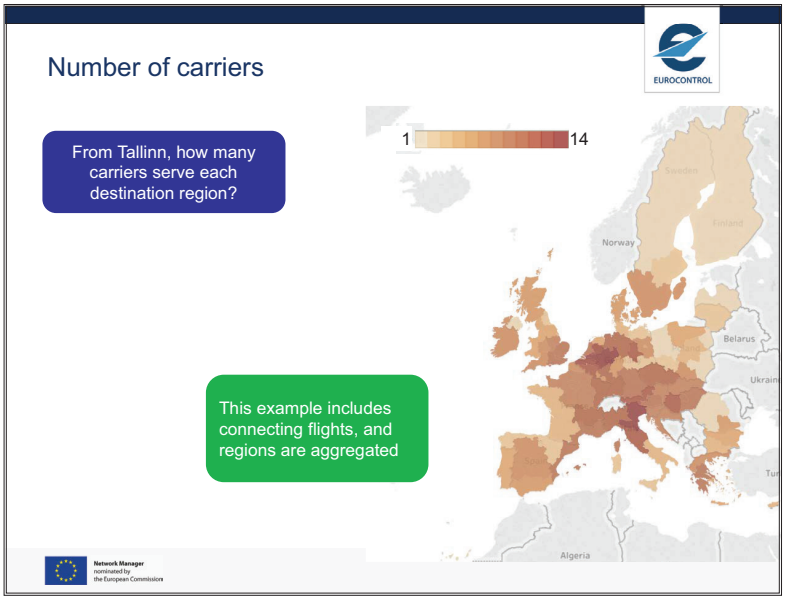


Figure 9 - Connectivity indicator: Number of carriers
Source: EUROCONTROL

D. Number of Carriers: What airlines are operating the route(s)?

The last indicator to measure connectivity and the quality of it, is the number of carriers that are offering flights between regions. The number of carriers that are active in a region is a proxy for price, according to EUROCONTROL. Their vision is that the more carriers are active on certain routes, the cheaper the fares will be. It is also a proxy for risk, as multiple airlines serving a region is a better guarantee that this region is connected to other parts of Europe. If there is only one airline, and it decides to leave, or it ceases operations, the connectivity loss will be immense for the region, and as a consequence, the local economy.

Link to the EUROCONTROL EU Aviation Connectivity Index:
ow.ly/5vWI30flnen

Audience Feedback on Connectivity Index

The Connectivity Index is an ambitious project which will undoubtedly become useful for policy making on regional, national and European level. It is clear that the system was developed with high standards of precision. After the index has been reviewed by several stakeholders from the aviation sector, there is however room for improvements that would make the Connectivity Index even more accurate for policy makers and more user-friendly for European citizens. Below, common recommendations are listed.

A. "Intermodality" as an Indicator for Connectivity

A very important indicator to measure connectivity is the presence of intermodal transport at an airport. Connectivity is more than just a connection of airports. It is the connection from one region to the other. Passengers want to know what places are easily reachable from an airport in a certain region. Taking into account the importance of surface access to airports is crucial. Next to this, the connection of the capillarity of cities nearby airports is often very bad. Public transport is good from main city/city centre to the airport, but other regions/villages around the main cities are not. This is called the first mile last mile problem.

Intermodal transport is becoming a norm in Europe. Rail and air companies are already working together, so high-speed trains (HST) must be included in the index in the near future. The audience insisted in unanimity on a quick introduction of other modes of transport that cover surface access to airports, and other modes of transport that already replace some short haul flights in Europe (HST). The promotion of intermodal transport is a priority for regions, as it is a good way to mitigate capacity and environmental issues.

An intermodality indicator should be created to show the number of other modes of transport available at a certain airport, city or region. They should be focussed on two themes, the environmental efficiency of the other modes of transport, and the integration level of ticketing systems and schedules of flights and e.g. trains. Aviation is of decisive importance for long-distance connections, both continental and intercontinental, but for regions, door-to-door journeys and the social benefits are determined by how well aviation interacts with other modes of transport in a cohesive transport system. It is not sufficient to study connectivity by mapping flights between airports. Remote regions often are situated far away from an airport, and therefore the "first mile last mile" problem should be taken into account. The proposal of Network Manager EUROCONTROL to measure connectivity by looking at region-pair connections[8] is therefore highly appreciated. An essential adjustment to their proposal should be that there must be focus on more access modes to airports than just cars.

While the rail liberalisation is opening up, it must be a priority to integrate Air-Rail, a growing trend in the aviation industry, in aviation connectivity measurements. A (high speed) train ride already serves as a substitute for short haul, regional or commuter flights in Europe or is often one of the legs of air journeys. This will contribute to reducing noise around airports and tackling climate change. To let the aviation industry contribute to the economy at a maximum level, it is important to integrate aviation in a well-functioning intermodal transport.

8. Indicator Options, A network connectivity indicator to support policy, EUROCONTROL

B. "Journey Duration" and "Price" as Indicators for Connectivity

Duration and cost of flights are indicators that must be taken into consideration. Citizens living in remote areas are often obliged to pay more for reaching the economic centre of Europe, while they often do not have the same budget as people living closer to the centre. Besides that, air journeys to leave and go to peripheral regions are mostly much more time consuming.

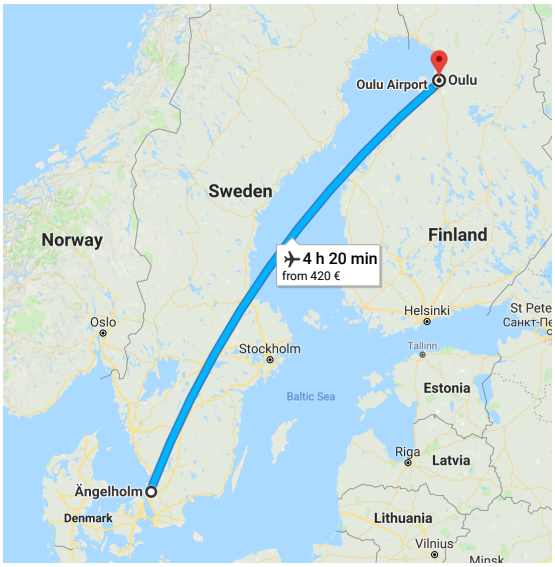
In the example (figure 10), the cheapest air journey from Ängelholm in Sweden to Oulu in Finland takes over nine hours, while the fastest connection takes 4h20min to cover the distance of 1.182,85km. If public transport would be considered, it would take multiple changes and it would take over one day of travelling. It is remarkable to see that the connection between Amsterdam and Rome, both inside the "blue banana", which are even further away from each other (1.291,44km) are connected directly, with a flight duration of 2h10min for one fifth of the price.

It is important that not only the number of carriers serving a certain airport with scheduled flights are mapped, but also non-scheduled aviation (charter flights) and general aviation (mainly business aviation). Because of ever changing airline models, charter airlines now offer flight-only tickets. In this way, charters are helping to boost connectivity between regions. This is also the case for general aviation. In 2017, they were good for 10% of all flight activities, of which 96% were operated on routes where no (or few) scheduled services are being maintained.

When measuring price of flights by looking at the number of carriers that are serving a certain airport, it is also important to distinguish stand-alone airlines and airlines that belong to a large group, such as the Lufthansa Group, Air France-KLM or the International Airlines Group. If an airport is only (or mainly) connected by multiple carriers belonging to the same group, it is hardly likely that prices will be lower just because of the fact that multiple carriers are serving an airport. It must also be taken into account that prices can be lower at an airport which is only served by one carrier if there is a competing airport with commercial air-passenger traffic nearby. It would be advisable to evaluate from "number of carriers" to "competition at or nearby airports" in a broader way as a proxy for price.

Ängelholm to Oulu
1.182,85 km - 9h. 15min.

Best flight			
EUR263 one way	11:00 a.m. – 9:15 p.m.	9h 15m	2 stops Change of airport
Sun, Dec 17	**11:00 a.m. – 12:15 a.m.** Ängelholm (AGH) – Stockholm (BMA) Propeller plane	1h 15m	
	Layover in Stockholm BMA to ARN Change of airport	4h 45m	
	5:00 p.m. – 6:55 p.m. Stockholm (ARN) – Helsinki (HEL)	0h 55m	
	Layover in Helsinki HEL	1h 20m	
	8:15 p.m. – 9:15 p.m. Helsinki (HEL) – Oulu (OUL)	1h 00m	



Amsterdam to Rome
1.291.44km - 2h. 25min.

Best flight			
EUR50 one way	7:00 a.m. – 9:25 a.m.	2h 25m	Nonstop
Sun, Dec 17	**7:00 a.m. – 9:25 a.m.** Amsterdam (AMS) – Rome (FCO)	2h 25m	

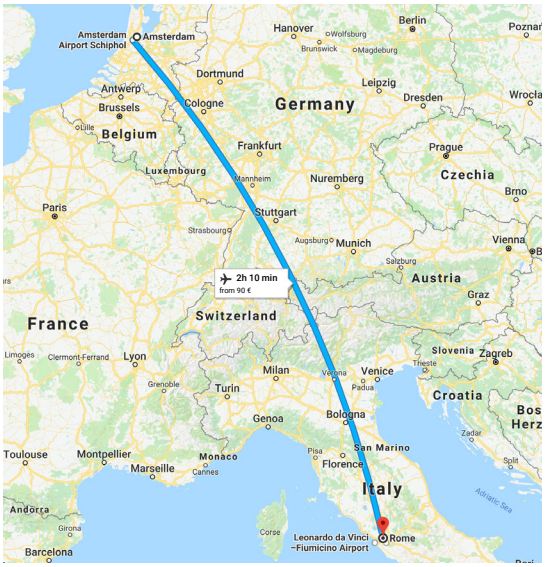


Figure 10 - Price and duration of an air journey between Ängelholm to Oulu, and between Amsterdam and Rome
Source: Google Flights (December 17, 2017)

C. Maintenance of Indicators and Usage of Index for Policymaking

It is of high value for the credibility of the Connectivity Index to clearly indicate from which sources the used data is coming from. Users of the index will trust the index more if it is clearly marked if information is coming from an official statistical bureau, like e.g. Eurostat. Besides that, it is unclear with what frequency the information of the index will be updated.

The Connectivity Index will be of great use when indicating where connectivity in Europe is good and where not. It must help to strive for more economic equality in the European Union, as air connectivity and economic growth are directly linked. It remains unclear for what specific policy purposes the Connectivity Index will be used in the near future to stimulate regional connectivity in Europe.

In order to improve regional air connectivity, it would be interesting to set up a "connectivity masterplan" per region. This plan can indicate strengths and weaknesses and opportunities for regions, which should enable them to let them improve connectivity in a well-informed way, so that no time, efforts or money are spilled on measures that won't improve much. It would be of great value if similar masterplans could be provided on Member State and European level. This could be an excellent addition to the TEN-T[9] project, that connects the entire European Union with various means of transport.

D. Network Ownership Structure

There are differences in network ownership structures of airports in Europe. One model is leading to sometimes impossible competition by major airports while in another model, the major airport is supporting smaller airports to remain operational. Excellent examples are the Dutch versus the Finnish network ownership structures. Structures like the one in The Netherlands lead to disproportionate competition for small airports that are often necessary to ensure connectivity between European regions.

In Finland, all airports are exploited by government-owned Finavia. The growing Helsinki-Vantaa Airport is profitable, and funds are used to financially support 20 smaller, remote airports that are crucial to ensure connectivity in Finland. In the Netherlands, the Royal Schiphol Group, 69,77% owned by the Dutch Ministry of Finance, owns and exploits the four largest airports in The Netherlands. It is 100% the owner of Amsterdam Airport Schiphol, Lelystad Airport (near Amsterdam) and Rotterdam-The Hague Airport. It also owns 51% of Eindhoven Airport. This means that it is very hard for the two remaining and smallest airports with passenger airline activity, Groningen Airport Eelde and Maastricht-Aachen Airport, to compete with the state-owned competitors in the country, which have very close ties to flag-carrier KLM and its partner airlines Air France and Transavia.

9. The TEN-T Programme was established by the European Commission to support the construction and upgrade of transport infrastructure across the European Union. The TEN-T Programme dedicated financial support towards the realisation of important transport infrastructure projects - in line with the overreaching goal of European competitiveness, job creation and cohesion (European Commission).

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