PRB | Performance review body of the single european sky

Performance Review Body
Advice on the Union-wide targets for RP4

Annex IV – Definition of comparator groups for cost-efficiency

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TABLE OF CONTENTS

1 INTRODUCTION

1 In accordance with point (c) of Article 9(4) of the Implementing Regulation (EU) 2019/317 (herein referred to as the Regulation), together with the adoption of the Union-wide performance targets for the fourth Reference Period (RP4), the Commission should establish the comparator groups of Air Navigation Service Providers (ANSPs) with a similar operational and economic environment for the purpose of assessing performance targets for the cost-efficiency KPA.

2 This Annex to the Performance Review Body's (PRB) advice on the Union-wide targets for RP4 provides recommendations to the Commission for the establishment of the comparator groups of ANSPs for RP4.

3 ANSPs experience diverse operational environments due to variations in ownership and governance, the economic environment, the configuration, and size of the airspace they manage, the traffic they handle, and their operational practices and staffing levels. While certain factors can be influenced or managed by ANSPs in some way, other factors can be beyond their control in the short term.

4 This Annex consists of the following sections:

- Section 2 describes the data, variables, and methodology applied for the RP3 comparator groups;
- Section 3 describes the methodology used to establish the RP4 comparator groups;
- Section 4 presents the proposed comparator groups for RP4; and
- Section 5 presents the conclusions and recommendations.

2 RP3 METHODOLOGY AND RESULTS

5 The comparator groups adopted for RP3 were advised by the PRB in the Annex IV to the "Updated PRB Advice to the Commission on RP3 Union-wide Targets" report of February 2019.[1] The comparator groups were an update of the preliminary results published in the Annex IV to the "EU-wide target ranges for RP3" report of June 2018.[2] Comparator groups were not updated following the Commission Implementing Decision (EU) 2021/891 setting revised Union-wide performance targets, as those groups were still considered to be appropriate.

6 In the preliminary analysis published in the "EU-wide target ranges for RP3" report of June 2018, comparator groups were defined applying a clustering technique (i.e. multi-dimensional analysis) combined with expert review. The variables considered were: (i) traffic volume, (ii) traffic complexity, (iii) traffic variability, (iv) cost of living index, and (v) unit Air Traffic Controller (ATCO) employment cost. All the variables referred to 2015 data. The methodology applied and variables used were the same as that used by Eurocontrol for setting the comparators group in RP2.

7 The clusters obtained from this analysis were:

- Cluster 1: The air navigation service providers of Austria, France, Germany, Italy, Spain, Switzerland, and the United Kingdom;
- Cluster 2: The air navigation service providers of Denmark, Finland, Ireland, Norway, and Sweden;
- Cluster 3: The air navigation service providers of Bulgaria, Croatia, Czech Republic, Hungary, Poland, Portugal, Romania, Slovakia, and Slovenia; and
- Cluster 4: The air navigation service providers of Cyprus, Estonia, Greece, Latvia, Lithuania, and Malta.

8 In the "Updated PRB Advice to the Commission on RP3 Union-wide Targets report" of February 2019, the methodology and variables applied remained unchanged, with data updated to the 2016 values. The cluster analysis provided the same results. Through expert judgement, a fifth cluster was created which included: Austria, Belgium-Luxembourg, the Netherlands, Switzerland. The ANSPs included were deemed as be subject to similar exogenous factor.

9 The resulting five comparator groups, as advised by the PRB and adopted by the Commission for RP3 were:

- Group A: The air navigation service providers of France, Germany, Italy, and Spain;
- Group B: The air navigation service providers of Denmark, Finland, Ireland, Norway, and Sweden;
- Group C: The air navigation service providers of Bulgaria, Croatia, Czech Republic, Hungary, Poland, Portugal, Romania, Slovakia, and Slovenia;
- Group D: The air navigation service providers of Cyprus, Estonia, Greece, Latvia, Lithuania and Malta; and
- Group E: The air navigation service providers of Austria, Belgium-Luxembourg, the Netherlands, and Switzerland.

10 Much of the analysis carried out for RP3 remains relevant today. However, the traffic recovery from COVID-19 pandemic, the rise of inflation, and Russia's war of aggression against Ukraine caused significant changes in the operational and economic reality of certain ANSPs.

[1] Updated PRB Advice to the Commission on RP3 Union-wide Targets - European Commission (europa.eu).
[2] EU-wide target ranges for RP3 For stakeholder consultation - European Commission (europa.eu).

3 RP4 METHODOLOGY

11 This Section provides a description of the data used, the methodology employed, and the analysis conducted by the PRB. The analysis is performed at main ANSP level, with the objective of identifying clusters of ANSPs with similar operational and economic environments.

3.1 Clustering technique

12 The statistical method applied is the same as that used for the setting of the RP3 comparator groups. The technique is the centroid-based clustering with k-means algorithm, which is the most widely used technique for this type of analysis. In the k-means algorithm, the observations (i.e. the ANSPs) are partitioned into clusters according to the similarity of the variable considered. To achieve this, the algorithm first selects k initial cluster centroids (i.e. the central point of the cluster) randomly from the given data set. Each point in the dataset is then assigned to the nearest centroid, based on the Euclidean distance between the point and the centroid. After the initial assignment, the algorithm computes the mean of all the points assigned to each centroid, which becomes the new centroid for that cluster. Then, the algorithm re-assigns each point to the nearest new centroid based on the updated distances. This process iteratively repeats until there is no further improvement in the assignment of points to clusters. The final result is a partition of the original dataset into k clusters.

13 As for RP2 and RP3, the PRB allocated the ANSPs to five clusters. This number allows to create clusters including a sufficiently high number of ANSPs while ensuring enough differentiation in terms of economic and operational environments.

3.2 Clustering variables considered

14 A set of possible variables, both exogenous (beyond ANSP control) and endogenous (within ANSP control), have been reviewed with the aim of identifying the most relevant ones. This review was based on the cluster analysis performed by the PRB for the RP3 target report. After examining the different possibilities, the following variables have been selected:

- Traffic variability;
- Traffic complexity;
- Traffic volume;
- Size of controlled airspace;
- Difference in traffic between 2019 and 2024;
- Price level index; and
- Inflation index.

15 All data is considered for the year 2022 at ANSP level, apart from price level index and inflation index which are at Member State level.

16 In comparison with the PRB's EU-wide target for RP3 reports from June 2018 and of February 2019, amendments to the clustering variables were made. The cost of living index and unit ATCO employment cost have been substituted by the price level and the inflation indices, as these variables are more coherent proxies of the economic environment. The price level index is a benchmark for the economic conditions faced by ANSPs, directly impacting, ATCO employment costs and costs of investments. The size of controlled airspace has also been added as a complementary indicator of the operational environment of the ANSPs. The metric for the difference in traffic between 2019 and 2024 has been considered as it serves as a proxy for the new operational reality following Russia's war of aggression against Ukraine and the recovery from the COVID-19 pandemic.

17 Among the variables studied, other indicators have been analysed and subsequently discarded. The total distance controlled by the ANSP has been discarded being highly correlated with the size of controlled airspace (i.e. not providing additional information to the statistical model). The same reasoning applied to the risk-free interest rate, which was correlated with the inflation index.

18 The final variables considered represent both the operational and economic conditions faced by ANSPs and allow for a high degree of analysis of the similarities between them:

- Traffic variability is calculated as the ratio of traffic in the peak month of a given year and the monthly average traffic of that year. This indicator has been calculated by the PRB following the Eurocontrol methodology. This indicator is a measure of seasonality, taking into account the fact that the level of traffic faced by ANSPs may vary greatly throughout the year. High variations in air traffic volume pose

a significant challenge to ANSPs on various aspects, such as infrastructure and staff planning. It is therefore an important operational factor defining the characteristics of an ANSP.

- Traffic complexity is estimated through a numerical score. This complexity score is based on the interactions arising when two aircrafts occupy the same portion of airspace at a given time. The complexity score has two components: Traffic density, which measures the distribution of traffic throughout the airspace, and the sum of horizontal, vertical and speed interactions. This score has been calculated by the PRB following the Performance Review Unit (PRU) methodology, as the indicator for 2022 is not available. Traffic complexity is one of the key factors explaining ATCOs' workload as the amount of service to an aircraft increases as the airspace environment becomes more complex. Therefore, traffic complexity has a direct influence on the operations and potentially on the costs incurred by an ANSP.
- Traffic volume is measured using the total Instrument Flight Rules (IFR) flights controlled by the ANSP. This data is sourced from the Air Traffic Management (ATM) Cost Effectiveness (ACE) yearly operational data, published by Eurocontrol. Traffic volume is a measure of the amount of traffic that ANSPs handle in a given year and therefore, it is a good proxy for their workload and size. As it has a direct impact on the costs incurred by an ANSP, the PRB has decided to include traffic volume in this analysis.
- Size of controlled airspace measures the amount of airspace (in square meters) controlled by ANSPs. This data is sourced from the ACE yearly operational data.
- The relative difference in traffic between 2019 and 2024 is measured as the ratio between the services units forecasted by STATFOR February 2024 base forecast for the year 2024 and the actual values of 2019.
- The price level index measures the differences in the general price levels of 2022 across countries. It is calculated by dividing the 2022 purchasing power parities by the 2022 nominal exchange rate. Eurostat is the source of this index.[3]
- The inflation index is another measure of the economic conditions faced by ANSPs. The source of the data is the 2022 monitoring reports provided by the Member States. This index has 2017 as base year (normalized to 100). The index, therefore, reflects the cumulative inflation from 2017 to 2022. This variable takes into account the significant rise in inflation that many Member States experienced during 2022 and its impact on the costs incurred by ANSPs.

19 The range of values between the variables can be wide (e.g. traffic volume in the '000s and traffic complexity as single digit scores). Consequently, to avoid potential distortions in the results (with the variables with larger values having higher weight), the variables have been standardized through mean centring and scaling to a standard deviation of 1.

20 Due to its unique nature (upper airspace only, across four Member States and three charging zones), MUAC has not been included in the statistical cluster analysis.

[3] Statistics | Eurostat (europa.eu). Data series: PLI EU27_2020=100. Date of download: 20/02/2024. Please note that the values on the Eurostat website are constantly updated.

4 RESULTS

4.1 Initial results of the cluster analysis

21 The initial clusters obtained grouped the ANSPs in five different comparator groups. Results are labelled by Member State rather than by ANSP. The following clusters have been obtained:

- **Cluster 1:** The air navigation service providers of France, Germany, Italy, and Spain
- **Cluster 2:** The air navigation service providers of Cyprus, Denmark, Finland, Ireland, Malta, Norway, Portugal, and Sweden.
- **Cluster 3:** The air navigation service providers of Bulgaria, Croatia, Greece, Hungary, Romania, Slovakia, and Slovenia.
- **Cluster 4:** The air navigation service providers of Czech Republic, Estonia, Latvia, Lithuania, and Poland.
- **Cluster 5:** The air navigation service providers of Austria, Belgium-Luxembourg, the Netherlands, and Switzerland.

22 These results show many similarities with the comparator groups adopted for RP3:

- Cluster 1 is composed of France, Germany, Italy, and Spain, which corresponds exactly to the RP3 comparator group. This is consistent as these countries represent the four largest ANSPs in terms of traffic controlled.
- Cluster 2 groups the same ANSPs as the RP3 cluster 2 (Denmark, Finland, Ireland, Norway, and Sweden) with the addition of Cyprus, Malta, and Portugal. These ANSPs are rather homogenous regarding traffic volumes, traffic complexity and traffic variability, but extremely heterogenous with respect to the economic variables.
- Cluster 3 groups the ANSPs with the highest traffic variability in the SES. All these ANSPs were grouped together during RP3, except for Greece.
- Cluster 4 includes Estonia, Latvia, and Lithuania, that in RP3 were clustered together, plus Czech Republic, and Poland. These ANSPs have been more severely impacted by Russia's war of aggression against Ukraine. These ANSPs are predicted to have some of the largest traffic reduction in 2024 compared to 2019 levels.
- Cluster 5 also remains unchanged compared to RP3, including the ANSPs with the highest traffic complexity in the SES. Price level index is also among the highest in Europe for these ANSPs.

23 Taking into account the high level of diversity in economic environment among the ANSPs in Cluster 2, the PRB recommends dividing it into two distinct clusters: One containing Cyprus, Ireland, Malta, and Portugal, and the other including Denmark, Finland, Norway and Sweden. This approach maintains the analytical integrity of the analysis and addresses the need to have smaller, more homogenous clusters. The resulting clusters are presented below:

- **Cluster A:** The air navigation service providers of France, Germany, Italy, and Spain;
- **Cluster B:** The air navigation service providers of Cyprus, Ireland, Malta, and Portugal;
- **Cluster C:** The air navigation service providers of Bulgaria, Croatia, Greece, Hungary, Romania, Slovakia, and Slovenia;
- **Cluster D:** The air navigation service providers of Czech Republic, Estonia, Latvia, Lithuania, and Poland.
- **Cluster E:** The air navigation service providers of Austria, Belgium-Luxembourg, the Netherlands, and Switzerland;
- **Cluster F:** The air navigation service providers of Denmark, Finland, Norway, and Sweden.

4.2 Analysis of operational factors

24 Figure 1 shows the differences between clusters in terms of traffic variability. Cluster C groups ANSPs subject to high levels of variability, while traffic variability for the other clusters is comparable.

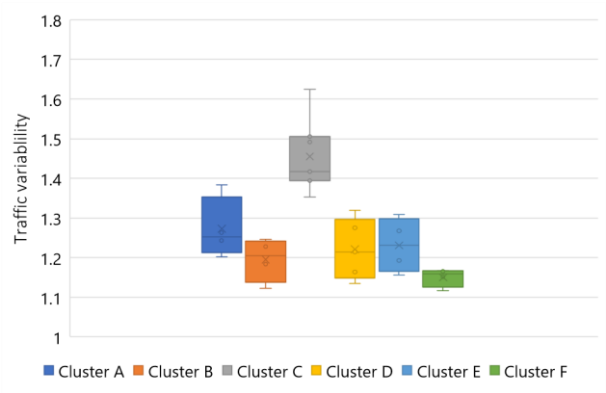

Figure 1 – Traffic variability for the six clusters (source: PRB elaboration).

25 Figure 2 shows the complexity of airspaces in the different clusters. Cluster E groups ANSPs with the highest level of complexity. Cluster A includes ANSPs with medium and high levels of traffic complexity. ANSPs in cluster C show medium levels of traffic complexity, while clusters B, D, and F have low traffic complexity. Cluster B includes ANSPs with oceanic traffic and a greater proportion of overflights, such as Ireland and Portugal.

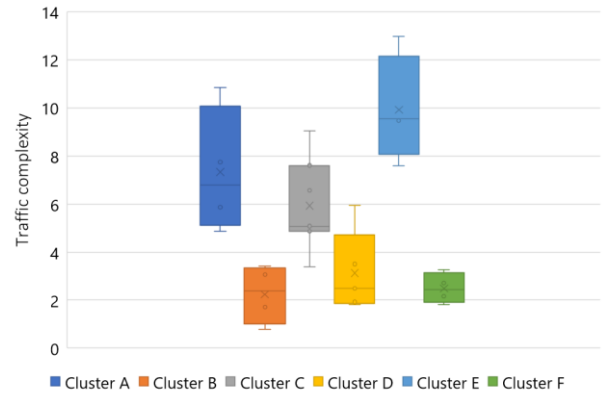

Figure 2 - Traffic complexity for the six clusters (source: PRB elaboration).

26 Figure 3 shows the level of traffic volume for each cluster, measured in terms of IFR flights. Cluster A controls by far the highest amount of IFR flights compared to all other clusters. Cluster C and Cluster E control a relatively higher amount of traffic compared to Clusters B, D, and F.

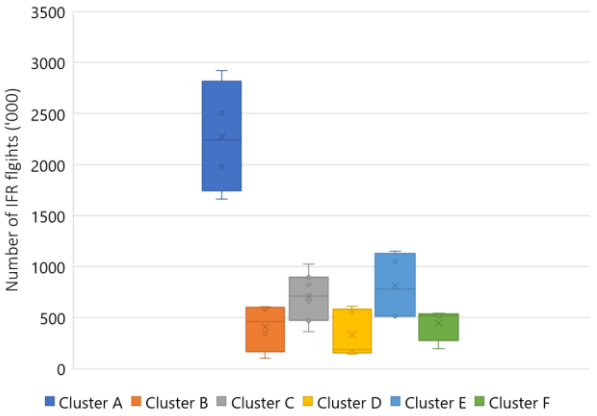

Figure 3 – Total IFR flights controlled by ANSP for the six clusters (source: PRB elaboration).

27 Figure 4 shows the comparison in size of the airspace controlled by the clustered ANSPs. Cluster A controls the largest airspace. Clusters B and F control a smaller airspace compared to Cluster A, but relatively large compared to the other ANSPs, even though there are differences among the individual ANSPs. Cluster C, D, and E control a significantly smaller airspace compared to the other clusters.

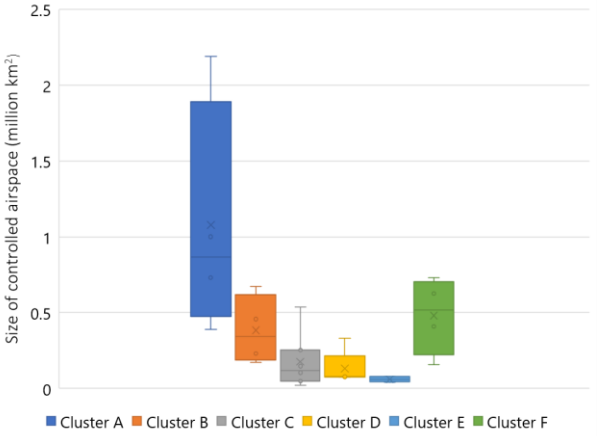

Figure 4 –Size of the airspace for the six clusters (source: PRB elaboration).

28 Figure 5 shows the differences in traffic (Service Units) between STATFOR February 2024 base forecast for 2024 and the 2019 actual values. Cluster C contains the ANSPs that have the largest positive difference in terms of forecasted traffic between 2024 and 2019, with Slovakia being the only ANSP within Cluster C showing a negative difference in terms of traffic. The ANSPs with the greatest decrease in traffic are all included in Cluster D, with Estonia and Latvia having the largest negative difference.

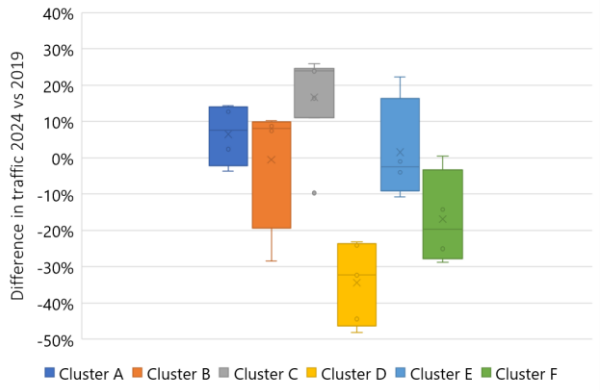

Figure 5 –Difference in traffic between 2024 and 2019 for the six clusters (source: PRB elaboration).

4.3 Analysis of economic factors

29 Figure 6 shows the differences for the 2022 price level index between the clusters. Clusters C and D have the lowest index compared to the other four clusters. Clusters E and F have the highest index compared to the other clusters, with Switzerland having the largest price level index.

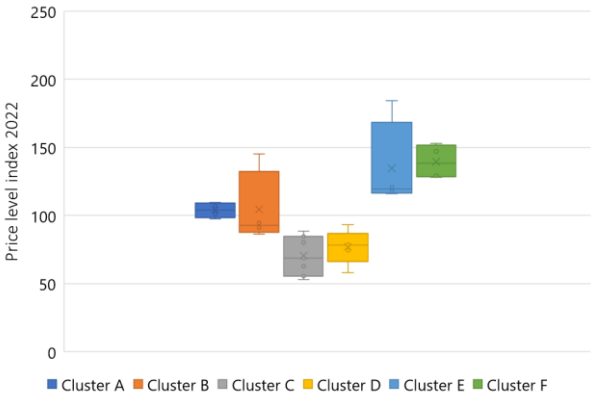

Figure 6 – Price level index 2022 for the six clusters (source: PRB elaboration).

30 Figure 7 shows the differences for the 2022 inflation index between the clusters. Clusters C and D have a relatively higher inflation index compared to the other four clusters. However, there is a high degree of variability within Cluster C. Switzerland, included in Cluster E, is the ANSP with the lowest inflation index.

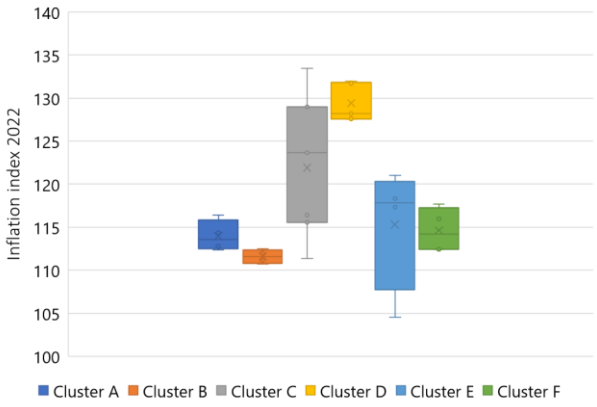

Figure 7 – Inflation index 2022 based on 2017 for the six clusters (source: PRB elaboration).

4.4 Analysis of the results

31 The results of the cluster analysis suggest that the clusters of ANSPs can be characterised as follows:

- Cluster A groups the four largest ANSPs in terms of traffic. They are subject to relatively high variability and show above-average traffic complexity. Their size of controlled airspace is large, although with differences between individual ANSPs. Their price level index is relatively high with small differences between the four ANSPs.
- Cluster B includes ANSPs in Western Europe like Ireland, as well as in the Mediterranean region as Cyprus and Malta, plus Portugal. Ireland and Portugal handle a particularly large number of overflights because of their geographical location. These ANSPs show low levels of traffic variability, complexity, and volume, but they control a relatively large airspace, although with some differences among them.
- Cluster C consists of ANSPs located in Central, Eastern, and Mediterranean Europe. They exhibit very high traffic variability, relatively high complexity, and lower traffic volume. They control a small size of airspace and are expected to have a significantly larger level of traffic in 2024 compared to 2019. These ANSPs show a lower-than-average price level index.
- Cluster D is a grouping of the ANSPs most impacted by Russia's war of aggression against Ukraine. They are all expected to have a significantly lower level of traffic in 2024

compared to 2019. They have relatively low traffic variability, complexity, and volume, and they control a small airspace. These ANSPs show a below-average price level index, while experiencing the highest inflation growth from 2017 to 2022.

- Cluster E includes ANSPs with the most complex airspace. These ANSPs show low traffic variability and relatively high traffic volume. They control the smallest airspace, while their price level index is among the highest in Europe.
- Cluster F includes ANSPs in Northern Europe. They show low levels of traffic variability, complexity and volume, but they control a relatively large airspace. All ANSPs show a very high price level index.

5 RECOMMENDATIONS

32 The PRB considers that the analysis has included all the relevant factors and that the resulting clusters are balanced. Therefore, the PRB recommends the Commission to adopt the following comparator groups:

- **Cluster A:** The air navigation service providers of France, Germany, Italy, and Spain;
- **Cluster B:** The air navigation service providers of Cyprus, Ireland, Malta, and Portugal;
- **Cluster C:** The air navigation service providers of Bulgaria, Croatia, Greece, Hungary, Romania, Slovakia, and Slovenia;
- **Cluster D:** The air navigation service providers of Czech Republic, Estonia, Latvia, Lithuania, and Poland;
- **Cluster E:** The air navigation service providers of Austria, Belgium-Luxembourg, the Netherlands, and Switzerland;
- **Cluster F:** The air navigation service providers of Denmark, Finland, Norway, and Sweden.