# ACE Handbook

Performance Review Unit

March 1, 2023

# Table of contents

# 1 Introduction

## 1.1 About this report

This document provides reference material that accompanies the Air Traffic Management Cost-Effectiveness (ACE) annual benchmarking reports, which are commissioned by EUROCONTROL's independent Performance Review Commission (PRC).

Starting with the ACE 2020 cycle, the information previously contained in the ACE reports have been reorganised in the following manner:

1. **The ACE analytical report** continues to provide a high level analysis of economic and financial cost-effectiveness performance in a given year at Pan-European system and ANSP level. It also analyses changes in ATM/CNS cost-effectiveness performance over the past 5 years and presents forward-looking information for the next 5 years. A particular focus is put on the three main economic drivers of cost-effectiveness (productivity, employment costs and support costs).
2. **The ACE handbook (this document)** provides general information on the scope of the analysis, outlines the processes involved in the production of the report, and includes explanations on the factors affecting performance and indicators used in the ACE benchmarking analysis.
3. **ANSP factsheets and individual ANSP short reports** (previously Part II of the ACE reports) are now only published on the web.

**The ACE Dashboard** continues to provide interactive functionalities that allow users to design and customise original analyses and presentations based on ACE data (starting in 2003 and updated one a year). The dashboard also gives access to individual ANSP short reports.

Digital versions of all the documents listed above as well as the ACE dashboard can be accessed at the following address: https://ansperformance.eu/economics/ace-overview/

## 1.2 Scope of analysis

The ACE report is based on information provided by ANSPs in compliance with Decision No. 88 of the Permanent Commission of EUROCONTROL (Permanent Commission for the Safety of Air Navigation 2015), which makes annual disclosure of ANS information mandatory, according to the Specification for Economic Information Disclosure (SEID) (EUROCONTROL 2012),

in all EUROCONTROL Member States. From a methodological point of view, the analysis focuses on gate-to-gate ATM/CNS provision costs and does not address performance relating to:

- oceanic ANS;
- services provided to military operational air traffic (OAT); or,
- airport (landside) management operations.

Similarly, the costs associated with other entities such as National Supervisory Authorities (NSAs), national MET providers and the EUROCONTROL Agency (although mentioned for completeness purposes in the introduction of the report) are not taken into account in the calculation of the ACE cost-effectiveness indicators (see Figure 6.1 for more details).

# 2 Production process and use of ANSPs Annual Reports

## 2.1 ACE report production process

The ACE report is produced by the Performance Review Unit with the support of the ACE Working Group, including ANSPs, regulatory authorities and airspace users' representatives. The process leading to the production of the ACE report, which comprises data analysis and consultation, is summarised in Figure 2.1 below.

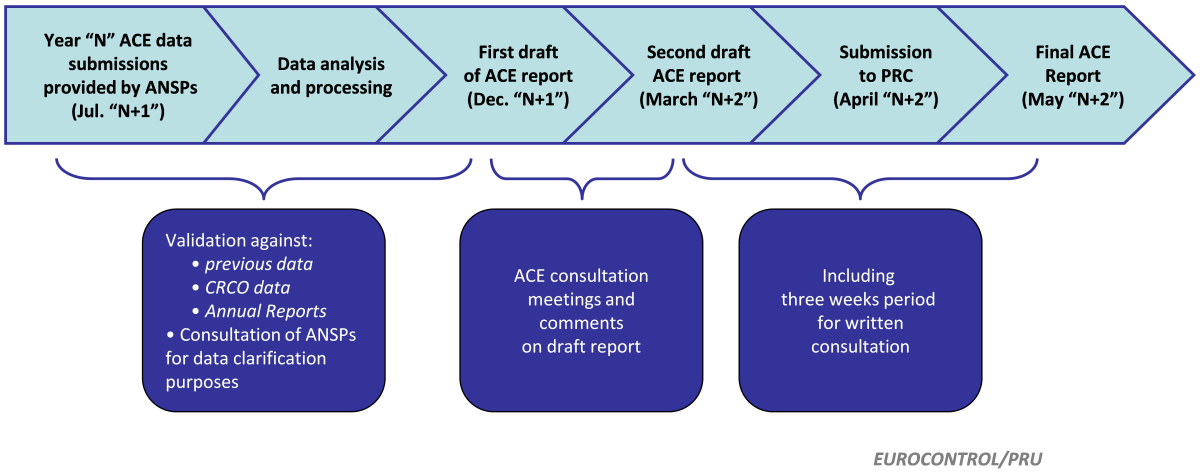


**Figure 2.1: Data analysis, processing and reporting**

In order to ensure comparability among ANSPs and the quality of the analysis, the information submitted by the ANSPs is subject to a thorough analysis and verification process which makes extensive use of ANSPs' Annual Reports and of their statutory financial accounts.

During this process a number of issues can emerge:

- Annual Reports with disclosure of financial accounts are not available for some ANSPs (see Section 2.2 below). This removes one important element in view of validating the financial data submitted.
- ANSPs which are involved in non-ANS activities (such as airport ownership and management) do not necessarily disclose separate accounts for their ANS and non-ANS ac-

tivities. This means that the financial data submitted for the ANS activities cannot be validated with the information provided in the Annual Report.

- Except for a few ANSPs, Annual Reports do not disclose the separate costs for the various segments of ANS (such as en-route and terminal ANS) which means that the cost breakdown provided under the En-route and Terminal columns in the ACE data submissions cannot be fully reconciled.

As ANSPs progressively comply with the SES Regulation on Service Provision (European Parliament and Council of the European Union 2004), which requires publication of Annual Reports including statutory accounts, and separation of ANS from non-ANS activity in ANSPs internal accounts, some of these shortcomings are expected to be gradually overcome.

In most cases, data recorded in the Network Manager (NM) database are used as the basis for the output metrics of the ACE data analysis.

## 2.2 ANSPs' Annual Reports

ANSPs' Annual Reports provide a valuable means of validating the ACE data.

The SES Service Provision Regulation (European Parliament and Council of the European Union 2004) came into force on 20 April 2004 and is applicable to ANSPs Financial Accounts in all EU Member States (plus Switzerland and Norway). This Regulation is also applicable to States which have signed the ECAA agreement or a Common Aviation Area agreement with the European Union, although the timing of its implementation is not yet decided for individual States. Among other provisions, the SPR requires that ANSPs meet certain standards of information disclosure (transparency) and reporting, and in particular that:

- ANSPs should draw up, submit to audit and publish their Financial Accounts (Art.12.1);
- in all cases, ANSPs should publish an Annual Report and regularly undergo an independent audit (Art 12.2); and,
- ANSPs should, in their internal accounting, identify the relevant costs and income for ANS broken down in accordance with EUROCONTROL's principles for establishing the cost-base for route facility charges and the calculation of unit rates and, where appropriate, shall keep consolidated accounts for other, non-air navigation services, as they would be required to do if the services in question were provided by separate undertakings (Art 12.3). The latter requirement is particularly relevant for the ANSPs which are part of an organisation which owns, manages and operates airports, such as HCAA and DHMI[1].

[1] Although it should be noted that DHMI is not covered by the SES regulations.

# 3 Methodological framework used to measure ANSPs gate-to-gate cost-effectiveness performance

## 3.1 Composite output metric and framework for cost-effectiveness performance analysis

The output measures for ANS provision are, for en-route, the en-route flight-hours controlled[1] and, for terminal ANS, the number of IFR airport movements controlled. In addition to those output metrics, it is important to consider a "gate-to-gate" perspective, because the boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis.

For this reason, an indicator combining the two separate output measures for en-route and terminal ANS provision has been calculated. The "composite gate-to-gate flight-hours" are determined by weighting the output measures by their respective average cost of the service for the whole Pan-European system. This average weighting factor is based on the total monetary value of the outputs over the period 2002-2020 and amounts to 0.27.

The composite gate-to-gate flight-hours are consequently defined as:

$$\text{Composite gate-to-gate flight-hours} = \text{En-route flight-hours} + (0.27 * \text{IFR airport movements})$$

In the ACE 2001-2006 Reports (Performance Review Unit 2023), two different weighting factors were used to compute ANSPs cost-effectiveness: one for the year under study and another to examine changes in performance across time. As the ACE data sample became larger in terms of years, the difference between these two weighting factors became insignificant. For the sake of simplicity, it was therefore proposed in the ACE 2007 benchmarking report to use only one weighting factor to analyse ANSPs performance for the year and to examine historical changes in cost-effectiveness.

[1] Controlled flight-hours are calculated by the Network Manager (NM) as the difference between the exit time and entry time of any given flight in the controlled airspace of an operational unit. Three types of flight-hours are currently computed by the NM (filed model, regulated model and current model). The data used for the cost-effectiveness analysis is based on the current model (Model 3 or CFTM) and includes flight-hours controlled in the ACC, APP and FIS operational units which are described in the NM environment.

Although the composite gate-to-gate output metric does not fully reflect all aspects of the complexity of the services provided, it is nevertheless the best metric currently available for the analysis of gate-to-gate cost-effectiveness[2].

For the sake of completeness, the gate-to-gate financial cost-effectiveness indicator is broken down into en-route and terminal components, with the output units being en-route flight-hours and IFR airport movements, respectively. There are cases where a high en-route cost per flight-hour correspond to a low terminal cost per IFR airport movement and vice versa.

The PRU has developed an analytical framework that allows cost-effectiveness to be broken down into a number of key components. This framework helps in understanding differences in cost-effectiveness by allowing examination of the detailed factors underlying it. It is important to note that the focus of the ACE analysis is on the ATM/CNS provision costs incurred by the ANSP. MET costs, EUROCONTROL costs and States/NSAs costs are not included as not always under the ANSPs direct management control.

The right-hand side of the Figure 3.1 shows that the financial cost-effectiveness indicator (ATM/CNS provision costs per composite flight-hour) is made up of three component performance **ratios**:

- Higher ATCO-hour productivity (composite flight-hours per ATCO-hour) improves cost-effectiveness;
- Lower ATCO **employment costs per ATCO-hour** improve cost-effectiveness; and,
- All other things being equal, a lower **support cost ratio** improves cost-effectiveness.

These three ratios multiplied together give the overall financial cost-effectiveness KPI.

The financial cost-effectiveness indicator can also be broken down into two additive factors:

- **ATCO employment costs per unit of output** is the ratio of the employment costs for the ATCOs in OPS to the output (measured in composite flight-hours). All other things being equal, lower ATCOs in OPS employment costs per unit of output will improve financial cost-effectiveness.
- **Support costs per unit of output** is the ratio of support costs to the output. All other things being equal, lower support costs per unit of output will improve financial cost-effectiveness.

The latter indicator is preferred to the support cost ratio for two main reasons. First, the support cost ratio cannot be viewed in isolation since a low ratio may simply be a symptom of high ATCO employment costs. Second, given that there are fixed costs in the provision of ATM/CNS (such as infrastructure and ATM systems), "support costs per unit of output" can give additional insights into the analysis of support costs and scale effects.

[2] Further details on the theoretical background to producing composite indicators can be found in a working paper on "*Total Factor Productivity of European ANSPs: basic concepts and application*" (Sept. 2005) (Performance Review Commission 2005).

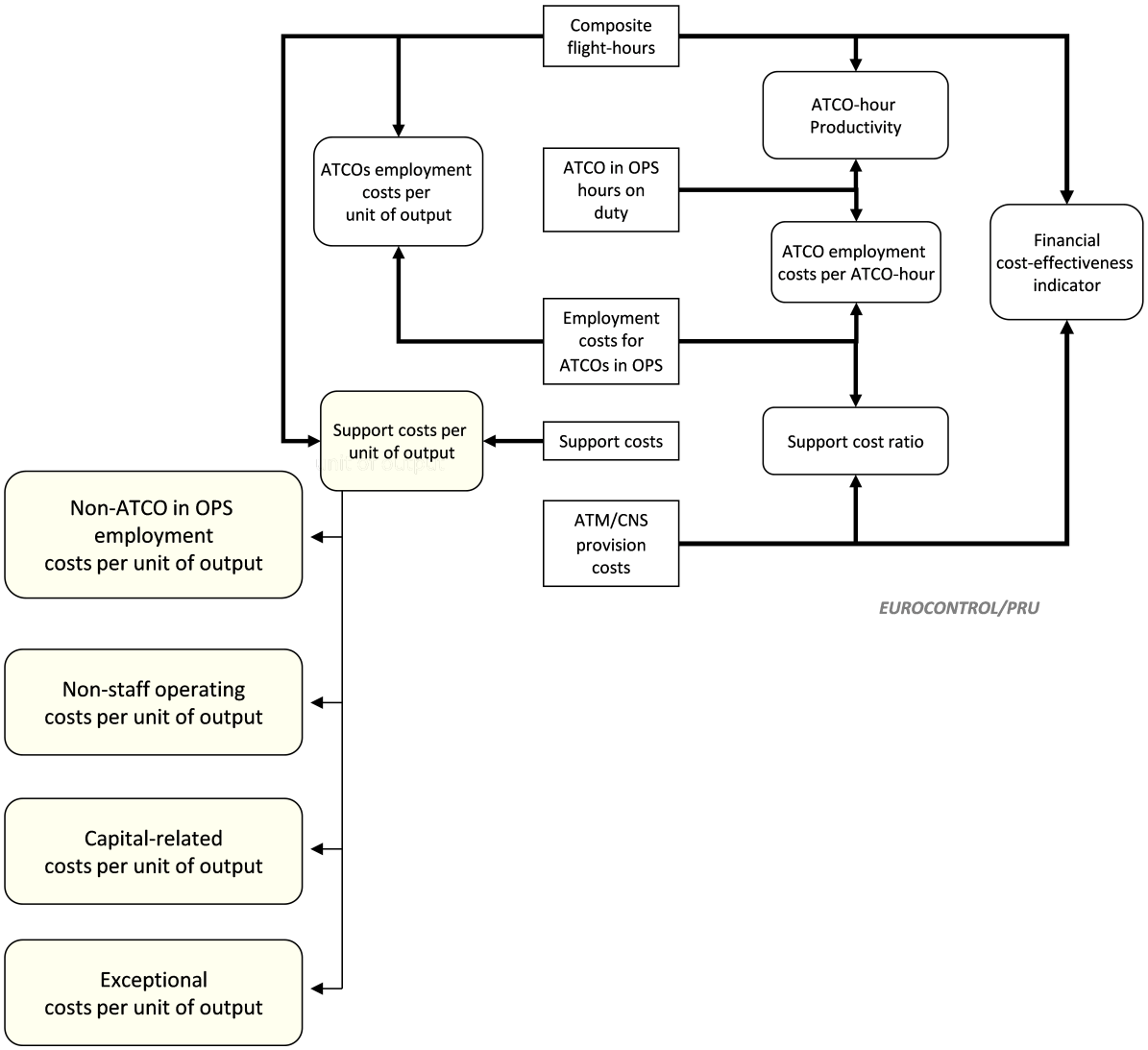


**Figure 3.1: Performance framework for gate-to-gate cost-effectiveness analysis**

## 3.2 Further methodological considerations on ATCO-hour productivity

The metric of ATCO-hour productivity used in the ACE report is measured as the ratio between composite flight-hours and ATCO in OPS hours on duty. It reflects the average productivity during a year for a given ANSP and does not give an indication of the productivity at peak times which can be substantially higher.

Large differences in ATCO-hour productivity are observed in the ACE analyses. These differences should not be seen in isolation, but together with other indicators such as ATCO employment costs and unit support costs. In addition, many factors contribute to the observed differences in ATCO-hour productivity. Some of these factors can be associated with operational conditions (such as traffic complexity and variability, the type of airspace under the ANSP responsibility or the number of airports operated by the ANSP potentially including low traffic tower operational units), legal and socio-economic conditions (e.g. general labour laws) and institutional issues (e.g. regulatory aspects and governance arrangements).

Other factors as yet unidentified (and not measured) such as the impact of different operational concepts and processes, the operational flexibility, could also affect ATCO productivity performance. There may also be cultural and managerial differences. These elements would deserve additional analysis in order to provide further insight on the differences in ATCO productivity and identify best practices.

Changes in ATCOs in OPS hours on duty could arise from:

- Changes in the number of FTE ATCOs in OPS (caused by such factors as newly licensed ATCOs, normal retirement, activation of an early retirement scheme);
- Changes in the number of hours on duty, through:
  - Modification of the contractual working hours following a new labour agreement;
  - Changes in the number of hours not on duty (for example, through an increase in average sickness or in refresher training time); or,
  - Changes in overtime (where applicable).

In the context of the yearly benchmarking activity, the ACE reports analyse ANSPs' productivity, both in terms of a cross-section analysis for the year under review and in terms of time series (usually a six-year period). This medium-term perspective is particularly useful for observing changes over time, given the specific characteristics of the ANS industry, which usually requires a certain lead-time to develop ATM systems and infrastructure.

Improvements in ATCO-hour productivity can result from more effective OPS room management and by making a better use of existing resources, for example through the adaptation of rosters (preferably individually-based to enhance flexibility) and shift times, effective management of overtime, and through the adaptation of sector opening times to traffic demand

patterns. Similarly, advanced ATM system functionalities and procedures are drivers for productivity improvements.

On the other hand, it is clear that some of the measures implemented by an ANSP to provide extra capacity can have a negative impact on its ATCO-hour productivity performance. This is, for example, the case of a sector split which will allow the ANSP to create additional capacity in its airspace at the expense of more ATCOs or ATCO-hours on duty required to man the additional sector(s).

## 3.3 Further methodological considerations on support costs

Contrary to ATCO employment costs, support costs encompass a variety of cost items which require specific analysis. There is a general acknowledgement that the Pan-European system has excessive support costs due to its high level of operational, organisational, technical and regulatory fragmentation.

Support costs can be broken down into four separate components that provide further insight into the nature of support costs:

a) **Employment costs for non-ATCO in OPS staff**; these cover ATCOs on other duties, trainees, technical support and administrative staff. These costs can be affected by the following factors:

- Outsourcing of non-core activities (such as maintenance of technical equipment, and professional training) could transfer costs from this category to non-staff costs.
- Research & development policies may involve ATM systems either being developed in-house, or purchased off-the-shelf. In principle, either solution could lead to the most cost-effective outcome, depending on circumstances; this would depend on whether there were, for example, significant economies of scale, or major transaction costs.
- Arrangements relating to the collective agreement and the pension scheme for non-ATCOs in OPS.

b) **Non-staff operating costs** mostly comprise expenses for energy, communications, contracted services, rentals, insurance, and taxes. These costs can be affected by the following factors:

- The terms and conditions of contracts for outsourced activities.
- Enhancement of the cooperation with other ANSPs to achieve synergies (sharing training of ATCOs, joint maintenance, and other matters).

c) **Capital-related costs** comprising depreciation and financing costs for the capital employed. These costs can be affected by the following factors:

- The magnitude of the investment programme.

- The accounting life of the assets.
- The degree to which assets are owned or rented.

d) **Exceptional costs**, which typically represent a very small proportion of support costs.

There are significant differences in the composition of support costs amongst the 38 ANSPs, and in particular in the proportion of employment costs and non-staff operating costs. The choice between providing some important operational support functions internally or externally has clearly an impact on the proportion of support costs that is classified as employment costs, non-staff operating costs, or capital-related costs. In some cases, the maintenance of ATM systems is outsourced and the corresponding costs are reported as non-staff operating costs. For other ANSPs, these activities are rather carried out by internal staff and the related costs appear as employment costs or as capital-related costs when, according to IFRS, the employment costs of staff working on R&D projects can be capitalised in the balance-sheet.

Employment costs are typically subject to complex bargaining agreements between ANSPs management and staff which usually are embedded into a collective agreement. The duration of the collective agreement, the terms and methods for renegotiation greatly vary across ANSPs. In some cases salary conditions are negotiated every year. High ATCO employment costs may be compensated for by high productivity. Therefore, in the context of staff planning and contract renegotiation, it is important for ANSPs to manage ATCOs employment costs effectively and to set quantitative objectives for ATCO productivity while providing sufficient capacity in order to minimise ATFM delays.

# 4 ATFM delays and cost-effectiveness performance

The quality of service provided by ANSPs has an impact on the efficiency of aircraft operations, which carry with them additional costs that need to be taken into consideration for a full economic assessment of ANSP performance. In the ACE benchmarking reports, an indicator of "economic" cost-effectiveness is computed at ANSP and Pan-European system levels by adding the ATM/CNS provision costs and the costs of ATFM ground delay, all expressed per composite flight-hour.

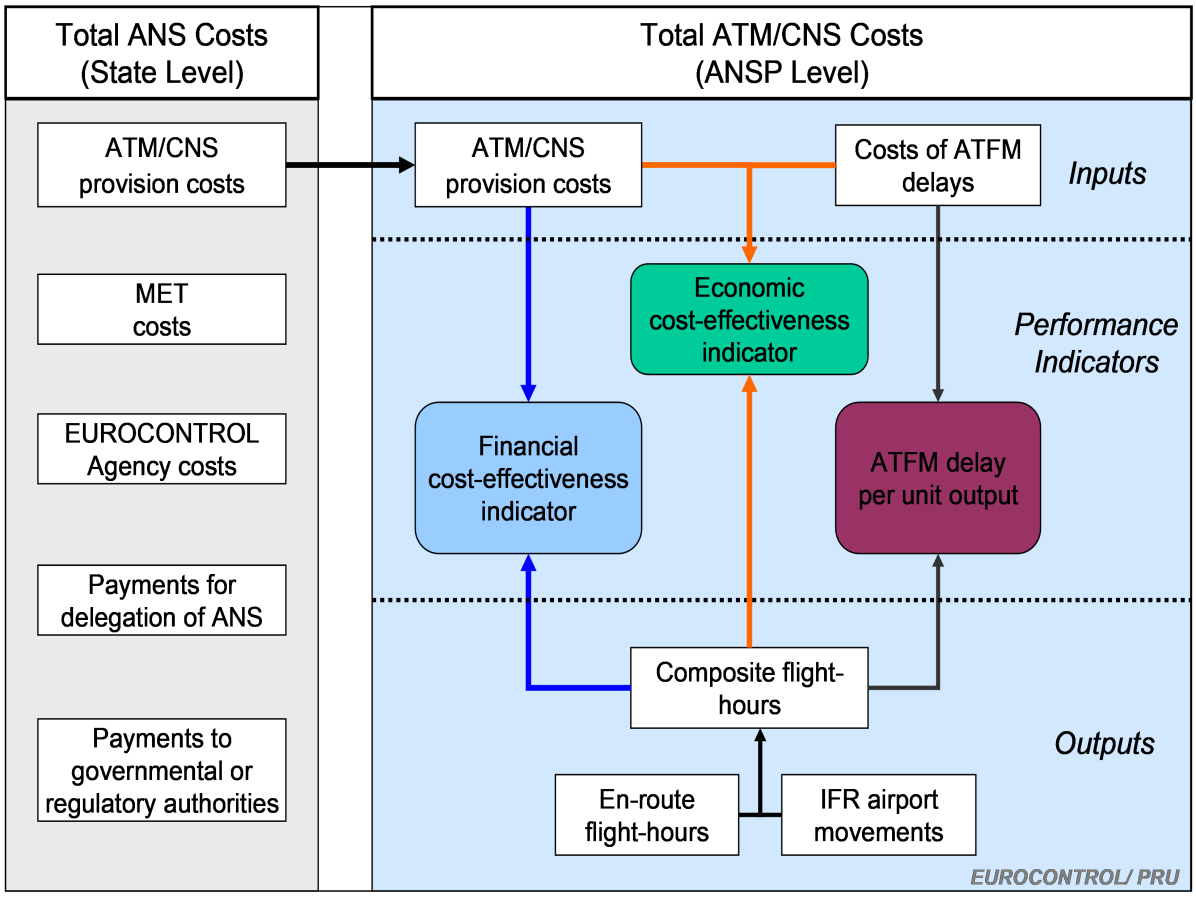


**Figure 4.1: Framework for economic cost-effectiveness performance analysis**

ATFM delays used in the ACE analysis are extracted from the Network Manager database. All

delay causes (e.g. capacity, weather, etc.) are considered.

Only airports where the ANSPs are responsible to provide ATC services are taken into account when aggregating airport delays at ANSP level. This is verified each year during the ACE data validation process. Airport ATFM delays also include departure delays.

ATFM delays are calculated after post-ops and eNM adjustments, which entails a re-allocation of ATFM delays across ACCs in order to account for the initiatives taken to improve performance at network level. This process was initially launched in 2016 but the magnitude of ATFM delay reallocation became really significant in 2018 and 2019 due to the large extent of the measures implemented by the NM. In order to have consistent time series within the ACE report, the adjusted ATFM delays are used retroactively starting from 2016.

Delays are taken into account independently of their duration. There is no distinction between delays lower or higher than 15 minutes.

The cost of ATFM delay in this report is based on the *European airline delay cost reference values*, published by the University of Westminster (University of Westminster 2015). In each new ACE report, the PRU expresses the cost of one minute of ATFM delay in the price base of the year under review, using the average European Union inflation rate published by EUROSTAT.

# 5 Factors affecting performance

## 5.1 Introduction

The ACE benchmarking analysis has the objective of comparing ATM cost-effectiveness performance across a wide range of ANSPs. The major focus of the ACE report is to examine and analyse the quantitative facts about the observed cost-effectiveness performance of the ANSPs. This factual analysis provides a comprehensive description and comparison of performance as viewed by the users of ATM/CNS services.

However, such a factual analysis cannot be either a complete explanation of performance differences between ANSPs, or an exhaustive guide on how performance can be improved, without some complementary consideration of how differences in performance arose.

The framework illustrated in Figure 5.1 shows **exogenous** (outside the control of ANSPs) and **endogenous** (under ANSPs' control) factors which influence ANSP performance.

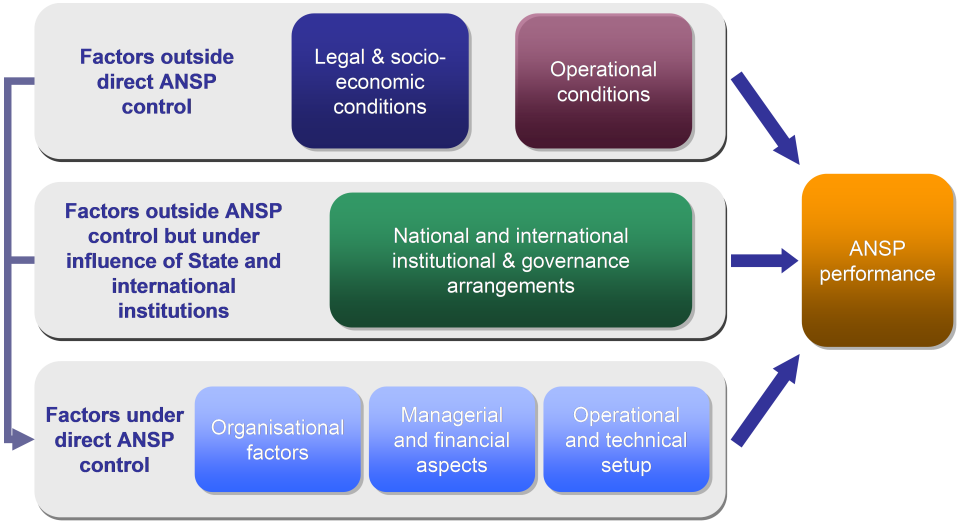


**Figure 5.1: Factors affecting cost-effectiveness performance**

## 5.2 Exogenous factors

Exogenous factors arise from the basic conditions in which an ANSP operates, which can differ from one country to another. Exogenous factors are likely to influence the way ANSPs organise and conduct their business. In some cases they may also affect the way an ANSP manages costs and determines the level of charges.

Exogenous factors cover a spectrum of observability and measurability. At one extreme, the impact of irrecoverable VAT on inputs, which differs from state to state, is readily quantified. It has a direct impact on apparent performance which can be perfectly adjusted for. At an intermediate level there are factors for which it is possible to derive metrics (examples are traffic complexity, market wage rates, and exchange rate volatility), but it is difficult to specify exactly how such factors might affect performance. Even more difficult to take into account are factors such as political influence (and interference) on ANS provision. Finally, there will inevitably be exogenous factors that are simply impossible to identify, although they are no less real than the other factors discussed.

In Figure 5.1, exogenous factors that could have an impact on performance have been classified into two main areas (top and central set of factors in Figure 5.1), according to which set of decision-makers have an influence over them. The top set, comprising legal and socio-economic conditions, and operational conditions, are affected by decision makers and conditions outside aviation policy-making. The central set, comprising institutional and governance arrangements, are exogenous to the ANSP but are influenced by aviation sector policy decisions.

Exogenous factors need, as far as possible to be taken into account both in achieving fair benchmarking, and in effective target setting:

- Local differences in exogenous factors can either create a direct advantage or a direct burden on performance;
- Local institutional and governance arrangements may have been set with the specific purpose of creating incentives to follow performance-driven strategies.

Capturing the local impact of an exogenous factor on ANSPs performance is not a straightforward exercise. First, there is no guarantee that a given exogenous factor will affect all ANSPs in the same manner. It is possible that similar conditions could create effects working in opposite direction (bringing both benefits and difficulties). Second, similar exogenous factors may not necessarily affect different ANSPs to the same degree, either because of endogenous factors relating to how an issue is managed, or by other exogenous factors constraining an ANSP's response. So a given factor might create a small burden in one ANSP, while affecting another more seriously.

The **legal and socio-economic conditions** prevailing in individual countries are affected by national policy-makers at a more general level (for example taxation policy), or by national and international macro-economic conditions. Major examples include the prevailing national wage rates, and levels and systems of taxation.

Some examples that affect ATM cost-effectiveness performance are illustrated in Figure 5.2.

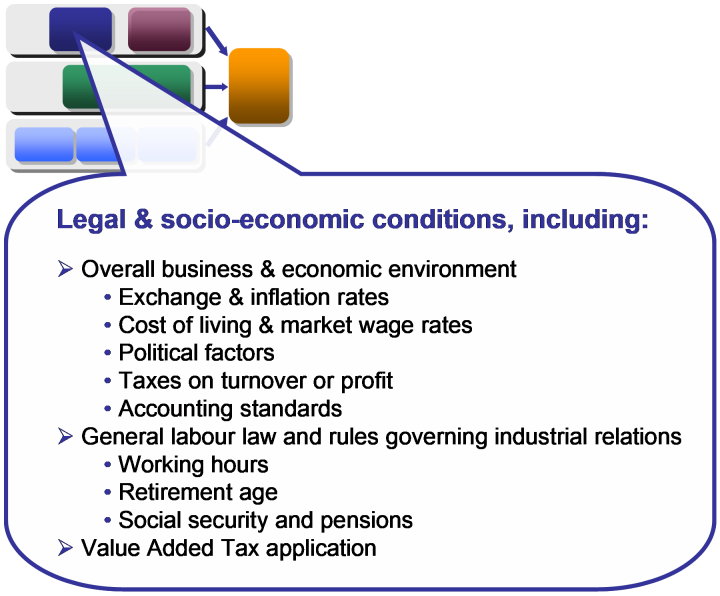


**Figure 5.2: Legal & socio-economic conditions**

The **operational conditions**, such as the traffic patterns the ANSP has to deal with, are determined by decisions made by airports, airlines, and especially, flying travellers.

Operational conditions include a number of factors, summarised in Figure 5.3.

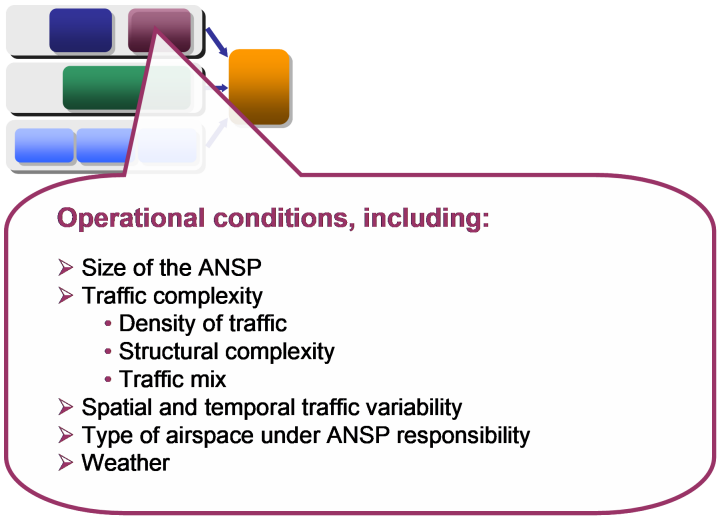


**Figure 5.3: Operational conditions**

Operational conditions undoubtedly have a direct impact on cost-effectiveness performance, although the extent and magnitude of the impact is not straightforward to isolate.

The **institutional and governance arrangements** for ANS in a particular country are set in place by the policies and specific aviation laws of each country. These factors are exogenous to the ANSP but decision-making concerning some of them is largely driven by national aviation policy-makers. Some of these factors relate to international requirements such as those imposed by ICAO, EUROCONTROL and the Single European Sky. These policies at State and European level are subject to changes given strategic objectives for the sector.

Figure 5.4 provides a list of such factors, relating to:

- the way ANS is regulated;
- the institutional structure surrounding ANS, the ANSP ownership and control structure; and
- the civil/military arrangements.

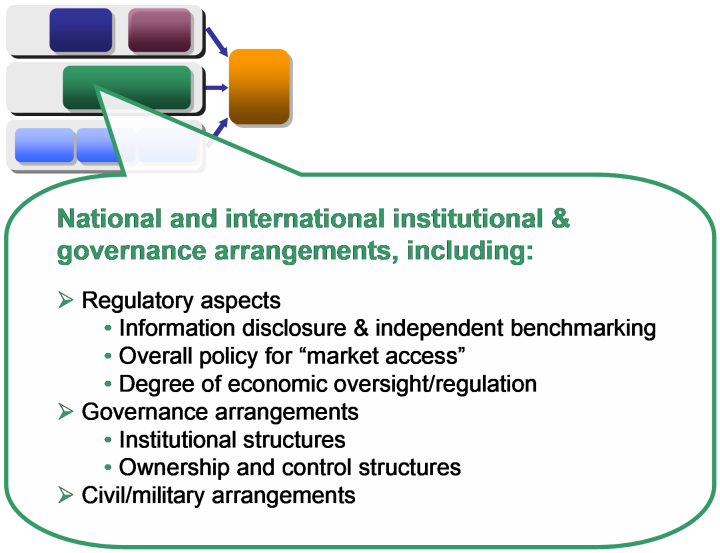


**Figure 5.4: Institutional & governance arrangements**

It is generally considered that institutional and governance arrangements will not affect ATM cost-effectiveness directly; rather they act as influences or constraints affecting endogenous factors (such as the overall business objectives, the internal organisation, and the operational setup between civil and military).

## 5.3 Endogenous factors

In principle, once the impact of all exogenous factors has been allowed for, the performance differences that remain should comprise residual inefficiency which lowers performance be-

low that obtained by best practice. Such residual inefficiency arises from a number of endogenous factors, under the direct control of ANSPs.

A better understanding of the endogenous factors would enable some progress in the analysis of benchmarking results, in the identification of best practices, and in the process of target setting.

Endogenous factors – the way that an ANSP manages its business to optimise performance – are influenced by exogenous factors. "Best practice" in any given area will depend on the exogenous circumstances. ANSPs can take action to fully exploit the benefit of their environment or to minimize the impact of relative disadvantages. Therefore, the impact of an exogenous factor should not be analysed in isolation from an analysis of the degree to which this impact has been minimised or maximized through appropriate internal measures.

Different data and methodologies from those currently used in the ACE Benchmarking Report would be required to investigate endogenous factors in more depth. Clearly, it is the responsibility of the ANSP to determine how best to respond to the local conditions.

Endogenous factors fall into three groups:

- organisational factors;
- managerial and financial aspects; and,
- operational and technical setup.

Figure 5.5 lists the factors that would need to be considered in the scope of a comprehensive analysis of the impact of **ANSP organisation** on performance. They mainly relate to four issues which are typically addressed in the Balanced Scorecard methodology.


**Figure 5.5: Organisational factors**

These issues are:

- The internal organisation structure;
- The degree to which assets and activities are retained in-house;
- Human resources; and
- Relationship with customer.

Not all organisational factors will directly affect cost-effectiveness; some enable or facilitate the achievement of performance when they are set in conformity with the business objectives. It is likely that no single model should constitute “best practice” in all circumstances.

Figure 5.6 provides a list of factors that would need to be considered in the scope of a comprehensive examination of the influence of ANSP **managerial and financial arrangements** on performance. They mainly relate to the following three issues:

- The quality of management;
- The collective bargaining process; and
- Financial and accounting considerations.

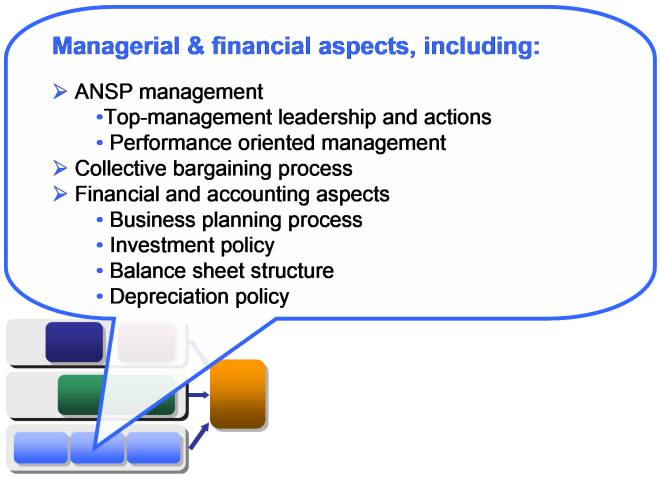


**Figure 5.6: Managerial & financial aspects**

Most of the managerial and financial aspects are expected to directly affect cost-effectiveness, since they have an impact, for example, on investment decisions, productivity and wage policies. The managerial and financial aspects are to some extent influenced by the ANSP organisational factors and by some of the exogenous factors (especially among the institutional and governance factors, and among the socio-economic factors).

Figure 5.7 provides a list of factors that would need to be considered in a comprehensive examination of the influence of **ANSP operational and technical setup** on performance. They mainly relate to the following three issues:

- Operational structure;
- Operational concepts and processes; and
- Operational flexibility.

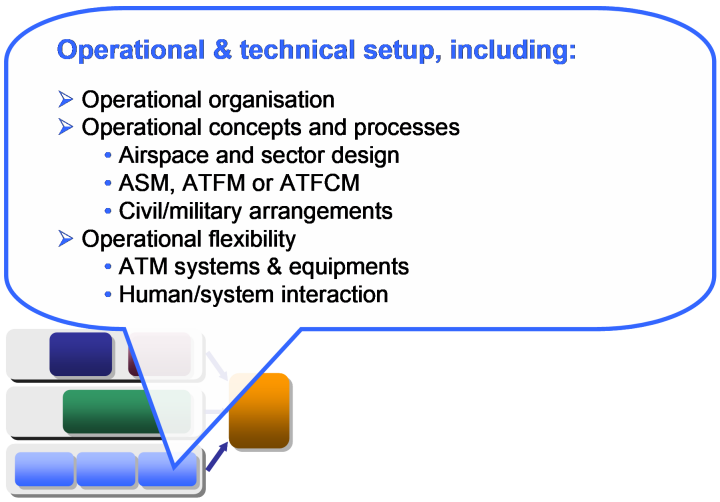


**Figure 5.7: Operational & technical setup**

The operational and technical setup of an ANSP is expected to be influenced by both exogenous factors (typically the operational environment) and other endogenous factors (such as internal organisation and investment policy). The operational and technical setup is expected to affect both labour and capital productivity and the level of support costs.

# 6 ANSP benchmarking and the SES Performance Scheme

The objective of this chapter is to explain the main differences between the ACE financial cost-effectiveness indicator and the Single European Sky (SES) en-route cost-efficiency KPI (as defined in Regulation (EU) N°2019/317 (European Commission 2019)).

First of all, it should be noted that these two indicators have been specified in response to different needs:

- The purpose of the ACE analysis is to benchmark the cost-effectiveness performance of ANSPs in providing gate-to-gate ATM/CNS services (where en-route and terminal ATM/CNS are considered together). The ACE financial cost-effectiveness indicator is computed as the ratio of ATM/CNS provision costs to composite flight-hours and it can be broken down into three components (ATCO-hour productivity, ATCO employment costs per ATCO-hour and unit support costs). These components allow interpreting the differences in cost-effectiveness performance observed across Pan-European ANSPs. The ACE benchmarking analysis also informs ATM stakeholders on the level and trends of the Pan-European system cost-effectiveness performance.

- The en-route cost-efficiency KPI (the Determined Unit Cost or DUC), which is defined in the Performance Scheme regulation, is used as part of the SES cost-efficiency performance target-setting and monitoring processes. This KPI is computed as the ratio of en-route ANS costs (in real terms) to service units at charging zone level, and reflects the costs of several entities, not only the ANSP. The en-route ANS costs (in nominal terms) and service units also form the basis to calculate the unit rate that is billed to airspace users within a charging zone.

The ACE benchmarking reports complement the SES target setting and monitoring activities by providing a detailed comparison of cost-effectiveness performance at ANSP level including a trend analysis of three main economic drivers (productivity, employment costs and support costs).

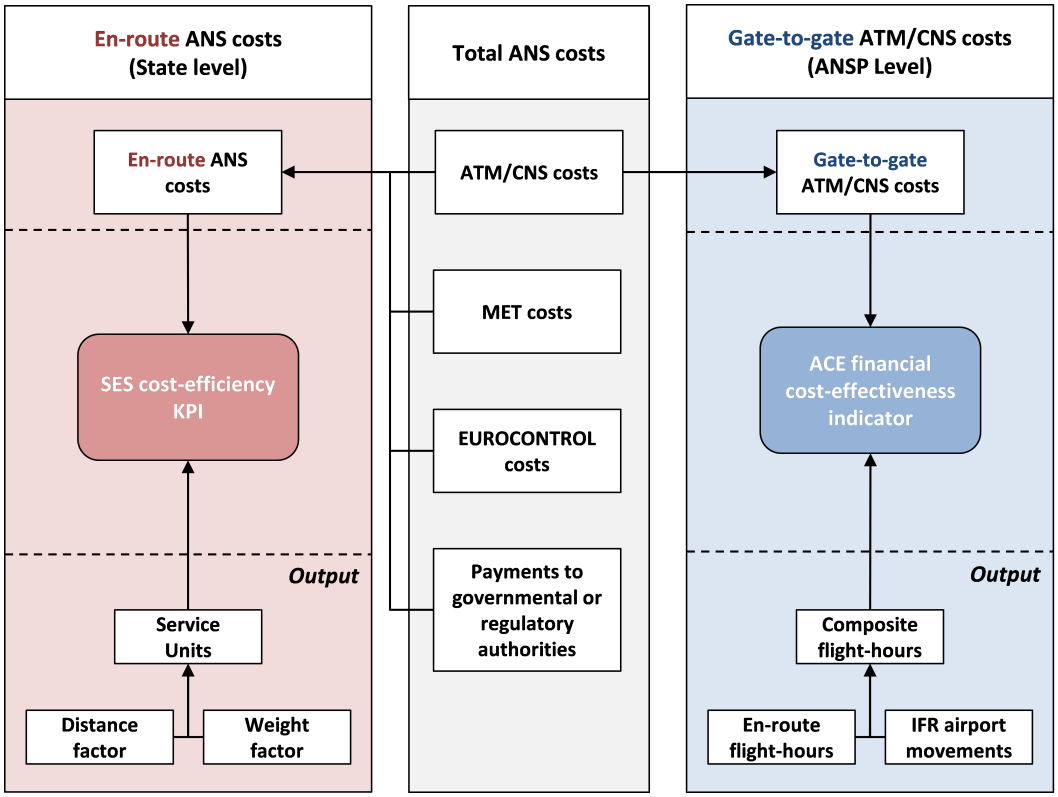


**Figure 6.1: ACE cost-effectiveness indicator and SES cost-efficiency KPI**

As shown in Figure 6.1, the main differences between the ACE financial cost-effectiveness indicator and the SES en-route cost-efficiency KPI are the following:

- **Operational scope**: En-route and terminal costs are considered together when benchmarking the economic performance of ANSPs in the ACE analysis. It is important to consider a "gate-to-gate" perspective because the boundaries used to allocate costs between en-route and terminal ANS vary between ANSPs and might introduce a bias in the cost-effectiveness analysis. On the other hand, the SES cost-efficiency KPI is computed for en-route and terminal ANS separately, for the purposes of the target-setting and/or monitoring processes.
- **Service scope**: Total ANS costs (including costs relating to the ANSPs, METSPs, EUROCONTROL, and NSAs) are used to compute the SES cost-efficiency KPI, while only the ANSPs ATM/CNS provision costs are included in the ACE benchmarking analysis.
- **Measure of the output**: The output metric used to compute the SES en-route cost-efficiency KPI is the number of en-route service units[1]. This metric is a function of

[1] Service unit $=$ distance factor $\times \sqrt{\frac{\text{MTOW}}{50}}$ According to EU Regulation 2019/317 (European Commission 2019, Annex VIII 1.1 and 1.2), *the en route service units shall be calculated as the product of the distance factor and the weight factor for the flight concerned. […] The distance factor in respect of a given charging zone shall be*

the aircraft weight and of the distance flown within a given charging zone. This is the metric which has been historically used to compute the en-route unit rate charged to airspace users. On the other hand, the ACE financial cost-effectiveness indicator is computed using composite flight-hours, which combine both flight-hours and IFR airport movements (see Section 3.1). It should be noted that the geographical area controlled by ANSPs operational units can substantially differ from the charging zones in case of delegation of ANS. The composite flight-hours therefore better reflect the operational activity performed by ANSPs, while service units are more appropriate when charging zones are considered.

*obtained by dividing by one hundred the number of kilometers flown.*

# 7 Treatment of monetary factors in the ACE benchmarking analysis

Presentation and comparison of historical series of financial data from different countries poses problems, especially when different currencies are involved, and inflation rates differ. There is a danger that time-series comparisons can be distorted by transient variations in exchange rates.

For this reason, the following approach has been adopted in the analysis for allowing for inflation and exchange rate variation. The financial elements of performance are assessed, for each year, in national currency. They are then converted to national currency in year-N prices using national inflation rates. Finally, for comparison purposes in year-N, all national currencies are converted to Euros using the year-N exchange rate.

This approach has the virtue that an ANSP's performance time series is not distorted by transient changes in exchange rates over the period. It does mean, however, that the performance figures for any ANSP in a given year prior to year-N are not the same as the figures in that year's ACE report, and cannot legitimately be compared with another ANSP's figures for the same year. Cross-sectional comparison using the figures in the ACE analytical report is only appropriate for year-N data.

The exchange rates used to convert the year-N data in Euros are those provided by the ANSPs in their ACE data submission.

The historical inflation figures used in ACE are obtained from EUROSTAT or from the International Monetary Fund when the information is not available in EUROSTAT website. For the projections (future years), the ANSPs' own assumptions concerning inflation rates are used.

Employment costs constitute a major part of ANS provision costs. Staff has to be recruited in local labour markets, and therefore the prevailing wage rates, for many different grades and types of staff, will have a major influence on the overall employment costs. There are a number of ways of measuring differences in prevailing wage levels between different countries. In the ACE benchmarking reports, unit employment costs are also compared when adjusted for Purchasing Power Parities (PPPs). Purchasing Power Parities (PPPs) are currency conversion rates that are applied to convert economic indicators in national currency to an artificial common currency (Purchasing Power Standard (PPS) for EUROSTAT statistics). The PPPs data used to adjust most of the ANSPs employment costs is extracted from EUROSTAT.

For four countries (Armenia, Georgia, Moldova and Ukraine), PPP data is not available in the EUROSTAT database. In these cases, the IMF database is used. Since in the IMF database, the PPPs are expressed in local currency per **international Dollar** rather than **PPS**, an adjustment

is made so that the figures used for ARMATS, Sakaeronavigatsia, MOLDATSA and UkSATSE are as consistent as possible with the data used for the rest of the ANSPs. The assumption underlying this adjustment is that the difference in PPPs between two countries shall be the same in the EUROSTAT and in the IMF databases.

There are some limitations[1] inherent to the use of PPPs and for this reason the ACE data analysis does not put a significant weight on results obtained with PPPs adjustments. PPPs are nevertheless a useful analytical tool in the context of international benchmarking.

[1] For instance, it is possible that, for a given country, the cost of living in regions where the ANSP headquarter and other main buildings (e.g. ACCs) are located is higher than the average value computed at national level.

# 8 Detailed information on the calculation of ACE indicators

## 8.1 Cost-effectiveness indicators

The main indicators used in ACE to analyse ANSPs cost-effectiveness are:

- economic cost-effectiveness;
- financial cost-effectiveness;
- ATCO-hour productivity;
- ATCO employment costs per ATCO-hour; and,
- support costs per composite flight-hour.

The table below presents the formulas used to calculate these indicators with reference to the SEID item numbers.

| () # | Indicator | Formula | Source |
|---|---|---|---|
| 1 | Composite flight-hours | En-route flight-hours +(0.27×IFR airport movements) | ***En-route flight-hours:*** Item D16, continental ANS<br>***IFR airport movements:*** Item D18, SES airports + Non-SES airports<br>**0.27** is the two-digits rounded weighting factor (see Chapter 3) |
| 2 | Economic cost-effectivenes | (Total service provision costs+Total costs of ATFM delays)/(Composite flight-hours) | ***Total service provision costs:*** Item A15 (en-route + terminal columns)<br>***Total costs of ATFM delays:*** Minutes of ATFM delays extracted from the Network manager database, monetarised using the cost of a minute of ATFM delays (see Chapter 4)<br>***Composite flight-hours:*** Formula #1 |
| 3 | Financial cost-effectiveness | (Total service provision costs)/(Composite flight-hours) | ***Total service provision costs:*** Item A15 (en-route + terminal columns)<br>***Composite flight-hours:*** Formula #1 |

| () # | Indicator | Formula | Source |
|---|---|---|---|
| 4 | ATCO-hour productivity | (Composite flight-hour)/(Sum of ATCO in OPS hours on duty) | ***Composite flight-hours:*** Formula #1<br>***Sum of ATCO in OPS hours on duty:*** Item D22 (ACCs + APPs+TWRs columns) |
| 5 | ATCO employment costs per ATCO-hour | (Staff costs for ATCOs in OPS)/(Sum of ATCO in OPS hours on duty) | ***Staff costs for ATCOs in OPS:*** Item C23 (en-route + terminal columns)<br>***Sum of ATCO in OPS hours on duty:*** Item D22 (ACCs + APPs+TWRs columns) |
| 6 | Support costs per composite flight-hour | (Total service provision costs-ATCOs in OPS Employment costs)/(Composite flight-hours) | ***Total service provision costs:*** Item A15 (en-route + terminal columns)<br>***ATCOs in OPS Employment costs:*** Item C23 (en-route + terminal columns)<br>***Composite flight-hours:*** Formula #1 |

## 8.2 Financial indicators used to monitor ANSPs liquidity and cash situation

The current ratio and cash-on-hand days indicators are used in ACE report to analyse ANSPs financial situation. The formulas and sources of data used for calculation are presented in the table below.

| () # | Indicator | Formula | Source |
|---|---|---|---|
| 1 | Current ratio | (Current assets)/(Current liabilities) | ***Current assets:*** Item B15 (total ANS column)<br>***Current liabilities:*** Item B30, (total ANS column) |
| 2 | Cash-on-hand days | (Cash in hand or at bank)/(Staff costs+Non-staff operating costs)×365 | ***Cash in hand or at bank***: Item B18 (total ANS column)<br>***Staff costs:*** Item A16, (total ANS column)<br>***Non-staff operating costs:*** Item A17 (total ANS column) |

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# Disclaimer

The Performance Review Unit (PRU) has made every effort to ensure that the information and analysis contained in this document are as accurate and complete as possible.

Should you find any errors or inconsistencies we would be grateful if you could please bring them to the PRU's attention.

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