Support study for an ex-post evaluation of the SES performance and charging schemes

Final Report

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EXECUTIVE SUMMARY

Introduction

The EU Single European Sky (SES) policy is a key pillar of the Community's aviation policy. SES should lead to an improvement of the performance of air traffic management in Europe, to the benefit of industry, environment, passengers and society at large. The EU Performance and Charging Schemes are an important instrument to realise this ambition.

Both the performance and charging schemes share the objective to improve the performance of what is essentially a monopoly-driven industry without competitive/market forces. The performance scheme sets a framework for improving performance through a series of reference periods that successively identify new targets to be reached. The charging scheme aims to set a level and transparent playing field for charges and support the performance scheme through tools that encourage higher performance (charge modulation, incentives etc.).

In the Better Regulation Package of the new Juncker Commission, there is a stronger emphasis on ex post evaluation in the policy cycle. This study is an application of that objective in the area of SES, by reviewing the effectiveness of the EU performance and charging schemes as defined in the Commission Implementing Regulation (EU) No 390/2013 laying down a performance scheme for air navigation services and network functions and Commission Implementing Regulation (EU) No Regulation 391/2013 laying down a common charging scheme for air navigation services.[1] The Terms of Reference (ToR) states that the objective of the evaluation is twofold:

- First, the objective is to evaluate the SES performance and charging schemes during the first reference period including the set-up of the Performance Review Body (PRB) and its support functions and compare this with the past arrangements. It is stated that the evaluation should also review the coherence and complementarity of other SES initiatives contributing to the achievements of performance targets.
- Second, the study should assess the quality of raw data and the underlying data handling that is used for the purposes of the performance and charging schemes.

In addition to the formal objectives of the study, the European Commission indicated during the kick-off meeting that the study should aim to provide lessons learned for the third reference period (RP3) preparations and planning. The scope of the study includes the first regulatory period, RP1, covering the period 2012-2014, as well as the results of the first year of the second reference period (RP2).

[1] Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions; Commission Implementing Regulation (EU) No 391/2013 of 3 May 2013 laying down a common charging scheme for air navigation services.

The evaluation concentrates on eight evaluation criteria to evaluate Regulations 390&391/2013: relevance, effectiveness, efficiency, coherence, European added value, sustainability acceptability and equity. Based on these evaluation criteria, the terms of reference further outlined 21 main evaluation questions. We have carried out extensive desk research, field research via different channels, analysis and validation activities with stakeholders.

The performance and charging schemes

Some key characteristics of the performance scheme are:

- It is implemented (on time) in 28 EU Member States plus Norway and Switzerland.
- The scheme distinguishes fixed reference periods (RP1: 2012-14, RP2: 2015-19).
- It contains four key performance areas (KPAs) (safety, environment, capacity, cost-efficiency), and within these, key performance indicators (KPIs) and performance indicators (PIs).
- There are union-wide performance targets and binding national/functional airspace block (FAB) targets, which should be consistent with Union-wide targets.
- The European Commission (EC) carries out an assessment of targets, assisted by the independent PRB.
- Ongoing monitoring and reporting of performance by the national supervisory authorities (NSAs) and the EC, assisted by the PRB and its support function.

Key characteristics of the charging scheme are:

- Costs are distinguished between those included in the scheme ('determined') and those which are not included. For example, where certain services are provided subject to market, conditions the scheme allows these to be excluded from the calculation of determined costs.
- Cost-sharing arrangement: the cost sharing arrangement makes provisions for the determined costs to be adjusted during the reference period where these are unforeseen, but otherwise over the period cost increases or decreases are borne or retained, respectively, by the ANSP (or Member State or other entity).
- Traffic Risk Sharing arrangement: the costs or benefits that arise when the traffic handled is significantly lower or higher than anticipated are shared with airspace users. In this way, risk is spread more evenly along the aviation supply chain.
- Member States are mandated to apply financial incentives for air navigation service providers (ANSPs) for cost-efficiency, capacity and environment.

Conclusions

The EU performance and charging schemes resulted in increased transparency of ATM performance among stakeholders and further led to more harmonised reporting of ATM performance. As a result, the EU performance and charging schemes overall catalysed an improved performance in EU ATM/ANS, but not to the degree that was aimed for, due to a variety of factors (see further below). The system is complex (for example due to the amount of indicators and their complexity in some cases and features like the adjustment mechanism) and entails significant reporting requirements and data checks by the PRB and some duplications in reporting are identified.

Relevance: The KPAs in the Performance Scheme are overall relevant, since these broadly cover the needs of society (timely and environmentally friendly air transport) and airspace users (timely and efficient air navigation service provision). The only relevant topic not covered is the fragmentation of European airspace, considering general aviation out of scope.

Coherence: In general, the scheme is consistent with other European initiatives: the Single European Sky research programme (SESAR), FABs, the Network Manager (NM) and national approaches. The different process steps in the cycle from target setting to review of reported data are also generally coherent. Nevertheless, within the different process steps and structures, we note some weaknesses:

- The target setting process is subject to political compromises, as Member States, which have an interest in the financial results of the ANSPs, have to agree on the targets for these ANSPs.
- The same argument applies for the enforcement of targets. Member States have to vote in majority for corrective measures of non-compliant member states.
- The final agreement on local targets takes too long (in some cases well into the reference period), which, given the long lead in ANSP implementation, may impact the scheme's effectiveness and credibility.
- Furthermore, there is a mismatch between national targets from the performance plans and the Union wide targets, which means that the Union-wide targets are not met.
- There is a lack of flexibility in the target-setting, resulting in targets that do not properly address the dynamics of the business and local circumstances, e.g. in terms of traffic demand developments.
- The scheme does not integrate well with FABs, and FAB targets are simple aggregations of national targets. None of the KPAs are directly managed by FABs, and the FAB influence on these is minimal at best. Requiring FAB level targets is thus of questionable value.
- The Regulations mandate the application of incentives of a financial nature in the KPAs of capacity and cost efficiency and non-financial incentives in the KPA of environment. However, these incentive mechanisms are applied with different complexity among FABs and Member States, resulting in differences in effectiveness.
- National Supervisory Authorities (NSAs) are generally regarded as having insufficient expertise and resources to manage the scheme, hence being overly reliant on ANSPs. This view is expressed by ANSPs, the PRB and NSAs themselves.

Several stakeholders expressed the concern that the interdependencies between KPAs are not sufficiently recognised by the schemes. However, the study team considers that service providers in general always have to deal with a balance between costs, quality of service and safety; the current target-setting in the schemes provides sufficient autonomy in this respect.

- Effectiveness: Considering the Regulation's objectives and performance targets set in the 4 KPAs, it is concluded that, overall, the schemes have only partially fulfilled their stated objectives. Performance on all four KPAs measurably improved in the context of significantly lower traffic levels than planned in the National Performance Plans (NPPs), and the performance and charging schemes contributed to these achievements Nevertheless, the targets for flight efficiency, cost efficiency and capacity were not fully met. For the four KPAs, indicators and data quality, the conclusions are as follows:
- Safety: The rationale behind the selection of the current safety performance indicators is sound, and the scheme has resulted in improvements in terms of focus on performance of the indicators. To the extent that improved focus delivers an improved level of safety, the Performance Scheme had a marginally positive influence on the level of safety. While aviation safety performance is also monitored, controlled and improved by mechanisms outside the performance scheme, the inclusion of safety in the scheme serves as a counterbalance to the effects from other KPAs.
- Environment: The European horizontal en-route flight efficiency, the most relevant indicator within the KPA, has improved over the years although not enough to meet the targets. The scheme has contributed to this, although the degree of control of ANSPs is limited.
- Cost efficiency: Although national targets have, legally speaking, been met by design, the aggregated NPP targets were less ambitious than the Union-wide target as agreed in the Single Sky Committee (SSC). The actual level of the en-route unit costs at Union level were higher than SSC targets throughout RP1. The actual unit costs for users were significantly higher than the target each year. The conclusion is therefore that the Union-wide target has not fully been met in any of the years in RP1. Nevertheless, our study finds also that cost-efficiency within the SES area has increased over RP1 in real terms, also measured by the true costs incurred by users. During RP1, capital expenditures have been delayed, although these were included in the cost base. The monitoring of capital expenditures was weak during RP1. The ratio of en-route costs to terminal costs did not significantly change, as terminal costs also decreased during RP1. The study found specific weaknesses of the system related to the cost efficiency:
  - It is difficult to reconcile the audited accounts with the reporting tables under the schemes. Hence there is a risk that unaudited information is submitted.
  - The system may be undermined due to 'gaming' by ANSPs or NSAs – using possibilities that are not in the spirit of the system and that lead to unwanted outcomes considering the goals of the SES Performance and Charging legislation. Examples that came forward

are costs being shifted forward to a subsequent reference period and deviations from the traffic forecasts used for union-wide targets.
    - The costs base subject to inflation correction is to be defined by the Member States. This means that costs that are not subject to inflation, such as some capital expenditures, may be corrected for inflation. Stakeholders point to the application of inaccurate inflation values, however the study team did not find evidence for this.
- Capacity: Prior to RP1, the period 2004-2011 saw average en-route delay per flight at 1.2 min/flight but subsequently the average achieved value during 2012-15 was 0.6 min/flight. The primary motivation for improved delay performance is likely to be the performance scheme.
- Suitability of indicators: Whilst the indicators in each KPA are seen as having a number of shortfalls, there appear to be few alternatives that would significantly improve the scheme without introducing complexity or additional indicators.
- Data quality: The data appears sufficiently accurate for the purposes of target setting, accepting performance plans and monitoring. The data quality process of the PRB/PRU is to exclude data where there are apparent errors and to include them once these errors are understood and treated.

PRB set-up: The PRB's analysis as evidence for target setting was robust in its range and depth and subjected to stakeholder consultation. The advice given to the Commission for the target setting was accepted and the performance turned out to be close to the set targets, although the cost efficiency target was lowered in the final deliberations of the SSC. This suggests that the final agreed targets were deliverable within the context of the operational challenges, national regulatory frameworks and the ambition of States. We therefore consider that the PRB has carried out its tasks effectively. At the same time, however, it is noted that the PRB has raised issues to the EC and SSC over the support from Eurocontrol. This has led to the Commission's action to set the PRB as of 2017 in a different form (experts appointed directly by the Commission and supported by a new contractor).

EU added value: The EU performance and charging schemes have provided additional value across all KPAs compared to what could have been achieved at national or regional level.

Efficiency and equity: Overall, the benefits to users and passengers significantly outweigh the costs of the system: benefits are estimated at € 3.4 bn for the evaluation period, the costs at € 87 million in total. This does not mean that the system is fully efficient or that all the benefits accrue solely from the performance scheme, which acts as a catalyst for improvement. Stakeholders report the following weaknesses: duplications in different layers; a lack of (visible) impact of some PIs in the system, which still requires more precise reporting; and a heavy data submission and handling process.

Sustainability: The performance outcomes achieved during a reference period are not likely to be taken away by lower performance in a subsequent reference period. A possible exception is in the cost efficiency KPA, where the

traffic volume and cost variables are such that sustaining benefits in the long term is difficult to predict.

Acceptability: The EU performance and charging schemes and its four KPAs are accepted by the stakeholders. Although airspace users would like to have seen more pressure to obtain better results, they see the economic regulation as the appropriate tool to address the monopoly position of the ANSPs.

Recommendations

Below we provide some recommendations to strengthen the performance and charging schemes. We distinguish between general recommendations and KPA-specific recommendations.

General recommendations
It is recommended that the Commission streamlines the procedures to declare local targets more rapidly when they are found to be inconsistent with Union-wide targets. Subsequently, it is recommended that when the PRB advises on Union wide targets, it also sets the required ambition levels for individual states in order to overcome more rapidly any potential discrepancies between local targets and Union wide targets. This may be coupled with a sanctions regime if local targets are considered inconsistent with the EU wide target, although the study team considers that the effectiveness of the schemes is larger if national targets are mutually accepted rather than imposed top-down (certainly if failure to meet the targets is not enforced in any way).

The experience of RP1 is that only one third of states achieved all targets in all years. Thus there can be no confidence that states will achieve the targets they commit to at national level. This needs to be a focus for the EC, otherwise the scheme risks losing credibility. This can be done by introducing a clear sanctioning mechanism in case targets are not met – which should apply without regard to the (economic and traffic) size of the Member States . Another option is to focus on the underlying ANSP cost inputs, assumptions and variables. These need to be tested rather than accepting a value based on theoretical parameters or driven by compliance with the European level target. What is needed is for ANSP plans to be examined in detail by appropriately qualified, independent (from the state and ANSP) and experienced experts. A necessary complement is to strengthen the capacity of NSAs to perform their tasks satisfactorily, and possible support measures should be explored. It is recommended to include the oversight practices of NSAs regarding the EU performance and charging scheme as a priority of the regular standardisation audits of NSAs by EASA.

Thirdly, we recommend that the FAB dimension is reviewed. It appears to be adding little value as FABs do not have integrated business plans and do not deliver an integrated service, both of which remain at national level.

Fourthly, we recommend that reporting requirements of the performance and charging scheme are streamlined with other European and national reporting requirements to avoid duplication.

KPA-specific recommendations

For each of the four KPAs, we have formulated some specific recommendations based on the findings and conclusions as presented in the previous section. Many of the recommendations address the indicators in the different KPAs.

- Environment KPA
  - Investigate the inclusion of vertical flight efficiency, including for approach and departure operations.
  - Investigate the inclusion of time-based horizontal flight efficiency indicators, on the basis that time is a closer proxy to airspace user costs than distance.
- Safety KPA
  - A balanced combination of outcome-based indicators and leading indicators is now the most appropriate way to monitor safety performance. A limited number of outcome-based indicators should be introduced to improve measurement of safety performance.
  - The effectiveness of safety management (EoSM) indicator should be improved and maintained as a leading indicator. The EoSM questionnaire could be modified to make it less difficult to complete.
  - Targets can be set for process-based indicators. Targets for indicators based on the number of reported occurrences should not be introduced in safety, as this is potentially counterproductive and could harm safety levels.
- Cost efficiency KPA
  - Consider a total economic value indicator, incorporating the quantifiable impacts of the other KPAs (not only delays within Capacity, but also fuel consumption savings and CO2 emission benefits for Environment). Such an approach will require a mature tool to account for all relevant factors and correlate costs and benefits.
  - Use the actual unit rate level incurred by users and trends to monitor the true cost for users. Currently, due to the traffic and cost risk sharing mechanisms and related carry-overs, substantial differences emerge between unit rate and unit cost trends.
  - Introduce an EU target for Terminal ANS (TANS) to cover the need for a consistent regulatory approach to cost-efficiency, to prevent a possible shift from en-route to terminal costs in the future and to prevent that the already understaffed NSAs have to set and enforce local TANS targets.
  - Monitoring of CAPEX expenditures should be improved, for example by instituting monitoring on project-basis instead of nationally. Additionally, NSAs could be provided guidance on how to set-up and manage a CAPEX monitoring function.
  - Strengthen the incentive system in the area of cost efficiency. One option could be to adapt the traffic risk sharing mechanism, increasing ANSP exposure to the risks above 4.4 %. In the area of capacity, it is recommended to further develop guidance material for States and NSAs to develop effective incentive mechanisms. It is also recommended to further study the impacts of raising the 1% cap of the ANS revenue, which would strengthen incentives by increasing penalties. It is also recommended that the Commission disseminates best practices on the set-up and implementation of the incentive schemes.

  - Require that costs reported to the EC are associated with an auditor's statement to prevent a mismatch between the costs reported under the performance and charging schemes and the costs incurred by service providers as reported in their (audited) annual accounts.
  - Harmonise the use of the same (scenario of the) traffic forecast (i) in the local target setting as reported in the national performance plans and (ii) between local target setting and EU-wide target setting.
  - Issue guidelines about which costs are allowed to be subject to inflation correction and monitor the proper application of these guidelines. This prevents that costs that are not subject to inflation are corrected for inflation.
- Capacity KPA
  - Investigate the inclusion of percentage of flights delayed by more than 15 or 20 minutes', taking into account peak vs normal operations. It was noted that monitoring of the average delays hides the extremes, which cause most of the airspace user problems.
  - Consider weighted delay performance indicators. For example, to place greater weight on long delays and operationally critical departures in the morning.

SYNTHÈSE

Introduction

La politique de l'Union relative au ciel unique européen (SES) est un pilier essentiel de la politique communautaire dans le domaine de l'aviation. Il est nécessaire que le ciel unique européen conduise à une amélioration de la performance de la gestion de la circulation aérienne en Europe, au profit de ce secteur d'activité, de l'environnement, des passagers et, plus généralement, de la société. Les systèmes de performance et de tarification de l'Union européenne constituent des outils importants en vue de réaliser cette ambition.

L'un et l'autre de ces systèmes de performance et de tarification ont pour objectif commun l'amélioration de la performance de ce secteur d'activité qui est essentiellement un monopole ne subissant pas les lois du marché ou de la concurrence. Le système d'amélioration des performances définit un cadre pour développer la performance à travers une série de périodes de référence qui recensent les nouveaux objectifs à atteindre. Le système de tarification vise à établir une concurrence équitable, équilibrée et transparente au niveau des frais et prend en charge le système d'amélioration des performances par le biais d'outils qui incitent à un meilleur rendement (modulation des frais, incitations, etc.).

Dans le train de mesures en faveur d'une meilleure réglementation de la nouvelle commission Juncker, l'accent est mis avec force sur l'évaluation ex-post du cycle des politiques. La présente étude est le résultat de cet objectif dans le domaine du ciel unique européen via l'examen de l'efficacité des systèmes de performance et de tarification ainsi que définis dans le règlement d'exécution de la Commission, (UE) no 390/2013, fixant les règles d'un système de performance pour les services de navigation aérienne et les fonctions de réseau et le règlement d'exécution de la Commission (EU) 391/2013 fixant les règles d'un système commun de tarification des services de navigation aérienne.[2] Les termes de référence (ToR) stipulent que l'objectif de l'évaluation est double :

- Premièrement, l'objectif est d'évaluer la performance du ciel unique européen et des systèmes de tarification au cours de la première période comprenant l'introduction de l'organe d'évaluation des performances (PRB) et de ses fonctions d'appui, et de comparer le résultat avec les dispositions passées. Il est précisé qu'il est nécessaire que l'évaluation examine également la cohérence et la complémentarité des autres initiatives du ciel unique européen qui contribuent à la réalisation des objectifs de performance.

[2] Règlement d'exécution de la Commission (EU) no 391/2013 du 3 mai 2013 fixant un système de performance pour les services de navigation aérienne et les fonctions de réseau ; règlement d'exécution (EU) no 391/2013 du 3 mai 2013 fixant un système de tarification des services de navigation aérienne.

- Deuxièmement, il est nécessaire que l'étude évalue la qualité de l'exploitation des données brutes et des données sous-jacentes utilisées aux fins des systèmes de performance et de tarification.

Outre les objectifs officiels de l'étude, la Commission européenne a précisé, lors de la réunion de lancement, qu'il était nécessaire que l'étude vise à fournir des enseignements pour les préparations et la planification de la troisième période de référence (RP3). La portée de l'étude comprend la première période réglementaire, RP1, qui couvre la période 2012-2014, ainsi que les résultats de la première année de la deuxième période de référence (RP2).

L'évaluation se concentre sur huit critères d'appréciation pour évaluer les règlements 390 et 391/2013 : pertinence, efficacité, efficience, cohérence, valeur ajoutée européenne, acceptabilité de durabilité et équité. Sur la base des présents critères d'évaluation, les termes de référence présentèrent vingt et une questions d'évaluation principale supplémentaires. Nous avons effectué des recherches documentaires approfondies, des études sur le terrain via différents canaux, des analyses et activités de validation avec les parties prenantes.

Les systèmes de performance et de tarification

Certaines caractéristiques clés du système de performance sont :

- Celui-ci fut mis en pratique (dans les délais) dans les vingt huit États membres plus la Norvège et la Suisse.
- Le système distingue les périodes de référence fixes (RP1 : 2012-14, RP2 : 2015-19).
- Celui-ci comprend des domaines de performance clés (KPA) (sécurité, environnement, capacité, coût-efficacité) et, parmi ceux-ci, des indicateurs de performance clés (KPI) et des indicateurs de performance (PI).
- Il existe des objectifs de performance à l'échelle de l'Union et des objectifs contraignants de bloc d'espace aérien fonctionnel et national qui soient compatibles avec les objectifs pour l'ensemble de l'Union.
- La Commission européenne (CE) procède à une évaluation des objectifs, assistée en cela par l'organe d'évaluation des performances (PRB) qui est indépendant.
- Suivi et compte-rendu permanents de la performance par les autorités nationales de surveillance (NSA) et la CE, assistées par l'organe d'évaluation des performances (PRB) et ses fonctions d'appui.

Caractéristiques clés du système de tarification :

- On distingue les coûts entre ceux inclus dans le système (« déterminés ») et ceux qui ne sont pas inclus. Par exemple, lorsque certaines prestations fournies sont soumises aux fluctuations du marché, le système permet leur retrait pour le calcul des coûts déterminés.
- Mesures de partage des coûts : les mesures de partage des coûts prévoient que les coûts déterminés soient ajustés au cours de la période de référence lorsque ceux-ci sont imprévus, mais autrement sur la période au cours de laquelle les coûts augmentent ou diminuent, qu'ils

soient respectivement pris en charge ou retenus par les prestataires de services de navigation aérienne (ANSP) (État membre ou tout autre entité).

- Mesure de partage du risque lié au trafic : Les coûts ou recettes qui surviennent lorsque le trafic géré est significativement plus faible ou plus élevé qu'anticipé sont répartis entre les utilisateurs de l'espace aérien. De cette façon, le risque est réparti plus uniformément sur l'ensemble de la chaîne d'approvisionnement aéronautique.
- Les États membres sont tenus d'instaurer des incitations financières pour les fournisseurs de services de navigation aérienne (ANSP) pour le coût-efficacité, les moyens et l'environnement.

Conclusions

Les systèmes de performance et de tarification de l'Union ont résulté en davantage de transparence pour ce qui concernait les performances de la gestion de la circulation aérienne (ATM) au sein des parties prenantes et ont, en outre, conduit à des rapports plus harmonisés des performances de l'a circulation aérienne. En conséquence, les systèmes de performance et de tarification ont engendré une performance accrue au sein des services de circulation aérienne et des services de navigation aérienne européens (ATM/ANS), mais pas au niveau visé en raison de nombreux facteurs (cf. ci-dessous). Le système est complexe (par exemple, en raison du nombre d'indicateurs et, dans certains cas, de leur complexité, des fonctionnalités telles que le mécanisme d'ajustement) et implique des exigences élevées de compte-rendu, la vérification des données par l'organe d'évaluation des performances (PRB) ; on a relevé certaines redondances dans les rapports.

Pertinence : Les domaines de performance clés (KPA) dans le système de performance sont globalement pertinents, dans la mesure où ceux-ci couvrent largement les besoins de la société (transports aériens ponctuels et respectueux de l'environnement) et des utilisateurs de l'espace aérien (mise à disposition de services de navigation aérienne en temps opportun et efficaces). La seule question pertinente qui ne soit pas couverte est le morcellement de l'espace aérien européen, considérant que l'aviation générale n'est pas prise en compte.

Cohérence : En général, le système est compatible avec d'autres initiatives européennes : le programme d'études du ciel unique européen (SESAR), les blocs d'espace européen fonctionnel (FAB), le gestionnaire de réseau (NM) et les approches nationales. Les différentes étapes du cycle, de l'établissement des objectifs à l'examen des données rapportées, sont également, en général, cohérentes. Toutefois, nous avons relevé quelques faiblesses au sein des différentes étapes du processus et des structures :

- Le processus d'établissement des objectifs est sujet à des compromis politiques, alors que les États membres, qui ont un intérêt dans les résultats financiers des prestataires de services de navigation aérienne (ANSP), doivent se mettre d'accord sur les objectifs fixés à ceux-ci.
- L'introduction des objectifs fait l'objet d'un débat identique. Les États membres doivent voter en majorité pour des mesures correctives des États membres non-conformes.

- L’accord final relatif aux objectifs locaux prend trop de temps (dans certains cas, bien après l’entame de la période de référence) ce qui, compte tenu des longs délais d’introduction des prestataires de services de navigation aérienne (ANSP) pourrait affecter l’efficacité et la crédibilité du système.
- En outre, il existe un décalage entre les objectifs nationaux de l'exécution des programmes de performance et ceux à l’échelle de l’Union dans son ensemble, ce qui implique que les objectifs de l’Union ne soient pas atteints.
- Il existe un manque de flexibilité dans l'établissement des objectifs, ce qui résulte en des objectifs qui ne prennent pas en compte correctement la dynamique des affaires et les circonstances locales.
- Le système n’intègre pas correctement les blocs d’espace aérien fonctionnel (FAB) et les objectifs des FAB ne sont que de simples agrégats d’objectifs nationaux. Aucun des domaines de performance n’est géré directement par les blocs d’espace aérien fonctionnel (FAB) et l’incidence de ceux-ci est, au mieux, minime. On peut donc s’interroger sur l’exigence des objectifs de niveau des FAB.
- Les règlements imposent l’introduction d’incitations financières parmi les moyens des domaines de performance (KPA) relevant des capacités et du rendement, et des incitations non-financières pour les domaines (KPA) relevant de l’environnement. Néanmoins, ces mécanismes d’incitation sont introduits de façon plus ou moins complexes au sein des FAB et des États membres, ce qui entraîne des différences en termes d'efficacité.
- En général, on considère que les autorités nationales de surveillance (NSA) manquent de compétence et de moyens suffisants pour gérer le système et qu’en conséquence elles s’appuient de façon excessive sur les prestataires de services de navigation aérienne (ANSP). Cette opinion est celle des prestataires de services de navigation aérienne (ANSP), l’organe d’évaluation des performances (PRB) et des autorités nationales de surveillance elles-mêmes (NSA).

Plusieurs parties prenantes ont exprimé leurs craintes que les interdépendances entre les domaines de performance (KPA) ne soient pas suffisamment reconnues par les systèmes. Cependant, l’équipe de l’étude estime que les prestataires de service ont toujours, en général, à prendre en compte un équilibre entre coûts, qualité des prestations et sécurité ; la détermination actuelle des objectifs dans les systèmes octroie suffisamment d'autonomie à cet égard.

Efficacité : Considérant les objectifs du règlement et les objectifs de rendement fixés dans les quatre domaines de performance (KPA), on a conclu que, globalement, les systèmes n’ont que partiellement rempli les objectifs arrêtés. La performance des quatre domaines de performance a été améliorée de façon quantifiable dans le cadre de niveaux de trafic beaucoup plus faibles que prévus dans le plan de performance national (NPP) et les systèmes de performance et de tarification ont contribué à ces réalisations. Néanmoins, les objectifs relatifs à l'efficacité des vols, l’efficacité des coûts et des moyens n’ont été que partiellement atteints. Pour ce qui concerne les quatre domaines

de performance, indicateurs et qualité des données, les conclusions sont les suivantes :

- Sécurité : La motivation sous-jacente à la sélection des indicateurs de performance de la sécurité actuelle est saine et le système a produit des améliorations en termes de priorité portée sur la performance des indicateurs. Au point que d'avoir privilégié cette priorité, produit un niveau de sécurité amélioré ; le système de performance a eu une influence marginale positive sur le niveau de sécurité. Alors que la performance de la sécurité aérienne est également surveillée et contrôlée par des mécanismes extérieurs au système de performance, l'intégration de la sécurité dans le système sert de compensation aux effets produits pas d'autres domaines de performance (KPA).
- Environnement : L'efficacité horizontale moyenne des vols en route en Europe, l'indicateur le plus pertinent au sein des domaines de performance (KPA), s'est améliorée au cours des années, quoique pas suffisamment pour atteindre les objectifs fixés. Le système a participé à cette évolution, bien que le degré de contrôle des prestataires de services de navigation soit limité.
- Rendement : Quoique les objectifs nationaux eussent été respectés, d'un point de vue juridique, en termes de conception, l'agrégat des objectifs fut moins ambitieux que l'objectif à l'échelle de l'Union tel qu'adopté par le comité du ciel unique européen (SSC). Le niveau réel des coûts à l'unité en route au niveau de l'Union est plus élevé que les objectifs fixés par le comité du ciel unique au cours de la période de référence no 1. Les coûts réels à l'unité étaient notablement plus élevés que l'objectif pour toutes les années. La conclusion est donc que l'objectif à l'échelle de l'Union n'a pas été pleinement atteint pour l'une quelconque des années de la période de référence no 1. Néanmoins, notre étude montre également que le rapport coût-efficacité au sein du ciel unique européen a augmenté au cours de la période de référence no 1 en termes réels, également mesuré par les vrais coûts supportés par les utilisateurs. Au cours de la période de référence no 1, les dépenses en capital ont été différées, bien que celles-ci fussent comptabilisées dans la base de coûts. Le suivi des dépenses en capital a été faible au cours de la période de référence no 1. Le ratio des coûts en route sur les coûts terminaux n'a pas changé de façon substantielle, puisque les coûts terminaux ont également diminué au cours de la période de référence no 1. L'étude a mis en évidence des faiblesses spécifiques du système liées au coût-efficacité :
  - Il est difficile de rapprocher les comptes vérifiés avec les tableaux de notification au titre des systèmes. Par conséquent, il y a un risque que des renseignements non-vérifiés soient présentés.
  - Le système pourrait être compromis suite aux « manipulations » de prestataires de services de navigation aérienne (ANSP) ou d'autorités nationales de surveillance (ANE), à l'aide de moyens qui ne sont pas dans l'esprit du système, et qui conduiraient à des résultats indésirables si l'on considère les objectifs de la réglementation en matière de performance et de tarification du ciel unique européen (SES). Les exemples observés sont des coûts imputés à une période de référence ultérieure et des écarts par rapport aux prévisions de trafic utilisées pour les objectifs fixés à l'échelle de l'Union.

- La base de coûts, soumise à des corrections dues à l'inflation, sera définie par les États membres. Cela signifie que les coûts qui ne sont pas soumis à l'inflation, comme certaines dépenses en capital, peuvent être corrigés de l'inflation. Les parties prenantes ont évoqué l'application de taux d'inflation inexacts, bien que l'équipe de l'étude n'eût pas trouvé d'indices concrets à ce sujet.

- Moyens : Avant la période de référence no 1, au cours de la période 2004-2011, la moyenne de retard en-route relevée était de 1,2 min par vol, mais, par la suite, la valeur moyenne obtenue au cours de 2012-15 était de 0,6 min par vol. La motivation première en vue d'une amélioration de performance pour les retards est probablement le système de performance.
- Pertinence des indicateurs : Bien que les indicateurs pour chacun des domaines de performance (KPA) soient considérés comme ayant un certain nombre de lacunes, il semble y avoir peu d'autres solutions qui permettent d'améliorer de façon significative le système sans y ajouter davantage de complexité ou d'autres indicateurs.
- Qualité des données : Les données semblent suffisamment précises pour contribuer à la mise en place des objectifs, l'approbation des programmes de performance et le suivi. Le processus qui contribue à la fiabilité des données de l'organe d'évaluation des performances (PRB) et de l'unité d'examen des performances (PRU) consiste à extraire les données là où il existe des erreurs visibles et à les réintégrer une fois que ces erreurs ont été analysées et traitées.

Organe d'évaluation des performances : L'analyse de l'organe d'évaluation des performances en tant qu'outil pour définir des objectifs était solide quant à son ampleur et sa variété et a été soumise aux parties prenantes pour consultation. Les conseils donnés à la Commission pour la définition des objectifs ont été acceptés et la performance s'est avérée être proche des objectifs fixés, bien que l'objectif de coût-efficacité fût diminué au cours des délibérations finales du comité du ciel unique (SSC). Cela laisse entrevoir que les objectifs finaux convenus étaient accessibles dans le contexte des défis opérationnels, des cadres réglementaires nationaux et de l'ambition des États. Nous considérons donc que l'organe d'évaluation des performances a pleinement rempli sa mission. Cependant, il est à noter, qu'au même moment, l'organe d'évaluation des performances (PRB) a soumis des questions à la Communauté et au comité du ciel unique relatives à l'assistance d'Eurocontrol. Cela a conduit la Commission à envisager l'organe d'évaluation des performances sous une forme différente à compter de 2017 (experts désignés directement par la Commission et pris en charge par une nouvelle entreprise).

Valeur ajoutée pour l'Union : Les systèmes de performance et de tarification de l'Union ont apporté une valeur supplémentaire à travers tous les domaines de performance comparés à ce qui aurait pu être réalisé au niveau national ou régional.

Efficacité et équité : Dans l'ensemble, les avantages pour les utilisateurs et les passagers l'emportent nettement sur les coûts du système : les bénéfices sont estimés à 3,4 milliards d'euros pour la période d'évaluation, les coûts à

87 millions d'euros au total. Cela ne signifie pas que le système soit pleinement efficace ou que tous les bénéfices soient uniquement le fruit du système de performance agissant comme facteur d'amélioration. Les parties prenantes ont mentionné les faiblesses suivantes : des duplications à différents niveaux, absence d'impact (visible) de certains indicateurs de performance (PI) dans le système, qui exige plus de rapports encore plus précis et une soumission de données et un processus d'exploitations lourds.

Durabilité : Les résultats de performance obtenus au cours d'une période de référence sont peu susceptibles d'être annihilés par des performances moindres au cours d'une période de référence ultérieure. Une exception possible est le coût-efficacité des domaines de performance lorsque le volume de trafic et les variables de coût sont tels que le maintien des avantages sur le long terme peut s'avérer délicat à prévoir.

Acceptabilité : Les parties prenantes ont accepté les systèmes de performance et de tarification de l'Union et leurs quatre domaines de performance. Bien que les usagers de l'espace aérien eussent souhaité voir davantage de pression afin d'obtenir de meilleurs résultats, ils perçoivent l'évolution économique comme l'outil approprié pour répondre à la situation de monopole des prestataires de service de navigation aérienne.

Recommandations

Nous précisions, ci-dessous, quelques recommandations pour améliorer le rendement des systèmes de performance et de tarification. Nous faisons une distinction entre les recommandations générales et les recommandations spécifiques aux domaines de performance.

Recommandations générales

Il est recommandé que la Commission simplifie les procédures afin de définir des objectifs locaux plus rapidement lorsque ceux-ci sont jugés incompatibles avec les objectifs fixés à l'échelle de l'Union. En conséquence, il est recommandé que, lorsque l'organe d'évaluation des performances (PRB) fournit des indications sur les objectifs à l'échelle de l'Union, celui-ci définisse également les niveaux d'ambition nécessaire pour les États à titre individuel afin de surmonter plus rapidement d'éventuels écarts entre les objectifs locaux et ceux à l'échelle de l'Union. Cela peut être associé à un régime de sanctions dans le cas où les cibles locales soient considérées comme incompatibles avec les objectifs à l'échelle de l'Union, bien que l'équipe de l'étude estime que l'efficacité de ces systèmes soit plus importante dans le cas où les objectifs nationaux sont acceptés mutuellement plutôt qu'imposés du haut vers le bas (de façon certaine, si le fait de ne pas atteindre les objectifs n'entraîne aucune contrainte).

L'expérience de la période de référence no 1 est telle que seul un tiers des États a atteint les objectifs fixés sur l'ensemble des années. Il n'est existe, par conséquence, aucune garantie que les États atteignent les objectifs auxquels ils sont souscrit au niveau national. Ceci nécessite d'être une priorité pour l'Union, sinon le système pourrait perdre de sa crédibilité. Cela peut être réalisé par l'introduction d'un mécanisme clair de sanctions au cas où les

objectifs ne seraient pas atteints. Il serait nécessaire que celui-ci s'applique indépendamment de l'importance (économie et trafic) des États membres. Une autre option serait de se concentrer sur les coûts, les hypothèses et les variables sous-jacents des prestataires de navigation aérienne (ANSP). Ceux-ci nécessitent d'être testés au lieu d'accepter une valeur basée sur des paramètres théoriques ou formatés en conformité avec les objectifs à l'échelle de l'Union. Ce qui est nécessaire est que les programmes des prestataires de services de navigation aérienne (ANSP) soient étudiés en profondeur par des experts correctement qualifiés et expérimentés, indépendants (vis-à-vis de l'État et des ANSP). Un complément indispensable va renforcer les moyens des autorités nationales de surveillance en vue de mener à bien leurs tâches, et il est nécessaire d'explorer des mesures d'assistance. Il est préconisé d'intégrer les pratiques de surveillance des autorités nationales de surveillance concernant les systèmes de performance et de tarification de l'Union en tant que priorité des audits réguliers de l'AESA concernant les activités de normalisation des autorités nationales de surveillance.

Troisièmement, nous recommandons que la taille des blocs d'espace aérien fonctionnel (FAB) soit réexaminée. Il semble que cela n'apporte que peu de valeur dans la mesure où les FAB n'ont pas de plans d'activités intégrés et qu'ils ne fournissent pas de services intégrés, lesquels demeurent au niveau national.

Quatrièmement, nous recommandons que les exigences de compte-rendu des systèmes de performance et de tarification soient rationalisées en lien avec d'autres exigences en matière de rapports européens et nationaux afin d'éviter les redondances.

Recommandations spécifiques aux domaines de performance

Pour l'ensemble des quatre domaines de performance, nous avons formulé certaines recommandations fondées sur les constatations et conclusions présentées dans la section précédente. Bon nombre des recommandations portent sur les indicateurs dans les différents domaines de performance.

- Domaine de performance environnementale
  - Enquêter sur l'inclusion de l'efficacité verticale des vols, y compris pour les opérations d'approche et de départ.
  - Enquêter sur l'inclusion d'indicateurs d'efficacité horizontale des vols, en admettant que le délai est une approximation plus proche des coûts de l'exploitant de l'espace aérien que la distance.
- Domaines de performance relatifs à la sécurité
  - Une combinaison équilibrée d'indicateurs axés sur les résultats et d'indicateurs précurseurs est maintenant la façon la plus appropriée de contrôler la performance de la sécurité. Il serait nécessaire qu'un nombre limité d'indicateurs fondés sur les résultats soient intégrés pour améliorer l'évaluation des performances de sécurité.
  - L'indicateur d'efficacité des systèmes de gestion de la sécurité (EoSM) devrait être amélioré et maintenu en tant qu'indicateur précurseur. Le questionnaire EoSM pourrait être modifié pour le rendre moins difficile à remplir.
  - Il peut être possible de définir des objectifs pour les indicateurs basés sur des processus. Les objectifs pour les indicateurs basés sur le

nombre d'événements signalés ne devraient pas être introduits dans la sécurité dans la mesure où cela est potentiellement contre-productif et pourrait porter préjudice aux niveaux de sécurité.

- Domaine de performance du coût-efficacité
  - Considérons un indicateur de valeur économique totale, intégrant les impacts quantifiables des autres domaines de performance (non seulement des retards au sein des Moyens, mais également des économies sur la consommation de carburant et les avantages des émissions de CO2 pour l'environnement). Une telle approche nécessite un outil éprouvé pour prendre en compte tous les facteurs pertinents et mettre en corrélation coûts et avantages.
  - Utiliser le niveau de taux unitaire actuel supporté par les utilisateurs et les tendances pour suivre les coûts réels des utilisateurs. Actuellement, en raison du trafic, des mécanismes de partage des coûts et des risques et des reports qui y sont liés, des différences substantielles émergent entre l'évolution du taux unitaire et les tendances du coût unitaire.
  - Introduire un objectif européen pour les services de navigation aérienne terminaux (Terminal-ANS) pour répondre au besoin d'une approche réglementaire cohérente du coût-efficacité, afin d'éviter à l'avenir un transfert des coûts en route aux coûts terminaux et éviter que les autorités de surveillance nationales, déjà en sous-effectif, n'aient à définir et mettre en place des objectifs de coûts des services de navigation aérienne terminaux (TANS).
  - Le suivi des dépenses en capital (CAPEX) devrait être amélioré ; par exemple, en instituant un suivi sur la base d'un projet au lieu de l'échelle nationale. En outre, on pourrait fournir aux autorités de surveillance nationale des lignes directrices sur la façon d'élaborer et gérer une fonction de suivi des dépenses en capital (CAPEX).
  - Renforcer le système d'incitation dans le domaine du coût-efficacité. Une des options pourrait être d'adapter le mécanisme de partage des risques du trafic, en augmentant le risque d'exposition aux risques des prestataires de services de navigation aérienne (ANSP) au-delà de 4,4 %. Dans le domaine des moyens, il est préconisé de développer davantage des documents d'orientation pour les États membres et les autorités de surveillance nationales en vue de développer des mécanismes d'incitation efficaces. Il est également recommandé d'étudier plus avant les impacts relatifs au relèvement du 1 % plafond des revenus des services de navigation aérienne, ce qui renforcerait les incitations en augmentant les pénalités. Il est également recommandé que la Commission diffuse les meilleures pratiques relatives à l'introduction et la mise en place des systèmes d'incitation.
  - Exiger que les coûts déclarés à l'Union soient associés à un rapport d'audit afin d'éviter un décalage entre les coûts déclarés au titre des systèmes de performance et de tarification et les coûts supportés par les prestataires de service ainsi qu'indiqués dans leurs états financiers annuels (certifiés).
  - Harmoniser l'utilisation de la même (scénario de) prévision de trafic (i) dans la définition des objectifs locaux comme indiqué dans les

programmes de performance nationaux et (ii) entre la définition d'objectifs locaux et la définition d'objectifs l'échelle de l'Union.
  - Publier des recommandations relatives aux coûts qu'il est permis de corriger de l'inflation et suivre l'application correcte de ces recommandations. Cela évite que les coûts qui ne sont pas soumis à la l'inflation ne soient corrigés de l'inflation.
- Domaine de performance des moyens
  - Enquêter sur l'inclusion du pourcentage de vols retardés de plus de 15 ou 20 minutes, en prenant en compte les opérations en période de pointe par rapport aux opérations en période normale. Nous avons remarqué que le suivi des délais moyens cache les extrêmes, qui causent la plupart des problèmes aux utilisateurs de l'espace aérien.
  - Prendre en compte des indicateurs de performance de retard pondérés. Par exemple, mettre davantage d'impact sur les longs retards et départs critiques sur le plan opérationnel du matin.

List of acronyms

Abbreviation	Meaning
A-CDM	Airport Collaborative Decision Making
ACC	Air Traffic Control Centre
ACE	ATM Cost Effectiveness
ANS	Air Navigation Services
ANSP	Air Navigation Service Providers
ASMA	arriving sequencing and metering area
ATFM	Air Traffic Flight Management
ATM	Air Traffic Management
ATM-S	ATM-specific occurrences
CDRs	Conditional Routes
CFMU	Central Flow Management Unit
CODA	Central Office Delay Analysis
CRCO	Central Route Charges Office
DUC	Determined Unit Cost
EASA	European Aviation Safety Agency
EoSM	Effectiveness of Safety Management
FAB	Functional Airspace Blocks
FIR	Flight Information Region
FUA	Flexible Use of Airspace
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
KEP	horizontal en-route flight inefficiency in flight plans
KPA	Key Performance Area
KPI	Key Performance Indicator
MS	Member State
NCP	NSA Coordination Platform
NPP	National Performance Plans
NSA	National Supervisory Authorities
OPC	Open Public Consultation
PRB	Performance Review Body
PRC	Performance Review Commission
PRR	Performance Review Reports (by the PRC)
PRU	Performance Review Unit, support unit of PRB
RAT	Risk Analysis Tool
RI	Runway Incursions
RP1	Reference period, 2012 - 2014
RP2	Reference period, 2015 - 2019
SES	Single European Sky
SESAR	Single European Sky ATM Research
SMI	Separation Minima Infringements
SMS	Safety Management System
SSC	Single Sky Committee
STATFOR	Statistics and Forecasts
TANS	Terminal Air Navigation Services
ToR	Terms of Reference

PART I – INTRODUCTION, CONTEXT AND METHODOLOGY

1 INTRODUCTION

1.1 Background and objectives

The EU Single European Sky (SES) policy is a key pillar of the Community's aviation policy. SES should lead to an improvement of the performance of air traffic management in Europe, to the benefit of industry, environment, passengers and society at large. The EU Performance and Charging Scheme is an important instrument to realise this ambition.

Both the performance and charging scheme share objectives in improving the performance of what is essentially a monopoly-driven industry without competitive/market forces. The performance scheme sets a framework for improving performance through a series of reference periods that successively identify new targets to be reached. The charges scheme aims to set a level and transparent playing field for charges and support the performance scheme through tools that encourage higher performance (charge modulation, incentives etc.).

Improved ATM performance should benefit airspace users, their passengers and the environment. For example, better cost efficiency should be reflected in the performance of airlines and lower fares for passengers, creating a larger economic benefit for the EU. The EU has determined more specific objectives via targets on key performance areas.

In the Better Regulation Package of the new Juncker Commission, there is a stronger emphasis on ex post evaluation in the policy cycle. This study is an application of that objective in the area of SES, by reviewing the effectiveness of the EU performance and charging schemes. The Terms of Reference (ToR) state that the objective of the evaluation is twofold:

- First, the objective is to evaluate the SES performance and charging schemes during the first reference period including the set-up of the PRB and its support functions and compare this with the past arrangements. It is stated that the evaluation should also review the coherence and complementarity of other SES initiatives contributing to the achievements of performance targets.
- Second, the study should assess the quality of raw data and the underlying data handling that is used for the purposes of the performance and charging schemes.

In addition to the formal objectives of the study, the European Commission indicated during the kick-off meeting that the study should aim to provide lessons learned for RP3 preparations and planning.

The first regulatory period, RP1, covers the period 2012-2014 and we note that the terms of reference require that "results of the first year of the second reference period should be included in the ex-post evaluation". We also note that over this period of analysis that whilst preceding regulations will apply (performance scheme 691/2010, charges scheme 1794/2006) for practical

purposes regulations 390/2013 and 391/2013 are the most relevant for this work. Nevertheless, the evaluation will incorporate the aspects of Regulation 691/2010 where applicable, in particular taking into account the date of entry into force of the different Articles of Regulation 390/2013 with respect to targets set on key performance indicators (KPIs).[3]

1.2 Status and structure of this report

This report is the fourth report provided under this study. It is the final report, in which the results of desk research, field research and validation activities during workshops with PRB, EASA and external stakeholder have been combined.

This report consists of three parts.

- Part I, which provides the introduction, context of the schemes and the methodological approach adopted in this study.
- Part II, analysis, where we provide in 11 chapters the answers to the different evaluation questions, as well as a SWOT analysis.
- Part III, conclusions and recommendations.

[3] For example, Regulation 390/2013 introduces additional indicators on e.g. flight efficiency - i.e. planned and actual flight efficiency, with the latter only becoming applicable as of 2015 with the start of RP2. These distinctions will be clearly identified in the evaluation.

2 The EU performance and charging scheme

2.1 The steps towards the set-up of the scheme

Before the SES

The introduction of civil jet airliners in the 1950's gave rise to serious discussions among concerned European States, in both the civil and the military fora.[4] These discussions prompted work on the EUROCONTOL Convention relating to Cooperation for the Safety of Air Navigation, signed in 1960[5] and ratified in 1963. The contracting members agreed *"to strengthen their co-operation in matters of air navigation and in particular to provide for the common organisation of the air traffic services in the upper air space*". Formally, they established the EUROCONTROL organisation with its two organs: a Permanent Commission for the safety of air navigation and an "air traffic services Agency".

From the start, EUROCONTOL combined regulatory as well as service provision functions. In 1979, a working cooperation agreement was made between the Organisation and the European Commission, which took account of the competencies of both organisations. The Organisation underwent major structural modifications in the late 1980s and early 1990s in order to meet the growing challenges of European air traffic management (ATM), culminating in a revised Convention that was signed in 1997. Among other developments, this led to the establishment of two commissions:

- The Safety Regulation Commission (SRC), which provides advice to ensure consistent high levels of safety in air traffic management (ATM) within the ECAC area through cooperation between States on safety regulation,. The SRC is supported by a Safety Regulation Unit (SRU), working with national experts and operating within the EUROCONTROL Agency with the appropriate level of independence.
- The Performance Review Commission, which provides objective information and independent advice to EUROCONTROL's Governing Bodies on European Air Traffic Management Performance, on the basis of extensive research, data analysis and consultation with stakeholders. Its purpose is "*to ensure the effective management of the European Air Traffic Management System through a strong, transparent and independent performance review''*. The PRC is supported in its work by the Performance Review Unit (PRU) of the EUROCONTROL Agency.

SES I and II

In 1999, the European Commission introduced the Single European Sky (SES) initiative, which was launched in 2000. This was followed by the establishment of the European Aviation Safety Agency (EASA) in 2002 and the adoption of the basic legislation n 2004. The Single European Sky Regulations

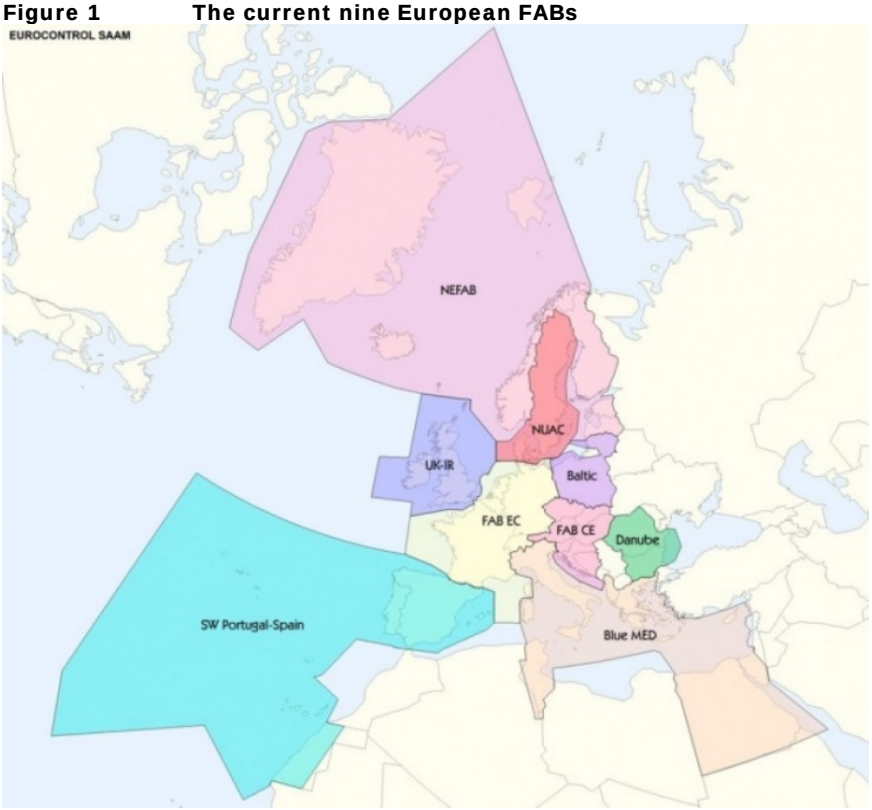
[4] The short history presented in this chapter is based in large part on John McInally (2010). EUROCONTROL History Book, December 2010, see also: https://www.eurocontrol.int/sites/default/files/publication/files/2011-history-book.pdf .

[5] Signed by France, United Kingdom, Belgium, the Netherlands, Luxembourg, Federal German Republic.

(Package 1) brought ATM under EU competence with the aim of reducing the fragmentation of European airspace and increasing its capacity. In March 2006, the European Commission's Single European Sky ATM Research (SESAR) programme was launched. In 2009, the second Single European Sky Package (SES II) was adopted, which introduced the EU Performance Scheme that is currently under study. In July 2010, EU regulation 691(2010) was adopted, "*laying down a performance scheme for air navigation services and network functions*".

The Functional Airspace Block (FAB) concept[6] was developed in the first legislative package of the Single European Sky (SES I) as one of the primary means for reducing airspace fragmentation. The second legislative package (SES II) tackled the creation of FABs in terms of service provision, in addition to the airspace organisation issues. The twofold objective of the legislative packages is to optimise air traffic flows and increase the efficiency of air traffic services in Europe.

Figure 1 The current nine European FABs



Source: Eurocontrol

The drivers for introducing the performance and charging scheme

After the introduction of SES in 2004, there existed a self-regulatory regime on performance of ATM. This resulted in 'a patchwork of performance', underlining that the good performance of some actors was outweighed by the

[6] That is: an airspace block based on operational requirements and established regardless of State boundaries, where the provision of air navigation services and related functions is performance-driven and optimised through enhanced cooperation among air navigation service providers or, when appropriate, an integrated provider.

poor performance of others[7]. In its 2008 Communication on the second package of measures, *Single European Sky II: towards more sustainable and better performing aviation*, the European Commission proposed a reform of the European air traffic system in order to meet the challenge of addressing these performance shortcomings in light of expected increases in air traffic. The Communication identified the need to increase safety levels in parallel with increasing traffic; the need to ensure better alignment of the route network with European traffic in order to improve sustainability of aviation; the need to ensure that capacity keeps pace with increasing demand; the potential scope for improvement in cost-efficiency; and the need to reduce airspace fragmentation. The underlying problems that were mentioned were the lack of long term planning, the fact that ATC is provided by entities with a natural monopoly, the lack of precise real-time information on the shortest available routes, the lack of a consistent safety approach and the history of Europe that organised its ATC nationally with fragmentation of airspace as a result. As such, the European Commission proposed the following three-step sketch for the performance scheme in its 2008 Communication:

1. An independent performance review body monitors and assesses the performance of the system. It develops indicators for the various performance areas and proposes Community wide targets. Stakeholders will be able to provide input on the framing and selection of indicators to increase general acceptance. The NSAs are also encouraged to comment, possibly forming a common representative meeting to exchange views.
2. The Commission approves the performance targets and passes them on to the national supervisory authorities. These organise wide consultations, notably with airspace users, to agree on proposals for national/regional targets consistent with the network-wide targets.
3. The agreed targets are binding.

2.2 The content of the scheme

The initial set of Regulations

EU Performance Scheme implemented in 2010

The EU Performance Scheme was implemented in 2010 by means of the adoption of Commission Regulation 691/2010.[8] The Regulation states that the overall objective of the performance scheme is to "contribute to the sustainable development of the air transport system by improving overall efficiency of the air navigation services across the key performance areas of safety, environment, capacity and cost-efficiency, in line with the Performance Framework of the ATM Master Plan, while having due regard to the overriding safety objectives." The main operational elements of the performance scheme as described in the Regulation 691/2010 are as follows:

[7] European Commission, 2008, Single European Sky II: towards more sustainable and better performing aviation, COM(2008)389 Final.

[8] Commission Regulation 691/2010 laying down a performance scheme for air navigation services and network functions and amending Regulation (EC) No 2096/2005 laying down common requirements for the provision of air navigation services

- The performance scheme should provide for indicators and **binding targets** on the key performance areas of safety, environment, capacity and cost-efficiency with required safety levels fully achieved and maintained while also allowing for performance target setting in the other key performance areas.
- The performance scheme should address air navigation services through a **gate-to-gate approach,** including airports.
- The European Commission, together **with the European Aviation Safety Agency (EASA), shall coordinate** the safety aspects of the performance scheme, including the setting-up, revision, and implementation of key safety performance indicators and safety performance targets, as well as ensuring the consistency of the safety key performance indicators and targets with the implementation of the European Aviation Safety Programme.
- National Supervisory Authorities (NSAs) have a key role to play in the implementation of the performance scheme. **The NSAs shall be responsible for the elaboration,** at national or functional airspace block (FAB) level**, of the performance plans, the performance oversight and for the monitoring of performance plans and targets.** EU Member States should therefore ensure that they are in a position to effectively carry out these additional responsibilities.
- The Commission proposes the European Union-wide performance targets to the Member States in the Single Sky Committee as per the procedure referred to in Article 5(3) of Regulation (EC) No 549/2004 following consultations with the authorities, organisations and other stakeholders concerned. This means that the proposed targets are subject to **approval via qualified majority voting of the Member States**.
- Key performance indicators should be specific and measurable and allow for the allocation of responsibility for achieving the performance targets. The associated **targets should be achievable, realistic and timely** with the aim to effectively steer the sustainable performance of air navigation services
- The European Commission designates the **Performance Review Body (PRB**) for a fixed term (e.g. 5 years) to assist it in the implementation of the performance scheme.

The performance scheme allows for targets to be revised on the basis of changes to the evidence base for targets (e.g. factual or assumption changes). A further important tool is that of on-going monitoring by NSAs, supported by alert mechanisms that can lead to focused corrective action during the reference period.

The implementation and operation of the performance scheme is realised in reference periods. The first reference period (RP1) ran from 2012 to 2014 inclusive. The second reference period (RP2) runs for five calendar years, from 2015 to 2019 inclusive.

EU Charging Scheme implemented in 2006

The common Charging Scheme has been implemented via the adoption of Commission Regulation (EC) No 1794/2006 of 6 December **2006**. The Regulation is designed to encourage the safe, efficient and effective provision

of air navigation services to the users that finance the system and to promote integrated service provision. It pursues the overall objective of improving the cost efficiency of air navigation systems in Europe. It is designed to ensure transparency and consultation on how such costs are calculated and split between the various services. The key principle continued to be full cost recovery, meaning that service providers are allowed to charge their full costs to airspace users. It introduced provisions regarding terminal charges. In order to translate the financial consequences of the performance scheme into the charging scheme, Regulation 1794/2006 was amended by Regulation 1191/2010. The scheme was revised in 2013, as described below.

The second set of Regulations

The Regulations 691/2010 and 1794/2010 were replaced by Regulations 390/2013 and 391/2013. The main changes introduced by Regulation 390/2013 are as follows:

- The requirement to develop a performance plan is now also applicable to the execution of network functions (the Network Manager) rather than only to ANSPs.
- Regulation 691/2010 contained a provision that Member States were allowed to impose incentive schemes on airspace users. This has been replaced by an article that allows member states to modulate charges, further outlined in Regulation 391/2013.
- A revision of the environment KPI and the introduction of additional performance indicators (e.g. Just Culture as indicator for local level).

The specific means by which the charging scheme complements the performance scheme are captured in the following articles:

- Article 13. Unit charges are based on forecast costs divided by forecast en-route service units, with certain adjustments and carry-overs allowable from year to year. Errors in forecasting versus actual service units in year 'n' are subject to banded adjustments in year 'n+2', with no adjustments allowable where the forecast error is less than 2% ('Article 13 Traffic Risk Sharing'). Under this arrangement, the costs or benefits that arise when the traffic handled is significantly lower or higher than anticipated are shared with airspace users. In this way, risk is spread more evenly along the aviation supply chain.
- Article 14. Costs are distinguished between those included in the scheme ('determined') and those not. For example, where certain services are provided subject to market conditions, the scheme allows these to be excluded from the calculation of determined costs. Similarly to traffic risk sharing, Article 14 'Cost sharing' makes provisions for the determined costs to be adjusted during the reference period where these are unforeseen, but otherwise over the period cost increases are borne or decreases are retained by the ANSP (or Member State or other entity).
- Article 15. Member States are empowered to apply financial incentives for ANSPs in the key performance areas of capacity and environment. The incentives comprise bonuses for exceeding targets and penalties for under-achieving targets. Incentives are implemented by adjustments to the adopted determined costs in year 'n+2' in relation to the

performance in year ‘n’, with a maximum amount of +/- 1% of revenue adjustments (of year ‘n’).

- Article 16. Member States can also modulate charges incurred by airspace users to improve performance. This is with particular reference to optimising the use of air navigation services, reducing the environmental impact of flying and reducing the overall costs of ANS and their efficiency. The charges modulation does not change the overall revenue, but provides a financial tool for ANSPs to improve capacity or flight efficiency. The modulation also applies to accelerate the deployment of SESAR ATM capabilities.

The different actors involved

The performance scheme outlines the responsibilities of the Member States, NSAs, ANSPs, the Commission and the PRB, respectively. The impact and effectiveness of the scheme is strongly influenced by how effectively these actors are able to carry out their responsibilities. Their particular roles are defined broadly as follows:

- Member States are responsible for the adoption of the scheme and the performance plans at national/FAB level and for the effectiveness of their respective NSA (i.e. by providing adequate resources and capabilities).
- National Supervisory Authorities (NSAs), oversee the implementation of the performance scheme. They are responsible for drawing up the performance plans, carrying out performance oversight and monitoring implementation. They have a particular responsibility to ensure incentive schemes (Art. 15) and charges modulation (Art. 16) are properly implemented. In RP1, Performance Plans were at State Level with at national or FAB level, but 390(2013) now requires performance plans to be at FAB level.
- The Single Sky Committee (SSC) comprises Member States’ representatives and observers. It exercises the role of controlling implementing power given from the Parliament and the Council to the Commission and decides on the final targets adopted by qualified majority voting.
- The Commission has an overall oversight role for the regulations in addition to being responsible for adopting Union-wide performance targets in consultation with the Network Manager, NSAs and stakeholders. The Commission relies on independent advice from the Performance Review Body, in particular in target setting and acceptance of performance plans. The Commission also coordinates with EASA to ensure that safety aspects of the performance scheme are properly addressed and that the safety KPIs are in line with the European Aviation Safety Programme.
- The Performance Review Body is charged with providing independent advice to the Commission on the performance of air navigation services and network functions. The PRB also serves NSAs, providing an independent review of performance plans (analysis, benchmarking) and target setting (see below).
- The Performance Review Unit of Eurocontrol is contracted by the European Commission to support the PRB.

- ANSPs, who ultimately deliver the expected improvement in performance, also contribute to the NSAs' development of performance plans.
- The Network Manager both supports the Commission and FABs in network level performance considerations as well as develops its own Network Performance Plan.
- Air transport operators have a data provision requirement and are also consulted in the target setting process.
- Airport operators have a data provision requirement.
- Airport coordinators have a data provision requirement (on slot coordination).

The Performance Review Body

- Article 11.2 of Regulation 549/2004 already indicated that the Commission may designate an impartial and competent body to act as a 'performance review body'. With the introduction of the EU Performance and Charging Scheme, a Performance Review Body (PRB) was established. Regulation 390/2013 states: *the Commission may be assisted in implementing the performance scheme by a Performance Review Body. This body should be able to give independent advice to the Commission in all areas that influence the performance of air navigation services and network functions*. The chairman and currently 12 members of the PRB are appointed by the Commission. In 2010, the Commission designated the Performance Review Commission (PRC) of Eurocontrol as the PRB. In 2014, this designation was temporarily extended until the end of 2016. The 12 members of the PRB and PRC are de facto the same persons. The PRB is supported by the Performance Review Unit (PRU) of Eurocontrol, under a contract between the Commission and Eurocontrol, which is funded from the EU budget. The Commission has recently launched a call for tender regarding the future support to the PRB.

- The PRB produces regular reports including on the monitoring of performance achievements during the reference period. The PRB also provides advice to the Commission on the setting of union-wide performance targets as well as on the assessment of performance plans. The designated tasks of the PRB are specified in Article 3 of Regulation 390/2013.

Indicators and union-wide targets

The table below gives an overview of the Key Performance Indicators (KPIs) and Performance Indicators (PIs) that are used per KPA, as well as the targets that were set under RP1 and RP2 for the various KPAs. In the table:

- KPIs already in place during RP1 are indicated in '**blue and bold**'
- KPIs introduced only in RP2 are indicated in 'blue'
- PIs (indicators that only had a reporting requirement, but no target) are indicated in 'black'.

The **safety KPA** only had reporting requirements during RP1 for the following categories:

- Effectiveness of Safety Management (EoSM) of Member States and their air navigation service providers – which is a judgement based on questionnaire inputs.
- Application of the severity classification based on the Risk Analysis Tool (RAT) methodology to the reporting of, as a minimum, Separation Minima Infringements (SMI); Runway Incursions (RI); and ATM-specific occurrences (ATM-S) at all Air Traffic Service Units.
- Reporting by Member States and their air navigation service providers on the level of presence and corresponding level of absence of Just Culture (JC).

From RP2 onwards, targets for EoSM and application of the RAT are set to be met for 2017 and 2019.

The **capacity KPA** had 'enroute Air Traffic Flow Management (ATFM) delay per flight' as its KPI during RP1, where a target was set to be met by 2014. Reporting requirements were set for 'arrival ATFM delay per flight'.

For the **environment KPA**, the horizontal efficiency of the planned trajectory of a flight was taken as the KPI during RP1, for which targets were set to be met in 2014. In RP2, the horizontal efficiency of the actual trajectory is added as a KPI for which a target is set.

Finally, the **cost-efficiency KPA** has the Determined Unit Rate (DUR) for enroute Air Navigation Services (ANS) as its KPI, where targets were set for each year during RP1, finally targeting a DUR of 53.92 EUR_{2009} in 2014.

Table 2.1 KPIs and targets

KPA	Indicators	RP1	RP2
Safety	Minimum Level of EoSM Application of RAT to SMI RI ATM-S Application of Just Culture	No Union-wide targets on safety	Union-wide targets are set at achieving high levels of effectiveness of safety management and full application of the severity classification based on the RAT methodology by 2019. No targets are set for just culture.
Capacity	En-route ATFM delay per flight Arrival ATFM delay per flight	The en-route ATFM delay is 0,5 minute per flight for the whole year 2014	The en-route ATFM delay is 0,5 minutes per flight for each year
Environment	Horizontal efficiency – last filed (KEP) Horizontal efficiency – actual trajectory* [Additional time in taxi-out]* [Additional time in ASMA]*	Reduction of -0,75% of the route extension in 2014 compared to 2009	Reduction of the average horizontal en-route flight inefficiency for the last filed flight plan trajectory to 4,1% and for the actual trajectory to 2,6%
Cost-efficiency	DUR for en-route ANS DUR for Terminal ANS**	Reduction of the average EU-wide determined unit rate for en-route ANS from € 59,97 in 2011 to € 53,92 in 2014 (expressed in real terms per service unit, Euro2009), with intermediate annual values of € 57,88 in 2012 and € 55,87 in 2013	Reduction of the average EU-wide determined unit rate for en-route ANS from € 56,64 for 2015, € 54,95 for 2016, € 52,98 for 2017, € 51,00 for 2018, and € 49,10 for 2019 (expressed in real terms per service unit, Euro2009)

* These indicators were included as Capacity Performance Indicators in Regulation 691/2010, but have been moved to Environment in Regulation 390/2013.

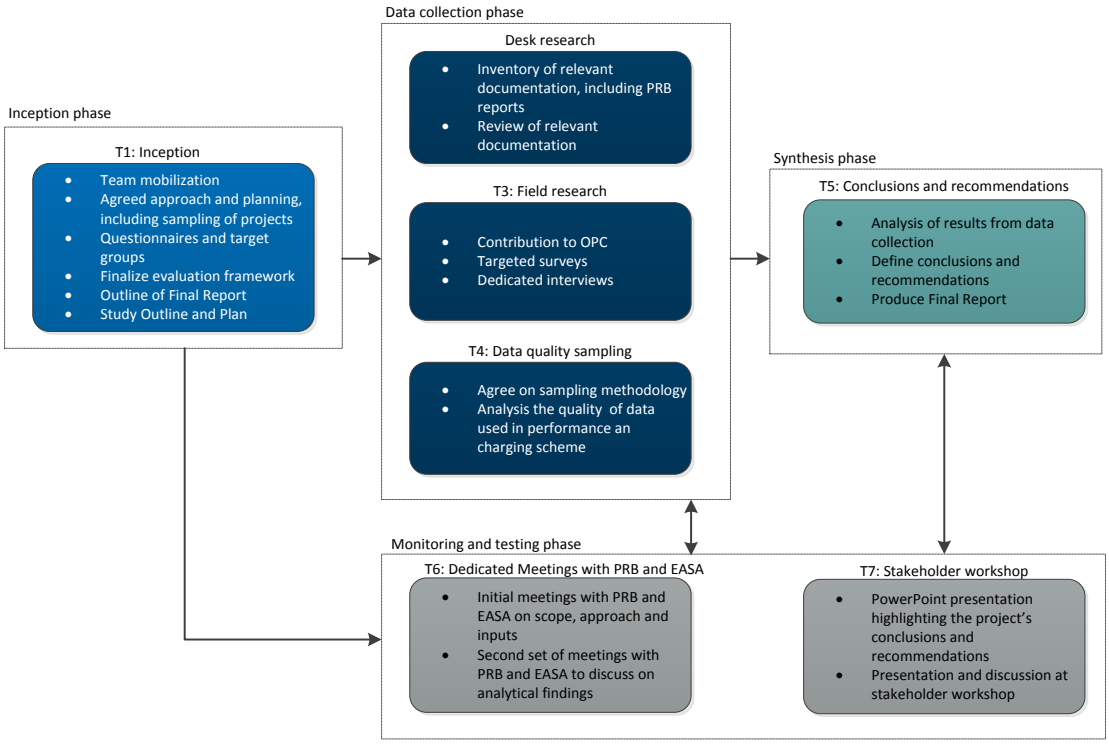
** the indicator for terminal ANS costs applies only from the beginning of the third year of RP2 according to Regulation 390/2013.

3 METHODOLOGICAL ASPECTS

3.1 Methodological approach

The methodological approach to this evaluation is based on a combination of desk research, stakeholder consultation and validation exercises with the PRB, EASA and other relevant stakeholders. The approach is divided into 7 principal tasks as included in the ToR and presented in Figure 2.

Figure 2 Methodological approach



Source: Ecorys.

A key objective of this evaluation study was to go beyond the collection and verification of the data that has been published by the PRB and Eurocontrol etc. This data, which was scrutinised and collected during the desk research activities, provided a starting point for the evaluation. The study went beyond what is formally collected in order to identify if, in fact, the indicators and related targets are the correct ones to measure the performance objectives in question. The study also addressed whether stakeholders perceive any deficiencies to the current operation of the schemes; to this end the stakeholder consultations were an important input.

The consultation process was constituted by three parallel activities: (1) the Open Public Consultation, (2) the targeted stakeholder survey, and (3) the stakeholder interviews:

- The Open Public Consultation (OPC), which was primarily used as secondary evidence of stakeholders' opinions, ran for three months from 7 June 2016 to 4 September 2016. In total, 48 stakeholders responded to the OPC. The largest respondent group was ANSPs (19 respondents),

followed by NSAs and airspace users (8 respondents each), ministries (3 respondents), trade unions and airport operators (2 respondents each); the remaining groups, each with 1 respondent, were academic institutions, a FAB-ANSP representative and an NGO.

- The targeted survey was used to collect more detailed information, for example on costs, which could not be easily included in the OPC, from a wide range of a relatively large group of stakeholders. Four targeted surveys were developed and distributed to the following groups: NSAs, ANSPs, Airspace Users, and Other. The 'other' group included respondents from academic institutions, airport operators and the Network Manager, trade union / staff professional associations. The survey ran from 7 July 2016 to 4 September 2016. In total, 76 individual responses were received from the targeted survey. The largest group was NSAs (24 respondents), followed by ANSPs (23 respondents) and Ministries (13 respondents); the remaining categories each accounted for 4 or less respondents.

- Stakeholder interviews were used to complement the survey and acquire in-depth understanding on the key items identified and the desk research. Interviews were conducted with the following groups of stakeholders:
  - ANSPs: 6 (including 1 representative organisation)
  - NSAs and Ministries: 7 (including 1 NSA Coordination Platform)
  - Airspace users: 4 (1 individual, 3 representative bodies)
  - Staff representative organisations: 3
  - Manufacturing industry: 1
  - PRB: 1
  - EASA: 1
  - PRU: 3 meetings / mini-workshops were conducted on data quality.

- The topics covered included:
  - Topical coverage, using interviews for those areas where information gap plugging or verification is most needed;
  - Coverage of stakeholders from all seven categories;
  - Geographic spread across Europe;
  - Mix of association and individual stakeholder level.

For the testing and validation activities, the study team organised two stakeholder workshops: One was arranged with the PRB and EASA, and a second with a wider set of stakeholders. These meetings were organised on 10 and 17 November 2016, respectively.

3.2 Evaluation criteria and questions

The evaluation concentrates on the evaluation criteria outlined in the ToR, defined as follows:

- The relevance of Regulations 390&391/2013, i.e. the extent to which intervention's objectives are pertinent to the needs, problems and issues to be addressed.

- The effectiveness of Regulation 390&391/2013, i.e. the extent to which set objectives are achieved. This includes the PRB set-up and the data quality of data submitted in the frame of the regulations.
- The efficiency of Regulation 390&391/2013, i.e. the extent to which desired effects are achieved at a reasonable cost.
- The coherence of Regulation 390&391/2013, i.e. the extent to which the intervention logic is non-contradictory and/or Regulation 390&391/2013 does not contradict other interventions with similar objectives.
- The European Added Value of Regulation 390&391/2013, i.e. the value resulting from Regulation 390&391/2013, which is additional to the value that would have been otherwise created by Member State action alone.
- The Sustainability of Regulation 390&391/2013, i.e. the extent to which the Regulations are expect to result in effects that last in time and over several reference periods and to interdependencies between key performance areas and reference periods.
- The Acceptability of Regulation 390&391/2013, i.e. the extent to which schemes are accepted by stakeholders and the public.
- The Equity of Regulation 390&391/2013, i.e. the extent to which the Regulations lead to distributional effects across stakeholders and regions.

Based on these evaluation criteria, the ToR further outlined 21 main evaluation questions. These evaluation questions are incorporated in the evaluation framework (see section 3.3 for description), the final analysis of which is included in Part II of this report.

3.3 Evaluation framework

The evaluation framework is developed to evaluate Regulation 390&391/2013 on the basis of critical, evidence-based judgement. This evaluation framework consists of the following components:

1. What do we measure? This part starts with the evaluation questions as presented in the ToR. Where useful, the evaluation questions are further broken down into sub-questions to come to an understanding of what exactly should be measured when answering each individual question.
2. How do we measure? This part defines how we measure the information that is required to answer the evaluation questions. In a first step, we defined the relevant indicator(s) per evaluation question, together with the anticipated source for collecting the information in question. In addition to the indicator, additional inputs for the evaluation were included, together with sources. Additional inputs were derived from literature, legal documents, questionnaires, stakeholder consultation, interview minutes and workshops. These additional inputs were used to either complement the results of the indicators or provide an alternative basis for assessment in case the indicator(s) provide too limited or no information.
3. Methodological basis - how to respond to the evaluation question? This part explains how the indicator(s) and additional information collected enabled the study team to respond to the evaluation question. In this

section, the limitations of the indicator(s) and additional inputs are also noted.

The evaluation framework enabled the study team to iteratively refine our understanding of the evaluation questions and to define and link the necessary inputs and indicators to each evaluation question. It also served as guidance for the data collection and analysis process. In the final stage of the evaluation, the evaluation framework served as guidance for the study team's review of the evidence basis for answering each of the evaluation questions. The final evaluation framework is provided in Annex 2; the resulting final analysis is presented per question in Part II to this report.

3.4 Data

Two main data streams were used during the desk research activities of the evaluation of Regulation 390/2013 and 391/2013. These are the annual PRB Monitoring Reports (Volumes 1-4) and the Annual Performance Review Reports (PRR) of the PRC. The former provided the underlying quantitative data for analysing the effectiveness of the Performance and Charging Schemes, while the latter provided information to set the baseline scenario.

The issue of data quality is treated as a distinct point of analysis within the evaluation. This is analysed in Chapter 6 to this report.

3.5 Limitations of the evaluation

3.5.1 Attribution challenge

A major challenge in any evaluation is to determine the extent to which we can attribute observed changes to a given policy or intervention, or whether the change would have occurred in the absence of the intervention. This challenge also applies to the evaluation of the SES performance and charging schemes, particularly to the attribution of observed changes in safety, environment, capacity and cost efficiency performance to the Regulations.

To address the attribution challenge, the study has followed a counterfactual approach to establish a sound baseline scenario across the four defined KPAs. A key difficulty remains in defining a credible approximation to what would have occurred in the absence of the intervention, as this requires extensive data sets on policy outcomes collected before and after the intervention. Given the limited availability of such data sets, the study focuses on a limited number of indicators to make an estimation of a 'business as usual' scenario in a continuation of the pre-RP1 baseline (i.e. 2009 – 2012 performance data). This is then compared with the actual performance outcomes during RP1.

In order to avoid giving a causal interpretation to observed differences that are due to factors beyond the SES performance and charging schemes, it is necessary to identify the extent to which the ANSPs implemented concrete actions to realise the respective performance targets. To this end, the

targeted surveys and interview guides included specific questions aimed at identifying the actions taken by relevant actors in association with identified changes in any of the four KPAs throughout the implementation of the Performance Scheme.

This two-fold approach to approximating a counterfactual scenario and isolating changes that may have resulted due to other initiatives, rather than the Performance Scheme, enables the study team to conclude that the EU performance and charging schemes overall resulted in increased performance in EU ATM/ANS. However, given the limitations to data availability as mentioned above, it is not possible to conclude the strength of the causal link with any degree of certainty, in particular vis-à-vis capacity and cost efficiency. The specific limitations to the individual findings per KPA are highlighted under the relevant evaluation question analysis in Chapter 4.

3.5.2 Gaps in evidence base for evaluation questions

The study team reviewed the evidence basis for answering the evaluation questions in IR2 and concluded that overall, there is sufficient information to carry out the analysis for the different evaluation criteria. Nevertheless, beyond the attribution challenge, a number of data gaps persist, which create some limitations on the evaluation analysis. These are elaborated in the following paragraphs.

For the evaluation of cost-efficiency performance, the study does not take into account the first year of RP2 (2015) as this data has not yet been published. This is more an issue of scoping than a limitation to the evaluation, but it is worth mentioning here.

For the evaluation of efficiency, the study team noted a data deficiency in the area of costs of the schemes for stakeholders that would be required to answer the evaluation questions on efficiency. The quantitative question in the targeted survey concerning the FTE involved to implement the scheme was poorly answered (3 ANSPs and 3 NSAs), and in many cases only qualitatively. On the basis of the survey responses, the study team was able to make an average approximation of costs incurred by NSAs and ANSPs in terms of estimated increase in FTE to deal with the performance and charging schemes. The estimates were subsequently discussed and verified during the stakeholder workshop. A similar approach was used to estimate and validate the additional effort required by airspace users and other stakeholders. These estimates must therefore be treated as an average approximation.

Evaluation question 14 is whether all Member States implemented the SES schemes in a coherent and satisfactory manner. The information collection process was not tuned to make an assessment per member state on the exact implementation of the schemes (e.g. as in an audit), as we indicated in our inception report. However, relevant aspects for assessing the implementation of the schemes within Member States are the actions taken by national authorities in the event that the performance of ANSPs is deemed insufficient. It can be noted that the collection of evidence on the effectiveness of such actions is somewhat constrained by the fact that the timescales of such

interactions are as long as RP1 itself, and effects may not yet have materialised. Notwithstanding these data limitations, the data collected via the field research as reported in the IR 2 is considered to provide a sufficient sampling basis to review if there are major discrepancies between Member States on implementation of the schemes and additionally to exemplify cases on incoherent or unsatisfactory implementation. Based on these two streams we are able to provide a substantiated answer to this evaluation question on the implementation of the schemes within Member States.

Finally, the evaluation of EU added value is constrained by the ability (or lack thereof) to make an exact attribution of the effects of the performance and charging scheme compared to a situation of absence of the performance and charging scheme, as discussed in Chapter 3.5.1 above. This is further complicated by the fact that, based on the feedback received via the targeted survey, OPC and stakeholder interviews, stakeholders hold rather opposing views on the EU added value. These issues and potential limitations are explored in Chapter 10 of this report.

PART II – ANALYSIS

4 EFFECTIVENESS

This section can be broken down in 5 main parts: 4 concerning the effectiveness per KPA and 1 concerning the effectiveness of the Performance and Charging Schemes overall. Below, we first present the answers to the evaluation questions that relate to the KPAs, and then, on the basis of this, provide and substantiate our evaluation of the effectiveness of the scheme in general.

4.1 EQ 1a Effect on Capacity

1.a. What is the effect on capacity that has been achieved during RP1?

Answer to evaluation question

The main conclusion is that capacity within the Single European Sky area has increased over RP1-2 (2012-2015).

Table 4.1 EU-level delay performance

En-route ATFM delay per flight (minutes)	RP1			RP2
	2012	2013	2014	2015
Target	To be reached by end 2014:		0.50	0.50
Achieved	0.63	0.54	0.61	0.76
Difference (Achieved – Target)	0.13	0.05	0.11	0.26

Source: PRU Performance Dashboard[9]

Prior to RP1, the period 2004-2011 saw average enroute delay per flight at 1.2 min/flight but subsequently the average during RP1-2 (2012-2015) was 0.6 min/flight. There have been no other obvious causal factors and we note that sector productivity does not appear to have improved much[10], so the main impact on capacity appears to be ANSPs investing in capacity ahead of demand.

Prior to RP1, ANSPs may have been motivated in part by the benchmarking data published by the PRC in PRR reports. However, this is not likely to have caused such a distinct change in performance over RP1. I.e. the primary motivation for improved delay performance is likely to be the performance scheme. We therefore attribute this difference in performance of ~0.6min/flight as being the impact of the performance scheme, noting that the actual EU performance target was not met.

The PRB also commented that ATFM delay is not currently a key issue for airlines, with IATA content with current delay performance, albeit that further work is required on airport delay. This may reflect the issue that ATC delay is

[9] http://www.eurocontrol.int/prudata/dashboard/eur_view_2014.html.

[10] The study examined the changes in capacity, flights and sector productivity for 8 ACCs: Nicosia, Lisboa, Skyguide, Zagreb, Bordeaux, Marseille, Langen, Warszawa and Barcelona. Over the period 2011-15 the capacity of these ACCs typically varied by < 10% against traffic changes of 5-10%. Changes to sector productivity over the period 2011-2014 were ~0 to 5%. Only Zagreb and Lisbon showed any appreciable increase in sector productivity.

at most 25% of 'All causes delay', and enroute delay less than half of this (airport and weather related contributing more than half). We also note that delay is increasing in the second year of RP2, and may be a greater focus for airspace users if not brought under control for the remainder of the period.

Main conclusion Desk research

Whilst the target has not been met, there has still been a distinct improvement in delay performance.

Subconclusions Desk research

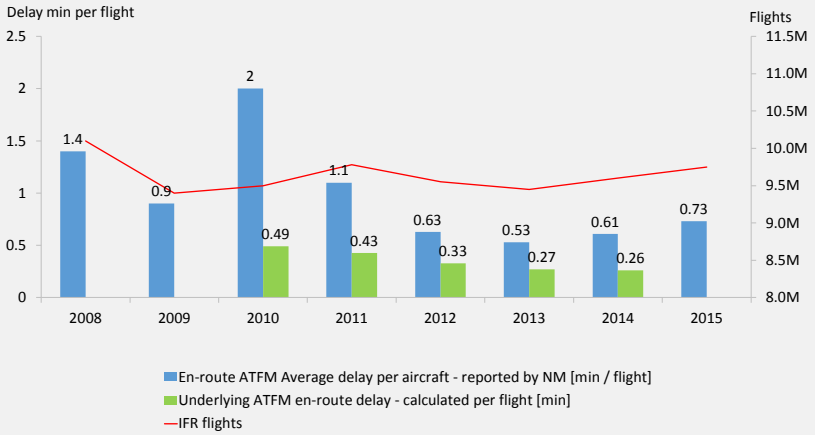
At Union-level

1. From the PRB's calculations the target of 0.5 min/flight should have been attainable throughout 2012-2015 as they allowed additional headroom of 0.09min/flight. Whilst the target was nearly met in 2014, since then delay has increased, as has traffic over the same period. NB, the target of 0.5min/flight assumes is built from the following components:[11]

	min/flight
Cost-optimum capacity	0.18
Allowances for severe weather	0.14
Network disruptions	0.09
Total	41
Rounded to	0.50

To explore the effects of those underperforming we have made an estimate of underlying delay by substituting, at the ACC level, high delay values with the minimum delay achieved in the preceding 2 years. I.e. the assumption is that if a lower delay has been achieved in previous years by an ACC, the delay should have been feasible in subsequent years. This is a simplification of what is a complex network environment, particularly when there is traffic volatility due to geo-political factors, but serves to exclude the effects of short term problems with capacity and staff and give an indication of what might be achievable.

Figure 3 Study team estimate of underlying delay



The figure shows that our estimate of underlying delay is within the range 0.26 – 0.49 min per flight. We believe this illustrates the high impact of the minority of States that underachieve and supports the PRB's target setting of 0.5min/flight.

[11] PRB, 'EU-wide targets for RP2 indicative performance ranges for consultation', Feb 2013.

2. The reasons for the delay target not being met are down to a small number of ANSPs which dominate the shortfall in performance. During 2012-15 there were 12 exceptions where the ANSP or FAB level plan was not achieved. These issues mainly concern BLUEMED (Cyprus, Greece), FABEC (France) and SW FAB (Portugal). All other ANSPs met or exceeded the capacity target. All other entities met or exceeded their plans.

Table 4.2 Exceptions to planned delay performance (2012-2015)

				ATFM delay per flight (min)		
Year	ANSP/ FAB	Total flights	En-route ATFM delay (min)	Plan	Actual	Actual - Plan
2012	NAV Portugal (Continental)	435700	281190	0.25	0.65	0.40
2012	Avinor	590204	163624	0.04	0.28	0.24
2013	DCAC Cyprus	277397	599553	1.70	2.16	0.46
2013	NAV Portugal (Continental)	446709	121001	0.20	0.27	0.07
2014	FABEC	5512253	3078951	0.50	0.56	0.06
2014	DCAC Cyprus	304328	581283	1.00	1.91	0.91
2014	PANSA	690554	547357	0.48	0.79	0.31
2014	NAV Portugal (Continental)	477295	239504	0.15	0.50	0.35
2014	Finavia	229263	27510	0.02	0.12	0.10
2015	FABEC	5666716	3920847	0.48	0.69	0.21
2015	BLUE MED FAB	2326841	1481562	0.35	0.64	0.29
2015	SW FAB	1781608	821479	0.30	0.46	0.16

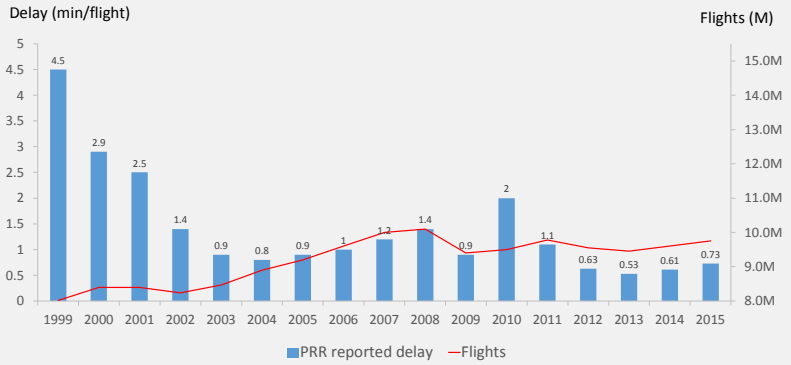
3. The main causes of exceedance of delay targets (from those States that did so) is due to 'capacity' (e.g. system related) and 'staffing' problems, with problems evident in Cyprus, France, Greece and Portugal.

4. Delay is correlated to traffic. Since 2008 annual en-route delay mostly rises and falls with demand. The study has correlated ACC delay against flights over the years 2008-2014 (source: PRB dashboard) from[12] and found a statistically significant correlation ($R = 0.82$ and a p value < 0.01 for a sample size of 287 data pairs – i.e. less than 1% chance that the correlation is random.). Delay is also predominantly driven by the higher demand in the summer season. PRR 2015 shows average daily flights ranging from ~21,000 (January) to ~31,000 (August), or an approximate 50% variation in seasonal demand. The dominant impact on delay

[12] The source of ACC data was the PRB's online dashboard.

exceeding the 0.5min/flight target typically occurs in the summer months, June-August.

Figure 4 Evolution of delay (EUROCONTROL PRR data)



5. The en-route ATFM delay is 5% - 13% of the all-causes delay. Additional ANS attributable delays (airports, weather effects) make ANS delay around 25% of total delay.
6. Airline all-causes delay is a different source for delay measurement, based on airline reports collated by CODA, but also appears to follow a similar trend as ATFM delay. This signals similar issues in demand-capacity balancing as traffic grows and also shared challenges with traffic volatility between airspace users and ANSPs.
7. Airline reported ATFM delay is lower than that measured by the Network Manager. Whilst the Network Manager measures ATFM delay only, airlines may attribute a delay to ATFM and other causes, such as a delay in boarding. For example, the ATFM delay may be 45min, but the airline records a 20min delay from another cause. The result is the Network Manager reporting an ATFM delay of 45min and the airline reporting 25min.
8. A comparison with US data is inconclusive, as delay is managed differently in the US. However, we note that there is a similar correlation between delay and traffic.
9. The second capacity KPI is the Airport ATFM arrival delay per flight (min/arrival). This applies from RP2 onwards and is defined as the average minutes of arrival ATFM delay per flight attributable to terminal and airport air navigation services and caused by landing restrictions at the destination airport. The 2015 performance was 0.64 min/flight, with notable under-performance compared to that planned for: Switzerland (0.43min/flight planned. 2.48 actual), the Netherlands (2 min/flight planned, actual 2.91) and Finland. These values are highlighted in bold in the table below.

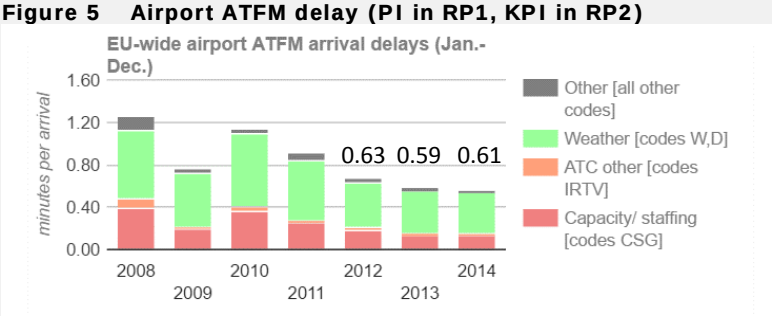
Table 4.3 2015 Under-performance on Airport ATFM arrival delay per flight (min/arrival)

State	# airports	Plan (annual)	Actual	Difference	FLTS [ARR]	Airport arr. [total]	ATFM delay
Switzerland	2	0.43	2.48	2.05	219,731	543,977	
Netherlands	4	2	2.91	0.91	253,097	735,638	
Finland	1	0.13	0.55	0.42	84,595	46,87	
United Kingdom	9	0.87	0.95	0.08	790,376	748,54	
Bulgaria	1	0	0	0	21,702	0	

All other States report differences of zero (Estonia, Lithuania, Portugal, Romania, Slovakia, Slovenia) or below target (Croatia, Ireland, Latvia, Hungary, Denmark, Malta, Spain, Czech Republic, Norway, France, Sweden, Germany, Italy, Luxembourg, Austria, Belgium, Cyprus, Greece, Poland).

To compare the 2015 figure (0.64min/flight) against preceding years the performance dashboard data is shown in the following figure:

Figure 5 Airport ATFM delay (PI in RP1, KPI in RP2)



10. The importance of the work of the Network Manager, whilst not being a focus for this study, should not be underestimated. The Network Manager plays a particular role in demand-capacity balancing, amongst other things: it identifies shortfalls in capacity in the network and advises ANSPs on capacity requirements to meet the delay targets; it coordinates collaborative decision making to minimise the impact of disruptions at the network level; it provides tools to reduce the need to apply regulations etc. The Network Manager estimates its overall impact to lead to a reduction of delay of ~10%. This effect is difficult to isolate however, as the Network Manager services are enacted by ANSPs through its direct and indirect support to them. We note that in some cases where the Network Manager has identified capacity needs, these are not delivered by ANSPs, with consequential poor delay performance.

At national level (with regard to NPP targets)

- As mentioned above, over 2012-15, most States met or exceeded their performance targets, but just 8 States dominated the delay figures leading to the EU target not being met: NAV Portugal (Continental); Avinor; DCAC Cyprus; France; PANSA; Finavia; Greece; and Cyprus.

Main conclusion Field research

The majority (83%) of respondents judged that the achievements in the capacity KPI during RP1 and the first year of RP2 to be either in line or greater than expectation, although airspace users judged that the achievements were lower than expectation. Noting that the indicator is a measure of delay, the majority of respondents also believe that the schemes 'somewhat improved' actual capacity. Surprisingly, airspace users tended to believe that there was some improvement in the capacity whereas many ANSPs responded that there was no impact in actual capacity. (The latter point may be interpreted that ANSPs see gains as better ATFCM rather than capacity improvements.)

The en-route delay KPI is the 'right one', with some comments received on its definition and use. To quote: The capacity KPIs are "understandable metrics,

the source is sound and there are procedures in place to increase the reliability and consistency of the data."

Arrival ATFM delay was also generally seen as being an acceptable indicator, but there was less support for ASMA and additional time in taxi-out (N.B. these indicators are included in capacity in RP1 and environment in RP2). The reduced support for these indicators reflects concerns about how they are measured and that they are not fully controllable by ANSPs.

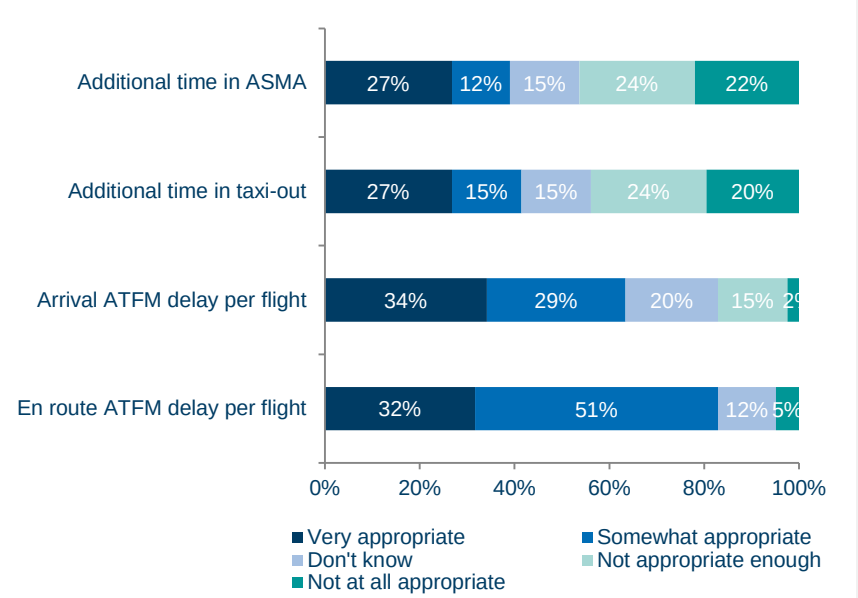
There was believed to be an under-investment in capacity in RP1 that has an impact on users that has not been appropriately evaluated and no mitigation is planned for RP2.

Subconclusions Field research

Suitability of indicators – could be used for acceptability of the scheme

En-route and arrival delay indicators are acceptable indicators to stakeholders, with less support for additional time in ASMA and taxi-out, as indicated by the stakeholder survey responses to the question on "the appropriateness of the Capacity KPIs":

Figure 6 Appropriateness of KPI and PIs in the KPA of Capacity (N=41)



Time spent in ASMA and taxi-out have been criticised for lack of maturity, but this may reflect that they are relatively new indicators and the effort required in generating them has not been rewarded by the insight that they were intended to deliver. At a meeting with the PRB the study was informed of unpublished work which shows the time in taxi-out indicator is already showing the impact of A-CDM on airport operations. – our conclusion is that both indicators should be allowed to run further.

A related concern from the consultations is that these indicators are not fully controllable by ANSPs. This concern affects other indicators but may be a moot point, in that the intention is for ANSPs to focus on elements within their control, such as by implementing CDM processes. To attempt to make the indicator more precisely reflective of ANSP control could introduce complexity, which ANSPs also want to see reduced.

This concern was particularly raised against the taxi-out indicator and to some

extent the ASMA indicator. The PRB views the use of these indicators as extending the coverage of delay performance assessment to other areas where ANSPs have an impact. I.e. the intent is not to make ANSPs manage the whole delay but their contribution to it. It is already widely recognised that ANS delay is a fraction of all-causes delay. Accepting that reactionary delays are difficult to assign, the wider management of different types of delay should encourage an overall reduction in delays.

The ASMA and taxi-out indicators have been criticised for being complex. Both are similar in that they compare the time taken for a movement between two points against a reference value. The reference value reflects the 'unimpeded' time. The intent is that changes over the course of a year should reflect changes in performance rather than, e.g. infrastructure changes, meteorological conditions (primarily wind in ASMA). The reference value is calculated from historic data and updated monthly if there are practical reasons for doing so, such as a change in airport layout. Our view is that this is less an issue of complexity and more to do with a lack of familiarity with the indicator and a lack of strong consensus on the calculation details.

Alternative indicators

The stakeholder consultation mostly gave proposals for refinement of indicators and the target setting process rather than alternative indicators. Proposals for new indicators were:

- % of flights delayed by > 15'/20', taking into account peak vs normal operations. It was noted that monitoring of the average delays hides the extremes, which cause most of the airspace user problems.
- Weighted delay performance indicators. For example, the UK has introduced additional metrics to the performance scheme, such as metrics that place greater weight on long delays and operationally critical departures in the morning.

On the existing indicators respondents also proposed:

- Presenting indicators differently, such as according to: delay attribution; length of delay; in respect of weekly or seasonal peaks. It was also commented that additional time in ASMA should be linked to the Environment KPA rather than capacity.
- Change the approach to target setting: include other airspace users and military; define traffic dependent capacity targets to account for traffic volatility; and add buffers to targets (we note that there effectively is a buffer of 0.09min/flight).
- Make the indicator calculations transparent. Whilst there are published methods from the Performance Dashboards, this does not include all details, so this is a useful recommendation to help ANSPs track their own performance, although the risk is that small errors will occur and the process will become caught up in minutiae.

Impacts of scheme on capacity

There is a general view that there is an interdependency between the capacity target and the cost-effectiveness target, and that the Cost-Efficiency KPA has put pressure on staffing and in turn on capacity.

Due to short term volatility in traffic levels and shifts in traffic patterns ANSPs have found it challenging to provide optimal capacity levels.

Airspace users were particularly concerned about the impact of strikes, but less so on the normal level of ATC capacity, which on average causes ~25% of the total delay that airspace users experience.

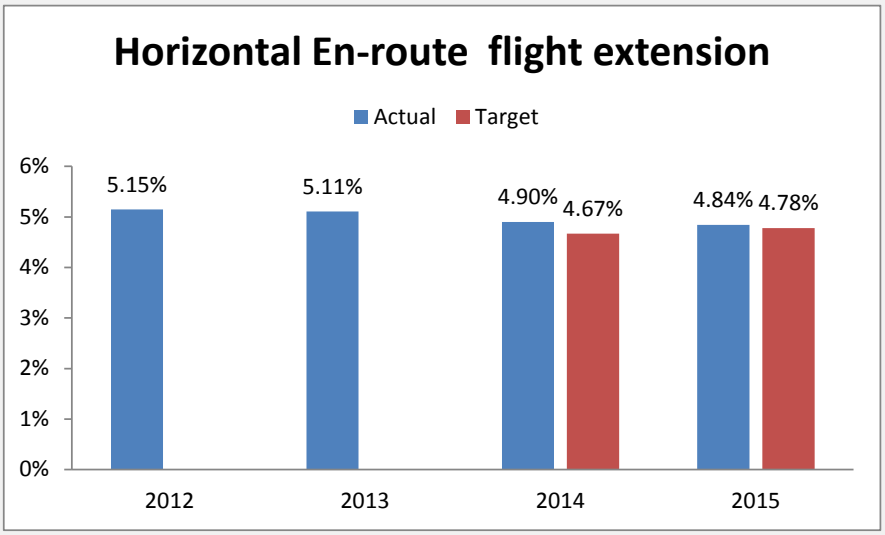
4.2 EQ 1b Effect on Environment

1b. What is the effect on environment that has been achieved during RP1?

Answer to evaluation question

The conclusion is that the en-route horizontal flight efficiency within the Single European Sky area has increased over RP1. This finding is based on the achieved numbers on the KPI for the
average horizontal en-route flight efficiency of last filed flight plan trajectory (KEP) over the period between 2012 and 2014: the flight extension has decreased from 5.15% in 2012 to 4.90% in 2014, with an intermediate value of 5.11% in 2013 and a subsequent value of 4.84% in 2015 (see Annual PRB monitoring reports, 2012-2015).

Figure 7 Realisation of en-route flight extension



Whether this decrease during RP1 can be considered as significant is best judged on the basis of the expectations. The expectations were quantified in terms of a target value of 4.67% for 2014, corresponding to 0.75% reduction of the figure for 2009. The target is not met, and the difference is 4.90% - 4.67% = 0.23% point.

In 2015, the new KEA KPI was meeting the target.

Optimising horizontal flight efficiency reduces the environmental impact of air transport: this saves fuel and, as fossil kerosene is by far the most used aircraft fuel, leads to less emission of greenhouse gasses and particles, such as carbon dioxide, hydrocarbons, carbon monoxide, nitrogen oxides and others. The trajectory of a flight is partially determined in the ANS domain and horizontal flight efficiency is therefore a relevant performance indicator for the KPA Environment. It is noted that not only does the environment benefit from increased horizontal flight efficiency, but also the airlines benefit from reduced flight time and fuel consumption, and hence operational costs.

If it is assumed that that the amount of emissions of greenhouse gasses and other particles in the en-route phases of flight increases linearly with the length of the en-route trajectories (as filed), the improvement corresponds to a reduction of 0.25% of these emissions during RP1 and 0.43% over the period since the reference year of 2009. The impact of ANS on emissions of greenhouse gasses and particles is relatively limited: the maximum gain is a reduction in the order of a few percentage points per flight; while there are ambitions for such reduction per year for the aviation industry as a whole. The pressure for setting more ambitious targets within the scheme is therefore mainly driven by the economic needs of airlines.

Any other environmental effects in broader terms are not covered by the performance scheme. First of all, noise and third party risk are not included. Secondly, vertical and speed flight efficiency are not covered. Thirdly, flight efficiency in the TMA or on the ground is not covered. In addition to that, it is noted that the KPI in RP1 considers the trajectories of the last flight plans and not the actual trajectories.

Member States and ANSPs have means to optimise horizontal flight efficiency although their span of control is limited. This should be taken into account when setting targets and (dis-)incentives but should not necessarily lead to more advanced indicators (to exclude external influences) or to a more advanced scheme (to include airlines) as there are disadvantages to that as well.

It is beneficial to include a performance indicator for vertical flight efficiency in RP3, although it might not be easy to find a relevant and comprehensible definition. One consideration is to limit the set of indicators to one for vertical flight efficiency in addition to the existing KEA-indicator, for the sake of simplicity and limited administration.

Main conclusion Desk research

There has been a decrease of the en-route flight extension (of the trajectories of the last filed flight plans) at Union-level during RP1, although not sufficient to meet the target which was not very ambitious. The span of control of ANSPs to influence the KPI value is limited.

Subconclusions Desk research

At Union-level

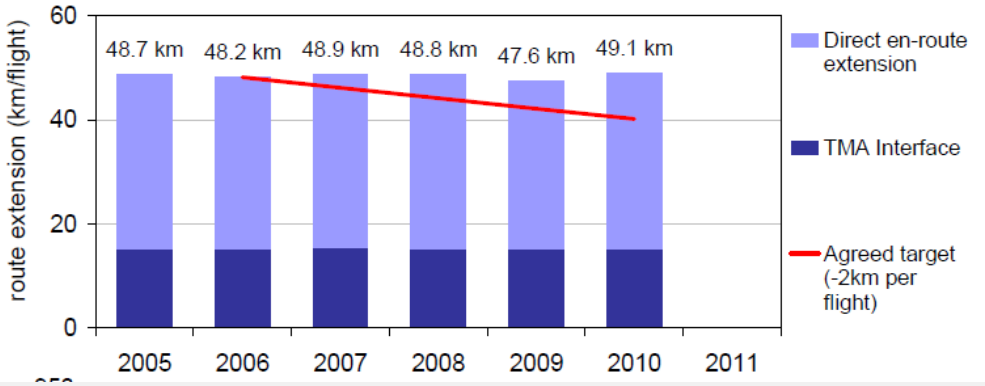
1. Flight efficiency within the domain of ANS throughout Europe is reported since 2004.[13] There are technical issues that make a straightforward comparison over the years difficult: the rounding of numbers (from one decimal in the past to two, currently applied); a change in the size of the TMA in the definition of the indicator (an increase from 30NM to 40 NM); missing data in some years in certain States; changes in the algorithms used; and a change in focus (from actually flown trajectory to last filed flight plan). Taking these issues into account, the following global conclusions can however be drawn:
   - The overall horizontal en-route flight extension tends to be rather stable over the years;

[13] A relevant performance indicator is mentioned in the PRR2002, but not mentioned in 2003, and therefore not considered here.

- There were ambitions to decrease the overall horizontal en-route flight extensions, however they have not been realised on time;
- The extension due to the en-route network design (i.e., the lack of available short routes) seems to decrease, at least more than other extensions (due to the TMA interface, the selection of routes and the tactical routing).

The first two conclusions are illustrated with the figure below from the Performance Review Report 2010.

Figure 8 Horizontal flight extension , targets and TMA Interface



Source Graph copied from the [PRR2010]

The figure shows a rather stable value for the horizontal flight extension and an agreed target that is not met. It is noted that the actual values cannot be compared to the values in the SES scheme because of technical differences.

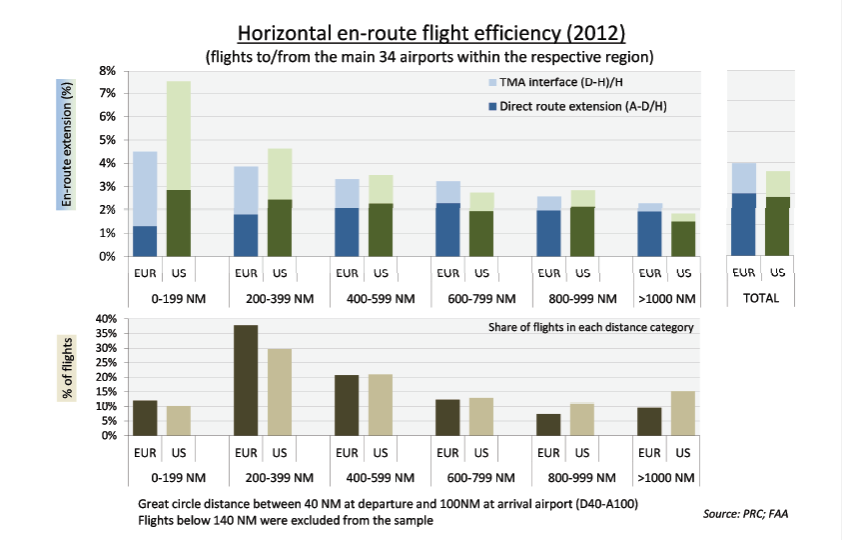
2. A comparison with the flight extensions in the US, for example, is difficult because of technical issues, and a comparison of the long term trends therefore seems impossible.[14] Even if such a comparison could be made, it would be difficult to draw conclusions about flight efficiency on the basis of such figures, as there are differences between the traffic demand, geography, airline industry, air traffic flow management and the balance of the performance parameters in the US and in Europe.

   The following graph, which was reported in the Federal Aviation Administration (FAA)-Eurocontrol publication *Comparison of ATM-related performance: U.S. – Europe,* is however interesting as it shows that the overall flight extension in the US is lower than in Europe, but not for short flights.[15] The actual values in the graph cannot be compared to the values in the SES scheme because of technical differences in the definitions.

[14] The issues now include: different trajectories are considered (actually flown and last flight plan filed), different flight sets are considered (all IFR flights and IFR flights between main airports) and different circles around airports are excluded for the en-route parts (30NM, 40NM and 100NM).

[15] See also [PRR2008].

Figure 9 Horizontal en-route flight efficiency



Source: *Comparison of ATM-related performance: U.S. – Europe*, November 2013. Produced by Performance Review Commission (Eurocontrol) and Air Traffic Organisation System Operation Services (FAA).

3. In 2015, the first year of RP2, the value of the European-wide average horizontal en-route flight extension of last filed flight plan trajectory (KEP) has decreased further, although not sufficient to meet the target set for that year, see also Figure 7 above.

   One KPI is added in RP2, namely the average horizontal en-route flight efficiency of the actual trajectory (KEA), both on EU and FAB level. As this indicator refers to the real world, taking into account Air Traffic Control, it is a better indicator of the environmental burden of air traffic. The European wide average of horizontal flight extension of the actual trajectories in 2015 turns out to be 2.80% (see Annual PRB monitoring report 2015), meeting the target value of 2.96%. That value is significant lower than the KEP-value of 4.84% for 2015. This difference shows that air traffic controller on average are supportive in tactically shortening flight paths. It can also be seen as an indication that airlines on purpose file flight plans that optimize costs, not flight efficiency, see also the paragraph below. The PRB, in its monitoring report 2015, states that it suggests `perverse behaviour…due to cost efficiency interdependency` and that further investigation is necessary. It can also be seen as an indication that airlines are not fully aware of opportunities offered by the network, such as the availability of Conditional Routes. The PRB therefore states that it might be tried to `reduce wastage of effort and disproportionate ANSP reorganization which is not used by the users.`

   Moreover several PIs are added for RP2:

   a) Effectiveness of booking procedures for FUA, on EU and national level;
   b) Rate of planning of CDRs, on EU and national level;
   c) Effective use of CDRs, on EU and national level;
   d) Additional time in the taxi-out phase, at national and airport level;
   e) Additional time in terminal airspace, at national and airport level.

   The latter two are adopted from the KPA Capacity.

4. Horizontal en-route flight efficiency is determined by a number of factors and influences.

ANSPs have several elements in their span of control. Strategically, they are involved in the design of the Air Traffic Services Route Network. They also create Free Route Airspaces, supply sufficient capacity for airspaces to be used and coordinate with the military authorities regarding the availability of shared airspace (booking procedures for flexible use of airspace (FUA), use of conditional routes (CDRs). Tactically, air traffic controllers determine the actual trajectories of the flights by their clearances and instructions.[16]

Member States have an influence on their ANSPs, and they are involved in airspace allocation. This involves coordination with the military authorities, both on strategic and tactical time scales. At EU level, coordination and cooperation of the Member States is relevant given that the geography of military airspaces across Member States limits optimal route design.

The Network Manager influences the en-route flight efficiency as rerouting flights is sometimes the preferred balance between demand and supply, for example to avoid delays.[17]

It is for these influences that the ANSPs, Member States and the Network Manager are accountable for horizontal en-route flight efficiency on EU level in RP1 (and partially on national and FAB level in RP2). There are, however, other influences outside the ANS domain. There are the airlines that make selections of the available routes in their flight plans, taking into account distance, winds and unit costs (the latter is sometimes referred to as cost displacement). In addition to that, there are influences outside the aviation domain, such as winds, thunder storms and the political and military situations that make airspace unavailable for civil usage.

5. The target for the KPI KEP can be compared with the targets set by Flight Path 2050, the SES high level goals and the SESAR performance ambitions. There are huge differences in these target-settings with respect to scope, time period and means. However, by adopting rough, straightforward assumptions, the targets can be translated into a reduction of fuel consumption per flight in percentages per year. The targets then read:
   - Flight Path 2050: 3.5%;
   - SES high level goals: 0.6%;
   - SESAR: 0.3%
   - Performance scheme: 0.1%.

Comparison to baseline (2009)

In 2009, the average horizontal en-route flight efficiency of last filed flight plan trajectory was 5.42%.

At national level

There is information about the indicator for horizontal en-route flight extension for the SES States in RP1, but it is not difficult to deduce trends on national level for a number of reasons:

- RP1 is relatively short: it covers only three years and there is insufficient information about the actual performance in 2012 as there was no consistent reporting on the horizontal flight efficiency at State level due to technical issues, such as the assignment of route

[16] Tactical air traffic control does influence horizontal flight efficiency as defined by the indicator KEA but not as defined by KEP.

[17] Moreover the Network Manager has a role in making the airlines aware of available routes.

extensions. Consequently, only two years can be compared, i.e. 2013 and 2014. Comparing performance over two years provides only one delta value, which is not a strong basis for trending analysis in general.[18]

- The methodology to allocate route extensions to individual States is well-developed and generally accepted since 2007 [PRR2007]. The improvement of the en-route network was by then considered a Pan-European issue, in which the improvement within States may not deliver the desired objective[19] [PRR2009]. The introduction of Free Route Airspace (FRA) and other initiatives at national level since then did, quite probably, improve the performance in some States, but this might not appear in the limited time window of RP1: a State that implemented direct routings in, say, 2010 might produce an "equal score", while another State that has implemented the direct routings in 2012 only has a "positive score".
- The horizontal en-route flight extension indicator is influenced by non-structural effects, such as ash clouds (in the past), strikes, special events, crisis situations such as in Ukraine, long-lasting closures of airspace, such as in Libyan, Syrian and Iraqi airspace (see also NM annual report 2014) and fluctuating traffic densities (while higher traffic complexities in general imply more delay, and in order to avoid that, more route extensions, see e.g. [PRR 2008].
- There are no targets formulated yet on national level, also because of the aspects mentioned above (insufficient time series data available yet, the need for a European approach, and the sensitivity to external or coincidental factors).

The figure below presents the horizontal en-route flight extension per SES State in the years 2013 and 2014. The data show that while there are significant fluctuations per year and across States, a clear trend is not discernible. This can be substantiated by considering the reduction of the en-route flight extension in 2014. Regarding only a reduction of -0.75% to be a significant improvement[20], it turns out that:

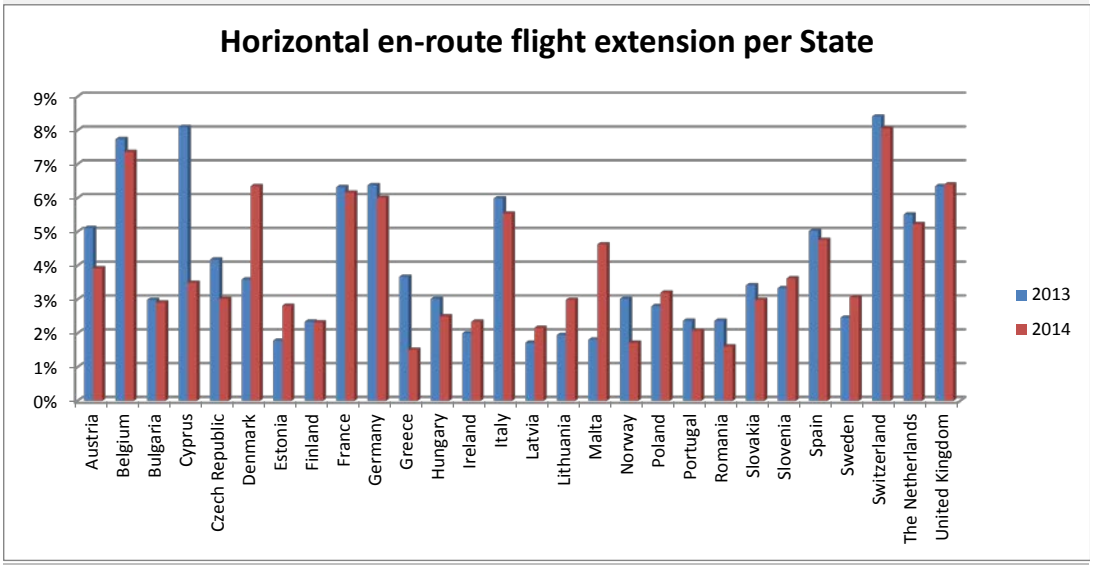
- In 6 States, there is a significant improvement;
- In 12 States, there is a non-significant improvement;
- In 10 States, there is no improvement.

[18] In addition, the first year of the RP2, 2015 can be taken into the calculations but as there is a shift in focus from the KEP to KEA in the transition from RP1 to RP2, this might obscure the conclusions.

[19] This is partly true today, as also the Network Manager, in particular the Route Network Design function, has the responsibility to increase horizontal flight efficiency, by e.g. harmonizing cross-national routes and Free Route Airspace initiatives or raising awareness concerning the availability of Conditional Routes (see also [European Route Network Improvement Plan]).

[20] Regarding a -0.75% point reduction in one year as significant is conservative as that corresponds to target for Europe as a whole to be realised in five years, see Subsection above. So, the reduction for a State is only considered significant if what should be realised in five years is realised in only one year.

Figure 10 Horizontal en-route flight extension per SES State in the years 2013 and 2014



Main conclusion Stakeholder consultation

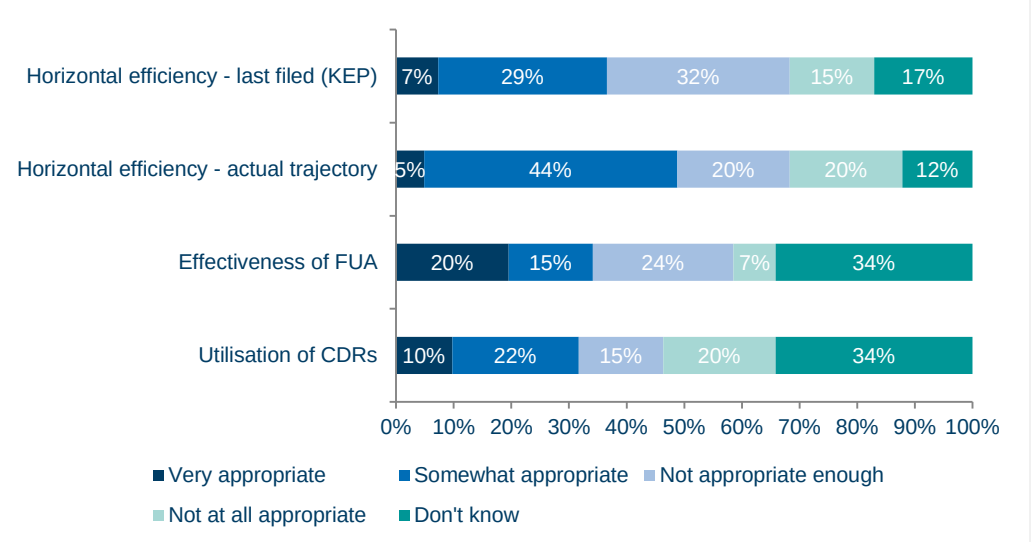
- The ANSPs have limited control over horizontal flight efficiency.
- Airlines asserted that the flight efficiency should be gate-to-gate to reflect fuel consumption for the entire flight.
- Vertical flight efficiency in the form of cruise, climb and descent profiles are not part of the scheme. Given their potential impact on operators, there is a strong argument that they should be included.

Subconclusions Stakeholder consultation

Suitability of indicators – could partially be used for acceptability of the scheme

- Respondents were requested to indicate to what extent the performance indicators in the KPA of environment prove appropriate to improving environment performance during RP1 and the first year of RP2. The figure below shows the distribution of the answers; it shows that the indicator on the actual trajectory (KEA) is considered the most appropriate one among the four.

Figure 11 Appropriateness of KPIs and PIs in the KPA of Environment (N=41)



The appropriateness of the indicators is perceived as relatively low: less than half of the respondents consider the individual indicators to be either very or somewhat appropriate. The main reasons for why the indicators are not considered appropriate are:

- There are several significant factors outside ANSP control, such as flight planning by airlines, processes operated by military authorities and closure of airspace due to political crises (see also Sub-conclusion Desk Research 4);
- Vertical flight efficiency is not captured (see also Answer to the evaluation Question);
- For some airspaces, horizontal flight efficiency is close to optimal.
- ANSPs and Member States have some concerns related to what is known as the cost displacement issue.[21] Airlines sometimes select routes that minimize their economic costs and, as some ANSPs charge more than others, this might lead to longer routes. The issue not only relates to the limited span of ANSP and Member State control over the KPI value but also carries an intrinsic tension between the apparent scores on flight efficiency and cost efficiency. (If a certain, already relatively cost efficient ANSP in a certain Member State reduces its unit costs further, it may attract more flights. As the routes of these flights are extended, and as these route extensions are (at least partially[22]) to be allocated in the KPI for flight efficiency for that Member State, the national KPI-value for flight efficiency in that Member State will be lower than it would have otherwise been.)

Alternative indicators

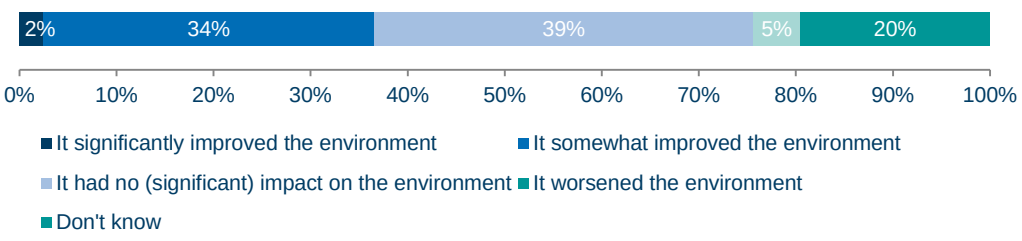
In line with the reasons for why stakeholders perceive the indicators as being relatively inappropriate, the following proposals were provided in response to a question concerning the use of alternative indicators:

- Focus more specifically on ANS controllable flight efficiency aspects; factor out external influences;
- Include vertical flight efficiency; ascending and descending activities near airports are important for environmental impact;
- Monitor and report the indicators in congested airspaces only.

Impacts of scheme on environment

Respondents of the questionnaire were requested to indicate the impact of the SES Performance Scheme during RP1 on the actual environment. The figure below shows the distribution of the answers.

Figure 12 Impact of the SES Performance Scheme on the environment (N=41)



[21] It is stated the issue can also be considered as a revenue displacement issue.

[22] The allocation of this route extension is calculated by means of the so called “achieved” values, in order to let the horizontal flight efficiencies at national level correspond to the horizontal flight efficiency at EU level.

This result can be summarized as follows: one third indicates a positive impact while two thirds indicate no impact, a negative impact or do not know. The authorities are slightly more positive about the impact on the environment than the ANSPs.

4.3 EQ 1c Effect on Cost-Efficiency

1.c. What is the effect on cost-efficiency that has been achieved during RP1?

Answer to evaluation question

The national Cost-Efficiency KPI targets have been met by design, as these were used for billing to airspace users. Over RP 1, it is noted that there is a discrepancy between the original SSC targets and the aggregated NPP targets, which meant that the original SSC targets have not been met in two out of three years. The NPP targets have, legally speaking, been met. In an operational sense, ANSPs have not improved their own cost efficiency as much as planned over RP1. In 2015, they have met their targets.

The main conclusion is therefore that cost-efficiency within the Single European Sky area has increased over RP1 and in 2015. This finding is based on the achieved numbers on the KPI for cost-efficiency – which decreased by EUR_{2009} 4.30 per ANS en-route service unit (p/su) between 2012 and 2014, indicating improved ANSP cost-efficiency. It is also based on the actual unit costs incurred by users – which decreased by EUR_{2009} 3.65 p/su between 2012 and 2014, indicating the system as a whole became more cost-efficient. This conclusion stands undisputed for all stakeholders. Moreover, total costs of the system went down by about EUR_{2009} 150 million while handling 6 million additional service units over RP1.

At the same time it is noted that the cost-efficiency improvements the scheme was intended to produce have not fully materialised: the targets that were set for cost-efficiency were, at least at Union-level, not met by ANSPs and charges to airspace users have not gone down by as much as intended. There is large variation at national level, where some states actually exceeded their targets and others fell short. Part of the reason why targets were not met is because there was lower traffic than forecast, which meant that fixed costs had to be spread over fewer service units. That targets were not met adds to ANSP costs, it only indirectly affected billing to airspace user (for example through the traffic risk-sharing mechanism).

Therefore, the question whether the effects achieved for cost-efficiency are *satisfactory* depends on the expectations one had of the scheme and where one is located (as some ANSPs' services became cheaper). Adopting the strict interpretation that 'targets were set to be met' means the answer to the evaluation question would move towards 'the effect has not been large enough'. On the other hand, a judgement based solely on the comparison between the starting and end points of the period would conclude that the improvements achieved are substantial, especially in the context of traffic levels that were lower than forecast.

Finally, as airspace users set their expectations based on the targeted unit

rates, the system would not be successful enough even if it met those targets due to the various adjustment mechanisms which lead to a different 'actual' costs for users than the target DUR.

Note: expanded calculations and an overview of data used can be found in Annex VI.

Main conclusion Desk research

ANSPs have operationally failed to meet the targets set during RP1 for the KPI for cost-efficiency and airspace users on average had to pay more than targeted (EUR_{2009} 1.45 p/su in 2012, EUR_{2009} 2.47 p/su in 2013 and EUR_{2009} 1.76 p/su in 2014). However, cost-efficiency has increased as the actual unit cost per service unit for en-route ANS decreased from EUR_{2009} 58.43 in 2012 to EUR_{2009} 54.13 in 2014 and airspace users on average paid EUR_{2009} 3.65 less per service unit in 2014 than in 2012.

Over RP2, the cost-efficiency target has been met both through billing and in operational terms (performance of ANSPs). Actual performance casts doubts as to why the 2015 target was not set more ambitiously, and suspicions of underestimation of traffic and overestimation of total en-route costs underline the study's finding that the system may be abused for gaming.

Table 4.4 Cost-efficiency performance under RP1 and RP2 first year, Union level (EUR2009)

Union level	2012		2013		2014		2015	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Union wide target	57.88	58.43	55.87	56.55	53.92	54.13	56.64	52.85
DUR from NPPs (i.e. planned, EUR2009)	57.75		56.69		54.84		55.33	
Actual unit costs for users (AUC-U)*	n/a	59.33	n/a	58.34	n/a	55.68	n/a	54.34

Source: PRB Annual Monitoring Reports. n/a = not applicable, n/av = not yet available

*Note: the AUC-U measure was not available for 2012, as the PRB has started including this only from 2013. Therefore, the measure as reported in table 26 in the PRB's Annual Monitoring Report for 2014 (Vol I: Union-wide) has been used.

Subconclusions Desk research

At Union-level

There has been a decrease in the actual unit cost from EUR_{2009} 58.43 per service unit in 2012 to EUR_{2009} 54.13 per service unit in 2014, meaning a 7.36 per cent decrease in unit costs has been achieved, which is higher than the targeted decrease of 6.4%.

At Union-level, ANSPs have failed to meet the Single Sky Committee targets for the cost-efficiency KPI throughout RP1.

Judged in terms of the change in unit costs in EUR_{2009}, one can say that the reduction in the DUC en-route decreased the gap between the target and the level actually achieved: the DUC en-route were EUR_{2009} 4.30 lower in 2014 than in 2012, meaning that the decrease per unit was EUR_{2009} 0.35 greater than the decrease encapsulated in the targets.

For 2012, the actual achieved DUC en-route was higher than both the DUC en-route and DUR NPP targets. In 2013 and 2014 the actual DUC en-route was lower the DUR NPP target, but not the Union-wide DUC en-route target. Therefore, during RP1 ANSPs were able to outperform their NPP target in two years (2013 and 2014).

It should be noted that a few large states (measured by number of traffic service units) account for a big part of the discrepancy between the targeted and achieved DUR at Union-level. (e.g. Germany, UK, Spain). They account for little less than a third of all Union-wide traffic, and almost 40 per cent of total en-route costs. The comparison of DUC to EU level shows the instances where the actual DUC achievements amounted to a larger than anticipated unit-price difference with the EU level.

Table 4.5 DUC numbers: comparison to EU-level

	planned	actual	planned	actual	planned	actual
	2012		2013		2014	
EU	€ 57,88	€ 58,43	€ 55,87	€ 56,55	€ 53,92	€ 54,13
DE	€ 71,42	€ 76,36	€ 69,81	€ 73,47	€ 67,81	€ 73,12
Δ with EU	€ 13,54	€ 17,93	€ 13,94	€ 16,92	€ 13,89	€ 18,99
UK	€ 68,99	€ 69,34	€ 69,13	€ 73,25	€ 66,36	€ 65,19
Δ with EU	€ 11,11	€ 10,91	€ 13,26	€ 16,70	€ 12,44	€ 11,06
ES (Cont)	€ 70,08	€ 73,08	€ 69,44	€ 67,63	€ 66,92	€ 63,83
Δ with EU	€ 12,20	€ 14,65	€ 13,57	€ 11,08	€ 13,00	€ 9,70
ES (Can)	€ 61,48	€ 64,54	€ 59,54	€ 64,43	€ 56,84	€ 63,98
Δ with EU	€ 3,60	€ 6,11	€ 3,67	€ 7,88	€ 2,92	€ 9,85

On average, actual costs for users have gone down from EUR_{2009} 59.33 in 2012 to EUR_{2009} 55.68 in 2014.

At EUR_{2009} 55.68, the actual unit costs for airspace users are EUR_{2009} 1.74 higher than what was targeted.

Our study finds also that cost-efficiency within the Single European Sky area has increased over RP1 in real terms. The DUR (planned) was set to decrease by **EUR_{2009} 2.91** (NPP targets). As this is the basis for the billing to users, unit costs went down. The actual level of en-route unit cost[23] decreased by **EUR_{2009} 4.30** between 2012 and 2014, indicating improved ANSP cost-efficiency. The actual unit costs *for users* decreased by **EUR_{2009} 3.65** between 2012 and 2014

Reference to total costs

As the KPI for cost-efficiency is set on a ratio, solely looking at the KPI might miss part of the picture. If traffic and costs both went down, the unit rate may not move much even though the system as a whole has become cheaper. Over 2015, the increase in traffic was greater than the increase in total en-route costs, which resulted in increased cost-efficiency (see section below on 2015 data).

Figure 13 below shows total costs plotted on the left vertical axis and total service units on the right vertical axis. This analysis of the evolution of total costs and traffic shows that from 2012 – 2014, the total costs of the

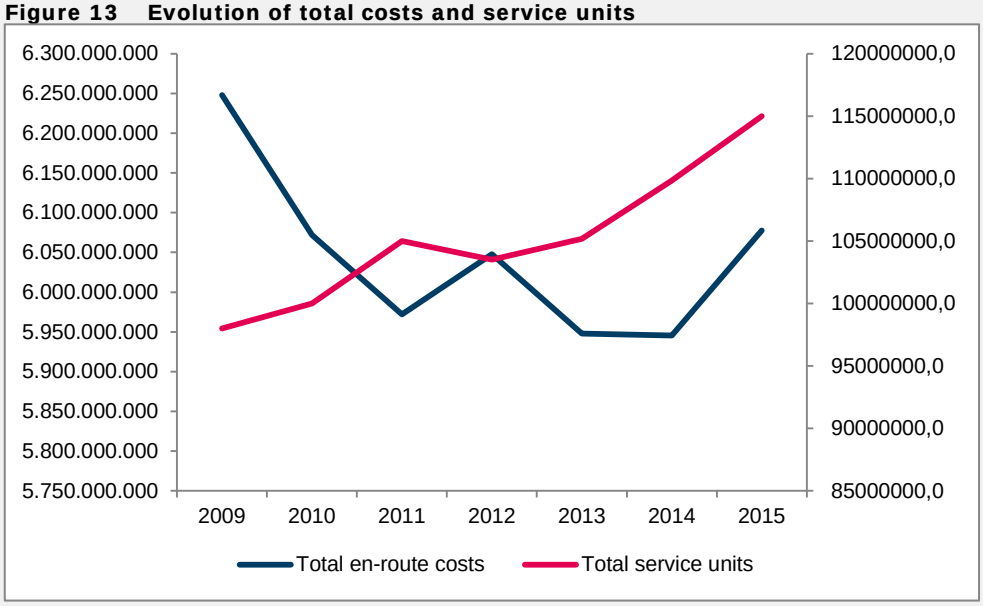
[23] A metric reported by the PRB that measures how ANSPs performed. This can be used to estimate ANSP-performance, but is NOT factored into billing to users.

ANSPs have gone down by about EUR$_{2009}$ 150 million while handling more than 6 million additional service units.

To put this in perspective, over the broader period of 2009 – 2014, the total costs of the ANSPs have gone down by about EUR$_{2009}$ 800 million while handling almost 12 million more service units. This means that the cost reductions achieved from 2009 -2011 (650 million) were more substantial than from 2012 – 2014 (150 million) in the face of an equal increase in traffic service units. This large decrease prior to RP1 may have been the result of the traffic decrease in 2008-2009, and ANSPs reacting to that. It should also be noted though that although the schemes were legally not effective prior to RP1, the Regulations were known and consultation and target setting was in full process, so as such the schemes already influence behaviour prior to RP1.

Over 2015, the increase in traffic was greater than the increase in total en-route costs, which resulted in increased cost-efficiency (see section below on 2015 data).

Figure 13 Evolution of total costs and service units



Note: total en-route costs are plotted on the left axis, total service units on the right axis.

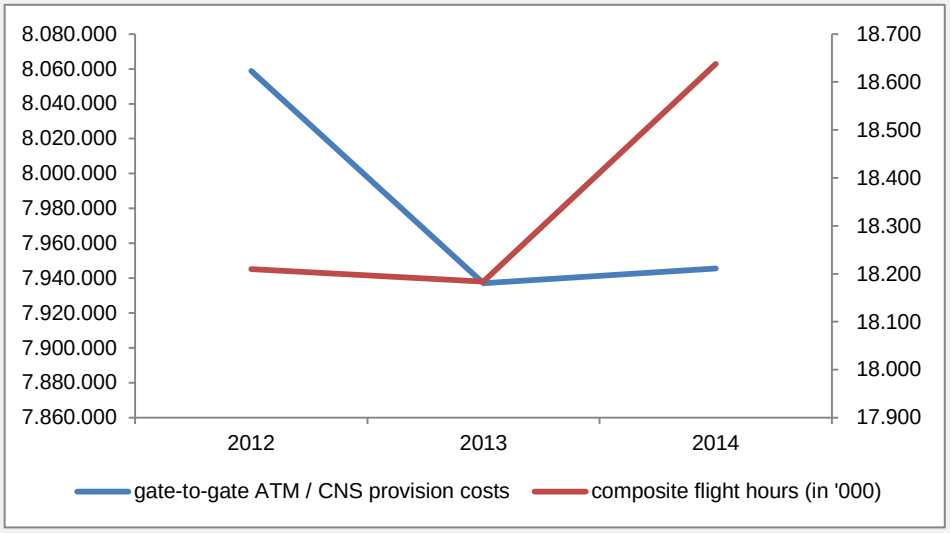
Table 4.6 Total costs at Union level from 2009 – 2014 (M EUR$_{2009}$)

		2009	2010	2011	2012		2013		2014	
		A	A	A	P	A	P	A	P	A
Union-wide	Total en-route costs	6,248	6,072	5,972	6,258	6,047	6,319	5,948	6,305	5,946
	Total terminal costs	1,454	1,416	1,459	1,477	1,395	1,470	1,343	1,476	1,349
	Total costs	8,094	7,878	7,914	7,735	7,443	7,788	7,291	7,780	7,294
Total service units (millions)		98	100	105	109	104	112	105	115	110
Unit price (EUR$_{2009}$)		63.70	60.40	56.90	57.88	58.43	55.87	56.55	53.92	54.13

Source: PRR reports (2009-2012), PRB reports (2012-2014), Ecorys
A = Actual level, P = Planned
Note: red indicates a greater negative deviation from the EU-level number, which works against achieving the SES PCS goals.

The ACE reports offer another way of looking at the evolution of cost-

efficiency. By plotting the gate-to-gate ATM / CNS provision costs against the evolution of composite flight hours we have an alternative way of showing the evolution of total costs vis-à-vis traffic. The graph below shows that over RP1, gate-to-gate ATM/CNS provision costs have decreased by 1.4% whereas composite flight hours have increased by 2.4%.



Source: PRC Annual ACE Benchmarking Reports

	2012	2013	2014	Δ 2012 - 2014	% Δ 2012 - 2014
Gate-to-gate ATM / CNS provision costs (in EUR_{2014}, '000)	8.058.826	7.937.182	7.945.482	-113.344	-1,4%
Composite flight hours (in '000)	18.210	18.184	18.638	428	2,4%

At national level (with regard to NPP targets)

6. States did not meet any cost-efficiency targets, namely Austria, Germany, the Netherlands, Switzerland, Finland, and the Canarias (Spain).
7. States met one out of three targets, namely Sweden, Estonia, Greece, Italy, Portugal, Romania and the United Kingdom;
8. States met two out of three targets, namely Cyprus, the Czech Republic, Denmark, Lithuania, Poland, Slovenia, and Continental Spain;
9. States met 3 out of three targets, namely Bulgaria, Belgium-Luxembourg, France, Hungary, Ireland, Latvia, Malta, Norway, and Slovakia;

Over the whole RP1 period, actual unit costs for airspace users went up in Estonia, Austria, Czech Republic, Germany, United Kingdom, Finland, Spain, and Portugal;

Over the whole RP1 period, actual unit costs for airspace users went down in Sweden, Norway, Bulgaria, Malta, Slovenia, Denmark, Belgium-Luxembourg, Hungary, Switzerland, Slovakia, the Netherlands, Romania, Cyprus, Latvia, Lithuania, Italy, Greece, Poland, France, and Ireland.

Comparison to baseline

In 2009, the unit cost was EUR_{2009} 63.70. This is significantly higher than the 2014 values during RP1:

- the DUR used for billing at EUR_{2009} 53.92
- the achieved unit price of EUR_{2009} 54.13

- the actual unit costs charged to users (with adjustments accounted for in the same year) of EUR_{2009} 55.68

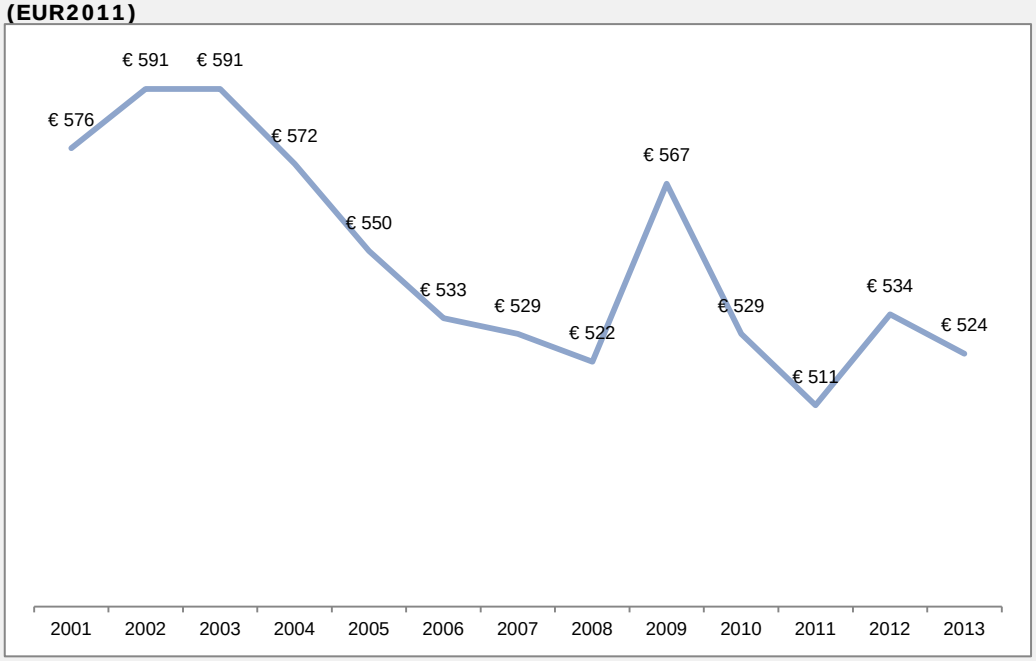
On the other hand, in 2011, the unit cost was EUR_{2009} 56.90. However, as the preparation towards RP1 (consultation, performance planning) was already in full force, this year is most likely already influenced by the performance and schemes. One could average this out, by comparing the RP1 performance with the average unit rate between 2009-2011, which is EUR_{2009} 60.33.

A comparison with the US has been made but was found not to be sufficiently informative to include in the analysis.

However, also during the period before RP1, there was monitoring of the cost efficiency performance done by the PRC, mainly through the ATM/CNS Provision Costs per composite flight hour indicator used in the ACE reports. Even though it is not a perfect proxy, it is still possible to distil useful information, as the available data goes back to 2001.

Over the period 2001-2012 (the start of RP1), cost-efficiency as measured in the ACE reports improved (i.e. unit costs went down) in 7 years and deteriorated in 2 years, with no significant change from 2002 to 2003. **The average annual reduction in costs in the pre-RP1 period amounted to 1.28 per cent**. It is noted that the reduction ATM/CNS Provision Costs achieved over RP1 is not an outlier compared to the development of this variable over the pre-RP1 period.[24]

Figure 14 Development of ATM/CNS Provision Costs per composite flight-hour (EUR2011)



Source: PRC Annual ACE Benchmarking Reports, Ecorys

If this trend would be applied on the 2009 unit cost value of EUR_{2009} 63.70, a

[24] This happened only once in the pre-RP1 period, between 2009 – 2011 (not shown here). This is entirely due to a spike in unit costs in 2009 due to a sharp traffic downturn and consequent normalisation of the rate in the years following.

baseline value of EUR_{2009} 61.93 would result for 2011.

In both cases, comparing the RP1 results, with an average 2009-2011 value or with a continued trend baseline value, the difference is significant.

Traffic

Some countries experienced much more traffic than forecast over RP1, most notably Malta, Norway and Bulgaria with actual traffic levels more than 10 per cent higher than forecast. Six more countries experienced higher traffic levels than expected. However, the majority of countries experienced traffic levels that were substantially below what was forecast, with 7 countries experiencing over 8 per cent less traffic than forecast and Austria, Spain and Finland topping the list with over 10 per cent less traffic than forecast. Union-wide, traffic fell short of what was forecast by 4.87 per cent.

2015 data from (Revised) Performance Plans

As data on the performance over 2015 were not available, the tables below show the data for ANSPs at Union level, as extracted from the NPPs. They reflect the Union-level numbers as encapsulated in the initial performance plans (evaluated in June 2014), the corresponding EC Decision in March 2015 on the non-compliance of (a number of) performance plans with the cost-efficiency targets, and the final numbers as submitted in the revised performance plans. Finally, an overview is given of the targets originally set for RP2 by the Commission.[25]

Three things stand out:

1. the planned DUC in the Revised Performance Plans has declined vis-à-vis the original performance plans, but the original targets for 2018 and 2019 will still not be met (*possibly as a consequence of the still not accepted revised FABEC performance plan*)
2. The original forecast determined costs for 2014 were much higher than those after revision in the second round, where they have been scrutinized by the PRB. This results in a Revised forecast DUC for 2014 that was much lower than the first forecast (EUR_{2009} 52.93 vs EUR_{2009} 57.37)
3. The NPP target unit rate for 2014 was 54.84, whereas the actual was 54.13.

This partially counteracts the achievements that have been made under RP1 in the area of cost-efficiency.

Source for tables below: PRB Assessment of RP2 FAB Revised Performance Targets. Union-wide view assessment report. To be found here: http://www.eusinglesky.eu/Documents/PRB%20Reports/Reference%20Period%20Two/Union-wide+view+-+PRB+Assessment+of+RP2+FAB+Revised+Performance+Targets+-+FIN.pdf

Note: the Determined Unit Cost referred to is the projected actual determined unit cost from the performance plan and is not used in the PRB Annual Monitoring Reports.

Table 4.7 Initial Performance Plan (June 2014)

[25] See COMMISSION IMPLEMENTING DECISION of 11 March 2014 setting the Union-wide performance targets for the air traffic management network and alert thresholds for the second reference period 2015-19.

Key figures: en-route	Value in	2014 F	2015 D	2016 D	2017 D	2018 D	2019 D	2011-19	2014-19	2015-19
Determined costs	M EUR_{2009}	6,250	6,279	6,258	6,250	6,206	6,159	0.2 %	0.3 %	0.5 %
Service units	'000s	108,944	111,802	113,849	115,763	117,857	120,159	1.5 %	2.0 %	1.8 %
Determined Unit cost	EUR_{2009}	57.37	56.16	54.97	53.99	52.66	51.26	1.2 %	2.2 %	2.3 %

Table 4.8 EC Decision (March 2015) on non-compliance of the RP2 cost-efficiency target

Key figures: en-route	Value	2015D	2016D	2017D	2018D	2019D	2015-19
Determined costs	M EUR_{2009}	6,276	6,263	6,259	6,216	6,168	0.4%
Service units	'000s	112,669	114,413	116,792	118,614	120,970	1.8%
Determined Unit cost	EUR_{2009}	55.7	54.74	53.73	52.41	50.99	2.2%

Table 4.9 Revised Performance Plan (July 2015)

Key figures: en-route	Value	2014 F	2015 D	2016 D	2017 D	2018 D	2019 D	2011-19	2014-19	2015-19
Determined costs	M EUR_{2009}	6,019	6,235	6,193	6,190	6,136	6,060	0.0 %	0.1 %	0.7 %
Service units	'000s	111,597	112,688	115,027	117,111	119,329	121,692	1.7 %	1.7 %	1.9 %
Determined Unit cost	EUR_{2009}	53.93	55.33	53.84	52.86	51.42	49.8	1.6 %	1.6 %	2.6 %

Table 4.10 Targets set for RP2

Key figures: en-route	Value	2015	2016	2017	2018	2019
Determined costs	M EUR_{2009}	6,148	6,056	5,904	5,757	5,613
Service units	'000s	108,541	110,196	111,436	112,884	114,305
Determined Unit cost	EUR_{2009}	56.64	54.95	52.98	51.00	49.10

Source: COMMISSION IMPLEMENTING DECISION of 11 March 2014 setting the Union-wide performance targets for the air traffic management network and alert thresholds for the second reference period 2015-19

2015 data from the PRB

Overall, we see that in 2015, the Union-level target has been met despite a growth in total en-route costs vis-à-vis 2014, as traffic increased more quickly than en-route costs.

It is notable that the achieved cost-efficiency for ANSPs (in operational terms) is significantly better than the target at some 4.5%. This performance casts doubt on as to why the DUC for 2015 was set higher (as measured in EUR2009) than in 2014: actual ANSP performance suggests a more ambitious

target would have been feasible. This finding underlines the study's finding that the system may be abused for gaming, as it seems the en-route costs were *over*estimated while the traffic was *under*estimated.

In 2015, the DUC for en-route ANS was set at 55.33 EUR, and operationally the ANSPs achieved a unit rate of 52.85 EUR at Union-level. This is some 2.48 EUR or 4.5% better than the target. The actual unit costs billed to users in 2015 were 1.40 EUR or 2.5% higher than the target. The 'true costs' for users in 2015 (target + all adjustments forthcoming from 2015) are -0.99 EUR2009 or 1.8% lower than the target, which is to the benefit of the airspace users.

	2015			
	Target	Achieved	Delta (EUR)	Delta (%)
DUC for en-route ANS	55.33	52.85	-2.48	-4.5%
Actual unit costs charged to users *	n/a	56.73	1.4	2.5%
Actual unit costs incurred by airspace	n/a	54.34	-0.99	-1.8%

Source: PRB Annual Monitoring Report 2015, Vol. 1.

* Calculated by dividing the total costs by the forecast en-route service units total. The actual total costs charged to users (EUR2009) amounted to 6,393.3 million EUR_{2009} in 2015. In total, 112,687,532 en-route service units were forecast for 2015. Source: PRB Annual Monitoring Report 2015, Volume I: p.45.

** Calculated by dividing the total costs by the actual en-route service units total. The actual total costs incurred by airspace users users (EUR2009) amounted to 6,249.3 million EUR2009 in 2015. In total, 114,994,014 en-route service units were handled in 2015. Source: PRB Annual Monitoring Report 2015, Volume I: p.45.

At Union-level, total en-route costs were 2.5% lower than planned, while traffic was 2.0 higher than planned. This helped the ANSP achieve the 2015 target in operational terms. It is noted that the total en-route costs (in EUR2009) as well as the number of traffic service units (en-route) in 2015 are higher than the totals in 2012.

	Planned	Actual	Delta (nominal)	Delta (%)
En-route costs (EUR2009)	6,235,113,277	6,077,537,050	-157,576,227	-2.5%
En-route service units	112,687,532	114,994,014	2,306,482	2.0%
DUC (EUR2009)	55.33	52.85	-2.48	-4.5%

Source: PRB Annual Monitoring Report 2015, Vol. 1.

Over 2015, terminal costs were 8.92 EUR or 4.9% lower than planned.

	Planned	Actual	Delta (nominal)	Delta (%)
Terminal costs (EUR2009)	1,118,019,472	1,084,905,609	-33,113,863	-3.0%
Terminal service units	6,181,013	6,318,950	137,937	2.2%
Real terminal costs per service unit (EUR2009)	€ 180.88	€ 171.96	-€ 8.92	-4.9%

Source: PRB Annual Monitoring Report 2015, Vol. 1.

Main conclusion field research

Although there is agreement among all stakeholders that there have been improvements in cost-efficiency, there are sharp differences in the valuation of these improvements. ANSPs and NSAs tend to view the improvements as either meeting or exceeding expectations, with the right KPI used to measure this. Airspace users on the other hand are negative: they find the improvements have not gone far enough, that the indicators used to measure cost-efficiency improvements are wholly unsuitable and argue that the failure to meet targets combined with unsuitable indicators has led to them being charged almost EUR_{2009} 1 billion more than agreed upon over RP1.

Subconclusions field research

Suitability of indicators: DUC for en-route ANS

The majority (83%) of respondents view a DUC for en-route ANS at least somewhat favourably as an appropriate indicator and target to measure cost efficiency performance.

Figure 15 Appropriateness of KPIs and PIs in the KPA of Cost Efficiency (N=39)

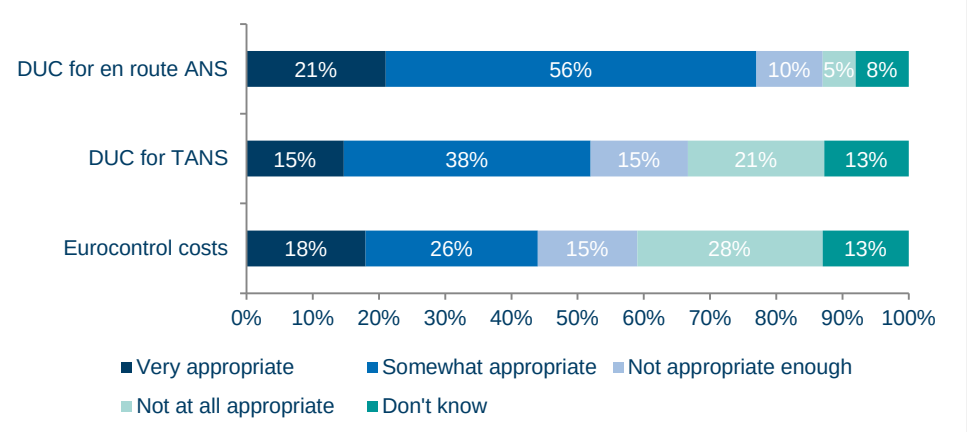
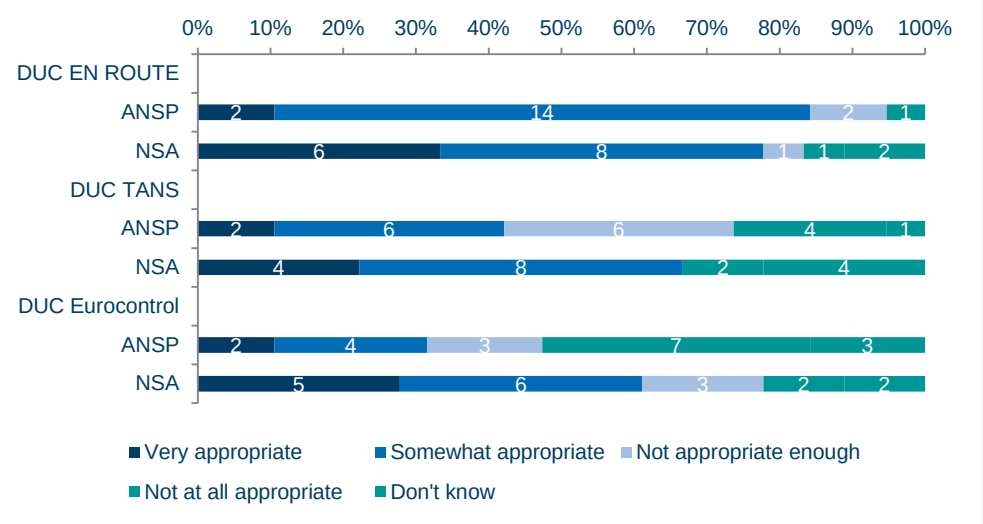


Figure 16 Appropriateness of KPIs and PIs in the KPA of Cost Efficiency, per stakeholder group (N=38)



The main concern with the indicator is that, in the present conditions, the focus is on controlling cost (i.e. focused on inputs) rather than on improving the performance of ANSPs. At the same time, the current approach does not sufficiently focus on the elements over which ANSPs have direct control (i.e. controllable costs), thereby increasing the risk associated with undermining the cost reduction incentive. This issue has been raised by all stakeholder groups.

A second concern, which is raised by both ANSPs and airspace users, is that the DUC for en-route ANS is not actually a target, but rather constitutes a ratio that entities – and ultimately the Member States – estimate on the basis of their annual cost base estimate for the whole reference period, divided by the forecast number of service units during the same period. Unrealistic (inflated) economic or traffic assumptions included in NPPs artificially enhance the actual cost-efficiency performance during the period and fail to capture the true costs for users. From the airspace user perspective, the targets are not binding, as there is no penalty attached to the non-delivery of the performance targets (despite the fact that additional incentives on capacity have been created).

A stakeholder from the NSA category further asserts that many of the current side effects of the Regulation, i.e. large carry-overs for some ANSPs, discrepancy between actual cost efficiency performance and the "true cost for users", unrealistic initial economic or traffic assumptions, which artificially inflate the cost efficiency performance during the assessment – could be overcome with greater flexibility. In particular, flexibility is needed to revise the performance plans in case of large deviations of the actual traffic from the initial forecast, making initial economic assumptions invalid (e.g. interest rates), or exempted costs reach unexpected levels. This could be done through a revision of alert mechanisms with thresholds for such deviations.

Suitability of indicators: other indicators

A majority of just under 60% (14 of 34 respondents) view TANS as an appropriate indicator to measure improvements in cost efficiency. These targets should, however, in the views of the stakeholders be set nationally and not at Union-level, to take into account local circumstances.

The opinion is split on Eurocontrol costs as an appropriate indicator to

measure improvements in cost-efficiency, with 50% viewing this at least somewhat favourably. An issue here is that Eurocontrol fixed costs have an impact on the unit rate, which has a dynamic element (namely traffic and corresponding service units).

Airspace users find the indicators on the whole not at all appropriate to measure improvements in cost-efficiency.

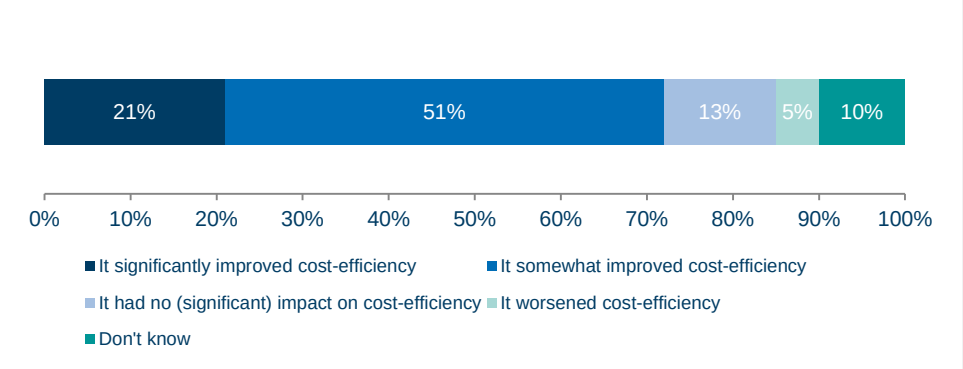
Alternative indicators

KPIs and targets that are better aligned to controllable costs, applying different approaches to different cost components. Concretely, respondents propose to treat capital expenditures (costs and depreciation), costs of equity and costs exempt from cost sharing in a different way – for example by excluding them from determined costs and making them be subject to full cost recovery – in order to focus ANSPs on enhancing the efficiency of controllable costs. This proposal is supported by 7 respondents to the survey. It is also mentioned that indicators should attempt to capture the flexibility needed to respond to events and developments, for example allowing for re-profiling of capital expenditures and to prioritise different aspects in response to customer requirements.

Impacts of scheme on cost-efficiency

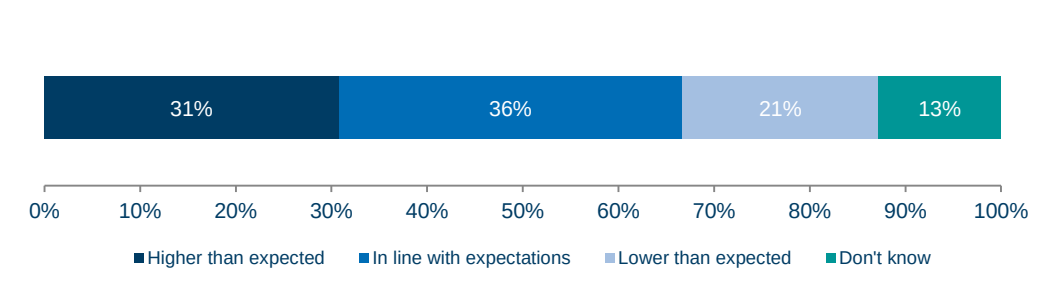
The majority (72%) of respondents indicates that the performance and charging scheme had an overall positive impact (somewhat or significantly improved cost efficiency). Of those respondents (who indicate an overall positive view), 71% are representatives of ANSPs.

Figure 17 Impact of the SES performance and charging scheme on cost-efficiency (N=39)



A minority of 31% of respondents indicates that achievements have exceeded expectations, while a further 36% indicate that achievements have been in line with expectations. When taking into account respondents' background, ANSPs account for more than 80% of those who indicate that achievements in the KPA of cost efficiency exceeded expectations. On the other hand, ANSPs account for less than two-fifths (3 out of 8 respondents) who indicate achievements below expectations.

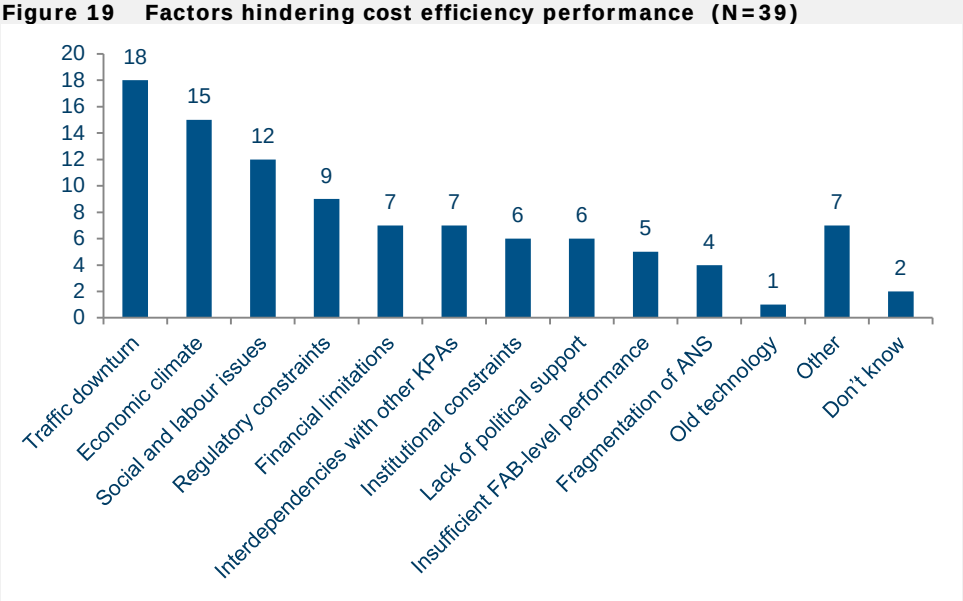
Figure 18 Achievements in the KPA of cost efficiency (N = 39)



ANSPs hold the most favourable view of the cost-efficiency achievements during RP1, while airspace users hold the most unfavourable view.

The most frequently cited hindering factors for achievements in cost-efficiency are '*traffic downturn*' (18 respondents), '*economic climate*' (15 respondents) and '*social and labour issues*' (12 respondents).

Figure 19 Factors hindering cost efficiency performance (N=39)



Charges to airspace users

Airspace users indicated that the they have paid € 1 billion more through planned investments that were not implemented, despite the fact that the traffic was about 5% below forecast during RP1.

As contributing factors for this increase, it was argued that the adjustment mechanisms foreseen under the Regulations (traffic risk, cost-sharing and exempted costs) allowed ANSPs to effectively raise the costs charged to airspace users, compared to the Determined Unit Rate in the National Performance Plans. Moreover, it was argued that traffic was purposely overestimated.

4.4 EQ 1d Improvement in Safety

Effectiveness
1.d. Was there an improvement of safety levels during RP 1? If yes, could they be attributed to the SES performance scheme?

Answer to the question

In order to answer this question it is first necessary to specify what we mean with the word 'safety'.

Safety is defined by ISO as the absence of unacceptable risk, where risk is defined as a combination of the probability and severity of harm. Therefore aviation safety performance can be described as the probability of an accident, with a lower probability indicating better performance. Accident probabilities cannot be measured directly but can be inferred by counting the number of accidents over a longer period of time. However, the likelihood of an accident is so low that we have to wait for quite a long time (multiple years) to obtain a reliable estimate. Therefore alternative indicators of safety performance are required. The probability of incidents is a logical proxy indicator for safety performance. However, the number of incidents must be determined from occurrence reporting, the completeness of which depends on the reporting culture. An increase in the number of reported incidents can therefore be the result of improved reporting culture or decreased safety performance.

Another alternative for measuring safety performance is to consider factors that enable 'safety' performance. These 'leading indicators' have the advantage that they do not rely on negative outcomes (incidents and accidents) to provide valuable information. The disadvantage is that leading indicators are often not directly ('loosely') coupled with safety outcomes.

Because of the limitations of both types of indicators, a balanced combination of outcome-based indicators and leading indicators is the most appropriate way to monitor safety performance.

The States were required to report on a number of Safety Performance Indicators (SPIs) in RP1. These were all leading indicators:

- Effectiveness of Safety Management (EoSM) of Member States and their air navigation service providers.
- Application of the severity classification based on the Risk Analysis Tool (RAT) methodology to the reporting of, as a minimum, Separation Minima Infringements (SMI); Runway Incursions (RI); and ATM-specific occurrences (ATM-S) at all Air Traffic Service Units.
- Reporting by Member States and their air navigation providers on the level of presence and corresponding level of absence of Just Culture (JC).

A well-established safety management system, a healthy safety culture and a good process for learning from past occurrences are essential factors that enable safety performance. Therefore the safety KPIs selected in RP1 are basically reasonable choices. This is confirmed by the stakeholders' opinion that the safety KPIs are indeed appropriate measures of safety performance. Performance on the safety KPIs has continuously improved since the start of

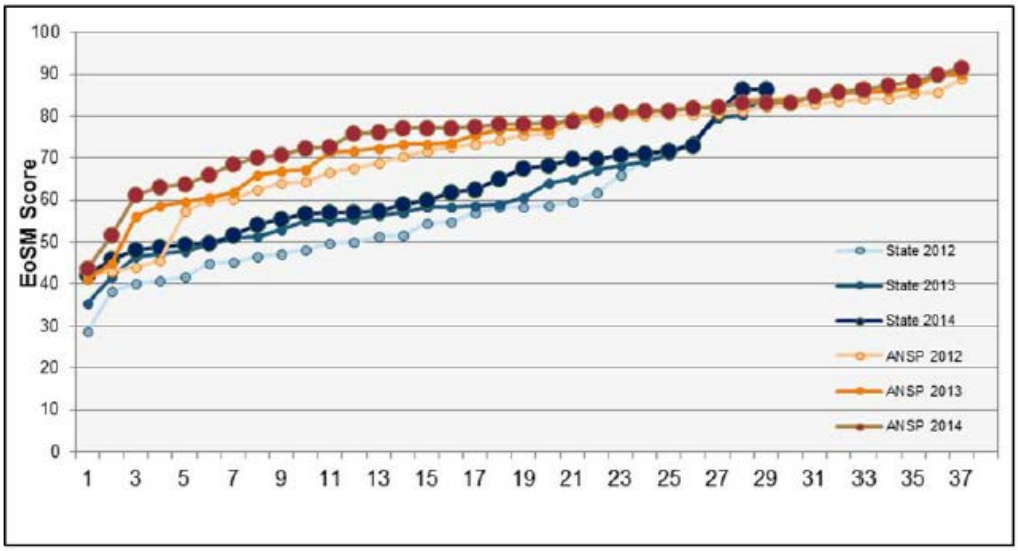
the SES performance scheme. The majority of stakeholders are of the opinion that a significant part of this improvement in performance on the safety KPIs can be attributed to the Performance Scheme, but that there are other drivers as well.

The level of safety, expressed as the number of serious incidents with ANS contribution, has also improved during RP1. According to the stakeholders consulted, the Performance Scheme had a marginally positive on this level of safety. This is indeed likely, but the difficulty in measuring safety performance and the loose coupling between leading indicators and safety outcomes (as described above) renders it impossible to support this impression with independent, objective data.

Main conclusion Desk research

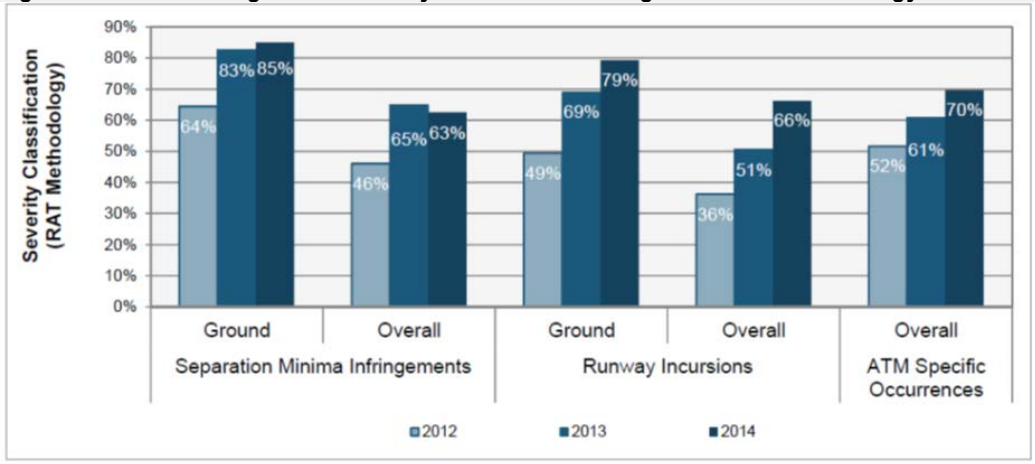
Performance on the safety KPIs has continuously improved since the start of the SES performance scheme. Figure 20 shows a continuous improvement in the implementation of safety management over RP1, and Figure 21 shows a continuous improvement in the application of the severity classification scheme for each of the three occurrences in the Performance Scheme score. The level of presence, and corresponding level of absence, of Just Culture at both States and ANSPs also shows constant improvement over RP1 (Source: PRB Annual Monitoring Report 2014, Vol. I.)

Figure 20 EoSM scores during RP1



Source: PRB Annual Monitoring Report 2014, Vol. I.

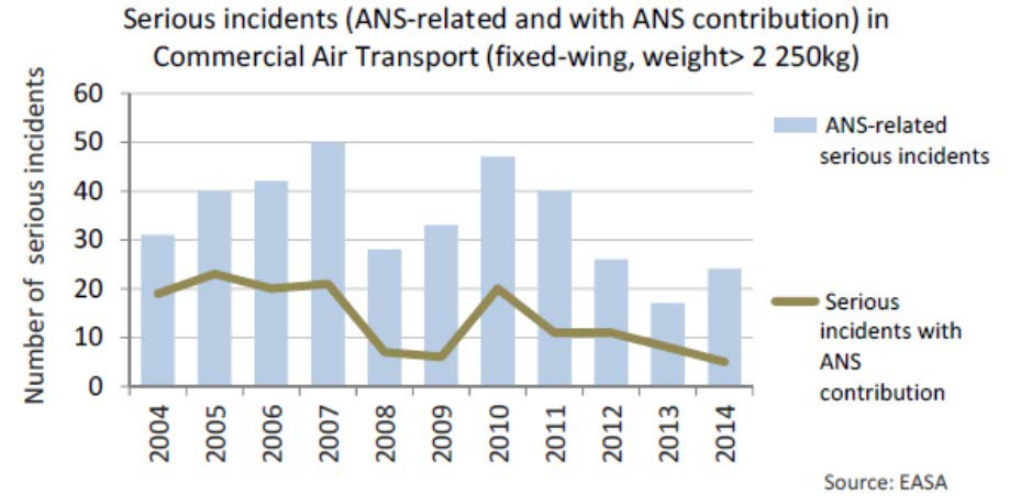
Figure 21 EU averages for severity assessment using the RAT methodology



Source: PRB Annual Monitoring Report 2014, Vol. I.

During RP1 there were no fatal ANS-related accidents and only one accident with ANS contribution (MET related) in 2013. The number of serious incidents with ANS contribution continued the positive trend observed since 2010 and decreased further in 2014 to the lowest level on record (see Figure 22). Separation minima infringements remained the single largest category for serious ANS-related incidents, followed by runway incursions (Eurocontrol; Performance Review Report 2014).

Figure 22 Serious incidents (ANS related and with ANS contribution in the Eurocontrol area



Main conclusion Field research

While the safety KPIs are considered appropriate, there is room for improvement with respect to the implementation. It is recognised by the stakeholders that the EoSM questionnaire is both difficult to complete and to standardise. The application of the RAT for SMI and RI is considered to be a good approach that reduces the subjectivity and supports the harmonization process. 'Application of RAT to ATM-specific occurrences (ATM-S)' is also seen by the majority of respondents as appropriate. Use of RAT for ATM-specific occurrences is considered to be ambiguous due to a lack of understanding of the definition of occurrences that should be assessed, even though further guidance has been provided. A general concern with the RAT method is that it

is has proven to be time and resource consuming.

Some stakeholders are of the opinion that safety should be a prerequisite to air transport operations rather than a KPA with a target, and that EASA is responsible for monitoring that the minimum required safety level is achieved.

However, the some stakeholders also indicated that safety KPIs are included as a counterbalance against effects resulting from targets on the other KPAs, and that they may have a longer term effect. It is also stated that the existing safety KPIs should not be abandoned because organisations spend a significant effort on these indicators.

4.5 *EQ 1e Effects on investment activity in ATM infrastructure during RP1*

1.e. What were the effects on investment activity in ATM infrastructure during RP1? Are there significant differences between investments planned in the performance plans and actual investments?

Answer to evaluation question

During RP1, a total value of approximately € 2.3 billion has actually been invested. There have been significant differences between investments planned in the NPPs and the actual investments realised: at Union-level, significantly less funds have been invested than was planned during RP1, in total almost 25 per cent or about 750 million EUR_{2009}. When looking only at 'main projects', some 21 per cent or about 386 million EUR_{2009}, less has been invested than planned.

This number is a result of under-investments by the vast majority of Member States, with only Slovenia, Germany, Switzerland, and Lithuania spending more than planned (and Austria, and Latvia spending more than planned on 'Main projects'). Taking RP1 as a whole, the following countries spent more than 50 per cent less than planned: Ireland, Belgium, MUAC, Netherlands, Romania, Spain, Finland, Portugal. Findings on CAPEX under-investments are corroborated by the finding that there has been a rise in the ANSPs' Return on Equity (RoE) throughout the EU.

Crucially, it is unclear from the reporting what happened with the capital reserved for investments that was not spent during RP1. In theory, appropriate handling would mean these unspent CAPEX should either be (partially) implemented during RP2 and/or (partially) deducted from RP2 CAPEX charges to users. This should be monitored closely by NSAs and the PRB during RP2. The PRB's Annual Monitoring Report for 2015, Volume 3 on CAPEX identifies that the issues highlighted here for RP1 have continued in 2015. The risk of inappropriate handling is highlighted especially. In 2015, underspending was widespread and the RoE much higher than planned.

Stakeholders are in agreement that the SES PCS are not equipped at this time to properly deal with investments, although ANSPs and NSAs have a more positive view overall of how CAPEX was dealt with (by them) during RP1 than do airspace users. Whereas ANSPs cite cost-efficiency pressures as having

had a negative effect on investments (and performance in the long run), airspace users indicate their frustrations about being charged large sums of money meant for investments, without these investments actually being implemented. The PRB acknowledges that during RP1 it did not have the right tools to monitor CAPEX developments appropriately. During the stakeholder consultation, it was recommended that CAPEX oversight is implemented at project level instead of at national level, to improve monitoring possibilities.

Main conclusion Desk research

Total investments were € 2.3 billion during RP1. There has been a large investment shortfall during RP1, with in total almost 25 per cent, or more than 750 million EUR_{2009} less being spent on investments than planned. When looking only at 'main projects', some 21 per cent less money, representing about 386 million EUR_{2009}, has been invested than planned. Only 6 countries spent more on investments (in total or on 'main projects') than planned, namely Slovenia, Germany, Switzerland, Austria, Latvia, and Lithuania.

The same story holds for 2015, where again significantly less CAPEX have taken place than planned.

Subconclusions Desk research

At Union-level

At EU-level actual capital expenditures have been less than the planned capital expenditures in the aggregated National Performance Plans throughout RP1. The difference was biggest in 2013, with almost 28 per cent less spent than planned, and averaged almost 25 per cent over the whole period. This corresponds to an investment expenditure shortfall of more than 750 million EUR_{2009}.

Table 4.11 CAPEX at EU level

	2012	2013	2014	RP1
Total planned CAPEX from NPPs (M,EUR2009)	1080.6	999.65	974.51	3054.76
Total actual CAPEX (M,EUR2009)	807.6	720.91	767.85	2296.37
Difference (M,EUR2009)	-272.99	-278.73	-206.66	-758.39
Difference (%)	-25.26 %	-27.88 %	-21.21 %	-24.83 %

There is a broadly consistent picture when considering capital expenditures into 'main projects', with investments consistently lower than planned, albeit that the shortfall is somewhat less severe. In this case, 2012 saw the biggest discrepancy with over 24 per cent less investment than planned. On average, some 21 per cent less was spent on investments into 'main projects' than planned, amounting to about 386 million EUR_{2009}.

Table 4.12 CAPEX in 'main projects' at EU level

	2012	2013	2014	RP1
Total planned CAPEX in 'main projects' from NPPs (M,EUR2009)	634.56	555.25	547.36	1737.17
Total actual CAPEX in 'main projects' (M,EUR2009)	480.33	446.78	440.03	1367.14
Difference (M,EUR2009)	**-156.89**	**120.53**	**-109.21**	**-386.63**
Difference (%)	**-24.31%**	**-19.54%**	**-19.61%**	**-21.30%**

At FAB level (with regard to NPP targets)

The BLUE MED FAB (Italy, Greece, Cyprus and Malta)[26] saw the smallest deviation with 6 per cent or almost 24 million EUR_{2009} investments less than planned, and the SW FAB (Spain and Portugal) saw the biggest with 62 percent or over 310 million EUR_{2009} less than planned.

Table 4.13 CAPEX total at FAB level, RP1

FAB	Total planned CAPEX from NPPs (M,EUR_{2009})	Total actual CAPEX (M,EUR_{2009})	Difference (M,EUR_{2009})	Difference (%)
BALTIC FAB	86.33	56.39	-29.94	-34.68%
BLUE MED	372.88	349.09	-23.79	-6.38%
DANUBE FAB	122.17	57.65	-64.52	-52.81%
DK-SE FAB	59.78	47.63	-12.15	-20.32%
FAB CE	285.26	225.07	-57.63	-21.10%
FABEC	1073.93	931.51	-142.42	-13.26%
NEFAB	106.45	69.42	-37.03	-34.79%
SW FAB	498.66	188.18	-310.48	-62.26%
UK-IRELAND FAB	449.29	371.41	-77.88	-17.33%
Total	**3054.75**	**2296.35**	**-755.84**	**-24.83%**

=

Table 4.14 CAPEX in 'main projects' at FAB level, RP1

FAB	Total planned CAPEX from NPPs (M,EUR_{2009})	Total actual CAPEX (M,EUR_{2009})	Difference (M,EUR_{2009})	Difference (%)
BALTIC FAB	63.44	35.82	-27.62	-43.54%
BLUE MED	244.7	217.38	-27.32	-11.16%
DANUBE FAB	110.55	30.75	-79.8	-72.18%
DK-SE FAB	30.26	27.89	-2.37	-7.83%
FAB CE	158.44	121.1	-53.94	-23.57%
FABEC	599.9	526.69	-73.21	-12.20%
NEFAB	78.95	58.59	-20.36	-25.79%
SW FAB	96.68	37.14	-59.54	-61.58%
UK-IRELAND FAB	354.25	311.78	-42.47	-11.99%
Total	**1737.17**	**1367.14**	**-386.63**	**-21.30%**

[26] Please note that data on capital investments is only available from Italy.

The DK-SE FAB (Denmark and Sweden) saw the smallest deviation with almost 8 per cent or more than 2 million EUR_{2009} investments less than planned, and the BALTIC FAB (Lithuania and Poland) saw the biggest with 44 percent or over 27 million EUR_{2009} less than planned.

At national level (with regard to NPP targets)

Considerable variation can be observed between ANSPs. In four countries, the ANSP spent more than planned: Slovenia (50.37%), Germany (33.64%), Lithuania (11.85%) and Switzerland (0.18%). The rest spent less than planned, with 8 ANSPs spending more than 50 per cent less than indicated.

More than planned	
Slovenia	50.37%
Germany	33.64%
Lithuania	11.85%
Switzerland	0.18%

Between 0 – 20 per cent less than planned	
Austria	-1.56%
Italy	-6.38%
Estonia	-14.54%
Denmark	-15.03%
United Kingdom	-15.17%
Slovakia	-17.86%
Latvia	-19.92%

Between 20 – 50 per cent less than planned	
Norway	-20.56%
France	-22.61%
Sweden	-23.70%
Hungary	-31.25%
Bulgaria	-35.73%
Poland	-37.68%
Czech Republic	-43.14%

More than 50 per cent less than planned	
Ireland	-53.38%
Belgium	-54.01%
MUAC	-55.59%
Netherlands	-58.31%
Romania	-60.12%
Spain	-61.82%
Finland	-66.42%
Portugal	-66.45%

Table 4.15 Total CAPEX over RP1, by ANSP (M EUR2009)

	Planned	Actual	Difference, EUR_{2009}	Difference (%)
Austria	82.06	80.78	1.28	-1.56%
Belgium	29.29	13.47	-15.82	-54.01%
Bulgaria	36.61	23.53	-13.08	-35.73%
Czech Republic	82.89	47.13	-35.76	-43.14%
Denmark	23.28	19.78	-3.50	-15.03%
Estonia	8.46	7.23	-1.23	-14.54%
Finland	34.37	11.54	-22.83	-66.42%
France	517.5	400.47	-117.03	-22.61%
Germany	251.62	336.26	84.64	33.64%
Greece	-	-	-	-
Hungary	61.05	41.97	-19.08	-31.25%
Ireland	25.42	11.85	-13.57	-53.38%
Italy	372.88	349.09	-23.79	-6.38%
Latvia	17.27	13.83	-3.44	-19.92%
Lithuania	5.23	5.85	0.62	11.85%
Malta	-	-	-	-
MUAC	58.09	25.8	-32.29	-55.59%
Netherlands	106.53	44.41	-62.12	-58.31%
Norway	46.35	36.82	-9.53	-20.56%
Poland	81.1	50.54	-30.56	-37.68%
Portugal	47.81	16.04	-31.77	-66.45%
Romania	85.56	34.12	-51.44	-60.12%
Slovakia	49.71	40.83	-8.88	-17.86%
Slovenia	9.55	14.36	4.81	50.37%
Spain	450.85	172.14	-278.71	-61.82%
Sweden	36.5	27.85	-8.65	-23.70%
Switzerland	110.9	111.1	0.20	0.18%
United Kingdom	423.87	359.56	-64.31	-15.17%
Total	**3054.75**	**2296.35**	**-755.84**	-24.83%

Note: red indicates no data was available.

The total capital expenditures into what are labelled 'main projects' by ANSPs over RP1 amounted to almost 1.4 billion $EUR_{2009,}$ whereas investments worth over 1.7 billion EUR_{2009} were planned. This amounts to an investment expenditure shortfall of over 21 per cent for 'main projects'.

Considerable variation is present here as well, with the same four countries 'overspending', complemented by Austria and Lithuania: Slovenia (67.09%), Germany (51.51%), Switzerland (33.05%), Austria (27.69%), Latvia (9.99%) and Lithuania (5.74%). The rest spent less than planned on main projects. Ten ANSPs spent more than 50 per cent less than planned, of which 2 even 75 per cent less than planned. This is listed in the overview and table below:

More than planned	
Slovenia	67.09%
Germany	51.51%
Switzerland	33.05%
Austria	27.69%
Latvia	9.99%
Lithuania	5.74%

Between 0 – 20 per cent less than planned	
Slovakia	-3.61%
Denmark	-5.97%
United Kingdom	-9.59%
Sweden	-9.80%
Italy	-11.16%
France	-16.19%

Between 20 – 50 per cent less than planned	
Norway	-20.56%
Estonia	-31.44%
Hungary	-33.60%
Poland	-47.96%

Between 50 – 75 per cent less than planned	
MUAC	-51.83%
Finland	-52.88%
Ireland	-55.78%
Belgium	-56%
Spain	-56.10%
Bulgaria	-56%
Portugal	-68.46%
Netherlands	-70.71%

More than 75 per cent less than planned	
Czech Republic	-76.03%
Romania	-78.66%

Table 4.16 Main CAPEX, by ANSP (M EUR2009)

	Planned	Actual	Difference. EUR_{2009}	Difference (%)
Austria	29.98	38.28	-8.3	27.69%
Belgium	25.4	11.21	-14.19	-56%
Bulgaria	32.17	14.02	-18.15	-56%
Czech Republic	49.02	11.75	-37.27	-76.03%
Denmark	15.57	14.64	-0.93	-5.97%
Estonia	8.46	5.8	-2.66	-31.44%

Finland	16.83	7.93	-8.90	-52.88%
France	297.26	249.14	-48.12	-16.19%
Germany	132.98	201.48	68.50	51.51%
Greece				
Hungary	36.9	24.5	-12.40	-33.60%
Ireland	18.43	8.15	-10.28	-55.78%
Italy	244.7	217.38	-27.32	-11.16%
Latvia	7.31	8.04	0.73	9.99%
Lithuania	5.23	5.53	0.30	5.74%
Malta				
MUAC	41.27	19.88	-21.39	-51.83%
Netherlands	88.71	25.98	-62.73	-70.71%
Norway	46.35	36.82	-9.53	-20.56%
Poland	58.21	30.29	-27.92	-47.96%
Portugal	42.87	13.52	-29.35	-68.46%
Romania	78.38	16.73	-61.65	-78.66%
Slovakia	34.67	33.42	-1.25	-3.61%
Slovenia	7.87	13.15	5.28	67.09%
Spain	53.81	23.62	-30.19	-56.10%
Sweden	14.69	13.25	-1.44	-9.80%
Switzerland	14.28	19	4.72	33.05%
United Kingdom	335.82	303.63	-32.19	-9.59%
Total	1737.17	1367.14	-386.63	-21.30%

Note: red indicates no data was available.

Return on Equity

Another way of thinking about the cost-efficiency of the scheme is by looking at the revenues and profit margins realised by the European ANSPs, taking into account the fact that RP1 saw an unexpectedly steep drop in traffic volumes. Our analysis shows that, even though at Union-level there was a decline in traffic, the average Return on Equity for ANSPs was larger than planned. This corresponds to lower CAPEX expenditures that, as a result, decrease the asset base vis-à-vis what was planned. Because the RoE is calculated as a ratio to the asset base, less CAPEX inflates the RoE measure.

We have calculated, on the basis of data from the PRB reports, the yearly over- or underperformance on Return on Equity in relation to the national targets as well as the over- or underperformance throughout RP1 as a whole. The same is done for traffic levels: on the basis of PRB data, we calculate the yearly over- or underproduction in terms of flight service units as well as the over- or underproduction for RP1 as a whole.[27]

The results are summarized in the table below. This shows that 19 countries performed better in terms of Return on Equity than planned for the period 2012 – 2014. Of these 19 countries, 12 countries had a larger Return on Equity than planned, even in the face of declining traffic volumes. The other 7 countries had a Return on Equity that was lower than the targets set in their national performance plans (NPPs).[28] (See Annexes I and II for the underlying data.)

Table 4.17 Return on Equity performance in relation to traffic volume changes

Overperforming Return on Equity (in reference to NPP target)		Underperforming Return on Equity (in reference to NPP target)	
Total	With declining traffic	Total	With increasing traffic
Union-wide	Union-wide	Malta	Malta
Cyprus	Cyprus	Romania	Romania
Czech Republic	Czech Republic	Sweden	
Denmark	Denmark	Germany	
Estonia	Estonia	Finland	
Belgium-Luxembourg	Belgium-Luxembourg	Norway	
France	France	Poland	
Switzerland	Switzerland		
Hungary	Hungary		
Ireland	Ireland		
Slovakia	Slovakia		
Slovenia	Slovenia		
Spain	Spain		
Austria			
Bulgaria			
Greece			
Italy			
Latvia			
Lithuania			
Portugal			
Overperformers	12	Underperformers	2

Source: Ecorys

[27] The underlying data is further detailed in the Annexes.

[28] Please note that the Netherlands is excluded from this analysis as the Dutch ANSP is financed entirely through debt instead of equity, and therefore has no Return on Equity. Croatia is not included as it only acceded to the SES scheme from RP2 onwards.

The table below shows that 15 countries saw their average Return on Equity (expressed in percentages) rise between 2012 and 2014. Of these 15 countries, 10 saw a rising Return on Equity even in the face of declining traffic volumes. The other 11 countries saw a Return on Equity (expressed in percentages) that was lower in 2014 than in 2012.[29]

Consequentially, even with a Union-wide decline in traffic, the average Return on Equity for ANSPs throughout the EU has risen.

Table 4.18 Return on Equity changes (2012-2014) in relation to traffic volumes

Return on Equity (%) higher in 2014 than 2012		Return on Equity (%) lower in 2014 than 2012	
Total	With declining traffic	Total	With increasing traffic
Union-wide	Union-wide	Bulgaria	Bulgaria
Cyprus	Cyprus	Italy	Italy
Denmark	Denmark	Malta	Malta
Sweden	Sweden	Romania	Romania
Belgium-Luxembourg	Belgium-Luxembourg	Czech Republic	
Switzerland	Switzerland	Estonia	
Finland	Finland	France	
Hungary	Hungary	Germany	
Ireland	Ireland	Norway	
Slovakia	Slovakia	Poland	
Spain	Spain	Slovenia	
Austria			
Greece			
Latvia			
Lithuania			
Portugal			
Overperformers	10	Underperformers	4

Source: Ecorys

The fact that 10 countries saw a Return on Equity that was higher in 2014 than in 2012 in the face of a sharp traffic downturn can be partially explained through the findings on unspent CAPEX.

2015 Data

The PRB's Annual Monitoring Report for 2015, Volume 3 on CAPEX identifies that the issues highlighted here for RP1 have continued in 2015, with an average investment shortfall of 27% (see table below). The risk of inappropriate handling is highlighted especially,[30] with the risk of inadequate handling of received funds and its re-imbursement to airspace users. In line with our findings, the PRB suggests a fundamental review of CAPEX deferred

[29] Please note that the Netherlands is excluded from this analysis as the Dutch ANSP is financed entirely through debt instead of equity, and therefore has no Return on Equity. Croatia is not included as it only acceded to the SES scheme from RP2 onwards.

[30] PRB RP2 Annual Monitoring Report (2015), Volume 3: CAPEX. To be found online here https://ec.europa.eu/transport/modes/air/single_european_sky/ses-performance_en. For risks associated with funding and reimbursement, see sections 2.2.6 – 2.2.19, pp.4-5.

spending handling and stresses that currently, project and spending tracking is unnecessarily complicated, with the resulting opaque system open to abuse.

All FABs except UK-IR underspent during 2015.

Table 4.19 Planned and actual CAPEX in 2015, per FAB

FAB	Planned	Actual	Delta (nominal)	Delta (%)
BALTIC	37.81	36.55	1.26	96.7%
BLUE MED	161.16	78.33	82.83	48.6%
DANUBE	46.96	23.21	23.75	49.4%
DK-SE	19.09	14.07	5.02	73.7%
FAB CE	92.32	74.64	17.68	80.8%
FABEC	394.03	280.42	113.61	71.2%
NEFAB	51.27	30.18	21.09	58.9%
SW	76.28	62.87	13.41	82.4%
UK-IR	135.46	139.13	-3.67	102.7%
Total	1014.38	739.4	274.98	72.9%

Source: PRB Annual Monitoring Report 2015, Vol. 3.

In 2015, the Return on Equity (pre-tax) of ANSPs was also significantly higher than planned, with an average of 12.6% actual RoE versus a planned RoE of 6.9% for 2015.

	Planned RoE	Actual RoE	Delta (%)
Union-wide	6.9	12.6	182.6%

Main conclusion Field research

Stakeholders cited various reasons for investments falling short of the target. Whereas ANSPs cited a variety of difficulties, airspace users argued that ANSPs have used money meant for investments to shore up their finances.

The difficulties posed by cost-efficiency pressures and the trade-off with investments was mentioned by ANSP stakeholders, where a trade-off between the short and longer term was recognised: in the short term, investments may be postponed to ensure the losses that result as a consequence of the cost-efficiency targets can be coped with. However in the longer term the lack of investments will have a negative impact on the (cost-efficiency) performance, as investments are needed to upgrade capabilities and capacity.

Subconclusions Field research

Suitability of indicators – could be used for acceptability of the scheme

When asked about negative unintended effects of the SES schemes, 60% answered in affirmative and only 19% noticed no negative effects. The majority of respondents noticed an increased administrative burden (especially on ANSPs and NSAs) due to the complexity of the schemes. They welcome simplification of the schemes and stated that some guidance on their application is necessary.

Many respondents claim that there are too many loopholes in the schemes due to their focusing on specific issues and neglecting the complete picture (interdependences between KPAs, local circumstances, specifics of small companies etc.) or neglecting areas where no targets are set. Also the complexity of schemes and conflicts between individual targets are believed to lead to inappropriate prioritising of targets and suboptimal trade-offs. A few respondents think that short-term thinking of the schemes leads to the neglect of important long-term issues, especially in relation to investments. Some respondents stated that the schemes set unrealistic targets (both too high or too low or irrelevant – due to local specifics).

KPIs and targets that are better aligned to controllable costs, applying different approaches to different cost components. Concretely, respondents propose to treat capital expenditures (costs and depreciation), costs of equity and costs exempt from cost sharing in a different way – for example by excluding them from determined costs and making them be subject to full cost recovery – in order to focus ANSPs on enhancing the efficiency of controllable costs. This proposal is supported by 7 respondents to the survey. It is also mentioned that indicators should attempt to capture the flexibility needed to respond to events and developments, for example allowing for re-profiling of capital expenditures and to prioritise different aspects in response to customer requirements.

Dealing with CAPEX

NSAs and ANSPs were asked about the way unspent capital expenditures during RP1 were dealt with during RP2. Out of 37 respondents, 17 (45%) indicated it was dealt with appropriately and 4 (11%) indicated 'mostly appropriate'. This slim majority of 21 respondents is opposed by 6 (16%) respondents stating it was only partially appropriate and 2 (5%) stating it was not appropriate at all.

Respondents were split about equally between ANSPs and NSAs. NSAs were more negative in their judgement than the ANSPs, accounting for both 'No' responses, as well as 4 out of 6 'partially' responses.

Some substantive suggestions for how unspent CAPEX could have been better dealt with have been given (only) by NSA-respondents:

- There should be clear guidance on handling of unspent CAPEX, with incentives (penalties) to ensure investments cannot be postponed and cancelled without consequences *(mentioned 2 times);*
- Capital expenditures are defined at high level in performance plans, not at project level. A lower level of oversight is needed to effectively monitor unspent capital expenditures;
- Introduction of a specific KPI for the preparation and implementation of the investment plan.
- Through the unlinking of capital expenditures and cost-efficiency: investment plans should be evaluated separately from the cost regulation.

One of the responses pointed towards a possible solution on the horizon:

- A Single Sky Committee Working Group on Economic Affairs is currently drafting guidelines for the handling of unspent expenditures. As soon as these are validated at SSC level, they will be available to ANSPs and NSAs.

NSAs and ANSPs were also asked whether the target setting process addresses long-term investments sufficiently. To this, 9 respondents (24%) indicated it did not, whereas 3 respondents (8%) said it did. Seven respondents (19%) indicated it was mostly sufficient, with double that number (14 or 38%) indicating it was only partially sufficient.

Leaving out the 'don't know' category, almost 70 per cent of respondents (69.7%) thinks the current target setting process is not sufficient to address long-term investment needs. Substantively, there are no differences in the views of ANSPs and NSAs, with 5 NSA- and 5 ANSP-respondents indicating it was either fully or mostly sufficiently dealt with, and 11 ANSPs and 11 NSA-respondents indicating it was only partially or not at all sufficiently addressed.

CAPEX charges to airspace users

Airspace users indicated that the Performance Scheme argued they have paid € 1 billion more than foreseen in the Performance Plans despite the fact that the traffic was 5% below forecasts during RP1. Part of this is due to non-realisation of the CAPEX plans (i.e. money planned for investments that was not spent).

Data gaps / limitations / notes

n/a

4.6 EQ 1f Was there a shift of cost allocation from en-route to terminal

1f. Was there a shift of costs between the regulated en-route activities and the not regulated terminal activities during RP1?

Answer to evaluation question

No evidence has been found for substantive shifts from regulated en-route activities to the not regulated terminal activities during RP1. In fact, the share that terminal costs represent in total ANSP costs has at Union level slightly declined, from 18.74 per cent to 18.49 per cent. At the same time it should be noted that when the longer period from 2009 to 2014 is considered, at Union level, the share that terminal costs represent in total ANSP costs has risen from 17.99 per cent to 18.49 per cent.

When evaluating the implications of these relative shifts, it should be noted that total terminal costs have gone down by EUR_{2009} 46.2 million over RP1 (and by EUR_{2009} 105.2 million in the period from 2009-2014). Also, in 2015 the share of terminal costs in the total costs has decreased to 15.2% (planned) or 15.1% (actual).

The majority of stakeholders consulted, including the airspace users, ANSPs and NSAs, indicated that they do not recognise potential shifts from terminal to en-route costs as being an issue. At the same time, there is broad support among stakeholders for instituting an indicator linked to Terminal Air Navigation Services (TANS), as long as this is a national responsibility to take into account the local circumstances ANSPs have to face.

The study team, however, considers the introduction of TANS targets at EU-level appropriate, given that there is still a possibility that shifts from regulated to unregulated activities will take place in the future and that there

is a need to consider the cost-efficiency of the system holistically. This means the regulatory approach should be in conformity between the en-route and terminal ANS costs. This is also to be seen in the light of the weak functioning of NSAs in the context of the performance scheme, as reported under the evaluation criterion Coherence further below.

Main conclusion Desk research

Percentage-wise, during the RP1 period the cost of the un-regulated terminal activities as a share of total costs for ANSPs have decreased by 0.25 percentage points. Looking at the period between 2009 and 2014, we see that the share of terminal costs out of total costs for ANSPs has risen by 0.53 percentage points. This is in line with findings from an earlier report by SDG[31]. This same study also notes significant differences between countries in the allocation of costs between en-route and terminal.

Subconclusions Desk research

At Union-level

Looking at the RP1 period:

- as total costs for ANSPs have gone down by EUR_{2009} 148.6 million;
- the terminal costs have declined *faster* than en-route costs (in percentages), going down by EUR_{2009} 46.3 million; so that
- the share that terminal costs represent in total ANSP costs has at Union-level declined from 18.74 per cent to 18.49 per cent.

Looking at the broader period from 2009-2014,

- while total costs for ANSPs have gone down by EUR_{2009} 799. 6 million from EUR_{2009} 8.1 billion to EUR_{2009} 7.3 billion;
- en-route costs have declined faster than terminal costs (absolutely and in percentages); and therefore
- while total terminal costs have gone down by EUR_{2009} 105.2 million;
- at Union level the share that terminal costs represent in total ANSP costs has risen by 0.53 percentage point from 17.99 per cent to 18.49 per cent.

In 2015, this share was planned to be significantly lower at 15.2%, with an actually achieved share of terminal costs vis-à-vis total costs at 15.1% - as shown in the table below.

Table 4.20 Union-wide share of terminal versus total costs, 2015

	2015	
	Planned	Actual
En-route costs	6,235,113,277	6,077,537,050
Terminal costs	1,118,019,472	1,084,905,609
% of terminal costs in total costs	15.2%	15.1%

At national level

There is large variation at national level regarding the change of the share of terminal costs in total ANSP costs from 2012-2014, with most countries experiencing a decrease but a sizable minority of 9 countries seeing an increase in this ratio.

[31] Steer Davies Gleave (April 2015), Policy options for the modulation of charges in the Single European Sky. Final Report for the European Commission, Directorate-General for Mobility and Transport, pp.85-86. To be found online at http://ec.europa.eu/transport/sites/transport/files/modes/air/studies/doc/ses/2015-04-policy-options-modulation-charges-in-ses.pdf

The distribution over RP1 is as follows:

Decrease in share of terminal costs vis-à-vis en-route costs

Spain (Canarias)	-3,17%
Bulgaria	-2,34%
Denmark	-1,99%
Spain (Continental)	-1,76%
Latvia	-1,53%
Greece	-1,29%
Sweden	-1,28%
Hungary	-1,15%
Germany	-0,88%
Italy	-0,84%
Portugal	-0,73%
Estonia	-0,55%
Belgium-Luxembourg	-0,36%
Slovenia	-0,22%
Finland	-0,18%
Cyprus	-0,16%
Czech Republic	-0,06%
Austria	-0,04%
France	-0,03%

No change in share of terminal costs vis-à-vis en-route costs

Poland	0,00%

Increase in share of terminal costs vis-à-vis en-route costs

Ireland	0,10%
United Kingdom	0,47%
The Netherlands	0,79%
Slovakia	0,81%
Norway	1,09%
Switzerland	2,29%
Lithuania	2,32%
Romania	2,66%
10. Malta	3,13%

Main conclusion Field research

Potential shifts from terminal to en-route costs are not recognised as being an issue by the majority of the stakeholders consulted, including airspace users, ANSPs and NSAs. However, a few NSAs and ANSPs have indicated they were aware of these costs being shifted. The magnitude of these shifts was indicated to be substantial, estimated at between 20 to 30 per cent. On the other hand, it was mentioned by several respondents that the cost-efficiency targets had a positive side-effect in reducing terminal costs as well, due to the synergies in the ANS cost basis.

A majority of respondents view instituting an indicator to measure Terminal Air Navigation Services (TANS) as an appropriate measure to monitor improvements in cost-efficiency. It was emphasized, however, that this indicator should be set nationally to take into account local circumstances of different airports. The study team, while appreciating the importance of the

local context, does not agree with this as it is deemed desirable to adopt a holistic regulatory approach to costs, treating both en-route and terminal costs in the same manner.

Subconclusions Field research

Suitability of indicators – could be used for acceptability of the scheme

Asked whether they were aware of costs being shifted from en-route to terminal, a majority of 82% (32 respondents) indicated 'no'. This includes the airspace users, and a majority of ANSPs and NSAs.

About 22% of NSAs (4 respondents) and 16% of ANSPs (3 respondents) indicated that they were aware of costs being shifted.

Asked about the magnitude of these shifts, the range of the responses was between 20 – 30%. One respondent added that it depends from one Member State to another and on the local constraints. Another added that it follows the NSA regulations regarding cost allocation.

A majority of just under 60% (14 of 34 respondents) view TANS as an appropriate indicator to measure improvements in cost efficiency. These targets should, however, be set nationally and not at Union-level, to take into account local circumstances.

The respondents were asked if they are aware of any other positive unintended effects of the schemes, not previously mentioned. Of those who answered this question positively (31%), many noticed the following:

- Due to synergies in the ANS cost basis, terminal determined cost has been reduced, even in the absence of the relevant EU wide target.

4.7 EQ 2 Have the objectives been achieved

2. Have the objectives been achieved? If not, which factors have hindered the achievement of objectives?

Answer to evaluation question

Following the introduction of the Single European Sky (SES) in 2004, there existed a self-regulatory regime on performance of ATM in Europe. It was in this context that the SES Performance and Charging Schemes were formulated. The self-regulatory regime resulted in 'a patchwork of performance' whereby the strong performance of some actors was outweighed by the poor performance of others.[32] It was further indicated in the EC's SESII Communication that safety levels needed to rise, the route network to be aligned with traffic, delays to be reduced, cost-efficiency to be improved and airspace fragmentation to be reduced. As part of the second package of the SES II legislation adopted in 2009, the Performance Scheme was introduced with the following stated objectives: "to contribute to the sustainable development of the air transport system by improving overall efficiency of ANS across the key performance areas of safety, environment, capacity and cost-efficiency, in consistency with those identified in the Performance Framework of the ATM Master Plan, all having regard to the overriding safety objectives."[33]

[32] European Commission, 2008, Single European Sky II: towards more sustainable and better performing aviation, COM (2008)389 final.

[33] Commission Implementing Regulation (EU) No 390/2013 of 3 May 2013 laying down a performance scheme for air navigation services and network functions

The RP1 performance targets, which were set in a context of increasing traffic (~+15% forecast from 2009 to 2014), foresaw capacity improvements exceeding traffic growth, in order to reduce en-route ATFM delays "below the best-ever achieved levels" (i.e. target set at 0.5 min/flight by 2014 and into RP2). Similarly, flight efficiency was to improve faster than traffic in order to ensure carbon neutrality of ANS during RP1. Costs were to kept "nearly unchanged", resulting in a significant decrease in the unit costs (approximately -13% compared to 2009).[34]

Taking into account the objectives outlined in the preceding 2 paragraphs, it is possible to conclude that the Performance and Charging Schemes have only partially fulfilled the stated objectives. On the one hand, performance across all 4 KPAs measurably improved, albeit in a context of significantly lower traffic levels than planned in the NPPS. Indeed, the lower traffic made targets / objectives in the area of capacity and environment easier to achieve, while making cost-efficiency targets more difficult to reach. The actual outcomes over RP1, however, failed to meet Union-level targets, and cost-efficiency saw the largest improvements of the 4 KPAs. In short:

- The level of safety, expressed as the number of serious incidents with ANS contribution has improved during RP1. Although the safety indicators are not directly coupled with safety outcomes, it is likely that the performance and charging scheme had a marginally positive influence on the level of safety because the indicators relate to essential factors that enable safety performance.
- Although en-route ATFM delay reached the best levels ever recorded in 2013 (0.53 min/flight), the target set for 2014 (0.5 min/flight) was not achieved (0.63 min/flight in achieved delay), and delay has since increased during 2015 and the first half of 2016, alongside traffic increases. Furthermore, it is not possible to conclude that initial improvements in capacity during RP1 were due to improved management of traffic flow or capacity increases as such.
- Flight efficiency performance improved faster than traffic, though slower than the target of 4,67% (-0,75% decrease).
- Cost-efficiency performance improved during RP1, with reductions in the actual unit costs incurred by the States and airspace users. In the legal sense, the Cost-Efficiency targets have been met by design, as these were used for billing to airspace users. In an operational sense, ANSPs have not improved their own cost efficiency as much as planned. ANSPs managed to reduce unit rates against the plans by cutting costs in response to lower revenues than planned arising from traffic downturn, so as to maintain or improve their profit margins. To this end, the risk-sharing is considered to have motivated behaviour as intended, while not always distributing benefits equally to airspace users (see Q21).

The most important endogenous factors identified as hindering achievements in line with expectations are the interdependencies between KPAS, financial limitations, lack of political support and social and labour issues. In particular, the interdependencies between KPAs is of critical importance going forward, widely viewed as disproportionately incentivising improvements in the area of

[34] PRB Annual Monitoring Report 2014 – Volume 1, p. 63-64.

cost efficiency at the expense of all other KPAs. Many respondents pointed out that current objectives do not sufficiently account for interdependencies between the objectives, between KPAs/KPIs and between different types of operators. It is felt that a greater coherence of, and balance between, the objectives, KPAs/KPIs and the performance contributions of different types of operators (e.g. ANSP, airspace users, airports) would better reflect the industry reality, as well as the diversity across Member States, and positively impact the realisation of the objectives.

In addition to these issues, two exogenous factors were responsible for lower than expected cost efficiency performance, namely the economic climate (i.e. the 2008 economic crisis) and resulting traffic downturn.

Main conclusion Desk research

Overall, EU-wide targets were not met for any of the KPAs for which Union-level targets were set, yet all KPAs saw improvements in the performance during RP1 and the first year of RP2 in comparison to the baseline. It can be concluded that, while improvements did materialise as intended by the performance and charging schemes, achievements were not sufficient to keep pace with EU-level targets.

The specific achievements and shortcomings are analysed in detail under the corresponding evaluation question (Q1.a – 1.d).

Main conclusion Field research

Respondents to both the OPC and the targeted surveys were requested to indicate the extent to which achievements have met expectations (i.e. objectives) for each KPA. These response have been summarised under the evaluation Q1.a-Q1.d.

Regarding the factors which have hindered the achievement of performance objectives, where relevant, the most important hindering factors (i.e. top-2 ranked per KPA from each survey) are:

1. Interdependencies with other KPAs (Safety, Environment)
2. Financial limitations (Safety, Capacity)
3. Lack of political support (Environment, Capacity)
4. Social and labour issues (Capacity, Cost efficiency)
5. Traffic downturn (Cost efficiency)
6. Economic climate (Cost efficiency)

Subconclusions Field research

Factors hindering the achievement of respondents' expectations in the KPA of safety

Among respondents to both the OPC questionnaire and targeted survey, the two most frequently cited factors hindering the achievement of respondents' expectations in the KPA of safety are '*interdependencies with other KPAs*' and '*financial limitations*'.

In the comments provided by the respondents, the limitations resulting from interdependencies are often explained by a limited overall investment budget for further pro-active safety measures and improvements. Financial limitations were linked to the difficult economic situation resulting from the economic crisis that occurred during RP1. Respondents commented that technology is costly by itself, and its installation, staff training, continued

maintenance and other related costs are very high. Thus, the price of safety comes in conflict with the objective to reduce cost.

In this context, it was also mentioned that improving safety should not be included in the Performance Scheme, but rather that the Performance System should only measure the increase or decrease of safety in relation to the other KPAs to ensure that no excessive strain on safety is introduced by the pressure on other KPAs.

Factors hindering the achievement of respondents' expectations in the KPA of environment

In both the OPC questionnaire and the targeted survey, excluding the category '*other*', the two most frequently cited factors hindering the achievement of respondents' expectations in the KPA of environment are '*interdependencies with other KPAs*' and '*lack of political support*'. Regarding interdependencies, the respondents mainly pointed out a conflict with the KPA of cost-efficiency: to save costs, airspace users tend to choose longer routes with lower navigation charges. Lack of political support was also an important factor in this respect: there is a lack of political willingness to implement a regulatory framework to force airlines to fly the shortest route as this opposes the goal to liberalize the ANS.

The third most frequently cited category in the OPC is '*fragmentation of ANS*' (cited by 11), whereas this hindering factor was cited by only 3 respondents to the targeted survey. It is said that the fragmentation of ANS, which is linked to the existence of national monopolies, renders little opportunity to change the current situation.

It can also be noted that the most frequently cited category in the targeted survey was 'Other'. A key argument in this respect is that airline flight planning choices is the main factor affecting routes flown, especially on longer haul routes where the flights are generally not planned based on the minimum distance, but on minimum cost or time. ANSPs are not able to influence this route selection which adversely affects ANSPs' ability to manage performance against the KEA metric. It was also argued that an environmental target should not be applied for ANSPs where Free Route Airspace exists as flight efficiency depends on the Airspace Users actions (or State airspace reservations).

Airline respondents to the targeted survey indicated that lack of political support, insufficient FAB-level performance and fragmentation of ANS are the factors hindering the achievement

Factors hindering the achievement of respondents' expectations in the KPA of capacity

Many of those who answered that the achievements in the KPA capacity are lower than expected simply referred to data on actual performance against targets set. Many consider that Member States and operators were not pushed hard enough to make the necessary investments, from which there were no significant consequences. Also, not all relevant factors influencing capacity were believed to be addressed, including, for example, the impact of staffing issues (including industrial action) and the lack of instruments to deal with social disruptions.

Among OPC respondents, the most frequently cited hindering factor in the KPA of capacity is '*social and labour issues*' (16 respondents), indicated by the majority of airspace users, many ANSPs and even one trade union. This was followed by '*lack of political support*' (11 respondents) and '*fragmentation of ANS*' (10 respondents). Lack of political support was elaborated as a combination of lack of will both on the part of States and ANSPs, lobbying and lack of incentives/ sanctions for non-compliance. Fragmentation of ANS and different regulatory frameworks for ANSPs also impacted the overall performance. To overcome institutional constraints, it was commented that civil-military coordination could be improved. Due to a reduction of traffic levels and budget limitations, some said that investments were limited to save costs. Faster SESAR deployment and more automation could help to increase capacity. The issue was also raised with how to measure ANSPs' performance where there was zero delay from the outset.

The most frequently identified hindering factor among respondents to the targeted survey was '*financial limitations*' (11 respondents), followed by '*social and labour issues*' (10 respondents). The NSAs and ANSPs broadly identified all of the factors as hindering achievements, although ANSPs did not chose '*Fragmentation of ANS*'. By comparison, airspace users chose a narrower range of factors: '*Lack of political support'*, '*Insufficient FAB-level performance*" and '*Fragmentation of ANS*'. The Network manager respondents identified '*Financial limitations*' and '*Insufficient FAB-level performance*'.

It can be observed among the respondents' clarifying comments that 'financial limitations' and 'interdependencies with other KPAs' are intrinsically linked: the most important interdependency is that of the cost-efficiency KPA. Given the context of a depressed economic climate and resulting drop in traffic, to which service providers responded by cutting costs in order to maintain or improve their margins, planned investments to increase capacity saw significant delays and/or cancellations altogether. Similarly, cost-cutting measures put pressure on staffing and in return, on capacity.
Social and labour issues appear to be very nation-specific, with references to ATCO strikes and social negotiations in some Member States as preventing further enhancements in the area of capacity.

Factors hindering the achievement of respondents' expectations in the KPA of cost efficiency

According to OPC respondents, social and labour issues (named by airspace users and ANSPs) lead the poll (16 respondents) regarding constraints to cost-efficiency. There is seen to be a lack of political will for reforms (due to vested interests), often linked to/or exacerbated by the absence of a fully independent regulator (14 respondents). The respondents also mentioned factors such as no possibility and /or incentives to reduce costs and lack of a reliable and accurate five-year traffic and service unit forecasts. Due to volatility of traffic volumes, there was a downturn of service units and routing changes (11 respondents). Few respondents think that a KPI on the network manager is necessary.

Respondents to the targeted survey, on the other hand, most commonly cited the following factors: '*traffic downturn*' (18 respondents), '*economic climate*' (15 respondents) and '*social and labour issues*' (12 respondents).

The European economic crisis and resulting drop in traffic are the most frequently cited factors said to constrain improved cost efficiency performance. The main impact stems from the traffic downturn as this is a factor beyond the direct control of the providers. However, given the link between macroeconomic indicators and the level of traffic demand, the negative economic climate in recent years has resulted in significantly lower traffic levels than forecast in the National Performance Plans (NPPs). This in turn impacted the cost/traffic ratios of ANSPs, which in many cases led to lower than expected income for ANSPs, as costs could not be immediately reduced to the same degree and level.

Notwithstanding the economic crisis and subsequent traffic downturn, several respondents point to the overall satisfactory level of performance achieved by ANSPs despite the major drop in traffic compared to the levels forecast in the NPPs. This is explained by the fact that many ANSPs responded in turn by adopting extensive cost containment strategies. ANSPs in many States reduced cost bases below determined costs forecast in NPPs. One ANSP notes that strong performance achieved in this way should be viewed with scepticism: “as it has been done in part by postponing investments, so those costs will reappear in the coming years, hampering additional costs reduction and in the meantime, the operational benefit of those investments have not materialised. In [this Member State], some salary adjustments shifted for unexpected “technical reasons”. Regarding RP2, the lack of revenues due to the RP1 traffic downturn, leading to major RP1 investments postponement to RP2, made it impossible for those States to reduce their costs in the period.”

In some cases, additional measures aimed at cost-savings and productivity gains require significant changes in ATCO rostering and managements (i.e. decrease in wages/salaries). Such measures are linked to local social dialogue cycles, which are not in line with the Performance Scheme calendar. Moreover, changes need several years to see an impact (low personnel turnover due to longer careers).

For example, in RP1, one ANSP “managed to satisfy the customer requirement of closing the ATCO shortage and at the same time to reduce its cost base more than it had planned. Due to the sharp decrease in traffic development, [the ANSP], however, was not able to meet the DUC target.”

To a lesser extent, the regulatory burden is argued to be so high that it consumes any gains made in cost-efficiency. Under the ‘other’ category, interest rates were cited as a factor that is not fully under the control of ANSPs (inflation).

Taking into account the different categories of stakeholders, respondents saw the hindering factors differently: whereas ANSPs and NSAs saw almost all factors as relevant in one way or another, for airspace users the most important factors seem to be lack of political support, insufficient FAB performance and fragmentation of ANS.

4.8 EQ 3: Are there other indicators that are more suitable

3. Are there other indicators that should have been used to measure or target performance improvement so as to better achieve the objectives?
Answer to evaluation question
Whilst the indicators in each KPA are seen as having a number of shortfalls, there appear to be few alternatives that would significantly improve the scheme without introducing complexity or additional indicators, which runs counter to the comments from stakeholders that the scheme should be simplified. For safety a balanced combination of outcome-based indicators and leading indicators is the most appropriate way to monitor performance. The PRB has established a process of trialling new indicators before reviewing and potentially using them for target setting. In the context of this process, the following recommendations are made: **Environment KPA** • Investigate the inclusion of vertical flight efficiency, including for approach and departure operations. • Investigate the inclusion of time-based horizontal flight efficiency indicators, on the basis that time is a closer proxy to airspace user costs than distance. **Safety KPA** • A limited number of outcome based indicators should be introduced to improve measurement of safety performance. • The EoSM indicator should be improved and maintained as leading indicator • It should be recognised that safety is a counterbalance to the other indicators and that indicators used by EASA or NSAs should not be replicated. • Targets can be set for process based indicators. Targets for indicators based on the number of reported occurrences should not be introduced in safety, as this is potentially counterproductive and could harm safety levels. **Cost efficiency KPA** • Consider a total economic value indicator, incorporating the quantifiable impacts of the other KPAs (not only delays within Capacity, but also fuel consumption savings and CO2 emission benefits for Environment). Such an approach will require a mature tool to account for all relevant factors and correlate costs and benefits. • Use the actual unit rate level and trend to monitor the true cost for users. Currently, due to the traffic and cost risk sharing mechanisms and related carry-overs, substantial differences emerge between unit rate and unit cost trends. • There should not be a target for TANS at the EU level, targets should be set nationally only. **Capacity KPA** • Investigate the inclusion of percentage of flights delayed by > 15'/20', taking into account peak vs normal operations. It was noted that monitoring of the average delays hides the extremes, which cause most of the airspace user problems. • Consider weighted delay performance indicators. For example, to place

greater weight on long delays and operationally critical departures in the morning.

Main conclusion

The established methods for introducing and trialling performance indicators should continue, but as a consequence of this study the following indicators should be assessed:

- Vertical flight efficiency.
- Time-based horizontal flight efficiency indicator(s)
- Total economic value indicator
- Actual unit rate to monitor the true cost for users
- Percentage of flights delayed by > 15'/20'
- Weighted delay performance indicators

Subconclusions

At Union-level

1. It has been suggested that there should be focus on ANS controllable aspects only, factoring out external influences. The concern that this brings is that it is likely to add to complexity and detailed arguments about whether performance was correctly attributed. Hence such a focus could be counterproductive to the main objective of the scheme.
2. There were numerous proposals for presenting indicators differently, to show aspects of ANSP performance that are not coming across in the high-level figures, for instance:
    - performance attribution – e.g. setting out different delay causes or highlighting where airspace users choose not to take the shortest route;
    - length of delay – for example, showing delays in histogram form to distinguish between short and long delays;
    - showing delay in respect of weekly or seasonal peaks.
3. There is a view that the Performance Scheme should be focused on indicators in congested airspaces only. This refers to concerns that there is a lot of 'null' reporting in respect of some States, for example those who have traditionally had low delay figures.
4. There is an argument that additional time in ASMA should be linked to the Environment KPA rather than capacity.
5. Traffic volatility should be captured within the scheme, providing flexibility to respond to events and developments, for example allowing for re-profiling of capital expenditures and to prioritise different aspects in response to customer requirements.
6. It was mentioned that automated recording systems should be in place to support the safety KPA. The PRB has reservations for this, in that a great deal of analysis and interpretation will be required, making such an indicator expensive to produce. The study supports this view, considering that such data is best used internally by ANSPs as part of their inputs to safety management.
7. There have been numerous suggestions to change the approach to target setting:
    - include other airspace users and military;
    - define traffic dependent capacity targets to account for traffic volatility;
    - add buffers to capacity targets (we note that there effectively is a buffer of 0.09min/flight).

At national level (with regard to NPP targets)
• There were several recommendations for more transparency in the calculation of indicators, so that these could be reproduced by ANSPs. Whilst there are published methods (Performance Dashboard), this does not include all details. The risk is that small errors will occur and the process will become caught up in minutiae. The way forward may be through further automation and the development of tools that ANSPs could use themselves.

4.9 EQ4: Are national and joint actions organised optimally

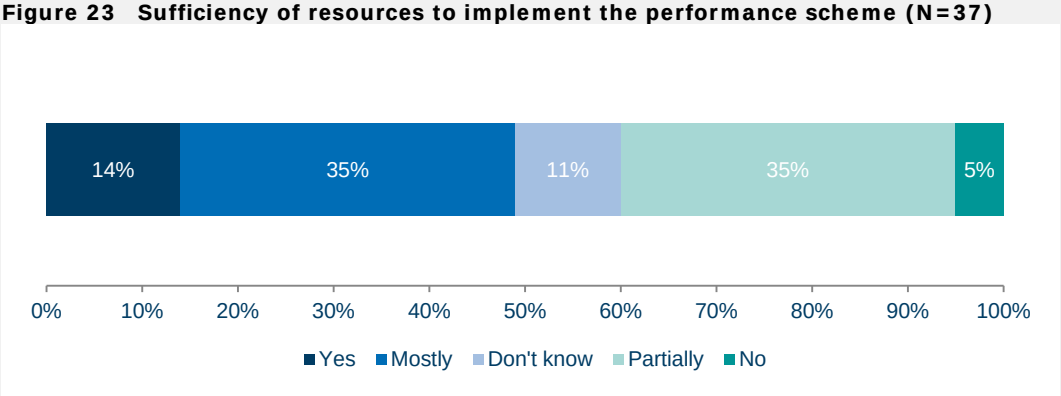
4. Are actions at national and EU level organised in a way to maximise their joint effects e.g. by mobilising resources at national level supporting the implementation of the performance scheme (e.g. working group of National Supervisory Authorities)?
Answer to evaluation question
The main conclusion is that the actions at national and EU level are not systematically organised in order to maximise their joint effects, but rather emerge by necessity in the context of growing requirements and shrinking (human) resources / capacity. While there are some examples of NSA working groups on performance, for example, joint actions tend to be organised within the FAB structures. There are many FAB initiatives that provide some joint effects benefits, however the majority of these initiatives only indirectly focus on the performance and charging scheme, with the exception of a sub-set of committees (e.g. FAB Financial and Performance Committees set up in certain FABs) with a clear mandate related to the Performance and Charging Scheme. We therefore conclude that the knowledge gaps and under-resourcing at certain NSAs is not fully covered by the majority of joint actions indicated by stakeholders.
Main conclusion Desk research
Not addressed in the desk research.
Main conclusion Field research
The stakeholder consultations reveal that there is no systematic or structured approach to organising actions at national and EU level with the intent to maximise their joint effects in support of implementing the performance scheme. Rather, due to resource and capacity constraints, in particular within NSAs, joint actions emerge by necessity. Both ANSPs and NSAs generally view the NSAs as being under-funded, lacking sufficient capacity (manpower) and expertise for the implementation of the performance scheme. It is said that this has led to a situation in which NSA resources are maximised by relying increasingly on ANSPs' expertise, in turning, risking the independence of the NSA body itself. To improve this situation, additional resources and capacity-building measures are foreseen, with examples such as EASA's network of analysts. At the same time, stakeholders provide many examples of activities that have been organised for these purposes, e.g. through training activities, knowledge sharing and various working groups meetings, although many of the indicated initiatives refer to FAB activities or initiatives.

Subconclusions Field research

On the availability of resources

The questionnaire asked whether respondents had sufficient availability and sufficiency of resources (e.g. number of staff, qualification of staff) to implement the performance scheme, with just under half of responses believing there is. NSA respondents were less confident that they had had sufficient resources, which is reflected in the detailed comments.

Figure 23 Sufficiency of resources to implement the performance scheme (N=37)



For NSAs, more training initiatives are a prerogative as it is difficult for existing staff to develop the required new responsibilities. It was commented that this means that only 1-2 people in each NSA are responsible with managing the entire performance scheme, and the pressure of this may cause individuals to leave. This is exacerbated by recruiting problems occur related to the lack of flexibility and the absence of effective tools to keep talented and expert resources within the organisation. An additional concern is the workload and expenses required in conducting the activity. One commented that in some NSAs the senior management have not approached the responsibilities well and have therefore not provided additional resources.

ANSPs cite an increasing workload in order to implement the performance scheme, with both NSAs and small ANSPs short of resources to even understand complicated regulations. Smaller organisations do also not have the manpower available to cope with the short peaks of work that are created by the scheme. ANSPs identified no main resource issues themselves but concerns about the shortage of staff in some NSAs, which they felt had little capability to manage the requirements of the performance scheme. A consequential effect is that NSAs may to rely on ANSPs, making it difficult to maintain an independent viewpoint. However, the ANSPs' concern arises from concerns of the ability of the NSAs to fully understand and communicate the local specific constraints to which ANSPs are subject. With highly capable NSAs, ANSPs are also better able to find a balancing opinion with the PRB. In the comments it was proposed to organise a common aid available to all NSAs. With the increasing role of FABs, this could be supported at FAB level.

In the OPC, when asked about positive unintended effects, one respondent noted the following:

The SES schemes created a (FAB) pool of experts, provided a network for exchange of information and practices with other stakeholders, created a comparative framework for performance assessment and increased overall transparency.

Regarding availability of resources / capabilities to effectively monitor cost

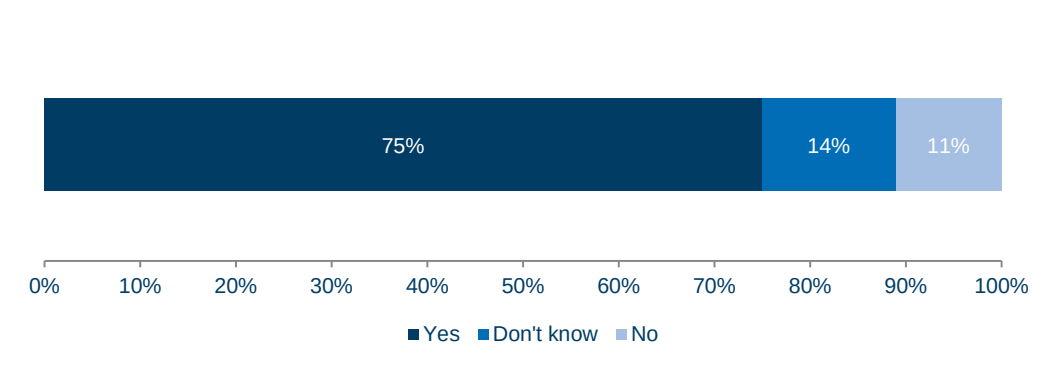
efficiency (relates to the additional burden to NSAs):
Overall, the respondents offer a moderately positive view, with nearly all respondents (13 of 15) who represent an NSA indicating that their oversight capabilities are at least partially sufficient. Just 2 of the 15 NSA respondents indicate that oversight capabilities are '*not at all*' sufficient. When asked to elaborate, one respondent notes that the amount of time and workload dedicated to ensuring oversight of cost efficiency performance comes at the expense of resources for the same purpose across other KPAs. [From the targeted survey]

It was also stated in interviews with Member States that the administrative burdens for national authorities are unnecessarily high. The different reasons for this that were provided include: changing formats, tight deadlines, unclear deadlines, many details (in particular, controllability of ANSP costs), missing data, limited resources and inconsistent data (e.g. coming from the ANSP and coming from the network manager).

On stakeholders' awareness of cooperative initiatives

Respondents were asked about their awareness of (and/or participation in) cooperative initiatives and actions at the national / FAB / EU level to support the implementation of the performance scheme (e.g. pooling expertise on performance aspects at FAB level, NSA working groups, etc.). As illustrated below, the responses were predominantly positive:

Figure 24 Awareness of cooperative initiatives and actions to support implementation of the performance scheme (N=36)



Respondents volunteered actions to different degrees, ranging from specific initiatives to the creation of (FAB) pools of experts to overall increased networking opportunities for the exchange of information and practices with other stakeholders. Several ANSPs cited their FAB cooperation actions but did not list them individually. The actions and initiatives cited as examples are listed below:

FAB initiatives:

- UK-IRL FAB Network Management
- NEFAB Free Route Airspace (together with Danish/Swedish ANSP)
- NEFAB Interim Deployment Program (NEFAB ATS-services)
- NEFAB ANSPs in NORACON consortium for SESAR Phase 1
- FABEC Financial and Performance Committee
- FABCE Aviation services, established in order to allow for common procurement and better Project Management
- NEFAB business plan including e.g SMS harmonisation
- Coordinated efforts within FABEC in all areas of the performance scheme

Other (non-FAB) performance initiatives (capacity and environment):

- iTEC (Interoperability Through European Collaboration - joint collaboration of European air navigation service providers to deliver a new flight data processing system to support the future ATM services)
- Borealis Free Route Airspace / 9-State NSA Group
- NSA coordination platform, and particularly the WG on Performance and FABs

- Other (non-FAB) economic initiatives:
- Single Sky Committee Group on economic aspects

- Other (non-FAB) safety initiatives:
- EASA audits

- Other (non-FAB) initiatives:
- Eurocontrol Certification study group
- Consultation platform for Deployment Programme implementation

It is worth noting the predominance of the FAB initiatives listed above. With the exception of the 'FABEC Financial and Performance Committee', the abovementioned FAB initiatives should have been implemented regardless of the Performance and Charging Schemes (i.e. in the absence of schemes). Therefore the listed FAB initiatives providing mostly indirect benefits to Performance and Charging Scheme objectives. With the increasing prevalence of FAB level targets during RP2, this link may logically increase, however the majority of the initiatives are indirectly linked to performance objectives.

5 PRB EFFECTIVENESS AND IMPACT

5.1 EQ 5 Was the PRB effective in providing independent advice to the EC

5. Was the PRB set-up (designation of Eurocontrol's PRC as PRB supported by Eurocontrol's PRU) during the first reference period effective in providing independent advice to the Commission in respects to its tasks laid down in Article 3(3) of Commission Implementing Regulation (EU) No 390/2013?
Answer to evaluation question
The PRB has been effective in providing independent advice to the Commission. It's advice on target setting has been based on substantial analysis of historical data and comparisons with US performance. The work was robust in its range and depth and subjected to stakeholder consultation. Whilst there have been criticisms of the PRB's independence, there is no evidence that any of these criticisms have borne out - its advice to the Commission on target setting was at or higher than the actual targets agreed by the Single Sky Committee. This suggests that the greater problem lies in the ambition of States and in delivering the performance scheme through national regulatory frameworks. At the same time, however, it is noted that the PRB has raised issues to the EC and SSC over the support from Eurocontrol. These issues were initially discussed at SSC/54 (July 2014), at which it was also reported that stakeholders had a strong preference to develop the PRB as an independent advisory agency[35]. The study has been informed that further issues were raised in SSC/57 (July 2015). These issues and the stakeholder support were key to the Commission's action to set up the PRB as of 2017 in a different form (experts appointed directly by the Commission and supported by a new contractor).
Main conclusion Desk research
The PRB has been effective in providing independent advice to the Commission.
Subconclusions Desk research
At Union-level
1. To assess the overall effectiveness of the PRB, the study has considered the run-up to the performance scheme and the achievements thereafter. The PRB carried out substantial analysis using historical data and comparisons with US performance as evidence for target setting. The work was robust in its range and depth and subjected to stakeholder consultation. The work also captured the likely risks, some of which have since materialised, such as the fall in traffic.
2. The advice given to the Commission was accepted and the performance out-turn has been close to the set targets, albeit that the Cost Efficiency target was lowered in the final deliberations of the Single Sky Committee. This suggests that the final targets were deliverable within the context of the operational challenges, national regulatory frameworks and ambition of

[35] ICB ATM Information Digest April 2015.

States. We therefore consider that the PRB has carried out its tasks effectively.

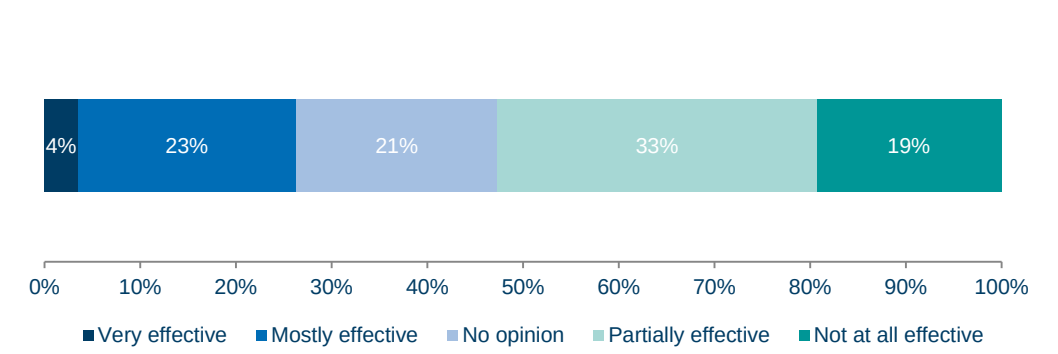
3. The study has looked at the parties involved in the production of KPIs, to see if there are any weaknesses in the chain of data. Because the KPI production process fully includes NSAs and ANSPs, they should be capable of validating any of the PRB data against their own. In practice ANSPs or NSAs may find it difficult to validate some KPIs due to the unique capabilities of the Network Manager. Nevertheless ANSPs and NSAs should be able to validate data approximately, which leads us to conclude that the governance around KPI production should be effective. However, two possible issues are apparent:
    - The EoSM audit of ANSPs by NSAs, where some NSAs may not have the capability to audit their ANSP.
    - The instances of 'regulatory capture' which have been raised during the initial study consultations. This raises questions around the impartiality of NSAs in target setting (particularly Cost Efficiency and capacity) and monitoring (of safety). The factual analysis and insights of the PRB/PRU and EASA should counter any tendency for regulatory bias.

Main conclusion Field research

In the stakeholder consultation the study sought opinion on the effectiveness of the PRB in each of 11 specific roles and responsibilities. To eight of these the opinion was largely positive and some example responses are given below:

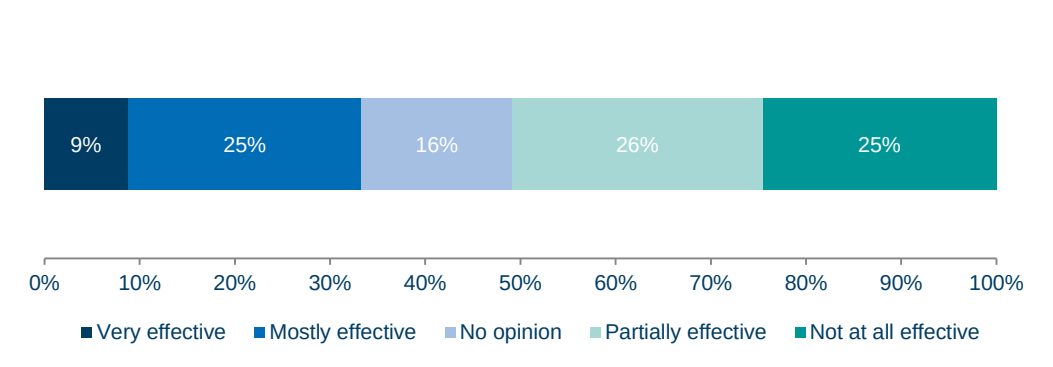
- The effectiveness of PRB setting and revising of Union-wide performance targets and alert thresholds was judged very - partially effective by ANSPs, NSAs and Ministries, although airlines mostly had the opposite view:

Figure 25 Effectiveness of PRB setting and revising of Union-wide performance targets and alert thresholds (N = 57)



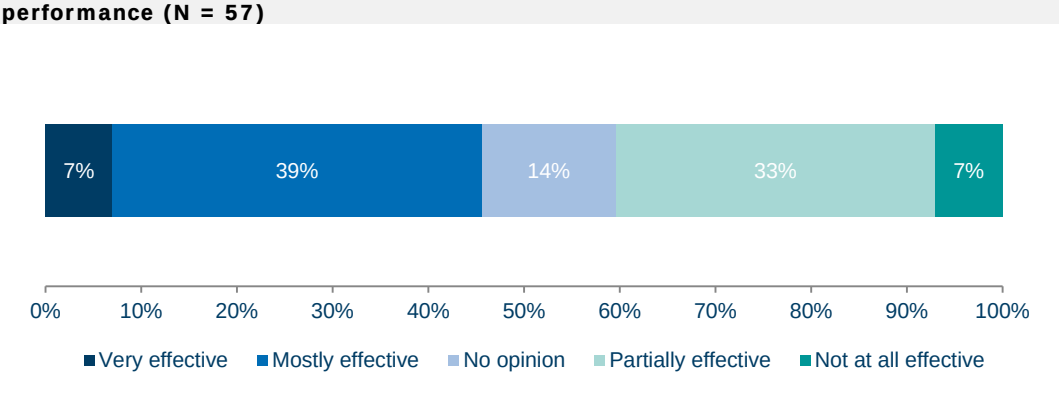
- There was slightly less support for the effectiveness of PRB consistency assessment of adopted performance plans:

Figure 26 Effectiveness of PRB consistency assessment of adopted performance plans (N = 57)



- Concerning the effectiveness of PRB monitoring, benchmarking and review of ANS, including investment and CAPEX at local and Union levels and of the performance of the network functions, respondents also judged the PRB effective:

Figure 27 Effectiveness of PRB Monitoring, benchmarking and review of ANS performance (N = 57)



There were also three areas which were judged in the majority to be only partially or not effective:

- Consistency of assessment of adopted performance plans – this seems to reflect the concerns that there is insufficient input from the local level in target setting.
- EU target setting – our view is that the perceived problems with target setting are not those of the PRB but with what is seen to be achievable by States.
- Definition of appropriate KPIs – this depends very much on perspective and the PRB is steering a difficult course between indicators that are practical without being unduly complex.

Subconclusions Field research

Some stakeholders believe the PRB is lacking expertise, such as financial/pensions and safety. The issue around pensions concerns the PRB not fully accounting for the different pension arrangements in States, where some ANSPs have been required to fund their pension schemes in an environment of low investment returns.

There were several issues raised about the independence of the PRB, and these have been amplified further at a meeting with the PRB, which has concerns, among other things, that it is not able to appoint its own members or fully direct the PRU. ANSPs generally believe the PRU to be doing good work, but also have concerns about institutional conflicts.

Some stakeholders also believe that the approach to monitoring/benchmarking etc. is too generic and high level. They also argue that target setting should be locally driven. The argument is that NSAs know their ANSPs better than the PRB. However, given the criticisms of NSA resources and skills, a robust local level of performance oversight could be difficult to achieve in the short term, so the study recommends that the PRB should continue to support NSAs in local target setting.

Stakeholders have argued for more transparency on the PRB's decision making, particularly around target setting.

Stakeholders proposed some improvements to the PRB in managing the performance scheme:

- Improve stakeholder interaction.
- Improve the process timelines. One comment was that the establishment of EU-wide targets and the drafting of Performance Plans should be parallel processes feeding each other; one engaging top-down and the other bottom-up. It is argued that this will give a better balance of top-down vs achieving local specificities and help time lines.
- Improve the visibility of the PRB's work programme.
- More guidance material should be provided.
- The PRB is too focused on costs and needs to consider the interdependencies.
- There should be a better balance between top-down assumptions in target setting and local, bottom-up realities.

In respect of RP3 regulatory framework, the respondents proposed that the following issues should be addressed for RP3:

- Lack of recognition of bottom-up considerations in the development of EU-level target proposals
- Lack of recognition of local requirements and circumstances in performance plan assessments.
- Interdependencies between KPAs/KPIs.
- Delays in meeting deadlines (e.g. assessment of performance plans).
- Monitoring templates should focus on their scope and not be used to gather additional information.
- New requirements appear after approval of the regulations and plans, while data gathering processes are not clear and sometimes lead to inconsistencies.

Data gaps / limitations

6 DATA QUALITY

6.1 *EQ 6 Was data of high enough quality for Commission and PRB usage*

6. Was the data that was submitted in accordance with Annex V of Commission Implementing Regulation (EU) No 390/2013 and the Annexes of Commission Implementing Regulation (EU) No 391/2013 of a quality that allowed the Commission and the PRB to use it in a proper way during RP1?
Answer to evaluation question
The data appears sufficiently accurate for the purposes of target setting, accepting performance plans and monitoring: • The study has estimated measurement errors for a sample of indicators (en-route delay and horizontal flight efficiency) and find that fractional errors are typically <2%. • In respect of the charging scheme our assessment is that random errors are low, but the main risk to accurate measurement is the extent that the charging data provided by NSAs may be reconciled with audited accounts. • Certain systematic errors have been discovered and addressed through enhancement of data consistency and validation checks. Our assessment is that these errors have not had a material effect on the performance scheme (2012-2015). Once errors have been identified the PRU/PRB has raised them with the EC to gain agreement on how they are treated and any remedial action for past indicators (such as re-calculation and publishing on the PRB dashboard. Our view is that some such errors were inevitable where the source of data is from operational systems. Where errors have been discovered they appear to have been dealt with relatively quickly considering the challenging timescales faced by the PRB and the PRU. • The PRU process is to exclude data where there are apparent errors, and include them once these errors are understood and treated. Thus errors affects the sample size rather than the data quality.
Main conclusion
The data submitted in accordance with regulations 390/2013 and 391/2013 and as managed by the PRU is of a quality that allowed the Commission and the PRB to use it in a proper way during RP1.
Subconclusions
At Union-level
1. A side question for the study was the independence of the Network Manager, which is the source of data by which it measures its own performance. From an exploration of the governance arrangements, the Network Manager appears to operate in an independent capacity, in that it is not motivated to provide anything other than accurate information and it is accountable to the Network Management Board, which has wide industry representation. Should the Network Manager itself be incentivised with respect to targets then additional measures may be needed, such as the PRU to do more of the raw data processing.
2. The allocation of delay causes by the Network Manager is a new post-ops process and as such is still being fine-tuned. The published post-ops process appears robust in that it allows the opportunity for ANSPs to

challenge delay allocations and, if they are not satisfied with the Network Manager's ruling, to escalate to NSAs and the Network Management Board. This process therefore appears to provide transparency. We would, however, suggest that the post-ops process is subject to review once it has been running for a year as the disputed delays appear small, and the need for the process is a consequence of how NSAs have enacted their incentives schemes, not how the KPI is defined. I.e. the 0.5min/flight EU + 2 delay target assumes all causes of delay.

3. EASA have raised concerns about the quality of safety data from some States and their access to it. Safety data was not part of the study's detailed investigations, but from the targeted survey it was noted that there is a lack of understanding of the definition of occurrences. Coupled with a deficiency of oversight in some States with under-performing NSAs, there are likely to be errors in the total number of reported occurrences: by under-reporting and incorrect classification for example. We propose that this issue is carried into the work programme of the PRB.

Estimates of measurement errors

The following sections describe assessments of data quality for en-route delay and flight efficiency, with some additional comments on airport data measurement.

En-route delay data quality

Systematic errors

Recalculation of slot times leading to over-estimation of delay at A-CDM airports. An issue arises with A-CDM airports where slot times are automatically recalculated without adjusting the EOBT. This means that delay may be over-estimated. The issue has been apparent for MUAC delays and it is estimated that the effect is to add 1-2% to estimated delay. This is currently being investigated by the PRU and Network Manager.

Ready to depart (REA36) message. An issue arose in 2015 where it was observed that once an REA message has been issued, the time at which the ETFMS receives the REA becomes the new EOBT. This will increase the delay in respect of the actual flight plan. For example, if EOBT was at 1100 and a RDY message issued at 1050, the Network Manager would add an additional 10 mins to the delay (CTOT- (EOBT+EXOT)). A change was introduced in April 2016, so that the RDY time is not included in the delay calculation. Following this change the Network Manager estimates that delays of previously affected flights will have decreased by 10-12%. NB, this is the only change that affects the amount of delay recorded, other changes implemented concern the attribution of delay causes only.

Random errors

We have estimated the error based on the precision of the CTOT and ETOT. These times are calculated in minutes and seconds but are then truncated[37] to minutes for operational use. This implies a round-off error of up to 59s, or t ~ +1.0 min. The indicator may be written as: average delay/flight, D_{AVG}.

$D_{AVG} = \frac{1}{N}\sum_{i=1}^{N}(CTOT_i\text{-}ETOT_i)$ where N is the number of IFR flights in the region of interest (State, FAB, SES Area). It follows that the delay error calculation is from delay D: D = CTOT $+\Delta_{CTOT}$ – ETOT $+\Delta_{ETOT.}$ Where both Δ_{CTOT} and Δ_{ETOT} are 1min and propagating these errors gives Δ_D = +/-1min. The error in the number of flights, N, is assumed to be negligible, so the estimate of the KPI error is based on Δ_D only. To find the fractional error Δ_D/D, we use the average delay per delayed flight of 20 min[38] and assume that delayed flights are 20% of total flights, so the fractional error is 1/(20/0.2) = 1%.[39] Furthermore, the summation of each delay, $D_{1..N}$, is assumed to have the same average error of 1%, so the estimated error in the KPI is 1%, for example 0.63+/-0.01 min when rounded to 2 decimal places.

Because the error is substantially smaller than the quantities being measured, it is sufficiently accurate to establish whether targets have been met at the EU level. However, caution is required so as not to over-interpret this error estimate, as the KPI comprises a measure of two *planned* times (ETOT and CTOT). From the earlier discussion on the number of flights, if flights were in error by as much as 5% this would increase the proportional error to 6%, e.g.

[36] "The REA message is designed to enable local ATC / ARO units to inform the ETFMS that a regulated flight is fully ready to depart before its EOBT / CTOT." Source: Network Manager Network Operations Handbook V20.

[37] http://prudata.webfactional.com/wiki/index.php/Airport_ATFM_delay. For example, a value of 10'59" would be truncated to 10'.

[38] Daily delay value from NM ATFCM Weekly Briefing 26/2016.

[39] NB, if this was a single physical quantity being measured the average error would be further multiplied by 1/√N, but this does not apply here.

0.63+/-0.04 min, which would also be sufficiently accurate for the objectives of the performance scheme.
Flight efficiency data quality

Systematic errors

The PRU have identified one systematic error, caused by the data provided having the date *and* time given for the first trajectory point only, with time only provided for subsequent data points. This created errors when the time crossed over into a new date (eg.23.59 to 00.01). In these cases the consistency checking algorithms identified the data as incorrect, as the latter data point (00.01) preceded the former (23.59) in time sequence. The consequence was that the affected records were filtered out from the KPI calculation.

Random errors

The indicator comprises measurements of different segments of a trajectory, comparing these to the calculation of 'achieved' distance. Achieved distance is a concept that has been introduced to account for measuring the indicator across different FAB boundaries, so that the sum of individual achieved distances adds up to the total great circle route between origin and destination.

The sources of measurement error are therefore believed to be represented by two cases:

1. The determination of the intercept points of a trajectory on a FAB boundary (entry and exit points).
2. The measurement of the actual trajectory length.

From discussions with the Network Manager we have learned that the errors from Correlated Position Report (CPR) data is ~+/1Nm per position (altitude measurement error has been disregarded as a minor effect).

To calculate the impact of this measurement error on the trajectory is complex so, within the scope of this study, we have assumed that the error in the overall trajectory is no more than +/- 1Nm in both latitude and longitude. For case (a) we estimate the uncertainty in trajectory length across a narrow region of FAB airspace that is 20Nm across. With an uncertainty in the entry and exit point of +/- 1Nm the variation in length of a straight trajectory is further simplified by considering the maximum trajectory as the hypotenuse of a triangle with sides of length 20Nm and 2Nm (from +/-1), which is 20.1NM. In this example the uncertainty in trajectory length Δ_L is 0.1Nm and the proportional error Δ_L/L = 0.5%.

In practice the FAB regions will be much larger than this example, which would imply a smaller proportional error than 0.5% in general. For case (b), we consider a 20Nm trajectory that is not a straight line and has an uncertainty in its length also of +/- 1Nm. This also provides a proportional error of 0.5%. Combining case (a) and (b) gives a total proportional error of 1%.[40] Assuming that the error in achieved distance H is the same as L, the combined fractional error in HFE is 2%, e.g. 4.67+/- 0.09.

[40] Note that if these values were known as standard deviations the appropriate propagation of errors formula would be the square root of the sum of squares of the constituent errors, I.e. SQRT(2) = 1.4%.

To form a view of whether the data quality is sufficient for the PRB to advise the EC, we consider that the target setting has been a 0.75% improvement in KEP relative to 2009 for RP1 (i.e. 4.67% by 2014) and 4.10% by 2019 in RP2. For KEA the target is to decrease from 2.96% in 2015 to 2.60% in 2019. The measurement error will be largest for KEA, as this is measured from CPR data rather than calculated from the flight plan. Given our estimated error of 2%, e.g. 2.96+/- 0.06, the error is substantially smaller than the quantities being measured and so the data should be sufficiently accurate to set targets and identify year on year improvements.

Following from the above, we suggest further work on these errors by the PRU to identify the standard deviation of (L-H)/H for a sample of origin-destination pairs, which should give a better indication of uncertainty in HFE.

Airport data quality

Systematic errors

- Airports are not always informed of the need to report data from their NSA and do not always have an operational need to measure the data specified (such as runway direction).
- Errors can arise from reference values changing due to changes in, e.g., stand configurations and even runway designation. Over time a number of checks have been developed so that these explainable differences can be readily identified and appropriate action taken. Any records that flag an error are excluded from the determination of the performance indicators. The calculation of PIs shows the number of records included, with the whole airport being excluded from the monthly analysis if there are errors in more than 10% of the records.
-

Random errors

Errors have not been estimated in the scope of this study but we note the following:

- Measurements of delay from different sources are tolerated within +/- 2 minutes. It was noted that Scheduled Time of Arrival (STA) was, for about 95% of records, the same measurement as Schedule In-Block Time (SIBT). STA may differ from SIBT where airports may use more precise timings, e.g. accurate to 1 min for airport planning purposes, whereas STA is used for passenger schedules and is less precise (~5 min accuracy).
- The different measures of flight events (OOOI), such as actual off-block times (AOBT) are typically recorded through ACARS messages. Airport docking systems are also used to record flight event times. In RP1 different definitions were being used by airlines, such as what constitutes the actual off-block time (AOBT), so CODA have been working to align contributors around a standard definition. For example, the airport might regard AOBT as when the gate is free for another aircraft, because this is linked to billing. An airline may record AOBT as when wheels are moving or above a particular speed (and then report via ACARS).

6.2 *EQ 7 Was handling, analysis and review of data, and resulting findings, effective*

7. Were the handling of data, the data analysis, the data review and resulting findings effective?
Answer to evaluation question
The processes for gathering and handling data appear robust: • Processes are documented in various forms, including high level descriptions and work orders. • Data gathering is supported by written guidance and coaching interventions with those responsible for providing data. • A wide variety of error checking and validation methods have been used to ensure that data used in calculating performance indicators is accurate. Data which does not meet these criteria are filtered out, so the effect of non-valid data is to reduce the sample size rather than affect the measurement accuracy. • Data gathering is through electronic means with good security management, which is particularly important in gathering sensitive economic data. • Data validation is a continuous exercise for the PRU and several issues have been discovered, analysed and treatments recommended to DG MOVE. This covers not only measurement techniques but issues where the regulations have been interpreted differently.
Main conclusion
The handling of data, the data analysis, the data review and resulting findings were effective.
Subconclusions
The following sections describe aspects of data handling for en-route delay, flight efficiency and airport data. Data handling processes have been under a process of continual improvement by the PRU and
En-route delay data handling
The process for handling delay data is a straightforward measurement of the component quantities (Delay = (CTOT – ETOT) / Flights). The number of flights is obtained from counting each flight record, which should not introduce any error. As this data is provided solely by the Network Manager there was a side question for the study on the independence of the Network Manager, our conclusion is independent in that it is not motivated to provide anything other than accurate information and is accountable to the Network Management Board, which has wide industry representation. There have been some practical matching issues where a flight might cross a dateline but the this has a very small impact on the overall number of flights. The discussions with the PRU and Network Manager led to the observation that comparisons with other sources of flight numbers may be unreliable. For example, not all airports record the same number of IFR flights as the Network Manager, potentially excluding business or GA flights. This is more prevalent at small airports, which may not have robust processes or high degrees of automation. The PRU cross-checks airport reported and Network Manager data on flights and estimates the difference to be around 5% at worst. This does not contribute to the estimate of error in the section “en-route delay data quality” under Question 7, as the KPI calculation is based on

the Network Manager data and not the airport-reported flights.

The Network Manager established a task force to look into delay measurement, which reported in 2012[41]. This identified a number of issues arising from operational practices that impact the performance measurement. The ODSG Task Force comprised airlines and ANSPs and agreed on the treatment of delay calculations so that the performance measures would be seen as rational and avoid the possibility to manipulate delay figures (e.g. by sending a REA message to reduce the delay). Some of the issues addressed, for already regulated flights, were as follows:[42]

- If the aircraft operator issues its own delay message with a new (later EOBT), the new EOBT is used to calculate the delay, which is less than the original delay.
- If the standard taxi time is increased, this results in a revised (later) ETOT and the delay may be reduced with respect to this revised ETOT.
- If a ready (REA) message is issued earlier than EOBT, the measured delay is increased. This is now changed so that the delay is calculated from the original EOBT, not the time of the REA message.
- If the flow controller updates the OBT, the original EOBT is still used to calculated the delay (otherwise the delay would be shorter).
- At an A-CDM airport the AO issues a new TTOT after the original CTOT (outside of the -5 – +10 min slot tolerance window), the ATFM delay is defined as the new CTOT – the original TTOT.

Flight efficiency data handling

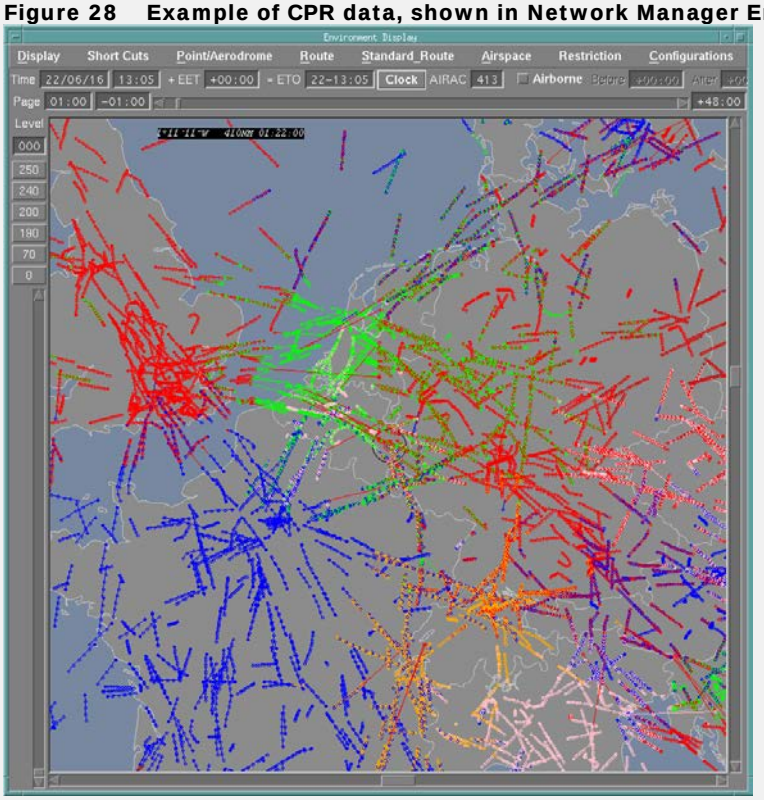
The basis for the measurement of trajectory is either the last flight plan filed (KEP) or surveillance data (KEA). The study focused on KEA, for which the raw data is gathered by the Network Manager in the form of 'Correlated Position Reports' (CPR) data, derived from secondary radar data[43] in the Asterix Category 62 format. The CPR data is continually sourced from each ACC via 'entry node' computers, which communicate the CPR data to the Network Manager for consolidation within the ETFMS. This data is used operationally to update flow management calculations. The entry nodes transmit data on a 30s cycle and the data is kept for 5 years.

41 ODSG Delay Calculation Task Force, June 2012.

42 EOBT = Estimated off block time, ETOT = estimated take-off time, TTOT = target take-off time.

43 There has been some recent work investigating the use of ADS-B data in place of CPR. This comparison has used the NM's 'Replay' tools, comparing predicted trajectories after inputs from CPR, ADS-B and ADS-B + CPR data. The measure of accuracy is in relation to the stability of prediction, i.e. if a trajectory is repeatedly recalculated this indicates a low accuracy of the input data. The calculation is deterministic, so the prediction would be repeated given the same input data. The conclusion was that ADS-B is as accurate as the CPR data but not always complete. There were also found more syntactical errors with ADS-B.

Figure 28 Example of CPR data, shown in Network Manager Environment Display



The CPR data is used to create a flight profile, which is known as a CPF. This is the data provided to the PRU/PRB. Each item of data reported is checked for basic syntax errors and whether the flight has actually been filed, for example where a VFR flight is included within the surveillance data (this occurs for a very small proportion of flights and this data is excluded). Alternatively, it is possible that a flight plan has not been received. The surveillance data is matched to flights so the progress of the flight can be used to update the flow management picture. Some deviation between planned and actual trajectory is possible if the flight is not following the flight plan, such as when a 'direct' is given. The Network Manager implements rules about how trajectories are computed and when they should be computed (currently the tolerance is to re-compute if the trajectory deviates by 1min or more).

Statistics are collected on error rate and sent to those in NMOPs responsible for operational data quality. If no CPR data is received for a flight then the system assumes that take-off is delayed by 5mins. I.e. no delay message has been sent for the flight, which could mean that the flight is suspended. Other errors trapped are based on implausible CPR points, such as implied speed between one point and another.

The Network Manager passes a set of data to the PRU for further analysis. This includes the CPF data, the calculated trajectory length and calculations of intersection points between the trajectory and distances of 40Nm and 100Nm from the origin and destination (4 points in total). The trajectory length is

computed from a smoothed function of the component CPR points. The PRU then runs a further series of consistency checks[44], such as checking that trajectory points are in correct time order and there are no discontinuities. Any record that fails the consistency check is excluded from the KPI calculation. This is around 10% of records, which implies that around 90% of ~10M or ~9M records were used in the calculation of the KPI in 2015.

Airport data handling

Airport data is nominally supplied to CODA but the pre-processing and analysis is done by the PRU. By comparison, CODA's data collection is currently through files sent by email, although a similar web interface may be used in future. Not all airports provide the correct data so a variety of quality checks have been developed. A specification for information to be supplied was issued in 2012 and now airports are required to report according to this specification through a web-interface. Airports are required to demonstrate compliance with a validation web-reporting interface before being admitted to the live environment. Much of the airport information comes from the units that also supply data for billing. This is useful to note as the implication is that there is some data checking by airports for correct billing, although this may not be prior to submission to the PRU.

Data is uploaded by airports into the DANSAP (Data from ANS operational performance at airports) dashboard. In 2015 83 airports out of a possible 173 airports were compliant with the RP2 requirements. The PRU notes that some States have nominated a large number of airports to report under the scheme, and not all of these nominated airports may in practice be able to achieve the technical maturity to report.

Once data has been uploaded it undergoes a series of quality checks: format, completeness validity, consistency and comparability, timeliness and accuracy. The uploaded data is rejected if any fields fail the compliance checks. These checks and the process is described in the document 'Airport Operator Data Flow – Data Specification', Edition Number 00-11. An example of a data consistency check is that the recorded milestones of a flight are in order of expected precedent and within reference values (such as unimpeded taxi times). Sometimes this flags errors because of changes at the airport which require the reference values to be updated.

The current processes have been operational since 2012, with an increasing number of airports qualifying to meet the required reporting quality. Updates are made each year to the automatic quality checking and advisory information is communicated annually to reporting airports.
Processes are documented and guidance has been communicated to airports to advise on how to submit data. Additional hands-on support is provided when airports first join the submission process and as problems arise.

[44] Further details in PRU Horizontal Flight Efficiency Indicator Methodology, 23/5/2014, but note that this is currently being updated.

Data is also cross checked with other sources such as CODA data, collected from airports directly. (data is submitted to CODA on a voluntary basis which has built up over the years and is provided by airlines and airports). The airport reported data is considered the primary source but is also checked for inconsistencies against other sources than CODA. For example, airport-sourced flight records are compared with NM data to ascertain any key differences. This can be a flight by flight comparison. The data are normally able to be matched to within a few percent of records. Typical differences are that private and military flights are not included in airport reported data but are in NM data. Airports are provided with an overall summary of compliance, which shows, for example, any concerns over the accuracy of the matching/cross referencing of AOBT between airport-reported and airline reported data.

Data checks are run on each month's data. Airport data that appears to be outside of expected tolerances is reviewed in detail by an operator reviewing preceding months' data and drilling down into reasons why the data may be different. Some data is required from sources other than direct from the airport, such as CPR data from the NM. Aircraft type used to be sourced from the NM but now is sourced from the airport. For the taxi-out PI, all data is sourced from the airport.

Data gaps / limitations

6.3 *EQ8 Were allocations of cross border activity allocated correctly (in view of delegated airspace)*

8. Did the data analysis take sufficiently account of existing agreements of delegation of airspace in Europe so that results of cross border activity were allocated correctly?

Answer to evaluation question

The study estimates that a small systematic error has been introduced in the measurement of delay and potentially flight efficiency for RP2 which measures performance according to FIR boundary, in comparison to RP1 which measured performance according to operational boundaries. Information on this was only available towards the end of the study period so the study team has made a rough estimate of the size of error as <2%.

The study has looked into whether cross-border delegations of service have impacted the measurement of indicators, as the areas of responsibility of the individual ANSPs (operational boundaries) are not necessarily coincidental with the geographical boundaries of the State.[45] The operational boundaries are defined by the air traffic service providers providing the service, whilst the geographic boundaries by the FIR(s). This issue is relevant only for performance indicators that could show different results depending on whether the measurement uses operational boundaries or FIR boundaries.

[45] http://prudata.webfactional.com/wiki/index.php/Minutes_of_en_route_ATFM_delay_per_flight.

Theoretically this applies to all indicators, but in practice it is only relevant if the indicator value depends on the specific characteristics of a geographical area. It therefore applies to the en-route delay and flight efficiency indicators. It does not apply to the safety indicators because these are linked to processes in organisations, and does not apply to cost efficiency indicators , because these are linked to charging zones defined by States. A further consideration is whether the indicators are reported at FAB level, as any measurement differences will only be relevant if they are inter-FAB, rather than within a FAB.

From discussion with the PRU, there is a difference in measurement of performance in RP1, which was based on operational boundaries, and RP2, which is based on FIR boundaries. Hence the PRB presents indicators calculated with the FIR boundary whilst the Network Manager presents indicators from the perspective of operational boundaries.

Main conclusion

The data analysis handled service delegations correctly in RP1, but the change of measurement boundary in RP2 has introduced a <2% systematic error that needs to be addressed.

Subconclusions

At Union-level

1. Most delegations are small and the Specification for Information Disclosure (sections 3.3.3 and 3.3.4) requires reporting only if they are more than 5% of State/FAB airspace. The main example identified in this study is that of the Tyrol region, which is Austrian airspace for which service is delegated mostly to DFS (ACCs Karlsruhe and Munich), with some control of traffic by skyguide (ACC Zurich). In this case delays with a geographical reference LO are assigned to Austria and with GD are assigned to Germany. According to the PRU this means that delay is generally allocated to Germany as DFS have not used a separate LO designation.
2. Traffic count is based on the ATC Unit Areas provided by Network Manager, which are in line with 'operational boundaries' and not FIRs. Hence the North-South Traffic count for Tyrol flights is included in Germany's performance and not Austria's. Taking these two aspects of delay and flights together, and according to the FIR boundary view, some of FABCE delay performance is included in FABEC. Our consideration of this issue is as follows:
    - Ideally a correction is needed so that the reported delay maps to the FIRs. However, from an examination of the sectorisation in the region, the ED sectors that cover the Tyrol region also cover areas of German airspace, so a means of disaggregating the performance is needed; such as assuming a geographical split, which we estimate may be at most a 50:50 apportionment of the sector delays from Germany to Austria.
    - Most delegations are small, <5% of airspace, so the effect may also be small, but this depends on the performance of the area in question (delay and flight efficiency). To size the problem at EU level, we estimate that no more than 5% of services are delegated, and that at least 50% of these are within a FAB (and so do not cause any problem of apportionment). Also assuming that delay is also split 50:50 between States (for cross border sectorisation), the size of

difference would be ~ 5%x 50% x 50% = 1.25%. I.e. we estimate the impact on performance measurement to be less than 2%. More detailed investigation is required to confirm this.

Data gaps / limitations

The initial enquiries of the study concluded that differences in cross-border allocations of performance were minimal, particularly where performance is measured on a FAB basis. However, following a meeting with the PRB on 10 November 2016 the issue has been reconsidered in the light of the service delegations between Austria and Germany in the Tyrol region. Whilst we estimate that the effects are small, the study has requested information from the PRU on the delegations identified in the Specification for Information Disclosure sections 3.3.3 and 3.3.4.

7 EFFICIENCY

7.1 EQ 9 Were outputs and effects obtained at a reasonable cost

9. Were the outputs and (expected) effects obtained at a reasonable cost? (This should include estimates of the costs at all levels (EU level (including PRB), national level (NSA costs, etc.), airspace users and other stakeholders participating in the scheme.)
Answer to evaluation question
The benefits of the SES performance and charging schemes have significantly outweighed the costs during the period under evaluation. In quantitative terms, the benefits amounts to € 3.4 bn in terms of delay reduction improvements for users and passengers, and reduction of the en-route service provision costs. These benefits are considered to be catalysed by the schemes, whereby efforts (investment) by ANSPs were required for their realisation. Also there is relation with other SES pillars such as the NM. In addition, there are benefits that have been qualified but not quantified (improved flight efficiency, increased transparency on ATM performance, increased uniformity in reporting on ATM performance). The costs of the system has been valued at € 87 million during the evaluation period. The majority of stakeholders agree that the effects have been obtained cost-efficiently, although many point to the fact that the system is complex and leads to a high administrative burden. This is not substantiated by their effort reporting on the system.
Main conclusion Desk research
The benefits catalysed by the performance and charging schemes are estimated at € 3.4 bn for the evaluation period, while the costs have been estimated at € 87 million in total.
Subconclusions Desk research
The **costs** of the system are directly incurred by different stakeholders: • The EU funding for the PRB in support of the schemes since the PRB designation is approximately €7 million per annum (including PRU support). • EASA: There are current 2 FTE involved in the performance scheme at EASA. • The costs of NSA supervision of the SES initiative ranges between € 60-75 million per year during the evaluation period. However, this includes all costs of NSAs and thus is significantly higher than the pure costs of the performance and charging schemes. The targeted survey results point at an increase of 2-3 FTE as a result of the introduction of the performance scheme. • Airspace users: while before RP1 there were already consultations with users taking place, the performance and charging schemes resulted to an increase in consultations and across the board more involvement of airspace users. Based on input from the PRB, the increase is estimated at 15 FTE of persons from airspace users associations and individual airlines to be significantly involved in the performance and charging schemes. This might be complemented by involvement of users at

local level, but it has proved difficult to obtain data on this. The stress of the work at local level is during the consultations as part of the performance planning, which has taken place now twice since the performance and charging schemes have been implemented during a short period. On the other hand, during our consultations we have also identified that some users rely on their representative associations in Brussels regarding the performance schemes. Therefore, we assume that the 15 FTE covers all in all the airspace user involvement in the scheme as a net increase compared to the pre-RP1 period.

- ANSPs: the survey response indicated an increase of staff involved in the performance and charging schemes of approximately 2-4 FTE compared to the pre-RP1 period. As the response rate to this question in the survey was relatively low, we have discussed this issue during the workshop with stakeholders and there were no signals that the order of magnitude was significantly wrong. We assume therefore that on average per ANSP the increase amounts to +3 FTE.

Based on the above, the costs of the schemes are estimated in the order of almost € 22 million per year, or around € 87 million for the entire evaluation period. This is summarised in the table below.

Table 7.1 Estimated costs of the schemes per stakeholder type

	FTE	# actors	Annual labour cost per FTE	Annual costs (M€)	Costs 2012-2015 (M€)
PRB and PRU				€ 7	€ 28,0
EASA	2	1	€ 95.000[46]	€ 0,2	€ 0,8
NSAs	3	30	€ 55.000[47]	€ 5,0	€ 19,8
ANSPs	3	30	€ 92.000[48]	€ 8,3	€ 33,1
Airspace users	15		€ 92.000[49]	€ 1,4	€ 5,5
Total costs				€ 21,8	€ 87,2

A large share of these costs are passed on to the airspace users via the ANS charges, and eventually to the passenger. Costs of NM efforts have not been included.

The quantified benefits of the SES performance and charging scheme have been valued at approximately € 3.4 bn. These stem from:

- Impact on delays, which benefits airspace users and their customers
- Impact on the en-route costs, which benefits users and eventually their customers as this will most likely be passed through to them via the ticket price.

[46] Based on Ecorys, 2015, Study on the resources deployed in the area of European aviation safety before and after the creation of EASA

[47] Idem

[48] Average employment costs for support staff. Based on Performance Review Commission, 2016, ATM Cost-Effectiveness (ACE) 2014 Benchmarking Report with 2015- 2019 outlook

[49] No data available. Same value as for ANSPs assumed.

Additionally, there is a positive Impact on the horizontal flight efficiency, which benefits users and their customers, but could not be quantified. Furthermore, there is a common positive impact noted resulting from increased transparency regarding ATM performance and more uniform reporting.

The quantified benefits to the schemes have been estimated by comparing the values for delay and cost efficiency[50] with a baseline trend in the absence of the performance and charging scheme. Clearly this baseline is hypothetical, as there has not been a situation during 2012-2014 without the schemes in place. Also between 2009 and 2011, while the schemes were not implemented, the preparation towards the first reference period was in full swing, i.e. target setting and performance planning, so to some extent the schemes could already have influenced the 2009-2011 values. This is more likely for the years close to the reference period. Hence by taking the average 2009-2011 value this effect is to a large extent excluded from the analysis.

Table 7.2 Quantified benefits of performance and charging schemes compared to baseline

	€ M
Total benefits reduced delays for airlines (2012-2015)	1139
Total benefits reduced delays for passengers (2012-2015)	771
Total benefits costs reduction for airlines (2012-2015)	1512
Total benefits quantified	3422

These benefits are considered to be catalysed by the schemes, through which efforts (investment) by ANSPs were required for their realisation. There is also a relation with other SES pillars such as the NM

The calculation is explained in further detail under question 20.

Main conclusion Field research

Overall, the scheme is considered to be more cost-efficient than cost-inefficient. Benefits from ANSP cost reduction and service improvement outweigh costs. Nevertheless, there are expensive elements, some of which the added value is questionable. Double reporting is inefficient. See also question 11.

Subconclusions Field research

Survey outcomes

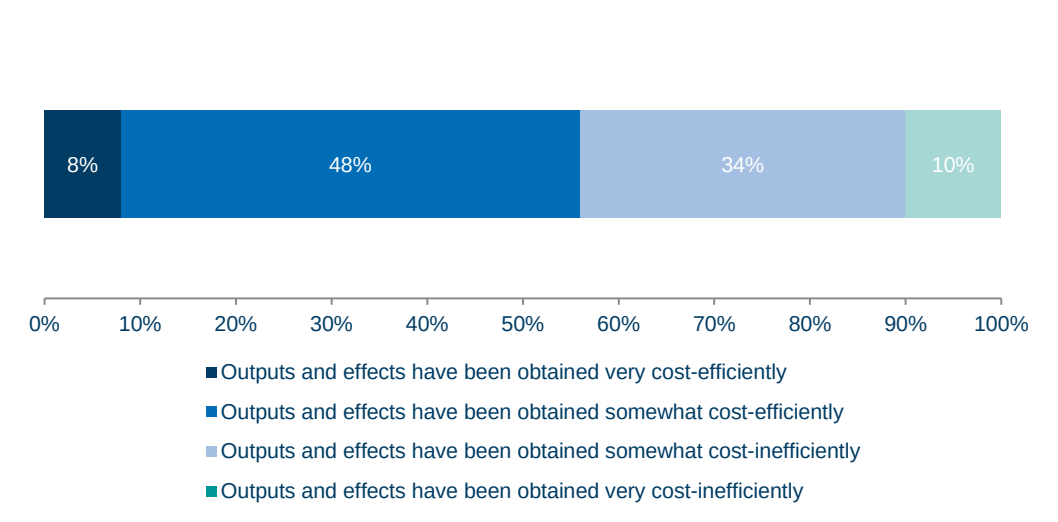
Overall

- Respondents offer a moderately positive assessment of the overall efficiency of the performance and charging scheme in the targeted survey, as shown in the figure below, with over half of respondents (56%) indicating that outputs and effects of the system (i.e. achievement of the objectives) have been obtained at a reasonable cost (i.e. '*outputs and effects have been obtained very cost-efficiently*' or '*outputs and effects*

[50] Actual costs incurred by users (AUC-U), also referred to as true costs for the users, hence taking into account adjustments.

have been obtained somewhat cost-efficiently'). Just 10% of respondents view the scheme to be very cost-inefficient.

Figure 29 Cost efficiency of the system (N=50)



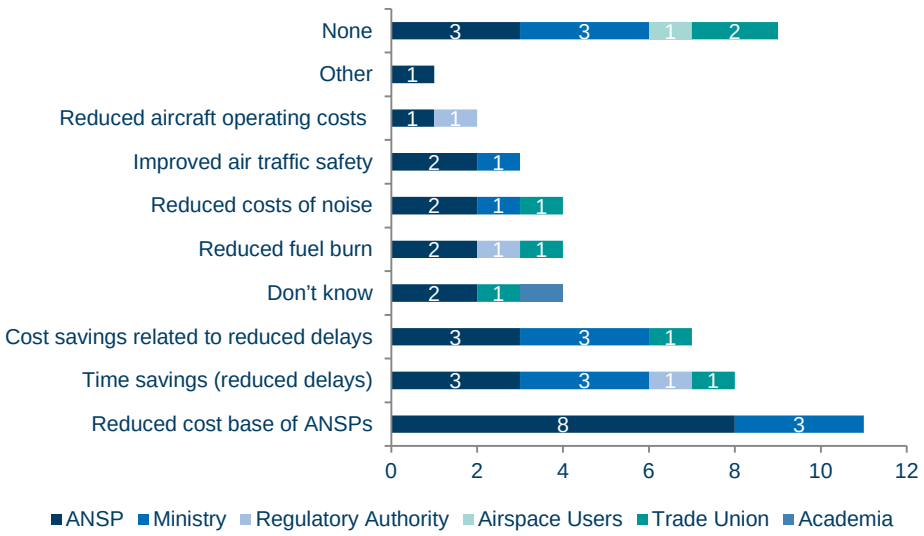
Overall, in terms of the balance of views for different stakeholder categories, NSAs are more positive than ANSPs, accounting for 68% and 25% of all positive responses, respectively. By contrast, ANSPs account for just under half of respondents (45%) who view the system to be either very or somewhat cost-inefficient, compared to 27% for NSAs. Airspace users surveyed also view the system to be very cost-inefficient.

Within the category of respondents indicating that outputs and effects have been obtained '*somewhat cost efficiently'*, there is a general agreement that the scheme has delivered benefits to European ATM in broad terms, which are deemed to sufficiently outweigh the additional burdens stemming from reporting and monitoring requirements.

Among those who do not agree that outputs and effects of the scheme have been obtained at a reasonable cost (i.e. 'Outputs and effects have been obtained somewhat cost-inefficiently' or 'Outputs and effects have been obtained very cost-inefficiently'), the majority point to the overall increase in the workload for both ANSPs and NSAs to implement the scheme, most notably in the context of reporting requirements, which take both time and resources.

The figure below shows the number of respondents indicating having achieved various cost savings / benefits across different aspects of the performance scheme. The most frequently cited cost saving / benefit category is '*reduced cost based of ANSPs'* (11 respondents), followed by '*time savings'* as a result of better ANS service and fewer delays' (8 respondents) and '*cost savings related to reduced delays*' (7 respondents). Nine respondents indicated that no benefits were obtained.

Figure 30 Cost savings / benefits (per stakeholder group)



Interviews

Member States are of the opinion that the administrative burden incurred by the national authorities is unnecessarily high. The interviewees from this category provided different explanations for the high administrative burden: changing formats, tight deadlines, unclear deadlines, many details (in particular: in the controllability of ANSP cost), missing data, limited resources and inconsistent data (e.g., coming from the ANSP and coming from the Network Manager).

- When discussing whether the burden is unnecessarily high, all interviewees referred to 'double reporting', e.g. to the Eurocontrol CRCO and for the SES scheme

Some interviewees from the member states also doubted the efficiency of reporting of some items such as:

- the filling in of the safety metric, as they are subjective anyway
- the horizontal flight efficiency in a particular Member State, as it is very close to optimal; and
- the details in the ANSPs costs, as it does not seem very relevant, given the uncertain assumptions.

ANSPs have found that the scheme has clearly added to their workload and are not wholly convinced that this is justified by the improvements in performance arising from the scheme.

Data gaps / limitations

The effort of the NM is not included in the costs assessment. Additionally, the costs estimate for ANSPs and NSA has been based on a limited response in the survey. As a mitigation approach, we have discussed the draft findings during the external workshop with stakeholders. None of the participants indicated that the efforts were over or under estimated by the study team.

7.2 *EQ 10 Could the same results have been achieved with a less complex system and at lower costs*

10. Could the same results have been achieved with a system that is less complex and requires less intervention (less data, etc), thus at lower costs?

Answer to evaluation question

No, the study team does not find evidence that the same order or magnitude of results could have been achieved against much lower costs. Nevertheless, marginal system costs savings are possible.

As discussed under the previous question, the benefits of the system amount to approximately € 3.4 bn over the entire evaluation period, while the costs have been assessed at around € 87 million. These benefits stem to a large extent from the delay reductions catalysed by the performance and charging schemes, and to a lesser extent from cost efficiency improvements. Additionally there have been benefits in the area of flight efficiency, as well as more general benefits from increased transparency and uniform reporting on EU ATM performance. The costs are primarily stemming from the effort of PRB and PRU, ANSPs and NSAs.

The majority of stakeholders think that the same results could have been achieved in the absence of the performance and charging schemes. In their response, the only firm rationale presented is that ongoing customer dialogue is also very instrumental to achieve the same benefits. The study team notes that before the Regulations were implemented, the concept of customer dialogue did not result in the same performance achievements as during RP1 and the first year of RP2. Also, airspace users indicate that the level of customer dialogue differs significantly per ANSP and that dialogue does not automatically result in performance achievements. Additionally, they argue that in the context of the performance plan development there is significant consultation, but nevertheless even in a system with targets, the targets are not met. As indicated under question 16, the EU added value of the performance and charging scheme is generally acknowledged. The study team therefore concludes that it is difficult to foresee how the same results could have been achieved under a different system than the performance and charging scheme.

Subsequently, the question is if the complexity and level of intervention in the same system can be decreased without affecting the results of the schemes. Complexity and a high level of intervention can be found in:

- the performance plan development and review
- the reporting requirement and subsequent monitoring by PRB and its support in general
- the reporting and review of cost-efficiency data, including the review of the allowable adjustments, which eventually end up in the charges billed to users.

The performance plan development and review has proven to be a long process, including extensive consultations at national and EU level. At the beginning of RP2, for example, only 4 performance plans out of the 9 were approved, while clearly it should be the case at the start of a reference period

that all plans are accepted. To date, the targets in the performance plan of FABEC have not been formally declared consistent with the union wide targets by means of implementing decision. However, the study team did not come across concrete suggestions to decrease the effort associated with the performance plan development. The only apparent alternative would be to abolish the union-wide targets and stick to local targets only (as advocated by some stakeholders). This would eliminate the efforts associated with revising performance plans to be consistent with national targets. However, under a system with local targets it is highly questionable if the same results would be achieved as in a system with union-wide targets.

Another element of the system that requires significant interaction and occasional intervention is the reporting requirement for all KPIs and PIs, and the subsequent monitoring of these indicators by the PRB and PRU. All in all, there is a substantial data reporting requirement in place that all needs to be checked and monitored. As it has been described in evaluation question 6-8 on the data quality, there are substantial checks and controls being implemented by the PRU to assess the data quality. At the same time, there is no evidence that KPIs or PIs are being considered of limited value. Nevertheless, the stakeholder survey indicates that there are duplications on different levels, that could be avoided and would lead to lower costs.

Finally, the reporting requirement on cost efficiency is quite extensive, as is the monitoring and review of this data. This is especially applicable for the allowable adjustments. In the end, the outcome of this affects what users will be paying and for this reason the significant attention to this data is understood. For example, the reports on actual costs that are allocated to the cost exempted is a complex matter that differs per country. This can significantly influence the charges that users pay, thus requiring substantial effort from the PRB and PRU to assess these submissions. Obviously, one approach would be to abolish (some of) the adjustment mechanisms, which would save on subsequent assessments of these aspects. However, the different adjustment measures all have their merits, as is also indicated by stakeholders (see also question 21), so taking out these elements seems ineffective.

A final note is that during RP1, all of the relevant actors operating within the schemes had to gain experience with the implementation of the schemes, and guidance had to be made along these lines. Processes have become more streamlined over the course of the period under evaluation.

Main conclusion Desk research

The main results are approximately € 3.4 bn of benefits for users and passengers, see also the previous evaluation question for the assumptions behind that. The issues of complexity and potential alternatives have not been addressed in the desk research.

Main conclusion Field research

Stakeholders indicate that there is scope for cost reduction, especially in the area of administrative costs. Duplication on different levels is reported. The majority of stakeholders think that the same results could have been achieved in the absence of the performance and charging schemes, but without firm substantiation.

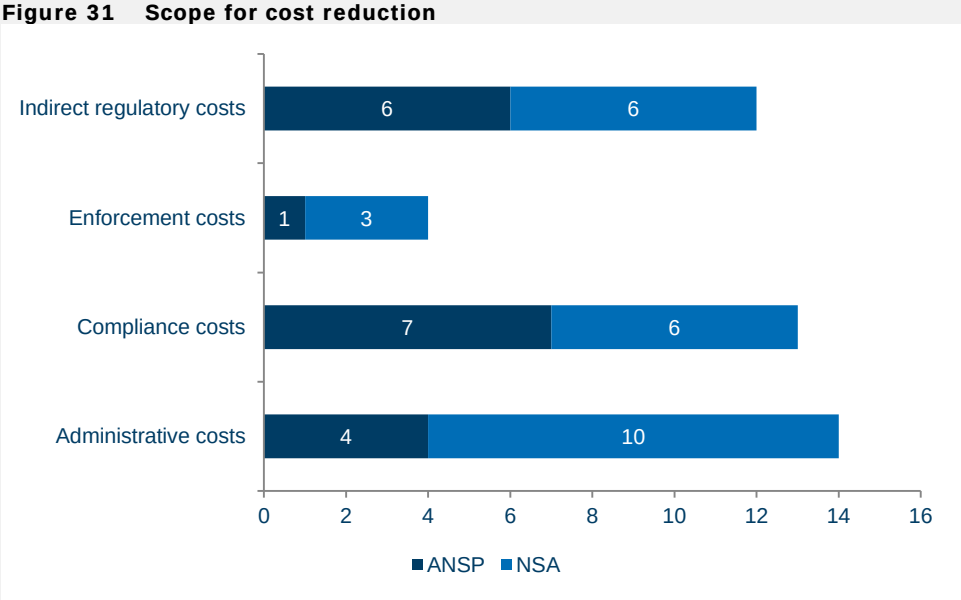
Subconclusions Field research

Survey outcomes

Overall

In the targeted survey, when asked to elaborate which area has the greatest scope for potential cost reductions, the most frequently cited cost category is '*administrative costs*', in particular related to the reporting obligations – e.g. streamlining reporting obligations between mechanisms to avoid duplication - with NSAs accounting for the majority of these responses. ANSPs are mainly split between '*compliance costs*' and '*indirect regulatory costs*'. The distribution of response is shown in Figure 31 below.

Figure 31 Scope for cost reduction



Related to the above question, respondents were asked to reflect whether the introduction of the performance and charging schemes has led to the duplication of any reporting efforts. Overall, 23 respondents confirm duplication in reporting requirements, while 11 do not indicate having experienced any duplication. Three main forms of duplication are identified:

- Duplication between mechanisms: For example, safety is reported through EASA channels, Eurocontrol channels and through the performance scheme monitoring. Investments are reported through the performance scheme and through LSSIP and SDM (SESAR) reporting channels. Costs are reported through the performance scheme and through the Eurocontrol channel for the En-Route Charges Enlarged Committee.
- Duplication between levels: For example, between the Performance Scheme and national monitoring and reporting requirements.
- Duplication with respect to data requirements: Respondents note that there are different data requirements for different types of reports, e.g. Performance Review, ACE Report, Safety reporting and the PRB's Annual Monitoring Report.

On the other hand, one NSA points to the substantial effort being made at the National and FAB level to channel and streamline different reporting requirements and data requests in order to reduce duplication as well as to ensure greater consistency. This respondent does not see the Performance

and Charging schemes as solely responsible for the extensive reporting requests.

When asked to reflect on whether the achievements (cost savings / benefits identified in Figure 30) could have been achieved in the absence of the SES charging and performance regulation, including the binding EU-wide target setting for Member States / FABs, only 4 respondents (of 36 who answered the question) do not believe the achievements could have been obtained in the absence of the scheme. According to one, European ATM would have performed worse under full cost recovery, while another points to the increased effectiveness resulting through partnerships and expanding developments of ATM systems and deployment. A much larger number of respondents (17 respondents) hold a less positive view on the effect of the scheme and is of the opinion that that in the absence of the scheme the same benefits could have been achieved. Some of the sceptic respondents indicate that customer dialogue would have resulted in the same results, others point at the increasing contribution of bilateral agreements between adjacent ATS providers.

The response to this question thus contradicts with the question on EU added value of the EU performance and charging scheme (see question 16), which is generally acknowledged.

Interviews

On the question of whether the same performance levels could be achieved in the absence of the scheme, ANSPs hold a favourable view, on the basis that performance is driven by customer pressure. This customer pressure is felt in day to day operations where, by virtue of strong customer engagement, ANSPs are able to respond to customer concerns and improve services. A concern of ANSPs is that it is difficult to translate the local customer requirements to the EU level. Local customer engagement informs on local needs and constraints that will differ across the EU. Those ANSPs that maintain a high level of interaction with customers are subject to their scrutiny on services and investment plans/performance. By including a high degree of customer consultation with performance and investment planning it was felt that ANSPs should adequately capture and meet customer expectations.

8 RELEVANCE

8.1 *EQ 11 Do the objectives still correspond to the needs of the aviation sector*

Relevance 11. Do the objectives of the scheme still correspond to the needs of the aviation sector and usefully supplement the EU aviation and transport policy in more general terms?
Answer to evaluation question
It is generally agreed that the KPAs in the schemes broadly cover the needs of society and airspace users, considering General Aviation and Security out of scope. The schemes constitute important elements of the Single European Sky initiative and are supplementary to other elements of the related EU aviation and transport policy, in that the performance and charging schemes measure and drive operational performance, whereas the other elements, such as SESAR or the system of Functional Airspace Blocks, the Network Manager and NSAs, could partially be considered as enablers for the performance improvements in practice. The set of objectives within the schemes is, however, not entirely complete given that noise, flight efficiency other than horizontal, flight time (as considered in SESAR), flexibility of the ANS system to scale with increasing traffic demand and the accuracy of the delay predictions are not taken into account. Moreover, airlines indicate that the problem of state aid and sustaining national monopolies is slowing down the realisation of the objectives of the schemes, and they seem to be right. This relates to the fragmentation of the European air navigation service provisioning and to the lack of commercial pressure on ANSPs. Defragmentation and competence of ANSPs can therefore be considered to reflect the needs of airspace users, although they are not the focus of the EU aviation policy. Airlines themselves do not consider the abovementioned needs as primary goals, and they understand that schemes currently under evaluation cannot tackle these problems directly. Instead, airlines consider defragmentation and competition as means to further improve the cost efficiency and quality of service, corresponding to the objectives of the schemes. It is, however, not foreseen that the push of the schemes towards further improvements will indeed lead to this. Some ANPSs and Member States indicate that the schemes are focused on the issues in the core of congested European airspace (lack of capacity, high unit costs, route extension) but not on issues that affect their respective airspace.
Main conclusion Desk research
The KPAs Cost Efficiency, Safety, Environment and Capacity are widely accepted. There was no significant discussion about them during the initial stakeholder consultations, nor is there currently a debate on their relevance. There is no reasons to assume that these KPAs will lose relevance in the mid-term future.

The set of KPAs can be considered to be complete in the sense that no relevant performance area is missing from the scheme.

Subconclusions Desk research

1. The KPAs Cost Efficiency, Safety, Environment and Capacity are not only adopted in the SES schemes but also in the SES higher goals, the SESAR targets, the Flight Plan 2050. Moreover, they can by recognized in the vision of IATA and the statements from European airlines and airline associations.
2. The completeness of the set of KPAs within the schemes can be verified by considering whether other relevant EU initiatives, stakeholders, organisations or the general public express ambitions and concerns in any other area. In this respect, one issue regarding the scope is apparent: the schemes are relevant for commercial air transport but not for general aviation. Moreover, SESAR and Flight Path 2050 express ambitions in the KPA of Security, while the SES performance scheme does not address security.

   In addition to verifying the completeness of the KPAs themselves, the identified ambitions and concerns to be addressed by the schemes should be mapped against the performance indicators within the KPAs. Here again, several discrepancies emerge. Apart from the technical aspects[51], the following significant aspects are not included within the scope of the SES PCS schemes: noise, flight efficiency other than horizontal, flight time (as considered in SESAR), flexibility of the ANS system to scale with increasing traffic demand and the accuracy of the delay predictions (as considered relevant by airlines in their turn around processes).
3. The schemes were introduced with the approach that they can be developed over time in the sequential Reference Periods. Some ideal or preferred indicators were not selected for RP1 for reasons such the unavailability of uniform and consistent data over a significant period, using the experience of the SRC and PRC over the years before, being assisted by the SRU and PRU respectively.
4. The schemes have limited relevance if the targets are too hard or too easy to obtain. In order to make a comparison, three other sets of targets covering at least partially the future performance of the European ATM system are considered:
   - The Flight Path 2050 targets [Flight path 2050]. These goals are visionary targets set by the High Level Group on Aviation Research, convened by the Commission, in order to deduce a long term aviation research agenda.
   - The SES high level goals [SES goals]. These goals are political targets set by the Commission, to be reached by either the implementation of SES initiatives or by any other developments.
   - The SESAR performance ambitions [SESAR targets]. These goals are design hurdles for the technological ATM improvements, feasible after delivery and deployment of the SESAR solutions.

[51] These technical aspects (such as: the difference between leading and lagging safety performance indicators, between last filed an actual trajectories and between en-route airspace and TMA) are treated per KPA in the answers to the evaluation questions on effectiveness.

Because of the differences in nature, scope, intention and time-frame, a high level comparison of these target-settings is only possible after adopting straightforward but somewhat crude assumptions. The differences in the time-frames means that the ambition levels of the targets cannot directly be compared. An over-all consistency check by means of a quantitative comparison can however be executed by simply assuming that all performance improvements are constant and gradual over time. The differences in scope with respect to the target levels can be bypassed by adopting straightforward and crude expectations:

- The ATM domain can contribute in the range of 10% - 40% to performance improvements in the whole aviation domain, depending on the performance area;
- The ATM technology provided within SESAR can contribute in the range of 30% - 70% to performance improvements in the ATM domain, depending on the performance area.

If targeted contributions turn out to lie in these ranges, they are stated to be "in line".

After a quantitative analysis of the targets, with several straightforward assumptions, approximations and models, the following qualitative statements are deduced.

Table 8.1 Comparison of the targets per performance area, taking into account their differences in scope, time-frame and nature

	Safety	Capacity	Environment	Cost efficiency
SES high level wrt FP 2050	In line	More ambitious	Less ambitious	N/AA)
SESAR wrt SES high level	In line	In line	In line	Less ambitious
SES schemes wrt SES high level	Limited in scopeB) Less ambitious	Limited in scopeC) Less ambitious	Limited in scopeD) Less ambitious	Less ambitious
SES schemes wrt FP 2050	Limited in scopeB) Less ambitious	Limited in scopeC) In line	Limited in scopeD) Less ambitious	N/AA)

A) Flight Path 2050 does not include cost efficiency targets.
B) The performance schemes do not include targets for the risk per flight.
C) The performance schemes do not include targets for delay in the terminal areas.
D) The performance schemes do not include target for flight efficiency in the terminal area, neither for vertical or speed flight efficiency.

Since the targets in the schemes are less ambitious than the comparable target-settings and are limited in scope, it might be concluded that these targets are not too hard to realise. It might be tempting to conclude that they are too easy to realise. It then should however be noticed that the other target settings are visionary and therefore a bit loose while the targets of the schemes come with sharp definitions, monitoring and incentives and dis-incentives.

Main conclusion Stakeholder consultation

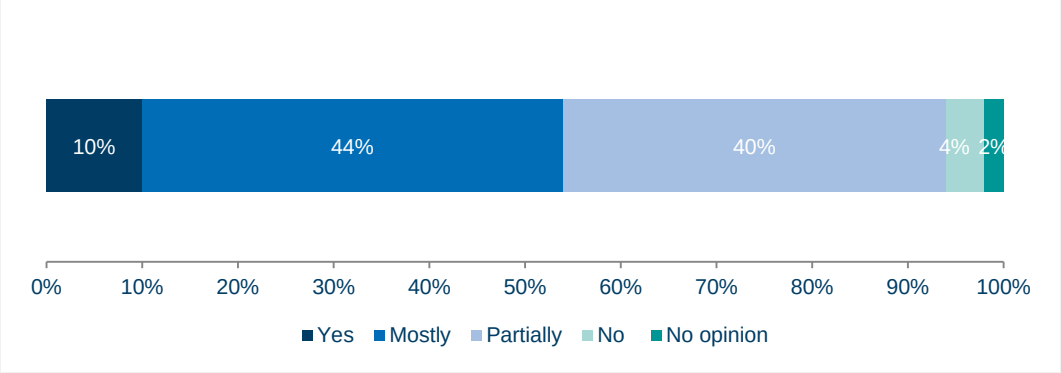
Overall, stakeholders agree with the statement that the objectives of the schemes correspond to the needs. Most of them agree mostly or partially but when asked why they cannot agree fully, the reasons do not concern the

incompleteness of the KPAs but rather the effectiveness or concerns about the implementation of the schemes.

Subconclusions Stakeholder consultation

The respondents of the OPC and the questionnaire were asked whether they believe that the objectives of the SES performance and charging schemes still correspond to current needs of the aviation sector and their passenger and freight customers. Figure 32 below shows the distribution of the answers of the OPC, which roughly corresponds to the distribution of the answers of the questionnaire. The majority holds the opinion that the objectives of the SES performance schemes still correspond to the needs of stakeholders: 44% state that they mostly correspond and 10% that they fully correspond.

Figure 32 The extent to which the objectives of the SES performance and charging schemes still correspond to current needs of the aviation sector, passengers and customers



ANSPs were less positive about the extent of covering the needs for European air navigation services compared to the Member States (NSAs and Ministry of Transports).

There are several reasons why correspondents indicate that the objectives of the SES schemes do not fully correspond to the current needs of the aviation sector, passengers and customers. These reasons include lack of flexibility, no sufficient account for interdependencies between the objectives, no appropriate balance of the objectives and a dependency on issues that cannot be controlled.[52] No correspondent indicated that there is a whole KPA missing; some indicated that environmental issues (e.g. noise prevention) and interests of passengers and freight customers are neglected.

There is some difference in opinions among the interviewed representatives of the Member States
concerning the relevance of the different KPIs and targets. Although the interviewees agree that a large benefit was obtained for the Cost-efficiency KPA, some interviewees mention that for environment and capacity (ATFM delay), the challenges are not en-route. Additionally, some believe that safety is not well accounted for. One interviewee believes that safety should not be covered in the scheme but as a standard that everybody has to meet.

When airlines are asked about the relevance of the schemes, they indicate that a gate-to-gate view is required to satisfy the airline ambitions in terms of service cost and quality.

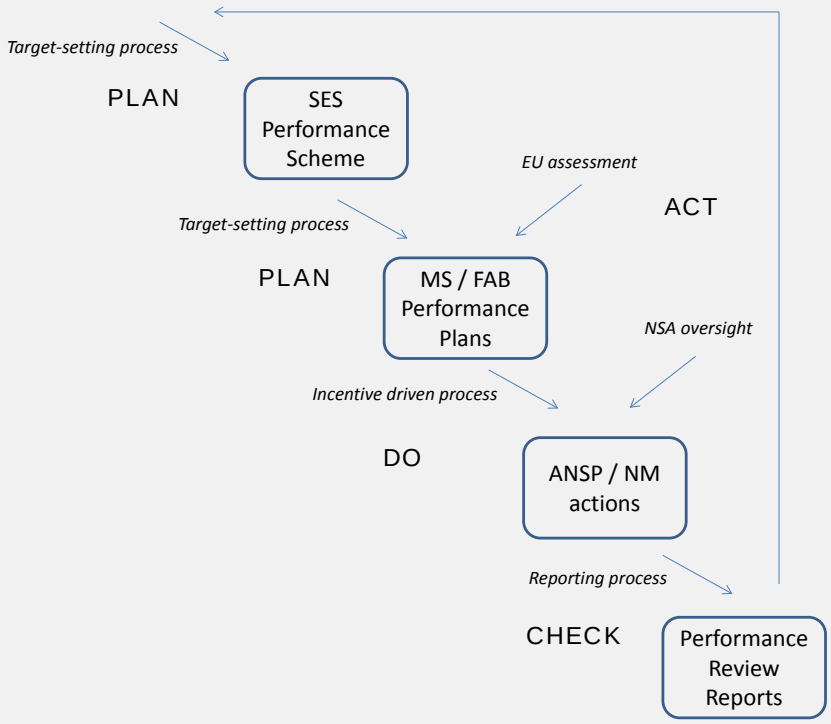
[52] These reasons are given by the respondents in the questions about relevance but are further addressed in the chapters on effectiveness and acceptance.

9 COHERENCE

9.1 *EQ 12 Are SES PCS coherent, do they consistently contribute to improving overall performance*

Coherence
12. Are the SES performance and charging schemes coherent in that all procedures included in this legislation contribute consistently to improve the overall performance of air navigation services and network functions?
Answer to evaluation question
Most procedures relevant for the schemes are in place and work consistently with the aim to improve performance. However, based on the analysis and consultation, we note particular shortcomings in the implementation of the different processes. • The target setting process is subject to political compromises, as national member states, with an interest in the financial results of the ANSPS, have to agree on the targets for these ANSPs. • The same argument applies for the enforcement of targets. Member states have to vote in majority for corrective measures of non-compliant member states. • The final agreement on national targets takes too long and is not always finalised before the reference period commences. Given the long lead in ANSP implementation, this may impact the effectiveness and credibility of the scheme. • Furthermore, in some cases, there is a mismatch between national targets from the performance plans and the Union wide targets. • There is a lack of flexibility in the target-setting, resulting in targets not properly addressing the dynamics of the business and local circumstances • The scheme does not integrate well with FABs, and FAB targets are simple amalgams of national targets. The reality is that none of the KPAs are directly managed by FABs and the FAB influence on these is minimal at best. Requiring FAB level targets is thus of questionable value.
Main conclusion Desk research
The relevant procedures included in the legislation are in place. Nevertheless, we have found shortcomings regarding the mismatch between union-wide targets and national targets, the lack of enforcement of targets and the late approval of performance plans or even disapproval of unit rates during a reference period.
Subconclusions Desk research
The completeness of the procedures in the legislation can best be considered in terms of the Demming cycle, as illustrated in the figure below:

Figure 33 The Demming cycle in the design of the global process of the SES



The figure shows that all of the main mechanisms are in place, and the design of the global process can be considered as coherent.

There is no mechanism that ensures that targets set at EU level boil down to targets set at national and FAB level, and to make sure that when those national targets are met, the target at the EU level is also met. This is a political issue to a certain extent, as the EU has several mechanisms to push the national and FAB targets into the preferred directions but does not have the legislative power to enforce that.

There are cases of late approval / disapproval of performance plans. For example, the EU Commission announced in March 2016 that unit rates of some countries were non-compliant with the charging schemes for 2015 and 2016, more than a year after the start of RP253.

The scheme is not well integrated with the FABs system, whereby FAB targets are simple aggregations of national targets. The reality is that none of the KPAs are directly managed by FABs, and the FAB influence on these is minimal at best. This is an outcome of a parallel study on the progress of FABs54.

Main conclusion Field research

The schemes are considered quite coherent in the sense that the processes (monitoring, reporting, setting targets, creating incentives etc.) consistently work towards the same high level goals. However, throughout the implementation of the different steps, various issues are mentioned. This is explained below.

53 COMMISSION IMPLEMENTING DECISION (EU) 2016/419

54 Integra, Ecorys, Winsland, Progress study on the implementation of FABs, Draft final report, December 2016.

Subconclusions Field research

Throughout the consultation process (i.e. OPC, targeted surveys and interview programme), stakeholders were requested to indicate whether and to which extent they perceive any incoherence or inconsistency in the SES PCS procedures in practice. The outcome of the consultations, however, do not reveal any general or widely accepted inconsistency. The most frequently cited issue, raised by ANPS and Member States, is that the local and temporary circumstances are not well accounted for, especially in the case of the charging schemes and in adapting the established targets.[55]

- Stakeholders indicated in the Questionnaire that the cost-effectiveness targets for RP2 have been watered down without due regard for the investments (and risks of duplication) and without assessing the impact on capacity.

When asked about the procedures of the schemes in practice, representatives of the Member States expressed some critical remarks, mostly on practical issues. For RP1 the interviewees felt that the process was unnecessarily compressed towards the end and that to improve this there should be a shared objective for a given RP. The scheme was considered an administrative burden. The template of the performance plan was not found to be clear nor in a suitable format (i.e., the Excel spreadsheet). Stakeholders further commented that the criteria used by the PRB to assess the plans were not known when the performance plans were written; i.e. knowing these criteria will help in developing a plan more efficiently.

ANSPs and airlines do not agree on the assertion that targets were watered-down during the preparation processes.

ANSPs indicate that they have little influence over the target setting process at national or EU level and this has been a concern in the sense that the target setting may not reflect local needs, which are driven by customer requirements. Their view is that NSAs have generally been following a top down apportionment of the EU targets, whereas a bottom-up assessment will better reflect local or regional needs. A FAB example of this was where the NSAs were guided by Network Manager capacity estimates in RP1, which did not reflect planned capacity, but later accepted that merits of a bottom-up approach in RP2. There is also some frustration from FAB ANSPs that their EU level proposals are not taken on board by the EC.

Airlines indicate implicitly that the NSAs seem to take the side of the ANSPs over users. A related issue concerns investments. During RP1, the investment plans have not been implemented by the ANSPs as they were approved and sent to the airspace users. There is a gap of more than € 800,000,000[56] between approved and implemented investments. These costs have been charged to the airspace users. One of the interviewees noted that for RP1, traffic forecasts were purposefully overstated. The investment forecasts were based on these traffic forecasts. Because traffic was less than foreseen, some investments were not implemented and airspace users paid for capacity increases that did not materialise. This was done by ANSPs to make windfall profits. Italy was cited as an example of this practice, where the war in Libya

[55] See also the answers on the questions on the effectiveness and efficiency of the schemes.

[56] In nominal terms, or €700,000,000 in EUR_{2009} terms.

led to a massive downgrade of traffic forecasts without lowering capacity investment costs. Also mentioned was the lack of a mechanism to hold ANSPs accountable for delays following strikes. Airspace users now fully pay this cost.

Overall, there is no coherence or balance between the KPIs of Environment, Capacity and Cost-efficiency. A challenging Environment or Capacity target would require strong investments, which pushes down Cost-efficiency.

9.2 *EQ 13 Are interdependencies between the four KPAs of the scheme sufficiently addressed*

Coherence
13. Are the interdependencies of between the four key areas in the scheme sufficiently acknowledged and addressed, and if not, how could this be improved?
Answer to evaluation question

It is generally agreed that there are interdependencies between the four KPAs. These interdependencies are not formally acknowledged in the legislation but are addressed in the discussions about the target-setting. ANSPs and Member States express their concerns about these interdependencies as they threaten their autonomy.

Before answering the question on how to better acknowledge these interdependencies, the following is noted. Service providers in general have to deal with the natural tensions between cost efficiency and quality of service to an extent that depends on the commercial competence and the relations with those who pay for the services and those who receive the services. These tensions imply difficulties in management and operations. ANSPs, like any other service providers, suffer from these tensions and resulting challenges. This partially explains the concerns of ANSPs regarding the interdependencies in the schemes.

In the operations of ANSPs, there is also often a tension between safety, on one hand, and the other performance areas on the other hand. The ANSPs did not raise many concerns about this tension, which is explained by the fact that the safety indicators within the performance schemes are on aspects of safety management (like safety culture and RAT application), whichcan be optimized rather independently from daily operations.

Stakeholders propose two potential means to control the interdependencies of the schemes in a better way. These, are a) to address the interdependencies in the schemes, possibly following further research and b) to involve other parties in the schemes as well. Some stakeholders support the idea of a mechanism in which airlines negotiate directly with ANPSs on, for example, investments, and hence costs, for reducing delay.

However, these potential means imply a relatively large and complex reorganization of the management of air navigation service provisioning with an uncertain result. As it seems that the current tensions in realizing the

performance objectives are not too large for ANSPs, such improvements to addressing the interdependencies are not recommended on the basis of the results of this study.

This also holds for the cost displacement issue. It is indeed unfair that an ANSP that improved cost efficiency may obtain lower scores for flight efficiency (as its airspace might attract extended flights of airlines that seek the most economical routes). However, airlines should continue to be given a large degree of freedom to select routes on the basis of their preferences. It is also not argued, explicitly or implicitly, that ANSPs are fully accountable for a lack of flight efficiency in their airspace.

Main conclusion Desk research

The legislation only partially addresses the tensions underlying the requirement to achieve several objectives at the same time.

Subconclusions Desk research

The legislation on the schemes mention the interdependencies in the "whereas" parts, stating that "the assessment … of the … performance plans and targets should be global, weighting each target against the others in a balanced way, considering justified trade-offs between different performance areas, having regard to the overriding safety objectives" [EU121-2011] and "given the strong links between the different key performance areas, the interdependencies between performance targets, having regard to the overriding safety objectives, should be duly taken into account in the preparation and monitoring of the performance scheme" [EU390-2013]. How these interdependencies in the performance schemes are to be addressed is however not explicitly indicated.

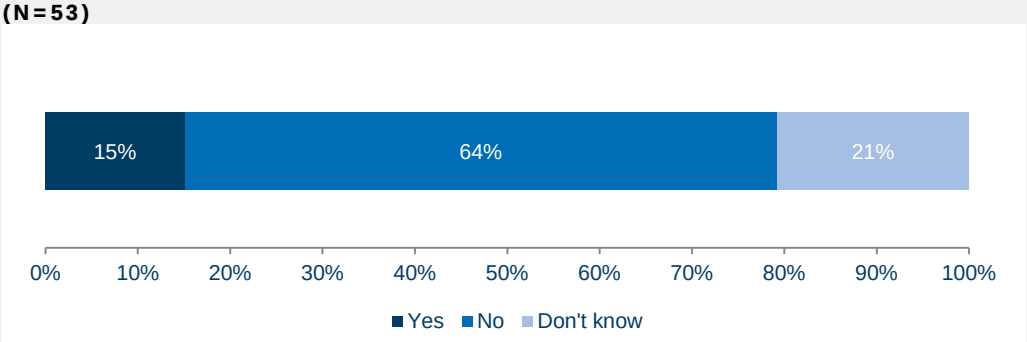
Main conclusion Field research

Many stakeholders point out that the current objectives do not sufficiently account for interdependencies between the objectives and between KPAs/KPIs. It is felt that a greater coherence of, and balance between, the objectives, KPAs/KPIs and the performance contributions of different types of operators (e.g. ANSP, airspace users, airports) would better reflect the industry reality, as well as the diversity across Member States, and positively impact the realisation of the objectives.

Subconclusions Field research

Respondents of the questionnaire were requested to indicate whether the interdependencies between the four key performance areas have been sufficiently acknowledged and addressed in the context of implementing the schemes. The figure shows the distribution of the answers.

Figure 34 Sufficiency of approach to address interdependencies between the 4 KPAs (N=53)



ANSPs are less positive on coherence than other parties; only 6% of the respondents representing an ANSP indicated an affirmative answer (against 15% overall, and e.g. 25% of the respondents representing an NSA).

In the subsequent questions in the questionnaire on how the interdependencies have been exploited to maximise the benefits and how the coherence could be improved, the following issues were mentioned, among other things:

- The interdependencies between the performances areas are not well known and should be researched. Some respondents consider this an urgent matter. Some respondents consider the dependencies very complex. Some respondents refer to earlier studies on how to address these interdependencies, considered as failed. A better understanding of the interdependencies would lead to sharper definitions and more balanced target-setting and incentive schemes.
- The priorities of the KPAs might be set in a more balanced way.
- The top-down (Europe -> States -> ANSPs) leads to a one-size-fits-all approach that does not correspond correctly to the local circumstances;
- The main dependency is that a better performance in safety, environment and capacity typically requires investments while Cost Efficiency is typically improved by cutting investments.
- Another dependency often referred to is that if an ANSP cuts unit costs, the horizontal flight efficiency is decreased as some airlines might choose to fly detours in order to avoid ANSP cost (especially now that fuel is rather cheap)[57]

In the interviews, representatives of Member States and ANSPS often mention the issue of the interdependencies between the indicators, especially the conflict in insisting on cost efficiency on one hand and on pressing towards on investments for performance improvements on the other hand (see also preceding comments under objectives and goals). Some interviewees expressed that these interdependencies do not constitute problems yet, but might in the future when targets become tighter, and the ANSPs may be suffocated. Some interviewees remarked that the interdependencies are complex and should be researched first before they can be addressed, despite failures in the past.

Representatives of the ANSPs indicate the need to have more autonomy to change ANSP investment priorities in response to traffic and customer needs, keeping NPV neutral for customers.

An example in which an ANSP has to act in an unreasonable way -like sacrificing safety or creating delay- only in order to comply with the schemes is not identified.

[57] This issue is also referred to as the cost displacement issue and treated in somewhat more detail in the answers to the question of the effectiveness in the KPA Environment.

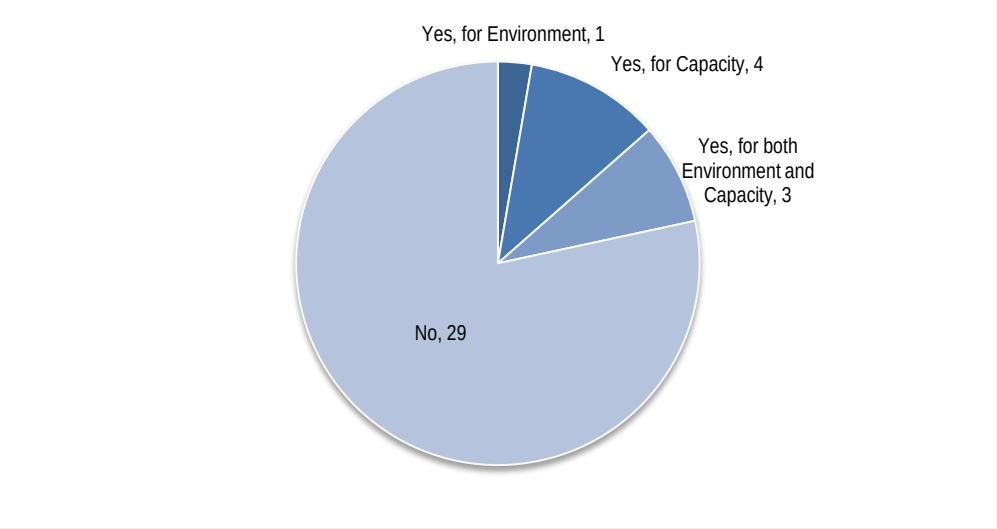
9.3 *EQ 14 Have all MS and entities implemented the performance scheme coherently and satisfactorily*

Coherence 14 Have all Member States and entities concerned implemented the SES performance scheme in a coherent and satisfactory manner?
Answer to evaluation question
Overall, the Member States have each implemented the SES performance scheme in a coherent manner. There are some concerns as to whether this is satisfactory. Specific concerns include, for example, the implementation of incentive schemes, which have been implemented differently by member states in terms of scope and application.
Main conclusion Desk research
There are no indications of Member States that have not implemented the SES performance scheme either in full or in part.
Subconclusions Desk research
With only an insignificant amount of exceptions, Member States and entities concerned implemented the performance scheme in a coherent matter: the tasks for reporting, monitoring, participating in the consultations at EU level, discussing performance with the ANSPs and taking corrective measures are allocated and executed. Most of these tasks are allocated to the NSAs, some to the ministries of Transport.
The required incentives schemes are adopted by the Member States. There are indications that Member States have adopted optional incentives and penalties for the KPAs safety, environment and capacity (complementary to the required financial incentive).
Main conclusion Field research
There are no indications of serious problems of Member States which have not implemented the SES performance scheme in a coherent. A majority of the Member States has opted not to make use of the additional incentives.
Subconclusions Field research
The interviewed representatives of the Member Stares all considered the scheme quite coherent in the sense that the processes (monitoring, reporting, setting targets, creating incentives etc.) consistently work towards the same high level goals.
All the interviewees representing Member States commented that their States have implemented the required incentive mechanisms. There is not much experience with the application of these mechanisms since it was not often necessary to impose penalties. There is a difference in opinion among the interviewees as to whether the bonuses/penalties are sufficiently high. One interviewee argues that the bonuses/penalties are not large enough to motivate increased performance while another argues that it is not the amount that counts but ANSPs would want to avoid any potential bad publicity, e.g. if a newspaper reports that they have received a penalty. An interviewee mentions that the current system is not always fair because an ANSP is not always causing the delay, but they are accountable for it. Additionally, in some States the ATFM delay is close to zero. Meeting the targets in that State is much easier than meeting the targets in a State with heavier traffic which is more prone to delay. Some interviewees argue that the effectiveness and fairness of the incentives can be improved by providing additional guidelines and tools about how to make calculations in terms of

revenues, bonuses and penalties.

- NSAs and ANSPs were asked in the questionnaire to indicate whether the additional incentive mechanisms had been used in their Member State. As shown in the figure below, 1 respondent indicated their Member State had introduced this only for Environment, 4 for Capacity and 3 for both Environment and Capacity. A large majority of 29 respondents (78.4%) indicated that their Member State had opted not to make use of the additional incentives.

Figure 35 States indicating use of incentive mechanisms (N=37)



As indicated in Table 9.1 below, there are some differences in responses from the NSA and ANSP groups. These are most likely the effect of the different national compositions of these groups. (Note that one response seems not to have been properly processed in the survey.)

Table 9.1 Application of additional incentive mechanisms, per stakeholder category

	Environment	Capacity	Both	None
NSA	1	1	2	14
ANSP	0	3	1	14

Additional remark

The table above provides the short answer to the question whether the Member States have implemented the SES performance scheme in a coherent manner, but not to the questions whether that was also in a satisfactory manner. That answer is difficult as it depends on the point of view and as it touches several aspects, including the administrative burden for the Member States themselves – a concern expressed by the representatives of the Member States- and the lack of empowerment of NSAs to impose sanctions or the lack of oversight capabilities to fully monitor and enforce the implementation of cost-efficiency planning requirements – a concern expressed by the representatives of the airlines). These aspects are treated in the answers of the other questions concerning the appropriateness of the implementation of the scheme.

9.4 *EQ 15 Are provisions of SES PCS coherent complementary, and non-duplicating*

Coherence

15 Are the provisions of EU 390-2013 and EU 391-2013, as well as the achievement of the performance and charging targets, coherent, complementary and not duplicating other EU initiatives with similar objectives?

Answer to evaluation question

The performance schemes are coherent with other initiatives. The schemes constitute important elements of the Single European Sky initiative, and is supplementary to other elements of the related EU aviation and transport policy, as it measures and drives the operational performance, where other elements, such as SESAR or the institution of Functional Airspace Blocks, the Network Manager and NSAs, could partially be considered as enablers for the performance improvements in practice.

Main conclusion Desk research

See our conclusion in Evaluation question 11.

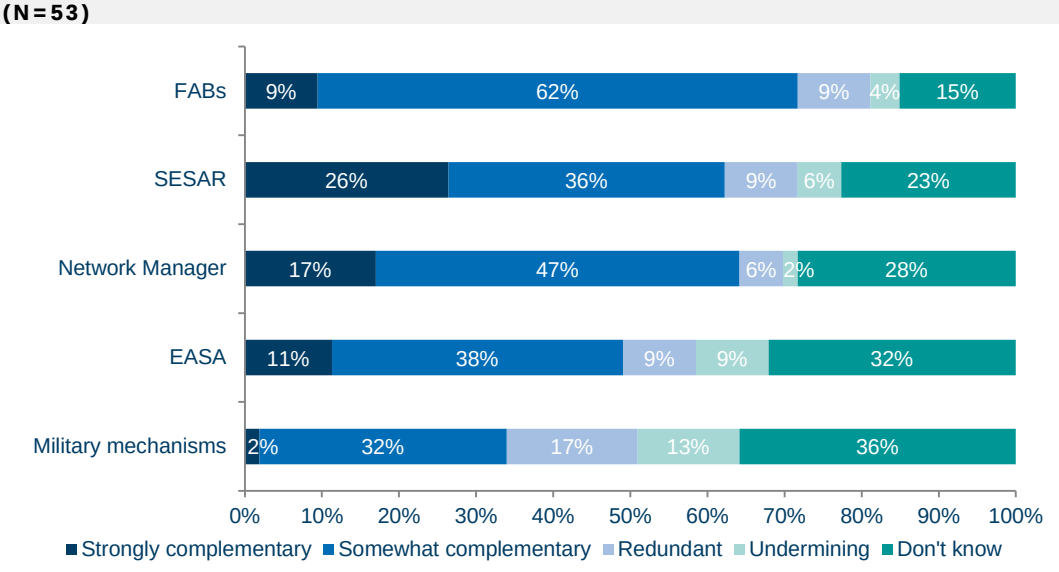
Main conclusion Field research

In general, stakeholders are quite positive about the coherence of the schemes and other EU initiatives. There are however critical remarks about the FABs, data provisioning, the principles of the Risk Assessment Tool (RAT) and the Occurrence Reporting Rule, the coordination of the EASA regulations and the performance schemes, the direction of the several policies and the difference in the gate to gate view between SESAR and the schemes.

Subconclusions Field research

The figure below shows the distribution of responses to the question: The Commission Implementing Regulations (EU) 390/2013 and (EU) No 391/2013 lay out the provisions of the SES performance and charging schemes, respectively. In your experience, are the requirements of the schemes, including the achievement of performance targets, complementary and not duplicating and/or undermining other SES initiatives with similar objectives?

Figure 36 Coherence of the SES performance scheme with other SES initiatives (N=53)



When asked to elaborate on overlaps, trade-offs or inconsistencies, several issues are mentioned. An issue that is mentioned is the relation between the KPA safety and EASA actions; some representatives of national safety authorities expressed the opinion that EASA should supervise all safety related matters under the same regulations. Several positive remarks were made about the consistency of the SES schemes and the SESAR initiative, with some critical remarks concerning the costs of SESAR in the light of the cost efficiency on the short term. Although the repsondents were not so positive about the consistency with the military, only the following three comments were provided in response to the open question:

- Military position is that they are outside of the scope of the EU regulation.
- The military requirements could in some way hinder the cost efficiency program; there needs to be more effective use of the released airspace.
- If a state has an integrated system for civil and military, the possibilities for cross border services are limited. Establishing a separate system for military would cost more than the potential savings from giving up the national ANSP.

Some respondents have critical remarks about the FABs in this respect: FABs do not contribute much in term of performance improvements, their institution costs a lot of money, they constitute another layer in the steering of operational improvements and they bring uncertainty on the role of NSAs.

The remarks on SESAR are limited and in general positive, i.e., confirming complementarity with the SES schemes. Some respondents make the side remarks that SESAR deployment process will have a negative effect on cost efficiency on the short term.

Several respondents see room for improvement when it comes to the consistency of the schemes with other European initiatives:

- there is redundancy in the data provided by ANSPs and NSAs to EASA and Eurocontrol; this causes a considerable administrative workload on ANSPs and NSAs;
- there are inconsistencies in the principles of the Risk Assessment Tool (RAT) and the Occurrence Reporting Rule;
- the EASA regulations and the performance schemes are not coordinated.

When it comes to the coherence of the schemes in relation to other EU initiatives, most interviewees are quite positive. Some however express the opinion that EASA should supervise all safety related matters, without overlap or complementarity with the performance scheme. One expressed that local initiatives like Borealis are probably more effective because the partners are directly involved.

Concerns around coherence of the performance scheme expressed by the interviewed representatives of the ANSPs are:

- There is a need to better align the requirements of the performance scheme and SESAR which has its own performance indicators. The SESAR indicators are appropriate for R&D but should not necessarily be absorbed into the performance scheme KPIs.
- There are a lot of policies being developed that do not all sit in a single comprehensive SES framework. This creates confusion around the different policy threads: harmonisation from EASA, industrial policy from SESAR, performance framework and with the SES policy thread limited to the ANS domain. Clarification on the direction of these activities is needed.
- In the safety area, the European Risk classification scheme for aviation

occurrence reporting is not compatible with the RAT, and ANSPs would not wish to see it mandated in preference to the RAT.

- SESAR is addressing gate to gate performance, which is not yet the case for the performance scheme.
- Implementing Rules cause a concern as they are prescriptive on technical solutions. Datalink has generated a lot of cost but no benefit, because the regulation was made before there was a mature solution. The import is that the investment could have been spent on other innovation.

10 EU ADDED VALUE

10.1 EQ 16 What is the additional value of the SES PCS compared to national and/or regional action

16. What is the additional value of the SES performance and charging scheme with target setting at Union-level compared to what could have been achieved by Member States at national and/or regional level? Would it have been possible to have the same results without the EU intervention (including PRB)?
Answer to evaluation question
The SES PCS has provided additional value compared to what could have been achieved at national or regional level. This holds for all the KPAs. A majority of stakeholders agree that the PCS has been a (major) contributor to the improvements achieved for all of the KPAs, with the exception of Safety. Moreover, it is found the PRB has been effective in providing independent advice to the Commission, on which the target setting could be based. At the same time, it is noted there are concerns which mainly refer to a lack of PRB independence.
Main conclusion Desk research
As discussed in the answers to Evaluation Questions 1a-1d and EQ5, the PCS (including the PRB) has provided added value compared to national or regional actions: • Capacity: the average delay declined during RP1-2 (2012-2015) from 1.2 min/flight to 0.6 m/fl; • Environment: the actual horizontal flight extension amounted to 4.9% in 2014, compared to 5.4% in 2009; • Cost-Efficiency: the DUR was EUR_{2009} 54.13 in 2014, compared to EUR_{2009} 63.70 in 2009; • Safety: Performance on the safety PIs has continuously improved since the start of the SES performance scheme; • PRB: The PRB has been effective in providing independent advice to the Commission.
Main conclusion Field research
Stakeholders in general believe that the SES performance and charging initiative have added value. This was delivered in various ways: • Performance improvements were achieved either more quickly, or were higher than would have been achieved in the absence of the schemes • Added value lies in uniform and transparent reporting across ANSPs • There is an increased awareness among ANSPs of the need to improve cost-efficiency and capacity performance The majority of the respondents consider the SES performance and charging scheme of added value compared to solely national actions, with 20% agreeing fully, 25% agreeing mostly, and 30% agreeing partly to this statement. Only 11% did not agree. The achievements relate mostly to the cost-efficiency KPA. A majority of NSA and a small majority of ANSP

respondents (58%) stated the schemes were either the most important or a significantly important driver of performance improvements. Respondents from the Ministries overwhelmingly (89%) saw the schemes as dominant or significant drivers. Respondents from staff bodies saw it as an insignificant (25%) or even a counterproductive (50%) driver.

Notably, one of the most important conclusions from the stakeholder interviews is a so-called 'non-event': no stakeholder has argued *against* a system at EU level as such, criticisms were only levied against the current form of the system.

There are however concerns about the (lack of) independence of the PRB, which are shared broadly among the stakeholder groups.

Subconclusions F Coherence of the SES performance scheme with other SES initiatives (N=53)
ield research

Survey outcomes

Overall

Respondents were asked to what extent the SES performance and charging initiative covers the needs of European air navigation services. Only 25% responded with a "Fully" or "Mostly". The majority (56%) answered "Partially". Less than 8% answered "Not at all". From the elaboration given by the respondents, it can be concluded that in general they believe that the SES performance and charging initiative has been an important driver in increased awareness and delivered some performance improvement (especially in reduction of costs), but there are a number of issues that are not sufficiently addressed or recognized, including

- Differences in local circumstances;
- Dependency on issues that cannot be controlled, i.e. inflation in the economy in general and the inflation of costs incurred by the providers
- Interdependencies between KPIs

To the 64 respondents, 6 statements were provided about the change that the SES performance and charging initiative has resulted in. From this list, the following were noted as the top 3 changes due to the schemes

1. There is a trend towards more uniform and transparent reporting about ANSP performance (42 out of 64 respondents agreed with this statement);
2. There is trend towards performance based management of ANSPs (21 respondents out of 64 agreed with this statement);
3. The schemes gradually improve the performance of the air navigation service at a reasonable speed, given the inevitable barriers (19 respondents out of 64 agreed with this statement);

Respondents were asked if they would consider the charging and performance schemes to be useful in terms of improving ANS performance in their State, compared to what could have been achieved by Member States at regional level. About 75% of the respondents consider the SES performance and charging scheme of added value, with 45% agreeing mostly of fully (20% answered "Yes" and 25% answered "Mostly", with 30% answering "Partly"). Only 11% did not agree.

In the elaboration, some respondents stated that the SES Performance and Charging Scheme helped in improving the cost-efficiency and that nothing would have happened without it, while some others argue that Member States probably would have achieved the same result but on a much longer timescale.

Respondents were asked to indicate what fraction of the performance improvements from 2012 onwards were attributable to the SES performance schemes, when taking into consideration other motivators such as customers satisfaction, pressure from society, own ambitions for sustainability and reputation, employee satisfaction, and financial considerations.

Of the 59 respondents, 10 (16.9%) indicated the schemes were the main motivator and 28 (47.5%) indicated that they explain a significant part of the performance improvements. Negative views on the performance schemes were held by a sizable minority of 21 respondents (35.6%), of which 14 (23.7%) attributed a negligible role and 7 (11.9%) attributed a negative role to them. Overall, the schemes are seen as a positive and substantial factor in improving performance.

Across respondent groups, some variation can be discerned: a majority of NSA and a small majority of ANSP respondents (58%) stated the schemes were either the most important or a significantly important driver. Respondents from the Ministries overwhelmingly (89%) saw the schemes as dominant or significant drivers. Respondents from staff bodies saw it as an insignificant (25%) or even a counterproductive (50%) driver.

Two ways were mentioned in which the schemes benefitted performance: one is through the application of a coherent, consistent framework at Union-level, the other is through shortening the timeline for performance improvements (that would have been implemented in any case). A number of NSA-respondents reiterate that the performance improvements would have taken place in the context of national programmes anyway.

Up to this point, the impact of the performance scheme has mostly been felt in the KPA of Cost-efficiency, receiving a weighted score of 46 per cent from the 59 respondents. Safety is the least impacted according to respondents, with a weighted score of just 13 per cent.

Interviews Member States (NSAs and Ministries)

The majority of the interviewees consider the SES performance and charging schemes as an important step forwards. Although for airspace users it might seem that the schemes are not delivering quickly enough and they do not yet see the level of benefit they want to see, the SES performance and charging schemes is providing benefits. The interviewees mentioned:

- The ANSPs and NSAs are now engaged and co-operating. ANSPs and NSAs are now more aware of their responsibility and accountability. ANSPs became more aware that the capacity and costs need to improve.
- Costs and also capacity are improving
- Information is provided in a more uniform and transparent way.

On the other hand, there are some weak points, especially in implementation, where there is believed to be room for improvement. The interviewees mention:

- Lack of flexibility to address local circumstances.
- Dependency between the KPIs.

- External influence: drop in traffic levels, inflation, pension costs.
- The regulations were perceived as a heavy administrative reporting burden. ICT issues and double reporting did not help the situation.
- Lack of effectiveness of the supervisory power of the NSAs in the performance schemes. ANSPs sometimes proposed Performance Plans lacking in rigour that were not sufficiently challenged by NSAs.

Interviews ANSPs

On the whole ANSPs thought that the performance scheme has had a positive impact at EU level, primarily through cost efficiency. This is offset by views that the scheme has introduced an administrative burden to ANSPs so that the net value of the scheme is still to be demonstrated. Example positive impacts cited are that the scheme has encouraged investment by some States that were previously under-investing.

Some ANSPs felt that the reductions during the recession would have occurred anyway due to customer pressure, and evidenced this by their response in previous downturns such as 2001. UK NATS believes that the Performance Scheme has had a relatively minor impact on its pre-existing national performance regulation. This is particularly the case in target setting where, for example, the UK NSA has set more stringent targets for cost efficiency and environment for RP2 than the EU-wide targets.

A particular effect at the EU level is that the scheme has led to greater transparency, through openly published indicators, particularly in safety; although the quality of reported safety data could be improved.

Interviews ANSP staff representatives

The overall view, shared by all three staff organisation, of the SES Performance and Charging schemes and especially the target-setting is that it is a political process, in which airlines have too much influence due to their strong lobbying efforts. The views of the ANSP industry are not taken into account enough. The whole decision making process is considered inefficient. They argue this has created a system that reflects a 'paper reality' and is not geared towards improving actual performance. This results in binding targets which are too prescriptive, hindering flexibility and freedom of choice of the ANSPs to respond to situations based on their expert opinion.

Furthermore, they declare the system is too rigid, as targets are set for multiple years and it is not possible to change these in the meantime. One example is that it is, in their words, almost impossible to get a revision to the traffic forecast accepted: this is too difficult and takes too long. One of the consequences of this rigidity is that States resort to 'gaming' to meet their targets.

One of the fundamental problems is that Air Traffic Management is treated as if it were an airline industry, while it actually is an infrastructure.

Interviews Airspace users

According to one of the interviewees, the scheme as a whole is relevant and an economic regulation is the appropriate tool to address the monopoly position of the ANSPs. However, the current parameters of the economic Regulation are not enough to reach the high target set at the political level: a reduction of the costs of Air Navigation Services by 50 per cent.

Although the association had been in touch with the Commission during the process of the target setting, the outcomes did not reflect the stance of airspace users. A problem is that Member States have a vested interest in their ANSPs and are definitely 'on their side' instead of that of the airlines.

The current structure has incentives foreseen by law but no uniform system to assess these incentives, as each country is allowed to keep its own system. It results in a cumbersome and inefficient system that is not transparent for the airspace users. It also leads to gaps in the network that will never be fulfilled, as there are no penalties for this.

KPAs and PRB

The stakeholder feedback on the impact of the scheme per KPA is detailed in questions 1a-1d. These amounted to:

- Capacity: there is a general view that there is an interdependency between the capacity target and the cost-effectiveness target, and that the Cost-Efficiency KPA has put pressure on staffing and in turn on capacity.
- Environment: one third indicates a positive impact on Environment while two thirds indicate no impact, a negative impact or do not know. The authorities are slightly more positive about the impact on the environment than the ANSPs.
- Cost-Efficiency: The majority (72%) of respondents indicates that the performance and charging scheme had an overall positive impact (somewhat or significantly improved cost efficiency). Of those respondents (who indicate an overall positive view), 71% are representatives of ANSPs.
- Safety: stakeholders indicated that safety PIs are included as a counterbalance against effects resulting from targets on the other KPAs, and that the existing safety KPIs should not be abandoned because organisations spent a significant effort on these indicators, which may have a longer term effect.

PRB

There were several issues raised by ANSPs and airspace users about the independence of the PRB, and these have been amplified further at a meeting with the PRB. The PRB itself has concerns, among other things, that it is not able to appoint its own members or fully direct the PRU. ANSPs generally believe the PRU to be doing good work, but also have concerns about institutional conflicts.

11 SUSTAINABILITY

11.1 EQ 17 Will the effects last or is there a risk achievements in one RP are annulled by less performance in subsequent RPs

17. Will the effects last, in the medium or long term and over several reference periods or is there a risk that achievements in one reference period are taken away by less performance in a subsequent reference period?
Answer to evaluation question
In terms of performance outcomes enduring into and beyond the current reference period: **Safety** – Unknown. RP1 was about embedding a harmonised safety assessment mechanism and not about defining the level of safety. As these mechanisms mature they can be expected to be maintained into the future and produce stronger outcomes. **Environment** – Yes, the achievements should endure as based primarily on improvements in route efficiency impacting horizontal flight efficiency. These could be expected to be sustained subject to inefficiencies introduced by factors such as geopolitical issues closing airspace and any noise issues requiring airspace changes. **Capacity** – Yes, the achievements should endure, but as traffic grows there is an on-going requirement for additional capacity and increasing constraints at the bottlenecks in the gate to gate system, be they en-route, TMA, Aerodrome or on airport. Capacity added in one RP will not be lost, provided the ANSPs maintain existing assets and resources and undertake investment in additional capacity (assets and resources), and adopt new technology and operations concepts to improve the productivity of those assets and resources. The implementation of SESAR projects has the potential to impact capacity as new procedures are brought into operation. **Cost Efficiency** – Maybe, but the achievements may not endure if costs are strongly influenced by factors over which the ANSP has limited control, e.g. regulatory requirements impacting staffing or CAPEX requirements, pension scheme valuations, interest rates.
Main conclusion Desk research
The performance outcomes achieved enduring a reference period are not likely to be taken away by less performance in a subsequent reference period, except in the Cost Efficiency area where the traffic volume and cost variables are such that sustaining benefits long term is difficult to predict.
Sub-conclusions Desk research
At Union-level
1. **Safety -** there are no Union-wide safety targets, the States are required to report on a number of Safety Performance Indicators relating to systems implementation in RP1. These are underway and should be sustained though it is recognised they will require on-going refinement.
2. **Environment –** despite the target not being achieved, in terms of the trend being sustained, there is still capacity to improve the route network through Direct Routing and improved route availability through FUA, AFUA and other concepts. Thus the trend of gradual

improvement, as opposed to quantum change, should be expected to continue.

3. **Capacity** - Traffic volumes are the single most significant driver of performance – these are acknowledged as being cyclical and thus it is reasonable to assume, based on history, that capacity will be constrained in any period of unanticipated high growth.
4. **Cost Efficiency -** targets have been found challenging by States, particularly in respect of traffic downturns and additional costs such as pensions.

At national level (with regard to NPP targets)

- **Safety** – at a State level data indicates the gradual adoption of the safety related systems defined for RP1. Based on experience with other implementations of procedures – common licensing being an example – it can be expected there will continue to be variation in the level of sophistication of reporting process and this will provide a challenge in reporting on safety metrics in future RP.
- **Environment** – there is insufficient data available to draw meaningful conclusions at a state level.
- **Capacity** – the majority of States achieved their plan. Noting the potential for rapid traffic growth to impact capacity, the Performance Scheme has the effect of bringing under performance in this area into focus and giving impetus to addressing the constraints that exist. As such, whilst there will continue to be exceptions at national level, but it would be reasonable to assume these will continue to be the exception.
- **Cost Efficiency -** based on performance in RP1 illustrates that year on year reductions are possible.

Main conclusion Field research

There were some reservations which indicate potential risk that achievements in one reference period are offset by lower performance in a subsequent period. Notable among these:

Safety- there is significant concern on the incompatibility of incentivising reporting versus the principles of Just Culture and measuring incident severity which is not measuring safety.

Environment – the overall perception is that HFE is largely out of the control of ANSPs and therefore changes to the Performance Scheme should not adversely impact gains already made.

Capacity - recognising the role of the Network Manager would enhance its capacity to drive network performance from an en-route perspective and increase the likelihood constraints in the system will be identified and addressed beyond what may happen under a State by State approach.

Cost Efficiency - Several respondents noted implementation of the ATM Master Plan / SESAR will drive CAPEX and project cost which will negatively impact the Cost Efficiency targets, as will temporary deferment of CAPEX to respond to short term drops in traffic volume. Thus the ability to sustain the cost savings achieved to date may be challenged by the SES itself and the benefits from RP1 to be lost in RP+ as SESAR is implemented.

11.2 EQ 18 Are there benefits shifted from one KPA to another throughout an RP or between RPs

18. Are there benefits shifted from one key performance area to another throughout a reference period or between reference periods (interdependencies)?
Answer to evaluation question
There is no evidence to suggest that there is a transfer of benefits from one KPA to another at the European or National level. However, at National level, the reality is that there will be a need to balance the performance impacts of various options, particularly those relating to the Cost Efficiency and Capacity dimensions.
Main conclusion Desk research
There is a transfer in benefits between KPA. This occurs at a national level and is part of the role of ANSP management in meeting their responsibilities to manage the entity consistent with the conflicting requirements of their stakeholders. The data provided by States in their performance plans does not provide sufficient detail to assess the value transfer – even if there were an agreed methodology for doing so.
Sub-conclusions Desk research
At Union-level
The KPA trade-off occurs at national level not EU level, where targets are expected to be met across all indicators with no recognition of the potential for a trade-off between indicators; States are expected to meet every target and every State level target is expected to be consistent with the European level target.
At national level (with regard to NPP targets)
Strictly speaking, performance is not 'traded off' but rather the ANSP manages its business with its existing assets, personnel, user requirements, systems lifecycles, funding streams etc. and there are performance outcomes flowing from this. The reality is that the levers for an ANSP to pull are limited and that change in ANS takes time, hence concerns over the 3-year horizon of RP1. Accordingly, whilst the performance scheme KPAs are important, other more practical and immediate considerations can drive ANSP decision making. Nevertheless, we make the following observations on trade-offs: • Cost efficiency v Capacity The most recognised trade-off is between the costs of investing in new systems, staff and procedures and the resulting increase in capacity. It is also cyclical with system capacity being increased in steps as new sectors are opened. Traffic growth, on the other hand, is dynamic. The challenge for the ANSP is to accurately align capacity steps with traffic, recognising there may be long lead times involved in system procurement and staff recruitment and training. As a consequence there are trade-offs – delay a new sector and save on financing costs, depreciation, staff and implementation project costs, but incur capacity constraints which result in delay. Alternatively, bring forward a new sector and incur the associated costs and have excess capacity but have an impact on cost efficiency as a consequence. Such decisions are made routinely taking account of the environment in which the ANSP operates. • Cost efficiency v Horizontal Flight Efficiency Changes to routing or implementation of new airspace sectors may reduce route extension. These may have a cost impact where simulation of new

sectors is required, new procedures or update of AIP and FDP databases are required, but these costs are relatively minor. They may also have a positive impact on revenue through improved route availability.

- Cost efficiency v Safety

There may potentially be shifting of benefits from the Safety area to Cost Efficiency in the form of deferred expenditure on safety nets, on training, on enhanced safety procedures. However, there is no evidence a conscious trade-off is occurring between these factors.

- Capacity v Safety

There may potentially be a shift of benefits from the Safety area to Capacity in the form of deferred expenditure on enhanced capacity creating sectors operating at peak for extended periods. This could result in excessive overtime or other practices to cope with the traffic with inadequate resources and a potential adverse impact on the relative level of safety. However, there is no evidence a conscious trade-off is occurring between these factors and no ANSP would provide a service which it does not regard as safe.

Main conclusion Field research

Many stakeholders point out that the current objectives do not sufficiently account for interdependencies between the objectives and between KPAs/KPIs. It is felt that a greater coherence of, and balance between, the objectives, KPAs/KPIs and the performance contributions of different types of operators (e.g. ANSP, airspace users, airports) would better reflect the industry reality, as well as the diversity across Member States, and positively impact the realisation of the objectives.

Stakeholders note that the interdependencies between the Cost Efficiency and Capacity KPA in particular are complex and should be analysed by appropriate operational and technical experts before targets are finalised.

Data gaps / limitations

There are information gaps in that the States are required to produce Performance Plans but these do not adequately address the issue of the potential trade-off between KPAs. This would be useful, particularly as stakeholders are suggesting there needs to be more flexibility for States to make trade-offs to reflect national realities and priorities as opposed to being driven by a European level target.

12 ACCEPTABILITY

12.1 EQ 19 To what extent are the schemes accepted by stakeholders

19. To what extent are the schemes accepted by stakeholders, in particular those listed in Article 10 of Regulation (EC) No 549/2004, and/or the general public?

Answer to evaluation question

Performance scheme is accepted by the stakeholders.[58] Although airspace users would like to have seen more pressure to obtain better results, they see the economic regulation as the appropriate tool to address the monopoly position of the ANSPs.

Main conclusion Desk research

The four KPAs are widely accepted. The stakeholders, in particular the airlines, were invited to provide input and comments in the designs phase and there are no stakeholder lobbies to add or to get rid of one. The set of KPAs is therefore considered relevant for the aviation sector.

The Commission and the PRB have actively consulted stakeholders during the process of developing the regulations and setting the EU-wide performance targets for RP1 and RP2, which is illustrated by a number of examples:

- As part of the process for developing EU regulations, the stakeholders are invited to provide comments on the regulations. This process has also been followed for the regulations regarding the Performance and Charging Scheme.
- Following Article 6 of Regulation (EC) No 549/2004, the Commission established an 'industry consultation body', to which air navigation service providers, associations of airspace users, airport operators, the manufacturing industry and professional staff representative bodies shall belong. The role of this body shall solely be to advise the Commission on the implementation of the single European sky.
- On 20 December 2010, the European Commission decided to create a separate, specific expert group on the social dimension of the Single European Sky. This group is consulted on all Commission proposals in the field of the Single European Sky having a significant social impact (Decision of 20 December 2010 C/2010/9016). The inclusion of safety performance indicators was a compromise stemming from the social dialogue. Initially they were not in the SES performance and charging scheme proposals. It was included as a counterbalance (handbrake function) against the effects resulting from setting targets on the other KPAs.
- In the beginning of 2010, the PRB in consultation with Stakeholders developed in collaboration with EASA proposals for EU-wide targets. The final proposals were developed taking feedback from stakeholders

[58] The stakeholders listed in Regulation (EC) No 549/2004 are: air navigation service providers, airport operators, relevant airspace users or relevant groups representing airspace users, military authorities, manufacturing industry and professional staff representative bodies. Additional stakeholders are the general public, NSAs and Member States.

into account. Responses are given to individual comments wherever possible in the time available so as to ensure a maximum level of transparency. In total 63 responses were obtained.[59]

- The PRB proposal was open for stakeholder consultation and resulted in the Commission Decision.[60] The targets for Environment and Capacity were kept the same. The target for Cost-efficiency became higher than the PRB proposal.
- In developing proposals for Union-wide targets for RP2 the PRB has sought stakeholders' opinions via a range of methods, including document publication, questionnaires and meetings, from 2012 to 2013. Based on these results, the PRB gave an advice to the Commission[61,62] (Ref. 3 and 4), leading to the Commission Implementing Decision on March 2014[63] (Ref 5).

Main conclusion Field research

Member States:
The Member States that we interviewed, generally agreed that RP1 was seen as a transition or test phase and RP2 was used for further improvement. Hence RP 1 should be evaluated as such with the main test in RP3, where the lessons learned can be implemented. There is seen to be a lot of pressure on RP3 for which all should play their role properly to make it a success. Whilst interviewees agree that some benefits could have been achieved in another way, they accept that the SES performance and charging schemes (and the underlying regulation) were the right way to implement this in the EU.

ANSPs
The ANSPs that were interviewed see the added value of the scheme. Although there were initially some discussions, they are currently actively participating in achieving the goals. This is also the opinion of the Member States that have been interviewed.

Airspace users
According to one of the interviewees, the scheme as a whole is relevant and an economic regulation is the appropriate tool to address the monopoly position of the ANSPs. However, the current parameters of the economic Regulation are not enough to reach the high target set at the political level: a reduction of the costs of Air Navigation Services by 50%. Although the association that has been interviewed had been in touch with the Commission during the process of the target setting, the outcomes did not reflect the stance of airspace users. A problem is that Member States have a vested interest in their ANSPs and are definitely 'on their side' instead of that of the airlines.

[59] PRB, SES II Performance Scheme, Proposed EU-wide Performance Targets for the period 2012-2014, 27 September 2010.

[60] Commission Decision of 21 February 2011 setting the European Union-wide performance targets and alert thresholds for the provision of air navigation services for the years 2012 to 2014.

[61] PRB, Report on the preparation of the revision of the SES Performance Scheme addressing RP2 and beyond RELEASED ISSUE Version 1.0, 17 July 2012.

[62] PRB advice to the Commission in the setting of Union-wide performance targets for RP2, Final Report, 27 September 2013.

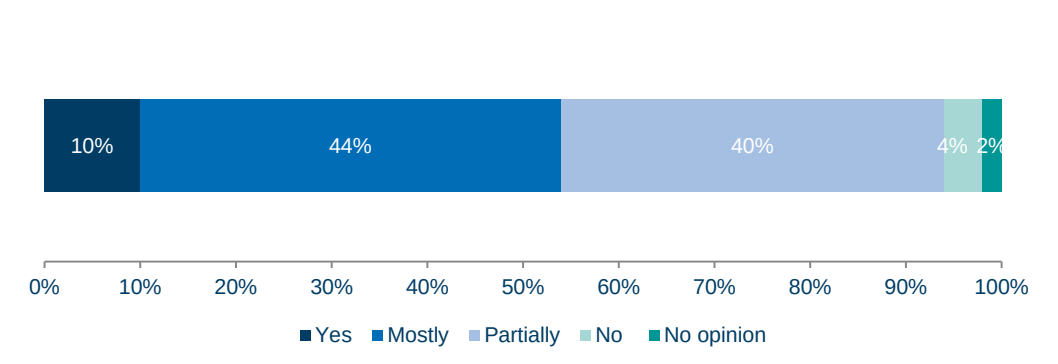
[63] Commission Implementing Decision of 11 March 2014 setting the Union-wide performance targets for the air traffic management network and alert thresholds for the second reference period 2015-19.

From the survey the following conclusions were drawn regarding the regulation:

- Many stakeholders think that the regulations need to be simplified in line with the EU Better Regulation guidelines. Currently the Regulations are perceived to be too complex for the implementation at the national level (too many targets, lack of flexibility, administrative burden, poor understanding by stakeholders), which leads to the "one size fits all" situation at the implementation level. Specifically, it is perceived that current objectives do not allow: taking account of national/local and economic circumstances (consequences of the economic crisis, local technical possibilities); differentiating between large and smaller companies and responding to the dynamics of the business (due to overly long planning periods). The regulations should allow for fast and flexible adaptation to the changing environment, not least by adjusting the length of the currently too long planning periods.
- At the same time, some respondents feel that the regulations do not go far enough in providing uniform rules necessary to avoid different interpretations and applications at the local level and to break national monopolies in order to create the SES.

In the OPC, respondents were asked whether they believe that the objectives of the SES performance and charging schemes still correspond to current needs of the aviation sector and their passenger and freight customers. The figure below shows the distribution of the answers. The majority find that the objectives of the SES performance schemes still correspond to the needs of stakeholders: 44% state that they mostly correspond and 10% that they fully correspond.

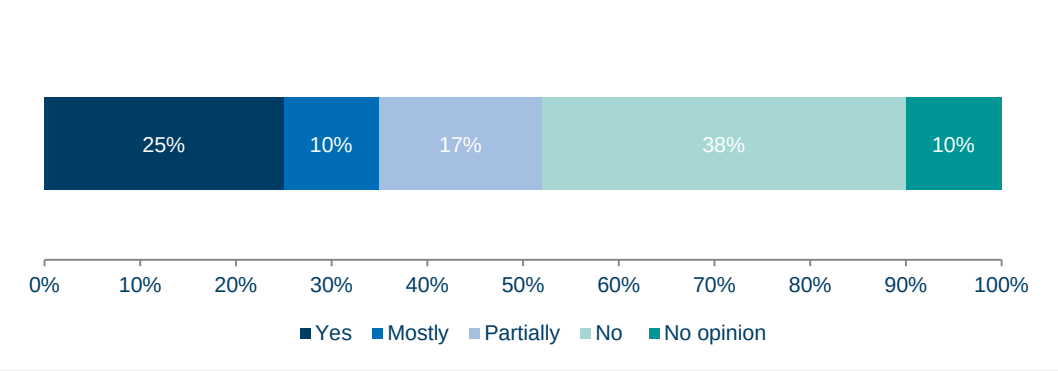
Figure 37 The extent to which the objectives of the SES performance and charging schemes still correspond to current needs of the aviation sector, passengers and customers



More specifically, the majority of respondents consider the current high-level objectives of the SES Regulations, namely cost transparency and efficiency, service quality, environment and safety, to be still valid for the Reference Period 3 (RP3). Realisation of these objectives is the primary challenge that is, however, caused by certain deficiencies in the target-setting. It is widely felt that the current objectives should be revised and/or rendered more precise to ensure a successful outcome for RP3.

With regard to representing passengers' and freight customers' interests, the respondents were asked whether they consider national supervisory authorities (NSAs) to be the right party/proxy for this. The opinions were quite divided (see figure below). 38% of respondents considered NSAs not to be the right place, among which were all airspace users, five ANSPs and even one NSA. 25% of respondents thought NSAs to be the right place to represent interests of passengers and customers, among which were many ANSPs and three NSAs. 17% thought that NSAs were partially the right place and 10% that they were mostly the right place, among which three NSAs were in the former group and one NSA in the latter. Unfortunately, there were no elaborations by the respondents in answering this question.

Figure 38 The extent to which NSAs are the right party to represent passengers and freight customers



Data gaps / limitations

- It should be noted that there is, to a limited extent, duplication in the responses received and analysed from the OPC and from the targeted survey, due to a number of respondents having answered to both.
- No specific responses have been obtained that could be attributed solely to stakeholder group "general public" and not also to other stakeholder groups.

13 EQUITY

13.1 *EQ 20 How fairly are the different effects of the SES PCS distributed across stakeholders and regions*

20. How fairly are the different effects resulting from the introduction of the SES performance and charging schemes distributed across the different stakeholders and regions?
Answer to evaluation question
Overall, the effects are fairly distributed among stakeholders. The benefits for airspace users is significantly higher than for ANSPs, and it may be assumed that in the current competitive environment these benefits are passed through to passengers to a large extent. Additionally from that also passengers gain significantly from delay reduction. This is what one would expect from an economic regulation like the performance and charging scheme. Clearly, the benefits for users and passengers could have been higher if the targets would have been fully met. Also airspace users bear the risk of exchange rate fluctuations (but also the benefit if the rate develops at their advantage). Overall, there is quite a varied geographic performance when taking into consideration the equity of effects across all KPAs.
Main conclusion IR1
Overall, both ANSPs/ATSPs, airspace users and passengers have realised substantial economic benefits following the implementation of the SES PCS in 2012. Comparing average performance in the area of capacity over the preceding years (2004-2011), the average delay under the performance scheme (2012-2015) showed an improvement of 0.6 min/flight. This translates into cost savings of € 1.1 billion retained by airspace users and € 771 million in savings for passengers. In the area of cost efficiency, comparing yearly performance during RP1 with the average DUR achieved during the three preceding years (2009-2011), cost savings to airspace users amounted to a total of € 1.5 billion related to cost-efficiency performance. It is assumed that airspace users further benefit from cost savings on fuel reductions due to overall reductions in distance flown, however it has not been possible to make an estimation due to insufficient data on absolute reductions in distance flown. Therefore the net economic benefit to airspace users (hence excluding the benefit for passengers) over the course of RP1 and the first year of RP2 is estimated at approximately € 2.7 billion.[64] It may be assumed that these will be passed through to their customers, but the degree to which this has occurred is outside the scope of this study. At the same time, the additional amounts to be billed to airspace users through future years' unit rates due to the adjustment mechanisms totalled € 747,1 million throughout RP1. For the first year of RP2, actual costs incurred by airspace users in respect of aviation activities performed in 2015 are lower than the determined costs billed based on actual TSUs, which translates into forthcoming reimbursements to airspace users of € 143,9 million.

[64] Figures may not add up due to rounding.

The net gain to ANSPs, which are mainly related to cost reductions that are then retained by the ANSPs under the cost-sharing mechanism, amounted to a total of € 430 million during RP1 and a further € 207,7 million in 2015.

The aggregated economic values at EU level compared to the baseline for each of the main stakeholders are shown below.

	Cost savings from capacity performance	Cost savings from cost efficiency performance	Net gains / losses due to adjustment mechanisms	
Compared to:	**Baseline**	**Baseline**	**Plan (RP1)**	**Plan (2015)**
ANSP	-	-	€ 430,9 M	€ 207,7 M
Airspace users	€ 1.139 M	€ 1.512,6 M	€ - 747,1 M	€ 143,9 M
Passengers	€ 771 M	-	-	-

Although the amounts charged to airspace users exceed the targets stated in the performance plans by a total of € 747 million during RP1 as a result of the various adjustment mechanisms, we can nevertheless conclude that these are significantly offset by the much larger overall gains realised by airspace users when compared to the preceding years (i.e. baseline scenario). Specifically, comparing actual capacity and cost efficiency performance to the baseline scenario, overall cost savings to airspace users amount to an estimated € 2.7 billion over the course of RP1 and the first year of RP2. At the same time, cost savings to passengers during the period amounted to an estimated € 771 million and a further € 638,6 million to ANSPs (i.e. € 430,9 million during RP1 and € 207,7 million in 2015). We can therefore conclude that airspace users realise larger overall gains than ANSPs

The calculations for each of the above figures, including baseline estimates, are presented in the subsequent paragraphs.

Subconclusions Desk research

Geographic distribution

Overall, there is quite a varied geographic performance when taking into consideration the equity of effects across all KPAs. The most consistent under performer is Poland, having fallen short across the environment, capacity and cost-efficiency KPAs. FABEC states, in particular Germany, the Netherlands and Switzerland, consistently under perform on the capacity and cost-efficiency indicators. IT can also be noted that many states which improved their cost-efficiency performance under performed in the areas of flight efficiency (e.g. Denmark, Sweden, Estonia, Ireland, Latvia, Lithuania, Malta, Slovenia and the UK). Greece, Norway and Romania were the only three states to significantly improve horizontal flight efficiency, achieve 2014 capacity targets and improve cost efficiency performance at the same time.

For a detailed analysis of geographic distribution of gains/losses across Member States from the implementation of the various adjustment mechanisms – from the perspective of both States/ATSPs and airspace

users – see Q 21.

Stakeholder level – ANSPs / States

The analysis of the ATSPs results at Union-level during RP1 shows that, for each year, the (main) ATSPs of SES states generated a net gain for the en-route activity as a result of the different adjustments, amounting to a net gain of € 430,9 M during RP1. These gains are comprised of 3 distinct elements, summarised in the table below:

Table 13.1 Net gains / losses of (main) ATSPs due to adjustments during RP1

	2012	2013	2014	Total RP1	2015
Cost sharing	€ 206,5	€ 292,9	€ 308,1	€ 807,5	€ 164,5
Traffic risk sharing	€ -127,5	€ -144,2	€ -135,2	€ -406,9	€ 33,3
Incentives	€ 13,3	€ 6,3	€ 10,7	€ 30,3	€ 9,9
Total	€ 92,3	€ 155	€ 183,6	€ 430,9	€ 207,7

Source: PRB Reports 2012 -2014, Vol 1 & 2.

During the first year of RP2, ATSPs generated the largest net gain for en-route activity since the Performance and Charging Schemes were enacted – amounting to a total net gain of € 207,7 M for 2015, A key factor contributing to this situation is the fact that for the first time since the schemes were implemented, actual traffic was higher than planned in the PPs, resulting in gains (instead of losses) to be kept y States / ATSPs following the traffic risk-sharing arrangements.

Economic benefits from environment and capacity accrue to airspace users, with no direct benefits to States/ANSPs.

Stakeholder level – Airspace users and their customers

Cost savings to airlines from improvements in the quality of service:

Compared to the average delay over the preceding years (2004 – 2011), the average delay under the performance scheme (2012-2015) showed an improvement of 0.6min/flight. Two valuations of delay enable us to translate the improvement in delay into an economic benefit:

1) The delay costs to airlines may be valued at an average of € 49.5/min, which excludes passengers' lost opportunity costs.
2) Including passenger lost opportunity costs, the valuation of delay per minute rises to € 83, which is the value used in RP2 target setting in 2013.

The total economic benefits accruing to airspace users due to improvements in delay performance under the performance scheme are an estimated € 1,1 (excluding passenger benefits) to € 1,9 billion (including passenger benefits). The net benefit for the passengers is thus around € 800 million. The calculations are summarised in the following table:

Table 13.2 Cost savings to airspace users and their customers from improved quality of service

a) Cost of 1 min of delay on average (€)	€ 49,50	€83,00
b) Average flights 2012-2015	9.587.500	
c) Average min of delay per flight avoided	0.6	
d) Minutes of delay avoided per year = b x c	5.752.500	
e) Cost savings per year (€) = a x d	€ 285 M	€ 478 M
f) Economic benefit over 4 year period (€) =	€ 1.139	€ 1.910

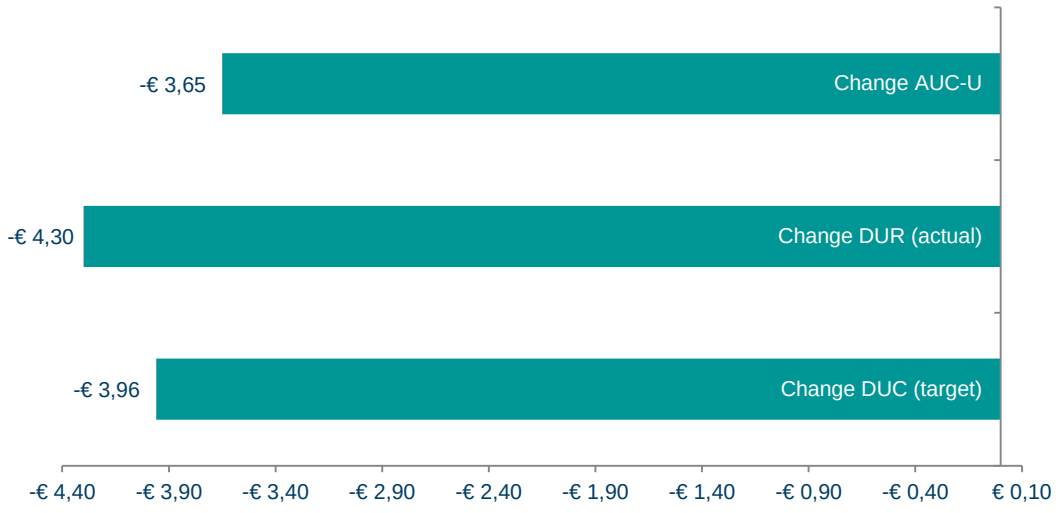
e x 4	M	M

We consider these delay benefits largely catalysed by the performance scheme. Nevertheless, also other SES initiatives, notably the network manager work is likely to have had an influence. Also ANSPs needed to invest in capacity to realise these effects.

Economic costs / benefits to airspace users resulting from cost-efficiency performance:
During RP1, the actual unit costs to users decreased € 3,65 in 2014 compared to 2012. This represents an reduction in the true costs incurred by airspace users of 6% over the course of RP1.

First, the overall reduction in the DUR, calculated on the basis of the actual costs and actual service units per year, compared to the determined unit costs set out in the NPPs, as well as the reduction in actual unit costs to users (AUC-U) are shown in the graph below. It can be observed that, on the ANSP side, cost efficiency improved during RP1 by 7,4%, or 0,4% more than projected, while the actual unit cost to users was reduced by 6% (-€ 3,65 in 2014 compared to 2012). This shows that the reduction in the actual unit costs for users was lower than the reduction in the determined unit rates of ANSPs.

Figure 39 Economic costs / benefits to airspace users from cost-efficiency performance



As illustrated in question 21, total amount of adjustments that the airspace user bore during RP1 and the first year of RP2 amounted to an additional € 603,2 M (i.e. € -747 million during RP1 and reimbursements of € 143,9 M for 2015 activities) (i.e. the true costs for users) to be billed in future unit rates. Comparing this with the baseline, we can make an estimation of the change and net effects to users from the performance. We use the following valuations of the baseline: comparison to the average actual determined unit rate achieved over the preceding 3 years (2009 – 2011), which gives a baseline estimate of € 60,33.

Compared to the actual determined unit rate achieved over the preceding 3 years (2009 – 2011, € 60,33), RP1 saw improvements in the actual unit costs for users of € 1,00 in 2012, € 1,99 in 2013 and € 4,65 in 2014; and € 5,98 in

2015. Therefore, for the years 2012 to 2015 inclusive, the net gain to airspace users in terms of the difference between the true economic costs for users compared to the baseline scenario is estimated at € 1.512,6 billion[65].

Table 13.3 Estimated economic benefits to airspace users from adjustment mechanisms

a) Average actual DUR 2009-2011 (€)	€ 60,33			
	2012	2013	2014	2015
b) Actual unit cost for users (AUC-U) (€)	€ 59,33	€ 58,34	€ 55,68	€ 54,35
c) Difference in average DUR with AUC-U (€) = (a – b)	€ 1,00	€ 1,99	€ 4,65	€ 5,98
d) Actual service units 2012 – 2014	103.501.763	105.171.670	109.836.771	114.994.014
e) Cost savings per year (€) = c x d	€ 103,8 M	€ 209,6 M	€ 511,1M	€ 688 M
f) Economic benefits over 3 years (€) = sum of e	€ 1.512,6 B			

Finally, regarding fuel cost benefits to airlines as a result of reduced distance flown, no data was available on the absolute reduction of miles flown to enable an assessment of the additional cost savings to airlines. It is assumed that there is some additional economic benefit to airlines due to improvements in flight efficiency, though the exact amount is not possible to estimate.

Stakeholder level – NSAs / Other

No concrete economic benefits are realised on the part of NSAs.

Main conclusion Field research

Respondents to the survey indicate that the majority of the effects / benefits have benefitted ANSPs, via reduced costs bases, which appear not to have been transferred to airspace users. Airspace users conclude no cost savings / benefits have materialised via reduced charges or costs incurred. Moreover, there is no perceived gain with respect to reduce delays or time-savings.

From the airspace user perspective, many of the current side effects of the Regulation, i.e. large carry-overs for some ANSPs, discrepancy between actual cost efficiency performance and the “true cost for users”, unrealistic initial economic or traffic assumptions, which artificially inflate the cost efficiency performance during the assessment – could be overcome with greater flexibility. In particular, flexibility is needed to revise the performance plans in

[65] When the longer term trend of the evolution of the unit costs would be applied as baseline, on average a 1.4% reduction per annum during 2001-2008 and if this figure would be applied on the unit rates per 2009, a comparable figure in terms of user benefits in the area of cost efficiency results (€ 780 million). When only 2011, as the last year before RP1, would be considered as the baseline value, there would be a net loss for airspace users of € 260 million in the area of cost efficiency. However, the study team doesn’t consider this a sound baseline as 2011 was already fully influenced by the performance and charging scheme.

case of large deviations of the actual traffic from the initial forecast, making initial economic assumptions invalid (e.g. interest rates), or exempted costs reach unexpected levels. This could be done through a revision of alert mechanisms with thresholds for such deviations. The study team notes that these concerns mainly relate to what could have been the ultimate benefit to users (compared to the performance pans) and not so much what the scheme in the current constellation did incur in terms of benefits to them (compared to the baseline). Airlines consider the fact that they bear the exchange rate risk as unfair. The study team considers this consistent with other charges (e.g. airport charges), while it is also understood that this is different compared to a situation where they procure for example systems.

Subconclusions Field research

ANSP views

ANSP respondents mainly refer to the benefits resulting from reduced cost bases as the main cost saving/benefit. However multiple respondents maintain that the cost savings of the ANSP would most likely have been achieved even in the absence of the SES regulations.

It is further stated that there has been limited impact at the local level/providers, mainly due to the failure to consider local specifics/ specifics of small companies (e.g. the trade-off (or conflict) between cost-efficiency and investments or capacity). This point is also recognised by the respondents positively assessing the impact of the SES schemes.

Airspace user views

Airspace users do not hold a favourable view on the equity of the schemes in relation to ANSPs. They assert that, largely due to the adjustment mechanisms foreseen under the Regulation, the performance and charging scheme effectively increased charges to airspace users by 1 billion more than was foreseen in the performance plans. all in spite of the fact that traffic was 5% lower than forecast. Moreover, it was argued that traffic was purposely overestimated. Finally, they indicated that the risk of exchange rate fluctuations are borne by the airspace users, which may add up significantly.

Trade union / Staff representative body views

- From a staff point of view there appears to be no positive impact from the SES performance scheme. Cost pressure has resulted in fewer staff, working increased traffic, with curtailed spending on investment. This appears to be in service of airline profitability and the tiny percentage that ticket prices may end up being reduced by (and that is far from certain) does nothing to offset the greater delays that the traveling public will suffer. The performance scheme seems to be less about providing value for the traveling public and more about increasing profitability for the airspace user.

Effects for society / passengers

One survey respondent pointed out the following shortcoming: Air fares have not decreased despite gains in savings, extended routes. The final effect has to be seen for increased mobility for EU passengers and cargo shippers.

13.2 EQ 21 What is the distributional effect between stakeholders of carry-overs

21. What is the distributional effect between stakeholders of carry-overs (e.g. inflation adjustments, cost exempt from cost-sharing, traffic adjustments, etc. that are allowed under the SES charging scheme)?

Answer to evaluation question

At Union level, throughout RP1, the (main) ATSPs of SES states generated a net gain of just over a half of a billion euros (i.e. € 430,9 M) as a result of the adjustment mechanisms for cost-sharing, traffic risk sharing and the incentives schemes for improving quality of service, and a further € 207,7 M in 2015. This is constituted by three main elements, as shown in Table 13.4.

Table 13.4 Net gains / losses of (main) ATSPs due to adjustments during RP1 and RP2

	2012	2013	2014	Total RP1	2015
Cost sharing	€ 206,5	€ 292,9	€ 308,1	€ 807,5	€ 164,5
Traffic risk sharing	€ -127,5	€ -144,2	€ -135,2	€ -406,9	€ 33,3
Incentives	€ 13,3	€ 6,3	€ 10,7	€ 30,3	€ 9,9
Total	€ 92,3	€ 155	€ 183,6	€ 430,9	€ 207,7

Source: PRB Reports 2012 -2015, Vol 1 & 2.

At the Member State level, taking the adjustment mechanisms together, just 5 Member States incurred a net loss in respect to the activities performed throughout RP1. These are:

Germany	€ -64,8 M
Romania	€ -13,8 M
The Netherlands	€ -13,1 M
Norway	€ -1,5 M
Finalnd	€ -0,05 M

At the same time, while actual unit costs incurred by airspace users in respect to the activities performed during RP1 decreased by 6% from 2012 to 2014, the additional amounts to be billed to airspace users through future years' unit rates due to the adjustment mechanisms foreseen in the Performance and Charging Schemes totalled € -747,1 M (i.e. +€ 282,2 M from 2012 activities, + € 160.6 M from 2014 activities and + € 303.3 M from 2013 activities). By contrast, in 2015, actual costs incurred by airspace users were lower than the determined costs billed based on actual TSUs, which translates into forthcoming reimbursements to airspace users of € 143,9 million. These costs are constituted by 5 main adjustments, as shown in Table 13.5.

Table 13.5 Cost adjustments incurred by airspace users during RP1 and 2015

	2012	2013	2014	Total RP1	2015
Inflation adjustment	€ -54,1	€ -34,2	€ 48,9	€ -39,4	€ 84,3
Traffic risk-sharing adjustments	€ -125,5	€ -182,0	€ -150,4	€ -457,9	€ 31,9
Adjustments from the difference in traffic	€ -50,7	€ -63,9	€ -58,1	€ -172,7	€ 8,6
Bonuses / Penalties	€ -13,3	€ -6,3	€ -10,7	€ -30,3	€ -9,2
Costs exempt from cost-sharing	€ -39,6	€ -16,9	€ 9,7	€ -46,8	€ -16,8
Other Revenues[66]	-	-	-	-	€ 45,2
Total	€ -283,2	€ -303,3	€ -160,6	€ -747,1	€ 143,9

Source: PRB Reports 2012 -2015, Vol 1 & 2.

Airspace users point to the fact that true costs to users do not match the targets and actual performance. It is argued that airspace users paid 1 billion more than foreseen in the Performance Plans, despite the fact that traffic was down by 5% compared to the forecasts in RP1. The situation in 2015 is significantly different from RP1, when actual traffic was always lower than planned in the NPPs, contributing to substantial losses from the traffic risk sharing arrangement. The other major difference observed in 2015 compared to RP1 is due to the inflation adjustment. Most States, actual inflation for 2015 was much lower than planned in the NPPs, which means that the inflation adjustment will result in a reduction of the unit rates charged to airspace users in 2017.

It can be concluded that, although airspace users incurred more than foreseen in the performance plans during RP1, the adjustment mechanisms have succeeded in distributing the burden more equitably between the main players. True costs to users has also gone down compared to the starting point of RP1, although this decrease has not been sufficient to meet the projected benefits in the performance plans. Moreover, the true costs are still higher than the unit costs of ANSPs, despite lower than project traffic and 2015 saw the first year of net reimbursements to airspace users due to the adjustment mechanisms.

Main conclusion Desk research

The analysis of the ATSPs results at Union-level during RP1 shows that, for each year, the (main) ATSPs of SES states generated a net gain for the en-route activity as a result of the different adjustments, amounting to€ 92.3 M in 2012, € 155 M in 2013 and € 183.6 M in 2014. These gains are comprised of 3 distinct elements: (1) Cost sharing, (2) Traffic risk sharing, and (3) Incentive mechanisms. The breakdown per year and adjustment mechanism is shown in Table 13.1.

[66] In a majority of en-route charging zones, the amount of other revenues deducted from the determined costs is marginal or non-existent. However In 2015, several charging zones reported materially high levels of other revenues sufficiently large to provide an impact at Union-level. These are Spain Continental and Spain Canarias (€ 19,5 M) due to national public funding and commercial revenues; France (€ 7,4 M), due to reimbursements from the SESAR Joint Undertaking, commercial revenues and EC grants; and Croatia (€ 7,3 M) reflecting the revenues from service provision in Bosnia & Herzegovina.

At the Member State level, just 4 States incurred a net loss from the cost-sharing mechanism over the course of RP1: Romania (-14,4 M), Norway (-11,9 M), the Netherlands (-8,5 M) and Malta (-1,6 M). In all 4 cases, the State in question incurred a net loss for at least 2 out of the three years of RP1. By contrast, only 8 states realised a net gain related to the traffic risk sharing mechanism. These were: Norway (+10,4 M), Bulgaria (+5 M), Malta (+1,6 M), Cyprus (+1,4 M), Romania (+0,6 M), Slovakia (+0,5 M), Lithuania (+0,5 M) and Latvia (+0,3 M). Only 3 SES participating states implemented incentive schemes during RP1 (i.e. Hungary, Italy, UK). Both Italy and the UK realised a net gain from achieved bonuses, whereas Hungary incurred a net loss of-€ 4,4 M.

Regarding costs to airspace users, the amount charged to users through the yearly unit rates was, overall, lower than the determined costs in the National Performance Plans. However the actual en-route unit cost for airspace users, i.e. the "true cost for airspace users" differs from the costs **charged** during RP1 due the different adjustment mechanisms established by the Performance and Charging schemes. The true costs refer to the additional amounts that are charged / reimbursed to users through future years' unit rates as a result of yearly activities.

During RP1, the additional amounts to be billed to users in the future due to the various adjustment mechanisms totalled € -747,1 M . For 2015 activities, the net effect of the adjustments is a forthcoming reimbursement of € 143,9 M to airspace users. The main additional cost adjustments incurred by users in respect of RP1 are summarised in the Table 13.5.

The main driver for the negative adjustments during RP1, according to PRB reports, is related to the traffic shortfall in 2013 and 2014 compared to what was planned in the NPPs. The "true costs" (Actual unit cost incurred by users, AUC-U) for users are estimated at € 6,115.9 M in 2014, which is -2.1% lower than the amounts that were forecast to be charged for 2014 activities on the basis of RP1 PPs (i.e. 6,245.7 M), and at € 6,230.9 M in 2013, or -0.8% lower than forecast. The true costs for users in 2012 are estimated at € 6,141.1. This leads to an actual unit cost incurred by users for the en-route activity of € 59,33 in 2012; of € 58,34 in 2013; and of € 55,68 in 2014. By contrast, 2015 saw both higher traffic and lower inflation than planned in the NPPs, respectively. The actual costs incurred by airspace users in respect of the en-route activity in 2015 (€ 6.249,3 M) is 2,3% lower than the amounts billed in 2015 (€ 6.393, 3 M, based on the DUC and actual TSUs). The Union-wide figures are summarised in Table 13.6 below.

Table 13.6 Difference between the Union-wide DUR and actual unit cost incurred by users (AUC-U) during RP1

2012			2013			2014			2015		
DUC-NPP	DUC-Actual	AUC-U[67]	DUC NPP	DUC-Actual	AUC-U	DUC NPP	DUC-Actual	AUC-U	DUC NPP	DUC-Actual	AUC-U
57,88	58,43	59,33	55,87	56,55	58,34	53,92	54,13	55,68	55,33	52,85	54,35

Source: PRB Reports 2012 -2015, Vol 1 & 2.

We observe that although the actual unit cost to users decreased by 6% over the reference period, it consistently falls short of the Union-wide targets. Moreover, while States / ATSPs collectively reduced their 2013 and 2014 cost bases in line with lower revenues from reduced traffic, and managed to increase their economic surplus at the same time, airspace users consistently incurred a higher actual unit cost than the actual unit costs incurred by the States / ATSPs throughout RP1 and the first year of RP2.

Subconclusions Desk research

Cost sharing

At Union-level, the main ATSPs of SES states generated a net gain of € 807,5 M over all three years of RP1.

Table 13.7 Net gain / loss of main ATSPs from cost sharing during RP1

	2012	2013	2014	Total RP1	2015
Cost sharing	€ 206,5	€ 292,9	€ 308,1	€ 807,5	€ 164,5

The majority of SES states (86%) realised an overall net gain on en-route activity due to the cost sharing adjustments, with only 4 states experiencing a net loss during RP1.

- 4 states experienced net losses in 2 of the 3 years: Romania, Norway, the Netherlands and Malta. These are the same 4 states that bore an overall loss over the course of RP1 as a result of the cost sharing mechanism.
- 5 states bore a loss in 1 of the 3 years. In order of magnitude (from largest to smallest), these were: Germany, Poland, Bulgaria, Slovakia and Lithuania.
- The remaining 20 states realised gains resulting from the cost-sharing mechanism in all 3 years.

There is considerable variation between states with respect to the cumulative gains/losses retained by the States / ATSPs (illustrated below).

5 states retained cumulative gains exceeding € 50 M:

Spain	€ 175,6
UK	€ 148,6
France	€ 96,6
Italy	€ 90,8
Austria	€ 53,6

[67] Actual Unit Cost incurred by users, after taking into account adjustment. Also referred to as the true costs for the users.

12 states retained cumulative gains of between € 10 to € 50 M:

Ireland	€ 31,5
Greece	€ 29,2
Germany	€ 25,3
Portugal	€ 23,3
Denmark	€ 22,9
Poland	€ 22,9
Switzerland	€ 21,7
Hungary	€ 21,5
Sweden	€ 20,9
BE-LUX	€ 15,3
Czech Republic	€ 13,7
Bulgaria	€ 12,4

7 States retained cumulative gains below € 10 M:

Slovenia	€ 5,0
Finland	€ 4,6
Cyprus	€ 2,8
Estonia	€ 2,4
Slovakia	€ 1,4
Latvia	€ 1,1
Lithuania	€ 0,8

4 states incurred cumulative losses:

Malta	€ -1,6
Netherlands	€ -8,4
Norway	€ -11,9
Romania	€ -14,4

Costs exempt from cost sharing

Airspace users bore additional costs due to costs exempt from cost-sharing in 69% of the cases in 2013 (i.e. 20 States) and in 62% of the cases in 2014 (i.e. 18 States). In both years, a further 4 states did not report any costs exempt from cost-sharing.

Taking into account both years of RP1 for which costs exempt from cost-sharing were reported, the actual unit cost that the users incurred due to adjustments relating to the costs exempt from cost-sharing increased in 17 States, while costs were reimbursed in 14 states. No additional charge was reported in 3 states.

Increases of more than + € 0,5 to the actual unit costs for airspace users occurred in 4 states in 2013 and in 8 states in 2014. Portugal, the Netherlands and Switzerland reported costs exempt from cost-sharing in both years. The yearly and cumulative increase to the actual unit costs among these States/ATSPs is shown below.

2013		2014		Cumulative	
Sweden	€ -4.32	Austria	€ -2.52	Portugal	€ -3.17
Portugal	€ -2.08	Switzerland	€ -1.92	Switzerland	€ -2.47
Netherlands	€ -0.73	Netherlands	€ -1.70	Austria	€ -2.46
Switzerland	€ -0.56	UK	€ -1.43	Netherlands	€ -2.43
		Portugal	€ -1.09	UK	€ -1.64
		Italy	€ -0.76	Finland	€ -1.04
		Finland	€ -0.55	Cyprus	€ -0.98
		Cyprus	€ -0.52	Italy	€ -0.76
				Poland	€ -0.57
				Hungary	€ -0.53

Deductions of more than € –0,5 to the actual unit costs for airspace users were reported in 2 states in 2013 and in 5 states in 2014. It is further observed that Sweden, which reported the largest amount of costs exempt in 2013, reported the largest deductions for reimbursement in 2014. The yearly and cumulative reimbursements of the states reporting the largest amounts to be reimbursed to users is shown in below.

2013		2014		Cumulative	
BE-LUX	€ 0.64	Greece	€ 0.55	France	€ 0.95
Slovakia	€ 0.98	Spain (Cont.)	€ 0.56	Greece	€ 0.97
		BE-LUX	€ 0.68	BE-LUX	€ 1.32
		France	€ 0.86	Slovakia	€ 1.46
		Sweden	€ 7.33	Sweden	€ 3.02

Traffic risk sharing adjustment

As indicated in the PRB monitoring report 2014, the net loss of revenues due to the lower than planned traffic over RP1 as a whole amounted to approximately € 1.04 B_{2009}. As a result of the arrangements for traffic risk-sharing between States/ATSPs and airspace users, these losses were distributed as follows:

- States/ATSPs bear 39.3% of the loss, amounting to € 407,0 M_{2009};
- Airspace users bear 44.0%. of the loss, amounting to € 456,3 M_{2009};
- Airspace users bear an additional 16,7% of losses related to costs not

subject to traffic risk-sharing, i.e. the determined costs of other entities, namely States/EUROCONTROL/NSAs and MET Service Providers, amounting to € 172,7 M_{2009}.[68]

All together, the (main) ATSPs of SES states bore nearly € 407 M_{2009} in the lost revenues, while airspace users incurred an additional € 629.0 M_{2009} due to the adjustments resulting from the traffic risk-sharing mechanism and from the difference in traffic for costs not subject to traffic risk-sharing.[69] Yearly and total Union-level distribution of revenue losses between airspace users and States/ATSPs due to the traffic risk-sharing mechanism are shown in the table below for all of RP1.

Table 13.8 Distribution of losses borne by States/ATSPs and airspace users due to traffic risk sharing adjustments

	2012	2013	2014	Total RP1	2015
Borne by States/ ATSPs	€ -127,5	€ -144,2	€ -135,2	€ -406,9	€ 33,3
Borne by airspace users	€ -125,5	€ -180,2	€ -150,4	€ -456,1	€ 31,9
Borne by airspace users (costs not subject to TRS)	€ -50,7	€ -63,9	€ -58,1	€ -172,7	€ 8,6
Total	€ -303,7	€ -388,3	€ -343,7	€-1.035,7	€ 73,8

Traffic adjustment

In 2013, in 22 out of 29 cases, actual unit costs increased to reflect the difference in traffic for costs not subject to traffic risk sharing in 2013. In 2014, actual units costs increased in 19 cases. In both years, the largest increases (more than +1,0 EUR2009) were generated by the same 6 States.

Increases to the actual unit rates for users of more than +1,00 €:

2013		2014		Cumulative	
Spain (Cont.)	€ -1.77	Spain (Canarias)	€ -2.21	Spain (Canarias)	€ -3.89
Spain (Canarias)	€ -1.68	Spain (Cont.)	€ -1.56	Spain (Cont.)	€ -3.33
Austria	€ -1.45	Finland	€ -1.43	Finland	€ -2.84
Finland	€ -1.41	Germany	€ -1.42	Germany	€ -2.75
Germany	€ -1.33	Italy	€ -1.17	Austria	€ -2.55
Switzerland	€ -1.17	Austria	€ -1.10	Switzerland	€ -2.24
Italy	€ -1.06	Switzerland	€ -	Italy	€ -2.23

[68] The determined costs of the other entities such as States/NSAs/EUROCONTROL and MET Service Providers (which comprise around 10% of the total DCs at Union-wide level) are not subject to traffic risk-sharing and are fully reimbursed (or charged) to the airspace users, irrespective of traffic evolution.

[69] PRB Annual Monitoring Report 2014 Volume 1.

			1.07		
				United Kingdom	€ -1.86
				BE-Lux	€ -1.75
				Greece	€ -1.11

A total of 7 states generated deductions due to traffic adjustments in 2013, and a further 2 (for a total of 9) did so in 2014. The reimbursements per state are as follows

2013		2014		Cumulative	
Romania	€ 0.02	Latvia	€ 0.01	Latvia	€ 0.03
Poland	€ 0.02	Slovakia	€ 0.16	Romania	€ 0.14
Latvia	€ 0.04	Lithuania	€ 0.19	Slovakia	€ 0.21
Lithuania	€ 0.05	Romania	€ 0.21	Lithuania	€ 0.21
Bulgaria	€ 0.05	Hungary	€ 0.45	Hungary	€ 0.33
Cyprus	€ 0.61	Malta	€ 0.50	Cyprus	€ 0.92
Slovakia	€ 0.61	Norway	€ 0.83	Malta	€ 1.11
		Cyprus	€ 0.87	Bulgaria	€ 1.33
		Bulgaria	€ 1.29	Norway	€ 1.43

In 1 Member state, 2014 activities generated neither an increase or a deduction to the actual unit cost to airspace users: Portugal.

Inflation adjustment

During RP1, inflation adjustments generated from en-route activities have, in the majority of cases, benefited airspace users in the form of deductions to the actual unit costs. In 2013, deductions are observed in 14 out of 29 cases, whereas in 2014, deductions are observed in 25 out of 29 cases.

Considerable variations emerge at the national level, with 4 states generating combined deductions totalling more than € 2,00 in respect to the activities performed in 2013 and 2014: Sweden (-7,44 €), Bulgaria (- 4,83 €), Switzerland (- 4,59 €) and Cyprus (- 2,77 €) and Slovenia (- 2,43 €). A further 15 states saw total deductions from the two years of up to € 2,00. Of the 9 states which generated additional net costs to airspace users, 1 increase by + 6,01 € (UK) while a further 3 increased between +1,00 € and +1,27 € and the rest added costs of less than +1,00 € (net).

Combined deductions of more than 2,00 € :

	2013	2014	Net
Sweden	€ 3,10	€ 4,34	€ 7,44
Bulgaria	€ 1,98	€ 2,85	€ 4,83
Switzerland	€ 2,02	€ 2,56	€ 4,59
Cyprus	€ 0,86	€ 1,91	€ 2,77
Slovenia	€ 0,60	€ 1,83	€ 2,43

Deductions under 1,00 € :

	2013	2014	Net
Romania	€ 0,73	€ 1,21	€ 1,94
Poland	€ 0,44	€ 1,35	€ 1,79
Slovakia	€ -0,20	€ 1,46	€ 1,26
Latvia	€ 0,49	€ 0,76	€ 1,25
Greece	€ 0,20	€ 1,02	€ 1,22
Belgium-Luxembourg	€ 0,07	€ 1,14	€ 1,21
Denmark	€ -0,06	€ 1,11	€ 1,05
Czech Republic	€ 0,14	€ 0,88	€ 1,02
Norway	€ 0,40	€ 0,36	€ 0,76
Germany	€ -0,16	€ 0,81	€ 0,65
Hungary	€ -0,31	€ 0,94	€ 0,64
Malta	€ 0,15	€ 0,48	€ 0,63
Finland	€ -0,29	€ 0,75	€ 0,46
Ireland	€ 0,03	€ 0,43	€ 0,46
France	€ -0,04	€ 0,05	€ 0,01

Additional amounts to be charged :

	2013	2014	Net
Italy	€ -1,12	€ 1,06	€ -0,06
Lithuania	€ -0,75	€ 0,34	€ -0,41
Estonia	€ -0,52	€ 0,03	€ -0,49
Spain (Canarias)	€ -1,09	€ 0,18	€ -0,91
Portugal	€ -0,78	€ -0,16	€ -0,94
Spain (Continental)	€ -1,26	€ 0,19	€ -1,07
Austria	€ -1,00	€ -0,21	€ -1,21

The Netherlands	€ - 1,16	€ - 0,11	€ - 1,27
United Kingdom	€ - 3,17	€ - 2,84	€ - 6,01

Main conclusion Field research

ANSPs are most favourable to the traffic risk sharing mechanism, which is considered to be the most equitable with 66% of respondents indicating the mechanism to be at least partly equitable, and '*inflation adjustments*' are considered least equitable, with just 32% viewing it as at least partly equitable. Airspace users, by contrast, hold less favourable view on the equity of the performance and charging scheme. Airspace users affirmed that, largely due to the adjustment mechanisms foreseen under the Regulation, the performance and charging scheme effectively increased charges to airspace users by 1 billion more than was foreseen in the performance plans. This is all in spite of the fact that traffic was 5% lower than forecast. As contributing factors for this increase, it was argued that the adjustment mechanisms foreseen under the Regulations (traffic risk, cost-sharing and exempted costs) allowed ANSPs to effectively raise the costs charged to airspace users, compared to the Determined Unit Rate in the National Performance Plans. Moreover, it was argued that traffic was purposely overestimated.

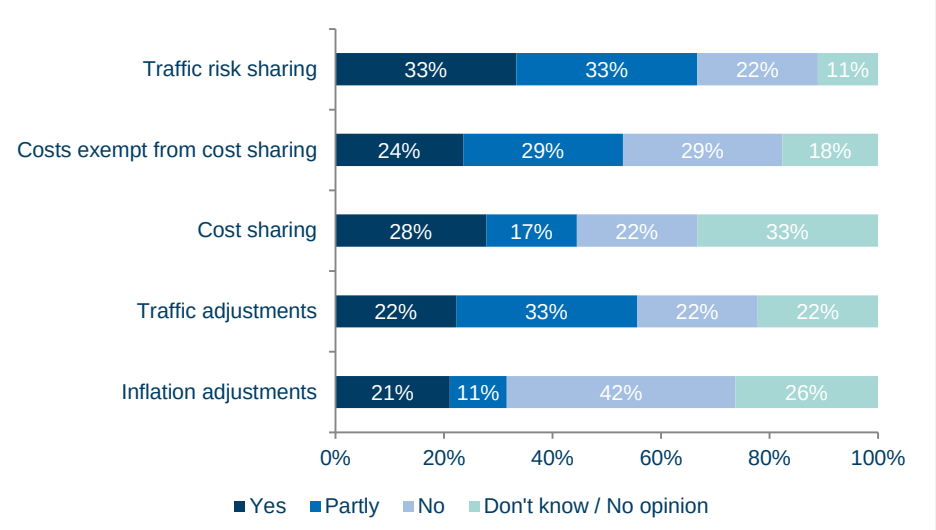
It is also suggested that the actual unit rate level and trend be used in order to monitor the true cost for users. Currently, due to the traffic and cost risk sharing mechanisms and related carry-overs, substantial differences emerge between Unit rate and Unit cost trends. The definition of true costs should also include exchange rate fluctuations, as at the moment, airspace users unjustly fully bear the exchange rate risks.

Subconclusions Field research

ANSP views on the equity of the schemes

Overall, the '*traffic risk sharing*' mechanism is considered to be the most equitable of the adjustments mechanisms, with 66% of respondents indicating the mechanism to be at least partly equitable, and '*inflation adjustments*' are considered least equitable. It is not possible to make an assessment across stakeholder groups, however, as only ANSPs answered this question.

Figure 40 Equity of schemes - Carry-overs (N=19)



Traffic risk sharing

- 66% of ANSP view the TRS mechanism to be at least partly equitable, while 1 acknowledged the risk for ANSPs could be increased within the dead-band of the 10%.

Costs exempt from cost sharing

- One ANSP asserts that MET costs could very well be costs 'subject to risk sharing'.
- Another ANSP reaffirmed the challenges associated with assessing and determining the eligibility of these costs for RP1, stating that different positions led to disputes throughout the process. It is expected that the process will be much smoother for RP2, given the amount of informatino required for RP2 PP and for annual monitoring reports.
- Exemptions should be kept to a minimum

Cost sharing

- Cost sharing provides most promising grounds for Cost Efficiency, however it should be kept within shorter reference periods of no longer than 3 years

Traffic adjustments

- The traffic forecast was not adjusted during RP1, despite it being obvious that the traffic forecast prior to RP1 would not materialise.

Inflation adjusments

- The inflation forecast (based on IMF estimates for all EU Member States) has led to significant differences paid by / returned to users. To reduce the instability of this factor, inflation forecasts should be the responsibility of the Member State.
- The inflation adjustment is applied to all costs, including those which are not inflation driven (e.g. capital expenditure).
- The inflation adjustments are not linked to the actual evolution in costs, which leads to high risk scenarios given that inflation is much lower than forecast combined with the case that the actual cost are not decreasing with the same amount. Instead the inflation could be linked to certain indexes linked to the actual costs in the ANSP's cost base.
- The risk is at 100% with the ANSP, although it is being planned with nominal values

Airspace users views on the equity of the schemes

The equity question was not answered by users in the survey. Nevertheless, from the interviews and external workshop, it became clear that users generally are of the opinion that they don't benefit sufficiently from the scheme, and that benefits mostly accrue to ANSPs.

14 SWOT ANALYSIS OF THE SES PERFORMANCE AND CHARGING SCHEMES

In this section, we provide an assessment of the strengths and weakness of the SES performance and charging schemes (from a system-internal perspective) and of the opportunities and threats of the schemes (from a system-external perspective). It builds on the analysis for each of the evaluation questions, that was presented in the previous chapters.

14.1 Strengths

The high level objectives for air navigation service provisioning are considered valid by all stakeholders.

The schemes provide a harmonised approach and pace of improvement across the EU with all process elements in place. Information is provided in a more uniform and transparent way. Awareness for further improvement is increased in several countries in several areas.

The schemes were and are an important driver for delivering sustainable performance improvements, in combination with other EU initiatives. The added value is positive, largely by their contributions in reduction of unit costs and of en-route delay.

The PRB, including the PRU support body, is generally regarded as performing its tasks well, in spite of concerns of independence and control.

Data handling is robust and data is of a sufficient quality to support the Commission in its deliberations.

14.2 Weaknesses

The final target setting is based on political compromise between the European Commission and the member states. These member states are in many cases in some way or another the owner of the ANSPs. As such, the member states have to decide on the return of equity of their own service providers, which flows in many cases to the national treasury.

Furthermore, there is in some cases a mismatch between national targets from the performance plans and the union wide targets.

Also it takes time before national targets are considered consistent with union-wide targets. In some cases, national targets were approved more than a year later than the start of RP2.

Many stakeholders consider the lack of flexibility in the target-setting a weakness, resulting in targets not properly addressing the dynamics of the business and local circumstances.

- Several stakeholders expressed the concern that the interdependencies between KPAs are not sufficiently recognised by the schemes. This concern refers to the tension between required actions for optimizations, mainly between cost efficiency and the other three KPAs and between safety and the other three KPAs. However, service providers in general always have to deal with a balance between costs, quality of service and safety; the current target-setting in the schemes provides sufficient autonomy in this respect.

During RP1, the meeting of targets has not been enforced. In fact, many targets have not been met, but without any consequence for state or ANSPs. This is not instrumental for achieving targets in the subsequent reference periods.

Ultimately, the Single Sky Committee decides on corrective measures against member states that don't meet the targets. This creates certain governance concerns, whereby the supervising and supervised entities form part of the same group that is responsible for voting on a given supervised entity's performance in the case of a possible non-compliance compared to target.

Article 12 of Regulation 390/2013 mandates that incentives of a financial nature in the key performance areas of capacity and cost efficiency and non-financial incentives in the key performance areas of environment. However, these incentive mechanisms are applied with different complexity among FABs and members states, and in cases the effectiveness related to achievement of the target is questioned by the PRB in their assessment of the performance plans.

The scheme has been criticised for being complex, with too many performance indicators, creating an administrative burden for ANSPs and NSAs. However, there are equally some concerns on the capabilities of ANSPs and NSAs that don't make the appropriate resources available. There is some reported overlap with other reporting requirements.

NSAs are generally regarded as having insufficient expertise and resources to manage the scheme, hence being overly reliant on ANSP.

The schemes do not contribute to the defragmentation of the European airspace and service provisioning. The FAB related elements in the performance scheme constitute an additional bureaucratic layer.

The PRB is thought to be lacking in a few areas of expertise, such as financing and pensions.

14.3 Opportunities

Setting up a pan-European economic regulation for a safety-driven industry is a challenge. Many stakeholders, including the PRB, has considered RP1 and to some extent also RP2 as trial periods, in which stakeholders can get used to the new schemes, and the systems and procedures can be shaped. As such, RP3 allows for fine-tuning in which the lessons learnt from RP1 can be used to improve the system.

The schemes can be further enhanced by introducing new or enhanced indicators. Some existing indicators can be removed or simplified, in order to reduce the administrative burden.

Further automation and a single point of data collection could further reduce administration.

Further capacity building for NSAs and some ANSPs can be implemented to gear the NSA capabilities towards what is required for the scheme. .

Engagement of users in the setting and monitoring process

14.4 Threats

There are concerns about the independence of the PRB, although no solid evidence that this has affected their advice to the Commission.

There are concerns about shortage of staff in some NSAs, which may result in insufficient capability to perform the activities related to the schemes. This is an recurrent issue, also mentioned as a an issue for SES2+, but has not been addressed adequately to date.

In the end performance change is dependent on the political will of the Member States. This political will plays two fundamental roles in the scheme. Firstly, (lack of) political will manifests itself in the difference between the Union-wide targets advised by the PRB and those adopted by the Single Sky Committee. The more challenging the targets, the more likely it is bigger performance improvements will be realised, and we observe the PRB recommendations are watered down. Secondly, political will plays an indirect role in the implementation of the scheme. Questions like 'Are targets met and what are the consequences for ANSPs when they are not? Which, if any, additional incentive mechanisms have been adopted nationally? How are NSAs enabled to perform their monitoring tasks?' are relevant here. The difference between the set targets and the achieved performance can, to some extent, serve as a (lagging) proxy for this issue. While performance did improve during RP1, it did not improve at the same pace as desired by users and the European Commission. Unless the decision structure about targets and corrective measures is changed, it remains likely that the performance improvements are incremental as in RP1.

15 PART III – CONCLUSIONS AND RECOMMENDATIONS

16 Conclusions and Recommendations

In this study, the EU SES performance and charging schemes have been evaluated for the first reference period and the first year of reference period 2. In this chapter, we present our conclusions and recommendations.

16.1 Conclusions

The EU decided to improve the performance of the Air Navigation Service Provisioning by implementing EU performance and charging schemes. These schemes introduced, amongst others elements, an independent Performance Review Body and binding performance targets that are set and monitored during cycles referred to as Reference Periods. This resulted in increased transparency of ATM performance among stakeholders and further led to more harmonised reporting of ATM performance. As a result, the EU performance and charging schemes overall catalysed an improved performance in EU ATM/ANS, but not to the degree that was aimed for, due to a variety of factors including weaknesses in the target setting process and enforcement, as well as ineffective operations of the NSAs (see further below). The actual performance improvement also depends on other initiatives in the frame of SES (e.g. the Network Manager) and local actions, especially in the area of capacity and horizontal flight efficiency. However, the system is complex (for example due to the amount of indicators and their complexity in some cases and features like the adjustment mechanism) and entails significant reporting requirements and data checks by the PRB, and some duplications in reporting are identified. We also note some weaknesses in the system. These are addressed below where we provide the conclusions per evaluation criterion.

Relevance

The KPAs in the Performance Scheme broadly cover the needs of society (timely and environmentally friendly air transport) and airspace users (timely and efficient air navigation service provision). The only relevant topic not covered is the fragmentation of European airspace, considering general aviation out of scope.

Coherence

In general, the scheme is consistent with other European initiatives: SESAR, FABs, the Network Manager and national approaches. The different process steps in the cycle from target setting to review of reported data are also generally coherent. Nevertheless, within the different process steps and structures, we note some weaknesses:

- The target setting process is subject to political compromises, as Member States, which have an interest in the financial results of the ANSPs, have to agree on the targets for these ANSPs.
- The same argument applies for the enforcement of targets. Member States have to vote in majority for corrective measures of non-compliant member states.

- The final agreement on local targets takes too long (in some cases well into the reference period) which, given the long lead in ANSP implementation, may impact the scheme's effectiveness and credibility.
- Furthermore, there is a mismatch between national targets from the performance plans and the Union wide targets, which means that the Union-wide targets are not met.
- There is a lack of flexibility in the target-setting, resulting in targets that do not properly address the dynamics of the business and local circumstances, e.g. in terms of traffic demand developments.
- The scheme does not integrate well with FABs, and FAB targets are simple aggregations of national targets. None of the KPAs are directly managed by FABs, and the FAB influence on these is minimal at best. Requiring FAB level targets is thus of questionable value.
- The Regulations mandate the application of incentives of a financial nature in the KPAs of capacity and cost efficiency and non-financial incentives in the KPA of environment. However, these incentive mechanisms are applied with different complexity among FABs and Member States, resulting in differences in effectiveness.
- National Supervisory Authorities (NSAs) are generally regarded as having insufficient expertise and resources to manage the scheme, hence being overly reliant on ANSPs. This view is expressed by ANSPs, the PRB and NSAs themselves.

- Several stakeholders expressed the concern that the interdependencies between KPAs are not sufficiently recognised by the schemes. This concern refers to the tension between required actions for optimizations, mainly between cost efficiency and the other three KPAs and between safety and the other three KPAs. However, service providers in general always have to deal with a balance between costs, quality of service and safety; the current target-setting in the schemes provides sufficient autonomy in this respect.

Effectiveness of the scheme - general

The aim of the EU SES Performance and Charging scheme (PCS) is to contribute to sustainable development of the air transport system by improving the overall efficiency of air navigation services across the KPAs of safety, environment, capacity and cost-efficiency, in line with the Performance Framework of the European Air Traffic Management (ATM) Master Plan, while having due regard for the overriding safety objectives. Considering the Regulation's objectives and the performance targets set in the four KPAs, it is concluded that, overall, the schemes have only partially fulfilled their stated objectives. Performance on all four KPAs measurably improved in the context of significantly lower traffic levels than planned in the National Performance Plans, and the performance and charging schemes contributed to these achievements. Nevertheless, the targets for flight efficiency, cost efficiency and capacity were not fully met.

Safety

The rationale behind the selection of the current safety performance indicators is sound, and the scheme has resulted in improvements in terms of focus on performance of the indicators. However, the most appropriate way to

monitor safety performance is by using a balanced combination of outcome-based indicators and leading indicators.

If outcome-based safety indicators are added to the scheme, target setting should be done cautiously. Targets for indicators based on the number of reported occurrences should not be introduced in safety, as this is potentially counterproductive and could harm safety levels.

To the extent that improved focus delivers an improved level of safety, the performance scheme had a marginally positive influence on the level of safety. While aviation safety performance is also monitored, controlled and improved by mechanisms outside the performance scheme, the inclusion of safety in the scheme serves as a counterbalance to the effects from other KPAs.
Of the existing safety performance indicators, the questionnaire to determine the EoSM is considered too difficult to complete. The application of the RAT is considered a good approach that reduces the subjectivity and supports the harmonization process, although further clarification and refinement may be required to remove some ambiguity.

Despite some difficulties with the existing safety performance indicators, significant effort has been spent on them, and they may have a longer-term positive effect on safety performance.

Environment
The European horizontal en-route flight efficiency, the most relevant indicator within the KPA, has improved over the years although not enough to meet the targets. The scheme has contributed to this, although the degree of control of ANSPs is limited. It is to be noted that the indicators within the KPA do not cover all relevant environmental impacts such as aircraft noise, TMA flight efficiency and speed and vertical flight efficiency. This lack of full coverage can be appreciated for the considered time-frame; it is now appropriate to take into account other flight efficiency sub-areas in a first-things-first approach.

Cost efficiency
- Although national targets have, legally speaking, been met by design, the aggregated NPP targets were less ambitious than the Union-wide target as agreed in the SSC. In operational terms, it is also clear that the actual level of the en-route unit costs at Union level were higher than SSC targets throughout RP1. The actual unit costs *for users* were significantly higher than the target each year. The conclusion is therefore that the Union-wide target has not fully been met in any of the years in RP1. Nevertheless, our study finds also that cost-efficiency within the SES area has increased over RP1 in real terms, also measured by the true costs incurred by users. The failure to meet union-wide targets can to a large extent be explained by the performance of Germany, the UK and Spain, who account for 40% of total en-route costs and missed their respective targets by between 11 and 19%.

- During RP1, capital expenditures have been delayed, although these were included in the cost base. The monitoring of capital expenditures was weak during RP1.

- The ratio of en-route costs to terminal costs did not significantly change, as terminal costs also decreased during RP1. This means there is no indication costs were shifted from the regulated en-route to unregulated terminal costs during RP1. There is however evidence that such a shift happened pre-RP1 and it remains a potential weakness of the system that en-route and terminal costs are differently regulated.

- The study found specific weaknesses of the system related to the cost efficiency:
- Although the SES common requirements legislation requires ANSPs to submit to the NSAs audited financial statements each year, it is difficult to reconcile the audited accounts with the reporting tables under the schemes. Hence there is a risk that unaudited information is submitted. It must be underlined that there is no evidence that there was any misuse of this situation during RP1 and RP2 to date.
- The system may be undermined due to 'gaming' by ANSPs or NSAs – using possibilities that are not in the spirit of the system and that lead to unwanted outcomes considering the goals of the SES Performance and Charging legislation. Although ANSPs argue that this is allowed, the study team notes that there are indications that costs are being shifted to a first year of a subsequent reference period. This may be partly due to the adjustment mechanisms allowed under the scheme. However, considering the evolution of actual costs, it is unlikely that this fully explains the shift. In addition, Member States are able to deviate with their own traffic forecasting from the forecast made to determine the Union wide targets. (The study has not investigated the relative accuracy of State forecasts versus Eurocontrol STATFOR.)
- The costs base subject to inflation correction is to be defined by the Member States. This means that costs that are not subject to inflation, such as some capital expenditures, may be corrected for inflation. Stakeholders point to the application of inaccurate inflation values, however the study team did not find evidence for this.

Capacity

Prior to RP1, the period 2004-2011 saw average en-route delay per flight at 1.2 min/flight but subsequently the average achieved value during 2012-15 was 0.6 min/flight. Concerning this impact, the PRB considers that setting binding targets led to a realisation that performance improvement was needed and consequently, the overall handling of traffic has improved. We also note that during this period there were no wide-scale operational or system changes to which such an improvement might otherwise be attributed to. Whilst prior to RP1 ANSPs may have been motivated by the benchmarking data published by the PRC in PRR reports, this is not likely to have caused such a distinct change in performance as seen over RP1; therefore the primary motivation for improved delay performance is likely to be the performance scheme.

Suitability of indicators

Whilst the indicators in each KPA are seen as having a number of shortfalls, there appear to be few alternatives that would significantly improve the scheme without introducing complexity or additional indicators, which runs counter to the comments from stakeholders that the scheme should be simplified. These indicators are addressed in the next section on recommendations.

PRB set-up

The PRB carried out substantial analysis using historical data and comparisons with US performance as evidence for target setting. The work was robust in its range and depth and subjected to stakeholder consultation. The work also captured the likely risks, some of which have since materialised, such as the fall in traffic. The advice given to the Commission for the target setting was accepted and the performance turned out to be close to the set targets, although the cost efficiency target was lowered in the final deliberations of the SSC. This suggests that the final agreed targets were deliverable within the context of the operational challenges, national regulatory frameworks and the ambition of States. We therefore consider that the PRB has carried out its tasks effectively. At the same time, however, it is noted that the PRB has raised issues to the EC and SSC over support from Eurocontrol. This has led to the Commission's action to set up the PRB as of 2017 in a different form (experts appointed directly by the Commission and supported by a new contractor).

Data quality

The data appears sufficiently accurate for the purposes of target setting, accepting performance plans and monitoring. The study has estimated measurement errors for a sample of indicators (enroute delay and horizontal flight efficiency) and found that fractional errors are typically <2%. In respect of the charging scheme our assessment is that the random errors appear to trapped by the quality checks of the PRU, which require the individual numbers to be consistent, but the main risk to accurate measurement is the extent that the charging data provided by NSAs may be reconciled with audited accounts. Certain systematic errors have been discovered and addressed through enhancement of data consistency and validation checks. Our assessment is that these errors have not had a material effect on the performance scheme (2012-2015). The data quality process is to exclude data where there are apparent errors, and to include them once these errors are understood and treated. Thus any errors affect the sample size rather than the data quality of the sample.

EU added value

The SES performance and charging schemes (PCS) have provided additional value compared to what could have been achieved at national or regional level. This holds for all of the KPAs, either because it enabled improvements that would not have taken place otherwise, or because it hastened the achievement of improvements that were set to be achieved anyway. The majority of stakeholders agree that the PCS has been an important contributor to the improvements achieved for all of the KPAs.

Moreover, it is found the PRB has been effective in providing independent advice to the Commission, on which the target setting could be based. At the same time, it is noted there are concerns which mainly refer to a lack of PRB independence.

Efficiency and equity

Overall, the benefits to users and passengers from delay reduction, cost-efficiency improvements and flight efficiency improvements significantly outweigh the costs of the system: benefits are estimated at € 3.4 bn for the evaluation period, the costs at € 87 million in total. This does not mean that the system is fully efficient or that all the benefits accrue solely from the performance scheme, which acts as a catalyst for improvement. Stakeholders report the following weaknesses: duplications in different layers; a lack of (visible) impact of some PIs in the system, which still requires more precise reporting; and a heavy data submission and handling process. The latter should, however, be seen in the context of starting-up the scheme in RP1, in which all actors had to get used to it, and systems needed to be put in place for future periods; however, if the KPIs change significantly these start-up costs could be seen as a loss.

Sustainability

The performance outcomes achieved during a reference period are not likely to be taken away by lower performance in a subsequent reference period. A possible exception is in the cost efficiency KPA, where the traffic volume and cost variables are such that sustaining benefits in the long term is difficult to predict. There is no evidence to suggest that there is a transfer of benefits from one KPA to another at the European or National level. However, at National level, the reality of ANSPs' business is that judgements about planning and investment may result in de facto trade-offs between KPAs. For example: under investment in capacity leading to better cost efficiency but incurring delay (and vice versa); changes to routes leading to improved flight efficiency but requiring investment in new sectors or procedures, or affecting revenues.

There is no evidence to suggest that there is a transfer of benefits from one KPA to another at the European or National level. However, at National level, the reality is that there will be a need to balance the performance impacts of various options, particularly those relating to the Cost Efficiency and Capacity dimensions.

Acceptability

The EU performance and charging schemes and its four KPAs are accepted by the stakeholders. Although airspace users would like to have seen more pressure to obtain better results, they see the economic regulation as the appropriate tool to address the monopoly position of the ANSPs.

The above also presents the distribution of effects among stakeholders. Costs to a large extent are for States, ANSPs (which may include these costs in the charges to users) and the EU, while the effects in terms of improved safety, cost efficiency, delay reductions and flight efficiency accrue to users and ultimately to passengers.

16.2 Recommendations

In this section we provide some recommendations to strengthen the performance and charging schemes. These recommendations are related to the conclusions, and more specifically regarding the weaknesses observed in the system. We distinguish between general recommendations and KPA-specific recommendations.

General recommendations

Both in RP1 and RP2, by the time the reference period commenced, the local targets from the performance plans did not match with the Union-wide targets. This affects the credibility of the system, but also weakens the overall ambition for a reference period. One option is to extend the role of the PRB, as envisaged already in the SES2+ policy package. However, this package was not adopted by the Member States. As an alternative, it is recommended that the Commission streamlines the procedures to declare local targets more rapidly when they are found to be inconsistent with Union-wide targets. Subsequently, it is recommended that when the PRB advises on Union wide targets, it also sets the required ambition levels for individual states in order to overcome more rapidly any potential discrepancies between local targets and Union wide targets. This may be coupled with a sanctions regime if local targets are considered inconsistent with the EU wide target, although the study team considers that the effectiveness of the schemes is larger if national targets are mutually accepted rather than imposed top-down (certainly if failure to meet the targets is not enforced in any way).

The experience of RP1 is that only one third of states achieved all targets in all years. Thus there can be no confidence that states will achieve the targets they commit to at national level. This needs to be a focus for the EC, otherwise the scheme risks losing credibility. This can be done by introducing a clear sanctioning mechanism in case targets are not met – which should apply without regard to the (economic and traffic) size of the Member States . Another option is to focus on the underlying ANSP cost inputs, assumptions and variables. These need to be tested rather than accepting a value based on theoretical parameters or driven by compliance with the European level target. What is needed is for ANSP plans to be examined in detail by appropriately qualified, independent (from the state and ANSP) and experienced experts. A necessary complement is to strengthen the capacity of NSAs to perform their tasks satisfactorily, and possible support measures should be explored. It is recommended to include the oversight practices of NSAs regarding the EU performance and charging scheme as a priority of the regular standardisation audits of NSAs by EASA.

Thirdly, we recommend that the FAB dimension is reviewed. It appears to be adding little value as FABs do not have integrated business plans and do not deliver an integrated service, both of which remain at national level.

Fourthly, we recommend that reporting requirements of the performance and charging scheme are streamlined with other European and national reporting requirements to avoid duplication.

KPA-specific recommendations

For each of the four KPAs, we have formulated some specific recommendations based on the findings and conclusions as presented in the previous section. Many of the recommendations address the indicators in the different KPAs. Despite calls by stakeholders to simplify the schemes, there appear to be few alternatives in terms of the indicators used in each KPA that would significantly improve the scheme without introducing complexity or additional indicators. The PRB has established a process of trialling new indicators before reviewing and potentially using them for target setting. In the context of this process, the following recommendations are made:

- Environment KPA
  - Investigate the inclusion of vertical flight efficiency, including for approach and departure operations.
  - Investigate the inclusion of time-based horizontal flight efficiency indicators, on the basis that time is a closer proxy to airspace user costs than distance.
- Safety KPA
  - A balanced combination of outcome based indicators and leading indicators is now the most appropriate way to monitor safety performance. A limited number of outcome-based indicators should be introduced to improve measurement of safety performance.
  - The EoSM indicator should be improved and maintained as a leading indicator. The EoSM questionnaire could be modified to make it less difficult to complete.
  - Targets can be set for process-based indicators. Targets for indicators based on the number of reported occurrences should not be introduced in safety, as this is potentially counterproductive and could harm safety levels.
- Cost efficiency KPA
  - Consider a total economic value indicator, incorporating the quantifiable impacts of the other KPAs (not only delays within Capacity, but also fuel consumption savings and CO2 emission benefits for Environment). Such an approach will require a mature tool to account for all relevant factors and correlate costs and benefits.
  - Use the actual unit rate level incurred by users and trends to monitor the true cost for users. Currently, due to the traffic and cost risk sharing mechanisms and related carry-overs, substantial differences emerge between unit rate and unit cost trends.
  - Introduce an EU target for TANS to cover the need for a consistent regulatory approach to cost-efficiency, to prevent a possible shift from en-route to terminal costs in the future and to prevent that the already understaffed NSAs have to set and enforce local TANS targets.
  - Monitoring of CAPEX expenditures should be improved, for example by instituting monitoring on project-basis instead of nationally. Additionally, NSAs could be provided guidance on how to set-up and manage a CAPEX monitoring function.
  - Strengthen the incentive system in the area of cost efficiency. One option could be to adapt the traffic risk sharing mechanism, increasing ANSP exposure to the risks above 4.4 %. In the area of

capacity, it is recommended to further develop guidance material for States and NSAs to develop effective incentive mechanisms. It is also recommended to further study the impacts of raising the 1% cap of the ANS revenue, which would strengthen incentives by increasing penalties. It is also recommended that the Commission disseminates best practices on the set-up and implementation of the incentive schemes.

  - Require that costs reported to the Commission are associated with an auditor's statement to prevent a mismatch between the costs reported under the performance and charging schemes and the costs incurred by service providers as reported in their (audited) annual accounts.
  - Harmonise the use of the same (scenario of the) traffic forecast (i) in the local target setting as reported in the national performance plans and (ii) between local target setting and EU-wide target setting.
  - Issue guidelines about which costs are allowed to be subject to inflation correction and monitor the proper application of these guidelines. This prevents that costs that are not subject to inflation are corrected for inflation.

- Capacity KPA
  - Investigate the inclusion of 'percentage of flights delayed by more than 15 or 20 minutes', taking into account peak vs normal operations. It was noted that monitoring of the average delays hides the extremes, which cause most of the airspace user problems.
  - Consider weighted delay performance indicators. For example, to place greater weight on long delays and operationally critical departures in the morning.

17 Annexes

Provided as separate document.

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