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Benchmarking of Air Navigation Services Providers by the Use of Composite Flight Hours; True or False?

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Abstract

European Air Traffic Management appears to be, in comparison to other similar systems in the world, cost inefficient and therefore constantly under pressure of airspace users to optimize. Benchmarking results are valuable for managerial decision making processes, however it is safe to assume that the methodology used, favours a narrow segment of ANSPs. By improvements introduced through this study, in particular in computing the Composite Flight Hours, the managerial decision-making process could most probably be more adequately supported.

Keywords: air navigation services provider, air traffic management, cost-effectiveness, Single European Sky, capacity, performance, performance targets, composite flight hours

1. Introduction

European Air Traffic Management (ATM) is considered to be relatively inefficient. It is a business that costs the airspace users around €8 billion per year (European Commission, 2010), which is around €2-3 billion per year more than other similar ATM systems in the world. This clearly calls for a change.

European Commission already in 2005 introduced the Single European Sky initiative, which is supposed to reduce delays and increase capacity by a factor of 3, improve safety by a factor of 10, reduce by 10% an impact of air travel on the environment and reduce ATM costs by 50% (SESAR Joint Undertaking, 2009). This all is to materialise through Single European Sky ATM Research Programme (SESAR), which is supposed to deliver new revolutionary technologies and on the other hand through organisation of airspace into functional blocks, according to traffic flows and not according to national borders.

Single European Sky second package (SES II) introduced in 2008, established performance targets in the domain of safety, capacity, effectiveness and environmental impact (EUROCONTROL, 2013).

In parallel to the activities done by the European Commission, The European Organisation for the Safety of Air Navigation (EUROCONTROL), already in 1998, through the Performance Review Commission (PRC) and Performance Review Unit (PRU), introduced performance review of Air Navigation Services Providers (ANSPs) and their target setting with guidelines to states on economic regulation (EUROCONTROL, 2013a).

2. Background

ANSPs are constantly pushed by the airspace users to deliver more for the same amount of money, to offer more capacity and to improve in all aspects. This resulted in the adoption of the European Commission decision in 2012, which has set the pan European performance targets for the provision of air navigation services for the first reference period until 2014.

One of the main inputs for benchmarking is the EUROCONTROL PRU/PRC ATM Cost-Effectiveness (ACE) benchmarking (EUROCONTROL, 2011). The ATM Cost-Effectiveness Benchmarking Report, which now covers 37 European states, has been regularly issued since 2002. Alternative to this report is the Civil Air Navigation Services Organisation (CANSO) Global Air Navigation Services Performance Report, which has previous year been issued for the second time in the row (CANSO, 2011). CANSO report focuses only on selected global ANSPs that have volunteered to be benchmarked.

Both reports are benchmarking similar issues by the use of similar factors and similar variables. They are trying to be as much objective as possible by taking into consideration both exogenous (factors outside the control of ANSP) and endogenous (factors entirely under the control of the ANSP) factors that can influence the ANSP performance.

Both reports also clearly state that the benchmarking is performed by factual analysis only and that methods for a proper normative analysis still need to be further developed. In this paper only ATM Cost-Effectiveness Benchmarking Report is further scrutinized.

Significant work has been done regarding the ATM performance optimisation. However authors of this paper were not able to find any paper that would challenge the use of Composite Flight Hours (CFH) in the recognized methods of benchmarking.

Since EUROCONTROL and CANSO benchmark the ANSPs with uniform methodology, regardless of the fact that the size of the ANSPs varies by the factor of 10 and that the amount of traffic also varies significantly per ANSP, the outcome of the benchmarking can hardly be considered as entirely objective. It is similar as if someone would benchmark cars ranging from sports cars to off-road cars with the same Key Performance Indicators (KPIs), not taking into consideration the particularities of the particular car class; simply assuming that a car is a car and disregarding that a particular car class services dedicated customer needs. Results of such benchmarking would surely not help the customers to take proper decisions.

The CFH in the ATM Cost-Effectiveness Benchmarking Report play significant role in the results and therefore deserve to be challenged.

3. Air Traffic Control Officer (ATCO)-Hour Productivity

EUROCONTROL PRU/PRC has set up the KPIs out of which the Financial Cost-Effectiveness – The European Air Traffic Management/Communication, Navigation Surveillance (ATM/CNS) provision costs per composite flight hour with the sub-set of KPIs is important for the purpose of this study.

Sub set of KPIs is the following:

- ATCO hour productivity i.e. efficiency with which an ANSP utilizes the ATCO man-power;
- ATCO employment costs per ATCO hour;
- ATCO employment costs per composite flight hour;

For the purpose of this study mainly ATCO-Hour Productivity will be further scrutinized.

According to PRU/PRC Methodology ATCO-Hour Productivity (AHP) is calculated by dividing Total Composite Flight Hours (CFH) by Total ATCO-Hours on duty (AH):

$$AHP = \frac{CFH}{AH} = \frac{EFH + (0.26IAM)}{N_{ATCOs}\ \bar{t}_{year}} \qquad (1)$$

In (1) the *CFH* are defined as the sum of the En-route Flight Hours (EFH) and IFR Airport Movements (IAM) multiplied by a factor; while *AH* are defined as the Total number of ATCOs (N_{ATCOs}) multiplied by the Average ATCO-Hours on duty per ATCO per year ($\bar{t}_{year}$).

The output of these calculations is the graph in Figure 1, similar to the graph in the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report showing the rank of the ANSPs per ATCO-Hour Productivity. Data for 2009 are used since the structure of the ACE Benchmarking Reports from 2010 on changed significantly, ceasing to provide some relevant data (e.g. average overflying times per ANSP), important for proper analysis. Nevertheless calculations presented in this study have been verified also with the available data form later ACE Benchmarking reports, proving consistency of the results.

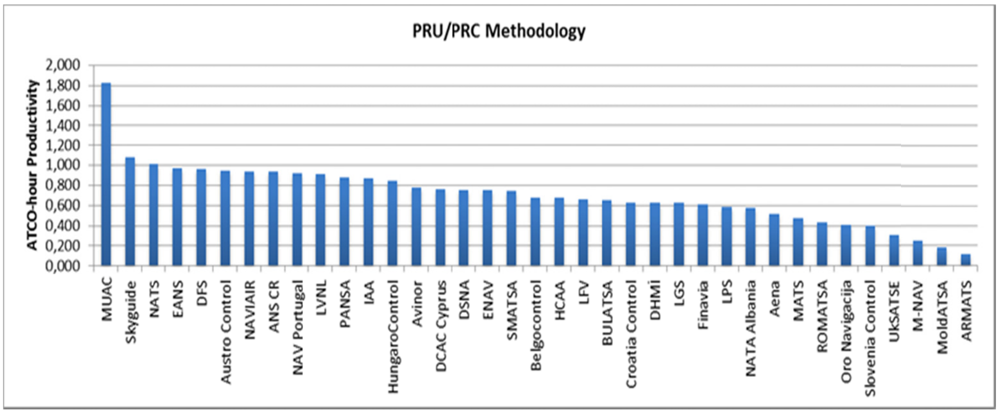

Figure 1. ATCO-hour productivity 2009

When comparing the ANSPs employment costs (EC) per *CFH* (EC/CFH) to the *EC* per *AH* (EC/AH), it can be concluded that the efficiency of those, having *EC*/*CFH* lower or similar to the *EC*/*AH,* is higher then of those, which have *EC*/*CFH* significantly higher then the *EC*/*AH*. Results are presented in Figure 2.

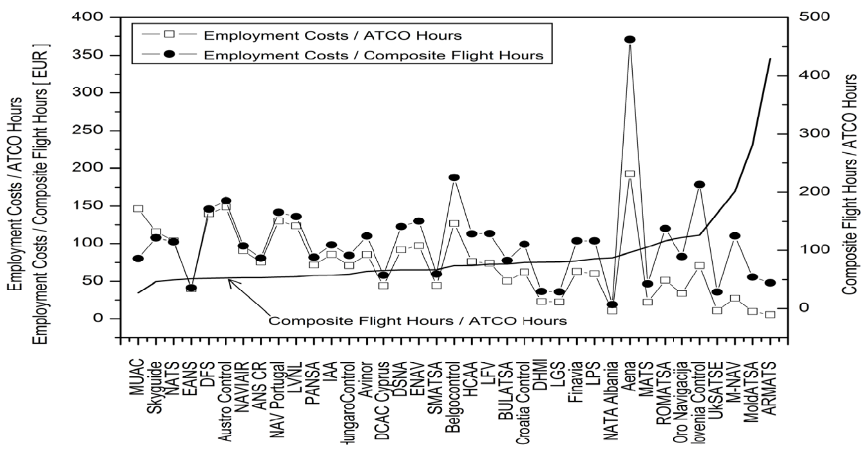

Figure 2. EC per CFH and AH

Judging from this conclusion, an ANSP in order to be efficient has to keep the *EC*/*AH* higher or equal to *EC*/*CFH*. Since *EC* on both sides of the formula are the same they can be eliminated from the equation, leading to the conclusion that in order to achieve efficiency, *CFH* need to be higher or equal to the *AH*. Using this logic it is simple to extract the factors that are influencing the efficiency. To enhance the ANSP's efficiency, the number of over flights (N_{of}) or *IAM*s has to be increased or on the other hand the N_{ATCOs} or the number of their hours on duty has to be decreased:

$$EFH + (0.26IAM) \geq N_{ATCOs}\ \bar{t}_{year} \tag{2}$$

Nothing that is suggested above can easily be achieved. Seasonal traffic variability, average overflying time or geographical location, etc. can heavily influence the *EFH*s. On the other hand size of the airport, passenger's demand, health of the local carrier(s) and attractiveness of the airport location can heavily influence the *IAM*s. Required terminal and en-route capacity dictate the N_{ATCOs}. This is again influenced by seasonal traffic variability, traffic demand and/or airspace complexity, etc. On the other hand safety of operations, legislative procedures and social dialogue dictate the average yearly ATCO-Hours on duty.

Benchmarking reports only present average ATCO-Hour productivity on a yearly basis. In order to get a sharper picture on what is happening throughout the whole year, heaving in mind that in majority of the ANSPs the traffic in January is usually half of the traffic in August, the calculations need to be done at least on a monthly basis.

Since there are no data readily available for a general public on how the *EFH* and *IAM* are distributed throughout the year, this trend has been calculated with the help of STATFOR data (EUROCONTROL, 2013b). The data of traffic per month per country showed that the traffic distributes Normally with the average correlation factor of over 0.96. Assuming that *EFH* and *IAM* distribute equally to the flights in the STATFOR database, the distribution of *EFH* and *IAM* combined in the monthly CFH_t is as follows:

$$CFH_t = CFH_0 + w^{-1}\sqrt{2\pi^{-1} ln4}\sum_{t=1}^{12}(CFH_t)\, e^{-2ln4\left(\frac{t-CFH_p}{w}\right)^2} \tag{3}$$

Where in (3):

- CFH_t are monthly CFH,
- CFH_0 are lowest CFH throughout the year,
- w is season duration,
- CFH_p are maximum CFH in a year.

The first trial has been done by calculating the monthly ATCO-Hour productivity for five high performers from the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report (MUAC has been deliberately excluded as it only provides service to the en-route traffic) and five low performers, keeping the countries as much as possible within the EU in order to make the results more objective and also to have the required data available as split costs for the en-route service and terminal service cannot be obtained in the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report. For that purpose the data have been extracted from the respective ANSP Performance Plans 2012-2014 (EUROCONTROL, 2013c), which are so far required and publicly available only for the EU countries.

To the surprise, the results presented in Figure 3 show that even in the busiest periods of the year low performers never achieve the productivity of the high performers in their quietest periods of the year.

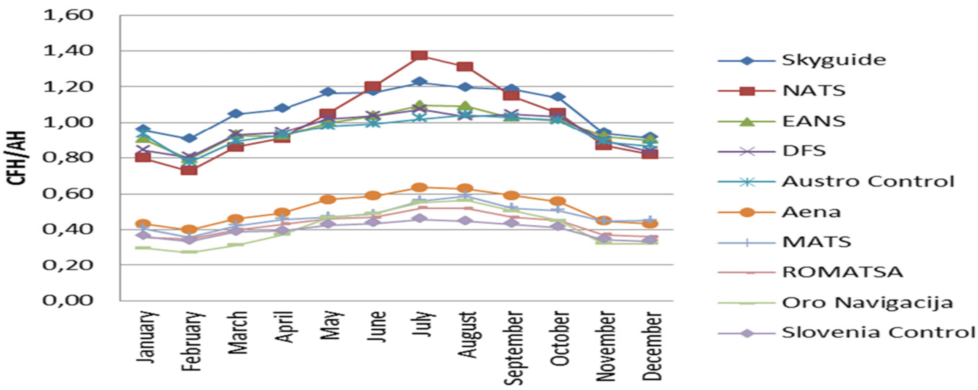

Figure 3. Monthly ATCO-hour productivity – PRU/PRC methodology

These results could imply that either low performers do their business extremely inefficiently, entirely in a wrong way, or that PRU/PRC methodology is not entirely objective.

To further explore the hypothesis above, firstly the En-route ATCO-Hour productivity has been calculated on a monthly basis, focusing only on the en-route CFH and en-route AH, entirely eliminating the terminal service. The results presented in Figure 4 show that the rank of the ANSPs suddenly changes and that the gap between high and low performers is not so clearly visible anymore. This could imply that terminal service in the PRU/PRC methodology plays an important role in the ATCO-Hour productivity.

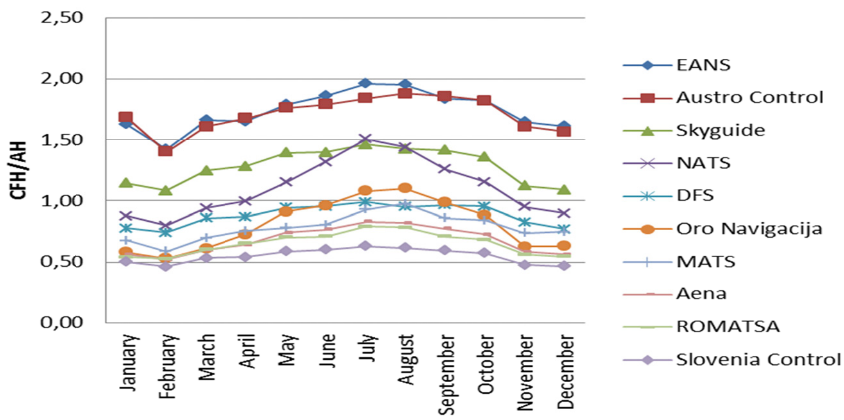

Figure 4. En-route ATCO-hour productivity – PRU/PRC methodology

Subsequently Terminal ATCO-Hour Productivity has been calculated on a monthly basis, focusing only on the terminal CFH and terminal AH, entirely eliminating the en-route service. Results presented in Figure 5 have been somehow expected as the graph clearly shows that ANSP providers with large hub airports with heavy traffic stand out from the ANSPs, which only serve local, smaller airports. This again supports the previous statement that the terminal service obviously plays an important role in the PRU/PRC methodology of benchmarking the performance.

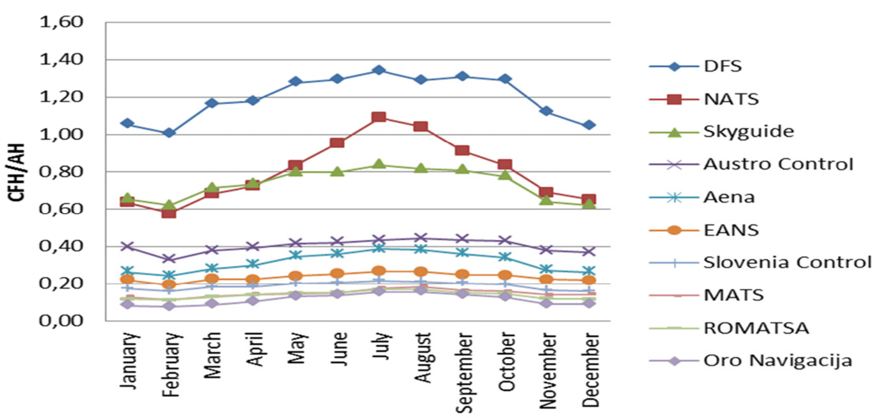

Figure 5. Terminal ATCO-hour productivity – PRU/PRC methodology

4. Composite Flight Hours Analysis

CFH used for benchmarking by PRU/PRC, for calculation of the ATCO-Hour Productivity, are according to (2) a sum of *EFH* and *IAM* multiplied by a factor.

EFH are a sum of actual minutes (expressed in hours) that flights have spent in particular area of responsibility of individual ANSP. They can be obtained from the EUROCONTROL statistical data. Same numbers can be obtained if the N_{of} are multiplied by the average overflying time of the particular airspace ($\bar{t}_{of}$):

$$EFH = N_{of}\bar{t}_{of} \tag{4}$$

For the selected ANSPs the $\bar{t}_{of}$ is 10 minutes for the ANSP with most of the traffic along the shortest routes and up to 34 minutes for the one that has most of the traffic along the longest routes of the route network. Average calculated overflying time for all 10 ANSPs is 19,07 minutes.

If *EFH* is calculated in the PRU/PRC way, this translates into one single over flight attributing to 0,166 *EFH,* if $\bar{t}_{of}$ is 10 minutes and to 0,566 *EFH* if $\bar{t}_{of}$ is 34 minutes. The difference is 340%, meaning that the first ANSP would need 3,4 times increase of traffic just to match the productivity of the second ANSP, providing that the number of *AH* remains the same. Already a common logic suggests that in real life this could never be achieved.

On the other hand it is not important whether the airport is a small regional airport or a large national hub since the weight factor attributed to *IAM* in any case uniformly translates to 0,26 *CFH* per single *IAM*. Due to this fact it might be potentially much more objective if the en-route part of the *CFH* is calculated in the same way by simply attributing the weighted factor also to the *EFH*. The average calculated overflying time for all the selected ANSPs could easily be used as this weighting factor. For the ten ANSPs selected in this study this factor is 0,317.

The results for ATCO-Hour Productivity calculated in the above-proposed way are presented in Figure 6.

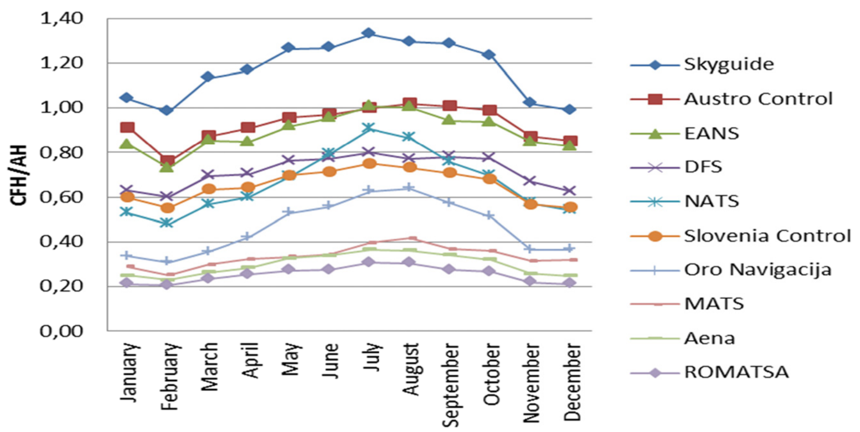

Figure 6. Adjusted ATCO-hour productivity

The rank of the ANSP changes significantly, also the size of the ANSP is not so decisive anymore.

5. Conclusions

Benchmarking of the ANSPs is becoming more and more important. The pressure on them to optimize is getting stronger from year to year as the aviation business, also in the light of global economic crisis, strives to survive. The competition among ANSPs, through reorganisation within FABs is getting stronger and stronger. The only mirror of the quality and efficiency of ANSPs performance so far are the benchmarking analyses. Therefore it is of the outmost importance that the methods for benchmarking are as objective as possible, ready to give fair results.

EUROCONTROL PRU/PRC KPIs are set in such a way that they use composite flight hours as a common denominator for calculation of efficiency criteria in many instances. The way the composite flight hours are set now, they clearly favour ANSPs that are lucky enough to have majority of the traffic along the longest routes, are geographically positioned so that the seasonal traffic variability is low and service large hub – airports with a lot of terminal traffic.

Each coin has two sides and so has Europe two different realities – on one hand large countries with mega cities like London, Frankfurt, Paris, Rome and on the other hand small countries with capitals in the size of the average European town. Both realities have completely different catchment areas of potential passengers but requiring the same quality of the Air Navigation services. And both realities have to exist and survive on the long term.

Regarding the performance of ANSPs, without the prejudice of a single provider – Single Sky initiative, it is too often concluded that larger ANSPs will be the ones that will stay in the business and that small ones will be forced to step back. This could not necessarily be true. As presented in Figure 3, Estonian ANSP goes hand in hand with the German or U.K. one. It looks like that they are compatible with the parameters of the current benchmarking methodology. Providing that the benchmarking methodology is adjusted in such a way that it would give more chance also to smaller or less trafficked ones, the picture then changes completely as presented in Figure 6.

ANSP business is specific and rarely follows common perception of general economy. The first priority of ANSPs is safety and capacity assurance; costs are important but not paramount. If an ANSP from another geographical area of responsibility was to take over the service provision of another ANSP, originating from that area, that ANSP would still have to overcame the same barriers or constraints as the original ANSP. Judging from that it is safe to assume that resulting from this action there would hardly be any synergy in enhancement of efficiency but would rather downgrade a bit the efficiency of the larger ANSP.

This paper proved that slight adjustment of the methodology leads to entirely different results. This supports the hypothesis that *CFH*, the way they are specified now, definitely influence the results of efficiency metrics, especially ATCO-Hour Productivity; according to the opinion of the authors, the current PRU/PRC favours, as already indicated above, larger ones with a lot of terminal traffic.

The proposed methodology of effective flight hours weighted by a factor of average overflying time gives only one example on how composite flight hour benchmarking methodology could potentially be improved (Figure 6). The sole purpose of benchmarking is to support decision-making. By improvements introduced the managerial decision-making process essential for ANSP cost-efficiency improvements would most probably be more adequately supported.

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